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Cutworms in Kentucky.

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KENTUCKY Agricultural Experiment Station.

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Address :

KENTUCKY AGRICULTURAL EXPERIMENT STATION,
LEXINGTON, KY.

BULLETIN NO. 58.

CUTWORMS IN KENTUCKY.

BY H. GARMAN.

The spring of 1895 was marked in Kentucky by an extraordinary abundance of cutworms in gardens and fields, and numerous complaints appeared in the papers published throughout the State concerning their attacks upon hemp, tobacco, corn, cabbage, tomatoes, strawberries, and almost everything else valued as a crop by farmers. Hemp especially suffered in Jessamine county. Garden truck of all kinds was cut down to such an extent that in some localities people became discouraged and hopeless of securing a stand.

As is usual when these insects become exceptionally common there was some migration of the worms from one piece of ground to another, which led correspondents to assume that an outbreak of the notorious army-worm was in progress, a mistake encouraged also by the fact that some of the cutworms which appeared were marked with stripes.

It was more than once explained to correspondents of the Station at the time of the outbreak that the true army-worm had nothing to do with the mischief then being done. It was not more common during the season in Kentucky, as far as I could learn, than it is usually. Almost any season a few of these worms can be found in damp meadow land among grasses, while adult army-worm moths are always rather common during the

summer. Only at long intervals do they assume the marching habit, and so far as my observations enable me to judge, they have not proved destructive here during the past five years. The injuries of last spring were solely the work of cutworms, of which two different kinds were especially abundant, while at least six other species had more or less to do with the injuries, some prevailing in one locality, others in another.

It was apparent as early as February that the worms were more than ordinarily common. At that time they could be found on warm days gathered together under boards and stones at the edges of plowed fields, and in pastures and meadows. In March they could be collected in large numbers in such situations, and with the starting growth of grasses and weeds they began to feed upon these, often cutting them away in the vicinity of their retreats to such an extent that their presence under boards might be detected by the gnawed condition of the vegetation about them. The common weed known as shepherd's purse (*Capsella bursa-pastoris*), blue-grass, and clover, seemed to be favorite food-plants.

When crops were planted farmers everywhere set up a shout of alarm and execration, for the lurking foes, which had not hitherto been observed by them, came out from their places of concealment and rapidly cut down the tender growths. They invaded even tobacco beds to destroy the plants before they were transplanted. Woody plants did not escape attack. The new growth of raspberry and blackberry canes were sometimes cut off. Onions were relished by some of the species. Potatoes, though not commonly subject to attack by cutworms, suffered a good deal in some localities.

Under date April 24, 1895, D. S. Dickinson, of Trenton, Todd Co., wrote to the Station:

"I send by to-day's mail a new pest to this section. This worm appeared in this locality about the 10th of April, and has been very destructive to corn and young

clover, also destroying young tobacco plants. They resemble the cutworm in looks and otherwise, also the armyworm in some respects, yet we think them neither."

In sending a second lot of cutworms to the Station, April 29, Mr. Dickinson wrote:

"I think they are disappearing gradually now, for in getting a second lot for you I have been unable to find any on tobacco plant beds. The injury from these worms so far has been more serious from loss of young clover than otherwise, as it is still time enough for a corn and tobacco crop. Around this section they are worse in certain places, even on the same farm, but I hear complaint from nearly every farmer."

With a package of cutworms sent to the Station, April 30, Mr. Halbert Rust, of Fairmount, Jefferson Co., wrote:

"Enclosed you will find a few examples of a worm that is now here in unlimited numbers. They are especially destructive to clover fields, and revel on green peas, onions, and garden vegetables, not overlooking strawberry plants, newly set, as well as old."

Through the kindness of Mr. J. E. Younglove and Mr. A. D. Webb, of Bowling Green, I received numerous examples of cutworms from Warren county. On May 6 Mr. Webb sent me over two hundred worms which he wrote me were collected by him in a few minutes.

The President of the State Horticultural Society, Mr. M. F. Johnson, wrote from Fern Creek, Jefferson Co., May 9:

"I send you by to-day's mail some cutworms which are devastating this region. I caught these specimens around my onions. They are cutting down my young potatoes, destroying many of the spring-set strawberry beds, and are now working in my older strawberry plant beds; are also cutting down the young raspberry and blackberry shoots. We have done a good deal of ditching, but, while we have caught large numbers, I have

little faith in the ditch, for it seems to me to be a spontaneous uprising from the earth everywhere."

