

FOURTEENTH REPORT  
OF THE  
STATE ENTOMOLOGIST  
ON THE  
NOXIOUS AND BENEFICIAL INSECTS  
OF THE  
STATE OF ILLINOIS.

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Third Annual Report of S. A. FORBES,  
For the year 1884.

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ARTICLE VI.—ON SOME INSECT ENEMIES OF THE  
SOFT MAPLE (*ACER DASYCARPUM*).

1. NOTES AND EXPERIMENTS ON THE SOFT MAPLE BARK LOUSE.

(*Pulvinaria innumerabilis*, Rathvon.)

Order HEMIPTERA. Family COCCIDÆ.

(Plate XI. Figs. 1 and 2.)

This annoying and even destructive species, which attracted so general attention four years ago and then suddenly disappeared from view, commenced, last year, to appear again in noticeable numbers on the soft maples throughout Central Illinois, and during the season just passed was excessively abundant throughout the State from at least as far south as Shelbyville to our northern limits. Notwithstanding the length at which it has been treated in former reports from this office, and the numerous articles upon it which have appeared in the agricultural and political papers during the last few years, great numbers of my correspondents were unacquainted with the name and life history of the species. In fact, fully half the entomological correspondence of this office during the months of June and July related to this bark louse. In the earlier articles upon it in the Report, some premature conclusions were reached with respect to its life history, and I do not know that exact experiment has heretofore been made with respect to its destruction.

The females of the preceding year which had wintered upon the twigs of the maples, began to attract general attention early in June, they having by this time attained their full growth and developed the cottony egg masses beneath the scales into which their bodies had become practically converted. By the middle of June it was easy to see that the lice were abundant almost everywhere upon the maple, and they commenced to appear likewise upon a number of other trees and plants. On the 14th, we noticed them upon the pear and box elder at Normal, and on the 16th, upon the grape and walnut at Quincy, and upon the pawpaw, grape, and honey locust, at Normal.

As the young hatched, they spread in great numbers over the vegetation in the vicinity of the trees where they had their origin, and attached themselves to a great variety of plants, both shrubby and herbaceous, besides those mentioned above. We found them upon the bass-wood, green ash, American elm, black locust, osage orange, plum, and cherry, and in their second stage upon leaves of clover and smartweed, upon wild cucumber, and upon the gooseberry. In fact, their young occurred, in the middle of July, upon nearly all the herbaceous plants within one or two hundred feet of infected trees; clover, plantain, *Polygonum*, mustard, various grasses, and *Bidens frondosa*, being the species apparently preferred. The latter plant seemed to suffer considerably from their attacks, the leaves being paled, spotted with yellow, and slightly curled when worst infested. By the latter part of July the larvæ in the second stage were common upon the under sides of the leaves of strawberries near infested trees, causing them to contract and curl.

The ultimate fate of these individuals which fixed themselves upon herbaceous plants and throve there, for a time at least, we neglected to make out, but it is probable that the greater part of them perished in autumn, although some may have succeeded in migrating at this period (when the young upon the trees are passing from the leaves to the twigs) to woody plants on which they could maintain themselves until the following season. The fact that in nurseries we sometimes found the young very abundant upon the suckers at the bases of the trunks of trees which were themselves but little infested, tended to confirm this supposition.

I noticed a marked difference in the stage of advancement of the brood upon different trees, some retaining still a considerable percentage of the eggs unhatched in the cottony masses attached to the twigs, after others had practically yielded all their young, and the obsolete bodies of the females and the egg masses had fallen to the ground, or were hanging in ragged shreds from the branches of the trees. As late as July 13, on some trees in Bloomington, fully twenty-five per cent. of the eggs were still unhatched. By the 20th of the month the young had nearly all left the nests of the mother bark lice and were established on the leaves, although a few eggs could occasionally be found which were still unhatched.

By the 16th August the injury effected by this new brood was at its height, and many trees in the vicinity of Bloomington lost a considerable part of their leaves, and the others were blackened and dwarfed, giving the branches a bare and unthrifty look.

By the 30th October all the living bark lice had deserted the leaves, except a few found occasionally upon the petioles, but thousands of them occurred upon the under sides of the twigs and branches of nearly every tree of the species worst infested, (*Acer dasycarpum*), the twigs being often crowded to their very tips.

