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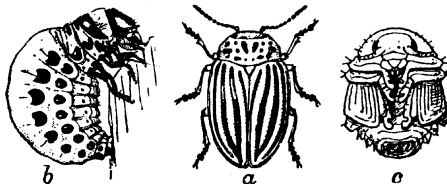
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STILLWATER, OKLAHOMA

—○—
EXTENSION DIVISION
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JAS. A. WILSON, DIRECTOR

—○—
GARDEN AND TRUCK CROP
INSECT PESTS

—○—
BY
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ENTOMOLOGY



GARDEN AND TRUCK CROP PESTS

INTRODUCTION

The following treatise covers all the more important insect pests of the truck and garden crops of Oklahoma.

Each species is given a general treatment, either under the heading of one of its main food plants, or the miscellaneous group in the back part of this bulletin. In cases where the same species has been discussed under one of its minor food plants, reference is made to the more general treatise which embraces or refers to methods of control.

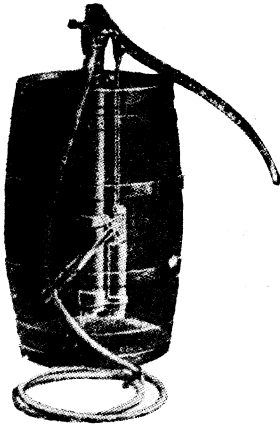
A few brief suggestions relative to spraying apparatus are given, which is followed by formulae or recipes that are numbered. These recipes are frequently referred to by number in the main context of the bulletin.

All of the principal garden plants as treated occur in the index. This is alphabetically arranged so that the discussion pertaining to any vegetable may be found from the pagination as given. Following the garden plant index are two alphabetically grouped indices on insects which are in both vernacular and technical language.

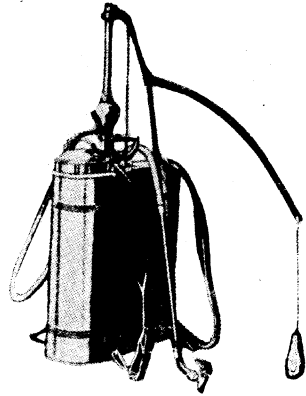
In order to be able to prevent or control damage by insects the agriculturist should be able to distinguish the different stages of development of the injurious forms, also their different methods of attacking the different plants which they damage. It frequently occurs that the yield of a crop is materially lessened by insects, the cause of the trouble being unknown by the manager, and the blame credited to some fault of the soil or weather.

CHEMICALS AND APPARATUS FOR MAKING APPLICATION

Insecticides that are used in controlling insects are generally poisonous. Lead arsenate and paris green are exceedingly poi-



Barrel Sprayer



Knapsack Sprayer



Row Sprayer

sonous. Lime, sulphur, pyrethrum powders, and some of the tobacco solutions are not to be considered as dangerously poisonous.

For applying any of the liquid sprays, a good spray pump, fitted with a good nozzle or nozzles is essential. For ordinary gardens, the knapsack sprayer is very convenient and handy (see accompanying illustrations). Its capacity is about five gallons. For large gardens, a barrel spray pump equipped with a row sprayer attachment can be used to great advantage. The barrel spray pump can be carried in a wagon as for orchard spraying, and the row attachment can be adjusted to the rear end of the wagon box and connect with a hose to the barrel spray pump.

The dry chemicals can be applied by use of a cheese cloth or other similar porous bag. The fine particles can easily be jostled through the pores of the cloth. Powder dusters are made especially for applying dry chemicals, and are a great saving over the former method. Ordinary "powder guns" which can be adjusted to spray one or two rows by adjusting the outlets can be obtained for six or seven dollars. Larger dusting machines are also manufactured for the purpose of spraying large fields by use of horsepower.

DIRECTIONS FOR PREPARING AND APPLYING CHEMICALS FOR CONTROLLING INSECTS

No. 1. LIME.—Lime answers for a great many purposes in the control of insects. The ordinary air-slaked, or, preferably, the hydrated lime, dusted on plants may be used as a repellent; mixed with paris green it acts as a diluent and aids in preventing the free arsenic of the paris green from burning foliage; mixed with copper sulphate it aids in killing disease germs and also acts as an adhesive.

No. 2. BORDEAUX MIXTURE.—In making a Bordeaux mixture the stone lime should be used. The following is a good general formula:

Lime, 6 pounds
Copper sulphate, 3 pounds
Water, 50 gallons.

Begin the evening before the day on which the mixture is to be used by placing the copper sulphate in a cheese cloth or other porous bag and suspending it in half of the water. The next morning slake the lime in a small part of the other half of the water; work it into a thin solution by the addition of more water until it is of a milky consistency, then add it to the remainder of the water. Use two vessels now and strain the limewater and the copper sulphate water at the same time into a third vessel. To do this mixing satisfactorily, one man should pour the copper sulphate while another is pouring the limewater, and still another is stirring the resultant liquid.

CAUTION.—Do not pour a vessel of limewater; then one of copper sulphate water; pour both simultaneously into one solution.

No. 3. BORDEAUX MIXTURE.—The Bordeaux mixture is good for controlling plant diseases, but at the same time it may act as an insect repellent, especially for flea beetles. An insecticide is often made of it by the addition of 2 pounds of arsenate of lead or 4 or 5 ounces of paris green to the 50 gallons of water. Either of these arsenicals should be made into a solution by using a very small quantity of the liquid at first. The amount of liquid can be gradually increased until a thin paste is formed, after which the solution can be mixed with the Bordeaux by stirring.

NO. 4. ARSENATE OF LEAD.—Arsenate of lead can be used in the powdered form by dusting it on the foliage at the rate of about 1 pound per acre to the 6 inches in height of plants.

Arsenate of lead can be used in a liquid form or spray at the rate of 1 pound to 25 gallons of water.

NO. 5. PARIS GREEN :—

Paris green, 5 ounces

Lime, 2 pounds

Water, 50 gallons.

Paris green is used quite extensively as an insecticide. It is always necessary to be cautious, however, in using it since tender foliage is likely to be injured unless it is used sparingly or plenty of lime is added to eliminate the caustic effect.

NO. 6. PARIS GREEN.—Dry.—When used dry, paris green should be diluted with hydrated lime or other similar substance and dusted on the infested plants while the air is calm and preferably when the plants are moist. The formula is:

Paris green, 1 pound

Lime (hydrated), 2 pounds.

NO 7. KEROSENE EMULSIONS—

Hard soap, $\frac{1}{2}$ pound

Soft water, 1 gallon

Kerosene, 2 gallons.

Shave the soap fine and thoroughly dissolve it in boiling soft water; remove from fire and add the 2 gallons of kerosene. Thoroughly emulsify by pumping it with an emulsion pump. This is known as a stock solution, which, when used, should be diluted with soft water.

One gallon of the stock solution should be diluted with 20 gallons of water for the tender foliage and for the more hardy plants, like cabbage, 1 part to 10 or 15 parts of water can be used.

Whale oil soap, or any kind of soap having an insecticidal value, is preferable to ordinary laundry soap.

The emulsion does not kill insects except when it is brought in contact with their bodies; consequently, it should be applied with a spray pump fitted with a good nozzle so that the insect under consideration can be dampened with it.

NO. 8. POTASSIUM CYANIDE.—This chemical is exceedingly poisonous. For ordinary use dissolve 1 ounce of potassium cyanide in 1 gallon of water. The solution will kill vegetation, and it should be used with caution.

NO. 9. CARBON BISULPHIDE.—This is an inflammable volatile liquid. The gas which can be made to emanate from it is used

in destroying stored seed insects or other pests which breed in storerooms. It is poisonous and sinks downward. Bins and storage rooms in which it is to be used should be air-tight, especially at the bottom and sides.

Formula:—

- 1 pound of liquid to 1,000 cubic feet of space; or
- 1 pound of the liquid to 100 bushels of grain; or
- 1 ounce of the liquid to 100 pounds of grain.

Application.—Pour the necessary amount of liquid in shallow pans placed on the surface of the infested seeds. Close enclosure and allow half a day for results.

No. 10. SULPHUR.—Apply copiously in the dry form by dusting the infested plants.

No. 11. PYRETHRUM, BULACH, HOFSTRA, PERSIAN OR DALMATIAN POWDER.—Apply copiously in the dry form as a dust powder, or at the rate of 2 ounces to 5 gallons of water. If a solution is to be used, the required amount of powder can best be made into a paste with a small quantity of water, and then diluted with the proper amount of water. (Hofstra is never used in solution.)

Poisoned Baits

The recognized standard remedy for combating cutworms is by the use of poisoned baits. These may be classed under two general heads: Vegetable baits and bran mash. One or the other of these should be applied as soon as an attack is noticed or expected.

Where at all practical it is well to have the ground clean and apply such a bait previous to the planting of the crop. Success is sure to attend its application as the worms under such conditions are practically compelled to feed upon it.

No. 12. THE VEGETABLE BAIT is prepared as follows: Spray a small patch of alfalfa, pig weed, or any useless succulent weed, with paris green, 4 ounces to 25 gallons of water, mow close to the ground and place sprayed plants in small heaps on the infested field.

No. 13. POISON BRAN MASH:

Bran	20	lbs.
Paris green	1	lb.
Cheap sirup	2	qts.
Water	3½	gals.
Oranges or lemons	3	

Mix the bran and paris green dry. Pour the sirup into the water, squeeze into this the juice of the fruit, and add the pulp

and rind chopped fine. Add this mixture to the poisoned bran and stir thoroughly. The use of the fruit is essential.

This makes sufficient material for from two to five acres. Broadcast it early in the morning before sunrise. The grasshoppers and cut worms prefer it when moist before the sun has dried it out. If applied in this way there is little or no danger to fowls.

No. 14. HEAT.—Heat can sometimes be advantageously applied to stored seeds. Porous bags of seeds, such as peas or beans, can be suddenly immersed in water 140° to 145° Fahrenheit for half a minute without injuring the germinating qualities. The heat will, however, be sufficient to destroy all the animal life present. After three or four immersions, each at an interval of about one minute, the seeds should, of course, be thoroughly spread out and dried before being resacked for storage.

Dry heat may also be used, and in many cases is used to a better advantage than the hot water. When several bushels of seeds are to be treated, as is often the case in mills or seed houses, a specially prepared room can be properly plumbed with steam pipes so that a steady temperature of 130° to 140° Fahrenheit may be maintained for about twenty-four hours. This will not injure the seeds, but will penetrate to the unexposed portions in the bulk, and thus destroy all animal life. This treatment is superior to other methods for controlling stored product pests because a single treatment is sufficient. Gases or fumes from chemicals ordinarily used do not injure the eggs of insects.

The following data relative to steam heat may be of advantage to persons desiring to use heat for killing stored product pests. Full and complete formulae may be obtained upon request:

Gauge Pressure.	Temperature Fahrenheit.	Gauge Pressure.	Temperature Fahrenheit.
00 lbs. or atmospheric pressure	212°	40 lbs. pressure ...	286°
10 lbs. pressure ..	240°	50 lbs. pressure ...	297°
20 lbs. pressure ..	259°	75 lbs. pressure ...	320°
30 lbs. pressure ..	274°	100 lbs. pressure ...	337°
		120 lbs. pressure ...	350°

Tobacco Insecticides

No. 15. TOBACCO DUST.—Tobacco dust is sometimes used as a repellent. Such cucurbits as cantaloupe, watermelon and cucumber are often infested with aphids or beetles which may be repelled by it if applied in the early season. A liberal application of tobacco dust around and on the germinating plants serves not only as a repellent, but also as a fertilizer. If the aphids are expected the application should be repeated after every rain until the vines are well developed.

No. 16. TOBACCO FUMIGANTS.—There are several convenient proprietary fumigants on the market which are made from tobacco extracts. Niko-Fume and Tobakine are examples of the product which is manufactured into convenient rolls or sheets for use. Such preparations are used considerably in greenhouse fumigation. They are also good for fumigating the melon vines when the latter begin to be infested with the aphid. A cover and frame is used for concentrating it on the infested vine.

Tobacco stems make a good fumigant for greenhouses infested with such pests as aphids. The stems are placed in a kettle or iron boiler and caused to smoulder, thus creating the maximum amount of gas.

No. 17.—BLACK LEAF 40.—This is a tobacco decoction that is used a great deal as an insecticide. About 1 part Black Leaf to 800 or 900 parts of water, or $\frac{1}{2}$ pound to 47 gallons of water, is ordinarily used for controlling aphids. Plants in general are not very susceptible to this insecticide, and for this reason it is much safer to apply than such remedies as kerosene emulsion.

GARDEN AND TRUCK CROP PESTS

BY C. E. SANBORN
 Entomologist Oklahoma Agricultural Experiment Station

Asparagus

STRIPED GARDEN CATERPILLAR
 (*Mamestra legitima*, Grote.)

The striped garden caterpillar hatches from an egg laid by a moth. It is an exceptionally highly colored larva, occasionally found infesting our garden plants. It is a general feeder, but shows a preference for asparagus, the legumes, and cruciferous plants. The stripes of the larva (see Fig. 1) are black and yellow, the lateral stripe, as shown, is divided, the upper portion being lighter than the lower.

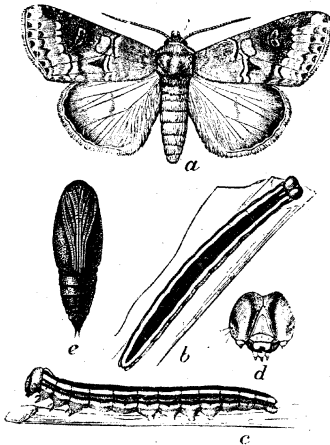


Figure 1.—Striped Garden Caterpillar. *a*, adult; *b*, dorsal view of larva; *c*, lateral view of larva; *d*, head of larva as seen in front; *e*, pupa. All natural size except *d*, which is enlarged. (From Dr. L. O. Howard, U. S. Bureau of Entomology.)

Remedies. — Arsenical Sprays. The most practical of this group of sprays is lead arsenate, but it should not be used on this plant during the time that it is being cut for market. The arsenate of lead may either be used in the powdered form and dusted on the foliage at the rate of about 1 pound

per acre, or it may be used in a liquid form at the rate of 1 pound to 25 gallons of water.

Bean

COMMON BEAN WEEVIL
 (*Bruchus obtectus*, Say.)

The bean weevil (see Fig. 2) oviposits in the pods oftentimes before the beans are harvested, so that when the beans are gathered and stored the infestation continues; and if some method is

not used the entire crop is likely to be destroyed while in the store room.

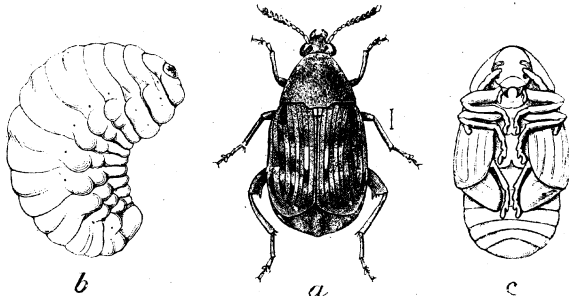


Figure 2.—The Bean Weevil. *a*, adult weevil; *b*, larva; *c*, pupa; all greatly enlarged. (From Dr. F. H. Chittenden, Yearbook for 1898, p. 239.)

The adult female makes a hole in the pod and inserts therein the eggs. After the beans have been removed from the pods the females deposit their eggs sporadically among them, or in the holes made by the forms issuing from the seed.

The eggs hatch in from a little less than a week to three weeks into larvae, which do the injury to the bean. From about eleven days to six weeks time is required for the development of the larvae, and from five to eighteen days for the pupae; making in all from three weeks to about three months for the complete development of the insect. Since the development continues in the store room there are about six generations of weevils per year.

Remedies.—No known remedy can be effectively applied for field use other than reducing the weevil by proper applications in store rooms. Fumigation and heating are the best remedies. (See No. 9, page 8, and No. 14, page 9.)

FOUR SPOTTED BEAN WEEVIL. (*Bruchus quadrimaculatus*, Fab.)

The Four-Spotted Bean Weevil (see Fig. 3) is similar in appearance and injury to the preceding.

The adults are not as ravenous as the young or larvae. The latter hatch from an egg which has been laid on the food by the parent beetle (see Fig. 4). Instead of coming out from the egg and crawling about over the bean, the young larva eats through that side of its egg which is in contact with the bean so that it finds food material as soon as it leaves the egg, because in ac-

completing the latter it channels directly into the bean, where

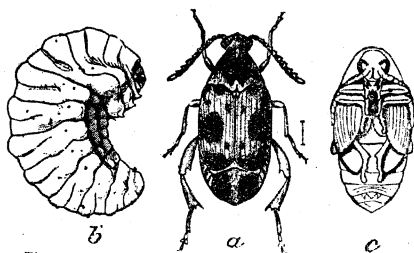


Figure 3.—The Four Spotted Bean Weevil. a, adult weevil; b, larva; c, pupa.

its complete development is concluded.

Remedies.—The same remedy is used as for the preceding insect. (See Nos. 9 and 14, pages 8 and 9.)

BEAN LEAF BEETLE (*Ceratoma trifurcata*, Forst.)

