

Transactions of the Kansas State Board of Agriculture, 1872

Section 11, Pages 301 - 330

This annual report from the Kansas State Board of Agriculture includes information on the birds and plants of Kansas. It also covers crops, livestock, and coal. County statistics include population, acreages, productions, live stock, and assessed valuation of property. State statistics and crop and livestock statistics are also included.

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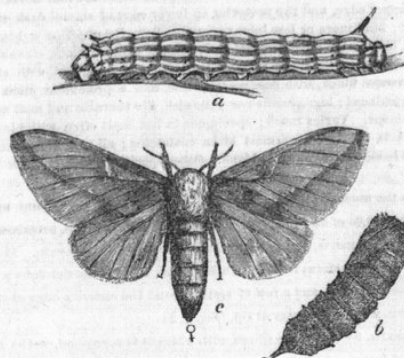
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THE GREEN-STRIPED MAPLE WORM—*Anisota rubicunda*, Fabr.

(Lepidoptera Bombycidae *)

[Fig. 1.]—



On the 28th of June I received the following letter:

DEAR SIR:—We are very much troubled out here in Kansas with worms. You no doubt know some persons who are always afflicted with worms. Those, however, that I wish to ask you about (I mean the worms, not the people) are those that are eating all the foliage off our shade trees—Soft Maples—they trouble none others.

About two years ago was the first I noticed; there were not a great many that year, but last year they came in increased numbers, so that very many trees were eaten entirely bare, there not being a single leaf left. This year they are appearing by the million on the trees in my yard, and in fact on all the Soft Maples in this vicinity. The first you discover will be the eggs laid in clusters on the under side of the leaves, generally near the end of the limbs on the new growth. They soon hatch and begin to eat, grow and spread over the trees, and when they have entirely stripped the tree they crawl down the body to the ground, under foot, into the houses and elsewhere in search of food. They grow to be about two inches long—great green worms.

The eggs are evidently laid by some kind of fly. In our city, and in fact in all this country, the Soft Maple, on account of its rapid growth, has been almost universally set out for shade trees, and this worm nuisance has come to be a serious question.

If they are a thing that has come to stay—to appear and reappear year after year—I propose to cut my trees down and plant something that is worm proof. You may be conversant with this matter and able to tell us at once their nature, and whether they are likely to be a permanent pest, and if there is any remedy for the nuisance. Doubtless they are in other parts of the country, but I have never seen any except in Kansas. If you can tell us anything about the matter, a letter from you would be most gratefully received by

Your Obedient Servant,

HORACE J. SMITH.

Ottawa, Franklin county, Kansas, June 24, 1872.

The worm referred to, as I at once inferred, and subsequently proved by specimens sent by Mr. Smith, was what may be popularly termed the Green-striped Maple Worm, of which figure 1, a, will serve as an illustration. Its usual color is greenish, being striped with pale yellowish green and dark green, and ornamented with spines, as in the figure. It is chiefly characterized by a rosy tint at the sides, near the end, and by two blunt, black horns about one-fifth of an inch long on the top of the second joint, projecting

* Throughout this paper I have in this manner indicated in brackets the Order and Family to which the insect treated of belongs.

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over the reddish yellow head. I subjoin a detailed description, as the caterpillar was unknown to Harris, and no good description is accessible to the ordinary student.

DESCRIPTION OF LARVA.

Length when full grown, 1.50 inches; general color, pale yellowish green; striped above alternately with eight very light (almost white) yellowish green lines, and seven of a darker green, inclining to black—the medio-dorsal one usually darkest, and showing palpitations; characterized by two black, blunt, anteriorly-projecting horns on joint 2; two lateral rows of posteriorly-projecting, more pointed, shorter spines, one (the largest) below and one above stigmata, and most prominent on joints 10 and 11, which are here somewhat dilated and tinged with rose-red. When examined with a lens the body, both above and below, is found to be thickly studded with transparent granulations, and there are four dorsal-polished sub-obsolete spines, the anterior on upper edge, and the posterior on lower edge of second dark stripe, and most prominent on joints 11 and 12; head more or less intense copal-yellow, the ocelli on a black ground; stigmata, in lower dark line, oval, black, with a pale central line; joint 1, with six black elevations on anterior edge; anal shield flattened, greenish, with a black blotch superiorly, and margined with eight black spines, the two terminal stoutest; venter black, with pale median line, and a prominent black spine each side, and sometimes others less prominent; legs greenish or yellowish, the thoracic and anal marked with black, the abdominal with rufous claspers. Varies much; specimens in last molt often with black predominating, the dark lines being jet black, the two lowermost often coalescing; all sometimes coalescing on joint 1, and anal shield, and the legs being almost entirely black. Other specimens with the pale colors predominating. Hundreds examined.

The eggs from which the worms hatch are deposited in batches of thirty and upwards, on the under side of a leaf. Each is about 0.05 of an inch long, sub-oval, slightly flattened, translucent and pale greenish.

The worms go through four molts, and come to their growth within a month. They then descend and enter the ground, where they transform to the chrysalis, which is of a deep rich brown color, roughened with small teeth or spines about the head, and a row of teeth around the anterior edge of the joints, and a tolerably long apical projection, which bifurcates at tip, (Fig. 1, b).

In due time this chrysalis, by aid of the spines with which it is furnished, works its way to the surface and gives forth the perfect insect, which is a most delicate moth, of a pale yellow color shaded with pink, as in the figure (c) which represents the female, the male having a somewhat smaller abdomen and broader, more pectinate antennae. This moth may be called the Rosy *Dryocampa*. It varies a good deal. In our western specimens the yellow predominates, the rose color being but faintly visible. Ordinarily the front wings might be described as rose color, with a yellow band running diagonally across the middle, and broadest on the anterior margin. I have seen eastern specimens where the rose color was quite intense on the front wings, and where the hind wings, which are more generally pure yellow, have a rosy band across them.

With us there are two broods of this insect each year, the first brood of worms appearing mostly during the month of June, and giving forth the moths the latter part of July, the second brood of worms appearing in September, wintering in the chrysalis state, and not issuing as moths till the following May.

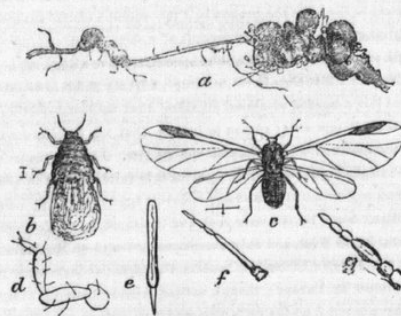
Dr. Harris gave to the genus to which this moth belongs the name of *Dryocampa*, meaning "oak-caterpillar," because all the other species of the genus feed on oaks; and though our maple worm prefers the soft maple, it will nevertheless also feed on oak, as it has been found thus feeding by my friend Wm. Saunders, of London, and I have myself fed it on oak in confinement.

Remedies.—This insect occasionally becomes injurious in the West, but seldom two years in succession. In 1867 it effectually stripped the soft maples around Peoria, Galesburg, Princeton and Monmouth, in Illinois, but attracted no particular attention the following year. When the worms are as abundant as they have been with Mr. Smith, the best way to get rid of them is to knock them down and destroy them. The insect should also be destroyed, as opportunity presents, in the other stages—of egg, chrysalis and moth.

THE APPLE-ROOT PLANT-LOUSE—*Eriosoma pyri* Fitch.

(Homoptera, Aphidae)

[Fig. 2.]



The roots of the apple tree are very often found to rot, and thus cause the death of the tree. Of these rots there appear to be three distinct kinds. One kind is that popularly known as "rotten root" in Southern Illinois, and seems to be a simple decomposition of the vegetable tissue, analogous to the rotting of the root of a cabbage for instance. Its cause is not clearly understood, though it seems to be a consequence of certain conditions of the soil. The other rot is a fungus growth, which, after covering the root with a thin layer of white fibrous substance, causes a sort of dry rot of the root, and which is common to both the Pear and the Apple. Some of the symptoms of this rot are: a rather earlier development or maturity of the branches; an excess of fruit buds, and a shortening or thickening of some twigs.

A third kind is superinduced by the punctures of the Apple-root Plant-louse. It may, I think, be distinguished from both the others by being more porous and soft, approximating the brown mold of a rotting log. The swellings and knots caused by the lice, though hard originally, soon lose their substance, and very frequently the finer roots, and almost always the fibrous roots waste entirely away. When the lice are abundant on young trees in nursery, their punctures, in this way, often prove extremely injurious.

The diagnosis of either of the first two kinds of rot must remain hidden, until our knowledge of these impalpable funguses shall have become more thorough, and until then no remedy can be suggested; but with the last kind, having traced it to its true cause, the means of prevention are at hand, and I will now give the history of the Apple-root Plant-louse.

For upwards of twenty years a Woolly Plant-louse has been known to infest the roots of the apple-tree, causing thereon swellings and deformations of almost every possible shape, and, when very numerous, killing the tree. In the more northerly parts of the Northern States this insect is comparatively rare, but in southerly latitudes it is exceedingly destructive in apple orchards.

As long ago as 1848, Mr. Fulton, of Chester county, Pennsylvania, found this root-louse and the knotty swellings produced by it to be so abundant on nursery trees in his neighborhood, that thousands of young trees had to be thrown away, and it became difficult to supply the market. (Downing's *Horticulturist*, III., p. 394.) And in August, 1858, M. L. Dunlap (*Rural*) stated in the *Chicago Tribune*, that in an orchard near Alton, "the Woolly Aphis infests the roots in immense numbers, and by sucking up the sap destroys the trees, which in its effect has much the appearance of dry rot."

Although this insect usually confines itself to the roots of the tree, yet a few may occasionally be found on the suckers that spring up round the butt of the trunk, and even on the trunk and limbs, especially in places where a branch has been formerly amputated, and nature is closing up the old wound by a circle of new bark. Where it works upon the naked trunk, it often causes a mass of little granulations to sprout out, about the size of cabbage-seeds, thus producing on a small scale, the same effects that it does upon the roots. Wherever the insect works, small as it is, it may be easily recognized by the peculiar bluish-white

cottony matter which it secretes from its body, and which is never met with in the case of the common Apple-tree Plant-louse that inhabits the leaves and the tips of the twigs.

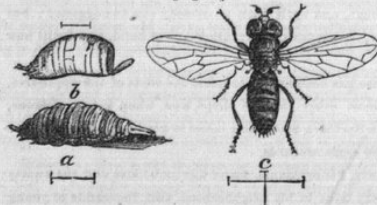
Figure 2 at the head of this article, fully illustrates the Apple-root Plant-louse. A portion of a knotty root as it appears after the punctures of the lice is represented at *a*, the larva state at *b*, and the winged state at *c*; while *d* represents the leg, *e* the proboscis, *f* the antenna of the winged individual, and *g* that of the larva, all highly magnified. The young louse is of a deep flesh or pink color, and the proboscis extends the whole length of the body, while the older specimens have a deeper, purplish hue.

It is pretty generally known that they have in Europe, a Woolly Aphis or so-called "American Blight" on their apple trees; and it is conceded on almost all sides* that the last insect was imported into Europe from this country, and there is now every reason to believe that the two insects are identical, or that at furthest they can only be considered as varieties of one species. I last summer took especial pains to examine the Woolly-louse on the apple trees in Europe, for it is quite common in the orchards around London. I could find no difference between them and our American type, though they seemed to thrive better and perhaps secrete more cottony down in the more cool and moist climate. Yet while in this country our root-louse is very injurious in the West, and only exceptionally found on the limbs above ground, (though more often so found in the Eastern States,) all authors that I am acquainted with have spoken of it as occurring solely on the limbs in Europe; though several friends both in France and England have informed me that they have found it on the roots also, and that in those cases it caused just such swellings as our root-louse does here. I know in St. Louis of an old apple tree, standing in a yard where the ground is trodden hard, the limbs of which have been for the past three years more or less affected with this insect, though none can be found on the roots. But where the ground is more porous, and not so closely pressed to the roots, it seldom occurs on the branches, but often on the roots, even in the immediate neighborhood. Upon the closest examination I cannot find the slightest difference between the root and branch-inhabiting lice, and no doubt their habitat is governed somewhat by the character of the soil, though in this country their normal habit is to attack the roots, and to appear above ground only occasionally in the fall.

NATURAL ENEMIES.

