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A Few Common Insect Pests.

Approved by the Station Council.

ALSTON ELLIS, President.

FORT COLLINS, COLORADO.

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A Few Common Insect Pests.

BY C. P. GILLETTE.

The present paper has been prepared, not because of the original matter that we wish to put into it, but because there seems to be a widespread need of information in the State concerning the insects herein mentioned. There are many other insects equally troublesome that might be mentioned had we time and space to do so. To those who suffer from such pests, we would say that the Entomologist of the Station is always glad to receive and reply to personal letters making inquiry concerning any injurious insect. Specimens of the insect doing the injury should, whenever possible, be sent with the inquiry.

THE IMPORTED CABBAGE WORM.

(*Pieris rapae* Linn.)

This insect was imported from Europe into Canada about thirty-six years ago. It spread rapidly in all directions, and now is found in injurious numbers from the Atlantic to the Pacific, and, through the Northern States, at least, is the most destructive insect attacking cabbage and cauliflower.

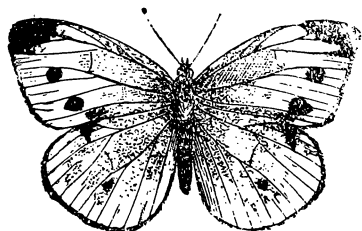


FIG. 1.

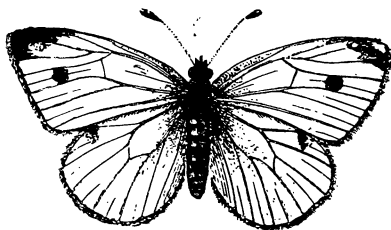


FIG. 2.

The mature insect is a white butterfly [Figs. 1 and 2]. It measures a trifle over $1\frac{1}{2}$ inches from tip to tip of the front wings when spread, the female being a little larger than the male, as is usually the case among butterflies and moths. As seen from above, the body, bases of the wings and the tips of the fore wings are black or blackish in both sexes. The female [Fig. 1] has, a little beyond the middle of

the fore wing, two black spots, and there is another spot in line with these on the anterior border of the hind wing. On the under side, the female has two black spots on the fore wing, and the tip of the fore wing and the entire surface of the hind wing are sulphur yellow.

The male [Fig. 2] differs from the female by having but one black spot on the fore wing above, and being a little whiter in color. These butterflies appear early in the spring, and the female is ready to deposit eggs for the first brood of worms as soon as early cabbages are transplanted into the gardens. The eggs are elongate, yellowish white objects, and just large enough to be plainly seen with the naked eye. They are deposited singly during daylight, and nearly always upon the outer surface of the spreading leaves, and not upon the cabbage head. When the butterflies are flitting abundantly over the cabbages, a moment's watching will be rewarded by seeing one or more of these eggs deposited. In a very few days the eggs hatch, and the little green worms begin to feed upon the leaves. They gradually work inward to the head, and



FIG. 3.

late in the season a large number of worms that are half grown or more may be found eating into the base of the head, often entirely ruining it. In from two to three weeks after hatching the worms become mature [Fig. 3 a], and then change to a green chrysalis [Fig. 3 b], in which stage they eat nothing, and remain quiet unless disturbed. If the worms were very numerous, some of these chrysalids may be found attached to the leaves of the cabbage, but most of the worms will crawl away to undergo their transformations upon other near objects.

In the course of a week or ten days, the chrysalis splits along the back and the butterfly emerges. In a few days more the females begin to deposit eggs for a second brood of worms.

How many rounds of development there are in a year depends upon the length of the summer season. There are probably not

less than three generations yearly in central Colorado. The number of worms increases many fold with each generation, so it is important that the first brood be as largely destroyed as possible. If three-fourths of the first brood were destroyed, there would be only one-fourth as many in the second brood as if none of the first brood were killed.

Food Plants.—Although this insect does its chief injury to cabbage and cauliflower, it also attacks many other cruciferous plants, as kale, radish, turnip, and mustard.