This insect (see Fig. 5) resembles the cucumber beetle in appearance. It is a native of this country, and quite commonly attacks both beans and peas. The adult lays its eggs in clusters of six or more at the base of the food plant. The larval form feeds on the roots and main stems below the surface. The full-grown bug eats large, round holes in the leaves of the bean and pea. Unless a close examination is made, the beetles will not be seen, because they cling to the under side of the leaves while eating.

Remedies.—When the

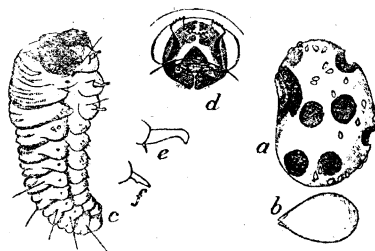


Figure 4.—Larva and work of the Four Spotted Bean Weevil. a, cowpea, showing eggs and exit holes of the weevil; b, egg greatly magnified; c, larva; d, e, f, head, leg, and spiracle magnified of same. (From Dr. F. H. Chittenden; pp. 245-6 of Yearbook.

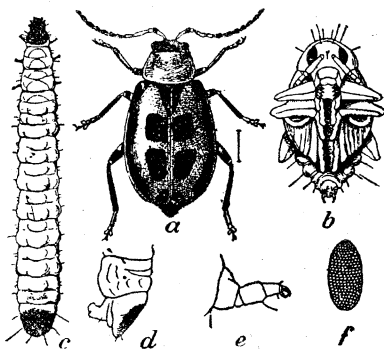


Figure 5.—The Bean Leaf Beetle. a, adult beetle; b, pupa; c, larva; d, side view of anal segment of larva; e, leg of same; f, egg. a, b, c, enlarged about six times; d, e, f, more enlarged. (Dr. F. H. Chittenden; Yearbook 1898, p. 253.)

infestation is small during the early season the adults can be gathered by hand to a practical extent. This method should be augmented by an arsenical spray, provided the beans or peas—especially the beans—are not being gathered for culinary purposes. In case the plants are young and not bearing, lead arsenate at the rate of 1 pound to 25 gallons of water may be used with safety. Later on, however, when the fruit is to be gathered within two or three weeks, no lead arsenate should be applied. In case the beetles are numerous and injurious at this time, a dust spray of paris green at the rate of 1 pound to the acre may be applied instead of arsenate of lead, because it does not adhere to the plants like the former, and there is no danger of being poisoned by eating the beans, provided they have been washed after being picked.

The following insects also affect the bean:*

Blister Beetle, Black
 Boll Worm
 Cutworm, The Cotton
 Cowpea Pod Weevil
 Garden Flea Hopper
 Blister Beetle, The Gray
 Cutworm, The Greasy
 Pea Weevil
 Seed Corn Maggot
 Blister Beetle, The Spotted
 Cutworm, The Spotted.

Beet

BEET ARMY WORM

(*Laphygma exigua*, Hbn.)

The moth of the beet army worm (see Fig. 6) is the usual size of moths of this general group. The larva is rather slender, greenish in color, with distinct dark lateral stripes. It feeds on a variety of plants, but the beet seems to be the favorite host. They begin by feeding on the tops, but when these are devoured they continue feeding downward below the crown of the beet. Treatment should be made as soon as the attack begins in order to be most practical.

Remedies.—Apply arsenate of lead as a spray at the rate of 1 pound to 25 gallons of water.

SPOTTED CUTWORM

(*Noctua c-nigrum*, Linn.)

The spotted cutworm (see Fig. 7) is one of our most com-

*NOTE.—For remedies, consult index for each of the above insects.

mon and destructive species of this class. It is very cosmopolitan in food habit—in fact, omniverous; it also has a climbing habit, and sometimes migrates in numbers like the army worms.

The larvae feed on a wide variety of crops, including beets, cabbage, cauliflower, turnip, pea, carrot, tomato, celery, rhubarb, currant, gooseberry, corn, clover and ornamental plants.

The cutworm is pale brown or gray with greenish or olive tints, the last segment marked with oblique lines.

Remedies.—The remedy for this insect is the same as for the beet army worm, except in cases where it is feeding on such plants as the tomato, where part of the

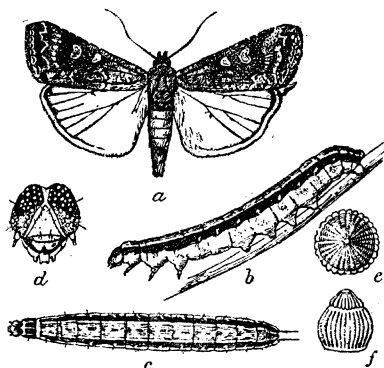


Figure 6.—The Beet Army Worm. *a*, adult; *b*, larva, lateral view; *c*, larva, dorsal view; *d*, head of larva; *e*, egg, viewed from above; *f*, egg, from side. All enlarged. (*e* and *f*, after Hofmann; *a* and *d*, after Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

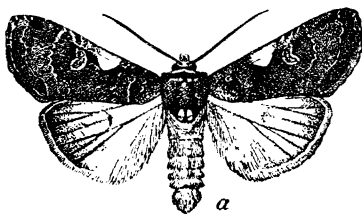


Figure 7.—The Spotted Cutworm. *a*, moth; *b*, larva, somewhat enlarged. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

GREASY CUTWORM (*Agrotis ypsilon*, Rott.)

The greasy cutworm (see Fig. 8) is one of the important, cosmopolitan species, typical of its class. It is found feeding on the beet, newly set tomato plants, lettuce, cabbage, corn, potato and tobacco.

plant or fruit is to be used within a few days for food. In case of the cabbage or similar plant, it makes no difference since the outer or protecting leaves on which the poison has been placed are to be removed before the vegetable is prepared for the table.

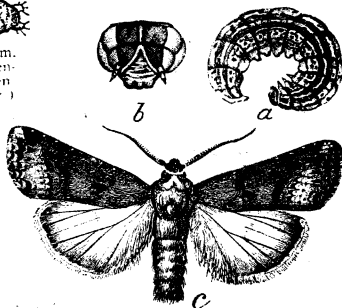


Figure 8.—The Greasy Cutworm. *c*, moth; *a*, larva; *b*, head of same, somewhat enlarged. (From U. S. Bureau of Entomology.)

The larva is of comparatively the same size and general dull, dirty brown coloration as is characteristic of the cutworm class. The lower portion of the body is pale green and of a greasy cast all over.

Remedies.—The same as for the beet army worm.

WESTERN ARMY CUTWORM
(*Chorizagrotis agrestis*, Grote.)

The Western Army Cutworm (see Fig. 9) has not as yet gained the wide reputation as a pest accorded most of the allied species. Its food originally consisted of the wild grasses, and it is only when these are replaced by staple crops, or when they fail, that these worms are likely to work an injury.

The mature larva measures about two inches in length. The color varies from pale to dark brown, with alternating longitudinal bands of light and dark. The body is nearly smooth, only a few short hairs being present.

Remedy.—See No. 4, page 7.

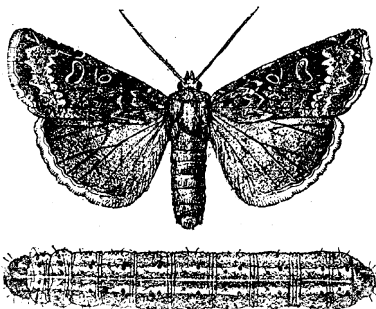


Figure 9.—The Western Army Cutworm. Moth above; dorsal view of larva below. Somewhat enlarged. (From U. S. Bureau of Entomology.)

Cabbage

THE CABBAGE APHIDS

(*Aphis brassicae*, Linn.)

(*Myzus persicae*, Sulz.)

Of these two insects, the species *brassicae* (see Fig. 10; also

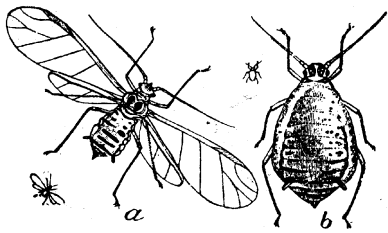


Figure 10.—Cabbage Aphid. *a*, winged form; *b*, wingless form. Much enlarged. (After Curtis.)

Fig. 47) is the more mealy or powdered one in appearance. Both are very injurious to cabbage and difficult to control. Both species are very prolific. They produce living young instead of eggs, which, within a week or ten days, begin reproducing

at the rate of six or eight per day. Large numbers of these often accrue, and, being more or less hidden and protected by the cabbage leaves, to which they are similar in color, pass unnoticed until the plants here and there through the patch become stunted and darker in appearance than the others. The aphid sucks the sap from the plant and does not devour the foliage. On account of its method of obtaining food no arsenical should be applied for it.

Remedies.—If upon examining them numerous brown forms of the dead aphids are found attached to the leaves, or small, black, elongate, living parasitical forms (see Fig. 23) are noticed, no remedies should be applied, since this indicates that the parasites are attacking and killing them. If no parasites are present and the aphids are beginning to destroy the cabbage, fumigants or sprays should be applied. Black Leaf 40, which is a tobacco extract, should be diluted at the rate of $\frac{1}{2}$ pint to 40 or 50 gallons of water and sprayed on the plants. As this is a contact spray the liquid must be sprayed on and between the leaves so that all the aphids will be touched by it, else the effect will be of but little value. If the method of fumigation is used, hoods consisting of an eight or ten-cent quality of muslin should be stretched over a frame (a wooden barrel hoop cut into semicircles and bolted together with a small bolt in the center of each is sufficient) of suitable size. Fumes made by burning Tobakine or Niko-Fume Tobacco paper will destroy the aphids in a few minutes. The best method is prevention. Do not allow the cabbage stalks to stand in the field. After harvest all should be fed to animals or buried deeply.

IMPORTED CABBAGE WORM

(*Pontia rapae*, Linn.)

Cabbage is particularly susceptible to the attack of insects of various kinds, the most common of which is doubtless the green cabbage worm. The eggs from which these worms hatch are deposited on the cabbage by the adult butterfly (see Fig. 11). It is of medium size, and white with the exception of one or two pairs of black spots on the top side of its wings. Since the adult feeds on sweets, such as the nectar of flowers, it may be seen flying about nearly any kind of plant, and occasionally lighting on the blossoms to sip its food. The eggs, however, are deposited on the cole plants, and especially cabbage. They hatch in from four to eight days. The resultant worm is not very conspicuous on account of its protective coloration. So closely allied is it in color to the cabbage that were it not for the defoliation and exudation made by it, a person could scarcely find one. When the worm attains its growth, which requires about two weeks' time, it attaches its caudal end to the under side of a leaf

or other convenient object, suspends its central portion by means

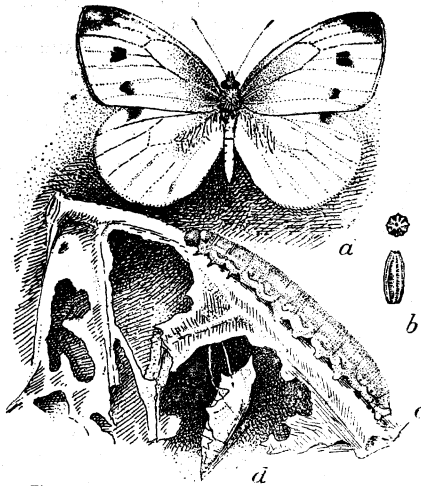


Figure 11.—Imported Cabbage Worm. Female butterfly which lays the egg (*a*, as seen from above; *b*, as seen from side) that hatches into the worm as shown at *c* on a partly eaten cabbage leaf. *c* Transforms into the pupa as shown at *d*, that emerges into adult as shown above. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

of a silken cord which it attaches by each end to the object; then pupates, that is, transforms to the pupal stage. It remains in this stage about one week, then issues as an adult butterfly. The entire time spent by the immature forms is from three to five weeks during the summer, but much longer during cold weather, because the insect passes the winter in the pupal stage.

Remedies.—An arsenical should be applied to the cabbage early in the season. Frequent spraying with arsenate of lead at the rate of 1

THE SOUTHERN CABBAGE BUTTERFLY (*Pontia protodice*, Boisd.)

This insect (see Fig. 12) resembles the preceding one to a marked extent both in appearance and habit. It was the original injurious cabbage worm before the advent of the previous one, which was imported from Europe and became conspicuous in the United States in 1865.

Remedies.—Methods for controlling this worm are practically the same as for the preceding.

CROSS-STRIPED CABBAGE WORM (*Evergestis rimosalis*, Guen.)

The adult of this worm is a moth (see Fig. 13). The worm penetrates the heads of cabbage to such an extent that they are

oftentimes rendered unfit for market. Protection to the cabbage is rendered by an early arsenical application. If the worms are allowed to enter the cabbage heads they will be beyond the limits of control. Consequently it is necessary to be cautious and cause a remedy to act as a preventive as much as possible. (See remedies 4, 5 and 6, page 7.)

IMPORTED CABBAGE
WEB WORM
(*Helula undalis*, Fab.)

This insect (see Fig. 14) is of recent introduction into the United States and is especially present in the South. It is concealed in its method of injury more than the previously mentioned forms. The young plants are mainly attacked in the bud be-

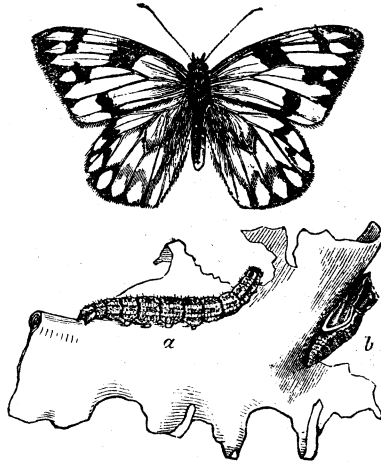


Figure 12.—The Southern Cabbage Butterfly. Upper figure, adult female; a, larva at work; b, pupa.

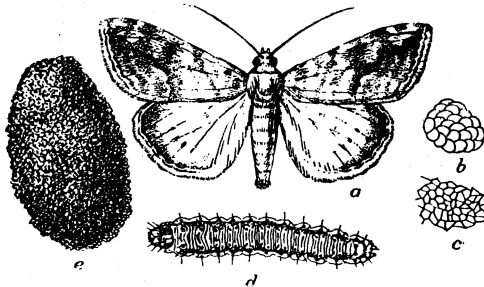


Figure 13.—The Cross-Striped Cabbage Worm. a, moth; b, egg mass; c, sculpture of egg; d, larva; e, cocoon. a, d and c twice natural size; b, much enlarged; e, more enlarged. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

cause the worm develops by devouring this part of the plant. It spins a web for its protection. This has an opening at one end through which the larvae may crawl out or in. These worms become very abundant at times, and when a large brood is present the entire cabbage may suffer destruction unless a remedy is applied in time to prevent it.

Remedies.—Use a spray of lead arsenate at the rate of 1 pound to 25 gallons of water. (Also see remedies Nos. 4, 5 and 6.)

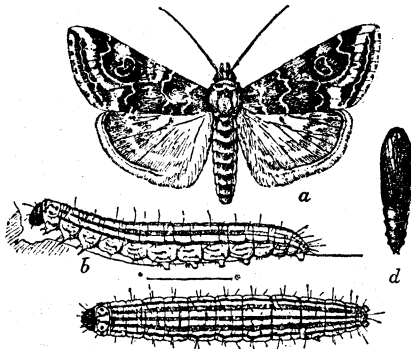


Figure 14.—Imported Garden Web Worm. *a*, adult; *b*, larva, side view; *c*, same, top view; *d*, pupa. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

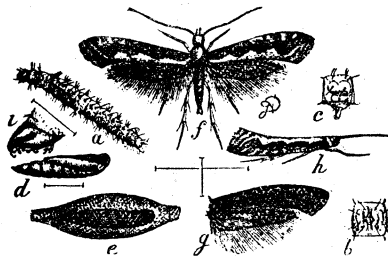


Figure 15.—Diamond Back Moth. *a*, larva; *b*, enlarged tergum; *c*, enlarged lateral side of segment; *d*, pupa; *e*, cocoon; *f*, moth, dorsal view; *g*, moth, lateral view. (From U. S. Bureau of Entomology.)

indicates that a new growth of leaves which have not been treated are present, or that the spray has lost its poisonous effect. Spraying may be repeated as necessary every two or three weeks until the head is half grown or even later without impairing it for culinary purposes. Since the plant cannot absorb the poison there can neither be any in the head, nor any on the outside, if the leaves are properly removed, even if sprayed on the same day as gathered.

CABBAGE MAGGOT

(*Pegomya brassicae*, Bauche.)

The cabbage maggot is an immature form of a fly (see Fig. 16.). The latter is about three-sixteenths of an inch long, some-

THE DIAMOND-BACK MOTH

(*Plutella maculipennis*, Curtis.)

The larval stage of this moth is not as injurious to cabbage as some of the previously mentioned species, but it often does its share of injury to cabbage. Attack is generally on the under side of the leaves. Fig. 15 shows the different stages of the moth.

Remedies. — See Nos. 4, 5 and 6, page 7.

