

there was an increase in numbers although still not up to the average. What I would consider normal conditions were not reached until 1954, although even then certain species were still absent. Those species which I mentioned as occurring in abnormal numbers in 1951 were reduced to minimum populations the following year, which is usually what happens following over-abundance. To correctly assess the effect of weather variations on insects is a most difficult matter for, apart from the direct effect of destruction of food plants, intolerance to excessive heat and low humidity, the actions of predators, parasites and diseases have to be taken

into account, and as these vary with each species, the problem becomes exceedingly complex. Periods of abundance may be long or short according to the species, and weather cycles may have a direct effect on the length of these periods. Thirty-five years ago many species of Heteroptera and Homoptera were much more abundant than they are now. I have not seen some of the species which were abundant then, for twenty years or more; and some have re-occurred only occasionally. But eventually when favourable conditions return, each species will regain its former abundance.

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## NOTES ON THE LIFE HISTORIES OF FOUR SPECIES OF MOTHS (LEPIDOPTERA: PHALAENIDAE) INDIGENOUS TO VANCOUVER ISLAND, BRITISH COLUMBIA

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Among several life histories and partial life histories, worked out during the year 1954 the following are submitted as a contribution to our knowledge of local entomology.

### *Ulosyneda subtermina* Sm.

This is a Western American species, occurring from British Columbia to California. In British Columbia it seems to be confined to Vancouver Island, wherever its food plant the Garry Oak (*Quercus garryana*) grows. Information regarding the early stages is not readily obtainable, at any rate I am not aware of any published records.

Although not a conspicuously coloured moth it is quite distinctive, with shades of ashy brown dotted with black at tip of forewings, and etched with darker lines, unlike any other moth of similar size and appearance. It measures one and one half to one and three quarter inches (40-47mm.) in wing expanse. It is a night flier, and is readily attracted to artificial light in the vicinity of the Garry oak during the months of April and May.

Material for the present account was obtained in a light trap. A female taken on May 11 was confined

in a jar with several dead oak leaves. Twenty-five eggs were laid in a compact group under one of the leaves where it was in close contact with the bottom of the jar, suggesting what in fact is the case, that the ovipositor is long and flexible enabling the moth to lay her eggs well into the crevices of bark or twig.

**Ovum.** Laid May 11th. Size 1 by 1 mm. At first globular, soon losing this form due to pressure of the other eggs or contact with the substratum; shell very fragile, membranous, hyaline, easily conforming to the irregularities of site and position, more or less translucent, with very faint ribs and cross ribs, contents showing as an amorphous creamy substance. During the development of the larva within the egg the only change noted was an obscure dark spot in the centre of the creamy contents.

#### Larva

**1st Instar.** May 22; newly hatched larva 4 mm. in length. It did not eat the egg membrane. Bilobed head and cervical plate shiny, dark chocolate in colour. Body smooth with segments well marked by intersegmental constrictions, colour a very pale translucent green. Three pairs of claspers. The young larva is very active, looping along rapidly and with much swinging of the body in all directions, evidently in search of food. When disturbed it emits a light silken thread that prevents it from falling to the ground. At all times it avoids the light, feeding between the Garry oak leaves or within their curled edges. When at rest it stretches out along the underside of a leaf.

**2nd Instar.** May 28; length 5-7 mm. Head dark brown or black. Body colour now light green to blue grey, with a series of six longitudinal indistinct or interrupted pale brown lines; spiracles black. At a later stage in the second instar the subdorsal lines show a well marked intermittent thickening and thinning on each segment, giving the effect of a series of short dashes, one on each segment. Below the subdorsals are two very

thin whitish lines followed by a broader light grey spiracular line. The spiracular line merges into the dull soiled-white colour of the underside. The larva is negatively phototropic. If exposed to the light it lies still momentarily, then rapidly wriggles under cover of the leaves or the scraps of lichen-covered bark provided for it.

**3rd Instar.** June 9; length 10 mm. Head black. General colour grey to bluish-green. A faint bluish-green dorsal line. Subdorsals with well marked bracket-like dashes on each segment. A dark spot between the dashes gives a chain-like appearance to each of the subdorsals. Several fine milky white lines between the subdorsals and the spiracular line. As it grows larger the larva tends to abandon the leaves when not feeding, which is only at night, and seeks the cover of the bark and lichens at the bottom of the cage. It closely resembles the lichens among which it lies and from which it is almost indistinguishable.

**4th Instar.** June 20; length 20 mm. Head square, black on lower part of front blending into grey-green on vertex, an oblique fuscous dash on each side, cervical plate grey-green marked with two parallel dark brown bars one on each side. Body dark fuscous olive, a faint white-edged bluish dorsal line, subdorsal interrupted marks very conspicuous, these marks slightly curved, the convex side towards the dorsum. Ground colour of body finely etched with drab olive colour. Length at end of 4th instar 30-35 mm.

