PSYCHE.

FURTHER NOTES ON SOME TINEID LARVAE.

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(Continued from page 137.)

The regular ratio of growth between the different stages of these minims would scarcely be believed by one unfamiliar with such facts; thus the lengths of this species (N. pteliacella) at its several molts are, as above stated, 0.8, 1.6, and 3.2 mm., and to adopt the language of the anthropologists, its "cranial capacity," as indicated by the width of the head at the widest point, is in the different casts of the same larva, 0.0825, 0.165, and 0.33 mm.

The mine is a very pretty one; and several of them together give to a leaf a very singular appearance. The mines frequently cross themselves and each other, and sometimes almost the entire contents of a leaf are eaten out. There is a similar mine in oak (Quercus) and another in hickory (Carya). In these, however, there is no little blotch at the beginning, the frass is deposited in a central line in the first part (corresponding to the first stage of larval life?), as it also is in the last 12 mm. of the mine, as in this species. This last character is preparatory to leaving the mine to pupate, and does not indicate a molt accomplished, as the other changes in the character of the mine do; but it is probable that every change in the mode of feeding, and in the character of the mine, and every decided break in the continuity of the frass made by a larva in early life, indicates that it has just completed a molt. Yet there are many Nepticula mines in which I have not only failed to find any molt, but also have failed to find any indication of one. Perhaps the enlargement of the mine of N. fuscotibiaeella two days before it ceases to feed may indicate that a molt then takes place, but I have not found that its does.

The only cocoons that I have seen were yellowish green and about 2 mm. long; they were between the side of the glass breeding jar and the earth in the bottom of it. Does it pupate underground?

Aspidisca saliciella Cham. The egg is deposited usually at the side of the midrib in willow leaves [Salix]; the larva makes a mine just wide enough to hold it, along the midrib, and 2.12 mm. long; here it undergoes its first molt, being at the time 1.06 mm. long. It then leaves the midrib and makes a clavate mine 3.36 mm. long, when it undergoes
its second molt, being now 2.12 mm. long. It then eats out the parenchyma, making a small irregular roundish blotch from which it cuts out the little oval case in which it pupates. Its length after it has finished feeding is 4.24 mm. The larva hibernates; in all of its stages, except as hereinafter stated, it is pale yellow with a fuscous spot on the under surface of each segment except the head and anal segment, and two hairs (one of them very small) project from each side of each of the same segments. The body is cylindrical and depressed; feet are represented (?) by sucker-like discs, and the trophi from its exit from the egg are of the ordinary form, that is the spinneret, maxillae and palpi are distinct, as well as the other organs. Each molt in the mine occupies twelve hours. It is only recently that I have been able to follow its life history, having formerly supposed that it molted only once. The width of the head of each cast is, 0.101, 0.202, 0.303 mm. I give these figures as showing the regularity of the relative sizes of the same insect at its different molts. But it will be observed that there are two ratios. In Aspidisca and Nepticula the larva in each stage increases its length by adding the length of the preceding stage, as 1.06, 2.12, 4.24 mm. and 0.8, 1.6, 3.2 mm.; whilst in Lithocolletis, Leucanthiza and others the length of the larva at the end of its first stage is added in each of its succeeding feeding stages (0.81, 1.62, 2.43, 3.24, 4.05 mm.). In Aspidisca and others what corresponds to the third molt of Lithocolletis and others seems to be skipped, and a double length added at the fourth. In many larvae there is, however, a fifth molt, which seems to be the equivalent of the sixth one in Lithocolletis, the fifth also being skipped.

The larva undergoes another (its third) molt in its case, after the case has been attached for pupation, but previous to the molt by which the pupa is formed. If the case is opened, some days after it has been finally attached, a white silken cocoon will be found inside, fitting closely to the body of the pupa, and the cast skin will be found between the cocoon and the case. There are therefore four larval stages. In the last stage the appearance of the larva differs greatly from that of the previous stages. It is now yellow, without maculae, and the sucker-like spots on the thoracic segments have disappeared. I have long known the larva in this condition, but only recently discovered that it attained it by a third molt, though the difference in its appearance suggested as much. Prof. J. H. Comstock, in his “Report of the Entomologist of the U. S. Department of Agriculture, for the year 1879,” pl. 2, fig. 2, b and c, gives figures of these last two (or third and fourth) larval stages.

The mode of progress in the larvae of Aspidisca is one of the most surprising in the insect world. As above stated there are no true feet or prolegs; every vestige of them has vanished except on the second and third thoracic segments, where they are represented (?) by the little sucker-like discs before mentioned. But these discs are not suckers. They are distinct depressions both on the ventral and dorsal surfaces. They do not exude any glutinous or other secretion by which the larva gains foothold. The larvae are thus apparently without any means of progress. Yet encumbered by
their case, and with the whole body en-
cased except the head and first, and
sometimes the second, segment, they will
climb trees and fences, travel through and
over grass and weeds and irregularities
of ground for distances sometimes of
many metres before they finally attach
their cases. I was long puzzled to know
how they accomplished it, supposing that
it was by means of the discs, by suction or
by exuding from them a glutinous secre-
tion. Experiment and observation have
solved the problem. There is no suction
or secretion; and the discs have nothing
to do with it; they are not organs of lo-
comotion. The larvae travel solely by
means of their silk. The head and fol-
lowing segment, and sometimes the next,
are protruded from one end of the case
(the larvae sometimes close one end and
open the other), then successive taps are
given with the end of the spinneret to
the surface on which the larva lies,
and thus a minute byssus is formed, to
which the spinneret adheres; the body is
then contracted so that the under surface
of the case is brought into contact with
the byssus and apex of the spinneret,
and thus the case is attached. The head
and segments are again extended, and
another byssus is made, and, the body
contracting, the case is again brought up
and attached. Its attachment is only by
a few silken threads each of which is less
than 0.0002 mm. in diameter, and the
fresh silk readily stretches or breaks.
This is the sole mode of progress of the
larva.

I have not followed the changes of
A. splendioriferella or any of the species
other than A. saliciella; but the mines
and larvae of all resemble each other so
much that there is no reason to suppose
there is any difference in their histories
other than such as relates to size, orna-
mentation and food plant.

Antispila. In this genus I know the spe-
cies nyssaefoliella, cornifoliella, viticordi-
foliella and ampelopsiella in their last and
penultimate larval stages. In their last
stage all are flat, white, footless larvae; the
first then having a length of 4.07 mm.
when fully grown, and the last of 3.30
mm. In the penultimate stage all have
the ventral maculae on all of the segments,
except the head and the two hindmost
segments of the abdomen. I have never
seen a molt in any of the species, but there
has evidently been a molt between the
two stages above mentioned, and I have
found the cast skin of this molt in the
mines. From the size of these two
stages, and from the size and form of the
mine, and from analogy with Aspidisca, I
have no doubt that there is an earlier molt
which takes place in the first three above-
mentioned species when the larva is about
1.35 mm. long; and in ampelopsiella
when it is about 1.1 mm. long. I know
the larvae of A. hydrangeaeella Cham.
and A. isabella Clem. only in their penul-
timate stages. They are very much like
the other larvae. Isabella in size agrees
with viticordifoliella, and hydrangeaeella
is but little larger than ampelopsiella.
The mines of all greatly resemble those
of Aspidisca, but are larger; and like
nearly all Tineid mines known to me they
are at first linear, ending in a blotch which
frequently obliterates more or less of the
linear part of the mine. They no doubt
leave their eggs with mouth parts of the
ordinary form, like Aspidisca and Nep-
ticula.
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