Spray the plants thoroughly while they are young and the effect will be apparent for several days. The spray should be repeated whenever the worms show their presence, because this

what smaller than the ordinary typhoid fly, and has proportionately larger wings. The adult is capable of laying about fifty eggs. The latter are deposited on the ground near the base of the plant, or in an abrasure of the root near the surface of the ground. About four to ten days' time is required for the hatching of the eggs. The larvae descend the main root or else enter the soil to the small rootlets through crevices of the ground. They begin feeding on the rootlets and finally enter the main root, where the final results are so serious that the plant often dies from the effect. Within three or four weeks the larvae become full grown and leave the main root by entering the soil, where they transform

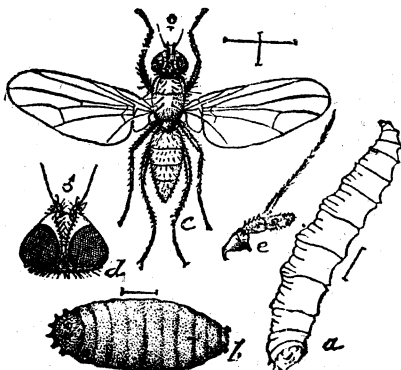


Figure 16.—Cabbage Maggot. *d*, front view of the head of the fly shown at *c*; *b* is the pupa; *a* is the larva or maggot which hatches from an egg deposited by the fly. (From Riley.)

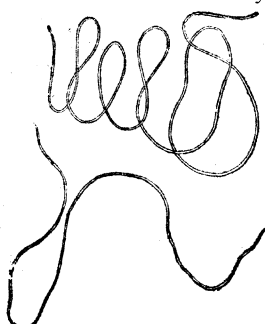


Figure 17.—"Cabbage Snake." (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

to the pupal stage. The latter stage requires about two weeks, although the adult does not always issue until the following spring. There are about three broods during the year, but unless late plantings are made the later broods do not prove to be as serious as the first one. The plants may be infested at any time during the growth, but the older, tougher roots are more resistant and less injured than the young plant roots.

Remedies.—Since the eggs are laid on the surface of the ground near the plant, it follows that repeated cultivation, resulting in a change of soil near the plant, will be quite effective. Fall and winter plowing is good for destroying the over-wintering pupae. The burning of the accumulated weed and brush piles near the garden during winter will destroy many of the adults which often hibernate in such places.

General Remedies.—The first advantage that should be taken by the gardener is the early destruction by deep burying of all

cabbage stalks. It is often the case that stalks of an early crop of cabbage are left standing throughout the year instead of being destroyed soon after harvest. Such management is a big expense in combating these insects. There is no good excuse for the creation of such a needless waste. It is only self-taxation of unknown potentiality to breed insect enemies in such a fashion. The summer multiplication should be stopped, and late cabbage stalks should be treated the same as the earlier varieties in order to prevent the late forms of insects from hibernating throughout the winter. When such suggestions are not heeded, it will be necessary to use the more expensive methods of control, which are chemical applications.

CABBAGE HAIR WORM
(*Mermis albicans*, Dies.)

Through the agency of "hearsayings" and fictitious newspaper reports, many grave charges by poisoning have been reported as caused by the "cabbage snake".

This harmless worm is from two to nine inches long, often much curled, threadlike and whitish in color (see Fig. 17). It is an internal parasite of grasshoppers and caterpillars. When the latter infested insects are on cabbage the parasite either from the death of the former, or other reason, issues through the body wall and enters the cabbage. There should be no cause for alarm when one of these little, harmless worms is found in the head of a cabbage. The time spent in discussing such a trifle should be used in waging war against the common typhoid fly.

TARNISHED PLANT BUG
(*Lygus pratensis*, Linn.)

The Tarnished Plant Bug is a very common insect. It is elliptical in outline and about one-fifth of an inch long. In color it varies considerably. At first the young are yellowish-green, but this changes as development proceeds until finally the bug is pale, obscure, grayish-brown, marked with black and yellow; the thorax, or that part of the insect between the head and wings, is red.

The insect is injurious to nearly all kinds of plants. Not only the foliage and stems are attacked, but sometimes the fruit is badly malformed by it. On account of its piercing mouth parts it is enabled to carry and transmit diseases like blights and wilts from diseased to healthy plants.

The principal garden plants affected by it are cabbage, cucumber, potato and turnip.

Remedies.—Clean farming is of special importance, since this

pest breeds abundantly in weeds. A contact spray is the most advisable chemical application to be used. (See No. 7, page 7.)

GARDEN FLEA HOPPER
(*Halticus uhleri*, Giard.)

Somewhat similar to the tarnished plant bug. Use same treatment. (See Fig. 18.)

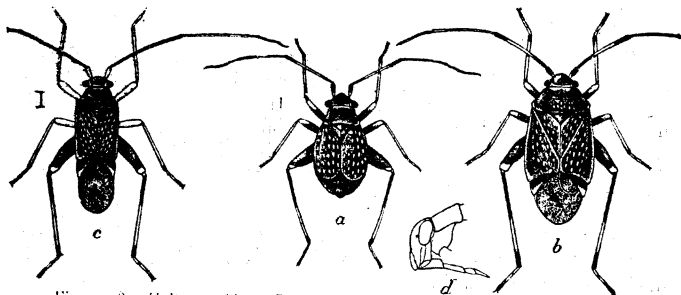


Figure 18.—*Halticus uhleri* (Giard). *a*, brachypterous female; *b*, full winged female; *c*, male; *d*, head of male in outline, showing beak. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

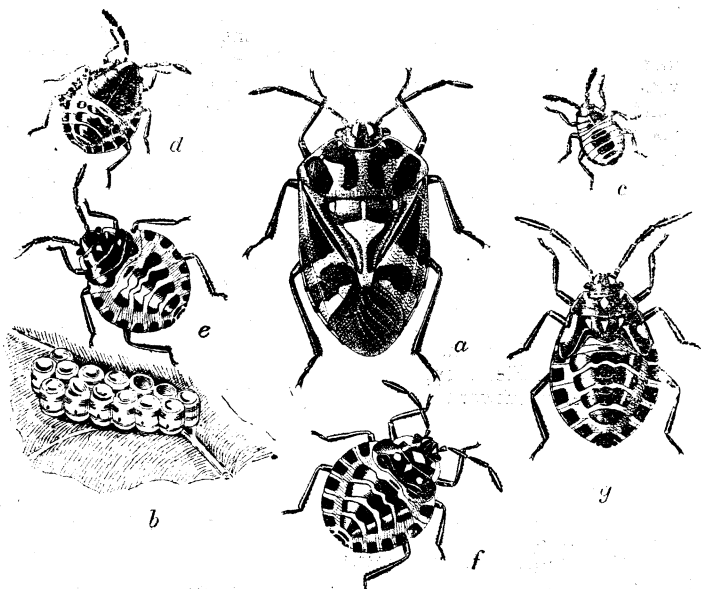


Figure 19.—The Harlequin Cabbage Bug. *a*, adult; *b*, egg mass; *c*, *d*, *e*, *f*, and *g*, stages of the nymphal form. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

HARLEQUIN CABBAGE BUG

(Murgantia histrionica, Hahn.)

This bug, like the aphids and chinchbugs, sucks its food from the leaves of the plant. When numerous its effect is similar to that of scorching the plants with fire. The leaves turn brown and young plants are sometimes killed, while older ones are prevented from maturing.

The adults pass the winter in rubbish in or near the cabbage fields. Only a few are necessary to stock a large field. Many eggs are deposited in small clusters of about a dozen each on the under side of the leaves of the food plant (see Fig. 19). These soon hatch into young bugs which suck their food from the leaves. The young are often dark in color and may be mistaken for some other insect.

They should be treated at once, however, since, if they are allowed to attain their growth and reproduce, the infestation is likely to become uncontrollable.

The entire Brassicae or cabbage family is subject to their attack.

Remedies.—All stomach poisons are ineffective. Furthermore, since contact sprays are of little value except for the very young forms, it follows that methods of prevention followed by hand-picking must be resorted to. All weeds and rubbish on and about the field should be destroyed in the fall of the year. Early plantings of mustard may be made so that the hibernating forms may be decoyed and destroyed before cabbage is transplanted. It is very important that the hibernating brood should be destroyed, because if this is accomplished the fields will be free of the pest throughout the season.

The following insects also infest cabbage:*

- Black Blister Beetle
- Cotton Cutworm
- Garden Flea Hopper
- Greasy Cutworm
- Imbricated Snout Beetle
- Onion Thrips
- Seed Corn Maggot
- Spotted Cutworm
- Striped Garden Caterpillar
- Striped Turnip Flea Beetle
- Three-Lined Blister Beetle.

*NOTE.—For remedies, consult index for each of the above insects.

Cantaloupe

THE MELON APHIS

(*Aphis gossypii*, Glov.)

The melon aphis (see Fig. 20) is a very small insect and is known by some as a louse. It is a louse in one sense of the word, that is, a plant louse, quite distinct, however, from the species affecting animals. The individuals are soft-bodied and green to light green or yellowish-green when on melon vines, but often slate colored or dark when on cotton. A few of the individuals can nearly always be found during the summer time which have wings, as shown in the illustration, but the majority have no wings. They, under ordinary conditions, consist entirely of females which lay no eggs, but reproduce living young at the rate of from four to eight per day. Each young ordinarily becomes full grown at the age of about a week and continues reproduction

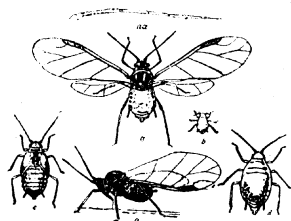


Figure 20.—Melon Aphis. *aa*, antennae or feeler, *a*, winged female. *b*, young nymph or larva; *c*, last stage of nymph; *d*, wingless female—all enlarged. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

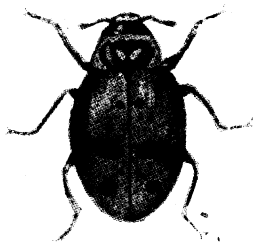


Figure 21 *a*.—Lady Bug. From Dr. S. J. Hunter, University of Kansas.)



Figure 21 *b*.—Larvae or Young of the Lady Bug. (From Dr. S. J. Hunter, University of Kansas.)

for about one month. From this history, as briefly given, there is no need for wondering how a whole field of melons can be affected in a few days after an infestation is started.

In addition to the cantaloupes, they affect watermelon, cucumber, squash and cotton, as well as several weeds and ornamental plants.



Figure 21 *c*.—Eggs of Lady Bug. (From Dr. S. J. Hunter, University of Kansas.)

There are several insects which prey upon the melon louse, which should be protected when possible. The most common form of these (often mentioned as inimical insects) are as follows:

1. The Lady Bug and its young (see Fig. 21, *a* and *b*). The latter, which hatch from eggs shown at *c*, Fig. 21, are dark colored worms with a few reddish spots on their backs, and six legs on the under side near the head. In transforming to the adult stage they attach themselves by the tail to an object, shed their skins (see Fig. 21 *d*), turn from a dark to a light yellow color and soon transforms to the beetle stage.

2. The Lace-Wing Fly and its young (see Fig. 22). The adults are about one-half inch long, of a greenish color, and have four lacelike wings. They lay their little pearl-colored eggs on pale, slender stalks about half an inch long. These hatch into

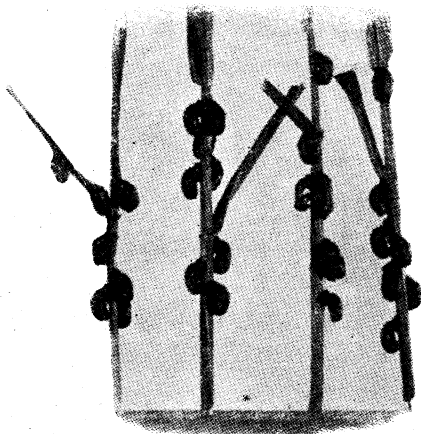


Figure 21 *d*.—Pupae of Lady Bug. (From Dr. S. J. Hunter, University of Kansas.)

six-footed larvae or worms, which are somewhat similar in form and habit to the larvae of the lady bug.

3. The Scymnus Beetle and its young. The former is a little dark brown or black beetle about one-fourth the size of the lady bug. The young is covered with a white, woolly coat. Their food habits are similar to those of the lady bugs mentioned, but on account of their size they can devour only about one-third as many aphids as the former.

4. Several Species of Young Syrphus Flies.—The adults are yellowish in color and are sometimes known as sweat bees. They eat the honeydew secreted by the aphids, but their young, which are footless, sluglike worms, eat about as many aphids as the lady bugs,

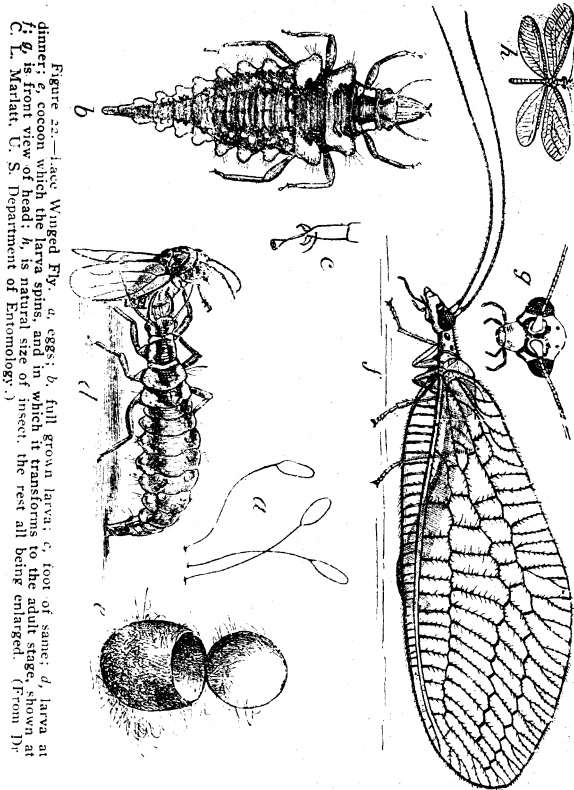


Figure 22.—Lace Winged Fly: *a*, eggs; *b*, full grown larva; *c*, foot of same; *d*, larva at dinner; *e*, cocoon which the larva spins, and in which it transforms to the adult stage, shown at *f*; *g*, its front view of head; *h*, its natural size of insect, the rest all being enlarged. (From Dr. C. L. Marshall, U. S. Department of Entomology.)

5. The Internal Parasites.—These, in many places, are often present in numbers equal to the melon aphid. They are like the little bees (Fig. 23) that lay eggs in the green bug. A few days after an egg is laid in the body of the melon louse by them the louse turns brown and is attached to the leaf by the young bee which hatches from the egg. When the young bee develops it gnaws a circular hole in the top of the aphid's body (see Fig. 24) through which it escapes.

Remedies.—1. Construction of Apparatus.—For vines two or three feet long, a light frame 4 feet wide and 6 feet long, supported by legs 8 inches long, is a convenient size. Construct a frame and nail an 8-inch leg to each corner. For frames 6 feet long, or longer, strengthen by connecting the ends with a cross-piece. Two diagonals should be used for strengthening the

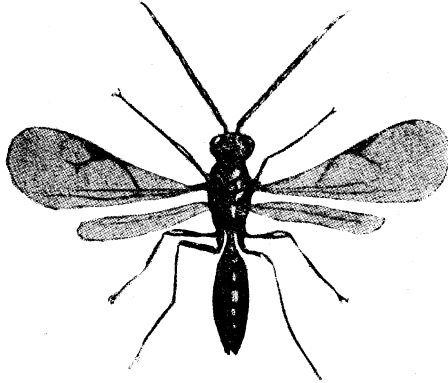


Figure 23.—Wasplike Parasite, *L. tritici*. (From Dr. S. J. Hunter, University of Kansas.)

frame, and also for convenience in handling, but one of the latter should not be attached until the cloth cover is in position. The latter may be made of seven or eight-cent muslin, or a cheaper grade, which is not porous enough to allow a passage of gas after being oiled.

The size of the cloth should be prepared two feet wider and two feet longer than the frame which is to be covered. This is sufficient for an 8-inch wall and a 4-inch lap to the ground. On the latter dirt may be placed to keep the gas from escaping.

After the cloth has been sewed and cut into the size desired, it should be saturated in a vessel of linseed oil, which will fill the pores. It should then be wrung out, slightly dried and placed over the frame and held in place by nailing the diagonal to the frame above the cloth. Four covers of above size may be rendered sufficiently gastight by the use of 1 gallon of linseed oil.

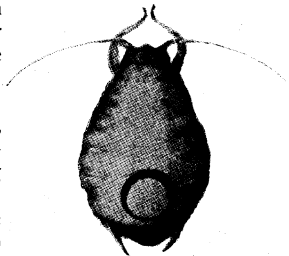


Figure 24.—A Parasitized Aphid. (From Dr. S. J. Hunter, University of Kansas.)

The number of frames to be made depends on the amount of infestation and the rapidity of the operator. In ordinary cases about ten frames are sufficient for one man's attention.