An old student of the State College, Mr. W. F. Nichols, wrote from Clarkson, Grayson Co., May 13:

"Can you give me any information with regard to the pests known as cutworms and army-worm? We are wonderfully infested with them this year, and any information concerning their nature and remedies for them will be a godsend to our people."

From Mr. J. Speed, of Elk Creek, Spencer Co. I received on May 20 a package of wheat infested with Hessian fly, and with it some of the cutworms. He wrote concerning the latter as follows:

"In the package with the wheat you will find two boxes. One marked 'traveling cutworms' contains the fellows that were taken to be army-worms. There are very few left now, and they are not moving, but are mainly under the largest mulleins. The other box contains the common sort we dig out of the corn hills; they are rarely seen on the surface."

All of the worms sent to the Station by these gentlemen and all of those observed by me at work on crops in this vicinity were true cutworms, and not a single genuine army-worm was found among them. The greater part of the material sent in, probably 90 per cent., represented but two distinct kinds, both of which can be found among growing plants in spring any season. So there was nothing very anomalous about the appearance of the pests except their unusual abundance and the marching habit, which latter, however, they never exhibited with the unanimity of purpose and persistence of the true army-worm. The latter march in bodies which devour nearly every green herb before them and occur in such numbers that they sometimes creep over each other in their eagerness to get forward. The species which was most active in migrating is known in its adult condition (See plate, fig. C, enlarged $\frac{3}{4}$) as a small gray moth (*Fel-*

tia gladiaria), and in its larva stage as the clay-backed cutworm (Plate, figs. D and E). It is the "traveling cutworm" of Mr. J. Speed's letter, quoted above. It constituted three-fourths of those sent to the Station by Mr. Webb, of Bowling Green, a large part of those sent in by Mr. Dickinson, of Trenton, and was among those received from President Johnson of the Horticultural Society. It was also one of the most abundant species here at Lexington.

1. The Traveling Cutworm

(*Feltia gladiaria*).

When fully grown and ready to retire into the ground, this cutworm measures 1.34 inch in length and has a diameter of 0.25 inch. The general color is dull greenish or brownish gray. A rather wide area along the middle of the back generally contrasts sharply with the general tint, and is some shade of brown or yellow, varying from light straw yellow in some examples to dark brown in others. In the middle of this area one can generally make out a narrow pale line, often more clear because it is accompanied on each side by a faint dusky line. Outside the brown area along the back on each side is a couple of very narrow pale lines similar to the one in the middle of the back. The general tint on the side is commonly darker than that on the back, this being especially noticeable in the young. Beneath, the general color is obscure dull green, in life. The breathing pores (spiracles) along the sides are black; they form groups with certain brown dots which occur on the sides of the segments. The head is yellowish brown, with a pair of arcuate brown bands which start from the mouth and are accompanied by a fine network of brown lines on the sides of the head. A black eye-spot is present. A triangular region on the front of the head is brown like the cheeks.

The antennæ and the feelers (palpi) attached to the

lower lip are white, but with a hand magnifier one may see brown rings upon them. Just behind the head on the division next following is a smooth brown plate, across the middle of which passes the narrow pale line of the back. A similar but smaller plate is present on the last division of the body. The legs, of which there are eight pairs, including the slender jointed ones on the three divisions of the body behind the head with the soft fleshy legs along the hind part of the body, are all pale and not noticeably different from those of other cutworms; their arrangement and general character is the same also as in the true army-worm. Figures D and E of the plate give a good general idea of the worm.