The common insect enemies of the species were moderately abundant throughout the season, the small black Coccinellid beetle, *Hyperaspis signata*, whose larva is found embedded within the egg mass devouring the eggs, being the most destructive.

The minute hymenopterous parasite described by Miss Emily A. Smith under the name of *Coccophagus lecanii*\* was not infrequent. Numerous specimens emerged in our breeding cages early in October, at which time also the adult *Hyperaspis* appeared abundantly. Only an insignificant percentage of the brood was actually parasitized, however, and the number of these parasites occurring was far below those of the year 1880, at which time the last previous uprising of this species culminated. There is consequently every probability that the maple bark louse will be certainly not less abundant next year than this, but probably far more so, and that the year following will be marked by their almost total disappearance.

An interesting observation of my first assistant, Mr. H. Garman, is here inserted from his notes dated July 24.

"A nest of the goldfinch, *Chrysomitris tristis*, was found to-day in an osage orange hedge, and on examination proved to be covered outside with the silken nests and bodies of the female of *Pulvinaria innumerabilis*. These had been collected some distance away, as there were no maple trees in the neighborhood. There were no bark lice on the leaves of the hedge at a distance from the nest, but in the neighborhood of the latter the leaves were covered with them, some still active. The fact illustrates a means of dispersal for this bark louse which does not seem to have been noted by writers."

#### EXPERIMENTS.

For the purpose of testing precisely the value of various local applications to trees infested by the maple bark louse, I instituted a series of experiments with all the substances likely to be of economic use, and the results are herewith given.

#### *Kerosene Emulsion.*

On the 18th July, when the leaves of the trees were generally infested by the young, we began experiments with the kerosene emulsion, using a strong soap suds for the preparation of the emulsion, and diluting with water to give two and a half per cent. of kerosene.

Experiment 1.—At three p. m., a single leaf bearing many young lice was dipped in this fluid for a moment, and two hours later a number of the insects were taken from the leaf and examined with a microscope. All were evidently dead, and those on the leaf also

\*American Naturalist, Vol. XII, p. 661. J. Duncan Putnam in his admirable article on *Pulvinaria innumerabilis* published in Volume II of the Proceedings of the Davenport Academy of Sciences remarks, in a foot note to page 332, concerning this species: "I am very much inclined to think that *Platygaster lecanii*, described by Fitch in his 5th New York Report, as infesting *Lecanium quercitrans* may prove to be really a *Coccophagus* nearly allied if not identical with this species. The description applies too well, to easily believe that the two species belong to different families. In this event Dr. Fitch's reference to the Proctotrupidae is of course wrong."

I am not able, however, to agree with Mr. Putnam in this matter, as the description by Fitch to which he refers states that the antennae of his species are threadlike, with the joints slender, three times as long as thick, the last one not enlarged, whereas, in the specimens of *Coccophagus lecanii* bred by us from *Pulvinaria*, the antennae are somewhat clavate, the joints less than twice as long as thick, and the last one is decidedly enlarged.

commenced\*to loosen at the margins and curl upwards. At eight on the following morning a single example only was found capable of slight motion.

Experiment 2.—This was a repetition of the first experiment with identical results except that all the plant lice examined on the morning of the 19th were absolutely dead.

Experiment 3.—In this case the same solution was applied to an infested leaf with a camel's hair brush with the same effects, all the bark lice being dead at eight the following morning.

Experiment 4.—On the 22d of the month a two and a half per cent. dilution of the kerosene emulsion was thrown with a force pump and a tubular nozzle upon a branch of a soft maple tree. The leaves were not as thoroughly wetted as desirable. Four days after about half the young bark lice were alive, although it is possible that the branch treated had been restocked by young from other parts of the tree, as the insects were still moving about and no precaution had been taken to prevent such migration.

Experiment 5.—On the same day a branch of soft maple attached to the tree was dipped in a two and a half per cent. dilution of kerosene, and on the following day three-fourths of the bark lice were dead. Four days after a few were still alive, but not enough to do any appreciable harm, and another application would doubtless have killed them all.

Experiment 6.—On the 29th the same experiment was tried with a five per cent. dilution of kerosene, the emulsion being made with whale oil soap, and common soap suds being used for dilution. Two days later the bark lice remaining on the leaves of this branch were all dead.

