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A. S. Packard

First Annual Report on the injurious and
beneficial Insects of Massachusetts.

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F.B. Mink
Recd Aug. 1871

FIRST ANNUAL REPORT

ON THE

Injurious and Beneficial Insects

OF

MASSACHUSETTS.

✓
BY A. S. PACKARD, JR., M.D.,

ENTOMOLOGIST TO THE STATE BOARD OF AGRICULTURE.

BOSTON:

WRIGHT & POTTER, PRINTERS, No. 79 MILK STREET,
(CORNER OF FEDERAL STREET.)

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FIRST ANNUAL REPORT
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INJURIOUS AND BENEFICIAL INSECTS OF MASSACHUSETTS.

IMPORTANCE TO AGRICULTURISTS OF A KNOWLEDGE OF INSECTS.

In presenting my first annual report on the insects of our State injurious to vegetation, or in any way affecting human interests, it may not be out of place to state some facts, showing the importance to farmers of a knowledge of the habits and appearance of the insects with which they have to contend in their farming and gardening operations.

In the first place, however, we must not forget the good done by insects. They undoubtedly tend by their attacks to prevent an undue growth of vegetation. The pruning done to a tree or herb by certain insects undoubtedly causes a more healthy growth of the branches and leaves, and ultimately a greater production of fruit. Again, as pollen-bearers, insects are a most powerful agency in nature. It is undoubtedly the fact that the presence of bees in orchards increases the fruit crop, and the thousands of moths, wild bees and other insects, that seem to live without purpose, are really, though few realize it, among the best friends and allies of man.

Moreover, insects are of great use as scavengers, such as the young or maggots of the house fly, the mosquitoes, and numerous other forms, that seem created only to vex us when in the winged state. Still a larger proportion of insects are directly beneficial from their habit of attacking injurious species, such as the ichneumons, or parasitic hymenoptera, and certain para-

sitic flies, allied to the house fly, and many carnivorous species (wasps, beetles and flies, dragon flies and Aphis lions, etc.) that live upon other insects.

But few, however, suspect how enormous are the losses to crops in this country entailed by the attacks of the injurious species. In Europe, the subject of applied entomology has always attracted a great deal of attention. Most sumptuous works, elegant quartos prepared by naturalists known the world over, and published at government expense, together with smaller treatises, have frequently appeared; while the subject is taught in the numerous agricultural colleges and schools, especially of Germany.

In the densely populated countries of Europe, the losses occasioned by injurious insects are most severely felt, though from many causes, such as the greater abundance of their insect parasites, and the far greater care taken by the people to exterminate their insect enemies, they have not proved so destructive as in our own land.

In this connection I might quote from one of Dr. Asa Fitch's reports on the noxious insects of New York, where he says: "I find that in our wheat-fields here, the midge formed 59 per cent. of all the insects on this grain the past summer; whilst in France, the preceding summer, only 7 per cent. of the insects on wheat were of this species. In France, the parasitic destroyers amounted to 85 per cent.; while in this country our parasites form only 10 per cent."

As the writer has already remarked in the current volume of the *American Naturalist*, "a true knowledge of practical entomology may well be said to be in its infancy, when, as is well known to agriculturists, the cultivation of wheat has almost been given up in New England, New York, Pennsylvania, Ohio and Virginia, from the attacks of the wheat midge, Hessian fly, joint worm, and chinch bug." According to Dr. Shimer's estimate, says Mr. Riley, which may be considered a reasonable one, "in the year 1864 three-fourths of the wheat, and one-half of the corn crop were destroyed by the chinch bug throughout many extensive districts, comprising almost the entire North-West. At the annual rate of interest, according to the United States Census, in the State of Illinois, the wheat crop ought to have

been about thirty millions of bushels, and the corn crop about one hundred and thirty-eight million bushels. Putting the cash value of wheat at \$1.25, and that of corn at 50 cents, the cash value of the corn and wheat destroyed by this insignificant little bug, no bigger than a grain of rice, in one single State and one single year, will therefore, according to the above figures, foot up to the astounding total of OVER SEVENTY-THREE MILLIONS OF DOLLARS ! ”

The imported cabbage butterfly (*Pieris rapæ*), recently introduced from Europe, is estimated by the Abbé Provancher, a Canadian entomologist, to annually destroy two hundred and forty thousand dollars' worth of cabbages around Quebec. The Hessian fly, according to Dr. Fitch, destroyed fifteen million dollars' worth of wheat in New York State in one year (1854). The army worm of the North (*Leucania unipuncta*), which was so abundant in 1861, from New England to Kansas, was reported to have done damage that year in Eastern Massachusetts exceeding a half million of dollars. The joint worm (*Isosoma hordei*) alone sometimes cuts off whole fields of grain in Virginia and northward. The Colorado potato beetle is steadily moving eastward, now ravaging the fields in Indiana and Ohio, and only the forethought and ingenuity in devising means of checking its attacks, resulting from a thorough study of its habits, will deliver our wasted fields from its direful assaults.

These are the injuries done by the more abundant kinds of insects injurious to crops. We should not forget that each fruit or shade tree, garden shrub, or vegetable, has a host of insects peculiar to it, and which, year after year, renew their attacks. I could enumerate upwards of fifty species of insects which prey upon cereals and grass, and as many which infest our field crops. Some thirty well known species ravage our garden vegetables. There are nearly fifty species which attack the grape-vine, and their number is rapidly increasing. About seventy-five species make their annual onset upon the apple-tree, and nearly an equal number may be found upon the plum, pear, peach and cherry. Among our shade trees, over fifty species infest the oak ; twenty-five the elm ; seventy-five the walnut, and over one hundred species of insects prey upon the pine.

Indeed, we may reasonably calculate the annual loss in our country alone from noxious animals, and the lower forms of plants, such as rust, smut and mildew, as (at a low estimate) not far from five hundred million dollars annually. Of this amount, at least one-tenth, or fifty million dollars, could probably be saved by human exertions.

To save a portion of this annual loss of food stuffs, fruits and lumber, should be the first object of farmers and gardeners. When this saving is made, farming will become a profitable and comparatively safe profession. While a few are well informed as to the losses sustained by injurious insects, and use means to ward off their attacks, their efforts are constantly foiled by the negligence of their neighbors. As illustrated so well by the history of the incursions of the army worm and canker worm, it is only by a combination between farmers and orchardists that these and other pests can be kept under. The matter can be best reached by legislation. We have fish and game laws; why should we not have an insect law? Why should we not frame a law providing that farmers, and all owning a garden or orchard, should co-operate in taking preventative measures against injurious insects, such as early or late planting of cereals, to avert the attacks of the wheat midge and Hessian fly; the burning of stubble in the autumn and spring to destroy the joint worm; the combined use of proper remedies against the canker worm, the various cut worms, and other noxious caterpillars? A law carried out by a proper State entomological constabulary, if it may be so designated, would compel the idle and shiftless to clear their farms and gardens of noxious animals.