**5th Instar.** June 27; length 32-34 mm. Head as before, colour pattern intensified by contrasting light and dark greys, dorsum of body segments with a pale grey-green anchor, or hour-glass-shaped marking. Thickened sections of the subdorsals conspicuous, a broad light grey super-spiracular line blends into the pale drab colour of the underside. Five well-developed claspers, those on the fourth and fifth abdominal segments having developed

during the last two or three moults. Length, just before pupation, averaged 42 mm.

**Pupa.** Pupation took place July 18 in a light cocoon spun among the debris at the bottom of the container. Length 20 mm. x 5 mm. slender, tapering posteriorly, surface dull, colour dark reddish-brown, cremaster consisting of two stout, straight, widely spaced spines, and a short slender one at the base of and on the outer side of each of the larger spines.

**Summary.** The eggs are laid in the spring, presumably in a crevice of the bark or between bud scales, their flexible texture allowing of a close application to the irregularities of the surface on which they may be deposited. The larva is very active when first hatched. Throughout all instars, the larva is negatively phototropic. It hides at first among the leaves, later in the crevices on the bark among the lichen growth, the colour and marking of which it resembles. At first possessing only three pairs of claspers it develops an additional two pairs in the last moults. At all times the larva is essentially an individualist.

In 1954, eggs laid May 11 hatched on May 22, 11 days; 1st instar 6 days; 2nd instar, May 28, 12 days; 3rd instar June 9, 11 days; 4th instar, June 20, 7 days. The 5th instar began June 27 and lasted 22 to 28 days, the feeding period being about 16 days, the larva remaining quiescent in the cocoon for a week or so before pupating. Pupated July 18 to 24, *i.e.*, 69 to 75 days from egg to pupa.

#### **Caenurgina erechtea parva** Blkme

The forage looper or common grass moth is widely distributed in North America from coast to coast in open grassy places where it flies on sunny days. It occasionally comes to artificial light.

In British Columbia it is double brooded, the spring form being considerably smaller than the summer one. It was to the small spring form that Blackmore (1920) gave the name

*parva*. Ferguson (1953) in his Lepidoptera of Nova Scotia, also mentions the small spring form of this species, so this seasonal dimorphism apparently occurs over a wide range. I have no evidence yet as to whether the summer form passes the winter in the pupal or larval stage. This might have a bearing on the occurrence of the smaller specimens of spring. In some species of moths, for instance, *Xanthorhoe defensaria*, the spring form is the largest.

Eggs were obtained from an individual of the summer brood (*erechtea*) on July 26, 1953. These hatched on August 4 but all the larvae died from lack of the proper food plant which was not known at that time. As the commoner vetches, which constitute the food plant of the spring brood, are drying up at that season of the year, there may be an alternate and as yet unknown food plant of a more succulent type.

**Ovum.** Female taken in the Hudson's Bay Woods, Victoria, Vancouver Island, laid 30 ova on May 4, 1954. They were scattered about the bottom of the box, each one lightly cemented to the surface. Length about 1 by 1 mm., spherical and finely ribbed, colour grass-green, irregularly spotted with brown.

#### **Larva**

**1st Instar.** May 18, length 3 mm. Head colourless. Body translucent, three pairs of claspers. Very active, looped rapidly about, emitting a light silken thread as it proceeded. Did not eat shell. Fed on *Trifolium pratense*, *Vicia sativa*, *Trifolium dubium* and *Lathyrus nuttallii*; it nibbled at *Dactylus glomerata*, but preferred *Vicia sativa*.

**2nd Instar.** May 24, length 6 mm. Head pale brown, body green with six thin brownish longitudinal lines; spiracles black, claspers brown at tip.

**3rd Instar.** June 2, length 10 mm. Head light brown with darker brown and white stripes. Body grey green to blue grey; four double longitudinal brown stripes continuous with those on the head. Under side grey with four dark brown longitudinal lines.

**4th Instar.** June 11, length 15 mm. Colour and markings as before except that the under side has a black white-edged central line flanked by three thin fuscous lines on each side, thoracic legs dark brown. When disturbed raises the front part of body, doubling the head back along the under side. When at rest it lies closely appressed in full length along the stem of food plant. As the body tapers slightly at each end it blends into the stem, the double longitudinal lines further helping to camouflage it.

**5th Instar.** June 20, length 25-35 mm. Head light brown with lines as before although some larvae have head black with a central light brown line; body brownish to fuscous, original double lines less strongly marked. By July 12 it was full-fed. General colour a dead-grass shade of yellowish-brown varying from light ash to sienna brown in some individuals; the double lines traceable and with numerous fine lines and vermiculations between that help to break up the solid effect of a plain colour. Most of the larvae pupated at this time, spinning a light cocoon among the leaves of the food plant.