Most of our cutworms are active during the spring when plants are coming up, and then go into the ground for their second change, and from July to September emerge as adult moths which lay eggs in the fall for the next season's brood. The traveling cutworm shows a peculiarity in its development that is worth mentioning here. My examples went into the ground like the other kinds, but remained worms, without eating, for a considerable period. On June 19, when I supposed those kept in breeding jars had changed to pupæ, I found them lying unchanged in the soil kept in the jars. Professor Forbes, of Illinois, observed the same peculiarity, and states that his confined examples continued as worms until August 6. I suspect that some individuals teed now and then during this time, for I heard during July complaints of injury to strawberry plants, and received a mutilated cutworm, which seemed to be this species, taken among injured strawberry plants August 4. In the breeding jars at the Station, however, they did not come out to get the food provided for them. It would seem that they underwent a sort of æstivation similar to the torpid hibernating condition of many animals, and only changed to pupæ towards fall. Just when this latter change occurs I am unable to say, for after taking the

worms from the earth several times I decided not to disturb my breeding cage examples again, lest by doing so I might prevent them from becoming moths—a matter of some importance, since the species could not be determined positively without the adult.

The first moth to mature came out of the ground at the Station on September 17, and the last one to emerge on October 1. The period during which it is abroad here thus appears to coincide very closely with that observed by Professor Forbes in Illinois, who records in his fifth report September 15 to October 13, as its time of appearance.

Moths reared by me at the Experiment Station measure about 1.34 inch in spread of wings. The general color is sooty blackish. The markings of the front wings are small and very obscure. The hind wings are sooty outwardly, and become paler toward the base. Both front and hind wings have a small central black mark beneath. The appendages and body are gray.

2. The Dingy Cutworm

(Feltia jaculifera).

With the traveling cutworm most of our correspondents sent in another worm which appears to have done a good deal of injury in some localities. It does not seem so much inclined to travel about during the day as does the other, and while occurring everywhere in the State was not so generally injurious last spring. In structure and size the two are much alike. Some slight differences of color will enable one to distinguish the dingy cutworm. It has the same broad clay-colored or yellowish brown area along the back, but on each division of the body from each margin of the area above mentioned an oblique blackish line extends forward into the area. Each of these lines, sometimes very faint, passes through two small bristle-bearing dots. At each side of the area

is a broken longitudinal black stripe, represented in the traveling cutworm by a nearly continuous brown shade. By the side of each breathing pore is a black dot, which is a little more conspicuous than corresponding dots on the related species. The pale longitudinal lines, quite characteristic of the traveling worm, are here only imperfectly represented. The markings of the two worms are otherwise similar, the head having the dark curved bars, the black eye-spot and the network of brown lines on the cheeks. This worm is a common garden pest every year, and does a large share in cutting off newly set plants. It constituted more than half of the cutworms sent to the Station by Mr. Dickinson from Todd county. The moth is quite different from the adult of the traveling cutworm. It is shown at A in the plate enlarged one-sixth. It begins to come out of the ground in August, my records showing it abroad at Lexington from August 27 until September 23. During this time it is frequently seen about our lamps at night, and large numbers can be secured by brushing trees with sweetened mixtures, such as molasses and stale beer, or vinegar. It is also common about rotting apples and the refuse from cider mills.

3. The Dingy Cutworm.

(*Feltia subgothica*).

We have another cutworm moth in the State so much like the above that the two are very likely to be confounded. This moth is represented at B in the plate. A comparison of A and B will give a fair idea of the differences. A noticeable difference among others is the more extensively pale hind wings in B, in which also the dark marginal area begins more abruptly. The cutworms from this moth appear with the others in spring. The adult moth may be seen abroad from July 10 until September 25.

4. The Greasy Cutworm

(*Agrotis ypsilon*).

This worm measures 1.50 to 1.60 inch in length when outstretched. Its general color is dull gray or brown, sometimes approaching black. Markings not decided, but commonly a couple of obscure, pale lines are apparent on the sides just above the breathing pores. Head brown, darker above. The adult moth is represented at G in the plate, enlarged about one-sixth. The worms appear in May and continue until the latter part of June (June 21 is my latest date), when the last of them go into the ground. The adults have been observed at Lexington from June 25 until September 23. Freshly emerged adults have been noted as common on June 29; on July 12 I have recorded them as very common; from this on they become less abundant, but are frequent among the moths which enter dwellings as late as September 1.

This cutworm is especially destructive in Kentucky to newly set tobacco plants and to corn. It has been observed cutting off young tomato plants in other States.

5. The Variegated Cutworm

(*Peridroma saucia*).