Natural Enemies.—At Fort Collins there are three very important parasites that attack this insect. The most important of these is a minute green fly (**Pteromalus puparum* Linn.), belonging to the order *Hymenoptera*. This little parasite does not kill the larva, or worm, but the chrysalis. The chrysalids lose their green color and become very dark, and, in a short time, instead of butterflies, there will appear from each chrysalis forty or fifty specimens of this parasitic fly.

On the 9th of September, 1891, a quantity of chrysalids were gathered from the College garden, and in every case they were parasitized by this insect.

Another small, four-winged parasite (**Apanteles glomeratus* Linn.), which is black in color, attacks the larvæ and destroys many of them. By tearing open nearly mature worms, the maggots of this parasite can often be found in large numbers inside. Before the worm changes to a chrysalis, these maggots eat through the body wall, and each spins about itself a yellowish silken cocoon. Each of these little cocoons is about one-eighth of an inch long, and all together form a mass a half inch or more in length. These masses are usually found upon the leaves of infested plants, and would be liable to be taken by the gardener as some insect enemy in disguise. These little parasites are of great service to the gardener, and should not be destroyed.

Another parasite that is common here, attacking the cabbage worms, is a two-winged fly (***Anthomyia sp.*), which closely resembles the common house-fly. The flies themselves will seldom be noticed, but among the leaves of the cabbages late in summer will be found numerous barrel-shaped, mahogany-colored objects about one-eighth of an inch in length. These are the pupæ—or puparia, as the entomologist would say—of this fly. These puparia should not be destroyed, as each incloses an insect very beneficial to the gardener.

The time may come when these allies of the gardener will be numerous enough to exterminate the enemy without his assistance,

* Determined by W. H. Ashmead, Dep. of Agr., Washington, D. C.

** Determined by Prof. C. H. T. Townsend, formerly of Las Cruces, N. M.

but as yet he will have to lend a helping hand or fail to gather a bountiful harvest.

REMEDIES.

As the eggs are mostly deposited upon the outer surface of the leaves, and the worms feed for some time before reaching the head, these insects may be nearly all destroyed by the prompt application of any one of several good remedies.

Among the cheapest, most easily applied, and, to our mind, the best of the remedies to destroy cabbage worms, are the arsenites, London purple or Paris green. We have given abundant proof of the harmlessness of such applications to those who eat the cabbages, in Bulletin 12 of the Iowa Experiment Station.

Thoroughly mix one ounce of the poison in six pounds of flour, and dust it very lightly over the plants from a cheese-cloth sack in the evening or early morning, when a little dew is still upon the leaves. The first application should be made soon after the plants are set out. Certainly, no one can think that there would be the slightest danger in making such treatment up to the time that the heads begin to form. After the heads have formed, the poison can be applied mostly to the outer leaves; but if any is put upon the head itself it is almost impossible that it should do harm, as the surface leaves of the head are not eaten, and these leaves in a growing cabbage are continually spreading and becoming outer leaves. Neither can the poison be washed by rain into the cabbage, for the outer leaves do not run into the head. I should not think it advisable to apply the poisons nearer than a week or ten days to the time of harvesting the cabbages, and it would never be necessary to do so.

Patent insecticides, such as Slug Shot and Oxide of Silicates, have been much used by gardeners for the destruction of cabbage worms. The poison in these insecticides is Paris green, but no one ever heard of a person being poisoned from eating cabbages thus treated. These patent insecticides are much more dangerous to use than one a person prepares himself, for he is usually ignorant as to the composition of patent compounds, and is more liable to be careless with them.

For those who prefer not to use the arsenites, there is probably no better remedy than insect powder, or Buhach. This substance kills by coming in external contact with the worms, and is best applied by means of a blower that sends the fine particles of dust down between the leaves of the plants.

This powder is not poisonous to man, and hence is very safe to use or to have in the house. The chief objection to this substance is its expense. Buhach may be purchased directly from the Buhach Manufacturing Co., Stockton, Cal., at 60 cents a pound.

The powder is very light, and a pound will treat a large number of plants.