In the succeeding pages will be noticed a few insects which have lately attracted attention as new to the State, and several others, not yet common, but with which it is desirable to become acquainted. A few beneficial insects are described as types of an immense number, which prey on noxious caterpillars and other insects.

INSECTS AFFECTING THE CURRANT.

The Imported Currant Saw Fly.—As there is no account of this destructive insect to be found in any very accessible source, the following notice is prepared. The writer is indebted partly

to Western naturalists for information regarding its habits, as it is a comparatively new insect to this State.

It was imported from Europe into nurseries at Rochester, New York, during the year 1860. It seems since that time to have spread westward and eastward, arriving in Eastern Massachusetts about 1865, as I am informed by Mr. F. G. Sanborn. For two seasons past it has been very destructive in gardens in Essex County.

The parent of this worm is a saw fly, so named from bearing a saw-like sting, or ovipositor, with which it pierces the leaves or stalks of plants, cutting a gash, in which it deposits an egg, the egg passing out from the ovary through the oviduct, and thence through the blades of the ovipositor into the wound made in the plant. While most of the members of this family cut a gash in the leaf, into which an egg is pushed, a few, as in the present insect, simply place them on the under surface of the leaf, as seen in Fig. 1. (1) The fly has four wings, and belongs to the same group of insects (Hymenoptera) that comprises the bee, wasp, and ichneumon fly.

The following account of its habits is taken from the writer's Guide to the Study of Insects: "There are about fifty species of *Nematus* in this country, of which the most injurious one, the Gooseberry saw fly, has been brought from Europe. Professor Winchell, who has studied this insect in Ann Arbor, Mich., where it has been very destructive, observed the female on the 16th of June, while depositing her cylindrical, whitish and transparent eggs in regular rows along the under

FIG. 1.

side of the veins of the leaves, at the rate of about one in forty-five seconds. The embryo escapes from the egg in four days. It feeds, moults and burrows into the ground within a period of eight days. It remains thirteen days in the ground, being most of the time in the pupa state, while the fly lives nine days.

The first brood of worms appeared May 21st ; the second brood June 25th." Fig. 1 shows the eggs deposited along the under side of the mid-ribs of the leaf ; 2, the holes bored by the very young larvæ ; and 3, those eaten by the larger worms.

Fig. 2, (*a*, enlarged) represents the worm when fully grown.

FIG. 2.

It is then cylindrical, pale green, with a pale green head, with the segment next behind the head, and the third segment from the end of the body, together with the last or anal segment yellow ; the 16 false or abdominal legs are also yellow ; the six thoracic legs are horn-colored. The body is transversely wrinkled, especially on the back, and is slightly hairy. The eyes are black, and the jaws (mandibles) are black, and on the inner side of the edge reddish. It is about three-quarters of an inch in length.

Previous to the last moult, however, and before it has gained its full size, preparatory to passing into the adult or winged condition, the body is covered with black tubercles ; from each of which arises a stiff black hair. There is also a supra-anal, or dorsal black patch on the last segment of the body, from which arises a pair of black spines. On the back of the false caterpillar the tubercles become smooth and transversely oval, and arranged

in two regular rows. Moreover, a still more important characteristic of the worm in this stage is the jet-black head, which in the fully grown insect is pale pea-green.

In Salem, my attention was drawn to the ravages of this worm by Dr. William Mack, who found them feeding on the currants in his garden June 8th. At this time they were spinning their cocoons, which were of silk, tough, dense, like parchment, and at first green, then becoming blackish, and covered with particles of dirt, and attached to the leaves in the breeding box. Out of doors they may be found the first week in June, and again during the first week in July among the leaves and stalks on the bushes, or among the leaves lying on the ground, or perhaps more frequently a little under the surface of the ground. Here they remain between two and three weeks in June, the adult flies (in Salem) appearing June 25th. At nearly the same date (June 29th) the worms of the second brood were spinning their cocoons. These cocoons (belonging to the second brood) remain under ground or on the leaves about the roots through the winter, the flies appearing in the spring and laying their eggs as soon as the leaves unfold.

Not having specimens of both sexes of this saw fly at hand I compile the following description (often using their own words) from Messrs. Walsh and Riley's account in the *American Entomologist*, Vol. 2, p. 16, from which these illustrations (Figs. 3 *a* and 3 *b*) are taken.

The female (Fig. 3 *b*) is a quarter of an inch long ($\frac{22}{100}$ — $\frac{28}{100}$ inch), and is of a bright honey-yellow color. The head is black, with all the parts between and below the origin of the antennæ, except the tip of the mandibles (jaws) dull honey-yellow. The antennæ are brown-black, often tinged with reddish above, except towards the base, and beneath entirely dull reddish, except the two basal joints. They are four-fifths as long as the body; the third joint,

FIG. 3.

when viewed sideways, is four times as long as wide; the third, fourth and fifth joints are equal in length, the remaining joints slowly diminishing in length. On the thorax are four conspicuous black spots, and other smaller ones. The legs are bright honey-yellow; the basal or hip joints (coxæ and trochanters) whitish, while the extreme tips of the hind shanks (tibiæ) and the whole of the hind toe-joints (tarsi) are blackish brown. The wings are glossy, with dark veins, and expand a little over half an inch.

The male (Fig. 3 *a*) is rather smaller ($\frac{20}{100}$ inch in length), and is black. The head is dull honey-yellow. The antennæ are brown-black, often a little reddish beneath, except towards the base; they are as long as the body, and while longer than in the female are also somewhat flattened out. The thorax has the wing-scales and the prothorax, or collar, honey-yellow. The under side and tip of the abdomen are honey-yellow.

The injury done to currant bushes during the past year was very great. In June we saw them in great numbers in a garden at Lawrence, where they had stripped the bushes, eating the leaves down to the leaf-stalk, myriads clustering upon the branches. The birds evidently do not feed upon them, and thus in dealing with this insect we are deprived of one of the most powerful agencies in nature for restraining a superabundance of insect life.