Methods of Application.—Place the frame over the infested plant. Take one sheet of Aphis Punk, or one-half sheet of Niko-Fume paper, tear into two equal parts, light same, and put each piece in a tin oyster or similar can, which has perforations at the bottom edge, made by driving a large nail through the side, and place each can in opposite corners of the frame, but not on the vine; light according to directions. By this time many of the beneficial insects have escaped from under the cover. With a hoe or other convenient tool place a little dirt on the border of the cloth which lies on the ground to prevent the escape of gas. The frame should remain in position long enough to suffocate all aphids under it, which is usually from three to thirty minutes.

In large fields a liquid spray has been found to be more practical than fumigation. The liquid spray is made of Black Leaf 40, which is a liquid extract from tobacco. One-half pint of this diluted with 40 to 50 gallons of water and sprayed on the vines from beneath upward by the use of an up-to-date spray pump is quite practical during any age of the vine up until the melons begin to ripen.

The following insects also infest the cantaloupe:*

Imbricated Snout Beetle
Onion Thrips
Southern Corn Root Worm
Striped Cucumber Beetle.

Carrot

The carrot, generally speaking, is quite free from insect pests.

The following pests sometimes affect it:*

Black Blister Beetle
Spotted Cutworm
Striped Garden Caterpillar.

Cauliflower

The following insects sometimes affect cauliflower:*

Cabbage Aphis
Harlequin Cabbage Bug
Onion Thrips
Spotted Cutworm
Striped Garden Caterpillar.

*NOTE.—For remedies, consult index for each of the above insects.

Celery**THE CELERY LOOPER**
(*Plusia simplex*, Guen.)

The Celery Looper is not a very common insect, but it may occasionally be found infesting beets, lettuce, and especially celery. The mature larva measures about one and one-half inches, and is



Figure 25.—Celery Looper. Male moth at left; larva at right, somewhat enlarged. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

rather robust posteriorly. The color is a fairly pale, yellowish-green, rather strongly marked with white lines, as shown in Fig. 25. It derives its name from the peculiar looping movement taken in locomotion, due to the absence of legs on the sixth and seventh segments.

Remedies.—The same as for the following insects, which also affect celery:*

Spotted Cutworm
Striped Garden Caterpillar.

*NOTE.—For remedies, consult index for each of the above insects.

Collard

This is a hardy plant and generally speaking is quite free from insect pests. The following insects sometimes affect it:*

Cabbage Aphis
Striped Garden Caterpillar.

*NOTE.—For remedies, consult index for each of the above insects.

Corn—Sweet**THE CORN BILL BUGS**
(*Sphenophorus sp.*)

The Corn Bill Bugs or Snout Beetles, of which there are several species infesting the corn plant, are of various



Figure 26.—Corn Bill Bug. Upper figure, dorsal or back view; lower figure, lateral or side view. (From Dr. Forbes.)

sizes and colors, though usually of a fair size and tending to a dull black color, and having the surface much marked with shallow, longitudinal ridges (see Fig. 26). Most of them seem to spend the winter in the adult stage, hibernating in the crowns of bunch and similar grasses, especially in low land.

The main damage is done to corn soon after germination. The adults straddle a young stalk and with the long snout, at the outer end of which are located the teeth, penetrate the stalk by lacerating the outer leaves. Then with the mouth parts in the tender stalk they eat upward and downward, channeling the heart. In nearly all cases of this kind the bug works on the plant near the ground with its head downward. When numerous in fields of early corn the entire crop is soon completely destroyed. Fortunately only one brood occurs per year, and does not disseminate to any great extent except by overflow of water in valley lands which sometimes transfer them from a higher field to a lower field.

Remedies.—A rotation of crops is quite effective. When present in any field, the latter should be planted in some other crop, because corn is about the only cultivated crop chiefly attacked by them.

Cutworms (see Fig. 27).—Comprise several species of caterpillars which appear as moths in their adult form. Many often prove very serious, damaging such crops as wheat, corn and garden crops.

Remedies.—The recognized standard remedy for combating worms is the use of poisoned baits. These may be classed under two general headings: Vegetable baits and bran baits. One or

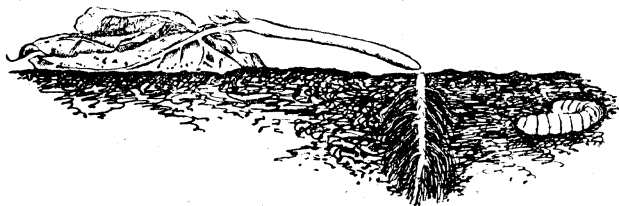


Figure 27.—Cutworm.

the other of these should be applied as soon as an attack is noticed or expected, preferably before the attack; that is, in such places of garden land, that have previously been infested (see Nos. 12 and 13, page 8). Where at all practicable it is well to have the ground clean and apply such a bait previous to the planting of the crop. Success is sure to attend its application under such conditions, because there is no other food available, provided the ground is well cultivated.

SOD OR ROOT WEB WORM
(*Crambus caliginosellus*, Clem.)

This pest affects corn by eating its way through the base of the stalk near the ground. The cause of the wilting of the corn caused by it is often overlooked. Upon investigation, however, during the beginning of an infestation the parent, which is a moth, can be observed. After flying a short distance it will alight on such an object as a blade of grass, to which it hugs up closely, and quickly rolls its wings snugly around its abdomen, giving it a cylindrical appearance. The larvae are pinkish, brownish or reddish, and covered with rows of rather coarse hair, each springing from a dark spot. These larvae rest during the day in a small web sack, and feed during the night at the surface of the soil or on the roots of our lawn and meadow grasses. Where sod land is used for corn it may become badly infested, thus necessitating the replanting of the crop.

SOUTHERN CORN ROOT WORM
(*Diabrotica 12-punctata*, Oliv.)

The adult of this worm is a beetle about one-fourth of an inch in length. The ground color is yellowish green, the wing covers marked with twelve black dots (see Fig. 28). The larva is slender, soft-bodied, smooth and cylindrical; the head is short, rounded and brownish.

The adult feeds upon the flower and fruit of the cucumber, melon and similar plants. The larvae do considerable damage to

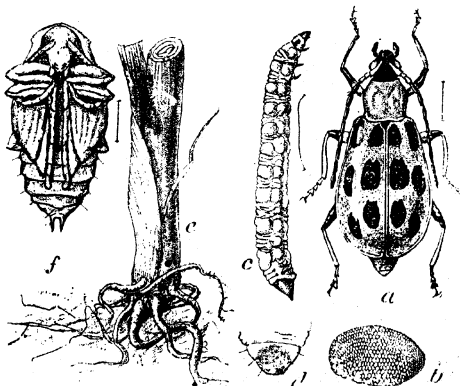


Figure 28.—Southern Corn Root Worm. a, beetle; b, egg; c, root worm; d, anal end of same, dorsal view; e, exit holes of worm in young plant; f, pupa. (From U. S. Bureau of Entomology.)

corn by feeding on the roots. They also infest the roots of the cucurbits and other plants.

Infestation often continues from early spring until August, the larvae bore into and through the root, thus weakening the stalk, and sometimes entirely killing it.

Remedies.—Rotation of crops, by avoiding the cucurbit group. Deep fall plowing should be done where the adult beetle is present. When the larvae are present in the roots of the plants there is no good way of eliminating them without destroying the plants. The adults may be controlled to a marked extent by using remedies advised in Nos. 1, 4 and 6, pages 6 and 7.

WHITE GRUBS

While there are several fairly distinct species of insects included in this group, their relation to the subject matter of this bulletin is such that they may all be classed under the general head of white grubs. The adult of the white grubs include our

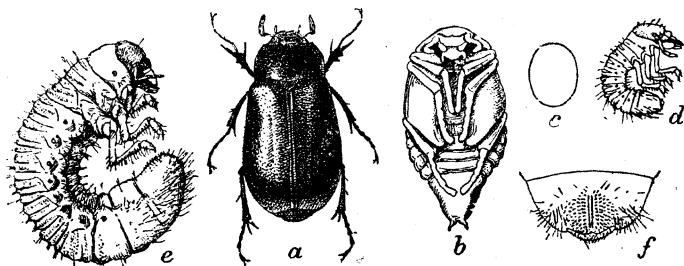


Figure 29.—White Grub. *a*, beetle; *b*, pupa; *c*, egg; *d*, newly hatched grub; *e*, mature grub. All enlarged. (From U. S. Bureau of Entomology.)

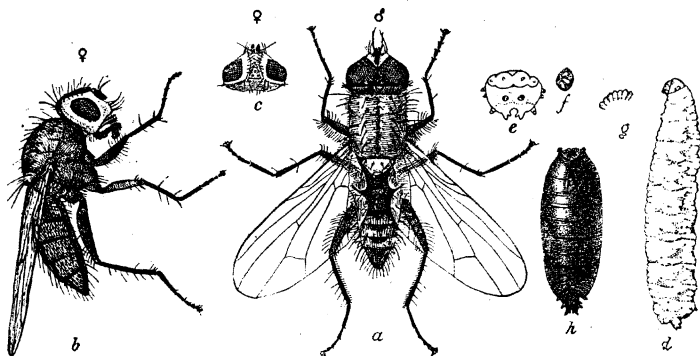


Figure 30.—Seed Corn Maggot. *a*, lateral view of female fly; *b*, dorsal view of head of female; *c*, larva or maggot; *d*, pupa. (From U. S. Bureau of Entomology.)

common May or June beetle, the green June beetle and others (see Fig. 29). The natural habitat of these insects is the grasses on the roots of which the majority of the larvae develop. They infest a wide range of staple crops, however, and when in large numbers they require special attention. The injury to sweet corn may begin as soon as the roots of the plant are large enough to prove attractive to the grubs.

Remedies.—There is no remedy to be adopted after the crop is infested. Care should be observed in the selection of land, sod land being the most liable to infestation. Early fall plowing and, where practical, the pasturing of hogs on the infested land, will lessen their numbers materially. Clean culture is of special importance.

SEED CORN MAGGOT
(*Pegomya fusciceps*, Zett.)

The seed corn maggot hatches from an egg deposited by a fly (see Fig. 30). Such seeds as corn, onion, cabbage, turnip, radish, pea, bean, beets and potatoes are often destroyed at the time of their germination or soon afterward.

The nature of its work, its life history and the remedies are similar to that of the cabbage maggot, for which see page 21.

CORN EAR WORM
(*Heliothis obsoleta*,
Haw.)

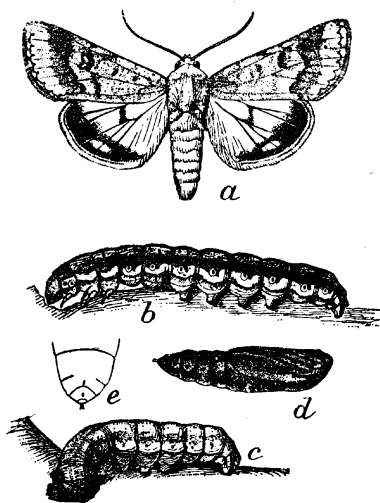


Figure 37.—Corn Ear Worm. *a*, moth; *b*, larval view of worm feeding; *c*, worm entering the ground to pupate; *d*, pupa. (From U. S. Bureau of Entomology.)

The larvae of the corn worm are termed respectively the corn worm, the cotton boll worm, the tomato worm and the tobacco worm, depending on the host it infests. The insect passes the winter as a pupa in the soil. The first adult moths emerge when early corn is about six inches high. These moths measure nearly three-fourths inch in length, with a wing expanse of nearly one and one-half inches. They vary considerably in color, but are usually some

shade of yellow with a broken darker border to the wing (see Fig. 31). These moths deposit eggs singly on both upper and lower surfaces of the leaf, on the stems, blossoms, and, in case of corn, on the silks of their host. The larvae may feed for awhile on the silk, but it is to the ear that the real characteristic injury occurs.

Remedies.—There is but little that can be done after the corn is once infested in the ear, because the insect's habits are such as to make it difficult of control by any direct application. The rotation of crops, planting of sweet corn on soil not near to or used the previous season by some crop subject to infestation is beneficial. Fall plowing is the recognized method of control, since this will bring the hibernating pupae to the surface, subject to the effect of the birds and elements.

GRASSHOPPERS

There are many species of grasshoppers in Oklahoma. They lay their eggs (see Fig. 32) in hard ground, under fences or along the borders of plowed fields and gardens, or in hay and pasture lands. The yellow-legged kind (*Melanoplus differentialis*) does more damage ordinarily, however than any other species. Sometimes one or two specimens in a greenhouse or flower window do a great deal of damage before the cause is ascertained. When a general outbreak occurs, not only gardens, but entire fields are devastated in Oklahoma. Many letters are sent to this Station requesting remedies during the late summer or fall after the broods have practically developed. It is almost too late to control any insect in a practical way after it has attained the adult stage. The conversion of badly infested fields into poultry pastures is advisable. Fall plowing of cultivated fields and spring burning of hay lands is profitable. In cases where broods are beginning to make their appearance, use Nos. 4, 5, 6, page 7, or 13, page 8

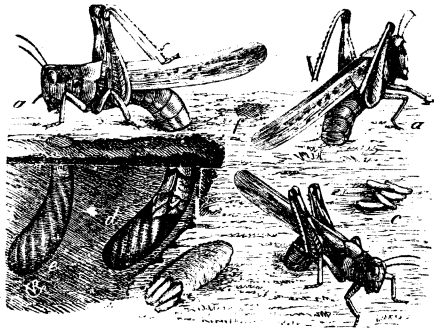


Figure 32.—Grasshoppers Laying Eggs.

The following insects also attack corn:*

Army Worm

Chinchbug

Black Blister Beetle

False Chinchbug.

*NOTE.—For remedies, consult index for each of the above insects.

Cucumber

STRIPED CUCUMBER BEETLE

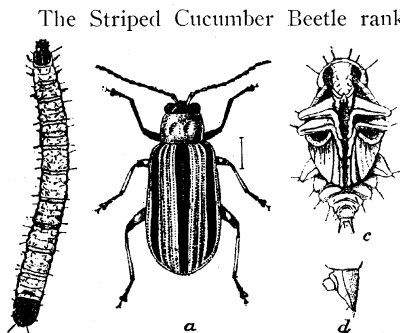
(Diabrotica vittata, Fab.)

Figure 33.—The Striped Cucumber Beetle. a, beetle; larva at the left; c, pupa. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

The Striped Cucumber Beetle ranks easily among the very worst of our garden and truck crop pests. From the time cucumber, melon and squash plants appear above ground, or even before, and until the vegetable is ready for market, they are subject to the attacks of this beetle and its larva. The injury done by this insect may be classed under three general heads: 1, The direct attack of the adult beetle above ground to the plant and fruit; 2, indirectly by the adult beetle as a transmitter of disease germs; 3, the injury done by the larva working on the roots. The adult beetles play the most havoc in the early season, attacking and often destroying many young plants of the cucurbit group. They may also carry the bacterial wilt disease, causing the plants to wither and die. They feed on the vines, stems and often seriously interfere with the sale of the fruit by disfiguring the rind. The larvae working underground may infest the roots, causing the death of the plants or so weakening them that they cannot bear fruit.

The adult beetle (see Fig. 33) measures about two-fifths of an inch in length; in color it is striped with yellow and black.

Remedies.—This is one of our insects which is very difficult to control. The direct application of arsenical sprays will aid materially in this, but can scarcely be relied upon to hold the insect in subjection when abundant.

Covering Young Plants.—Prevention of injury to young plants early in the season may be had by the use of coverings. A frame may be made of two half hoops, or of wires bent in the shape of croquet arches, set at right angles over the plant, the ends inserted in the ground. A covering of gauze having the edges covered with earth, may be placed over this. The plants need this protection only while small, and the same materials may be used year after year.

Early Planting.—Start the plants in frames or hotbeds, or plant the very early varieties, getting the plants well started before the appearance of the beetles. In this connection, delay planting the late varieties until the early appearing beetles have deposited their eggs.

Planting an Excess of Seed.—In connection with other precautionary measures, planting an excess of seed, thus distributing the injury, will offer a certain degree of relief. Planting beans in alternate rows before the time for cucumbers will give some relief; the beetles collecting here are not driven by hunger to attack the young cucurbits. A method suggested as giving good results consists in planting the hill in four patches or squares, one square each week. No. 1 is fairly sure to be taken; and should Nos. 2 and 3 also be taken, there is a reasonable chance of checking the beetle before No. 4 is reached.

Clean Culture and Crops.—Clean cultivation is a preventive that a person is almost compelled to recognize and practice in the control of this insect. As soon as the crop is gathered the plants and rubbish should be collected and buried or burned. It might be well to start a few plants late, or, if a few are desired for seed, leave these at the time the field is cleaned; the insects remaining will collect here and should be destroyed.

Driving.—In the morning, when the beetles are active, air-slaked lime dusted over the plants will help to free the vines of infestation, since the beetles are easily frightened and many are consequently driven from the fields by the application. Leave a portion of the field undisturbed by the lime treatment, which should have had a previous treatment of lead arsenate, 1 pound to 25 gallons of water, or paris green at the rate of $\frac{1}{8}$ pound to 30 gallons of water. The beetles will collect on the sprayed plants and the poison will be effective.

Wood ashes, soot or Hofstra dusted on the plants is often used with good effect.

Kerosene and turpentine, thoroughly mixed with land plaster or gypsum serves as a good repellent. The vapors from the turpentine are said to be especially distasteful.