A remedy much recommended by Dr. Riley is hot water. Water may be poured boiling hot into a watering-pot and applied at once to the caterpillars, and, if the plants are not too thoroughly drenched, the latter will not be harmed, while all the worms touched by the water will be destroyed. Worms that are protected upon the under side of the leaves cannot, of course, be treated.

Kerosene emulsion, if applied in extra strength and with considerable force, will also kill many of the worms, but I have not found this substance of much value in destroying the larvæ of *Pieris rapæ*.

THE SOUTHERN CABBAGE BUTTERFLY.

(*Pieris protodice* Bd.)

This insect [Figs. 4 and 5] resembles the preceding in the mature state, and has very similar food habits. It is a native of North America, and does its chief injuries in the Southern States. It is

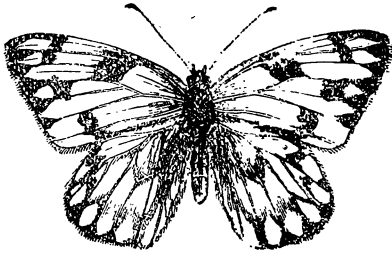


FIG. 4.

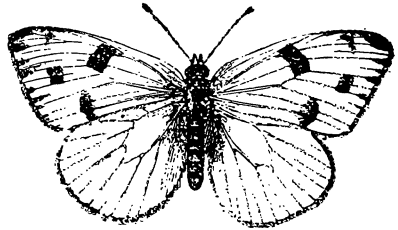


FIG. 5.

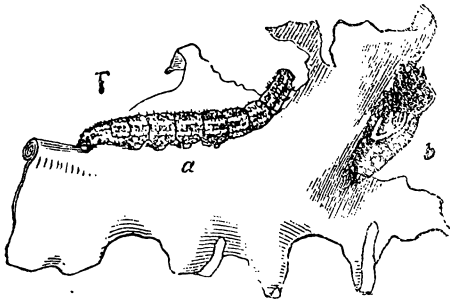


FIG. 6.

quite abundant as far north as Fort Collins, and, only a few *years ago, was said to do more harm to cabbages in Colorado than the preceding species. The markings of this butterfly, both male and

* Bulletin 6, Colorado Experiment Station, p. 15.

female, are so well shown in the accompanying illustrations [Figs. 4 and 5] that a description seems unnecessary. The female has more dark markings than the male, and the latter is usually more marked with black than the male of the imported species.

The larva [Fig. 6 *a*] is readily distinguished from the larva of the preceding species by having two longitudinal yellow stripes upon either side of the body, and by having the body covered with small black spots.

The remedies are the same as for the preceding species.

THE CABBAGE PLUSIA.

(*Plusia brassicae* Riley.)

This insect in the mature state is a moth [Fig. 7 *c*], spanning about one and three-eighths of an inch from tip to tip of the fore wings when spread.

The color of the anterior wings above is dark brown, shaded with lighter brown and gray, and with a conspicuous silver patch near the center. Running forward and inward from these white

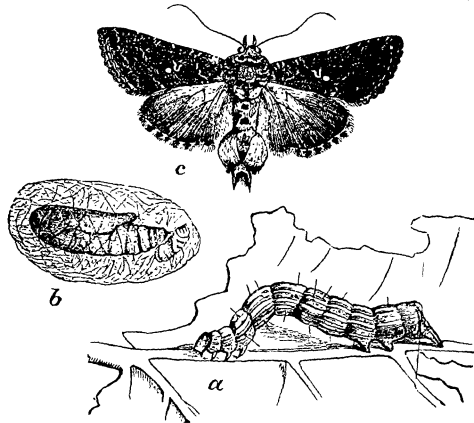


FIG. 7.

patches is a light colored stripe on either wing, extending to the anterior border. The wings in the illustration are too black, and the white spot is too small for the specimens of this insect in our collection. The posterior wings are dark brown, lighter towards the base, and are fringed with white scales, in which are dusky patches at the termination of each vein in the wing.

