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A MEADOW CATERPILLAR

CONTENTS

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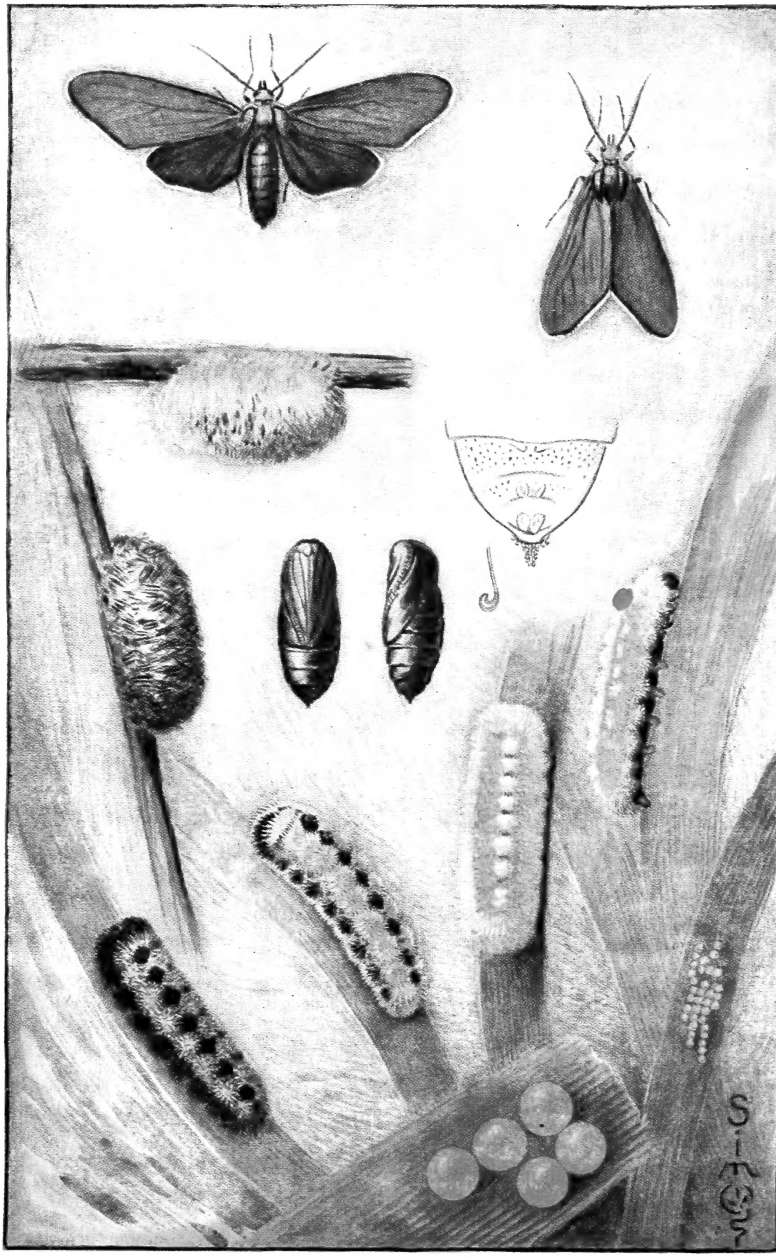

FIG 48. *Ctenucha virginica*—Eggs, caterpillars, pupae, cocoons, and moths. See also page 320.

BULLETIN 302

A MEADOW CATERPILLAR.[1]

"The Adventurer" *(Ctenucha virginica)*

By Edith M. Patch

Introduction

Because of the striking appearance and the peculiar habits of both the caterpillar and the moth, this meadow insect attracts attention even when not abundant. If the weight of numbers should be added to its conspicuousness, interest in its manner of life and economic status, naturally, would be increased.

That it is a common insect in Maine, is indicated by the fact that these moths have been noticeable every summer for the past seventeen years or more and that the caterpillars are frequently sent to the Station for determination during thaw spells in early spring before the snow has disappeared—a time, in this part of the country, when an active insect is in itself a curiosity.

An insect constantly present without becoming abundant is a circumstance to be accounted for by natural checks. These checks, it would seem, must have been in operation with fairly uniform results for many successive years; for *Ctenucha virginica* has hardly a mention in economic publications and never has been common enough to have been given a popular name, the nearest approach to such being the "Virginian Ctenucha." Because the caterpillar is often active during a winter's thaw in the north, and because the moth flies by day (times when most caterpillars are dormant and most moths are hiding); I have called the insect the "adventurer" a name which will serve the convenience of this bulletin.