Experiment 7.—On the 29th, on the other hand, an application was made to a branch by dipping in a two and a half per cent. dilution, soap suds being again used as the diluent, and five days thereafter no considerable diminution in the number of living bark lice was apparent. It seems likely, however, considering the length of time that had elapsed between the experiment and the observation, that the branch had been restocked by young from other parts of the tree, as the lice were still actively crawling about.

Experiment 8.—On the 31st of the month the leaves of a branch of soft maple which was stocked with young bark lice were dipped in a five per cent. dilution of kerosene emulsion like that used in the preceding experiment. Five days later a few living bark lice still occurred upon the leaves, but nearly all had disappeared.

Experiment 9.—On the 6th August a similar experiment was made with a similar fluid, but containing ten per cent. of kerosene. The branch treated was not examined until nine days afterwards. The leaves were not at all injured by a solution of this strength. Many bark lice still remained upon them, but they had perhaps been restocked with living young.

In all the preceding observations the effect upon this bark lice was determined by microscopic examination, the sign of death relied

upon being the cessation of the heart's action. As the young were transparent when viewed by transmitted light, the motion of the heart of living specimens was easily detected.

#### *Whale Oil Soap.*

From the 19th to the 22d several experiments were tried by dipping the leaves in a solution of whale oil soap, or brushing their surfaces with it, but as the strength of the solution was not noted in these preliminary trials, I need only say that they were in all cases effectual.

Experiment 10.—On the 23d a branch of a tree infested with bark lice was dipped in a suds of whale oil soap containing a pound to a gallon of water, and on the morning of the following day the lice were all dead. Two days later, however, the leaves dipped in this solution showed signs of injury, the margins of most of them having blackened and dried up. Naturally the younger leaves at the tip of the branch were most severely injured, some having been almost wholly destroyed. On the 29th, nearly all the leaves had fallen off this branch.

Experiment 11.—On the 25th July, leaves were dipped in a solution containing a quarter of a pound of whale oil soap to the gallon, and on the 26th the bark lice were mostly dead, only a small percentage showing a feeble movement of the heart.

Experiment 12.—The above experiment was varied by using a solution double the strength just mentioned. On the following day all the specimens examined were dead.

Experiment 13.—On the 28th, experiment 12 was repeated with identical results, all the bark lice being dead two days later.

Experiment 14.—This was a repetition of experiment 11. The twigs were not examined, however, until five days afterwards. At this time, at least seventy-five per cent. of the bark lice upon the leaves were dead and many which were not killed seemed to have been driven from the leaves as if the soap suds were obnoxious to them. This was shown by their having fixed themselves upon the petioles and twigs, a fact not elsewhere observed so early in the season. The leaves were again very slightly injured at their margins, and a few, perhaps, eventually fell before their time.

Experiment 15.—A repetition of experiment 12. Five days after treatment not a single living bark louse could be found upon a leaf containing a hundred or so, all being brown and loosened, so that a touch dislodged them. The leaves, however, were slightly blackened at the margins, and some were doubtless injured enough to cause them to fall.

The experiments with whale oil soap were, consequently, less satisfactory than those with the kerosene emulsion, an application of the suds, strong enough to effect the purpose, being very likely to injure the leaves at least as much as the bark lice would have done.

*Laundry Soap.*

Experiment 16.—Three applications of strong solutions of laundry soap were made with a brush to infested leaves, from the 19th to the 22d July, with the effect to destroy all the bark lice, occasionally, however, with trifling damage to the leaves. The effect of these applications apparently differed but little from those of the whale oil soap.

*Pyrethrum.*

Experiment 17.—Although expecting nothing from the application of pyrethrum, we made a few experiments with it, commencing July 19. As they were all entirely inefficient, the results need not be given further than to say that the fresh pyrethrum powder suspended in water in quantities varying from a tablespoonful to the gallon up to an excessive proportion was applied by brushing and dipping, without any effect whatever. Pure pyrethrum was also dusted upon the leaves without result.

*Carbolic Acid.*

Experiment 18.—July 19, leaves infested with the young bark lice were thoroughly wetted with carbolized water (a teaspoonful of the pure liquid acid to the gallon) and examined five hours later. The bark lice were all alive. This experiment was twice repeated, both in the laboratory and the field, with only negative results.