From the enormous rate at which all plant-lice multiply, it is plain that if there were no check upon the increase of the Apple-root Plant-louse, it would in a few years' time sweep away whole orchards, especially in southern latitudes. Luckily for the fruit-growers and fruit-lovers, there exists two, at all events, and probably three such checks. The first is a very minute parasitic fly, which Prof. Haldeman figured

[Fig. 3.]



and described in 1851 as infesting in the larva state his supposed Woolly Plant-louse.† The second is a footless maggot (Fig. 3, *a*) about one-half an inch long, and of a dirty yellow color. It is generally found more or less covered with mud, and with the woolly matter secreted by the lice, and is not by any means easily discerned. It changes in the fall to the pupa state (Fig. 3, *b*) from which, in the following spring, there emerges the perfect fly, (Fig. 3, *c*) which may be

known as the Root-louse Syrphus-fly (*Pipiza radicum*, Walsh and Riley). It was first described in the *American Entomologist* for January, 1869.

The third insect which preys upon these Root plant-lice, at least in Missouri, is a small species of lady-bird, belonging to the genus *Scymnus*. The larva of this beetle is still more difficult to recognize among the lice, as it is covered on the back with little tufts of woolly matter, secreted from its own body. •

* M. Eudes-Deslongchamps and M. Blot are the only authors, according to Amyot and Serville, who believe it is indigenous to Europe.

† This fly belongs to the *Chalcis* family in the Order *Hymenoptera*, and was named *Eriophitus mali* by Prof. Haldeman. The figure and description will be found in the *Farm Journal* for 1851, pp. 130-31.

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It is, when full grown, somewhat larger than the lice, and altogether more active, and is distinguished furthermore by the woolly matter being of an even length and distributed over the back in transverse rows. Mr. J. F. Waters, of Springfield, Missouri, sent to me a number of the apple root-lice, with some of these little ladybird larvæ among them, which he erroneously supposed to be the old lice. In due time I bred the perfect beetle from them, and it proved to be a species which the French Entomologist, Mulsant, had described as *Scymnus cervicalis*. It is a very inconspicuous little beetle, about 0.05 of an inch long, and of a deep brown color, the thorax being of a lighter brown. From subsequent correspondence with Mr. Waters I learned that the lice upon which these little friends of ours were preying, were taken right from the surface of the ground, so that it is possible that this ladybird only attacks them when it can get at them above ground; though, judging from analogy, I strongly suspect it also seeks them out in their underground quarters.

ARTIFICIAL REMEDIES.

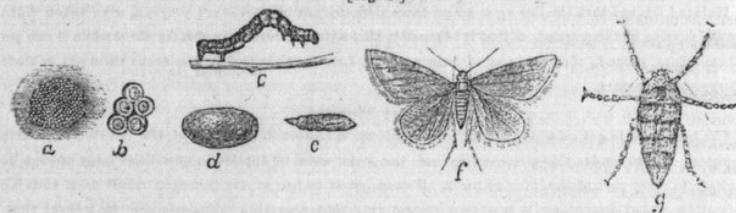
The best mode to get rid of the apple root plant-louse is to drench the roots of the infested tree with hot water. But to render this process effectual, the water must be applied in quantities large enough to penetrate to every part of the infested roots. There need be no fear of any injurious result from such an application of hot water; for it is a very general rule that vegetable organisms can, for a short time, stand a much higher temperature than animal organisms, without any injury to their tissues. In laying bare the roots for a better application of the water, a sharp eye should be kept for the friends above described, and when espied they should be tenderly laid aside till after the slaughter of the enemy. Mulching around the infested trees has been found, by Mr. E. A. Riehl and others, of Alton, Illinois, to have the effect of bringing the lice to the surface of the ground, where they can be more easily reached by the hot water.

But it is extremely difficult, if not impossible, to clear the roots of a large tree of these lice; and the great object of the Kansas fruit grower should be to prevent the introduction of the louse upon young trees obtained from the nursery. Let the roots of all young trees be thoroughly examined before planting, and if any of these little cottony lice are found upon them, soak the roots in a decoction of strong tobacco-water, mixed with about a pint of soap to the gallon of water. One set of roots may be soaking in a large vessel while others are being planted. If the saving of time be an object the liquid may be used hot, and the roots simply dipped a few times.

THE CANKER-WORM—*Anisopteryx vernata*, Peck.

(Lepidoptera Phalaenidae.)

[Fig. 4.]



As this orchard scourge is but too abundant in many localities throughout the surrounding States of Iowa, Illinois and Missouri, it has, no doubt, already obtained a footing in some of your Kansas orchards, and if my memory does not fail me, I have heard the fact stated at one of the meetings of your Farmers' Institute at the Agricultural College at Manhattan. In any event it behooves your fruit-growers to inform themselves as to its habits and appearance, which I will relate, very much in the words of an article in the second Missouri report, with some few changes and amplifications.

This word CANKER-WORM has formed the heading of so many articles in our various Agricultural and Horticultural journals during the last ten or twelve years, and its natural history has been so fully given in the standard work of Dr. Harris, that one almost wonders where there can be a reading farmer who does not know how properly to fight it. But then, new generations are ever replacing those which pass away, so that the same stories will doubtless have to be repeated to the end of time. Facis in Nature will always bear repeating, and since, as we have already seen, it may be laid down as a maxim that no injurious insect can be successfully combated without a thorough knowledge of its habits and transformations, I will recount those of the Canker-worm, and afterwards state the proper remedy.

The eggs of this insect are very minute, measuring about 0.03 inch in length and 0.02 in diameter. In form they are not unlike a miniature hen's egg, minutely roughened and with longitudinal irregular depressions. They reflect prismatic colors, and are deposited close together in rows, forming batches such as that shown in the above figure 4, *a* representing them of the natural size, and *b* representing them magnified. They are glued by a grayish varnish which the mother moth secretes, and they are attached to the trunk, and may almost always be found on the inside of loose scales of bark, each batch consisting of upwards of a hundred eggs. The moth also has a habit of filling the vacated cases of *Phycita nebulo*, or the Rascal Leaf-Crumpler, with her eggs; and, indeed, it seems to be her habit to hide them as much as possible.

As the leaves begin to form, these eggs hatch into minute, thread-like span-worms, which in from three to four weeks afterwards acquire their full size, when they appear as at figure 4, *c*. The Canker-worm is distinguished from most other caterpillars that attack the Apple, by having but four prolegs at the end of the body. The normal number of such prolegs in caterpillars, is ten, and it is the lack of the foremost six which obliges our insect to span or loop, from which habit the characteristic name GEOMETRIDÆ has been given to the group to which it belongs.

When full-grown this worm measures scarcely an inch in length, and is commonly ash-gray on the back, darker at the side and yellowish beneath. It varies greatly in the intensity of its markings however,

[Fig. 5.]



gray, green, and yellow ones occurring in the same brood, and the most constant character by which it may be distinguished from other span-worms of the same size, is the pattern of the head, which, no matter what the general hue of the body may be, is usually shaded and marked as in the annexed figure 5. The markings of the worm vary, indeed, so much that without this criterion I could hardly venture to determine a Canker-worm larva myself.

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I subjoin a very full description of this worm from numerous average specimens, as it is of considerable importance, that an orchardist may be able to ascertain definitely whether he is troubled with the true Canker-worm or not. For if he mistakes some other span-worm which produces winged females as well as winged males, for the genuine Canker-worm which is apterous in the female moth state, it becomes very obvious that all his efforts to try and prevent the ravages of the spurious Canker-worm by the most approved and well-tried methods, will not only fail most absolutely, but he will lose all faith in such remedies, and may, perchance, if he is given to the use of the quill, vent his wrath and disappointment by sending to some one of the horticultural journals of the land, a pithy article "based upon FACTS [?] and EXPERIENCE," showing up the utter worthlessness of the Canker-worm remedies!

It is from such lack of true knowledge that the City Fathers of Baltimore, Maryland, went to the useless expense of furnishing oil troughs for all their large elm trees which were being defoliated, under the delusive idea that the insect committing the ravage was the Canker-worm; whereas it turned out to be the larva of a little imported Beetle, (*Galeruca californiensis*, Fabr.), the female of which has ample wings, and can fly as readily as a bird from tree to tree; and it is from such oversights, that paragraphs like the following take their rise. This one may be found in the *Boston Journal* for May 23d, 1866:

ORIGIN OF CANKER-WORMS.

A Medford correspondent says that last fall he applied to his trees protectors which were pronounced the best in the neighborhood, and notwithstanding not a single grub passed over them, the trees, like others in the vicinity, are this season covered with worms which are now pursuing their devastating work. In his opinion the Canker-worms do not originate from the grub, and he challenges proof that they do. The subject is one worthy of investigation!

Whe-e-e-e-ou! It needs no comments here. The insect referred to might have been one of a dozen; and was in all probability what may be known as the forest span-worm (*Ennomos subsignaria*), the larva of a silvery-white moth which is winged in both sexes. This worm has the present year, 1872, swept over the forests in many parts of Ohio, causing the trees to look as though a fire had passed through them.

When first hatched, the young Canker-worms are of a dark olive-green, or brown hue, with a shiny black head and thoracic legs, with a whitish lateral and dorsal band, the latter having a darker central line along it. After the first moult, the head becomes lighter and mottled, and the light bands less conspicuous. After the second moult the bands are almost obliterated, and the body becomes more uniformly mottled and speckled with livid-brown; the head becomes still lighter and the prolegs being now large, spread out at almost a level with the venter. After the third (and I believe last) moult the appearance changes but little. The full grown larva averages 0.90 inch in length with an average diameter of 0.10 inch, being broadest on joint 11. It varies from light fleshy-gray to almost black. Head mottled as in Figure 5. Ends of body somewhat darker than middle. Joint 1 with a yellowish dorsal shield, the hinder margin in form of a rounded W. Viewed under a lens the body has a series of eight fine light yellowish, irregular, somewhat broken lines, running the whole length of the body, each one relieved by a darker shade each side of it. The two along middle of dorsum are close together, with the space between them usually dark, and occupied at anterior edge and middle of joints 5, 6, 7 and 11, by black marks somewhat in form of x, these marks being represented by simple black dots on the other joints. Space between these dorsal lines and the next lowest, lighter, and containing four black piliferous spots to each joint, the posterior ones rather further apart than the anterior ones, which on joint 11 form two larger elevated shiny black spots. Space between lines 2 and 3 darker than any other part of the body, and containing the stigmata which are perfectly round and black, with a light center, with a small piliferous spot anteriorly above and below them, and another behind them, this last becoming large on joints 5, 6, 7 and 8. Venter dark and livid at borders, with a pale greenish band along the middle, which has a pinkish patch in it on joints 5, 6, 7 and 8. Legs greenish at base, color of body at extremity. The markings are most distinct on the light specimens.

The Canker-worm is by no means confined in its destructive work to the Apple, for it likewise attacks the Plum, the Cherry, the Elm, and a variety of other trees. It is seldom ever noticed on our trees till the riddled and seared appearance of the foliage tell of its presence, for, like most other span-worms, it has the habit of resting in a stiff, straight posture, either at an angle of about 45 degrees from, or flat and parallel with the twig which it occupies—thus eluding detection.

After it has attained its full size, it either crawls down the tree or lets itself down by means of a silken thread, and burrows into the ground. Here, at a depth of two or three inches, it forms a rude cocoon of particles of earth intermixed with silk (Fig. 4, d.) Within two days after completing the cocoon the worm

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becomes a chrysalis of a light brown color. The sexes are now distinguishable, the male chrysalis (Fig. 4, c) being slender, pointed in front, and showing the wing-sheaths, while that of the female is larger and destitute of wing-sheaths.

In the latitude of St. Louis the worms have generally descended from the trees and entered the ground by the middle of May, though some remain till about the first of June. As I have amply proved, there is but one brood each year in this State, just as there is but one brood in Maine, and whether the worms enter the ground the first or the last of May, there they remain as chrysalides all through the summer and fall months, and the great majority of them till the following spring. A frost seems to be necessary to their proper development. Some come out during the first mild weather that succeeds the first frosts in November; others issue all through the winter whenever the ground is thawed, and the great bulk issue as soon as the frost is entirely out of the ground in spring. Many which I have bred issued during the warm weather of January.