On April 22, 1920 I counted 20 of these black and yellow grass caterpillars in a square yard of a field for which an estimation of 4000 per acre seemed conservative. This field was

[1]Papers from the Maine Agricultural Experiment Station; Entomology No. 107.

near Orono; but specimens received from other parts of the State gave evidence that the outbreak was more than local.

Apparently the natural checks to this insect had lost their grip, had themselves been checked. Handicaps removed, the grass caterpillars won the race in the spring of 1920 and demonstrated their ability to wax strong and multiply, a triumph achieved now and then by an ordinarily non-economic species.

Grass-eating caterpillars 4000 per acre composed an army strong enough to threaten our meadows; and the circumstance seemed to warrant entomological attention. The situation was, therefore, watched with some care and the resulting data are, perhaps, of enough interest to record, whether or not the insect concerned repeats its spectacular appearance here or elsewhere.

THE MOTH

Field collections of the adults during the summer of 1920 extended from late May to early August, the moths being most abundant from the middle of June to the middle of July. As these insects fly by day they are seen more often than night moths and are frequently mistaken for butterflies, although their manner of flight is moth-like. There is something furtive about their movements, which lack, altogether, the gay flitter of a butterfly, dancing in the sunshine.

The body of this moth is glistening peacock blue, with bright orange collar tufts. The head is orange, except for a peacock blue space in the middle of the face, with black appendages (antennae and mouth-parts). The wings, to a casual glance, are dull black; but, when given closer inspection, they are found to be wonderfully shaded. The fore wings which in certain lights are rusty black above, have color tones like changeable silk giving bronze, purple, and green reflections. Underneath, both fore and hind wings are much like the upper surface of the fore wing, though with the blue diffused over a larger area than just the base. The upper surface of the hind wings is blue-black or black-blue depending on the reflection. All the wings have the distal margin fringed with white. This white fringe, on some specimens, is continuous; on others it is interrupted by black, which gives a tattered appearance to the edge of the wing.

The male and female resemble each other closely in color, size, and habits of flight; although the antennae of the male are

more feathery, its abdomen is more slender and its fore wings lack the narrow buff line that fronts the costal edge of the fore wings of the female.

The moths frequent different flowers in season, both males and females feeding at Viburnum, white daisy, buttercup, clover, spreading dogbane, yarrow, meadow sweet and other blossoms. They seek dew, also; feeling, along the grass blades with the tip of the uncoiled tongue, for dew drops, which they sip as they do nectar. As they often visit conifers and other trees, colonized by aphids, it seems probable that they are attracted by honeydew. It is not unlikely that their vigorous appetites provide a strength that is not soon exhausted by their quiet habits and that they have a longer life than falls to the lot of most moths. The length of the season, fourteen weeks or more, during which these insects are on the wing, however, is due, in part, to the fact that the overwintering caterpillars do not all complete their growth by the same date in the spring. Thus the cocoons are spun at different times, providing for the appearance of newly emerged moths during a period of five or six weeks.

The female deposits her eggs in close-set rows, lengthwise a grass blade, the number of the rows controlled, in part, by the width of the grass blade; a narrow one having so few as three rows, while wider ones often have more. One moth, while under observation by Miss Morse, deposited eggs in several short rows, by beginning at the bottom of the first row and working up, then laying a row at the left of the first, next placing a row at the right of the first, next going to the left and keeping to the left until the space was filled, and then working on the right again. Sometimes 13 or more eggs are laid in the first row, sometimes as few as 12 compose the whole of a single batch. A moth deposits several batches of eggs, the highest total laid by a caged individual was 185. No dissections were made for egg counts. Moths confined without access to grass deposited their eggs on broad leaves or on the cloth sides of the cage, sometimes laying as many as 60 eggs in rows forming an irregular patch.

The Egg

The eggs are honey yellow with a surface appearing smooth to the unaided eye and slightly granular through the microscope. They are globular with base flattened at place of attachment.

Nine or ten days after the eggs are laid, the heads of the developing larvae color black and show through the pale thin shell, giving the eggs a dark appearance.[2] About two days later the hatching larvae eat their way through the shell, a process which can be watched through a low power microscopic lens, as the shell is nearly enough transparent to reveal the black head within and the sidewise motion of the jaws working for some time before the young free themselves. The empty shells are pearl white with iridescence, and on these the newly hatched larvae continue to feed before they seek another diet; finishing, from without, the meal they started from within the egg shell.