The female moth lays her eggs on the under side of the leaves, and the young larvæ, on hatching, perforate the leaves at first, and if numerous enough will finally eat all but the thick ribs. The larvæ [Fig. 7 *a*] are light green in color, with pale, longitudinal stripes, and are peculiar in appearance, being largest at the posterior

end of the body, as is well shown in the figure. They also differ from any of the preceding larvæ in looping the body when they travel, like the so-called "measuring worms" and "inch worms." The larva, when mature, unlike the preceding species, spins a slight silken cocoon [Fig. 7 *b*]. At the end of ten days or two weeks it comes forth as a moth. These cocoons are found among the leaves near the base of the cabbage head, if the larvæ are very abundant. There are from two to five broods of this insect in a year, the number depending upon the length of the summer season.

The food-plants of this insect, as given by Dr. Riley, are cabbage, kale, turnip, tomato, mignonette, dandelion, dock, clover, and a few others.

The remedies are the same as for *Pieris rapæ*.

THE CABBAGE PLUTELLA.

(*Plutella cruciferarum* Zell.)

This insect, in the mature stage, is also a moth, but a very small, narrow-winged one, that is liable to escape notice. It measures hardly more than half of an inch from tip to tip of the forewings when they are spread. The moth is shown with wings spread and closed at Fig. 8, *f* and *h*. The general color of the

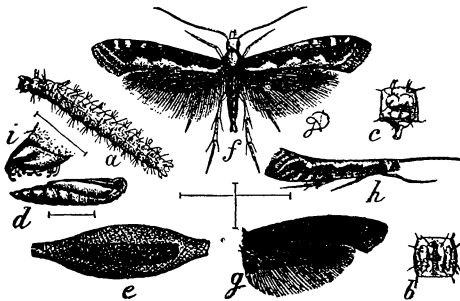


FIG. 8.

wing is dark to light brown, and there is a wavy, white line along the posterior margin. When the wings are closed over the abdomen the two white margins meet so as to make a conspicuous white dorsal stripe, which is continuous, with white upon the thorax and head. These markings are well shown at *f* and *h*, Fig. 8.

The winter is probably spent in the chrysalis stage, as the larvæ appear upon early cabbages about as soon as they are set out in this locality. These larvæ [Fig. 8 *a*] are slender, green in color, and are very active when disturbed, wriggling themselves quickly off the leaves and dropping on a silken thread.

When mature, the larvæ form delicate white cocoons [Fig. 8 *e*] among the leaves, and in a few days appear as moths. These

cocoons were found abundant in early-set cabbages near Fort Collins on June 10, this year, and the moths began emerging in our breeding cages on June 16. Last fall moths were reared as late as August 3. If the insect hibernates as a chrysalis [Fig. 8 *d*], there must have been a brood after the last date, so this insect is at least two, and probably three or four brooded, here. This insect seems to be increasing in numbers, and it would not be strange if it should become a serious pest, especially upon young cabbages, unless prompt action is taken to check its increase.

There is one reason, however, for hoping that it will not soon become seriously abundant, and that is, that there are in this locality a number of parasites preying upon it in the preparatory stages. In the Department of Agriculture report for 1883, p. 130, Dr. Riley mentions having bred from this insect a small hymenopterous parasite, *Limneria annulipes* Cr. From larvæ brought into the laboratory here last summer, were reared specimens of **Smicra delira* Cr., **Limneria dubitata* Cr., **Phæogenes discus* Cr., and a species of **Pteromalus*.

The remedies are the same as for the preceding species. The applications should be made early, so as to destroy the first brood, and thus prevent the increasing numbers of the succeeding broods.

FLEA-BEETLES.

(THE TWO-STRIPED FLEA-BEETLE, *Systema tenniata* Say.)