As this is an important and practical subject, let us digress for a moment, to notice some facts brought out by Mr. J. J. Weir, of the London Entomological Society, on the insects that seem distasteful to birds. He finds by caging up birds whose food is of a mixed character (purely insect-eating birds could not be kept alive in confinement), that all hairy caterpillars were uniformly uneaten. Such caterpillars are the "yellow bears" *Arctia* and *Spilosoma*, the salt-marsh caterpillars (*Leucarctia acraea*) and the caterpillar of the Vaporier moth (*Orgyia*), and the spring larvæ of butterflies; with these may perhaps be classed the European currant saw fly. He was disposed to consider that the "flavor of all these caterpillars is nauseous, and not that the mechanical troublesomeness of the hairs prevents their being eaten. Larvæ which spin webs, and are gregarious, are eaten by birds, but not with avidity; they appear very much to dislike

the web sticking to their beaks, and those completely concealed in the web are left unmolested. When branches covered with the web of *Hyponometa evonymella* (a little moth of the Tinea family) were introduced into the aviary, those larvæ only which ventured beyond the protection of the web were eaten." "Smooth-skinned, gaily-colored caterpillars (such as the currant Abraxas, or span worm), which never conceal themselves, but on the contrary appear to court observation" were not touched by the birds. He states, on the other hand, that "all caterpillars whose habits are nocturnal, and are dull-colored, with fleshy bodies and smooth skins, are eaten with the greatest avidity. Every species of green caterpillar is also much relished. All *Geometræ*, whose larvæ resemble twigs, as they stand out from the plant on their anal prolegs, are invariably eaten." Mr. A. G. Butler of London has also found that frogs and spiders will not eat the same larvæ rejected by birds, the frogs having an especial aversion to the currant span worms (Abraxas and Halia).

The natural enemies of the Currant saw fly are three kinds of ichneumon flies, of which one is a minute egg-parasite. Mr. Lintner of New York states that of fifty eggs laid by the parent saw fly, only four or five hatched out the currant worm. We see, then, that though the birds apparently destroy none, an immense number are carried off, even before they have a chance of doing any mischief, by minute insects of their own order.

One of the best remedies next to picking them off by hand, and which is really the most practicable method of getting rid of them, is to dust powdered white hellebore over the bushes, by sprinkling it from a muslin bag tied to a stick, as it otherwise excites violent sneezing. Used in this small quantity it is not poisonous. This is the remedy used with most success in the West, and recommended by Messrs. Walsh and Riley. Dr. W. Mack of Salem tells me that he has used a solution, consisting of a pound of copperas to six gallons of water, with much success. It blackens the leaves, but does not injure them permanently.

Dr. E. Worcester, of Waltham, according to the Boston Journal of Chemistry, finds that this worm "may be fully and almost immediately destroyed by the use of carbolate of lime. The doctor tried the powder in many instances during the past summer, and found that while it was fully as effective as helle-

bore, it was less disagreeable, less costly, and perfectly safe. The method of using it is to sprinkle it over the vines as soon as the worm makes its appearance, bringing it well in contact with the leaves, and soon the insect is destroyed. It will need but two or three applications, and the work is done."

This worm attacks the gooseberry as well as the currant, though in Massachusetts its ravages have been more confined to the latter shrub. As a preventative measure against its farther spread, in buying or transporting gooseberry and currant bushes, Walsh recommends that the roots be carefully cleaned of dirt, so that the cocoons may not be carried from one garden or nursery to another.

The Native Currant Saw Fly. As this species may be confounded with the European saw fly, though belonging to a different genus (*Pristiphora*), the following brief account of it is extracted from my Guide to the Study of Insects:—

This saw fly (Fig. 4 *a*, larva; *b*, female, from the "American

FIG. 4.

Entomologist"; *P. grossularie* of Walsh) "is a widely diffused species in the Northern and Western States, and injures the currant and gooseberry. The female fly is shining black, while the head is dull yellow,

and the legs are honey-yellow, with the tips of the six tarsi, and sometimes the extreme tips of the hinder tibiae, and of the tarsal joints, pale dusky for a quarter of their length. The wings are partly hyaline, with black veins, a honey-yellow costa, and a dusky stigma, edged with honey-yellow. The male differs a little in having black coxæ. Mr. Walsh states that the larva is a pale grass-green worm, half an inch long, with a black head, which becomes green after the last moult, but with a lateral brown stripe meeting with the opposite one on the top of the head, where it is more or less confluent; and a central brown-black spot on its face. It appears the last of June and early in July, and a second brood in August. They spin their cocoons on the bushes on which they feed, and the fly appears in two or three weeks, the specimens reared by him flying on the 26th of August." This worm may at once be distinguished from the

imported currant worm, by the absence of the minute black warts that cover the body of the latter. The same remedies should be used for this worm as are recommended for the preceding insect.

The Currant Span Worm. (Fig. 5, moth; Fig. 6, 1, 2, caterpillar, 3 pupa, from the "American Entomologist.") Many persons in speaking of the "currant worm" confound the caterpillar-like saw-fly larva with the well-known geometer caterpillar, which is a native species, and was long since described by Dr. Fitch, under the name of *Abraxas ribearia*. As soon as the

FIG. 5.

leaves of the currant are fairly expanded, late in May or early in June, the young caterpillars, scarcely thicker than a horse-hair, may be found eating little holes in them. In about three weeks after hatching, it becomes fully grown, being about an inch long, and bright yellow in color, the body being covered with large black dots. The chrysalis is shining reddish brown, about half an inch long, and may be found

FIG. 6.

late in June, either upon the ground or just under the surface. In two weeks after entering the chrysalis state the moth may be observed flying about the garden, or resting upon the leaves during cloudy weather. The moth is yellow ochreous, with dark, often nearly transparent blotches on the wings. It is not easily mistaken for any other moth. Mr. Riley, in an article on this insect in the "American Entomologist," states that by sprinkling powdered hellebore upon the leaves, or applying a solution of eight or twelve ounces to a bucketful of water, the caterpillars will be killed. Hand-picking assiduously followed up, and a

vigorous shaking of the bushes over a sheet, or newspaper, repeated twice a day will keep this insect within moderate bounds.

INSECTS INJURIOUS TO THE APPLE.

The Apple Leiopus. (Plate 1, Fig. 1, *Leiopus facetus* Say.) This new borer in the limbs of the apple was found June 11th in all its stages of growth in the rotten limb of an apple-tree in Chelsea, by Mr. C. A. Walker. The grubs, or larvæ, were fully grown, and more numerous than the pupæ or adult beetles. How destructive it is, or what the habits of the grubs are must be ascertained by further observation. It is evident from the facts already known, that there is probably but one brood of beetles a year; that they fly about and lay their eggs in the bark of the tree late in June, and probably during July; and that the young larvæ bore in under the bark, and become fully grown in the autumn, spending the winter under the bark probably both in the larva and pupa states, the beetles appearing during midsummer.