None of these methods used singly is likely to prove entirely successful, but by combining some of them in a practical manner and repeating the application when the occasion demands will give good results.

THE RED SPIDER

(*Tetranychus bimaculatus*, Harv.)

Technically speaking, the Red Spider is not an insect. Quite frequently, especially during drouthy weather, information is re-

quested from this Station relative to methods for controlling this plant eater. It is not nearly as large as is shown in the illustration (see Fig. 34), but on account of its rapidity of reproduction often occurs in great numbers on both sides of the leaves of such plants as cucumbers and many of the greenhouse plants.

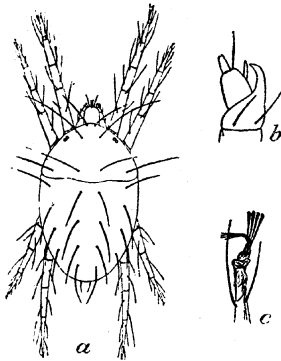


Figure 34.—The Red Spider. *a*, adult; *b*, head of same; *c*, foot. All much enlarged. (From U. S. Bureau of Entomology.)

The epidermis of the plant leaves is destroyed by the mite as it partakes of its food materials. Furthermore, the plants are partially suffocated by means of innumerable very fine webs, which are spun and attached to the leaves. In many instances such hardy plants as small evergreen trees are destroyed by this mite. For remedy use sulphur (see No. 10, page 8).

The following insects also sometimes affect the cucumber:*

Cotton Cutworms
 Imbricated Snout Beetle
 Melon Aphis
 Onion Thrips
 Southern Corn Root Worm
 Tarnished Plant Bug.

Eggplant

Eggplant is often more or less injured by some of the following insects:*

Flea Beetle
 Spinach Aphis
 Three-Lined Blister Beetle
 Tomato Worm.

Lettuce

Lettuce is commonly infested by the following insects

Greasy Cutworm
 Spinach Aphis.

*NOTE.—For remedies, consult index for each of the above insects.

Watermelon

Watermelon vines are infested by some of the following insects:*

Melon Aphis
 Striped Blister Beetle
 Striped Cucumber Beetle
 Southern Corn Root Worm
 Imbricated Snout Beetle.

Mustard

This is a hardy plant, but is sometimes infested by some of the following insects:*

Black Blister Beetle
 Cabbage Aphis
 Harlequin Bug
 Striped Garden Caterpillar.

Okra

Okra is a hardy plant, but it is sometimes infested with some of the following insects:*

Green Soldier Bug
 Melon Aphis
 Spinach Aphis
 Sharpshooter.

Onion

ONION MAGGOT

(*Pegomya cepetorum*, Meade.)

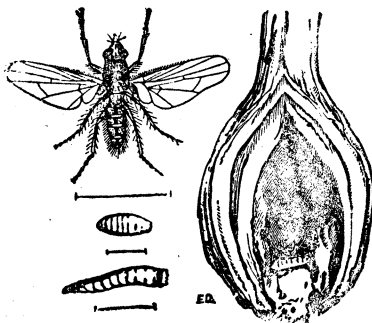


Figure 35.—Onion Maggot. Upper figure, adult fly; middle figure, pupa; lower figure, larva or maggot. Figure at right, infested onion, showing maggot in center near base. (After Riley.)

The Onion Maggot (see Fig. 35) is similar in habit and appearance to the cabbage maggot. This pest is not yet known to be serious in Oklahoma, and if clean culture is followed by the truck and garden growers, the probability of its destructiveness will be largely prohibited.

For remedies see same as for cabbage maggot page 21.

*NOTE.—For remedies, consult index for each of the above insects.

ONION THRIPS
(*Thrips tobaci*, Lind.)

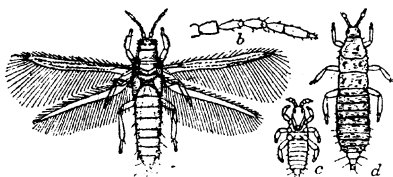


Figure 36.—Onion Thrips. *a*, adult; *b*, antennae or feeler of same; *c*, ventral view of nymph; *d*, dorsal view of full grown nymph. All enlarged. (From Dr. L. O. Howard, Chief of U. S. Bureau of Entomology.)

The Onion Thrips (see Fig. 36) are very small, the adult forms being about one-twentieth of an inch in length. They are pale yellow in color, except the thorax and fringe of the wings, which are slightly darker. These insects feed on a wide variety of our cultivated plants, such as onion, cabbage, parsley, melon, cucumber, squash, turnip, cauliflower and strawberry, attacking the flowers and the leaf surface of their host. Their presence is usually discovered by the wilting or yellow discoloration of the infested plants.

Remedies.—A 10% kerosene emulsion may be used. (See No. 7, page 7.)

Fumigation must sometimes be resorted to for such plants as the cucumber and melon. Greenhouse infestations are often best treated by fumigating with tobacco fumigants such as Niko Fume, Tobakine, etc. (See No. 16, page 9.)

The following insects also infest the onion:*

Imbricated Snout Beetle
Seed Corn Maggot.

Parsley

Generally free from insects, but is sometimes infested by the onion thrips. For remedy see No. 16, page 9.

Cowpea

COWPEA POD WEEVIL
(*Chalcodermus aeneus*, Boh.)

This insect is often mistaken for the boll weevil on account of its shape and size. It can be easily distinguished, however, from the latter on account of its darker color, and especially by its punctured appearance (see Fig. 37). The natural food plant of this weevil is the cowpea, although it sometimes attacks beans.

*NOTE.—For remedies, consult index for each of the above insects.

It evidently hibernates in the adult stage, since the mature forms are noticed in the spring as soon as the peas and beans have germinated.

Remedies.—During the early part of the summer many of the hibernating adults may be killed by the application of lead arsen-

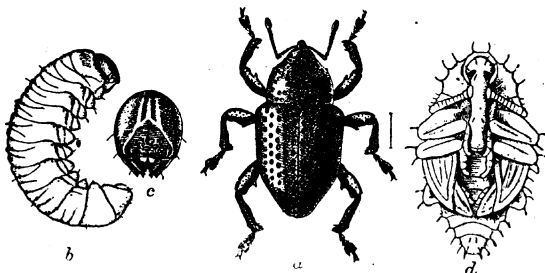


Figure 37.—Cowpea Pod Weevil. *a*, adult weevil; *b*, larva; *c*, head of same; *d*, pupa. All about five times enlarged except *c*, which is more enlarged. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

ate sprayed on the vines at the rate of 1 pound to 25 gallons of water, since at that season of the year they subsist on the foliage. After the bean and pea pods begin forming, applications of arsenate should be stopped, especially on beans which are to be used as string beans.

COWPEA WEEVIL

(*Bruchus chinensis*, Linn.)

The Cowpea Weevil is an especial enemy of the cowpea in

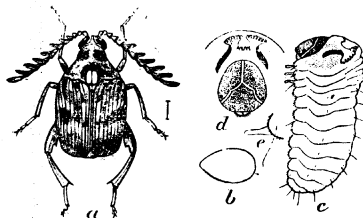


Figure 38.—Cowpea Weevil. *a*, adult male; *b*, egg; *c*, post-embryonic larva; *d*, front view of head of same; *e*, thoracic leg of same; *a* much enlarged, *b-e* more enlarged. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

this State and southward. The insect injures the seed in the same manner as the common bean weevil, and, like that species, it begins work in the field and continues operating in the stored seed until the latter is ruined as food for stock, and its germinating powers are destroyed or seriously injured.

The ground color of the beetle is dull red, variegated with yellow and gray, soft, short hairs. It may be distinguished from the similar species by the strongly scalloped or comb-like antennae of the male and the elevated white lobes at the base of the thorax. (See Fig. 38.)

Remedies.—Fumigation or application of heat. (See Nos. 8, 9 and 14, pages 7 and 8.)

GREEN SOLDIER BUG
(*Nezara hilaris*, Say.)

The Green Soldier Bug (see Fig. 39) is about the same size as the harlequin cabbage bug and injures plants in the same way; that is, by sucking their sap. The females deposit many eggs in clusters, generally on the under side of the leaves of the plants

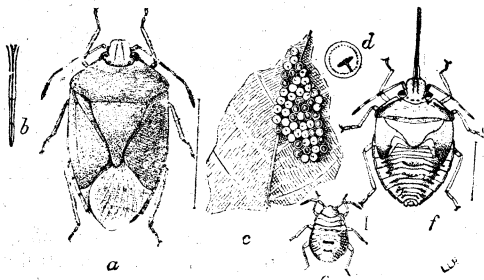


Figure 39.—Green Soldier Bug. *a*, adult; *b*, beak or piercing mouth part of same; *c*, eggs; *d*, single egg; *e*, young nymph; *f*, last stage of nymph; all enlarged. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

infested. At the time of hatching the eggs are of a vermilion color. The nymphs which hatch from the eggs are almost black, but as they grow their color changes until finally it becomes green in the adult stage. About three broods occur in a single season, and oftentimes do serious damage in the fall of the year, especially further south, to such crops as late potatoes. When numerous they will attack all garden crops, possibly except sweet potatoes. I have seen them attack corn in the roasting-ear by piercing the husks with their long threadlike mouth parts and sucking the milk until the ear was ruined.

Their attack on the potato or pea vine results in a wilting of that part beyond the base from where they puncture it. When general outbreak of these bugs occurs it is too late to apply any known remedy.

Remedies.—Largely preventive. (See treatment advised for harlequin bug.)

The following insects also affect the cowpea:*

Bean Weevil

Boll Worm

Spotted Cutworm

Three-Lined Blister Beetle.

*NOTE.—For remedies, consult index for each of the above insects.

Peas
PEA WEEVIL
(*Bruchus pisorum*, Linn.)

The injury caused by the pea weevil is similar to that of the other closely allied insects. The peas are infested by it in the field and the work of destruction continues after the seeds are stored.

This is the largest of the bean and pea weevils we have. It measures nearly one-fifth of an inch in length. The ground

color is black, covered with a brown pubescence, interwoven with white and black markings. The wing covers fail to extend to the point of the abdomen, which shows a white, hairy covering and two black spots, as shown in Fig. 40. The thorax is notched at the edge. When the pea pods are developing the adult deposits her eggs on the surface in such a manner as to cause them to become thoroughly attached thereto. As soon as the egg hatches the larva starts on its way through the pea hull to the interior of a pea (see Fig. 41) where it develops to the adult stage. It does not breed in matured peas. The best remedy is treatment of seed. (See Nos. 9 and 14, pages 7 and 8.)

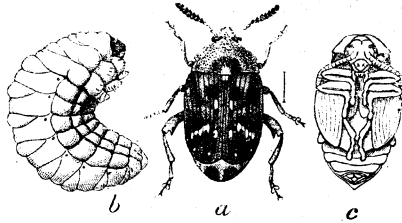


Figure 40.—Pea Weevil. *a*, adult; *b*, larva; *c*, pupa. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

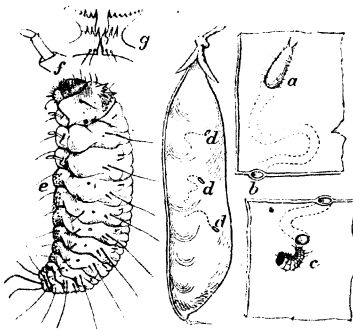


Figure 41.—Pea Weevil. *a*, egg on pod; *b*, cross-section of opening of larval mine; *c*, young larva and opening on inside of pod by which it had entered, enlarged; *d*, *d*, *d*, eggs on pod, slightly enlarged; *f*, leg of larva; *g*, prothoracic spinous processes, more enlarged. (From U. S. Bureau of Entomology.)

PEA APHIS
(*Macrosiphum pisi*, Kalt.)

Peas are sometimes attacked by numerous small insects that congregate near the more tender green parts of the vine. They are characterized by their pea-green color, long legs and feelers. Some of them have wings which are held edgewise on top of their backs (see Fig. 42). The average size is about three-sixteenths of an inch by about one-half as broad.

During the year 1900 the Atlantic States suf-

fered a loss of over \$4,000,000.00 from its effects. Such damage is largely accounted for by its remarkable reproductive powers. The progeny are born alive at the rate of about six per day until in some instances more than one hundred are produced by a single individual. The young in turn begin reproducing at the age of about ten days.

Remedies.—Since this aphid has a habit of playing “possum” to some extent when disturbed, great advantage can be taken by brushing the vines with pine or similar branches having leaves. The brushing should precede cultivation, preferably in the hot part of the day. The cultivation will then destroy by burying and dusting the fallen forms to such an extent that but few will remain after a few such treatments. (See also No. 17, page 10.)

There are several inimical insects, such as parasites and lady bugs, which are similar to those that destroy the melon aphid, for which consult the index. These, when present, should not be mistaken for the cause of the plant injury, since they do not eat vegetation, but make wholesale destruction of the pea aphids.

The following insects also infest the pea :*

Army Worm
Boll Worm
Seed Corn Maggot
Striped Blister Beetle
Imbricated Snout Beetle.

*NOTE.—For remedies, consult index for each of the above insects.

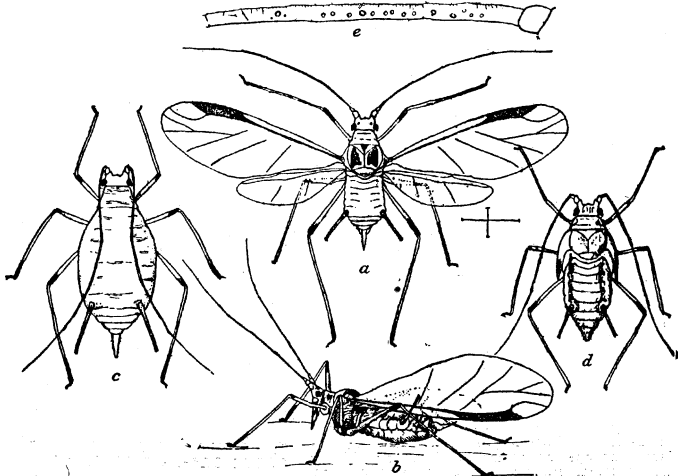


Figure 42.—Pea Aphid. *a*, winged female; *b*, same, from side, with wings folded in natural position as when feeding; *c*, apterous female; *d*, nymph in last stage; *e*, third joint of antennae of winged form; *a*, *d*, much enlarged; *e*, more enlarged. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

Pepper

Pepper plants are sometimes infested by the spinach aphid. (Consult the index for this insect; use remedy No. 17, page 10.)

Potato

POTATO STALK WEEVIL

(*Trichobaris trinotata*, Say.)

The Potato Stalk Weevil (see Fig. 43) has been known to do

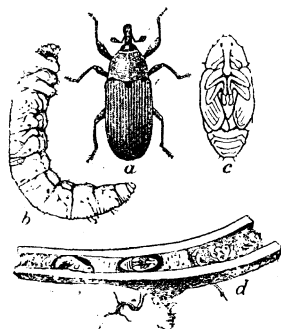


Figure 43.—The Potato Stalk Weevil. *a*, beetle; *b*, larva, from side; *c*, pupa; *d*, section of potato stalk opened to show larva and pupa in situ; *a*, *b*, *c*, enlarged five times; *d*, natural size. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

considerable damage to early potatoes by developing in the vines. The adult beetle is an ash-gray colored, black-headed, snouted weevil, with three small black spots on its back near the base of its wings. It is about one-sixth of an inch long by one-twelfth wide. The adult feeds to some extent on the foliage of the plants, but the main injury is done by the developing larva, which hatches in about a week or ten days from an egg deposited either in the stalks or branches, but usually the former. As the larva develops it eats its way tunneling downward to the root, then it reverses its position and enlarges the tunnel as it returns upward. When the larva has attained its full

growth it constructs a pupal cell from its castings and from fibers shredded from the stalk. Transformation to the adult stage is accomplished in from about eight to eleven days.

Being well protected, the adult does not issue at once, but remains in the stalk until the following spring. The effect to the green potato vine is quite noticeable on account of the wilting and blighted condition brought about by the developing larva. Early potatoes are more seriously affected than late ones. Since the insect is not easily noticed, the cause of injury is many times mistaken for blight or drouth.

Remedies.—The first advantage to be taken of this stalk weevil consists in not allowing weeds closely related to the potato to grow. Such plants are horsetettle, jimson weed and ground cherry. The second step is to pull the vines when they show signs of wilting. If dried before the larva develops, it will be destroyed.

COLORADO POTATO BEETLE

(Leptinotarsa decemlineata, Say.)

The Colorado Potato Beetle is, perhaps, one of the best known of our garden pests. The accompanying cut (see Fig. 44) will serve as a description of the insect development and work. The preferred food of this insect is the potato, and it shows a decided preference for the tender-leaved varieties. The tomato and a few other plants are sometimes infested.



Figure 44.—Colorado Potato Beetle. *a*, adult; *b*, eggs; *c*, young larva; *d*, full grown larva. (From Riley.)

Remedies.—Jarring and brushing are old methods, and of some avail in the early season, but cannot be depended on to control the insect. Fall and winter plowing, while of value in controlling other insects, is of but little value with this beetle as it is too hardy to be easily affected in such a manner.