The moths (Fig. 4, f, g,) show great disparity of sex, the male being fully winged while the female is entirely destitute of these appendages. The front wings of the male are pale ash-gray, crossed by three equidistant, jagged, more or less defined, black lines, all curved inwardly, and most distinct on the front or costal border, and by a somewhat broader whitish line, which runs from the posterior angle to the apex, the inner and terminal borders also being marked with black. The hind wings are silvery-gray, and the under surfaces are of the same uniform silvery-gray color, each wing with a dusky discal spot, the front wings each with an additional spot on the costa. Such is the appearance of the more common perfect specimens found in the West, but the wings are very thin and silky, and the scales easily rub off, so that it is almost impossible to capture a perfect specimen at large. They vary considerably also—so much so that Dr. Harris ranks a smaller form as a distinct species (*A. pometaria*) which I have however bred promiscuously with the more typical specimens. The most common variation from the brief description above given, is found in such specimens which have the dark lines obsolete, and an additional white line inside the one described. The female is ash-gray, the thorax with a black spot, the body more or less marked with black along the back, and the legs alternately marked with black and white.

It is the apterous condition of the female moth which gives us such complete control of this enemy, and which indicates

THE PROPER REMEDY.

The sole object of the female, after she leaves the earth, seems to be to provide for the continuance of her kind, and she instinctively places the precious burden, which is to give birth to the young which she herself is destined never to behold, upon the tree whose leaves are to nourish those young. All her life-energy is centered in the accomplishment of this one object, and she immediately makes for the tree upon issuing from the ground. Consequently, anything that will prevent her ascending the trunk will, in a great measure (but as we shall presently see, not entirely), preserve the tree from the ravages of the worm.

Numerous indeed have been the devices—patented or unpatented—which have at different times and in different parts of the country been used to accomplish this desired end; and every year our agricultural journals report individual experiments with some one or other of these devices—some favorable and others adverse. Tar, applied either directly around the body of the tree, or on strips of old canvas, on sheep-skin, or on stiff paper; refuse sorghum molasses, printers' ink, or slow-drying varnishes, or melted India rubber, which always retains its soft viscid state, applied in a similar manner; tin, lead, and rubber troughs to contain oil; belts of cotton, wool, etc., etc., have all been used, and with both good and bad results, very much according as they have been used intelligently or otherwise. Now, all these appliances, of whatsoever character, are divisible into two classes: first, those which prevent the ascension of the moth by entangling her feet, and trapping her fast, or by drowning her, and second, those which accomplish the same end by preventing her from getting a foothold, and thus causing her repeatedly to fall to the ground until she becomes exhausted and dies.

The first class of remedies is thoroughly effectual when applied understandingly and persistently. And by this I mean that the orchardist must know that many of the moths issue in the fall of the year, and that the application must, in consequence, be made at least as early as the latter part of October, and that they must be kept sticky, through all that freezing weather, till the leaves have well put out, in the following spring. Furthermore he must know that many of the moths—frustrated in their efforts to climb the tree—

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will deposit their eggs near the ground or anywhere below the application, and that the young worms hatching from them are able to pass behind the slightest crevice or over the finest straw. Thus, if troughs are used, they must be fitted over a bandage of cotton-wool, so that when the trough is drawn tightly around the tree, it will do no injury, and will at the same time cause the cotton to fill up all inequalities of the bark; the joint must likewise be kept smeared either with tar or molasses, and then the worms will not be able to pass. In the neglect to thus fasten them, lies the secret of failure which many report who use such troughs. The second class of contrivances are of no avail whatever, for although the moth is unable to travel over a very smooth surface, I know from experience that the young worms can march over the smoothest glass by aid of the glutinous silken thread which they are able to spin from the very moment they are born. For these reasons, even the "Merritt's Patent Tree-Protector," which was so well advertised by Mr. Howard in his otherwise excellent article on the Canker-worm, in the Michigan Agricultural Report for 1865, must be classed with the worthless patents. This "Protector" consists of a ring of glass grooved below and hung from the tree by a tent of canvas, to which it is fastened by an iron clamp.

I might enumerate a number of such ingenious contrivances both of glass, wood, tin, and isinglass, for heading off the female moth *only*, and some few which are sufficiently thorough to head off the young larvæ also; but they are all so expensive that I am perfectly convinced they will never be adopted in our large orchards; nor are they necessary, for some of the remedies already mentioned are altogether more simple and more effectual.

It cannot be denied that it requires a great deal of time, labor and expense to continually renew the applications of tar on every tree in a large orchard during so many months of the year; while its application directly to the bark is more or less injurious to the trees. For these reasons, refuse sorghum molasses will be found much better for the purpose, as it does not harden so rapidly, and is said not to be injurious to the tree. In neighborhoods where sorghum is grown, it is also much cheaper. That it will pay to do this work in orchards where the Canker-worm is known to be numerous, there cannot be the least doubt. The old adage, "What is worth doing at all is worth doing well," was never truer than in fighting this insect. Apply the remedy thoroughly during two successive years, and you have utterly routed the enemy, and this is more especially the case where an orchard is not in too close proximity to the timber, or to slovenly neighbors. Fail to apply the remedy, and the enemy will, in all probability, rout you. The reason is simple. The female being wingless, the insect is very local in its attacks, sometimes swarming in one orchard and being unknown in another which is but a mile away. Thus, after it is once exterminated, a sudden invasion is not to be expected, as in the case of the Tent Caterpillar, and of many other orchard pests; but when it has once obtained a footing in an orchard, it multiplies the more rapidly, for the very reason that it does not spread fast.

If oil troughs are used, it will be found much safer and surer to sink them in the ground close around the butt of the tree, instead of winding them around the trunk higher up. There will then be no chance for the young worms to get up between the trough and the tree. But it follows that this plan can be adopted only in an orchard which is kept perfectly clean.

Vigilance is the price of reward, and as it is always easier to prevent than to cure, it were well for the owners of young orchards, in neighborhoods where the Canker-worm is known to exist, to keep a sharp look-out for it; so that upon its first appearance the evil may be nipped in the bud. In the same manner that it is exterminated in the individual orchard, in like manner it may, by concert of action, be exterminated from any given locality. When once the worms are on a tree, a good jarring will suspend them all in mid-air, when the best way to kill them is by swinging a stick above them, which breaks the web and causes them to fall to the ground, when they may be prevented from ascending the tree by the methods already described, or by strewing straw on the ground and setting fire to it.

One word in commendation of late fall plowing and the use of hogs. A good deal has been said both for and against fall plowing, and the discussion which took place at the November (1868) meeting of the Alton (Illinois) Horticultural Society, will afford a sample of the different opinions held by individuals:

Dr. Long took the ground that fall plowing was one of the best and surest means of eradicating those insects which stay in the ground over winter. He said, some five or six years ago my orchard was badly infested with the Canker-worm; by late cultivation I almost, if not entirely, got rid of them.

Dr. Hull—I do not believe that fall plowing will destroy the larvæ of insects to any extent. I have



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dug up frozen lumps containing larvae that were not affected by freezing. I think the Canker-worm will not spread here as in New England.

J. Huggins—I have been led to believe, contrary to Dr. Hull's statement, that they will spread, and feel that there is great danger of their spreading. I believe fall plowing a great aid in the extermination of them. Cites a case where they have been almost entirely destroyed by late plowing, in an orchard that was nearly ruined by them.

Dr. Hull—If it be true that they will spread, why is it that none of Dr. Long's neighbors have them? He says he was badly overrun with them, and the fact that his neighbors were not, I think confirmation of my statement that they will not spread.

Dr. Long—My brother's orchard, adjoining mine, had double as many as my own. He fall plowed, and has very few left. He also cites the case of an old orchard in this section that was almost destroyed by them, but fall plowing has almost, if not entirely, destroyed them.

The following item from the "New York Weekly Tribune," of February 26, 1869, also bears on this point:

CANKER-WORMS DESTROYED BY PLOWING.

Mr. McNeil Witherton, in answer to W. Y. Monroe's request: I will state that I think that the Canker-worm can be destroyed by plowing the ground where they are late in the fall. The 28th of November, 1867 I was at my son David's in Wisconsin. He told me that the Canker-worms were in his orchard, and had injured his apple trees very much the past season; that a man who owns a nursery and keeps apple trees for sale, went into the orchard and examined the trees and worms, and said it was the Canker-worm that was injuring his orchard. I told him that about fifty years ago they had been in my father's orchard some six years, and killed a large number of the trees; that we plowed it late in the fall, and have never seen the Canker-worm there since. I advised him to plow his orchard immediately. The next day he plowed it as far as the worms had been in it. I received a letter from him a few weeks ago, stating that the Canker-worms were not in his orchard this year, and those trees that were injured and not killed last year, revived some this year.

Now there is no doubt but late plowing will produce somewhat different effects, according to the character of the soil and the depth of the plowing; but that it is more generally beneficial than otherwise I am perfectly convinced, and as for the assertion of Mr. Wm. P. Lippincott, of Vernon, Iowa, made some time ago in the *Iowa Homestead*, namely, that it left the ground full of harbors for the next year's breeding, it suffices to say that the insect does not breed in the ground, and holes or no holes, the worms will penetrate the soil whenever the time arrives to change to chrysalis. After the summer months the insect invariably lies in the chrysalis state, snugly entombed in a little earthen cell, very thinly lined with silk, from two to six inches below the surface. This cell, though frail, is a sufficient protection, so long as it is whole, from any excess of moisture, and at the same time prevents too much evaporation in case of summer drouth or dry winter freezing. Now I have proved by experiment that whenever this cell is disturbed or broken in cold weather the chrysalis has not the power to penetrate the ground again, and in the great majority of instances, either rots, dries out, becomes mouldy, or, if on the surface, is devoured by birds. Even summer plowing, if performed after the first of July, would work beneficially; and it is for this reason that clean, well cultivated orchards are more free from the attacks of this insect than slovenly and neglected ones. The only advantage of late fall plowing lies in the fact that the chrysalis is at that time too benumbed to work itself into the ground and form another cell, and that birds are then harder pushed for food, and more watchful for any such dainty morsel.

As to the efficiency of hogs, in rooting up and devouring the chrysalids, during the summer months abundant favorable testimony might be cited; but the facts are too obvious to need argument.

In his second annual report, as State Entomologist of Illinois, Dr. William Le Baron gives prominence to an article on this insect, and details much interesting experience had with it in 1871. This experience accords with and confirms what I have already written. He shows that the moths are most active in the evening; i. e., they are crepuscular, like almost all the species belonging to the same family. He also shows that the principal mode of migration is by the worms floating in the air and being blown while hanging from their threads. I subjoin his summary of remedies in his own words:

1st. Prevent the passage of the moths up the trees. The most approved plan heretofore used is to put a canvas or other cloth band, six inches or more in width, around the trunk and besmear it with tar, or a mixture of tar and molasses, applied every other day. The method suggested in this report is to put a band of rope or closely twisted hay around the trunk, and over this a tin band about four inches wide, placed so that the rope shall be at the middle of the tin, making a closed cavity below, and a free edge of

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tin above. The time to use these appliances is mostly in the month of March, but also at other times when the weather is sufficiently open to permit the insects to run.

2nd. If the moths are prevented from ascending the tree, they will deposit their eggs below the obstruction, and for the most part near to it. These eggs can be destroyed by a single application of kerosene oil.

3d. If the moths are not prevented from ascending the tree they will deposit their eggs mostly upon the under side of the scales of bark, on the upper part of the trunk and larger branches. Many of these can be destroyed by scraping off and burning the scales.

4th. If all precautions have been neglected and the eggs have been permitted to hatch, then, as soon as the worms are large enough to be easily seen, jar them from the trees and sweep them away with a pole, as they hang by their threads, and burn or otherwise destroy them.

5th. If the worms have matured and gone into the ground for winter quarters, plow the ground late in the fall, so as to expose the pupae to frost, and to the action of natural enemies.

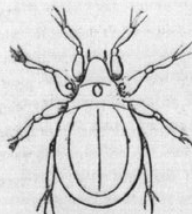
We wish to call particular attention to the rope and tin bands mentioned in the first paragraph. We have found this, upon the few trees to which we have applied it, an almost perfect barrier to the ascent of the moths, and we are very desirous that others should give it a trial on a larger scale. The method of putting on these bands is very simple. Take a piece of inch rope—old worn out rope is just as good as new—tack one end to the trunk, two feet or less from the ground, with a shingle nail, driven in so that the head shall not project beyond the level of the rope. Bring the rope round the tree, and let it lap by the beginning an inch or two, cut it off and fasten it in the same manner. Get the tinman to cut up some sheets of tin into strips four inches wide and fasten them together endwise, so that they shall be long enough to go round the trees over the rope band, having the rope at the middle. Let the ends of the tin lap a little, punch a hole through them and fasten them with a nail driven through the tin and rope into the tree.