BIBLIOGRAPHY AND SYNONYMY.—As given by Geo. H. Horn, M. D., in Trans. Am. Ent. Soc., Vol. XVI., p. 318:

- S. tenniata*, Say, Long's Second Expedition, p. 294; edit. Lec., i., p. 195.
- S. blanda*, Mels., Proc. Acad., iii., p. 161.
- S. ligata*, Lec., Pacific R. R. Rep., 1857, p. 68.
- S. ochracea*, Lec., Proc. Acad., 1858, p. 87.
- S. mitis*, Lec., Proc. Acad., 1858, p. 87.
- S. botenniata*, Lec., Col. Kan., 1859, p. 36.
- S. pallidula*, Boh., Eugen. Resa, p. 192.

This is one of the worst flea-beetles that gardeners have to contend with in Colorado, and, at the present time (June 24), is doing serious injury to the small potato plants in the College garden. The mature insect is shown much enlarged in Fig. 9. The actual length varies from 1-8th to 7-48ths of an inch. Viewed with the naked eye, the beetle appears black in color, with a reddish brown head and thorax, and a distinct light yellow line running nearly the entire length of each wing cover.

Prof. Bruner, of the University of Nebraska, speaks of this insect as very variable in its color, some specimens being almost white. The color of those taken here have been very uniform, and as above stated.

This flea-beetle, though widely distributed through the United States, seems to do its chief injuries in the West. The specimens in the collection here were taken by myself at Fort Collins, North

* Determined by W. H. Ashmead, Dep. of Agr., Washington, D. C.

Park, Dolores, and Aspen, of this State. Prof. Webster, formerly of Purdue University, Ind., in the Indiana Horticultural Transactions for 1890, reports this insect as attacking sugar beets, corn, potatoes and beans in that State. Prof. Bruner, of the University of Nebraska, in the Fifth Annual Report of the Nebraska Agricultural Experiment Station, p. 60, speaks of it as being most injurious of all the flea-beetles that attack the sugar beet. Mr. J. F. Wielandy, Santa Fe, N. M., in "Insect Life," Vol. III., page 122, reports this beetle as injurious to beans in his locality, and Dr. Riley, in replying to Mr. Wielandy's letter, states that the beetle is particularly injurious

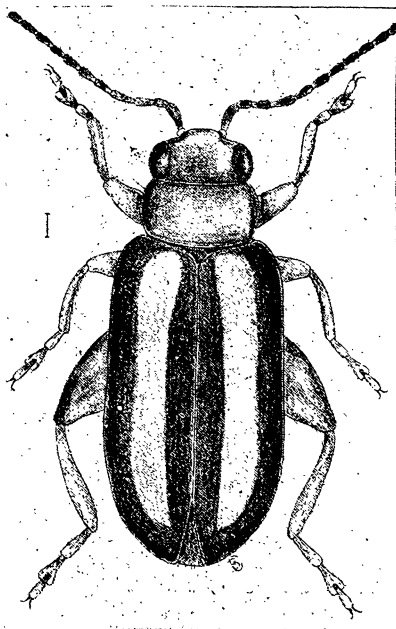


FIG. 9.

to the Cucurbitaceæ (melons, squashes, cucumbers, etc.). Prof. James Cassidy, in Bulletin 6 of this Station, reported the same insect as injurious to potatoes, beans, tomatoes, and beets. We have taken this beetle at Fort Collins during the past two summers feeding on potatoes, beets, alfalfa, lettuce, parsnips, egg plant, summer savory, and the following garden weeds: **Iva axillaris* (poverty weed), *Iva xanthiifolia*, *Salvia lanceolata*, *Verbena bracteosa*, *Solanum triflorum*, *Solanum rostratum*, *Helianthus annuus* (sunflower), *Helianthus petiolaris*, *Portulaca oleracea* (purslane), *Amarantus blitoides* (tumble weed), *Chenopodium spp.* (pig weed).

* The specific determinations of plants mentioned in this bulletin have been made mostly by Prof. C. S. Crandall, of this Station.

We have not seen this flea-beetle injuring the vines of cucurbitaceous plants in Colorado.

REMEDIES.

Although the flea-beetles devour the tissues of the plants upon which they feed, the arsenites, London purple and Paris green, have not been very useful in destroying them or preventing their attacks. From our own experience, we would put Buhach at the head of the list of remedies, if properly applied. To be of use, the powder should be applied dry before sunrise in the morning, while the beetles are cold, sluggish and damp with the dew of the night. After the sun is up and the beetles have been warmed into activity they will quickly jump away from any attempted application.