THE CATERPILLAR

The head of the caterpillar darkens inside the transparent egg-shell as do the hairs lying pressed against the inner surface, but otherwise the newly hatched larva is pallid. In a short time, usually before it has finished with its initial meal of egg-shell, the body colors to a whitish yellow and the tiny tubercles at the base of the spreading hairs become black. With each molt the dark hairs become more numerous but it is not until the fourth instar[3] that any of the black dorsal tufts are indicated and then but slightly and only on the first and eighth abdominal segments. In the fifth instar these two tufts are distinct though still small. In the sixth instar they become prominent and at this time also the two rows of yellow hairs along the back are first indicated. It is not until a later instar that the black dorsal tufts appear on the segments between the first and eighth.

The overwintering caterpillars are advanced enough in their development to show the dorsal row of 8 apparent tufts, the last of which, while appearing single, is composed of two, the hairs of which touch. These dorsal tufts, in all specimens seen by the writer are black up to and during the next to last instar. In the last instar some larvae retain black dorsal tufts and some have

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[2]See also page 319. Lot 1837 sub 111 and Lot 1825 sub 19.

[3]The term instar is applied to the form of an insect during the time between molts. The first larval instar is that extending from hatching to the first subsequent molt. The last larval instar of a caterpillar is that which immediately precedes either the chrysalis (with butterflies), or (with most moths) the pupal stage within the cocoon.

them replaced, at this time, with tufts of pure white hairs. In May 1919 lots of last-instar larvae were separated on the basis of black or white dorsal tufts and as male moths were reared from larvae of both color varieties, it cannot be considered a sex indication. This observation was repeated in 1920 with black-tufted larvae that formed their cocoons May 19 and subsequently. The moths which emerged from June 4 to June 8 comprised both males and females.

The last-instar larva have two well defined and definite color extremes: one with no white hairs and with yellow hairs only in two rows (one on each side of the dorsal tufts), and one with no black hairs and with yellow hairs only in two rows as indicated for the black variety. Between these two extremes are almost every degree of gradation with reference to the black and white hairs; those, however, having pure white tufts were never found by the writer to have any black hairs at all. But these dorsal tufts may be composed of white and black hairs mixed which together with a similar mixing of the rest of the body hairs gives a general gray effect. The two extremes and a common intermediate variety are given in the colored plate.

The caterpillars become dormant with the approach of cold weather but thaw out with warm days in the winter and at such times are frequently to be seen roving restlessly over melting snow as is also their habit in early spring.

Captive caterpillars were fed in my laboratory on the following grasses which they ate in September: Italian rye grass, English rye grass, smooth brome grass, Japanese millet, Rhode Island bent grass, creeping bent grass, timothy, red top, Kentucky blue grass and witch grass. I have found them in the spring feeding in the field on witch grass, sedge and iris. It is evident from this menu that they will accept a wide range of grasses as well as some vegetation outside the grass family. The age of the caterpillars as well as the succulence of the plants may have some influence on their appetites.

THE COCOON[4]

"Between the middle of May and early June, fewer and fewer of these caterpillars are to be seen. Instead we find an increasing number of black and yellow, or black and white and yellow objects along the grassy roadside or at the meadow margins. These objects attached to stubble or bush-stem or post or board or wire or any other convenient support, are the cocoons of our grass-eating caterpillars and vary in shade according to the complexion of the artists that fashioned them.

"I say 'artist' with a deliberate admiration for the creature that, without practice, weaves a structure so perfect. Any human, elated with the pride of construction, and pleased, when (with models for comparison and tardy skill wrung from much practice) the basket is finished, a triumph in 'arts and crafts' or 'domestic art'—any human would do well humbly to watch one inexperienced caterpillar weave one cocoon. Any of the spinning species will serve this purpose; but because most of them are hidden within one outer layer which they construct first, the whole process seldom can be followed. Our grass caterpillar, however, has a different method and can be watched until the cocoon is almost completed.

"He is not critical as to the slope of the foundation against which his masterpiece is to rest. Whether it be horizontal, vertical or any angle between seems a matter of indifference to him. An individual, therefore, who has selected the lower edge of a fence board may as well be chosen as any for the convenience of description.