The result of this contrivance is that the moths congregate below the obstruction, and sometimes pile up so as to go over onto the tin. But when they reach the upper edge of the tin they go round and round it till they become discouraged. They could easily go down on the inside of the tin and across the rope onto the tree, but so far at least as my experience goes, they do not do so. Their instinct impels them to go upwards, and these simple, unreasoning creatures do not know enough to overcome the difficulty by first going a little downward. They have not yet learned the art sometimes practiced by females higher in the scale, of stooping to conquer.

ENEMIES OF THE CANKER-WORM.

Like most of our noxious insects, the Canker-worm is subject to the attacks of cannibal and parasitic insects. It is also devoured by very many different birds, some of which almost entirely live on it; and

[Fig. 6.]



Dr. Packard, of Salem, Mass., has observed an elongated mite (*Nothrus ovivorus*, Fig. 6, enlarged) devouring its eggs. The most common parasite which I have yet discovered with us, is an undescribed, small, four-winged fly, belonging to the genus *Microgaster*, of the same size, but differing from the Military *Microgaster* (Fig. 7) which preys upon the Army [Fig. 7.] Worm. It differs also from most other insects of the same genus, by each individual larva, as it eats through the skin of the Canker-worm, spinning its pale greenish-white cocoon alone, and not in company. About ten per cent. of the worms which I have endeavored to breed, have been



destroyed by this parasite. Harris mentions the larva of another four-winged fly, and that of a two-winged fly, belonging to the genus *Tachina*, which also infest the worm, destroying about one-third of them in Massachusetts. There is also a very minute and undescribed species of *Platygaster*, which pierces the egg of the Canker-worm, and drops one of her own into it, from which in due time the perfect fly develops.

Among the Cannibal insects which prey upon it, may be mentioned the Ground-beetles, two of which I have found preying upon this worm, namely, the Rummaging Ground-beetle (*Calosoma scrutator*, Fabr.,

[Fig. 8.]

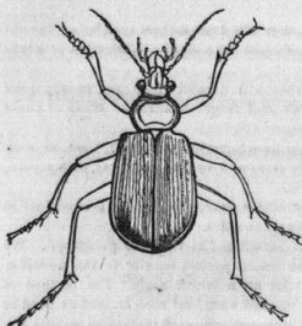


fig. 8,) a large and beautiful insect, with the wing-covers golden-green and the rest of the body marked with violet-blue, gold, green, and copper; and the Flery Ground-beetle (*Calosoma calidum*, Fabr., Fig. 9,) a black species of almost equal size, with copper colored spots on the wing-covers. These beetles are very active, and run over the ground in search of soft-bodied worms, and will even mount upon the trunks of trees for the same purpose.

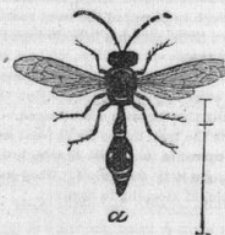
[Fig. 9.]



The Fraternal Potter-wasp (*Eumenes fraterna*, Say,) is stated by Harris to store her cells with Canker-

[Fig. 10.]

worms, often gathering eighteen or twenty of them for a single cell. This wasp (Fig. 10, a,) is quite common in St. Louis county, and uses other species besides Canker-worms as food for its young. Its clay nest (Fig. 10, b, entire; c, the same cut open shortly after it was built, showing the manner in which it is compactly crowded with green worms,) may often be found attached to the stems of the Goldenrod, and of other plants in the open air, or cemented under the loose bark of some tree. It has even been found attached to the leaves of a deciduous plant, and I have taken one from which the fly had already escaped, on a head of standing wheat, which indicates that the larva must sometimes develop very rapidly.

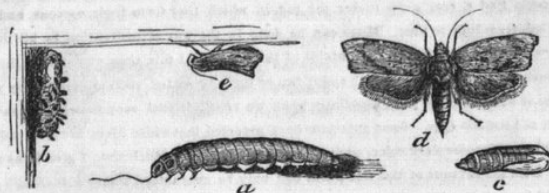


THE BEE-MOTH OR WAX MOTH—*Galleria cereana*, Fabr.

(Lepidoptera, Tineldæ.)

[From the first Missouri Entomological Report.]

[Fig. 11.]



Large hawk-moths sometimes enter a beehive for what honey they can get, and even mice have been known to enter a hive; while several parasites live upon the bees themselves. In our own State as I shall presently show there is a large two-winged fly which seizes the bee while on the wing and kills it. But by far the worst enemy the bee-keeper has to contend with, is the Bee-moth (*Galleria cereana*, Fabr.) This insect is so well known to bee men generally, that it scarcely needs a description. It is well illustrated above (Fig. 11) in all its stages, *a* showing the full grown worm, *b* the cocoon which it spins, *c* the chrysalis to which it changes, *d* the female with wings expanded, and *e* the male moth viewed from the side with the wings closed. It suffices to say that the color of the moth is dusky gray, the fore wings which are scalloped at the end, being more or less sprinkled and dotted with purple-brown. The female is generally a good deal larger than the male, though there is not so much difference between the sexes as some writers have supposed. The worms which produce these moths are of an ash-gray color above, and yellowish-white beneath.

The Rev. L. L. Longstroth, in his excellent work on the Honey-bee, which every bee-keeper should possess, has given such a complete account of the Bee-moth, that it is only necessary for me to mention a few of the most important facts with regard to it, my object being principally to show that there can be no such thing as a *moth-proof hive*; that wire-gauze contrivances are of no avail, and that the man who pretends to sell a *moth-proof hive*, may usually be set down as a know-nothing or as a swindler.

The Bee-moth was first introduced into this county from Europe, about the commencement of the present century, and it was, in all probability, imported with the common bee-hive. There are two broods of the moth each year, the first brood appearing in May and June, and the second, which is the most numerous, in August. During the day time, these moths remain quietly ensconced in some angle of the hive, but as night approaches, they become active, and the female uses her best endeavors to get into the hive, her object being to deposit her eggs in as favorable a place as possible. Wire-gauze contrivances are of no avail to keep her out, as she frequently commences flying before all the bees have ceased their work. But even if she were entirely prevented from entering the hive; she could yet deposit her eggs on the outside, or by means of her extensile ovipositor, thrust them in between the slightest joint or crack, and the young worms hatching from them, would readily make their way into the hive. The moment the worm is hatched, it commences spinning a silken tube for its protection, and this tube is enlarged as it increases in size. This worm cuts its channels right through the comb, feeding on the wax, and destroying the young bees on its way. When full-grown, it creeps into a corner of the hive or under some ledge at the bottom, and forms a tough white cocoon of silk intermingled with its own black excrement as in figure 11, *b*. In due time the moth emerges from this cocoon.

A worm-infested hive may generally be known by the discouraged aspect which the bees present, and by the bottom board being covered with pieces of bee-bread mixed with the black gunpowder-like excrement of the worm. It must not be forgotten, however, that in the spring of the year, pieces of bee-bread at

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the bottom of a hive *when not mixed with the black excrement*, is not necessarily a sign of the presence of the worm, but, on the contrary, may indicate industry and thrift. If a hive is very badly infested with the worm, it is better to drive out the bees and secure what honey and wax there may be left, than to preserve it as a moth breeder to infest the apiary. If put into a new hive, the bees may do something, and if they do not, there is no loss, as they would have perished, finally, from the ravages of the worm.

It should invariably be borne in mind that a strong stock of bees is ever capable of resisting, to a great extent, the attacks of the worm; while a starved or queenless swarm is quite indifferent to its attacks. In a common box hive, a good way to entrap the worms after they are once in a hive, is to raise the front upon two small wooden blocks, and to put a piece of woolen rag between the bottom board and the back of the hive. The worms find a cozy place under the rag, in which they form their cocoons, and may there be found and killed, from time to time. Much can be done in the way of prevention, by killing every morning the moths which may be found on the outside of the hives. At this time of the day, they allow themselves to be crushed with very good grace; and if two or three be killed each morning, they would form an important item at the end of the year, especially when we recollect that each female is capable of furnishing a hive with at least 300 eggs. Some apiarians have asserted that white hives are more subject to attack than those painted with some dark color, such as red or brown. In conclusion, I give it as my conviction that immunity from the ravages of this Bee-worm can only be guaranteed where a thorough control is had of both hive and bees; hence the great importance of the movable frame hive.

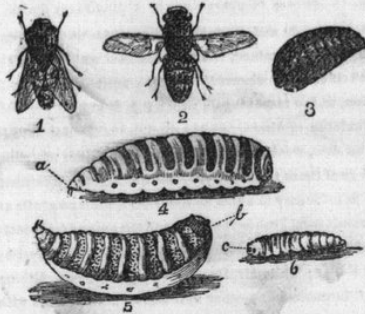
THE SHEEP BOT-FLY OR HEAD MAGGOT—*Estrus ovis*, Linn.

(Diptera, Estridae.)

[From the first Missouri Entomological Report.]

For the benefit of sheep raisers I give the following brief account of the insect which causes "Grub in the head." The annexed illustration (Fig. 12)

[Fig. 12.]



represents it in all its stages. 1 shows the Gaddy, life size, with wings closed; 2 the same with wings expanded; 3, the pupa from which the fly has escaped; 4 the full grown larva, dorsal view; 5 the same, ventral view; 6 the same when younger.

This insect is the dread of sheep in the Old as well as the New World, and was made mention of by the Greek physician, Alexander Trallien, as far back as the year 560.

The flies make their appearance in June and July, and deposit living maggots in the nostrils of the sheep. As soon as they are deposited they ascend the nostrils, causing great irritation on their way,

until they reach the frontal sinuses; there they attach themselves by the little hooks or tentacula placed each side of the head, to the membranes which line the cavities, feeding on the mucus which is always to be found in them. Until they attain their growth they are of a creamy white color, with two brown spots placed side by side on the posterior segment. These spots, (b, c) are spiracles or stigmata, through which the worm breathes. The segment with these two spiracles, is retractile, and can be drawn in and hidden at the worm's pleasure. When full grown, the grub becomes darker, particularly towards the tail, the white of the first two or three segments becoming dirty white on the 4th or 5th, and growing darker on each successive segment until the last, which is of a very deep brown. It has two small parallel hooks or tentacula at the head (a), and above these, two very small tubercles, not very easily shown in the engraving. It also has a small brown elevated round spot on each segment along the sides, which might at first be taken for spiracles but which are not, and also two small corneous appendages (5, b) on each side of the anus. The ventral region has a band of small elevated dots running the breadth of each segment in their middle, which, under the magnifier appear to be minute brown spines, all pointing posteriorly. (See Fig. 12, 5.) These aid the worm in its movements.

When ready to contract into a pupa, it descends down the nostrils of the sheep and falls to the ground, where it quickly buries itself, and in about forty-eight hours contracts to half its former size, and becomes smooth and hard and of a black color, tapering as in the larva towards the head. It remains in this state from forty to fifty days, or more, according to the weather, when the fly pushes open a little round cap piece at the head and thus arrives at maturity.

In this stage they look something like an overgrown house-fly. The ground color of the upper part of the head and thorax is a dull yellow, but they are so covered with little round elevated black spots and atoms, (scarcely distinguishable without the aid of a magnifier) that they have a brown appearance. The abdomen consists of five rings, is velvety and variegated with dark brown and straw color. On the under side it is of the same color, but not variegated in the same way, there being a dark spot in the middle of each ring. The feet are brown. The under side of the head is puffed out and white. The antennae are extremely small and spring from two lobes which are sunk into a cavity at the anterior and under part of the head. The eyes are purplish-brown, and three small eyelets are distinctly visible on the top of the head. It has no mouth, and cannot therefore take any nourishment. The wings are transparent and extend beyond the

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body, and the winglets which are quite large and white, cover entirely the poisers. Its only instinct seems to be the continuation of its kind. It is quite lazy, and except when attempting to deposit its young, its wings are seldom used.