The larva is rather long and slender, covered with fine hairs, and the end of the abdomen is rather blunt. The abdominal segments are very convex, and deeply separated by a wide suture. The thorax is about a third wider than the rest of the body. The three thoracic segments together are as long as they are wide. The prothoracic, or segment next the head, is somewhat lunate, and rather longer than the two surrounding segments; on the upper side is a slightly marked somewhat horny, square plate, but there is no thickening of the skin on the back of the succeeding segments, as usual in the larvæ of the family (Cerambycidæ) to which this borer belongs. It agrees in all respects with the larva of *Leiopus xanthoxyli* Shimer, except that the head is considerably smaller, including the under side and the mouth-parts, while the body is not so thick. In all other respects the description of the prickly ash borer (*L. xanthoxyli*) will agree with the present larva, for the larvæ of the two species, which differ very considerably in the beetle state, would be easily confounded. The same remedies may be used against this insect as against the well known striped apple-tree borer (*Saperda candida*).

The beetle itself is a slender, smooth-backed species with no ribs on the wing covers. It is pale ash gray, with a slight pur-

plish tinge. The head and prothorax are blackish except on the hinder edge of the prothorax. The antennæ are yellowish brown, with the basal joint and articulations between the other joints dark brown. The wing covers are pale ash, with a purplish tinge, and an irregular rounded spot just behind the scutellum, united when the wings are folded with a similar spot on the other wing cover. The shoulder of each wing-cover is tipped with black, which extends backwards from a longitudinal large black spot extending backwards and connecting with a broad black band which crosses the terminal third of the wing, leaving the tip pale gray. The front edge of this band forms an acute angle in the middle of the wing; this band is sometimes partially wanting, and is then broken up posteriorly into a few black spots. In front of this broad band is an oblique row of short (longitudinal) lines, the first and innermost being shortest; the second one nearly three times as long and parallel to the costal spot. It is a little less than a quarter of an inch (.20) in length.

The Prickly Ash Borer (*Leiopus xanthoxyli* Shimer, Plate 1, Fig. 2). In this connection descriptions of the different stages of this species, which has only yet been found in Illinois by Dr. Shimer, to whom I am indebted for specimens, would seem necessary, inasmuch as they throw light on the structure of the apple *Leiopus*. According to Dr. Shimer it bores into the limbs of the prickly ash.

The larva (Fig. 7, *a*, larva; *b*, upper side; *c*, under side of the head) is very much like that of the preceding species. The head is a little more than half as wide as the prothoracic ring. The basal (occipito-epicranial) region is transversely oblong, the basal piece (occiput) being very short, and transversely almost linear,

FIG. 7.

and separated by a well-marked suture from the middle portion (epicranium) of the head, the latter being nearly four times as broad as long, with the front edge straight; it is white, with the front edge pitchy black. The clypeus is smooth, trapezoidal in

form, and three times as wide as long. The upper lip (labrum) is thin, hairy, transversely elliptical, a little less than one-half as long as broad. The basal chin piece (submentum) is a large transversely oblong area, with the front edge piceous, and very slightly hollowed, while the posterior edge is very deeply hollowed out. The chin (mentum) is nearly square, widening at the base, which is continuous with the base of the maxillæ, the whole posterior edge being well rounded. The labial palpi are three-jointed, the basal joints of each palpus being large, and no longer than broad, and touching each other; the second joint is much slenderer, and about half as thick as the basal joint; the third joint is not quite so long, and is scarcely half as thick as the second; its tip is acute and reaches out as far as the end of the second joint of the maxillary palpi. The maxillary palpi are four-jointed, very broad at the base; the first joint is scarcely half as long as broad; the third is a little longer than the second, while the fourth is much slenderer than the others, and about the length of the second joint. The mandibles are large and powerful, when closed not reaching as far as the end of the maxillary palpi; the ends are truncated, gouge-like. On the prothorax is a large, obscurely marked, squarish, very slightly horny (chitinous) area, scattered over with hairs, especially on the anterior edge. On the upper side of each segment of the body is a broad oval area, with a series of oval gatherings or folds, on each side of the transverse mesial main fold; those on the three rings succeeding the head (thoracic) are the same, but broader. There are no rudimentary thoracic legs. The end of the abdomen is blunt, well rounded, with the extreme tip forming a rounded portion. It is .35 of an inch in length.

The pupa is white, and in the single specimen observed was quite far advanced, the body being covered with hairs. The wings were quite free from the body, and the antennæ curved around outside the wing-covers, their tips meeting at the base of the head. The first and second pairs of legs are folded at right angles to the body, the third pair being oblique to the body. The tips of the first pair of tarsi reach to the base of the second pair of tarsi; the tips of the second pair of tarsi do not reach to the base of the third pair of tarsi, the third tarsi not reaching to the tip of the abdomen by a distance equal to nearly their length. The prothorax is full and convex, the hinder

portion being larger in proportion to the rest of the body than in the adult beetle. It is a quarter of an inch in length. The beetle is characterized by four raised lines on each wing-cover, with five or six black dots on each line or rib. An oblique black line diverges from each side of the scutellum. Just in front of the middle is a triangular, pale space, bounded behind by an oblique, dark line. In color it resembles the bark of the ash; it is a quarter of an inch in length.

INSECTS INJURIOUS TO THE GRAPE.

The Grape Callidium.—(Plate 1, Fig. 3.) Several years ago I received from Dr. Shimer of Illinois, specimens of the larva, pupa and adult of this pretty insect (*Callidium amœnum* of Say), which is not uncommon in our own State. So much alike are all the borers of this family of long-horned beetles, that long and prolix descriptions and carefully drawn figures of the mouth parts (wherein most of the differences lie) are absolutely necessary for their identification.