"He first makes, with the silk which drools from the spinneret in his mouth, a thin mat about his own length. Clinging to this by the hooks of his 'false' feet, he works, back down, at the sides and ends of the cocoon which after a deal of patient labor outline a shallow oval with the edges about evenly woven down to perhaps an eighth of an inch. The fabric that he weaves, unlike that of many species, has but little silk in it for his cocoon

[4]It is impossible to watch the construction of this cocoon without a thrill that seems incompatable with ordinary bulletin diction. I may, therefore, perhaps be pardoned for interpolating at this point part of a paper on the same subject which first appeared in The Maine Naturalist, Vol. 1, No. 1.

is chiefly of hair-cloth. Now that the framework is well started it is easier to watch him as he clings, still back down, weaving with warp of hair and weft of silk, his flawless cloth. The source of his silk, a liquid stiffened by the first air that touches it, has been indicated but whence the hairy warp that composes the heavier part of the texture? Look—he swings the first few segments of his body to one side and reaching back with his head grasps a mouthful of hair close to his skin and pulls. The wisp secured he swings his head back to the cocoon edge and tucks it endwise into the entangling silk giving it a tug which anchors it by the barbs on the hair. Then throwing his newly spun silk in and out he weaves the filmy weft that holds the hairy warp in place.

"After he has worked the cocoon edge down to the fairly even width of about one-eighth of an inch he weaves longer at one place devoting himself for some time to one curved end before, with cautious creep, he turns him right about face and weaves concavely at the other end. Plucking the hair from his skin, mouthful by mouthful, putting each wisp into place and winding it with new spun silk, he weaves his perfect blanket, shaping it into a sleeping bag as he works. He labors without waste of time or material and with no false moves. When spinning and weaving at the right of him he pulls out hair from the right side of his body, not reaching to the left for his supply. He grasps his little bundle of hair in such a way that it can be poked into place in the cocoon edge and tugged tight with a deft in and out motion, without shifting his hold on it—uprooting it from his skin and embedding it in the cocoon edge without laying it down and picking it up again.

"When the ends are evenly rounded and the sides curved down to the proper depth, he draws the edges and weaves them together without a seam.

"So nicely has he regulated his supply to his needs that the hairs of his coat have just sufficed for the finished cocoon. He is now naked as a plucked fowl and reduced like a shorn poodle. He has toiled with a thrift so admirable that the old coat, no longer needed, has been remade into a sleeping bag, with no more than a few spears left over for scraps.

"When we consider that this perfectly formed object, is the first and only cocoon of the caterpillar,—that he has fashioned it

without model or experiment or experience or instruction, it gives us pause in our own conceit; and we wonder whether conscious intelligence is so superior to 'instinct' as some of us have been prone to think, or whether that structure fashioned by the inherited genius of the caterpillar is not in some respects far more wonderful than measured garment or raffia basket of human construction."

NATURAL CHECKS

In the introduction of this bulletin the statement was made that an insect, which maintained its status to the extent of being common for many consecutive years without becoming numerous, must be under the control of natural checks. A discussion of these may fall under the following headings:

WEATHER

It is a safe guess that a caterpillar, which overwinters without the protection of a hibernaculum, will be susceptible to unfavorable weather conditions. Living, as it does, during the late summer, fall, winter, and early spring months in the larval state makes its exposure to weather a long and varied one.

BIRDS

As the caterpillars are exposed to meadow-larks, bobolinks, crows, blackbirds, and other birds that frequent the ground, while they are young and before their bodies are protected by a heavy covering of hair, they must be natural prey to such insect-eating birds. In the spring the caterpillars are particularly noticeable creeping about in quest of the first growth of grass or sedge; and though they are by this time well covered with stiff hair, the over-worked theory that such caterpillars are thereby immune from bird attacks[5] cannot stand up against the testimony of my pet thrush (a veery with a broken wing) which whips

[5]See also "Useful Birds and their Protection" (Massachusetts Board of Agriculture) by Edward H. Forbush for an account of birds and hairy caterpillars.

these caterpillars *(Ctenucha virginica)* vigorously against the floor of the cage until, in a surprisingly short time, their bodies are beaten limp and naked, whereupon they are swallowed in one gulp.

In repeated tests with chickens young and half grown, and hens, these fowls refused to eat the caterpillars of this species. From this it may be inferred that the adventurer caterpillar in its later, hairy instars, would be preyed upon by certain birds and not by others.

The cocoon is not a firm affair as less silk than hair goes into its structure and the pupa within could be easily extracted by a hunting bird. The moths, being day fliers, are exposed to the attention of day birds.

PARASITES

The season of 1921 was a favorable one for the insect parasites of the adventurer. With abundant material for beedinrg, these little beneficial creatures waxed plentiful and proved efficient agents in reducing the numbers of the grass-feeding caterpillar.

