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THE HEPIALIDÆ, OR GHOST-MOTHS.

BY ALBERT F. WINN, WESTMOUNT, QUE.

The moths forming this family are not at all common in collections, are not strikingly beautiful, and are not particularly injurious to vegetation, but are so utterly unlike their relatives that a few general remarks may be of interest. The Hepialidæ are distributed through all parts of the world, most of the North American and European species being small or medium in size, expanding from a little over an inch to about four inches, the colours being mostly of various shades of browns, grays, yellow and white. In warmer lands, for example Australia and New Zealand, species are found of lovely colours, very large expanse of wings and heavy bodies. The male of one of the commonest European species, *H. humuli*, is of a pure white colour, and this, coupled with its odd habit of hovering in large numbers over the meadows, just at dusk, has caused it to be known as the Ghost-moth, and the family are often spoken of by this name, though also known as Swifts, on account of the rapid flight of some of the smaller species.

The scientific name is derived from the Greek *ῥπιαλος*, which means a shivering fit, a nightmare, a fever attended with violent shivering. Those who have hunted for these moths will appreciate the aptness of the name.

In North America there are a number of species, and in every Province of Canada one or more of them is to be found, but good series of specimens are in few collections, not because the moths are really rare in nature, but because their habits and life-histories are little understood. Unfortunately, also, the literature on the subject is meagre, and the question of which of the species on the lists are really distinct, and which are varieties or synonyms, is a very puzzling one.

The best known species in the East is probably Harris's Silver-spotted Ghost-moth, *H. argenteo-maculatus*, but as I am more familiar with the habits of our local species, *H. thule*, Strk., it will probably be best to select this. The Island of Montreal seems to be the headquarters of this moth, though its habitat extends to Ottawa in a westerly direction, probably north as far as the base of the Laurentian Mountains, but lack of entomologists to the east and south makes it, at present, impossible to limit the range in these directions. It is very regular in appearance,

June, 1909

about July 7th, seldom earlier, in backward seasons perhaps a week later, the flight lasting only about ten days. Having previously found a low-lying field, more or less swampy, with a good growth of scrub willows from four to ten feet high, the food of the larva, we set out after supper, allowing time to get on the ground a little before 8 o'clock. After getting the net and bottles ready, it is well to look over the field, selecting a spot, if possible, from which a good view over the bushes can be obtained, and one that is free from very treacherous or boggy places, as it is often necessary to move about rapidly. Cloudless evenings, with a light west wind, seem to be the most favourable; on cloudy nights the moths begin to fly a few minutes earlier, showing that they wait for a certain degree of darkness.

Five minutes past eight, and there is nothing flying, and nothing to indicate there ever will be, and we begin to get anxious as to whether there will be any sport, our eyes fixed on the air over the willows. The minutes pass—ten minutes past eight—now is the time. A shout comes from one of the party, "Look out, there's one," and flying quickly over the bushes, perhaps ten feet up, is seen a yellowish-white object, a moth expanding a little over three inches, with a long, thin body. There is no mistaking it for anything else, the position and shape of wings in flight is entirely unlike any other moth. We probably miss it as it passes by, but it turns, and comes back a little further in the swamp, suddenly arrests in its long flight, and begins to hover over a certain bush, dancing in the air, backwards and forward, as if it were the ball of a pendulum having a stroke of about two feet. Another moth of the same kind appears, apparently from nowhere, and joins the other in its mad gambol. Another, several more, till perhaps 12 or even 20 are all at it close together in the air. Sometimes they are provokingly just out of reach of the net, at other times it is easy to catch some of them. At the least touch of the net they close their wings and drop either into it or outside. If the former they are easily bottled, as they usually remain quiet for a short time, but it is well to be quick, for when they try to escape from the net the wings vibrate so rapidly that the specimens are ruined by the rubbing against the net. Those that fall to the ground or among the bushes are seldom to be found in the fast disappearing daylight, but they generally fly up again, sometimes to join the remainder of the dancers close by, sometimes to rush off elsewhere. These assemblages usually last only a few minutes;

I have never witnessed them after 8.30 p.m., the moths disappearing as quickly as they came. What do these gatherings mean? Why did they select one spot, hover over it for a while, and then disappear? The revellers were all males; on a willow twig below the swarm was the lady moth, whom they all sought. When a partner was selected, the others went off, perhaps to form other oscillating groups nearby, perhaps to hide till next evening (whether there is a corresponding flight in the morning twilight I know not), perhaps to be eaten up by the bats, which destroy quantities of the moths.

The females are seldom found flying till after the dance of the males is over. Their flight is altogether different, very swift, only a few feet from the ground, and usually in a great sweeping curve. As it is almost dark, it is difficult to make accurate observations on the habits of the females, but this style of flight is probably of importance to the moth in the disposition of her eggs. Most moths lay a comparatively small number of eggs, say 300 or 400, placing them on, or near, the plants on which the larvæ feed, but these Ghost-moths lay at least 2,000, and drop them broadcast as they fly about. There is a regular stream of eggs; it is like the discharge of bullets from a rapid-firing Maxim gun. If a piece of paper be held beneath the moth, when flying, or when held by the wings, the eggs can be heard pattering on the paper as if fine sand were being sifted through the fingers over it. The eggs are exceedingly small for such a large insect, being smaller than those of our tiny blue butterflies.