The arsenicals are the recognized means of control. The very best mixture for this insect is the arsenate of lead spray, which consists of 1 pound of arsenate of lead to 25 gallons of water.

Other insects which sometimes affect the potato are the following:*

- Black Blister Beetle
- Cotton Cutworm
- Garden Flea Beetle
- Gray Blister Beetle
- Greasy Cutworm
- Green Soldier Bug
- Seed Corn Maggot
- Spinach Aphis
- Striped Blister Beetle
- Tarnished Plant Bug
- Three-Lined Blister Beetle.

Potato—Sweet

The sweet potato is a hardy plant and only occasionally is it infested by insects. The following sometimes affect it:*

- Three-Lined Blister Beetle
- Imbricated Snout Beetle.

Pumpkin

The pumpkin is a hardy plant. It is, however, sometimes infested by the following insects:*

- Squash Bug
- Garden Flea Hopper
- Melon Aphis.

Radish

The radish is sometimes affected by some of the following insects:*

- Striped Blister Beetle
- Cabbage Aphis
- Seed Corn Maggot
- Imbricated Snout Beetle
- Striped Garden Caterpillar
- Cabbage Maggot.

*NOTE.—For remedies, consult index for each of the above insects.

Rape

This is a hardy plant, but is sometimes infested with some of the following insects:*

Cabbage Aphis
Harlequin Cabbage Bug
Spinach Aphis
Striped Garden Caterpillar.

Rhubarb

RHUBARB CURCULIO
(*Lixus concavus*, Say.)

This curculio injures the rhubarb by puncturing the stalks and stems with its beak, causing them to exude a gum. The larvae breed in weeds, such as the dock and sunflower.

Remedies.—The adult curculio (see Fig. 45) is so conspicuous and sluggish that it may be picked by hand. Destroy all weeds of the species mentioned about the garden. If the rhubarb is kept closely cut as for market the developing beetles in the stalks will not be able to mature.

The spotted cutworm also sometimes affects rhubarb; consult index for this insect.

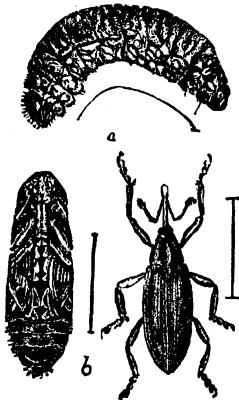


Figure 45.—Rhubarb Beetle.
a, larva; b, pupa. (From Webster.)

Rose

ROSE CHAFER

(*Macrodactylus subspinosus*, Fab.)

As the name implies, this insect is destructive to roses. It does not limit its attack to roses, however, since there seems to be but few plants which it will not attack. The adult bugs (see Fig. 46) are long-legged, light yellowish brown colored and nearly half an inch long. They generally make their appearance at about the time the grapes and the roses blossom, and their disappearance is from four to six weeks later. During their presence they are very destructive to foliage in general. The females often enter the soil where they lay little white colored eggs, scattered about from a few to several inches below the surface.

The eggs soon hatch into little white grubs which eat the roots of plants and grasses. The grubs continue to develop until fall, then they burrow deeply into the soil, where they pass the winter.

*NOTE.—For remedies, consult index for each of the above insects.

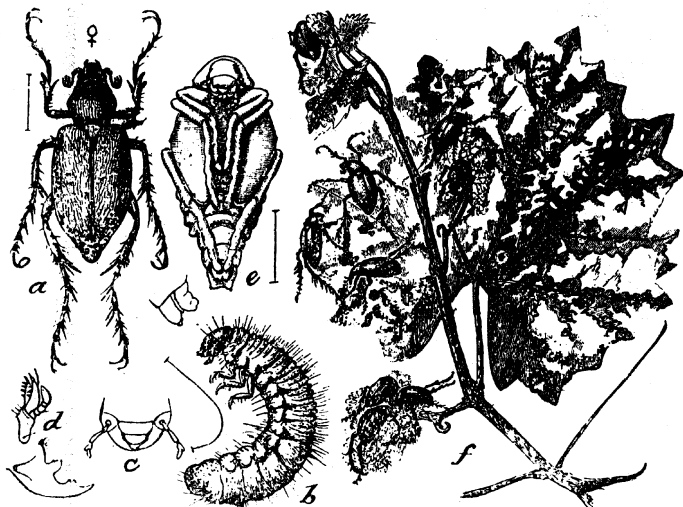


Figure 46.—Rose Chafer. *a*, adult Chafer; *b*, larva; *c*, *d*, mouth parts; *e*, pupa; *f*, Chafers at work on grape foliage. (From U. S. Bureau of Entomology.)

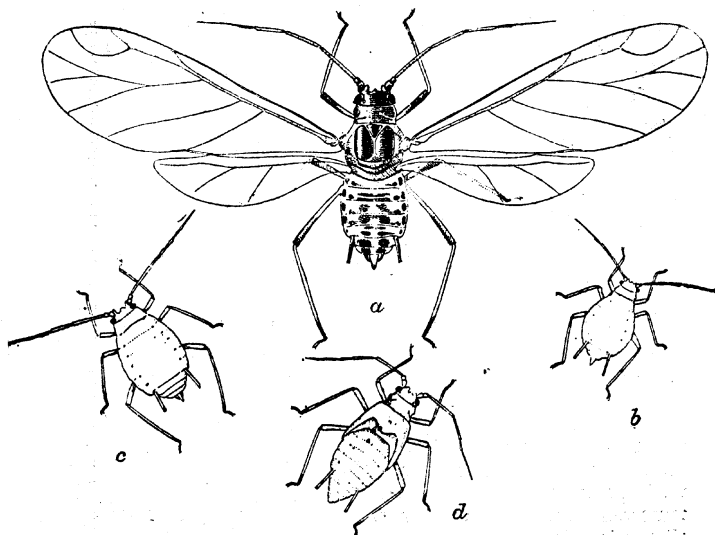


Figure 47.—Spinach Aphis. *a*, Winged adult; *b*, young nymph; *c*, older nymph; *d*, last stage of nymph or pupa; all greatly enlarged. (From U. S. Bureau of Entomology.)

The following spring they tunnel near the surface, where they transform to the adult stage, which later appears as previously stated.

Remedies.—Many remedies for controlling this bug have been suggested and tried, but none has yet been found that is more satisfactory than hand-picking. When the adults oviposit among the roots of perennials it is almost impossible to check the development of such a brood by cultivation, when oviposition occurs in the open field, however, the brood may be checked to a marked extent by ordinary cultivation and deep fall plowing. When oviposition occurs in corn fields and gardens, as it sometimes does, the developing brood can almost be annihilated by cultivation and early fall plowing. The developing fruit of grape vines can be bagged so that it will escape injury. Bagging is an old remedy for the rot, and consists in covering the developing bunches with small paper sacks with the top tied together around the stem at the base of the bunch.

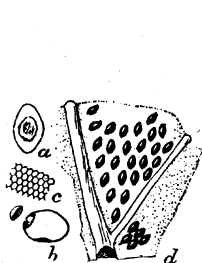


Figure 48 a.—Eggs of Squash Bug. Eggs on under side of leaf.

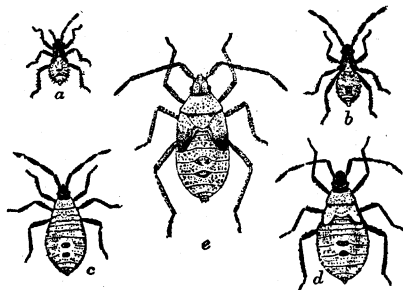


Figure 48 b.—Nymphs a-c, stages of development.

Spinach

SPINACH APHIS

(*Myzus persicae*, Sulz.)

The Spinach Aphis (see Fig. 47), is similar to the cabbage aphid in appearance with a few exceptions, the main difference being that the former is not protected by the powdery or pulverulent coating that is characteristic of the latter. In addition to spinach, it attacks cabbage, celery, lettuce, eggplant, mustard, potatoes, turnips, peppers, tomatoes, and, in fact, nearly all similar plants,

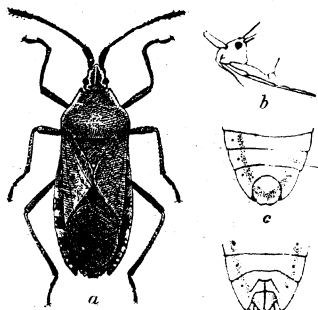


Figure 48c.—a. Adult Squash Bug. b. lateral view of head, showing beak (Figures 48 a-b-e, from U. S. Bureau of Entomology.)

This aphid is both one of the last to disappear and one of the first to appear each year. For this reason hotbed and greenhouse-grown plants are among those receiving the greatest injury from it. Dr. Chittenden of the U. S. Bureau of Entomology estimated a season's loss from this insect in a single locality in Virginia as \$750,000.00. From this estimate it is somewhat obvious that the pest is difficult to control.

Remedies.—Plants infested in greenhouses and hotbeds or cold frames should not be transplanted to open field without previous treatment. Fumigation with the common fumigant known as carbon bisulphide should not be made owing to the tenderness of the young plants. Niko-Fume Tobacco Paper, Aphid Punk, Tobakine, or tobacco leaves should be used by burning so as to create such a smudge as to kill the aphids. Sprays, in this particular instance, should not be used, since it is almost impossible to destroy every aphid by even a careful application. Furthermore, the plants being young and delicate, will be weakened by such an application as will destroy the insects. Later the hardier plants in the open field can be treated with No. 17, page 10.

If effectually controlled in the cold frames, earlier in the season, there will be but little possibility later of serious outbreak in the open field if the latter has been properly cultivated the preceding year. If the pest does occur in the open field on spinach and lettuce, it will ordinarily run its course, the length of time for which depends on the occurrence of its inimical insects, such as parasites, syrphus flies and lady bugs. (Fig. 21.)

Squash

THE SQUASH BUG (*Anasa tristis*, DeG.)

The common squash bug, or stink bug (Fig. 48), with its offensive odor, dirty brown coloration and destructive habits, is too well known to require any description. This insect may attack its host from the time of germination until the fruit is mature. It does not confine its depredations to the squash, but attacks many of the allied plants. The injury it causes the infested host is not confined to the piercing of the tissue and the extraction of the plant juices, but there is a little liquid injected by the insect at the time of puncturing the tissue which has a poisonous effect, causing the cells about the puncture to die; and, in the case of a young plant, a few punctures may cause its death.

Remedies.—The insect sucks its food, therefore, arsenical poisons are of no avail. It resembles the harlequin cabbage bug in that it is very resistant to insecticides. A chemical strong enough to affect the mature bugs will injure the plants.

The bugs tend to collect under shelters during the night. Advantage may be taken of this habit; and shingles, pieces of board or similar material placed at intervals about the field will act as traps. These should be examined in the early morning and the collected insects destroyed.

The remedies recommended for the harlequin cabbage bug (see page 24) and the striped cucumber beetle (see page 36) may be used to an advantage here. Clean culture, vigorous, healthy growth and an abundance of seed are all precautionary measures that pay well. Gather and destroy the vines as soon as the crop is harvested.

SQUASH VINE BORER
(*Melittia satyriniformis*, Hbn.)

The squash vines are often found infested with the larva of this insect. The eggs of the first brood are deposited in early spring on the vine near the base of the plant. The larvae enter near the crown and bore the vine. As they increase in size and their canal becomes larger, decay sets in and the vine weakens and dies. The adult borer measures one and one-half inches in length, is soft, somewhat flattened, and has ten distinct segments. The adult moth is a very showy creature (see Fig. 49), with tints of olive, orange and brown.

Remedies.—Plow in the fall and harrow deeply in the spring. Practice crop rotation, avoiding the cucurbit group until the pest is starved out. Encourage the growth of secondary roots by

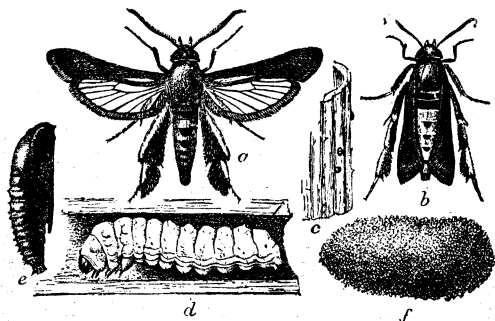


Figure 49.—Squash Vine Borer. a, b, male and female moth; c, eggs on section of squash vine; d, borer in vine; e, pupa; f, pupal case. (From U. S. Bureau of Entomology.)

covering the vines at the joints with earth. Keep the vines in a thrifty growing condition by intensive cultivation, and remove and destroy the vines when the crop is gathered. The borers

should be cut out of infested vines whenever they can be located before the vine is killed. In removing a borer, split the vine lengthwise instead of cutting transversely.

The following insects also affect the squash:*

False Chinchbug
Imbricated Snout Beetle
Onion Thrips
Striped Cucumber Beetle
Three-Lined Blister Beetle.

Strawberry

STRAWBERRY APHIS
(*Aphis forbesi*, Weed.)

Sometimes ants will be noticed near strawberry crowns moving about in a busy manner. A careful observation will reveal the fact that numerous small, dark colored plant lice may be on any part of the plant, especially on the under parts or on the roots in the soil.

The ants care for and protect them to a remarkable extent; in fact, the ants act the part of dairymaids. They reverse the feeding operation to some extent, however, since, instead of carrying the feed to the "cow" they often carry the cow to the feed. The feed for these cows is the sap from the strawberry plants, and the milk is the honeydew from the aphids.

These aphids are similar to and multiply at about the same rate as the melon louse (see Fig. 20), and often become very injurious to strawberry beds.

Remedies.—When the infestation is starting, or when only a small percentage of the vines are infested, seek out the latter and mark them by sticking a small pole or other convenient marker near the place. Prepare a solution of potassium cyanide by dissolving 1 ounce in a gallon of water. Saturate the colonies of ants and aphids with this and it will kill them. This solution will also kill vegetation, and must be used with care.

If the infestation is severe, rotation of crops should be resorted to. Any other crop will do for starving out the infestation. No strawberry vines should be allowed to grow near the infested area during the year of crop rotation.

The following insects also infest the strawberry:*

Army Worm
Onion Thrips.

*NOTE.—For remedies, consult index for each of the above insects.

Tomato

TOMATO WORMS

*(Phlegethontius sexta, Joh.)**(Phlegethonitus quinque maculata, Haw.)*

These worms are so much alike in general markings, life history and habits that they are treated here together. Their favorite food plant is tobacco, but they are by no means uncommon on the tomato, eggplant and occasionally the potato. The larvae are very conspicuous, and when nearly grown are of a light green color with broad bands of white on the sides, and a peculiar hornlike projection on the anal end. This spine is not poisonous and is not used as a means of defense (see Fig. 50). When dis-

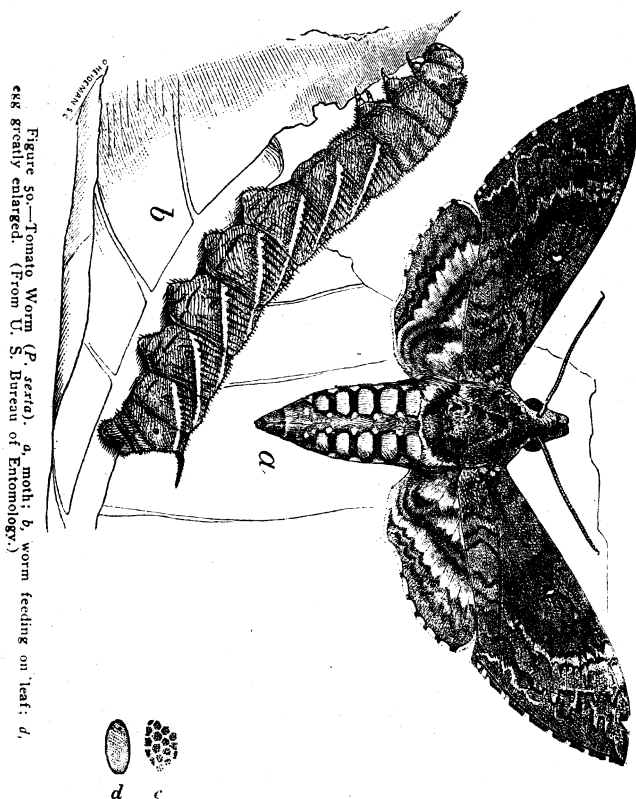


Figure 50.—Tomato Worm (*P. sexta*). a, moth; b, worm feeding on leaf; c, egg greatly enlarged. (From U. S. Bureau of Entomology.)

turbed they often rear themselves in an attitude of mock defiance. This has gained for them the name Sphinx caterpillar. These insects pass the winter in the soil as curious brown pupae with a handle-shaped process issuing from the top of the head and bending down to the side of the pupal case. This appendage has caused it to be named "jug-handle pupa". The adults are known as hawk or hummingbird moths. They fly principally at dusk, feeding on the nectar of those flowers possessing a long, tubular corolla, such as the honeysuckle, moon vine, trumpet vine, jimson weed and morning glory. They reach the nectar by means of a long, coiled sucking tube. These moths appear from late May until June, the time depending on the season. They pair and deposit eggs singly on the under side of the leaves. These eggs are spherical, smooth, yellowish green, and about one-twentieth of an inch in diameter. They hatch in from four to eight days, and the young larvae feed voraciously on the leaves of their host, attaining maturity in about a month, when they enter the soil to pupate.