The larva (Fig. 8, *b*, head seen from above; *c*, seen from beneath) has a small head, which is a little more than half as wide as the prothoracic segment. This latter, being the segment immediately succeeding the head, is half as long as broad, with a distinct median suture and four chitinous patches, the two middle ones transverse and irregularly oblong, being about twice as broad as long, the outer spots

FIG. 8.

being longitudinal to the segment, and oblong in form, or about twice as long as broad. The three segments succeeding are of nearly equal length and width, being about half as long as the prothoracic segment, and not much narrower. The body decreases in width towards the posterior half, which is of equal width throughout, the end suddenly rounding off; the terminal three segments are indicated by very slightly marked sutures, and together form a straight cylindrical portion nearly as long as the three segments in advance of it taken collectively. The

body is slightly hairy, with a few fine, pale hairs on the top of the segment next behind the head. The basal portion of the head (epicranium) is broad and smooth, with a few hairs on the edge. The eyes are two small black dots, each situated a little behind the base of the antennæ, and in a line with them. The frontal piece (clypeus) is very small, about three times as broad as long, while the minute upper lip (labrum) is two-thirds as long as broad; they together form a somewhat triangular portion resting on the inner edge of the mandibles, which are broad and short, the ends broad and square, and blackish in color. The antennæ are not quite so large or as long as the maxillary palpi; they are four-jointed; the first joint being thick, the third joint a third shorter than the third, while the fourth joint is filiform, and about as long as the second joint. The under side of the head is chitinous, with a mesial subtriangular fleshy area. The chin (mentum) is square, not much longer than broad. The under lip (labium) is one half as long as broad. The labial palpi are three-jointed, the basal joint being one-half as long as the second; the third joint is minute, short and hairy. The maxillary palpi are four-jointed, the first joint being twice as thick as the third, the second and third are of nearly equal length, while the fourth is slender and nearly as long as the second or third. The maxillary lobe is large and broad, reaching out to the labial palpi and as far as the end of the third joint of the maxillary palpi; there are a few hairs on the end of it.

On the upper side of the segments behind the prothoracic is a faint, transverse impressed line, with two or three short creases radiating from each end. On the eighth, ninth and tenth rings these creases become much longer and are parallel to the median line of the body, while the transverse crease disappears.

There are nine pairs of stigmata, one pair on the mesothorax, the remainder on the first eight abdominal segments. There are three pairs of rudimentary thoracic feet, represented by very minute two-jointed tubercles, the basal joint consisting of a simple chitinous ring. The under side of the body is more hairy than above. On the under side of the prothoracic segment is a pair of round, smooth, very slightly chitinous spots,

which are succeeded on each of the other rings by a pair of short, impressed oblique lines.

It is nearly half an inch (.45) in length.

It may be readily recognized by the four chitinous patches on the prothorax, and by the very minute clypeus and labrum. The upper side of the prothorax is inclined downward towards the head, but not so much as in *Clytus*.

The pupa is white, with the wing-covers reaching to the end of the second abdominal segment. The antennæ are not much curved, reaching to the end of the third abdominal segment, and resting above the legs. The prothorax is swollen just behind the middle, and is just as long as broad. The maxillary palpi are long, reaching nearly to the end of the coxæ. The labial palpi reach a little beyond the middle of the maxillary palpi. The two anterior pairs of legs are folded at right angles to the body, the third pair obliquely. The first pair of tarsi reach to the base of the second tarsi; the second pair of tarsi reach to the coxæ of the third pair of legs. It is a third of an inch (.33) in length.

The beetle itself has a reddish body, with Prussian-blue wing-covers. The prothorax is just as long as broad, with the sides moderately convex, and broadest just behind the middle. The antennæ and tibiæ are blackish brown, the tarsi being dull red, the hind pair being darker than the others, and the femora are reddish. The prothorax is distinctly punctured, while the elytra are very coarsely punctured. The scutellum is pale reddish. It is a quarter of an inch in length. The description of the beetle is taken from a single specimen received from Illinois.

INSECTS INJURIOUS TO FIELD CROPS.

The European Cabbage Butterfly.—We have two native kinds of white cabbage butterflies which have never done much harm to our cabbage and turnip crops. The first of these is the common white Northern cabbage butterfly, *Pieris oleracea* of Harris. Its habits are thus briefly described in the "Guide to the Study of Insects." "We have found the larvæ of this species on turnip leaves in the middle of August, at Chamberlain Farm in Northern Maine. They are of a dull green, and covered with dense hairs. When about to transform they suspend themselves by

the tail and a transverse loop, and their chrysalids are angular at the sides and pointed at both ends (Harris). The butterfly is white with the wings dusky next the body, the tips of the fore wings are yellowish beneath, and the hind wings are straw-colored beneath. The yellowish, pear-shaped, longitudinally ribbed eggs, are laid three or four on a single leaf. In a week or ten days the larvæ are hatched. They live three weeks before becoming full-fed. The chrysalis state lasts from ten to twelve days. There is an early summer (May) brood and a late summer (July) brood of butterflies."

While this kind feeds on the leaves of the cabbage and turnip, the Southern cabbage butterfly (*Pieris Protodice*), while in the caterpillar state, feeds on the outer leaves of the cabbage plant. It is often destructive in market gardens in the Middle and Southern States.

The European Rape butterfly (*Pieris rapæ* Schrank) is, however, a much more formidable insect, as it is more abundant where it occurs, and the caterpillar feeds inside of the cabbage-head when forming.

It was introduced from Europe to Quebec about the year 1857, having been captured in 1859 by Mr. Bowles, of that city. It rapidly spread into New England along the different railroads leading in from Canada, and is now common about Boston and New York. During the past year it has done much damage in gardens in Monmouth County, New Jersey, as I am informed by Dr. S. Lockwood. About Quebec it annually destroys 250,000 dollars' worth of cabbages, according to the Abbé Provancher. It is evident that, in this newly arrived insect, we have another formidable pest added to our list of imported insects.

As I have not personally had an opportunity of studying this insect, the following account is taken from Curtis' Farm Insects. The male butterfly (Fig. 9) is white, with the tips of the fore

FIG. 9.

wings black, dusted with white, while on the fore wings is a single, and in the female (Fig. 10) there are two large black spots, situated two-thirds of the distance from the base to the outer edge of the wing. It ex-

pands about two inches. The female lays her eggs singly on the under side of the leaves. The caterpillar (Fig. 11, *a*) is green, and so densely clothed with minute hairs as to be velvety; it has a yellowish stripe down the back, and another along each side, the belly being of a paler, brighter green; it is often more than an inch long, and about as thick as a large crow-quill. It changes in September under some board or stone, to a chrysalis, suspended by a thread spun over the back, as shown at fig. 11, *b*. It is of a pale flesh-brown color, freckled with black. It does not appear to have been very destructive in Europe, but, like other introduced species, it suddenly becomes a fearful scourge. The best remedies are evidently hand-picking when the caterpillars can be seen, and the capture of the butterflies by means of a light gauze net mounted on a wire ring a foot in diameter, and attached to a short pole. Affected cabbage heads should be carefully examined, and if much infested by worms, be burnt, for if they are suffered to lie about the garden after being pulled up, the caterpillars will attack the other plants.

FIG. 10.

FIG. 11.