A few additional experiments were made with tobacco water (one-half pound tobacco to a gallon of water); with hellebore (one ounce to the gallon); and with a weak solution of caustic soda,—in all cases without any favorable result, every individual being apparently alive in from one to three days after treatment.

As a general result of the above series of experiments we may say that a kerosene emulsion diluted with soap suds to a strength of from two and a half to five per cent., was found effective during the month of July and did not injure the leaves. This was the only substance experimented with which gave any promise of usefulness, with the exception of the whale oil and soaps, which were subject to the drawback already mentioned: that is the liability to injure the leaves if used in a solution strong enough to destroy the bark lice. Possibly if it were washed off shortly after application, as recommended by Dr. Lintner, the injurious result might be prevented, but this would too greatly increase the trouble and expense of the application.

*Washing off the Females and Egg Masses with Water.*

From correspondents in Northern Illinois, I learned that late in June, the practice became somewhat general of washing off the egg masses and the outworn bodies of the females with jets of water from the hydrants, throwing the water into the tree by means of a hose, but I have not yet been able to learn with what result. This method was, apparently, usually applied under the mistaken

notion that the principal injury to the trees was done by these last year's females, and that if they were removed the damage would be arrested. The real injury, I need not say, is done later in the season by the young hatching from the egg masses which make these females so conspicuous in spring and early summer. It is possible, however, that the method is a valuable one, as the washing away of the eggs before hatching, may not improbably result in the destruction of many of them. The young which hatch upon the ground would doubtless, most of them, make their way back to the tree, but if the rubbish beneath the tree were raked and burned after the egg masses had been dislodged by the water, the multiplication of the pest might probably be kept below the limit of injury.

[Since the above was written, I have received from Mr. S. M. Dunning, of Chicago, who thoroughly tried the hydrant method last June, twigs of a maple tree from which the egg masses had been carefully and completely washed off. The under sides of these twigs were well covered, in March, 1885, with half grown females,—scarcely, if at all, less abundantly so than was to have been expected if no treatment had been applied. The nearest other maples were across a dusty city street, and it is scarcely likely that the young were conveyed so far. A box elder in the same lot, which was also attacked by the bark lice, but not treated, may have divided its parasites with the maple; but, curiously, this tree had this spring fewer lice than the maple above mentioned. It is, therefore, improbable that the mere dislodgement of the egg masses with the water jet had any real effect on the numbers of the young lice. Indeed, it may have easily done more harm than good by destroying within the egg masses the larvæ of the Coccinellidæ to whose multiplication we have to look for the principal check on the increase of the next brood. This is, perhaps, the explanation of the inferior abundance of bark lice upon the box elder, as just mentioned. Destruction of the egg masses by burning, after dislodging them with water, seems to be necessary to any promise of success by this method. Further experiment is needed, however, and will be undertaken the coming season.]

## 2. THE OBLIQUE-BANDED LEAF ROLLER.

(*Cacæcia rosaceana*, HARRIS.)

This nearly omnivorous species, (not hitherto reported, however, from the maple), was by us found rolling the leaves of *Acer dasycarpum* in May, pupæ and larvæ collected on the 20th of that month emerging from July 9 to 13.

## 3. *Pandemis lamprosana*, ROBS.

Order LEPIDOPTERA. Family TORTRICIDÆ.

(Plate XI. Fig. 3.)

Among the leaf rollers upon the maple, collected May 10, was one of which we kept no description, which resulted in an imago of *Pandemis lamprosana*.



4. *Aleurodes aceris*, n. s.

Order HEMIPTERA. Family ALEURODIDÆ.

(Plate XI, Figs. 4 and 5.)

I have noticed, for several years, a peculiar bark louse upon the leaves of the maple, but have not bred it until the present year. The fully developed pupal scale is oval in general outline, somewhat lyrate, broadest posteriorly, contracted in front of the middle. Margins entire, surface densely granulated. The color is chocolate, mottled with white, the white varying in amount and tending to form three transverse bands. The central segmented area is usually irregularly mottled with white, and a quadrate patch, including the vent, is almost always brown; but, otherwise, the color may vary from nearly uniform brown to almost white. Outline sometimes slightly emarginate posteriorly. Length, .095 of an inch; greatest width, .045; width at anterior fourth, .036.