Remedies.—These larvae are attacked by a number of natural enemies and are subject to bacterial diseases. Hand-picking is effective. Spraying with paris green (see Nos. 5 and 6) is also effective, but caution must be used in spraying tomatoes that are about ready for market.

The tomato worm (*Heliothis obsoleta*) may prove a serious pest where tomatoes are grown on a commercial scale. For general description of this insect consult the index for the corn ear worm.

Remedies.—Avoid planting tomatoes on soil previously planted to corn, cotton or cowpeas, or too near fields of the same. An advantage may be taken of the insect's preference for corn and cowpeas, and a few rows of these planted as a trap crop at varying dates through the field. When these plants become infested the corn should be thoroughly cultivated in order to kill the pupae in the soil, and the cowpeas should be thoroughly poisoned with paris green at the rate of about 2 pounds per acre.

For general preventive measures consult the index for the corn ear worm.

The tomato is also infested by the following insects:*

- Black Blister Beetle
- Colorado Potato Beetle
- Cotton Cutworm
- Gray Blister Beetle
- Greasy Cutworm
- Imbricated Snout Beetle
- Spotted Cutworm
- Striped Blister Beetle.

*NOTE.—For remedies, consult index for each of the above insects.

Turnip

THE STRIPED TURNIP FLEA BEETLE

(Phyllotreta vittata, Fab.)

This is said to be the most injurious of any flea beetle known to our cruciferous crops. The adult is black with two irregular broad, yellow lines on its back (see Fig. 51).

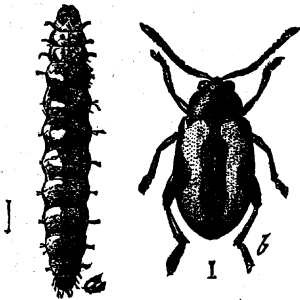


Figure 51.—Striped Turnip Flea Beetle. *a*, larva; *b*, adult. (From Riley, U. S. Department of Agriculture.)

Remedies.—Since the cabbage worms are generally among the first to be treated on cruciferous plants, it follows that other such insects as this one are also largely prevented from doing injury by the same treatment as given for the former. If, however, the flea beetles are not controlled by previous applications, a Bordeaux mixture should be added (see No. 3, page 6).

The following insects also attack turnips:*

- Cabbage Aphis
- Cabbage Maggot
- Onion Thrips
- Seed Corn Maggot
- Spinach Aphis
- Spotted Cutworm
- Striped Garden Caterpillar
- Tarnished Plant Bug.

THE FALSE CHINCHBUG
(Nysius angustatus, Uhl.)

The False Chinchbug (see Fig. 52) is very similar in appearance to the ordinary chinchbug. It is quite omniverous, however, in food habits as compared with the common chinchbug. I have seen them at work beneath the surface of the soil destroying

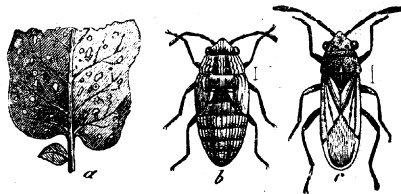


Figure 52.—False Chinch Bug. *a*, part of small leaf of potato, showing punctures of the bug; *b*, last stage of nymph; *c*, adult—*a*, natural size; *b*, *c*, much enlarged. (After Riley, U. S. Bureau of Entomology.)

*NOTE.—For remedies, consult index for each of the above insects.

germinating squashes, watermelons, cucumbers, cotton and corn. Their principal injury, however, is effected on such cruciferous plants as mustard, cabbage and turnips. When an outbreak of this bug occurs there generally results considerable damage from it, because they appear in great numbers, and seclude themselves beneath the plants where they pass unnoticed until much harm is done. Although this insect has been more or less pestiferous for many years, its life history is not well known. The present known remedies of control are not satisfactory. A suggested remedy is the kerosene emulsion or Black Leaf 40. (See Nos. 7 and 17, pages 7 and 10.)

Miscellaneous

ANTS

Gardens are sometimes infested with troublesome ants. No

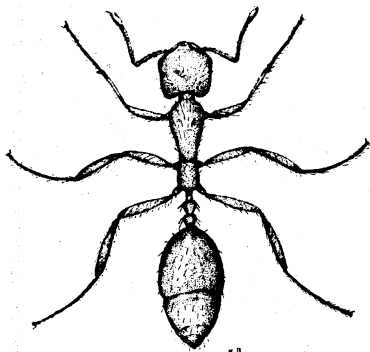


Figure 53.—Ant (*Monomorium minutum*, Mayr.), greatly enlarged. (From Dr. S. J. Hunter, University of Kansas.)

matter what species it may be (see Fig. 53) they can be readily controlled if the main nest can be found. In cases where difficulty is experienced in locating the main nest, a person should use a bait such as a small piece of meat, or a sweet substance, such as honey or sugar, which may be placed where the stray ants are noticed; within an hour or two examine the bait for the marauders; when they find it they will often form in a regular single file procession from their nest entrance to the bait.

The nest can then be easily located by this activity of the ants.

Remedies.—Dissolve 1 ounce of potassium cyanide in 1 gallon of water and saturate the nest entrance thoroughly with this solution. One treatment for a nest is generally sufficient if the main colony is near the surface, but if deep down in the ground a second application is often necessary within a week or ten days after the surviving forms have had time to make a new exit.

THE WHITE ANT

(*Termes flavipes*, Koll.)

Oftentimes garden plants will wilt and die without apparent

cause. If, however, the roots are examined, they may be found partially or wholly eaten, while a small subterranean passage containing small, white, antlike insects (see Fig. 54) will be found where the root is damaged. White grubs often do similar injury, but a careful search will reveal the cause, so that proper remedies may be applied.

Gardens where pieces of decaying timber lie partially or wholly buried are often most seriously infested. Other infested fields generally contain large decaying weed stalks because in them the white ants also seek protection.

Remedies.—Remove and burn the decaying pieces of wood and large weed stalks. When the nests are found, dope them with a liquid solution of potassium cyanide about 1 ounce to a gallon of water.

When colonies cannot be located, traps should be made by partly burying a few pieces of decaying wood near the tunnels.

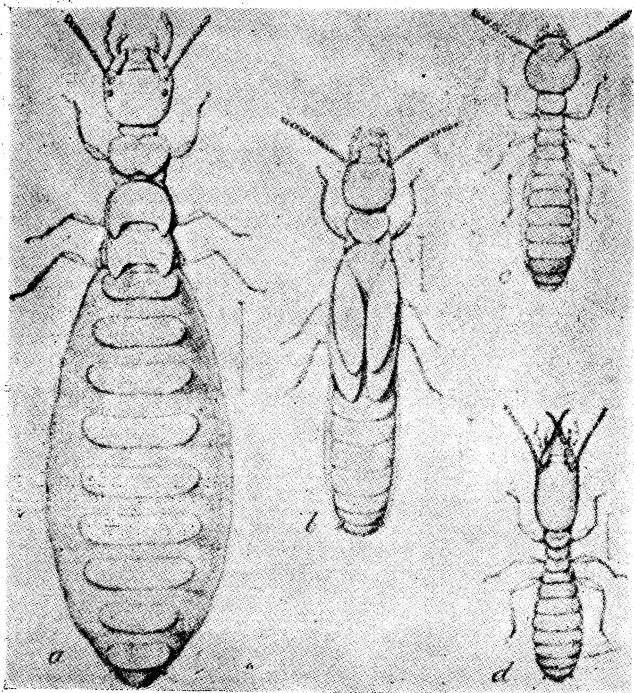


Figure 54.—“White Ants”. a, queen; b, nymph of winged female; c, worker; d, soldier; all enlarged. (From Dr. C. L. Marlatt, U. S. Bureau of Entomology.)

This will attract them for nesting purposes, and when they move to such a trap they can be treated with hot water, or with cyanide solution, or, preferably, with fire.

ARMY WORM

(*Leucania unipuncta*, Haw.)

The genuine Army Worm sometimes appears gregariously in great numbers, the significance of which is often primarily brought to our attention by its rapid destruction to vegetation; and secondarily, by its movement or dispersion in search of food. This peculiar dispersion of so many worms at the same time and generally in the same direction has caused them to be named army worms.

There are four or five other worms which have similar habits and are also called army worms. None of these, however, has been as injurious as the genuine army worm. (See Fig. 55.)

The chief method of dissemination is not by the caterpillar, as might be supposed, but by flight of the moth, which is near the ground, the movement being swift, jerky and darting. The length of the adult stage during the summer is from two to three weeks, because at the end of this time the adults have completed their oviposition.

Each female moth lays from 500 to 800 eggs in clusters of about twenty, each on the upper surface near the basal end of the grass blades. Each cluster is held in place and partially concealed by the protecting edges of the grass blades, which, with the eggs, is held together by an adhesive fluid secreted by the female at the time of oviposition.

Within a few days the eggs hatch into dull, reddish-brown worms marked with yellow and black longitudinal stripes. These

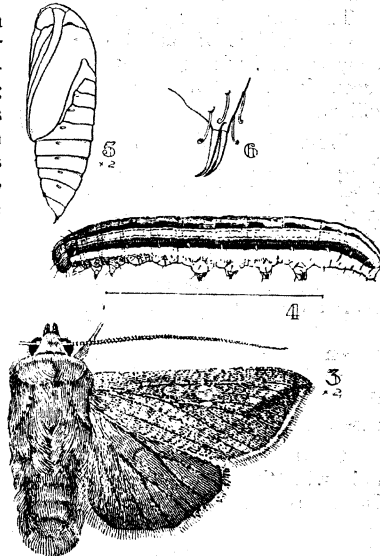


Figure 55.—Army Worm. 3, adult; 4, larva; 5, pupa; 6, caudal end of pupa. (From O. H. Swezey.)

larvae, of which there are about three broods per year, are quite closely related to cutworms in general appearance and habit. They can be distinguished, however, by their much more distinct striped markings, which range in color from light greenish yellow to greenish black and black.

When full grown, which is at the age of four or five weeks, the larvae disappear by entering the ground to a depth of one or two inches, where they transform to the adult, which requires about two weeks.

The adult moth is yellowish-brown in color with a white speck near the middle of each fore wing. During the adult stage the army worm feeds on the nectar of clover, apple, honeysuckle and yucca blossoms; but while it is in the immature or larval stage, it will eat any green plant except potato, pumpkin, grape and cotton.

Prevention and Remedy.—Prevention lies mostly in clean farming. Remnants of old hay stacks, straw stacks, fodder shocks and scattered pieces of fodder are frequently oviposited in during the early spring. The elimination of such accumulations by plowing under deeply or by burning them before the insects emerge from hibernating quarters is very important.

The best arsenical remedy to use after the worms have appeared is the poisoned bran mash. (See No. 13, page 8.) In sowing, cause it to lodge on the ground instead of on the foliage. When the worms come from their hiding places, which time is mostly at night or on cool, cloudy days, they will first begin eating that which is nearest and most attractive to them, and in this case the result is poison on an empty stomach.

Caution.—Such an application has a far-reaching effect; not only will other worms and bugs be affected, but, unless due care is exercised, chickens, pigs or other stock may be poisoned.

BLISTER BEETLES

The Blister Beetle has a very curious and interesting life history. During its immature or larval existence it lives in the ground after much the same fashion as the white grubs, except that it has quite a different food habit. The one redeeming feature of the blister beetle is that it develops to its adult stage on the eggs of such other injurious forms of insects as grasshoppers. Thousands of eggs are laid by some species on flowers or on the ground; and generally a good grasshopper year is followed by a horde of blister beetles, originating from a comparatively small number of the preced-



Figure 56.—Black Blister Beetle. (From U. S. Bureau of Entomology.)

ing year on account of their remarkable reproductive powers and plenty of grasshopper eggs on which to develop.

Remedies.—The old remedy of applying paris green is often advised and is in some instances good. The application must necessarily depend upon conditions. If the beetles are appearing sporadically on potatoes or similar vines, such a remedy might be safely applied in the dry form at the rate of 1 pound mixed with 10 to 20 pounds of hydrated lime or similar diluent. Where the insects are bunched together, especially early in the morning, a spray of gasoline is good. When they are numerous, but wild, (that is, flee from a person on being disturbed), it is well to take advantage of their timidity and drive them under the cover of a windrow of hay or straw, previously prepared on the leeward side of the field, where they can be easily destroyed by burning the windrow.

BLACK BLISTER BEETLE

(*Epicauta pennsylvanica*, DeG.)

The Black Blister Beetle (see Fig. 56) is sometimes known as the "aster bug". It is black and from about a fourth to half an inch long. About the time goldenrod begins to blossom this species appears and exemplifies itself as having a hearty appetite, being fond, not only of such flowering plants as asters and goldenrod, but also of such vegetables as potato, beet, carrot, bean, cabbage, corn, mustard and ripe tomatoes.

For *remedies* see Blister Beetles.

GRAY BLISTER BEETLE

(*Epicauta cinerac*, Forst.)

This species is of a uniform gray color, and a little over half

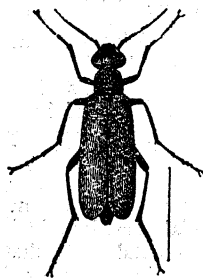


Figure 57.—Gray Blister Beetle. (From U. S. Bureau of Entomology.)

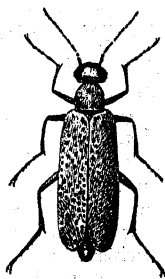


Figure 58.—The Spotted Blister Beetle, much enlarged. (U. S. Bureau of Entomology.)



Figure 59.—Striped Blister Beetle. (From U. S. Bureau of Entomology.)

an inch long (see Fig. 57). It appears late in the season and does considerable damage to ripe tomatoes. It is also a serious enemy to potatoes, beets and beans.

For *remedy* see Blister Beetles.

SPOTTED BLISTER BEETLE

(*Epicauta maculata*, Say.)

This beetle has small black spots which show through the short, fine, gray hairs with which the elytra or wing covers are covered (see Fig. 58). It is a little more than half an inch long. Besides having a fondness for beet tops, it sometimes attacks legumes.

For *remedy* see Blister Beetles.

STRIPED BLISTER BEETLE

(*Epicauta vittata*, Fab.)

Some people call this insect the "potato bug". Before the advent of the Colorado potato beetle this bug ranked first in the wholesale destruction of potato vines.

It is about one-half inch long (see Fig. 59) and has two black stripes alternating with yellow on each wing-cover. Besides having a fondness for potato, it relishes turnips, radishes, beans, peas, melons, corn, clover, alfalfa and ripe tomatoes.

They often congregate in droves. I have seen two or three hundred of them, all trying to eat a single ripe tomato at the same time. During a good beetle year they often appear in droves aggregating thousands of individuals.

For *remedy* see Blister Beetles.

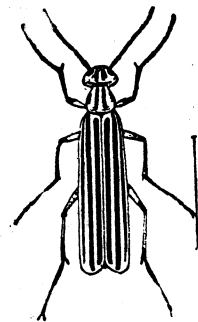


Figure 60. — Three Lined Blister Beetle. (From U. S. Bureau of Entomology.)

THREE-LINED BLISTER BEETLE

(*Epicauta lemniscauta*, Fab.)

This species has three black stripes alternating with yellow on each wing (see Fig. 60), and is nearly three-fourths of an inch long. It is extremely fond of beets and potatoes, but often being in company with many hundreds of its kind it will not refuse cabbage, potatoes, squash, alfalfa, cowpeas, tomato, sweet potato or eggplant. The writer has seen special varieties of the cowpea grown in experimental plots that were so badly infested within a few days' time that they had the appearance of having been scorched by fire.

CHINCHBUG

(Blissus leucopterus, Say.)

There is perhaps no insect capable of causing such wholesale havoc to crops in general as the chinchbug. Without doubt there is scarcely a season here but that it levies a heavy tax on our staple crops, and it is the exceptional season that reports do not come from some portion of the State of wholesale depredation. The adult insect (see Fig. 61) is very well known here, so that a general description will suffice.

It is practically black, with characteristic white wing covers. It measures some three-twentieths of an inch in length, and is about a fourth as broad as long, the sidelines from above are very straight and its ends blunt. It obtains its food by piercing the tissue with its beak and sucking the plant juices.

The insect hibernates over winter in the adult stage under debris, old boards, fence corners and old corn stalks. Its favorite winterquarters is, however, in the crowns of bunch grass; here they are found in moderate numbers every winter. They emerge in early spring and take flight to a suitable food plant, usually wheat, which is often the host for the first brood. Eggs are de-

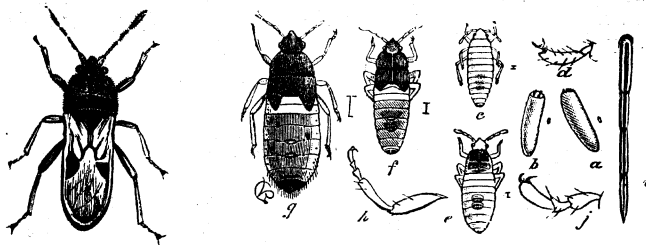


Figure 61.—Adult Chinch Bug.