A correspondent of the "*American Agriculturist*" for November, 1870, states that "it is estimated that the loss from this insect will, in the vicinity of New York [city] alone, exceed half a million of dollars; and already the price of cabbages has advanced." He says that Mr. Quinn, the owner of a large plantation, "has found carbolic powder, superphosphate, and lime together, to destroy them. The carbolic powder appears to be sawdust impregnated with carbolic acid. Salt has been recommended, but Mr. Quinn did not find dry salt efficacious, though lime has been reported by others as useful."

Mr. C. S. Minot, in an interesting article entitled "*Cabbage Butterflies*," in the "*American Entomologist*," vol. 2 (from which Figs. 9, 10 and 11 are taken), strongly recommends destroying the chrysalis, which may be found under chips, boards, stones, &c., and advises that boards, raised two inches above

the surface of the ground, be placed among the plants to attract the caterpillars when about to change to a chrysalis.

Mr. Curtis has described and figured several parasites of the three species of cabbage butterflies found in England, and he shows how thoroughly they keep in check these troublesome worms. Certain minute ichneumon flies (Chalcids) lay their eggs in those of the butterflies. Another chalcid fly (*Pteromalus brassicæ*) lays its eggs on the outside of the chrysalis of the white cabbage butterfly (*Pieris brassicæ*), and sometimes 200 or 300 of the little chalcid maggots have been found living riotously within a single chrysalis. They turn into minute brilliant flies, which multiply in excessive quantities. Mr. Curtis remarks that "some species of this extensive genus (*Pteromalus*), probably comprising nearly 1,000 species (!) swarm even in our houses, especially in the country, where in October and November I have seen immense numbers inside of the windows, and I believe that they hibernate behind the shutters, in the curtains, &c."

The Bean Weevil.—Since the article entitled "New and little known Injurious Insects" was printed in the last report of the Board of Agriculture, I sent specimens of the bean weevil, mentioned under the name of *Bruchus granarius*, to Dr. G. A. Horn, of Philadelphia, who pronounces it to be not the European *B. granarius*, but a native species (*B. varicornis* of Leconte). Mr. S. S. Rathvon, in the "American Entomologist" (Vol. 2, p. 118), states that Dr. Leconte, of Philadelphia, has had specimens of this species "raised from beans and cow-peas." Another common weevil is the *Bruchus obsoletus* of Say, a smaller species than the one mentioned above. It is blackish ash colored, and differs, according to Dr. Leconte, "in having the feet and the base and last joint of the antennæ black, whilst in *varicornis* they are testaceous (honey-yellow)."

INSECTS INJURIOUS TO SHADE AND FOREST TREES.

The Juniper Span Worm.—Many insects, either in the young or adult stages, or both, bear a wonderful resemblance to the plants, or portions of them, on which they feed, or disguise themselves in various ways to protect themselves from their insect or bird enemies. One of the most wonderful examples I have ever met with is the Juniper Span worm, (Plate 1, Fig. 4, and chry-

salis, top and side views), which with difficulty can be distinguished from the twigs on which it lives. The caterpillar of this family (Phalænidae, or Geometers) are well-known to resemble in color the leaves on which they feed, or the twigs among which they live, and some are ornamented with tubercles and other appendages, causing them to strikingly resemble the twigs on which they rest. Moreover, their habit, when at rest, of holding themselves out stiff and motionless, adds to the resemblance.

The caterpillar on the common juniper, was sent me from Norwich, Conn., by Mr. S. H. Scudder. The best description that could be given of it is to say that it would easily be mistaken for a portion of a twig of the tree on which it feeds. It is about an inch and a half long, and less than a line in thickness. Its body is rather rough, and with a few prominent tubercles in size and form resembling the scales left by the falling of the leaves of the juniper.

On the 17th of June it changed into a beautiful pea-green chrysalis, of the form indicated in Mr. Emerton's drawing. On the 29th of June the moth appeared, so that it lives about twelve days in the chrysalis state.

The moth proved to be an undescribed species, which may be called *Drepanodes juniperaria* (Plate 1, Fig. 5). It has unusually falcate fore wings. The ground color of the upper side of the wings is a pale fawn brown, with a rusty, but no purplish tinge, as in some other species of the genus; but the body and antennæ are pale fawn brown. The fore wings at the base are fawn brown, but with rather thick-set black scales, especially towards the inner line. This line is curved zigzag, rusty fawn brown and is very distinct; it begins at the basal third of the costa, and curving around opposite the discal dot, in a generally oblique direction, ends nearly as far from the base of the wing on the inner edge as on the costa; below the median vein the line is acutely zigzag, forming a tooth just below the lowest median veinlet, followed by a curve inwards on the submedian vein. The discal dot is small, black, but distinct. Just beyond the dot, the wing inside of the outer line is rusty, becoming deeper in tone next the line. The outer line is straight, white, narrow but sharply defined, and forms an acute angle opposite the apex, being reflected back on the costa. The line is shaded externally

with dense black scales, becoming thinner towards the outer edge of the wing. From the apex of the bend on the outer line starts a black streak, which is interrupted in the middle, but ends on the lower side of the hooked apex of the wing, which is unusually long and large. The fringe is rust colored, with the edge white. The outer edge of the wing is deeply hollowed out just below the apex, but below is full and convex. The hind wings are like the fore wings, but without the inner line. The discal dot is distinct, and the outer line is straight, ending just before reaching the costa. There is a broad costal white area. The legs and under side of the wings are fawn colored, densely speckled with black, giving it a peculiar silky, glossy appearance, suffused with a very slight wine-colored tint. The surface of both wings is uniform; the discal dots are more diffuse than above, being more distinct on the hind wings. The outer line is white, distinct, broader than above, and bent at right angles on to the costa, but the line disappears before reaching the hind edge, which is whitish. The black stripe sent out from the angle of the line, and reappearing on the hinder edge of the apex of the wing, is much as above. On the hind wings the line is straight, broader than on the fore wings, and extends on to the costa. The body is half an inch (.50) in length, and a fore wing measures .65 of an inch in length.

This fine species more nearly resembles Grote's *D. aquosus* from West Virginia, but differs in the outer line, and by not being at all tinged with purple on the upper side of the wings. It will undoubtedly soon be found in this State, and its caterpillar should be looked for on the Juniper during the last of May and early in June.

The Cedar Tineid. —(Plate 1, Fig. 6, enlarged; *a*, cocoon, nat. size.) This is a little moth, of which the caterpillar is unknown, though I found the moths and cocoons in abundance on a cedar tree in Brunswick, Maine, July 10th. It is undoubtedly similar in its habits to a little moth which lives not uncommonly on the apple-tree, and has been described by Dr. Clemens under the name of *Bucculatrix pomifoliella*. Its long, slender, white cocoons may be found, at any time after the leaves have fallen, on the branches of apple-trees.