The imago is pale yellow throughout; legs and abdomen paler; wings milky white; rostrum black at the extreme tip; veins yellowish; first joint of the antennæ scarcely longer than wide, the remaining joints filiform, the second nearly as long as the four following and about four times as long as the first, the fourth longer than the third, the third and fifth about equal, the sixth fusiform.

At Tamaroa, in Southern Illinois, soft maple trees were found badly infested by this bark louse, but elsewhere it has occurred in only trivial numbers. There are apparently two broods of this species in a year, scales collected in August, 1883, emerging April 10 to 24, 1884, and others, collected during the present summer, emerging August 4. From these larvæ several hymenopterous parasites belonging to the genus *Elaptus* escaped September 6, the species of which is apparently new.

*Elaptus aleurodis*, n. s. Plate XI, Fig. 6. Female. Length .03 of an inch; the head .005 inch; front wings .032 of an inch long and .001 inch wide; posterior wings .0032 inch wide at the widest point; antennæ as long as the head and whole body; scape stout, arcuate, rising to the top of the head, about as long as the three following joints, nearly smooth, as is also the second joint; remaining joints densely pilose; the club not jointed, as long as the three joints preceding; first joint obconic, second about the same length but narrower. Color black, surface shining, abdomen alutaceous, head and thorax punctured, antennæ yellow, legs entirely yellow, femora and tibiae of the middle and posterior legs black, their tarsi yellow.

Described from three specimens bred from *Aleurodes aceris*.

5. *Lygus invitus*, Say.

Order HEMIPTERA. Family CAPSIDÆ.

(Plate XII, Fig. 1.)

Brief mention may properly here be made of a species whose injuries to vegetation have not hitherto been serious, as far as known,

but which deserves attention as the near relative of one of the most injurious horticultural species (the tarnished plant bug), and also because, from its own abundance and habits, it may well become the author of serious mischief.

Although not agreeing precisely with any descriptions of Capsidæ accessible to me, I have little doubt, after careful study of about forty specimens collected in June, that the species is that described by Say as *Capsus irritus*. It differs materially from Say's original descriptions, but corresponds closely in most particulars with the description of a type specimen of Say's, published by Uhler in his notes on the Heteroptera in the collection of Dr. Harris,\* varying from that only in some color characters of little moment in so variable a genus.

#### DESCRIPTION.

The following description is condensed from that of Uhler, modified with respect to color to conform to our own specimens.

General color pale obscure yellow, varying to yellowish green. Antennæ and transverse carina at base of head very slender, the former nearly as long as the hemelytra. Surface of head polished, impunctured, clothed with short hairs. Tylus slender, short. Eyes large, prominent. Pronotum smooth, very convex, sparingly hairy, finely, densely and mostly confluent punctured, the punctures forming obscure transverse rugosities. The head and fore part of the thorax are slightly darker yellow, the antennæ are sometimes pale throughout, sometimes embrowned at tip and also at tip of second joint. A broad band on the pronotum, a little within the margin, extends backwards along the inner edge of the clavus, is continued as a dusky shade through the middle of the membrane, deepest along the inner edge of the inner cell, and extends distally into an indefinite dusky shade. This line is intersected at the tip of the corium by a transverse band of the same color extending to the edge of the hemelytra. When the wings are closed, these marks give the appearance of a median black stripe crossed at the tip of the corium by a black band, and forking at the scutellum. In the darker colored specimens the pronotal bands are frequently connected by a basal shade. The posterior half of the larger cell of the membrane is usually white. In many yellowish specimens the cuneus alone is green. The posterior thighs are commonly infuscate on the distal half, and the anterior tibiæ are often brown at tip. Length to tip of hemelytra 6 mm. Humeral breadth 1.66 mm.

On the 12th May the younger leaves of many of the common soft maples (*Acer dasycarpum*) near Normal, were observed to be curled, and specked with numerous semi-transparent spots, evidently the work of the larvæ of this capsid, found abundantly upon the affected leaves. On the 30th May, specimens collected were all of the second and third stages. On the 1st June, the first imagos were seen in the breeding cages and on the trees. By the 5th of that month nearly all the specimens collected had transformed to the imago, and the experiment was not carried farther.

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\* Proceedings of the Boston Society of Natural History, Vol. XIX, p. 407.