One fly (Diptera) at work in this way, and five wasp-like parasites (Hymenoptera) were under observation at Orono. The fly was not reared in captivity to the adult stage so that a determination was not secured. The others, however, were all bred repeatedly and yielded the following data:

Lot 1825 sub. 6. *Labrorychus* sp. near *prismaticum* Nort. (Det. A. B. Gahan March 3, 1921).

The first of these emerged from the pupae within the cocoons of the host, May 26, 1920. The eggs from which they hatched had been deposited in the caterpillar-host before the cocoons were formed; for these adventurer caterpillars were a lot that had been brought into the laboratory April 23, just seven days before they began to spin their cocoons. Apparently normal pupae were formed by the parasitized caterpillars after weaving good cocoons. Other parasites of this species emerged from adventurer cocoons in the laboratory June 18 to 21 and July 21. In death their abdomens are crooked at three angles but in life both sexes usually held their abdomens straightly extend-

ed. In this attitude, with their wings laid flat along the back, they had a peculiar short-skirted appearance. One male was observed at a strange acrobatic performance. He was standing on his head with his face flat against the bottom of the glass jar in which he was captive. His antennae were stretched out straight in one direction and his six legs were braced in the other. The first pair of legs being shortest, the second being longer, and the third being longest, the general effect was grotesque. His abdomen was erect, without a bend; and his wings laid flat against it. He kept this pose without a quiver for 15 minutes after he was first observed at the stunt. Then he walked off, as if standing on his head was but a part of his routine—as indeed I suppose it was, though I have never seen this demonstration before. Fig. 49. Central figure.

Lot 1825 subs. 8 and 9. *Amblyteles* sp. male and female. (Det. R. A. Cushman, January 11, 1921).

Specimens of this parasite, hatching from eggs deposited in the caterpillar, developed after the pupal transformation of the victim, as did *Labrorychus* sp. (sub. 6) and emerged from the adventurer cocoon. Orono material of this species emerged in the laboratory from the middle of June to the middle of July; and a specimen emerged July 8, from a cocoon collected at Pownal, Maine. Fig. 49. Lower row.

Lot 1825 sub. 12. *Coelopistha* sp. near *confusa* Girault, male and female. (Det. S. A. Rohwer, January 14, 1921)

Twenty-seven of these little parasites emerged from the pupa in one adventurer cocoon July 12. They jumped alertly but were not very active on their wings. They mated on the day of their emergence.

Lot 1825 sub. 15. *Iseropus coelebs* (Walsh), male and female. (Det. R. A. Cushman, January 11, 1921).

About thirty of this species emerged from captive adventurer cocoons the middle of July. Several individuals developed in a single pupa of its victim. Fig. 49. Upper row.

Lot 1837 sub. 111. *Telenomus spilosomatis* Ashm. males and females. (Det. R. U. Fouts, March 5, 1921).

An egg mass of the adventurer moth was collected by Miss Morse July 22, on account of its abnormal appearance. The eggs were light brown when collected and had turned black by August 3. August 9 the minute egg-parasites of the species indicated emerged from these eggs.

Lot 1825 sub. 19. Same species as Lot 1837 sub. 111.

Some eggs of the adventurer which were collected July 15 were normal in color when collected (yellow as usual). They turned brown and then black and, on August 9, 22 egg parasites emerged from this lot of eggs.

Acknowledgement

The aid of Miss Ruth Morse in the work underlying this bulletin should be acknowledged. Her observation of moth eggs, not of normal color, led to the rearing of a species of egg parasite; and much of the information recorded in this bulletin depended upon her care in rearing the larvae and collecting field material.

The Situation in 1921

The observations on which Bulletin 302 was based were completed during the fall of 1920. As might have been prophesied from the prevalence of parasites that year (if entomological prophecies are ever safe), the season of 1921 witnessed so effectual an ebb of the adventurer that no specimens of this insect were submitted to the Station for attention.

It is comforting to take note of such ebbs in the tide of insect life for, when some injurious insect seems to be getting the better of our vegetation and we are distressed because of the expense or other difficulties involved in combative campaigns, it is gratifying to remember that it happens now and again, even in the midst of our more or less futile attempts, that natural controls work automatically against many insects that might otherwise annually reap our harvests for their own purposes.

Nevertheless, the enjoyment we feel, when some threatened danger disappears through no exertions of our own, should not encourage us to sit idly by and wait for "providential aid;" because it is sometimes inconveniently delayed. It should be borne in mind that the ebb does not come until after the flood-tide and in those years, during which an injurious insect is on the increase, irremedial damage may be done.