It has lately become the fashion with many members of the Agricultural press, to ridicule the idea that sheep die at all from grub in the head, and many even deny that the grub is capable of any injury to the sheep whatever. From the fact that this grub may be found in the head of almost every sheep that dies, in the Western States at least, it is undoubtedly true that many other diseases are cloaked by the popular verdict of "grub in the head." It is none the less true however, that those Agricultural editors who pretend to instruct, simply show their lack of practical knowledge in butting against that, which must be the firm conviction of every flock master, viz: that sheep do die of grub in the head, Messrs. Youatt and Clark notwithstanding.

Mr. Youatt declares: "It is incompatible with that wisdom and goodness that are more and more evident in proportions as the phenomena of nature are closely examined, that the destined residence of the *Oestrus ovis* should be productive of continued inconvenience or disease." I agree most decidedly with Mr. Randall, that "this is as far fetched as a conclusion, as the reasoning on which it is founded."

If grub in the head is not productive of inconvenience or disease, as the disciples of Youatt have it, whence the suffering condition, the loss of appetite, the slow, weak gait, the frequent coughing, the slimy and purulent matter, sometimes so profusely secreted as at times to almost prevent the animal breathing? Whence the tossing and lowering of the head, and the fits of frenzy to which so naturally quiet and gentle an animal as the sheep is subject? All these symptoms result from grub in the head, and the animal frequently gets too weak to rise, and finally dies. These effects of the grub were well recognized and understood by such old writers and close observers as Reaumur and Kollar; while Mr. Dan'l Kelly, of Wheaton, Illinois Towne Brothers, of Geneva, Illinois, M. L. Cockrill, of Tennessee, and other well known flock-masters with whom I have either conversed or corresponded, are unanimous in ascribing these symptoms to the true cause; and the late S. P. Boardman, of Lincoln, Illinois, coincided with them in this respect. For my part, I would as soon believe that those parasites were beneficial, which are so injurious to man, either internally or externally, or those which prey upon our caterpillars and other insects, and invariably destroy them; for although when there are but few grubs in the head the injury they inflict is not perceptible, *they can never be beneficial*, and when numerous enough will undoubtedly cause death. They cannot live in the head of the sheep without causing great irritation by the spines with which the ventral region is covered and the hooks with which they cling to such a sensitive membrane as that which lines the sinuses. Moreover, when numerous enough to absorb more mucous than the sheep secretes, the grubs will feed on the membrane itself, and (according to the evidence of some practical sheep men) will even enter to the brain through the natural perforation of the ethmoid bone, through which pass the olfactory nerves; in either of which cases, they must cause the most excruciating pain. The natural fear also, which sheep have of the fly, and the pains they take to prevent its access to the nose, is of itself proof enough that it is obnoxious to them. The rabbit is subject to the attack of a very large gad-fly, (the *Cuterebra caniculi* of Clark.) I saw a half grown rabbit the past summer with an enormous swelling on each side of its neck. On examination these swellings were found to be caused by the grubs of this fly, and the rabbit was so weakened and emaciated that it could scarcely move. No one could witness such a sight without being convinced that the parasite was injurious.

In the *Prairie Farmer* of October 14, 1865, the fact was published that the sheep Bot-fly deposits *living* maggots in the nostrils of the sheep. It was published on the authority of Mr. Kelly, and both he and myself then believed it to be the first published account of the viviparous nature of the fly. But the following extract from a letter from the late lamented Samuel P. Boardman, of Lincoln, Illinois, shows that the same discovery has been made by three independent observers in this country. Mr. Boardman wrote as follows:

"All the authors, both European (at least all *English*) and American, from Youatt to Randall, will persist in saying that the fly deposits an *egg*, which hatches out and crawls up the nostrils of the sheep, etc., etc. Now three independent and perfectly original discoverers have in our own country within twenty-five years past, disproved the book account of the grub's transformations.

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"John Brown—'Old Osawattomie John Brown,'—published an account in an Agricultural paper (I forget what one) about twenty years since, of his seeing 'with his own eyes,' the fly drop the *perfectly formed and living grub* in the nostrils of the sheep. Some seven years since, 'Old Dan Kelly,' of Du Page county, Illinois, made the same discovery and supposed that he was the only man who had ever done it. At the time he made known his discovery at a meeting of the Illinois State Wool-Growers' Association held in Chicago, I thought also, that he was the first man to ever notice the like. Two or three years afterwards I saw the account of John Brown's discovery in the *Ohio Farmer*, copied from an old paper dated about seventeen years previously. When Kelly and I were at the meeting of the National Wool-Growers' Association, I went with him to the *Ohio Farmer* office, and I found in the file Old John Brown's account. Mr. Kelly took a copy of the *Farmer* containing it home with him. This makes *two* perfectly original and independent discoveries of the fact alleged. Now then, within a year past (I think) I have seen a letter from Mark Cockrill, of Tennessee, (who, before the war, was one of the oldest, largest and richest wool growers in the South, as well as one of the richest men in the South,) in which he speaks of having made the same discovery years ago, and in which he speaks of it as if he thought he was the only and original discoverer. Here are three men widely separated, who, we must acknowledge, are all capable and honest observers, and yet Randall, (or at least his publisher) continues to put forth in every new edition of the '*Practical Shepherd*,' the same old exploded (or should be) notion of the fly depositing *an egg*. I presume it is altogether likely that all modern English writers on sheep keep up the same thing—by copying from Youatt."

On one occasion in 1866, I myself obtained living maggots from one fly and Mr. Cockrill has since obtained over 300 living, moving worms from one that was caught while she was after the sheep. Many flesh-flies, if they cannot find suitable meat or carrion on which to lay their eggs, retain these eggs so long in their bodies that they hatch there into living larvae; and it is not impossible that the above observations were made with flies that had been so circumstanced, but I think it highly improbable and strongly incline to believe that it is the normal nature of this fly to produce living larvae. I incline to this belief the more strongly from the fact that it would be difficult to attach an egg to the slimy nostrils of a sheep.

To prevent it from depositing its young different means have been resorted to. Mr. Randall says that "some farmers turn up the soil in portions of their pastures so that the sheep may thrust their noses into the soft ground on approach of the fly, while others smear their noses with tar, or cause them to do so themselves." But as the fly is very persevering and generally attains her object, the means to be depended on the most is the dislodging of the larva, or "grub," and so far lime has been thought to be most effectual and should be given them that they may by sniffing it cause sneezing, and in many cases dislodge the grub. Some sheep keepers even shut their sheep up for several nights in a tight barn when first taken up in the fall, believing that the close and heated atmosphere induces the grub to descend and is therefore more readily dislodged, and that the injury accruing from such foul air is trifling compared with the benefit received by dislodging the grubs. Other sheep breeders are in the habit of fixing salt logs in their pastures of sufficient length to enable all the sheep to get at them. Into these logs, at distances of five or six inches, holes are bored with a two-inch auger, and during fly season a little salt is kept in these holes, while every two or three days tar is smeared around them with a brush. The sheep in obtaining the salt tar their noses and the odor of the tar keeps the fly away. In severe cases, where the grubs are already in the head, they may be dislodged in a measure by a feather dipped in turpentine, which should be run up the nose and gently turned.

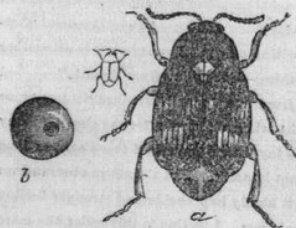
THE PEA-WEEVIL—*Bruchus pisi*, Linn.

(Coleoptera, Bruchidæ.)

[From the third Missouri Entomological Report.]

Our common garden pea has not many insect enemies, for with the exception of the Striped Flea-beetle, (*Haltica striolata*), which gnaws numerous small holes in the leaves, and the Corn-worm *alias* Boll-worm (*Heliothis armigera*), which eats into the pod, there are very few others besides the Pea-weevil under consideration. This species alone is so numerous, however, as to be a serious drawback to pea culture in this part of the country.

[Fig. 13.]



The term *Bruchus*, meaning a devourer, was given by the celebrated Linnaeus to a genus of beetles which at first appear to have very little resemblance to the Snout-beetles. They form, however, at present, a sub-family (*Bruchides*) of the great Snout-beetle family, though they possess nearly as close affinities to the great *Chrysomela* family, and really form a connecting link between the two. They are characterized by a depressed head and very short snout, by the antennæ being 11-jointed, straight and but slightly thickened towards the end, by the wing-covers being shorter than the abdomen, and by the rather long hind legs

and much swollen thighs. Their larvæ are short, arched and swollen in the middle, with a comparatively small head, and their depredations are confined, all over the world, to leguminous or pod-bearing plants.

They are far more abundant in the tropics than in more temperate climes, and in North America we have not many species to contend with. With the exception of the Honey-locust seed-weevil (*Spermophagus robinia*, Fabr.), which I have bred from the seeds of that tree, there are only two species, namely: the Pea and the Bean weevils that are really injurious in our State, though *Bruchus discoides*, Say, often, badly infests the seeds of *Ipomea*. A third species, however, namely, the Grain *Bruchus* of Europe, has lately been introduced into this country, and may some day become unduly multiplied in our midst.

The Pea-weevil is very generally dubbed "Pea-bug," but this latter term is not nearly so appropriate as the former, to which it should give way. Though everybody may not know by sight the perfect beetle, yet every one has most assuredly seen the work of the worm, and though knowledge of the fact may not add to our enjoyment of a mess of green peas, yet the fact nevertheless remains, that those of us in the Mississippi Valley who indulge in this delicious esculent, necessarily devour a young worm with nearly every pea that we eat. Gray's oft quoted lines,

—"Where ignorance is bliss,
'Tis folly to be wise,"

Would seem to apply here with great force; but when we reflect that the diminutive and almost imperceptible worm, nourished so to speak, in the very marrow of the pea, really has no flavor and produces no injurious effects on the human system; we can chuckle in our sleeves and console ourselves with the thought that, notwithstanding the above truism, "wisdom is justified of her children." Neither this nor any other of the true weevils mentioned in this paper, can do harm when taken as food in the larva state, but there is good testimony that the hard-shell beetles are injurious when fed in a ground or unground condition, along with the seeds they infest, either to man or to other animals.

The Pea-weevil which is here well illustrated, figure 13, *a* showing a back view, and 17, *b* a side view, the small outlines at the sides showing the natural size, is easily distinguished from all other species of the genus with which we are troubled, by its larger size, and by having on the tip of the abdomen projecting from the wing-covers, two dark oval spots, which cause the remaining white portion to look something like the letter T. It is about 0.18—0.20 inch long, and its general color is rusty-black, with more or less white

on the wing-covers, and a distinct white spot on the hinder part of the thorax near the scutel. There is notch on each lateral edge of the thorax, and a spine on the under side of the hind thighs near the apex. The four basal joints of the antennæ and the front and middle shanks and feet are more or less tawny. It is supposed to be an indigenous N. A. insect, and was first noticed many years ago around Philadelphia, from whence it has spread over most of the States where the pea is cultivated. This supposition is probably the correct one, though we have no means at present of proving it to be so, and certain it is that as the cultivated pea was introduced into this country our Pea-weevil must have originally fed on some other indigenous plant of the Pulse family. It is at present found in the more southern parts of Europe and in England, and is one of the few injurious insects which have found their way there from this country; but in accordance with the facts given in my last Report, under the head of "Imported Insects and Native American Insects," which clearly prove that our native plants and insects do not become naturalized in the Old World with anything like the facility with which those of the Old World are every day being naturalized here, this Pea-weevil does not begin to be as destructive there as it is at home.

THE FEMALE DEPOSITS HER EGGS ON THE OUTSIDE OF THE POD.

It is a very general remark that peas are "stung by the bug," and the impression prevails almost universally, not only among gardeners but with many entomologists, that the female weevil punctures and deposits her eggs in the pea in which the larva is to be nourished. It is a little singular that so many writers should have fallen into this error, for it is not only the accepted view amongst writers for the agricultural press, but has been adopted by many eminent entomologists, Taschenberg, Harris and Dr. Boisduval, being about the only authors who have rightly comprehended the true manner of egg-depositing. All this comes of course from one man's palming off the opinions of another as his own, and by his adopting such opinions, whether good or bad, without due credit. Even Noerdlinger in his "Kleinen Feunde der Landwirtschaft," though he cites the excellent and original observations of Taschenberg, feels himself called upon to doubt their correctness, and himself inclines to believe that the female may put her eggs in the pea. In Packard's Guide the eggs are erroneously said to be laid on the blossoms.