Length of fully grown worm about 1.50 inch. General color dull sooty brown, mottled with gray; a series of yellow spots along the middle of the back; a black blotch on the next to the last segment of the body; a series of crescent-shaped blackmarks along the sides at the breathing pores, and beneath the pores a yellow stripe. The moth is of about the same size as that of the greasy cutworm. It is shown at F in the plate, enlarged one-sixth. It is a very variable species, and in addition to the form represented in the plate another one with a yellowish brown shade along the front margin of the fore wings, is common.

The worms are active during April and May, then go into the ground during the early part of June, and begin to come out as moths about the middle of the latter month. Freshly emerged examples are common during the latter part of June, and examples continue to be frequent from this month until fall. My latest recorded capture at Lexington was taken October 25. The species passes the winter as an adult, in part at least.

The worms are very indiscriminate feeders, attacking among other things corn, clover, timothy, strawberries, tomatoes and sweet potatoes.

6. The Green Cutworm

(*Peridroma incivis*).

This is a green worm about 1.25 inch long, with a white stripe along each side of the body. It was observed to be common last spring at Bowling Green by Miss Sadie F. Price. I have not encountered the worm at Lexington, but the adult moth is common, occurring from June 9 to September 9. Prof. G. H. French, of Illinois, secured the worms in August and September, and a moth from one of them emerged on October 8. The species thus appears to be double brooded. The moth itself is of an ash-gray color, with velvety collar and a dark purple area along the outer ends of the front wings.

7. The Spotted Cutworm

(*Noctua bicarnea*).

Length of fully grown worm 1.25 inch. Dark gray, with two series of black spots on the back, wanting on the three first divisions, gradually larger toward the hind end of the body. The usual network of lines on the sides of the head is very distinct. The winter is spent in the worm state and the moths begin to come from the ground in May. From these moths a second brood of worms appears in July. At Lexington moths may be