When laid they are of a dirty white colour, turning black within a few hours. They are quite smooth, and do not adhere to the leaves or grass. One would think that eggs deposited in this haphazard manner would result in a very large percentage of deaths of the baby larvæ through not being able to find the proper food-plant, though possibly almost any tender roots may suffice for their first meals, or till they reached the proper kind.

The quick flight of the moth from one clump of bushes to another may tend to ensure the loss of the least possible number of eggs, and at the same time enable the female to deposit eggs over a much wider area. The larvæ feed on the roots, boring into them, but it seems impossible to breed them in confinement, and it is not yet known whether more than one year is spent in the larval stage.

Let us look at one of the moths which we have just caught, with its beautiful soft lemon-yellow wings, with brown costa, folded over the body

like a slanting roof. Perhaps the first things we notice are the antennæ, mere threads about three-sixteenths of an inch long. Then it is seen that the fore wings and hind wings are almost the same length and shape, reminding us of the dragon-flies. Looking at the under side, we notice the most important character of these moths, the manner in which the wings of each side are fastened together to assure their acting simultaneously. From near the base of the inner margin of the fore wings there projects a lobe, called the *jugum*, or yoke, which passes under the costa of the hind wings. In all other moths, except one small family of very minute species, the wings are connected by a bristle or bristles on the hind wings, or a large angle, extending under the primaries.

The legs of the males have very large tufts of hair, so the sexes can be separated at a glance. The venation is very peculiar, the front and hind wings being almost identical, while other moths have fewer veins in the secondaries, and from this and other characteristics, as well as their universal distribution, some entomologists are inclined to consider them a very ancient type of the Lepidoptera.

To look for the Silver-spotted Ghost-moth, *H. argenteo-maculatus*, instead of selecting a site where there is a growth of willows, we should search for alder bushes. The moths have similar habits, but they fly two or three weeks earlier in the season, and are found over a much larger territory.

Of these moths, the real treasure is the Golden Ghost, *H. auratus*, of which only one example has been recorded from Canada, the Rev. Dr. Fyles having been fortunate enough to take a specimen flying at dusk one July evening in 1865, in Brome Co., Que. The fore wings are decorated with pale brown markings and large patches of dull gold, on a dull lilac or pinkish-fuscous ground colour. The expanse of wings is about two inches. Nothing is known of its habits and life-history, and only a very few stray specimens have been found, but it seems to have a preference for mountain regions, as it has been taken in the Adirondacks, the Catskills, and the White Mountains.

A small species, now and then met with about Ottawa and through the Province of Quebec, but quite common in New Brunswick, Maine and New Hampshire, is called *H. mustelinus*. It expands only about an inch and a half, and is of varying shades of warm browns and grayish-browns, with darker brown bands and spots. The moths seem to frequent the pine

woods, and may often be found towards the end of July, or early in August, in the afternoons, resting on the pine-tree trunks from two to eight feet from the ground, their wings slantingly folded close over the body. At dusk they fly about in openings in the woods with exactly the same hovering flight as the larger species, but later in the evening are often attracted to lights in windows, sometimes in large numbers.

There are a number of other equally interesting species of these moths found in Canada, which space does not permit being even mentioned here, but it is hoped this article will serve to call attention to the group. In order to get accurate information about the distribution and variations of these little-known moths, it is desirable that the capture of any species should be placed on record, with the dates and localities. The writer is anxious to obtain, by exchange, specimens of all the North American species, from as many localities as possible, and will consider it a privilege to examine and return any specimens that may be sent for comparison.

SOME NEW SPECIES OF NORTH AMERICAN GEOMETRIDÆ.

BY JOHN A. GROSSBECK, NEW BRUNSWICK, N. J.

(Continued from page 157.)

Cleora agrestaria, new species.—Expanse, 27–30.5 mm. Head and palpi dark gray; front dark brown. Thorax and abdomen brownish-gray, the segments of the latter edged posteriorly with deep brown. Ground colour of wings whitish-gray, heavily overlaid with brownish-gray. Basal line absent. Intradiscal line blackish, contrasting, edged inwardly by an equally broad border of pale brown, commences on costa one-third out from base, and is directed outward toward centre of wing, but is lost a short distance below costa; begins again near discal spot, and extends slightly outcurved and obliquely inward to inner margin, ending quite close to root of wing. Extradiscal line blackish, faintly toothed outwardly on the veins, and edged externally below M_2 by a broad border of pale brown; begins on costa one-fourth in from apex, and appears only on the veins to M_1 , thence continuous to inner margin, being as a whole slightly outcurved from costa to middle of wing, then extends very obliquely inward, running almost parallel to intradiscal line. Subterminal line whitish, deeply scalloped, runs through centre of broad outer space; internally between M_1 to Cu_2 it is edged with a deep brown shade, and this joins with a subapical dash of the same colour. Terminal line black, scalloped,

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