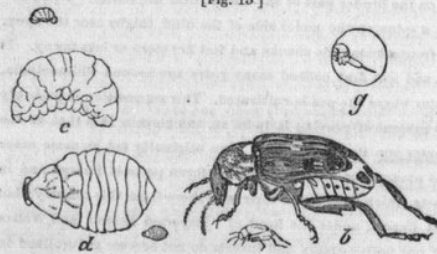
The true natural history of the Pea-weevil may be thus briefly told. The beetles begin to appear as soon as our peas are in bloom, and when the young pods form the female beetles gather upon them and deposit their eggs on any part whatever of the surface without attempting to insert the eggs within the pod.

The eggs, (Fig. 14,) are deep yellow, 0.085 inch long, three times as long as wide, fusiform, pointed in front, blunt behind, but larger anteriorly than posteriorly. They are fastened to the pod by some viscid fluid which dries white and glistens like silk. As the operation of depositing is only occasionally noticed during cloudy weather, we may safely assume that it takes place for the most part by night. If pea vines are carefully examined in this latitude any time during the month of June, the pods will often be found to have from one to fifteen or twenty such eggs upon them, and the black head of the future larva may frequently be noticed through the delicate shell.



As already stated, the eggs are deposited on all parts of the pod, and the mother beetle displays no particular sagacity in the number which she consigns to each, for I have often counted twice as many eggs as there were young peas, and the larvae from some of these eggs would of course have to perish, as only one can be fully developed in each pea. The newly hatched larva is of a deep yellow color with a black head, and it makes a direct cut through the pod into the nearest pea, the hole soon filling up in the pod, and leaving but a mere speck, not so large as a pin hole, in the pea. The larva feeds and grows apace and generally avoids the germ of the future sprout, perhaps because it is distasteful, so that most of the buggy peas will germinate as readily as those that have been untouched.

[Fig. 15.]



When full grown this larva presents the appearance of figure 15, c, (after Curtis) and with wonderful precognition of its future wants, eats a circular hole on one side of the pea, and leaves only the thin hull as a covering. It then retires and lines its cell with a thin and smooth layer of paste, pushing aside and entirely excluding all excrement, and in this cell it assumes the pupa state, (Fig. 16, d, after Curtis,) and eventually becomes a beetle, which, when ready to issue,

has only to eat its way through the thin piece of the hull which the larva had left covering the hole. It has been proved that the beetle would die if it had not during its larval life prepared this passage-way, for Ernest Menault asserts* that the beetle dies when the hole is pasted over with a piece of paper even thinner than the hull itself.

REMEDIES AND PREVENTIVES.

Sometimes, and especially when the summer has been hot and prolonged, many of the beetles will issue from the peas in the fall of the same year they are born, but as a more general rule they remain in the peas during the winter and do not issue till new vines are growing. Thus many remain in the seed peas until they are planted, and especially is this apt to be the case with such as are planted early. We see, therefore, how easily this insect may be introduced into districts previously free from it, by the careless planting of buggy peas, for it has been demonstrated that the beetle issues as readily from peas planted in the earth as it does from those stored away in the bin. All peas intended for seed should be examined and it can very soon be determined whether or not they are infested. The thin covering over the hole of the peas that contain weevils, and which may be called the eye-spot, is generally somewhat discolored, and by this eye-spot those peas which ought not to be planted can soon be distinguished. Where this covering is off and the pea presents the appearance of figure 15, b, there is little danger, for in that case the weevil has either left, or if still within the pea is usually dead. It would of course be tedious to carefully examine a large lot of peas, one by one, in order to separate those that are buggy, and the most expeditious way of separating the sound from the unsound, is to throw them into water, when the sound ones will mostly sink and the unsound swim.

There are however, other and more certain means of preventing the injuries of this insect, and whenever agriculture shall have progressed to that point where, by proper and thorough organization all the farmers of a county or of a district can by vote, mutually agree to carry out a measure with determination and in unison, then this insect can soon be exterminated; for it is easy to perceive that such a result would be accomplished by combinedly ceasing to cultivate any peas at all for one single year! Until some such united action can be brought about, we shall never become entirely exempt from this insect's depredations, for no matter how sound the peas may be that I plant, my vines are sure to be more or less visited by the beetles as long as I have slovenly neighbors. Yet comparatively, my peas will always be enough better to well pay for the trouble, even under these circumstances.

As already hinted the Pea-weevil prefers a warm to a cold climate, and its devastations are scarcely known in high latitudes. On this account the impression prevails that it does not occur in certain parts of Canada, and few persons are aware that it is nearly as bad, especially in Ontario, as it is with us. We are in the habit of sending to Canada for our seed peas, because we get them free from bugs; but the reason that their seedmen have such a reputation is to be traced to their greater care in destroying the weevil and in sorting their seed, rather than to any immunity from its ravages which their peas possess. The following extract from a letter from Mr. Wm. Saunders, of London, Ontario, who, as secretary of the Ontario Fruit Growers' Association, and as a prominent member of the Canadian Entomological Society, is as well posted perhaps, as any one in the Dominion, will give some idea of its occurrence there:

* *Insectes Nuisibles a l'Agriculture.*

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"The Pea-weevil I find prevails in all parts of Canada to a greater or lesser extent, from the Red River settlement to Quebec. In some places it is so numerous as to discourage farmers from attempting to grow peas at all, while other localities are but little troubled. About the neighborhood of Windsor (opposite Detroit) there are no peas grown worth speaking of; but sixty or seventy miles further east, towards London, they are an important crop, and about London, say within thirty or forty miles, and as far east as Guelph and Hamilton, will include the chief district from which your western supplies are drawn.

"During 1869 I grew a field of peas on my own farm. They produced a good crop and although we have some of them on hand yet I have never observed a buggy one amongst them, although I have examined them several times. But it is rare to find them so free as that and something depends on the season. Last season the weather was very wet and the crop very light, and the dealers tell me now that there are scarcely any peas fit to ship in the country on account of the bugs they contain. They say that they always have to select for shipping, and while sending them as clean as possible they do not profess to send them entirely free from bugs.

"Our farmers here are perhaps a little more particular than yours about their seed. They will sometimes keep it over till the second year or else scald it before planting so as to destroy a large proportion of the bugs. The general opinions seem to be that if peas are sown late, say about the first of June, they will be almost free from bugs in any season, and some adopt this method, but it is not by any means a general thing, for should the weather set in very hot as it sometimes does about that time, they would become somewhat dwarfed and the crop lessened. I have not heard of any one growing two crops in one season."

Many eminent seedsmen—Mr. Langdon for instance, as I have been credibly informed—effectually kill the weevils by enclosing the peas in tight vessels along with camphor. The same object is attained by keeping peas two years and taking care that the beetles do not escape before they die. Peas will grow well when kept for two years or even longer, but they should always be well dried so as not to mould. A good plan is to tie them up in bags and hang them in an airy place from the time they are gathered till about Christmas, and then in order that they may not become too dry, to put them into tight vessels. To a certain extent sound peas may be obtained by planting late, for the period of egg-depositing is limited to about a month. Peas, as Mr. F. A. Nitchy, of Jefferson City, has demonstrated, may be planted in the central part of the State as late as the first of June, and by the time the plants from such late planted seed begin to bear pods, all the weevils will have died and disappeared. Wherever a second crop of peas can be grown the same year, this second crop will be entirely free from weevils, and though there seems to be some difficulty in producing a second crop in our State on account of mildew, it is often done in higher latitudes. Choice lots of seed, if found to be infested when received from the seedsmen, may be thrown into hot water for a minute or two, and the sprouting of the peas will be quickened and most of the weevils, but not all, be killed. But whatever plan be adopted to obtain sound seed, it should be every man's aim, in duty to himself and to his neighbors, to plant none but bugless peas!

As natural checks, the Crow Black-bird is said to devour great numbers of the beetles in the spring, and according to Harris the Baltimore Oriole splits open the pods to get at the grubs contained in them.

THE ROSE CHAFER—*Macrodactylus subspinosus*, Fabr.

(Coleoptera, Melolonthidae.)

[Fig. 18.]



The following is one of several letters, all referring to the same insect, which I received from Kansas last June:

DEAR SIR: Having been appointed by our State Horticultural Society (at the meeting held at Humboldt this week) to conduct correspondence with you relative to an insect that troubles us greatly which we are unable to name correctly, I send you samples and description of the work done by it.

The extent of country over which it does damage enough to make it noticeable is, as far as I can learn, confined to only two or three counties (Allen, Woodson, Linn and Bourbon.) It has only been some three years since it appeared to be so troublesome as to call the attention of persons of common observation. Last year, (seventy-one), my first year in Kansas, I noticed it in the grape bloom, but not in very destructive numbers. It re-appeared May 25th this year, and began eating the grape bloom, and where very numerous, even the foliage. I have seen vines entirely stripped of leaves except the net-work. They do not trouble the fruit after it is as large as shot (No. 1.) Whole trees, and I am told whole orchards of peaches are eaten up—only the fruit. Several beetles stay on one peach until it is gone before going to another.

I have seen small, three year old cherry trees stripped of leaves and the fruit eaten entirely up too. They are about gone now; three weeks will suffice them I guess. We know of no remedy except hand-picking; but some who have only a few grapes to watch catch them in a basin of water into which they easily drop when disturbed, and so save their crop. The beetle devours the bloom of the blackberry and sometimes the young fruit. I can't find a correct description of it in your reports published by the State of Missouri. *Colaspis flavida* comes the nearest. But the description of the "Grape Fidia," in Bush's catalogue, comes nearer according to my observation. One man reported at the meeting of having seen it fourteen years ago in Linn county, first on wild persimmon blossoms and then on his grapes. But he caught them and has been troubled but little. Please return a description, etc., etc., for our benefit and instruction.

GENEVA, ALLEN CO., KANSAS.

Yours respectfully,

H. E. VAN DEMAN.

This insect is named in the heading and illustrated at figure 18. It is one of those species whose larva develops underground, and cannot be very well dealt with in this stage of its life. We must contend with it in the beetle form, and there is no other effectual means than by hand-picking or by shaking into vessels and on to sheets. It has been very abundant the present year; and as no better account has ever been written than that by Harris in his work on Injurious Insects, I quote some of the more important paragraphs.

"The natural history of the Rose Chafer, one of the greatest scourges with which our gardens and nurseries have been afflicted, was for a long time involved in mystery, but is at last fully cleared up. The prevalence of this insect on the rose, and its annual appearance coinciding with the blossoming of that flower, have gained for it the popular name by which it is here known. For some time after they were first noticed, rose-bugs appeared to be confined to their favorite, the blossoms of the rose; but within forty years they have prodigiously increased in number, have attacked at random various kinds of plants in swarms, and have become notorious for their extensive and deplorable ravages. The grapevine in particular, the cherry, plum and apple trees, have annually suffered by their depredations; many other fruit trees and shrubs, garden vegetables and corn, and even the trees of the forest and grass of the fields, have been laid under contribution by these indiscriminate feeders, by whom leaves, flowers and fruits are alike consumed. The unexpected arrival of these insects in swarms at the first coming, and their sudden disappearance at the close of their career, are remarkable facts in their history. They come forth from the ground during the second week in June, or about the time of the blossoming of the damask rose, and remain

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from thirty to forty days. At the end of this period the males become exhausted, fall to the ground and perish, while the females enter the earth, lay their eggs, return to the surface and after lingering a few days, die also.

"The eggs laid by each female are about thirty in number, and are deposited from one to four inches beneath the surface of the soil; they are nearly globular, whitish, and about one-thirtieth of an inch in diameter, and are hatched twenty days after they are laid. The young larvæ begin to feed on such tender roots as are within their reach. Like other grubs of the Scarabæans, they lie upon the side with the body curved so that the head and tail are nearly in contact; they move with difficulty on a level surface, and are continually falling over on one side or the other. They attain their full size in autumn, being then nearly three quarters of an inch long, and about an eighth of an inch in diameter. They are of a yellowish-white color, with a tinge of blue toward the hinder extremity, which is thick, and obtuse or rounded; a few short hairs are stattered on the surface of the body; there are six short legs, namely, a pair to each of the first three rings behind the head, and the latter is covered with a horny shell of a pale rust color. In October they descend below the reach of frost, and pass the winter in a torpid state. In the spring they approach towards the surface, and each one forms for itself a little cell of an oval shape, by turning around a great many times, so as to compress the earth and render the inside of the cavity hard and smooth. Within this cell the grub is transformed to a pupa during the month of May by casting off its skin, which is pushed downward in folds from the head to the tail. The pupa has somewhat the form of the perfected beetle, but it is of a yellowish-white color, and its short, stump-like wings, its antennæ, and its legs are folded upon the breast, and its whole body is enclosed in a thin film that wraps each part separately. During the month of June this filmy skin is rent, the included beetle withdraws from its body and its limbs, bursts open its earthen cell, and digs its way to the surface of the ground. Thus the various changes from the egg to the full development of the perfected beetle, are completed within the space of one year.