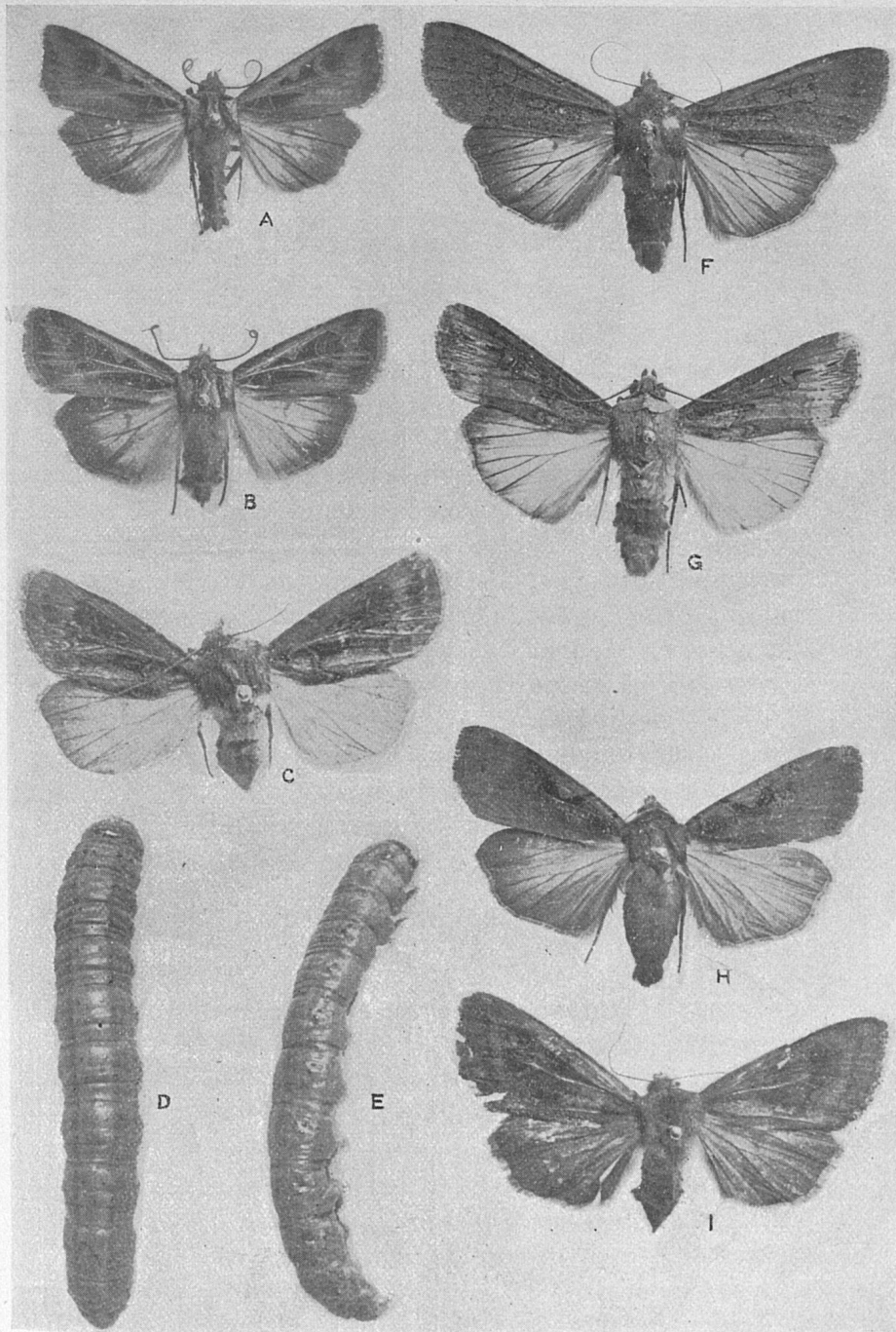


PLATE 1.—A, moth of dingy cutworm (*Feltia jaculifera*), enlarged one-sixth; B, moth of dingy cutworm (*Feltia subgothica*), enlarged one-sixth; C, moth of traveling cutworm (*Feltia gladiaria*), enlarged three-fourths; D and E, traveling cutworm, enlarged once; F, moth of variegated cutworm (*Peridroma saucia*), enlarged one-sixth; G, moth of greasy cutworm (*Agrotis ypsilon*), enlarged one-sixth; H, moth of spotted cutworm (*Noctua bicarnea*), enlarged one-fifth; I, moth of bronzed cutworm (*Nephelodes minians*), enlarged one-fifth. From photographs made at the Station.

seen until September. The moth is shown at H in the plate, enlarged one-fifth.

8. The W-marked Cutworm

(*Noctua clandestina*).

Length of grown worm about 1.15 inch. Color gray, speckled and mottled with dusky. Marked with four rows of black spots, the outermost row of each side along the row of breathing pores. The two series on the back have been represented as giving the appearance of a letter W on each segment, hence the common name; but the resemblance is not always evident. The worms appear very early in spring and soon go into the ground for pupation. They are abroad during April and May, and the moths appear in June. The only examples of the species which have come to my notice are two worms sent to the Station by Mr. D. S. Dickinson, of Todd county, captured April 23 with other cutworms taken among corn, clover and tobacco. The species is said by Dr. C. V. Riley to feed on cabbage, beans, buckwheat young pumpkin plants, and other succulent vegetation.

9. The Granulated Cutworm

(*Feltia annexa*).

This is a common species in Kentucky, the moths being very often attracted to sweets at night. The worm has not thus far been encountered here, but is known to have the cutworm characteristic of eating almost any vegetation. It is especially fond of knot-weed. Professor G. H. French has given a full account of its stages in the *Canadian Entomologist* (Vol. 14, p. 207). The following characters are taken from his description of the fully grown cutworm: Length 1.35 inch. Color above to near the breathing pores blackish gray, with a yellowish drab oblique mark on each segment, each mark broadest behind and mottled a little with the ground color. A

line just beneath the row of breathing pores on the side pale gray, slightly yellowish. Head pale greenish gray, slightly brownish on some, more or less drab brown on the cheeks, this mottled outside. Beneath pale greenish gray. I have observed the moths as early as June 29 at Lexington. By the 12th of July they are frequent, and continue abroad until September 1. The moths reared by Professor French came forth in October. The species is thus two brooded.

10. The Bristly Cutworm

(*Mamestra renigera*).

This is a small cutworm, measuring only about an inch in length. Its general color is yellowish gray. Along each side is a distinct black stripe, tapering at each end. The common name has reference to rather stiff black and yellow bristles, which are scattered over the body. The moth is dark brown, with some touches of white, gray, and green on the fore wings, together with a more or less conspicuous black spot. The wings expand only a trifle over an inch. The worms are found in gardens and pastures. Two broods appear annually, one in early spring, the other towards fall. The adult moths have been observed at Lexington from April 4 to June 29, and again from August 8 until September 24.