Dr. Clemens says that "the larva feeds externally on the leaf of the apple, at least at the time it was taken, in the latter part

of September. It is cylindrical and submoniliform; tapers anteriorly and posteriorly; with punctiform points and isolated hairs; first segment with rather abundant dorsal hairs; three pairs of thoracic feet and five abdominal pairs. Head small, ellipsoidal, brown; body dark yellowish green, tinged with reddish anteriorly; hairs blackish and short. Early in October the larva enters the pupa state, wearing an elongated, dirty white, ribbed cocoon, and appears as an imago during the latter part of the following April, or early in May." The present species seems to be undescribed, and may be called *Bucculatrix thuella*. It belongs to the extensive Tineid family, and its general appearance is sufficiently indicated by the drawing. The body and wings are pearly white, and the antennæ are white, with brown wings, while there is a low broad tuft of white scales between the antennæ, the crest being much flatter than in the species living on the apple. The fore wings are white, and crossed in the middle by a broad brown band, and beyond this band by alternating white and brown stripes, crossing from the front edge (costa) of the wing. On the end of the wing, and in the middle of the outer edge, is a conspicuous black spot, like the eye in a peacock's feather. To describe the wing and its markings more fully,—the basal half of the wing is white, unspotted, except a short, transverse brown band, extending from the inner edge, not quite to the middle of the wing. On each side of this band is a row of two or three minute dots. The middle band is broadest on the hind edge. Beyond and arising from the costa, where they are broadest, and extending to the opposite side of the wing, are six brown lines, alternating with white interspaces. These lines run together in the middle of the wing, brown dots being added, but which end as distinct lines on the inner end of the wing. The three outermost lines are much curved, and, with the curve of the fringe, form a circular area, in the middle of which, on the base of the fringe, is the curvilinear, rather thick, dark brown spot. The long fringe on the end of the wing is white at base, and brown at the end. The hind wings are pale brown, acutely pointed, with a long silvery fringe. The tibiæ and tarsi of the fore legs are brownish, while the hind legs are white, with a long fringe on the hindermost tibiæ. The length of one fore wing is .18; and the length of the body is .13 inch.

The cocoon is white, tough, dense, slender cylindrical, and

.20 inch in length. It is fastened by one side to the leaf, and differs from that of the apple *Bucculatrix* in not being ribbed longitudinally. A minute, beautifully brilliant green ichneumon (*Chalcis*) fly seems to attack in considerable numbers the chrysalids of this insect, as nearly half of those reared by me turned out one of these parasites. It is a species of a genus allied to *Eulophus*, having the antennæ pectinated, the terminal joints throwing off five long branches. It differs, however, from *Eulophus* among other characters by having a short, thick body, a small, conical abdomen, and short, thick antennæ. The fore wings are broad, triangular.

The Two-lined Telephorus.—(Plate 1, Fig. 7, beetle; Fig. 8,

larva. Fig. 12, *a*, top view of head and prothoracic segment; *at*, antennæ; *md*, mandibles; *b*, under side showing *mp* the maxillary palpi; *lp*, labial palpi; *f*, first pair of feet. The beetles of this and other species which belong to the family of fire-flies feed on the leaves of forest deciduous trees, especially the birch. The larvæ, however, devour snails and insects, and do no injury to vegetation. The larva of this species was identified by Mr. P. S. Sprague, who found it near Boston, under stones in spring, where it changes to a pupa, and early in May becomes a beetle, when it eats the newly expanded leaves of the birch.

The body of the larva is rather long and slender, thickest in the middle, where it is about twice as wide as the head, and tapers slightly towards each end of the body, the terminal segment being a little less than half as thick as the middle segment. The segments of the body behind the head are unusually convex, the sutures between them being very deep. The body is covered with fine, dense hairs, giving it a peculiar velvety appearance. Its general color is horn brown, the head being

darker. The head is remarkably flattened and square, being scarcely longer than broad, and densely covered with short hairs above and beneath. The antennæ are inserted on the side of the head, and immediately behind them on the side are the eyes; the occipital suture is situated midway between the base and the front edge of the head, forming a straight line just behind the eyes. The antennæ are two-jointed, and received into a large socket; the first joint is very short; the second joint four times as long as the first, a little slenderer, and increasing slightly in width towards the end, which is abrupt, and contains a minute, rudimentary third joint. The maxillæ are broad, subtriangular, projecting a third of their length beyond the labium, with the ends broad and square. The palpi extend out from the head as far as the antennæ, and are three-jointed, with the basal joint quite thick, rather longer than thick, while the second joint is very short, and one-half as long as thick; the third minute, rudimentary. The anterior edge of the occiput beneath is deeply hollowed out; the chin (mentum) is oblong, with very square edges, and is one-fourth longer than broad. The labial palpi are three-jointed, the basal joint very short, one-half as long as broad; second nearly twice as long as thick, third minute, rudimentary. The mandibles are large, stout, two-toothed, the inner tooth situated a considerable distance from the tip. The labrum is broad and perfectly square in front, with a median notch dividing the edge into two slight lobes. The clypeus is an illy defined oval, convex area.

Along the median line of the body is a slightly marked row of short, paler streaks, more continuous on the thoracic than the abdominal segments, forming on each of the latter segments an elongated spot situated on the anterior edge of each segment except the last. On each thoracic and the last abdominal segment is a pair of lateral oval brown spots, paler in the centre. Behind these on each abdominal segment (except the last) is a row of pale short lines, placed in the middle of the segment. Further down on each side is a similar row of short lines, which are, however, subdivided into two spots, which on the thoracic segments form a row of four or five pale dots. Between these two lines is a row of black dots, one on each segment. The legs are rather short, and quite hairy. The terminal segment of the abdomen is about as long as broad, and well rounded behind.

It is three-quarters (.75) of an inch in length. The pupa was not preserved. The beetle itself is soft-bodied, brownish black and reddish yellow. Its specific name (*bilineatus*) was given to it from the two short, broad, blackish bands on the prothorax, which is reddish yellow. The head is reddish yellow, with a broad black band between the eyes, and the antennæ are black. The body beneath is pale reddish, except the under side of the middle of the thorax (meso and meta-thorax). The legs are pale reddish at base, while the end of the femora and the tibiæ and tarsi are entirely black brown. It is about a third (.30) of an inch long.

BENEFICIAL INSECTS.