"Such being the metamorphoses and habits of these insects, it is evident that we cannot attack them in the egg, the grub, or the pupa state; the enemy in these stages is beyond our reach, and is subject to the control only of the natural but unknown means appointed by the Author of Nature to keep the insect tribes in check. When they have issued from their subterranean retreats, and have congregated upon our vines, trees and other vegetable productions, in the complete enjoyment of their propensities, we must unite our efforts to seize and crush the invaders. They must indeed be crushed, scalded or burned to deprive them of life, for they are not affected by any of the applications usually found destructive to other insects. Experience has proved the utility of gathering them by hand, or of shaking them or brushing them from the plants into tin vessels containing a little water. They should be collected daily during the period of their visitation, and should be committed to the flames or killed by scalding water."

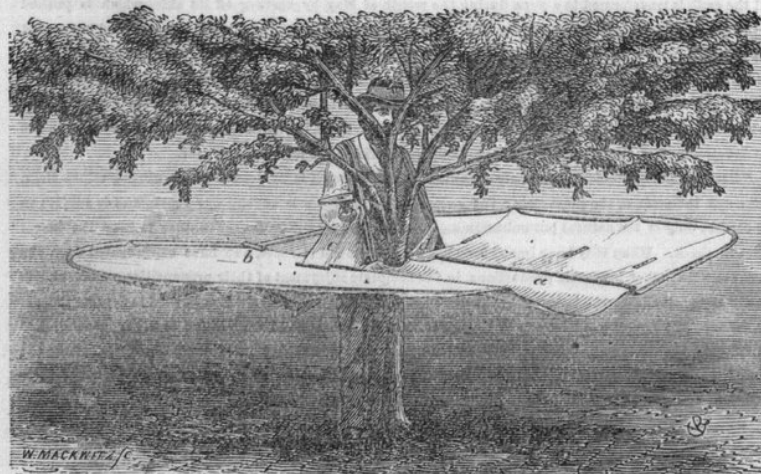
THE PLUM CURCULIO—*Conotrachelus nenuphar*.

(Coleoptera, Curculionidae.)

[From the Scientific American, August 3, 1872.]

The annexed engraving (Fig. 16,) represents an improvement by Dr. E. S. Hull—a well known and successful fruit grower of Alton, Illinois—upon his device, which was illustrated in Vol. XXI of the Scientific American, for catching that destructive "little Turk" known as the Curculio, or more properly, the Plum Curculio. It may be briefly described as an inverted umbrella, and has long been in use among the growers of stone fruit in his part of the country. Several modifications of and improvements on the original machine have been made, and notably one which runs on two wheels, by Mr. L. M. Ward, of Benton Harbor, Michigan, and one which opens and shuts, fan-like, by Dr. M. M. Hooten, of Centralia, Illinois.*

[Fig. 16.]



All these machines work on the same principle of jarring down and catching the beetles, and they are all intended to economize time and labor in the operation. The jarring is done either by a rubber bumper attached to the machine itself, or by a separate mallet. The former method was employed with the original Hull machine, but was very generally abandoned, as it was found to seriously injure the trees by bruising. Indeed, some years ago I became fully convinced that trees suffered too much from this bumping to make it practicable, unless a shouldered spike, against which the bumping might be done, were driven into the trunk of the tree.

Dr. Hull was wont to claim that he could use his machine without injury to the trees, but the present modification of it is an evidence that experience has taught him differently. In all rolling machines, whether upon one or two wheels, when the bumping was not done by the machine itself, it had to be done by a long pole tipped with rubber and used by a second person. But where I have used such a pole and separately jarred the larger boughs, the trees have been much injured in the course of a single year's work, and in some instances killed outright.

* Descriptions of these machines were given in the Third Missouri Entomological Report.

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The advantages of the present modification over the others may be thus briefly stated: It costs less and enables the operator to get close to the tree, to which he can give a sudden jar with a hatchet or hammer. This is best done by striking a screw or spike previously inserted into the trunk and purposely made with a shoulder so as to prevent driving; or by striking the end of a limb previously sawn squarely off. Such a hard, sudden jar with an iron instrument is far more effectual in bringing down the beetles than the more subdued bumping of a rubber mallet, as it is the sharpness and suddenness rather than the force of the blow which disturbs and alarms the little shy and cunning customers we have to deal with.

The working of the machine is very well indicated in the illustration (Fig. 16). There is a bag, *d*, in the center, into which the operator can brush all fallen fruit, and a bottle of cheap alcohol may be kept in the vest pocket into which the beetles should be thrown, or they may be simply crushed between the thumb and finger.

Let me now give you a condensed history of the pest which may be, in great part, conquered by the proper use of such machines, as such an account will not only show the philosophy of the machine, but will render it impossible for paragraphs like the following, which I clip from a late issue of the *Scientific American*, to find their way into your columns without comment:

CURCULIO ON PLUMS.

A correspondent says he wraps plum trees below the lower limbs with cotton, which he keeps wet with camphor and spirits of ammonia. He wets the cotton twice a week, and the result has been a good crop of plums and no Curculio. A correspondent in another journal says:

"I have seen various methods for keeping these insects off plum trees, but none so simple or yet so effectual as the following: Soak corn-cobs in sweetened water until thoroughly saturated, then suspend them to the limbs of the trees a little while after blossoming, being sure to burn the cobs after the fruit ripens, as they will be found full of the young insects. A good plan is to change the cobs every few weeks. My theory is this—that the insects deposit their eggs in the cobs in preference to doing so in the young plums. The first season I tried it upon one or two only, and in the summer was rewarded by a good crop of as fine plums as ever ripened, while those on the other trees fell off when about half grown. I have since tried it more thoroughly and have never known it to fail."

Now, as to the first remedy, your correspondent might just as well put the cotton round his chimney, under the delusive idea that he could thus keep the flies and mosquitoes out of his house. And as to the second, if persons will hang upon their trees sweetened cobs, as above described, they will, it is true, get eggs and larvæ enough, for some kinds of ants are attracted by the sugar and are very fond of consigning their eggs to the cozy and sweet recesses which such cobs afford. But they will get no eggs or young of the plum Curculio, and of that they may rest assured!

You have the satisfaction of being in good company in tacitly giving credence to this absurdity, for the paragraph quoted has been extensively copied, and such being the case it is not to be wondered at that the deluded mortal who first hit upon the idea imagined he had made a grand discovery.

Suppose a naturalist were to make the following announcement:

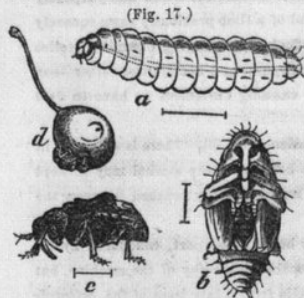
GREAT DISCOVERY! NO MORE CHICKENS KILLED BY HAWKS.

If gunny bags, after being dipped in diluted honey, are hung on the top of the chicken house, the hawks in the neighborhood will mistake them for nests and fill them with eggs. These bags, when full, are easily collected, the eggs destroyed, and the hawks thus exterminated.

What would be the result of such an announcement? Why every editor in the land, every ten-year old lad, would scout the whole as a most absurd fabrication, or else consider the author hopelessly insane. And yet this supposititious announcement would not be a whit more ridiculous than is the curculio-corn-cob story in the eyes of an entomologist. Now, I ask, why is it that the one announcement would be so universally considered to indicate stark staring madness on the part of its author, while the other will pass muster with the majority of well educated people? Simply because the natural history of the higher animals is taught, in its rudiments, in our schools and colleges, while that of the more lowly—but none the less interesting and instructive—generally remains a sealed book.

NATURAL HISTORY OF THE PLUM CURCULIO.

The plum curculio (*Conotrachelus neuphar*, Herbst) in the larva state, in which alone it is found working in the fruit, is a pale, yellowish, footless grub (Fig. 17, a). In the pupa state, in which it is found



underground, the color is about the same, but the members are distinctly visible (Fig. 17, b). In the beetle or mature form, it is roughened and warty (Fig. 17, c), and so colored with gray, brown, white and black, that when resting on the rough bark of a peach or a plum tree, it almost defies detection, and when lying on a flat surface, with the legs drawn in, looks precisely like a dead bud. It often makes a peculiar creaking stridulation, by rubbing the tip of the abdomen up and down against the wing covers.*

To condense the history of its habits into the briefest possible space, let me give a series of what I know, from personal experience, to be well tested and incontrovertible facts:

1. It is more numerous in timbered than in prairie regions.
2. Under the hard wing covers of the beetle there are folded up two ample membranous wings, with which it can fly and does fly; so that cotton bandages, or other like contrivances placed around trees as a safeguard against its attacks, are utterly useless and result from ignorance of the insect's habits and nature.
3. It does not often use its wings, however, when alarmed, but has a habit, in common with many others of its class, of dropping and "playing possum" upon the slightest disturbance.
4. It hibernates in the mature or beetle form, principally in the woods under the bark of trees, but also in any other shelter that presents, in the vicinity of the orchard. The same spring influences which cause our orchard trees to wake from their winter rest, also rouse the Curculio from its dormancy.
5. From this time on till fruit sets, these beetles are more or less active, and instinctively make their way to our orchards, where they feed on the buds, leaves and other tender parts of the trees. They are thus at this early season, more frequently found on the outside rows of an orchard, and especially on those trees nearest the woods, and they may be captured under traps long before their depredations on the fruit commence.
6. It is nocturnal rather than diurnal in its habits, except during the egg-depositing season, when the female more especially, may often be found at work during the day; both sexes at that time rest concealed on the underside of the more horizontal branches, or under whatever other shelter is afforded them in the orchard.
7. The female commences to oviposit as soon as the fruit is as large as a hazelnut. Oviposition is effected in the following manner: With the jaws at the end of her snout she cuts just through the skin of the fruit, and running the snout under the skin to the depth of about one-sixteenth of an inch, moves it back and forth until the cavity is large enough to receive the egg it is destined to contain. She next changes her position and drops an egg into the mouth of the cut; then veering round again she pushes it by means of her snout to the end of the passage; and afterwards cuts a crescent in front of the hole so as to undermine the egg and leave it in a sort of flap, her object being to deaden the flap so as to prevent the growing fruit from crushing the egg. This egg is white, oblong oval, and three-hundredths of an inch long. It swells slightly by endosmosis, and may easily be crushed by the thumb nail without injuring the fruit. The stock of determinable eggs in a female, even at the most pregnant season, seldom exceeds thirty, but doubtless ova continue to develop and are repeatedly impregnated, contrary to the more general

* If carefully examined, the elytra will be found to have, on their lower apical edge, a horny, slightly raised plate, about a third as long as the whole elytron, and transversely and obliquely ribbed by numerous parallel ridges. There is also a longer cord or carina near the sutural edge which may help to intensify the noise. The dorsal apex of the abdomen or pygidium forms a yellowish and roughened plate, with the sides horny and emarginate, so that when the abdomen plays up and down these horny edges grate or scrape at right angles against the rasp.

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rule in insect life, which is, that a single coitus suffices for the fertilization of the ova. The period of egg depositing extends over two months or more, and larvæ of all sizes may be found during the summer.

8. It is single brooded, that is, but one generation is produced annually; and, as a rule, no female lays eggs until she has passed the winter. I have kept specimens alive, and in a continued state of activity, over thirteen months.

9. During the beetle life, both sexes feed as long as the weather allows of activity. While fruit lasts they gouge holes in it, and after stone fruit has gone, pip fruit (apples especially) is badly attacked. At the proper season and under favorable conditions, these punctures and gougings are instrumental in spreading the dreaded peach rot, by forming proper *nidi* for fungi, such as that known by the name of *Mucor mucedo*.