11. The Glassy Cutworm

(*Xylophasia devastatrix*).

As the name signifies this cutworm is of a translucent whitish color. It lacks all evident markings, except a bluish line along the back. Head red. I have not thus far found this species common in Kentucky. In States further north it is sometimes very destructive in corn land recently in sod. An example taken by me November 25, 1889, emerged as an adult during the following April.

12. The Bronzed Cutworm*(Nephelodes minians).*

Among the cutworms found about cultivated lands one sometimes encounters a rather large striped species measuring about 1.75 inch in length. The stripes are seven in number on each side, four wide brown ones, and alternating with these three narrower yellow stripes. The head is yellowish gray. It is very fond of blue grass, but feeds also on corn and knot-weed. A single brood appears each year, the winter being spent as worms, and the moths coming out mostly in the late fall, when they sometimes enter dwellings at night, attracted by the light. My dates of capture are August 13, September 1-23. The moth is shown at I in the plate, enlarged one-fifth.

Cutworms in General.

Here are twelve distinct species of cutworms occurring in Kentucky. There are others that could be added to the list. Some are one-brooded, others two-brooded, and altogether it would seem that there was no crop exempt and no time of the year when one cutworm species or another was not engaged in its destructive work. But most of them are noticeably active only in the spring, and they are noticeable then chiefly because of their injuries to newly set plants and young growths. The later broods, when such occur, find an abundance of food everywhere. Garden truck is too far advanced to be checked perceptibly by them. If we can prevent the injuries of the early spring brood, therefore, we need not ordinarily concern ourselves about cutworms the rest of the summer.

The eggs of the majority of our cutworms are placed by the moths among grasses or weeds, sometimes on trees, in the fall. The young worms which hatch at this time must have food, and the moths will not place their eggs on land that does not provide this for them. This

fact explains why corn planted on sod land is generally badly injured by cutworms the first spring. By plowing under the grass the worms present in the field are deprived of their natural food, and are forced to feed upon the corn. The fact explains also the reason why cutworms are often worst along the edges of gardens. The young worms fed the preceding fall on a neglected strip along the fence, or, it may be, came into the garden from an adjoining meadow or pasture, where the moths placed the eggs the preceding fall.

Remedial Treatment.

Early fall plowing to destroy growths of grass or weeds likely to harbor cutworms during the winter is a lesson taught by the above facts in the life-history of these insects. Fire, too, can sometimes be employed in burning over land that is to be cultivated. All grasses along fences should be destroyed in the fall, winter, or early spring, but preferably in the fall, when cutworm injury threatens. By so doing the young are deprived of food and must either starve or go elsewhere. In the fields already in cultivation it is necessary in cutworm years to keep down all volunteer vegetation, both before the crop is planted and afterward. Clean culture will do much to guard against injuries. The worms invade an unkempt garden by preference. Scattered boards, bricks, stones and other rubbish afford them lurking places. These should be removed.

Enclosing the plants with paper or tin.—One of their most annoying habits is that of cutting off newly set plants. For thirty years or more intelligent gardeners have employed cylinders of stiff brown paper placed about newly set cabbage or tomato plants as a means of keeping the worms from them. The cutworms are unable to climb up a smooth, vertical surface, and consequently a cylinder of paper about a plant with loose earth drawn up about its lower edge so that the worms cannot

creep under is an effective protection so long as it is not wet from rain, and can often be made to keep the worms away until the enclosed plant is too large to be injured. Cylinders of tin about 5 or 6 inches high can be used in the same way, and while costing something at the beginning, can be put away when the cutworm season is past, for use another season. Some one has suggested that such cylinders may be made of strips of tin with the two ends folded so that they will hook into each other when brought together.

Small apple and other fruit trees are sometimes injured by what are known as climbing cutworms, which ascend the trunks by taking advantage of the roughness of the bark, and eat the buds. A tin cylinder secured about the trunk of a tree has been found an effective protection against such species. I have not thus far witnessed injury of this sort in Kentucky, but it has been observed in adjoining States and is liable to occur here.