Figure 62.—Stages of development. a, b, eggs, enlarged; c, eggs just hatched into young chinch bugs; e, f, first and second stages of development; g, pupal form; i, the sucking mouthpiece, enlarged.

posited about the roots and under the sheaths of the lower leaves, or even on the upper surface of the leaves. These hatch in about a month. The young nymphs appearing are a bright red, with a white band across the middle. As the insect develops it becomes a darker color. They continue to feed and grow on this plant until about harvest time, when, by the ripening of the wheat and subsequent harvesting, they are driven to seek a new field for food plants. It is at this time that the chinchbug is likely to prove of importance in the garden or corn field. There is a marked tendency on the part of the insect to crawl rather than fly. This habit may be taken advantage of in planning its control. Plow a deep furrow at right angles to their line of march. Drag

a log lengthwise up and down this furrow until a fine, deep dust mulch is prepared. The insects will find it impossible to climb the sides of the ditch as long as it remains dusty, and during hot weather will roast in the furrow. A slight shower, however, will ruin the trap. To make it more effective, postholes may be dug at convenient distances in the furrow and the insects will collect in them and can then be killed by the application of kerosene emulsion (see No. 7, page 7).

Another method is the placing of a thin strip of road oil or tar along the border of the field. Take a common watering pot, remove the sprinkling cap and pinch the end of the tubular spout so that a fine line of tar some half inch in width may be run. The first application will soak into the soil quickly, but after a few applications on hard ground one will have a barrier that will last for half a day or more. It is well to place postholes at convenient distances along this line of tar or oil for the masses of bugs to fall into. While this may appear as a considerable expense, practical tests have proved it of value in a bad chinchbug year.

The hibernating quarters offer an excellent field of attack. All rubbish and debris about the field should be buried deeply by plowing, or gathered and burned. Fence corners and hedges should not be allowed to become foul with litter. Plats or fields of bunch grass should be burned in the fall or early spring to destroy the hordes of insects which collect there.

COTTON CUTWORM
(*Prodenia ornithogalli*, Guen.)

The cotton cutworm varies considerably in general habits from

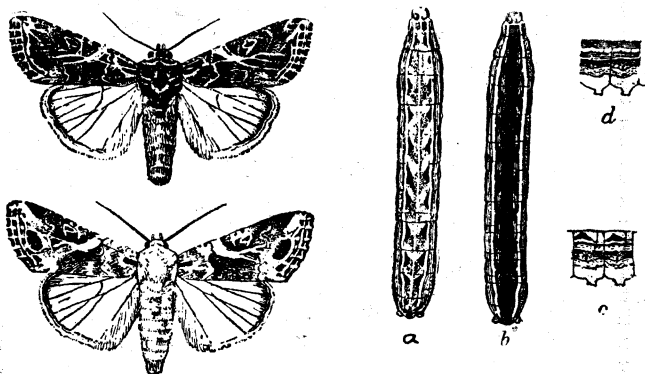


Figure 63.—Cotton Cutworm. Upper figure at left, male; lower, female; a, b, pale and dark forms of larva; c, lateral view of abdominal proleg segments of pale form; d, same of dark form, all enlarged. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

most of the species bearing the name "cutworm". It resembles more nearly the boll worm in its manner of work, boring rather than cutting. It infests beets, potatoes, tomatoes, asparagus, cabbage, cucumber, peach, cottonwood, several species of ornamental plants; is common on weeds, and also frequently found in green-houses. Both the larva and moth are subject to considerable variation in color from very light to very dark shadings. The ground color of the larva is olive or greenish-brown, finely lined with dark gray and brown, the upper surface being marked with a double row of velvety black or greenish spots. (See Fig. 63.)

Remedies.—Arsenical sprays, poison baits, etc. (See Nos. 5, 6, 12 and 13, pages 7 and 8.)

VARIEGATED CUTWORM
(*Peridroma saucia*, Hub.)

The variegated Cutworm, one of the climbers, is without doubt the most widely distributed and best known of any of our species of cutworms. It is very cosmopolitan in its feeding, living with apparent relish on a wide range of cultivated plants and

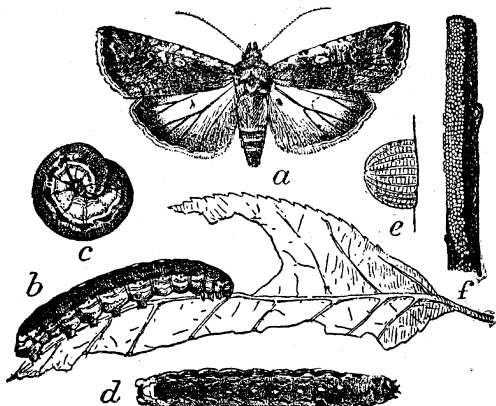


Figure 64.—The Variegated Cutworm. *a*, adult; *b*, *c*, *d*, full grown larvae; *e*, *f*, eggs; all natural size except *e*, which is greatly enlarged. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

capable of eking out an existence under most unfavorable circumstances.

The full grown cutworm (see Fig. 64) measures about one and three-fourths inches in length, is rather variable in color, as is also the moth. The ground color is rather dull brown flecked with gray and smoky-black above. There is a row of from four

to six round, yellow spots extending along the middle of the back or dorsal view, characteristic of the species.

Remedies.—See Nos. 4, 12 and 13, pages 7 and 8.)

FLEA BEETLES IN GENERAL

The Flea Beetles (see Figs. 65 and 66) are characterized by their jumping propensities. They are comparatively small and variously colored, usually, however, they are of a metallic hue or

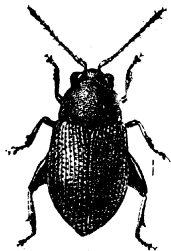


Figure 65.—Flea Beetle (*Chaetocnema pulicaria*, Mels). For size see the line at right. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

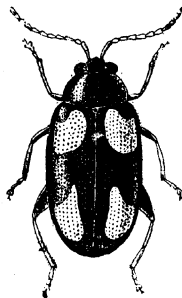


Figure 66. — Flea Beetle (*Phyllotreta bipustulata*, Fab.). For size see line at right. (From Dr. F. H. Chittenden, U. S. Bureau of Entomology.)

luster. The different species infest nearly all kinds of plants by eating small holes in the leaves and sometimes by puncturing the main stalk or vine. Young plants suffer from their attack more than the older, tougher ones.

Remedies.—Arsenicals and Bordeaux are the best remedies for these pests. Such plants as cabbage, tomato and eggplant, which have been germinated under glass, may often be treated advantageously by dipping the tops in a Bordeaux arsenical mixture after they have been removed for transplanting. For preparation of these remedies see Nos. 2 and 3, page 6.

GARDEN WEB WORM (*Loxostege similalis*, Guen.)

This insect is commonly known as the garden web worm on account of the fact that it spins a web about the leaves of the plant which it infests. It is also known as the careless worm on account of the fact that the careless weed is now and was one of its early food plants. It has also been "dubbed" the alfalfa web worm, since it webs and eats alfalfa. These examples show how

common names of insects establish themselves, and how some insects happen to have several common names. On account of its gregarious habits it is sometimes called the "army worm", which illustrates the fact that two or more insects may erroneously have the same common name.

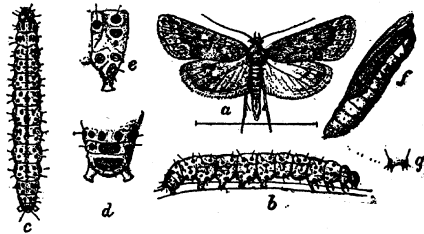


Figure 67.—The Garden Web Worm. *a*, male moth; *b*, larva, lateral view; *d*, anal segment; *e*, abdominal segment, lateral view; *f*, pupa; *g*, cremaster; *a*, *b*, *c*, *f*, somewhat enlarged. (After Riley, except *c*, which is from U. S. Bureau of Entomology.)

The garden web worm is distributed throughout the United States, so that each year a great amount of damage accrues from it, although its occurrence may not be in the

same locality each year.

The adult insect is a small moth (see Fig. 67), which may oviposit on vegetables of nearly every kind. In fact, it seems indifferent to the character of its food.

The insect is said to pass the winter in the ground as a pupa. The adults appear in the early spring when cotton is about four inches high. They often use this as a plant food, and infestation is started by the adults, which deposit eggs on the under or ventral side of the leaves. A few days after being deposited the eggs hatch into larvae, which remain more or less gregariously on the plants. Oftentimes considerable damage is done to cotton before it begins to set bolls.

About one month from the time of this deposition a new brood occurs. The second brood is likewise followed by consequent broods, so that by fall three or four broods may have been present in one locality. Of these broods, the second or third one seems to be the most injurious here, from the fact that it matures at a time when alfalfa is at about the right size to suffer greatly from its ravages. Again, there are more worms oftentimes in the second or third broods, mostly bearing on the fact that other insects which prey on them, known as "inimical insects", lessen the fourth brood, or sometimes both the third and fourth broods.

On account of the inimical insects the web worm does not occur abnormally every year. Sometimes the last brood which is to hibernate over winter is so decimated that few adults appear the following year or two in certain localities. Then the inimical

insects become few in numbers as they are bound to do on account of a shortage of food material, while web worms later become more abundant because of plenty of food material and no enemies.

Remedies.—One of the best preventives is fall and winter plowing of gardens and fields infested by the web worm. In fields grown in perennials, such as alfalfa, for instance, plowing, of course, is not advisable. A thorough renovation, however, can be accomplished by means of a “renovator”, a machine which is somewhat similar to a disking machine. This renovator aids in bringing the soil particles containing the pupae to the surface, where birds may obtain them or where the inclement weather of the following winter may have action on them.

When an infestation of worms occurs, a dry powder spray of paris green at the rate of about 1 pound per acre should be used, if the plants are not large enough for hay. If the latter happens to be the case, hay should be made at once and the web worm will be “shorn” of its food material, and will consequently perish.

If paris green is used, hay should not at once be made of the sprayed plants. A good rain should intervene, in which case the poison will be washed off. A lead arsenate solution may be used for cotton and some of the vegetables, but should never be used as an insecticide on alfalfa if the latter is to be cut for feeding purposes because of the adhesiveness of the solution and probable consequent poison of stock that may eat the hay.

IMBRICATED SNOUT BEETLE
(*Epicaerus imbricatus*, Say.)

The Imbricated Snout Beetle is a fairly common insect in our fields, gardens and orchards. It is a very cosmopolitan feeder, infesting among other plants the bean, pea, onion, radish, cab-

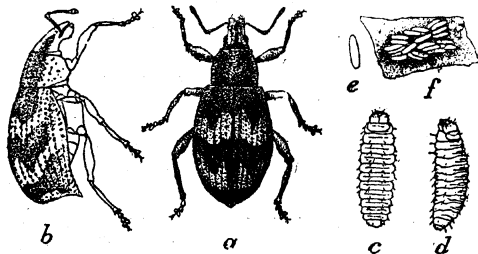


Figure 68.—Imbricated Snout Beetle. *a*, and *b*, adult; *c* and *d*, eggs. (From U. S. Bureau of Entomology.)

bage, cucumber, watermelon, cantaloupe, squash, corn, potato and peach trees.

The beetle is nearly half an inch in length, a ground color of light brown, with a lighter portion appearing brownish-gray and forming the pattern as shown in Fig. 68. The head is prolonged into a snout beak with elbowed antennae. The beetle has the habit of "playing possum" when disturbed.

Remedies.—Arsenical remedies, the same as for the potato beetle. (See Nos. 4, 5 and 6, page 7.)

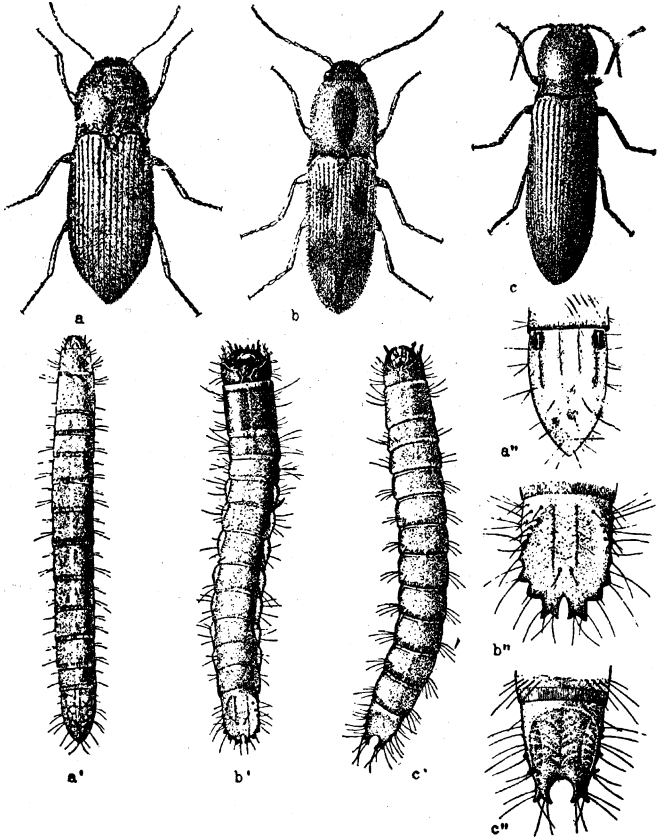


Figure 69.—Wireworms. *a*, Wheat Wireworm (*Agriotes mansus*), adult beetle; *a*₁, larva of same; *a*₂ last segment of same; *b*, *Drasterius elegans*, adult beetle; *b*₁, larva of same; *b*₂, last segment of same; *c*, *Asaphes decoloratus*, adult beetle; *c*₁, larva of same; *c*₂, last segment of same. (After Forbes.)

Advantage may be taken of the insect's habit of dropping as though dead when disturbed, by jarring infested trees and dislodging the beetle into a sheet placed below from which it may be removed and burned or otherwise destroyed.

WIRE WORMS

Gardens planted on new ground are often badly infested with "wire worms" (see Fig. 69). These are light brown or yellowish brown, tough-skinned worms, having six legs on the under side near the front end. Like the corn root worm they attack seeds, and, like white grubs, they attack the roots of plants. Injury is often quite pronounced from the early spring until corn is about knee high.

On account of the toughness of their smooth, rigid bodies, and by means of their hard heads and strong feet, they can burrow comparatively long distances through the soil. They even sometimes come out and crawl along the surface, entering when they locate proper food material.

When full grown they transform to the adult stage by forming smooth cells in the soil near the surface. The adult insect is a click beetle, which by a sudden bending of its body causes the click sound to be made.

Remedies.—Poisoned bait, such as fresh clover hay, that has been treated with an arsenical solution, placed in small piles in the infested field is a good remedy. Deep fall plowing is of advantage in controlling them. After ground has been thoroughly cultivated for three or four years local infestation generally disappears.

THE SHARPSHOOTER

(*Homalodisca triquetra*, Fab.)

Okra is one of the garden plants which is in favor with the sharpshooter (see Fig. 70), especially in the southern part of Oklahoma. Many fallacious ideas have been expressed concerning probable damage done by this insect; or, I should say, group of insects, because there are several that are similar in habit and appearance.

These bugs are sometimes called "squirrel bugs" and "doggers" on account of their peculiar habit of dodging to the opposite side of the twig or branch from the observer. They excrete or secrete a great deal of liquid when they are busily engaged sucking sap, and this has given rise to another common name.

Having lancetlike or piercing mouth parts they have been supposed to cause cotton squares and even bolls to shed off. Careful experiments with the insect, however, have failed to corroborate these ideas.

Many of our common succulent plants, such as okra, cowpea, grape, sorghum, new growth of forest and shade trees, horse weeds and sunflowers are infested by this bug and allied species. It lays its eggs in a row, side by side, just beneath the epidermis of the underside of the leaf, in clusters of ten to nineteen. Each cluster is generally "whitewashed" by the insect with a liquid excreted on it. This same liquid is also used by the insect apparently to disguise itself, or to cause its body to imitate the

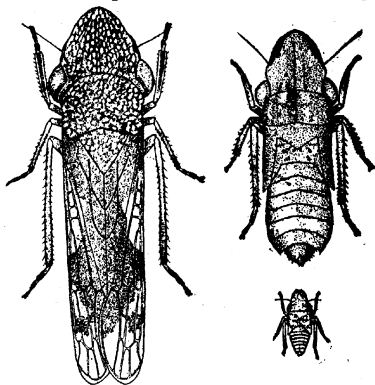


Figure 70.—Sharpshooter. Adult at left; last stage of nymph at right; young nymph below. (From Sanderson, U. S. Bureau of Entomology.)

head of a small snake or lizard, because with the tarsi of its hind legs it catches the liquid as it comes from the anus and plasters it on the wing covers. As soon as dried, the liquid is light colored and resembles two conspicuous eyes.

The last brood of the season hibernates over winter under leaves and trash, generally in or near wooded land. These issue rather early in the spring, but are not noticed until late in the season, generally July to August.

This bug is not particularly injurious except to a few plants, such as okra. The most practical prevention consists in the elimination of suitable places for the insect to hibernate.

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