A strong kerosene emulsion, sprayed forcibly and thoroughly upon the plants early in the morning, will also be effectual in destroying the beetles.

As the beetles feed on a great variety of plants, they can usually be driven from cultivated crops by a thorough application of lime, ashes or road-dust in the evening or early morning, while the dew is still on.

THE COLORADO CABBAGE FLEA-BEETLE.

(*Phyllotreta albionica* Lec.)

This is one of the smallest of the flea-beetles, measuring from 1-15th to 1-16th of an inch in length. It is uniformly black in color, with the first three joints of the antenna pale [Fig. 10].

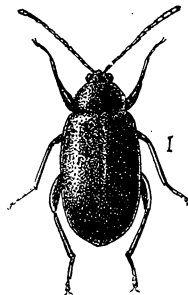


FIG. 10.

So far as we have been able to observe here, this is the only other flea-beetle that does serious injury to garden vegetables in Colorado.

We have taken this beetle feeding on cabbage, radish, beet, mustard, cauliflower, horseradish, and the Rocky Mountain bee

plant, *Cleome integrifolia*. The injury is done, as with all the flea-beetles, by eating little holes through the leaves, until the latter turn brown and crisp.

The remedies are the same as for the preceding species.

ONION THRIPS.

(*Thrips striatus* Osb. ?).

Several inquiries have come to this office concerning a minute fly that is ruining the onion crop, by causing the tops to turn white and die in July and August. The same insect has been noticed by us doing serious harm to onions in this vicinity and in other localities in the State during the past two summers.

The *Thripidæ* are very small insects, the largest measuring only about one-eighth of an inch in length. The mouth parts are rudimentary, and do not seem to be well fitted either for biting or piercing and sucking the juices of plants. Some forms are carniv-

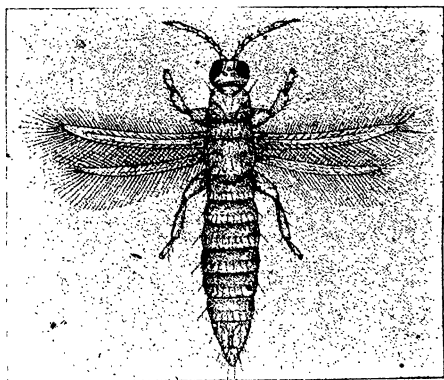


FIG. 11.

erous, but most that have been studied are vegetable feeding. In form they are long and slender; the wings, when present, are four in number, very narrow, and more or less ciliated with long, slender marginal hairs. In many there are also numerous stout hairs or spines on the surface and borders of the fore wings. The mature insects are usually very active, and when disturbed run about, throwing up the tip of the abdomen as if to sting, but they have no power to inflict such injury, and we have found by watching them under a glass that the abdomen is thrown up for the purpose of assisting in spreading the wings. Those studied seemed to have no power to spread the wings in any other way. After the wings

have been spread in this manner, they usually jump and then fly for a short distance.

Limothrips tritici Fitch, has long been known as an onion pest in the Eastern States, producing what is known as "white blight" of the onion tops. In the 16th Report of the State Entomologist of Illinois, p. 9, Dr. Forbes speaks of this insect as doing injury to strawberries in that State.

Fig. 11 is a representation of this insect, much enlarged, from a drawing made by Mr. C. F. Baker, and first published in the *American Florist*, Vol. VII, p. 168. It serves well to illustrate the female of our supposed *Thrips striatus*, except in the arrangement of the cilia of the wings. Fig. 12 *b* represents the arrangement of the cilia and spines upon the fore wing of the species that has been doing so much injury to onions in this State.