It is quite as essential for one to know what insects are beneficial to agriculture as what are injurious, and whenever any new facts relating to the habits and transformations of the former come to our knowledge, it will not be out of place to mention them in such a Report as this. Foremost among the beneficial kinds are the Tiger beetles (*Cicindelidæ*) and the ground or carnivorous beetles (*Carabidæ*). A good example of the latter is the American Galerita (*G. Janus* Fabr., Pl. 1, fig. 9), which is especially common in the spring months under stones, where it undoubtedly feeds largely upon cut-worms and other noxious caterpillars and grubs which take refuge in the same places.

FIG. 13.

The beetle is rather large (the cut representing it slightly larger than the life size), with a blackish body and reddish antennæ, legs and prothorax. The wing covers are blackish blue, while the body beneath, with the exception of the prothorax, is blackish brown. It is three-quarters of an inch long.

The larva (Fig. 13, *a*, upper; *b*, under side of the head) is a most singular creature, and was discovered

by Mr. J. H. Emerton of Salem, running under stones July 1, 1869. It is closely allied to the larva of *Galerita Lecontei* of the Southern States, a figure of which, with that of the pupa, is given in the "Guide to the Study of Insects." And though the beetle has not been directly reared from the young, there can be no doubt but that is the species to which we have referred it, as no other is found in the Northern States.

The body is long, slender, flattened, and of a dull, horny brown. The head is horny brown, but whitish on the sides and beneath; in form it is equilaterally triangular; hairy on the sides behind the eyes; one or two of the hairs on a side being nearly as long as the head itself. The eyes form two rounded black spots, each situated about one-third of the distance from the insertion of the antennæ to the base of the head. The clypeus is triangular, shield-like at the base, and reaching near to the base of the head. On the front edge, which is as broad as the clypeus is long, is a mesial bifid process nearly as long as the head, and dividing in the middle into two forks, each division being half the length of the entire process, and ending in a stout hair. The antennæ are long, slender, and four-jointed, the basal joint being equal in length to the bifid tubercle; second joint a little more than one-third as long as the basal; the third slightly longer than the second; fourth joint short, scarcely half as long as the third. From the third and fourth joints arise long, slender hairs, one or two of them being from one-half to two-thirds as long as the entire antenna. The maxillæ are long and slender, the basal joint curved, and as long as the under side of the head from the base to the end of the labium; from the basal joint arise two articulated divisions, the outer one four-jointed, the joints gradually increasing in length, the last obconic, acute. The inner division is nearly one-half shorter than the outer, and is two-jointed, the basal joint being rather thick, the second very slender, and a little longer than the first. The chin (mentum) is squarish, a little longer than broad, being slightly trapezoidal; the labium is somewhat trapezoidal in shape, about as long as broad, with an acute tooth between the base of the palpi. These last are two-jointed, the joints of equal length. The mandibles are very long, curved, sickle-shaped, as long as the head itself,

with a large acute tooth just before the middle, projecting straight out; beyond this the mandible is much slenderer.

The prothorax is remarkably long, being a third longer than broad, and widest very near the hinder edge. The succeeding segment is trapezoidal in form, as wide as long, and the third segment is shorter than broad. The basal segment of the abdomen is very short, being three times as broad as long; the remaining segments gradually increase in length. From the ninth abdominal ring arises a pair of remarkably long, four-jointed, filamentary appendages as long as the whole body, except the head; the basal joint is as long as the succeeding ones, and the fourth is half as long as the basal joint. A single long fine hair arises from each joint, and three similar ones radiate from the end of the last joint. The two last joints and base of the first one are whitish, the remainder brown; the bases of the first joints are so dilated on the inside that they touch each other. Between the anal stylets is the tenth segment of the abdomen; it is one-half as wide as the next segment, and is a little longer than broad; and terminated by two short, conical, contiguous appendages, slightly separated at their base, however. The dorsal thickened plates extend far down the sides of each segment of the abdomen; below, is an oblong longitudinal brown plate. The legs are long, and whitish at the base; the hip joint (trochanter) about as long as the tibiæ; tarsi longer than the tibiæ. The hind legs are nearly as long as the thorax and abdomen together. The legs are covered thickly with stout hairs. The body is .38 of an inch long, and the stylets .32 in addition.

Dragon Flies.—These animals do great service, both in the larval state when they live in ponds, and in the adult winged stage, when they consume immense quantities of mosquitoes, gall flies, midges and other noxious and troublesome insects. In the young stages these insects live at bottom of ponds or quiet brooks, and have the form figured on plate 1, figs. 10, 11. Their habits and structure are interesting, as they are very carnivorous and wily in their mode of attack. The labium, or under lip, covers the face like a mask, concealing their jaws. The pupa only differs from the larva in having rudiments of wings.

At a field meeting of the Essex Institute, held at Wakefield in June, 1869, Mr. F. W. Putnam, Director of the Peabody

Academy of Science, found the pupa (Pl. 1, fig. 10) of *Cordulia lateralis* Burm., and reared from it the dragon fly, which was kindly identified for me by Prof. Hagen, of the Museum of Comparative Zoölogy at Cambridge. This pupa may serve as a type of the larval form of this genus.

The body is broad and somewhat flat, the abdomen ending in two rather long spines. The head is somewhat triangular when seen from in front, and the eyes are rather large, though not so prominent as in the next species figured. The occipital region is rounded and smooth behind. The antennæ are seven-jointed, the two basal joints being thick, the remaining ones hair-like, and all of the same thickness. The space between the antennæ is smooth. The mask, or labium, is full and convex, reaching further up the front, and nearer the base of the antennæ, and the teeth along the edge are small, blunt, and do not interlock. The thorax is scarcely wider than long, and the rudimentary wings extend to the fourth abdominal segment. The abdomen is scarcely twice as long as broad; along the back is a median row of compressed spine-like processes projecting backwards. It is of a pale horn color, with a row of round lighter spots on each side of the abdomen, while the legs are banded with paler, and on each side of the thorax is a dark stripe. It is .80 of an inch in length, and .28 inch broad.

With this may be compared the pupa of another dragon fly, *Didymops* ? (Pl. 1, fig. 11), in which the head is square above, and the eyes are very small and projecting, adding to the angular appearance of the head. On each side at the base of the occiput is a blunt tubercle, and between the antennæ is a large triangular tubercle which is thin and up-curved, reaching to the end of the second joint of the antennæ. The teeth of the labium are large, triangular and interlock. The wing covers are long, and the upper pair extend to the end of the fifth segment of the abdomen. The legs are long, the tarsal claws are scarcely curved, and are remarkably long and slender, being nearly half as long as the tarsus itself. The abdomen is much flattened, nearly as broad as long, with a median row of dorsal, short, compressed, hook-like tubercles. The eighth abdominal segment ends in a pair of short spines. The creature is of a dark horn color, and is an inch long and half an inch wide.

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