A record of similar ebb-tides during the past 20 years would make a long list for Maine. Some of our orchardists have well-nigh forgotten what a red-humped caterpillar and a yellow-necked caterpillar look like. Tent-caterpillars have had their increases and decreases. Perhaps there has been no more striking example than the wiping out in a few days' time (by virtue of an epidemic disease) the saddled prominent caterpillar that in 1908 made thousands of acres of our forest growths look as bare in July as leafless winter woods.

EXPLANATION OF FIGURES.

FIGURE 48. THE ADVENTURER, *Ctenucha virginica.*

Eggs as deposited on grass blade, about natural size and a few enlarged; caterpillars showing color variations; cocoon (at left) made by caterpillar with many black hairs, cocoon (above) made by pale caterpillar; pupa, ventral and lateral aspects, and caudal tip greatly enlarged; the moths, female at left with wings expanded and male at right.

FIGURE 49, PARASITES OF THE ADVENTURER.

Iseropus coelebs (Walsh) male and female. (Lot 1825 sub. 15). Upper row.

Labrorychus sp. near *prismaticum* Norton. (Lot 1825 sub. 6). Central figure.

Amblyteles sp. male and female. (Lot 1825 subs. 8 and 9). Lower row.

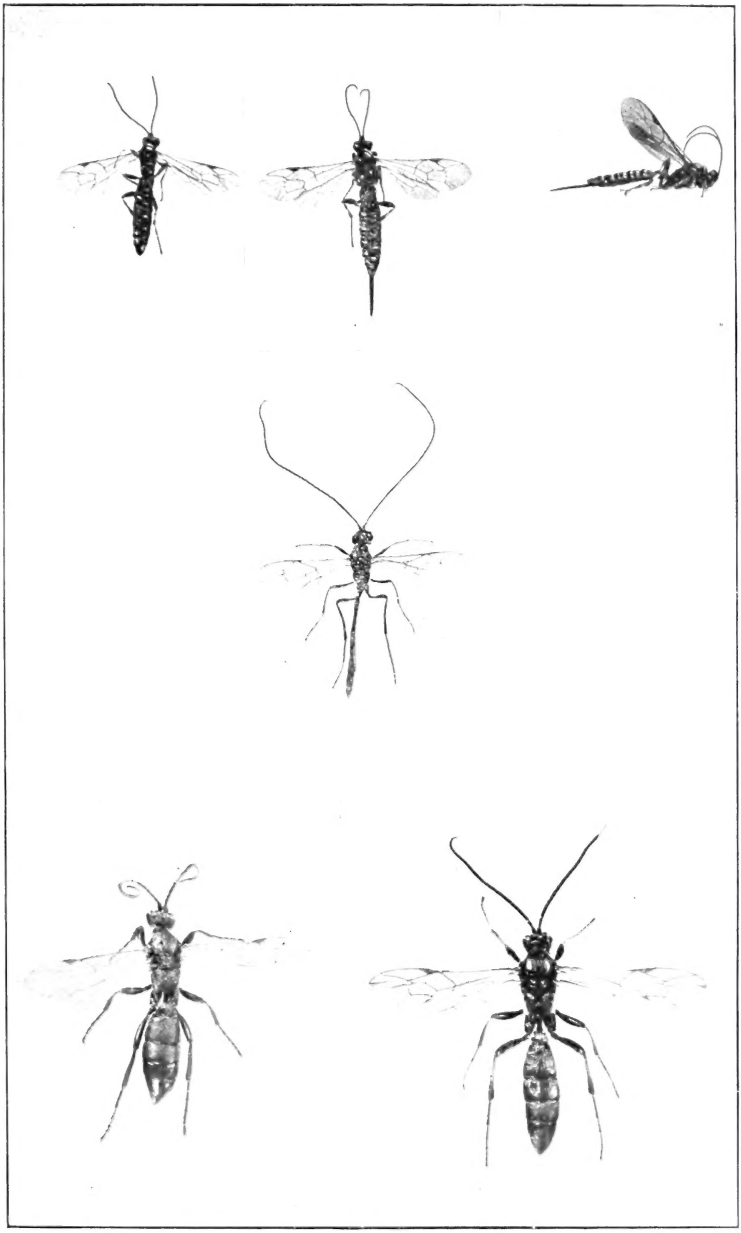

FIG. 49. Parasites of the Adventurer. For explanation see page 320.