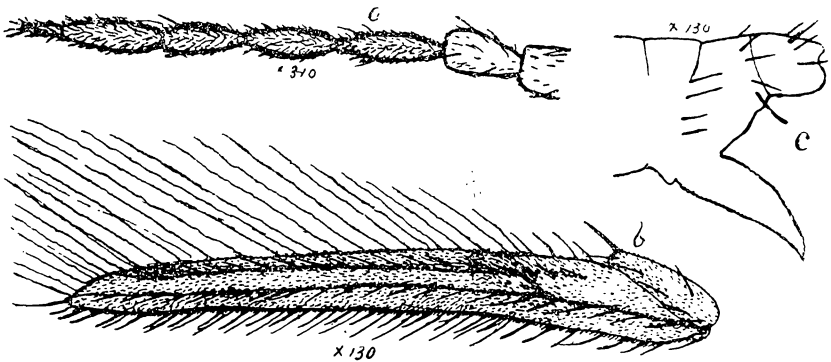


FIG. 12.

Numerous specimens of this insect were sent to Prof. Osborn, of the Iowa Agricultural College, and to Mr. Pergande, of the Department of Agriculture, Washington, D. C., and were, in both cases, determined as probably *Thrips striatus*. The mature female may be described as follows, from a quantity of material collected here: Length, 1-24th of an inch (1.1—1.3 mm.); color, from pale lemon yellow to brownish yellow, the darkest specimens appearing quite smoky. The only black parts are the compound eyes and the tips of the mouth parts. The antennæ are dusky towards the tips; the legs are concolorous with the body; the anterior wings are heavily fringed with slender, wavy hairs on the distal two-thirds of the posterior margin. [See Fig. 12 *b*.] On the anterior margin of these wings there is a row of short, stout black hairs along the entire length, the largest one being at the extreme tip. There is also on

the outer two-thirds of this margin a second row of somewhat longer and more slender hairs. On the surface of the wing are two parallel longitudinal veins, set with stout spines, the median one extending the entire length of the wing. In a favorable light the posterior vein can be seen to arise from the anterior at about one-fourth of its length from the base. The entire surfaces of both wings are set with minute spines. The hind wing is heavily fringed along the posterior margin, and sparsely set with short cilia along the anterior margin, and there is a faint median nerve.

The antenna [Fig. 12 *a*] appears to have but seven joints, even when viewed under a high power of the microscope. It is only with the most careful focusing and arrangement of the light that a possible minute eighth joint can be seen. In no case has it been as plainly seen as represented in the illustration.

This insect differs from the original description of *T. striatus* by having two rows of spines on the anterior wings, and by having the row of spines on the costal margin of the wing continued to the base. The paired spines on the last abdominal segment [see Fig. 12 *c*] would seem to us to put this insect in genus *Limothrips*.

Should the species prove to be new, we would suggest for it the name *Limothrips allii*.

There were certainly many hundreds, if not many thousands, of this insect in all stages of development upon single onion plants in this vicinity the past two summers. The young are usually found most abundant in the axils of the leaves.

Besides attacking the onion, this pest is common in various flowers, where it probably feeds upon the pollen or tender parts of the blossom.

Cucumbers are sometimes severely attacked by *Thripidae* in this State, causing the leaves to turn white and die. From an examination with a hand lens, the species doing this injury appeared identical with that on onions.

(*Coleothrips trifasciata* Fitch.)

This insect also belongs in the family *Thripidae*, but to a different genus (*Coleothrips*) from the preceding. It is black in color, and measures one-eighth of an inch in length. The name *trifasciata* was given it by Dr. Fitch, because of the bands across the fore wings—one at the base, one at the tip, and one about midway between these. This insect, which Dr. Fitch found common on wheat and in flowers of tanzey, we have found common upon onions in company with the preceding species. It is also common here in blossoms of alfalfa, wild sunflowers, and clover.

REMEDIES.

Several remedies were used against these pests last summer, the one proving most successful being kerosene emulsion, in the usual proportions. It should be thrown forcibly upon the plants, and care should be taken to wet thoroughly the axils of the leaves, where the young congregate. It will be an advantage here also to make the application early in the morning or in the evening, as the mature forms are less active then than in the heat of the day.