10. It prefers smooth skinned to rough skinned fruit, but will mature alike in plums, peaches, nectarines, apricots, cherries; in black knot on plum trees, and in some kinds of apples, pears, and quinces. There is also a larger phytophagous variety which breeds in the rind of walnuts and hickory nuts, but there is no evidence that this variety ever attacks the other fruits mentioned.

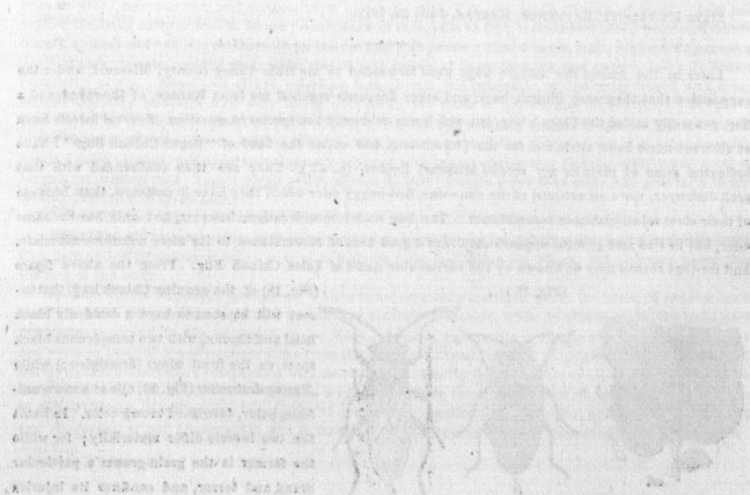
11. Varieties of the Chickasaw plum, such as the Miner, the De Soto, and what is known in some parts of Missouri as the Salt Plane plum, are almost entirely exempt from its attacks.

12. It is not subject to sudden decrease or increase, as are so many other noxious insects, for the reason that it is scarcely ever devoured by birds, and has not very many insect enemies.* Yet in a clayey soil, many perish while transforming, if the weather be very hot and dry, so as to bake and heat the earth to an unusual degree; and from this cause, together with the work of its few enemies, its numbers sometimes decrease so as to render it harmless. Such is the case in the vicinity of St. Louis the present year.

In these twelve paragraphs, we have all the more important facts in the life history of our little Turk. Exceptions to some of the rules stated, occasionally, but very rarely, occur.

From this history we can appreciate the value of the curculio catcher, as there is no other remedy against this pest but to catch and kill. This may be done by the catcher and by the use of traps in the shape of pieces of bark or shingle set around the trees; and by causing all fallen fruit to be picked up regularly either by hand or by hogs.

*Two true parasites (*Sigalphus curculionis*, Fitch, and *Porizon conotracheli*, Riley,) are known to infest it, while about half a dozen predaceous or cannibal insects have been found attacking it. Ants destroy the larvæ when they can get them and a species of *Thrips* destroys the eggs.



THE FALSE CHINCH BUG—(*Nysius destructor*, N. Sp.)

(Heteroptera, Lygaeidae.)

A NEW ENEMY TO THE GRAPEVINE, POTATO, CABBAGE, AND MANY CRUCIFEROUS PLANTS.

By calling this a new enemy, I do not wish to be understood to intimate that it never existed before. It has, in all probability, been in existence as long as its more injurious genuine name-sake; but I call it new because it has heretofore been unknown as an injurious insect, and because, further, it has not even been described by entomologists, though I have had it in my cabinet for some years.

[Fig. 18.]



a
leaf showing injuries.

KANSAS CITY, MISSOURI, June 15, 1872.

The first time I heard of the injuries of this insect was in the forepart of last May, when I learned that young Delaware vines belonging to Dr. James D. Davis, of Clarksville, Missouri, were being much injured by them, and that they were so numerous that the ground was literally covered with them. From specimens received, they all at that season proved to be in the immature stages. Subsequently I received the following letters which refer to the same insect:

DEAR SIR: Dr. Bell, living four miles from this city, sends in the enclosed insects which he says are destroying his potatoes. He wishes to know what they are, and if you can suggest any way of driving them off or protecting his crops against them. Will you be so kind as to write me. I send specimen of

Yours, truly,

W. B. STONE.

DEAR SIR: Many of our market gardeners are complaining of the ravages of a certain insect of the order Hemiptera of which I send specimens in box by same mail with this note. The pest in localities occurs in great numbers, injuring the foliage of turnips, beets, radishes and cabbages. Can you tell me the name and refer me to some account of this bug?

Thanks for your prompt reply to my inquiry concerning the White Grub Sprout. Hoping soon to hear from you, I remain most sincerely yours.

F. H. SNOW.

STATE UNIVERSITY, LAWRENCE, KANSAS, June 24, 1872.

Later in the season the mature bugs were forwarded to me from Taney county, Missouri, under the supposition that they were Chinch bugs, and other accounts reached me from Kansas, of the ravages of a bug, generally called the Chinch bug, but which was evidently the species in question. Several insects have at different times been mistaken for the Chinch bug, and under the head of "Bogus Chinch Bugs" I have indicated some of them in my second Missouri Report, (p. 31.). They are thus confounded with that arch-destroyer, more on account of the nauseous, bed-buggy odor which they have in common, than because of their close relationship or resemblance. The bug under consideration, however, not only has the same odor, but in size and general appearance bears a good deal of resemblance to its more notorious associate, and for that reason may be known by the vernacular name of False Chinch Bug. From the above figure

(Fig. 19.)



(Fig. 18) of the genuine Chinch bug, that insect will be seen to have a decidedly black head and thorax, with two conspicuous black spots on the front wings (*hemelytra*); while *Nysius destructor* (Fig. 19, c) is of a more uniform, paler, tarnished brown color. In habit the two insects differ materially; for while the former is the grain-grower's particular dread and terror, and confines its injuries

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almost entirely to cereals and grasses, the latter has not yet been found on cereals and shows a predilection for plants of the mustard family, though it attacks alike the Potato and even the Grape-vine.

In common with all other true Bugs, this insect feeds by suction; and the way in which it injures a plant is by depriving the same of its juices and causing it to wilt. The potato leaves sent me by Mr. Stone presented the appearance of figure 19, a, showing little rusty circular specks where the beak had been inserted, and little irregular holes which looked more as if made by some Flea-beetle, one of which, the Cucumber Flea-beetle (*Haltica cucumeris*, Harr.) is known to thus injure potato leaves.

I cannot now give you its complete natural history, as to do so will require further study of its habits which I hope to be able to make before the close of the year. From analogy we may infer that there are two or three broods in the course of the year, and that as in the case of the Chinch bug, it passes the winter in the perfect state, and is difficult to combat when once infesting the field or garden. Clean culture, and especially the burning of weeds and rubbish in the winter time, will doubtless prove to be the best guarantees against its injuries. The young bugs are without wings and are of a paler color with more or less distinct longitudinal dark lines on the head and thorax. The pupa (Fig. 19, b) has the front part of the body marked with more distinct red and brown lines, with the abdomen paler and with longitudinal pinkish mottlings. It is a very variable species in all stages, and I submit below a full description for those interested:

Nysius destructor, N. Sp. (Fig. 19, c.) General color grayish-brown, of shape of *N. thymi*, Wolff. Head either minutely or more coarsely punctate, and more or less distinctly pubescent; the surface usually brown, with a distinct black, longitudinal line each side, broadening on the crown, but generally leaving the orbit of the eyes pale; these lines sometimes more diffuse and occupying the whole surface except a median brown spot at base of crown, and a narrow paler spot on the clypeus; ocelli piceous; eyes either opaque, black or slate-color; face sometimes uniformly pubescent and appearing dark grayish-brown; but more generally black each side of rostrum, with a distinct yellowish-brown spot on the cheeks below the eyes; rostrum piceous, paler at base and reaching to hind coxæ; antennæ either pale yellowish-brown or darker brown, the torulus and first joint darkest. Thorax, pronotum narrowing anteriorly, the sides slightly sinuate, irregularly and more coarsely punctate than the head, more or less pubescent, dingy yellow or brown, with a transverse black band near the anterior edge, obscuring the incision and leaving the edge pale, especially in the middle, where there is often a conspicuous pale spot; also five more or less distinct longitudinal dark lines, the central one most persistent and leading on the posterior margin to a pale, shiny impunctate spot, the callus at hind angles, and sometimes an intermediate spot between it and the median one, and the entire posterior margin also pale and impunctate, scutellum dark, coarsely punctate, sometimes with a smooth median longitudinal ridge ending in a pale spot, and with the lateral margins pale; prosternum dark, more or less pubescent, the anterior and posterior margins, and a band outside of coxæ, more or less broadly pale; mesosternum and metasternum also dark with the pale spots outside of coxæ. Legs pale yellow, inclining more or less to brown; coxæ dark at base, pale at tip; trochanters pale; front and middle femora spotted more or less confluent on the outside with brown; hind femora, male, dark brown except at tips and base; female, spotted only; tibiae ringed with brown at base; tarsi marked more or less with brown, especially at tip. Hemelytra either colorless, transparent and prismatic, or distinctly tinged with dingy yellow, shallowly punctate and very finely pubescent, the veins of corium and clavus dingy yellow with brown streaks, the more constant of these streaks being two on posterior margin of corium and one at the top of clavus. Abdomen, male, tergum piceous, with the sutures and the side of some of the joints rarely paler, venter piceous, minutely and regularly covered with gray pubescence; female, sutures and spots on tergum more often pale; venter dingy yellow except at base; female paler than male, and generally larger. Average length 0.13 of an inch.

Larva.—Dingy yellow, with more or less distinct longitudinal dark lines, especially on head.

Pupa (Fig. 19, b) same color, with more distinct red and brown longitudinal lines, and two little tooth-like, pale yellow processes at inner base of hemelytra pads, indicating the wings; the abdomen paler than the rest of the body.

Described from numerous specimens. I have some, especially males, in which the black so predominates that the paler parts of the head and thorax are scarcely traceable, while in others again the pale parts predominate almost to the exclusion of the black. Indeed, so variable is the species that it is difficult to see wherein some of the specimens differ from the European *thymi*, or from *N. angustatus*, Uhler, and it is barely possible that future comparison will show specific identity between some or all of the three. But as long as authors fall to give the variation a species is liable to, or the number of specimens a description is drawn up from, it will remain impossible to decide such questions satisfactorily, and I name *destructor* at the suggestion of our Hemipterist, Mr. P. R. Uhler, of Baltimore, who has examined specimens which I sent him.

FOREST TREES IN KANSAS.

BY R. S. ELLIOTT.

The State of Kansas contains about fifty-two millions of acres. The aggregate timbered surface, mainly in the eastern part of the State, is estimated at two millions, five hundred and sixty thousand acres. The western three-fourths of the State, except fringes and groves on the water courses, are treeless plains.

The timbered surface of the State of Nebraska is estimated at four hundred and thirty thousand acres, in a total of forty-nine millions of acres; or less than one per cent. In the country south of Kansas the timbered surface is small in proportion to the whole. On the west are the open, treeless plains of Colorado, stretching two hundred miles to the mountains.

Thus, without shelter of mountain or forest north, south or west, Kansas must brave the winds with less than five per cent. of her own surface in timber.

In France and Germany, where the forests have long engaged the attention of government, experience has shown that not only to provide timber and fuel, but to secure the best results in agriculture, from one-fourth to one-third the entire surface of the country ought to be in forest. If Kansas, with scarce one-twentieth of her surface in timber, has been productive in general agriculture over large districts, remote from her best timbered portions, what may we not expect where her timbered surface is increased?

Forest culture should, therefore, if possible, attend settlement in all the open districts, not only to provide timber and fuel, but for amelioration of climate. It is attested by Arthur Bryant and other careful observers, that in Illinois, owing to obstructions by buildings, hedges, orchards, groves and wind-breaks, the fury of the winds, as compared with forty years ago, is very sensibly diminished. We may expect the same results to follow in Kansas, as our settlements extend.

Not only would the spread of forests check the winds, but it would also give us a better atmosphere to nourish vegetation. Whether or not the yearly rainfall can be increased by extensive tree-planting, there is no doubt that the air would contain more moisture. Evaporation after rains is less rapid from a wooded surface than in the open plain, thus prolonging the effect of the rain; and the foliage of the trees is constantly giving off moisture to the air. Growing crops near forests have heavier deposits of dew than those at a distance.