The use of poisoned bait.—Precautionary measures, such as fall plowing, clean culture, removal of rubbish, and the like, are always to be employed in dealing with cutworms if possible. But where the worms are in the soil before their presence is recognized the only thing to do is to employ the cylinders, take them from about plants each morning by hand, or else to use bait that will destroy them. Professor C. V. Riley some years ago, in one of his reports as United States Entomologist, suggested the use of Paris green on bundles of clover or other plants relished by cutworms placed at intervals among newly set plants. Bundles about as large as one's fist are dipped into Paris green water (a table spoonful of Paris green in a bucket full of water) and placed about the infested land in the evening. The worms feeding upon this bait may not be killed at once, but it requires very little to make them so sick that they will not eat other vegetation, and probably none of those eating the poison become mature. This fact is to be borne in mind

in testing the remedy. I have sometimes heard it stated that worms which fed upon weak mixtures of Paris green were not killed, and the inference was drawn that such mixtures were useless. Worms may remain alive for several days after eating leaves poisoned with the mixture used for ordinary spraying (1 pound to 160 gallons of water), but I find by experiment with the tobacco-worm that such worms take very little or no food, and finally die. A small worm is more quickly killed than a large one.

I make these statements in the interest of a fair test of this remedy by gardeners. Because some cutworms found about the poisoned bundles are alive is not good evidence that the bundles are not doing their work.

It is claimed on first-class authority that land can be cleared of cutworms before the crop is up by employing these poisoned bundles.

Cutworm Diseases.

Like the chinch-bug the cutworms are subject to diseases which appear to be caused by attacks of bacteria and other parasitic fungi. A good many of the cutworms sent me from Bowling Green last spring were affected in this way, and so many of them died that it was difficult to get adults from some of my breeding jars. Those affected with the trouble would often go into the ground as if to change to pupæ, but instead died, became flaccid and discolored, and when recently dead were filled with a clear yellowish fluid, in which were large numbers of bacilli,* some of them in active motion.

*For the economic entomologist I will add that these bacteria stain solidly in gentian violet; are oval in shape, and were seen only in couples. A drop of fluid obtained from the mouth of a sick worm contained many bacteria of several kinds, some in long rods, others shorter and in couples; also a great many micrococci. In the blood of this worm, obtained by snipping off a proleg with sharp scissors, I could find no bacteria, from which I infer that those found in the fluids of dead worms came primarily from the alimentary canal.

On May 25, 1895, in a lot of cutworms sent me by President Johnson of the Horticultural Society I found an example dead and rigid, with scattered white powdery masses of various sizes scattered over it. At this time these pustular masses were white, but by May 28 most of them had become sage-green and were so thickly placed as to cover most of the body. These growths had at first exactly the appearance of the fungus used in Illinois and Kansas for the destruction of the chinch-bug. With a view to learning if this was a parasite of the cutworm and could be made to destroy healthy worms I prepared on May 28 three jars with earth in the bottom, and put six worms obtained at Lexington in each, then cut in two the dead worm on which the fungus appeared and put a part in each of two jars leaving the third without. The following are the records made on these lots:

1. Treated lot. May 29, one worm dead and flaccid. May 30, remainder alive. June 3, remainder alive. June 11, two worms dead and showing same fungus growth as one used for infecting. June 19, remainder dead and with fungus growth on body.

2. Treated lot. May 29, all alive. June 3, all alive. July 11, three worms dead of the fungus disease. June 19, all the remainder dead of same disease.*

3. Not treated. May 29, one dead (no fungus growth). May 30, remainder alive. June 3, all remainder alive, some preparing to change to pupæ. June 11, one pupa formed and one worm dead of the fungus disease. June 19, remainder alive. August 30, two adult moths emerged (*Feltia jaculifera*). September 22, an adult moth emerged this morning (*Feltia gladiaria*). October 1, an adult of *Feltia gladiaria* out to to-day.

*These worms were left on the earth of the jar until July 31, when they were covered with a profuse white growth having every appearance of being the same as that used for chinch-bugs. Spores taken from the sage-green growth that appeared first were elongated, just a trifle constricted at the middle. The spores of the later growth were small and round, agreeing in size (.004 mm. or a trifle less) and shape with the fungus described as *Sporotrichum globuliferum*.