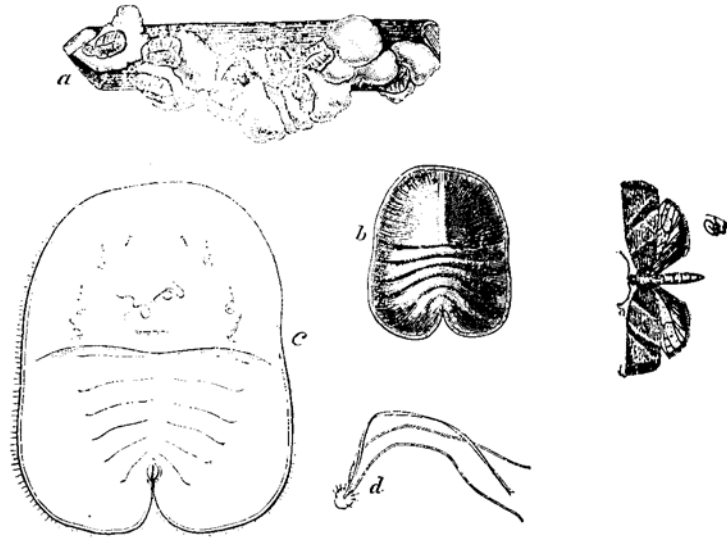


Fig. 1.

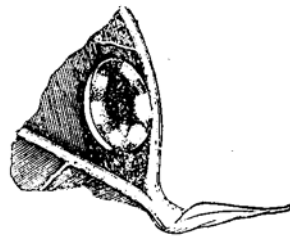


Fig. 4.

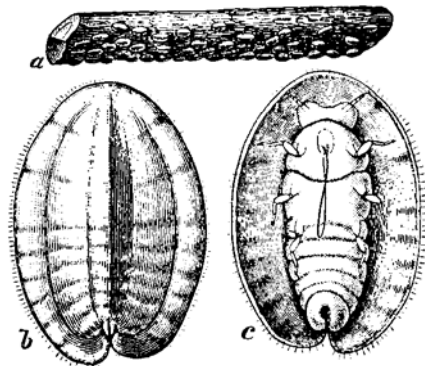


Fig. 2.



Fig. 5.

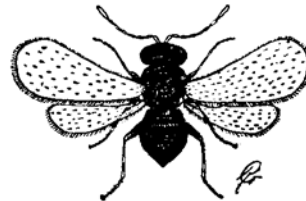


Fig. 6.

PLATE XII.

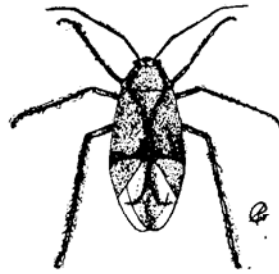


Fig. 1.



Fig. 2.



Fig. 3.



Fig. 5.

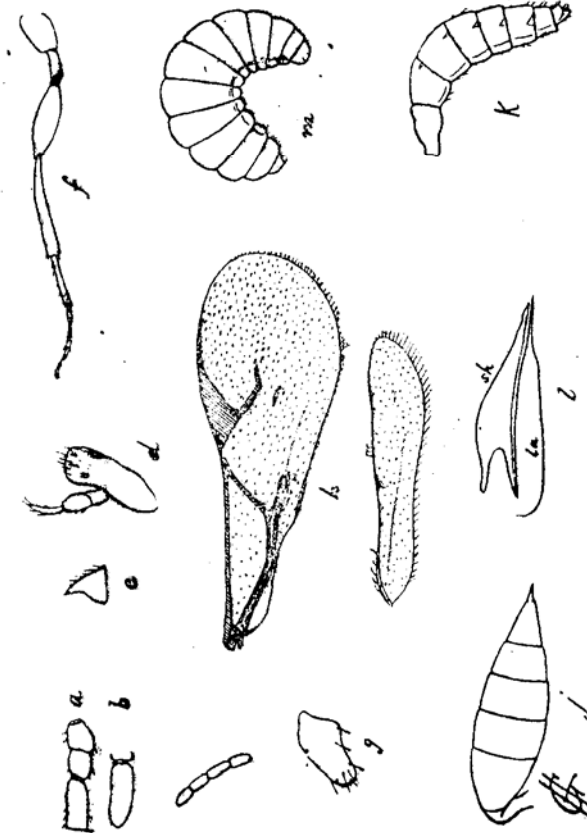


Fig. 4.