The above test indicates that the disease is communicable, and if this is true we may yet be able to employ the fungus in destroying cutworms out of doors. It will be observed that one of the worms of the untreated lot showed the fungus growth on June 11, from which it appears probable that the disease was widespread and that this worm was affected at the time it was put into the jar.

From the large proportion of cutworms that failed to complete their changes last spring it is probable that they will be less abundant in the spring of 1896. But if they are again troublesome the Station is prepared to furnish to those applying, packages of *Sporotrichum* with which to make a field test. Those wishing to make a trial of the fungus must agree to follow directions given them and report results to the Station.

Cutworm Enemies.

Birds, chickens, turkeys and pigs are very fond of cutworms and may under some circumstances be utilized for their destruction. The common bluebird is known to have a special fondness for them, and is with us during February, March and April. When cutworms are abroad it will do us valuable service in field and garden if left unmolested. Actual examination of the contents of the stomachs of ten bluebirds shot during February showed that 30 per cent. of the food consisted of cutworms during this month. During March also its food has been found to contain a large percentage of these insects.*

Of insect enemies the cutworms have many. Some of them are small, four-winged flies which, in the grub

*When farmers generally are aware of the very great value of our native birds as checks upon injurious insects they will see to it that laws are passed, and afterward enforced, prohibiting shooting them or destroying their nests. There has been a marked decrease in the numbers of birds in the Middle States in the past twenty years, and at the same rate of diminution some of our most valuable insect eating species will disappear in some sections during the next two decades. It falls to the agriculturist to check their destruction if possible.

state, live in their bodies. But parasites of this sort are not so useful for cutworms as for insects which live exposed during the day. Prof. Lawrence Bruner, of Nebraska, has, however, observed a fly (one of the two-winged sort) placing its eggs in large numbers on the granulated cutworm, which during 1889 was in his State so abundant that it came from its retreats to feed during the day, when clouds obscured the sunlight.

The True Army-Worm

(Leucania unipuncta).

In order that the army-worm may be recognized when it appears again in the State, I give below a brief account of it. It is a member of the same family as the cutworms.

The worm is of a dull clay color, with distinct dusky stripes. The back is very finely mottled with black, the mottling so close as to form a dusky median stripe, divided on the first three segments behind the head. A dark stripe on upper part of side and another wider one along the breathing pores, the front pores being included in it, and those towards the rear situated at its lower edge. Fleshy legs of the middle of the body, with a dark spot outside. Body pale beneath. Head with fine network of brown lines, and two stripes on the front which nearly meet above, and then diverge to the back of the head.

These worms occur every season on grasses in meadows, and are especially common among neglected blue-grass on low ground. On the experiment farm they occur each year on volunteer English blue-grass along the fences. They form armies only when very common, and ordinarily live like cutworms, hidden about the roots of grasses during the day and coming up to feed at night. The winter is spent in the worm stage. The most mischief is done by the brood which begins to appear in June.



Fig. 1. Showing worm, pupa, moth and eggs of the army-worm. The eggs are represented as attached to grass. Their size is shown by dots in the small square. Figures are of natural size.

The moth is common about electric lights in summer and frequently enters dwellings, where it does not attract the attention it might if its true character and capacity for mischief were known.

Three broods appear to develop here yearly, as may be seen by the following observations taken from notes made at intervals during several years.

April 17, 1891, one moth observed, the first of the season. May 24, 1890, moths occasional. June 2, 1892, young worms frequent in English blue-grass. June 29, 1892, moths very abundant. July 1, 1891, moths common. July 4, 1890, moths becoming common. July 5, 1890, moths extremely common, fresh. July 10, 1891, extremely common, some fresh. July 25, 1890, moths very common. July 28, 1889, moths at light. Aug. 5, 1891, moths less common than they have been, and worn. August 14, 1889, young worms common among oats stubble. Sep. 1, 1892, moths common. Oct. 26, 1895, one moth captured.

The remedy for army-worm injury is the use of fire during the winter on land on which the worms are at work. One piece of neglected grass land on a farm is generally the center in which they develop and from which they spread to adjoining crops. An acquaintance with the worm, so that it can be recognized in time to apply the remedy, would seem to be all that is required in dealing with this pest.