**Pupa.** Length 17 mm. x 5 mm. Reddish-purple colour with a glaucous bloom; cremaster consisting of four separated hooked spines in a row along the broad tip of the last segment.

**Imago.** On August 5, four emerged; on August 6, one; on August 7, five; August 8, two; August 11, two; all females but one. Thus fourteen adults were reared from thirty eggs. These were the large or summer brood originally described as *erechtea*.

*Caenurgina erechtea* measures one and one half inches (42mm.) across the expanded wings; while in the form *parva* it is only one and one quarter inches (34 mm.) from tip to tip.

**Summary.** Egg May 4 - 18 (14 days). Larva May 18 - July 12 (46 days). Pupa July 12 - August 5 - 11 (27 days approximately). Total period from egg to adult averaged about 87 days.

### **Caenurgina caerulea** Grt.

The blue grass moth occurs only in the Pacific coastal regions; in British Columbia it is found on Vancouver Island and in the Lower Fraser valley where it frequents grassy fields, and open slopes on hillsides at slightly higher elevations than *erechtea*. It is on the wing from April to June, flying by day in bright sunshine.

The blue grass moth has the distinction of being one of the very few blue moths. It measures one and one quarter inches (32 mm.) across the expanded wings.

**Ovum.** A female taken on Wells Mountain, Goldstream, Vancouver Island, laid a batch of 30 eggs on June 9, 1954, scattered and lightly cemented to bottom of box. Size .8 mm. x .8 mm. globular, with about 30 fine ribs, slightly flattened at point of adherence to substratum. Colour, grass-green becoming spotted with brown as development proceeds. Hatched on June 27.

### **Larva**

**1st Instar.** Length 3 mm. Very slender. Head pale brown, body colourless, translucent, a few long hairs on each segment. All hatched by June 29. Very restless; did not eat egg shell. Fed on *Vicia sativa* and *Lathyrus nuttallii*. Used a silk thread when moving about. Has three pairs of claspers.

**2nd Instar.** July 5, length 6 mm. Head pale brown; body smooth, hyaline showing green patches due to ingested food, two black longitudinal lines on dorsum, underside light grey. Towards the end of this instar the colour was more decided; blue-grey with double lines as in *C. erechtea*.

**3rd Instar.** July 19, length 15 mm. Colour light brownish, otherwise as before. Rested with body stretched out and closely applied to the stem, head and anal claspers extending along the stem so that the body seemed to be part of it.

**4th Instar.** July 28, length 25 mm. Very similar to *erechtea* but no black lines on underside. July 31, length 30 mm. General colour beige or dried

grass colour. Dorsal, subdorsals and spiracular lines with a fine grey line down centre of each one giving the effect of double lines (several finely etched lines between are not conspicuous). Underside with a small hyphen-like mark on centre of each segment. There was a tendency for all the markings to become less noticeable as the larva grew older.

**5th Instar.** August 15, length 35-40 mm. Head, beige to pale pinkish brown. General colour a dead grass hue tinged with pink, the four longitudinal double lines extending along the sides of the head as before, though very faintly marked. Development of the individual larvae was very irregular, some attaining twice the size of others towards the end of the larval life; hence pupation extended from August 21 to September 2. A light cocoon was spun among the leaves of the food plant.

**Pupa.** Length 13 mm. x 4 mm. Slender with a light bluish "bloom"; intersegmental areas of abdomen orange-brown, cremaster of two long and several short bristles with recurved tips in a transverse row on rounded tip of segment.

**Summary.** Egg June 9 - June 27 (19 days). Larva June 27 - August 25 (approximately 60 days). Pupa August 25 - May or June of the following year, 8-10 months. Total period egg to adult approximately 360 days.

**Discussion.** Considering the difference in size and colour of *erechtea parva* and *caerulea*, the ova, larvae and pupae are remarkably similar. In *erechtea parva* the larva is larger when full grown, and has several dark longitudinal lines on the underside. The pupa is also larger with the tip of the cremaster bearing four large spines, whereas in *caerulea* there is only one interrupted dark line on the underside. The pupa of *caerulea* has two large spines and several small ones on the cremaster.

The period of development from egg to pupa is sixty days in *parva* and eighty days in *caerulea*.

### ***Polia liquida* Grt.**

*Polia liquida* is a medium-sized moth measuring about one and one half inches across the expanded forewings, the general colour is a dark grey with strongly contrasting silvery-white markings. It is nocturnal and readily attracted to artificial light during the flight season, from May to June on Vancouver Island. *P. liquida* is a western North American species. In British Columbia it is recorded from southern Vancouver Island and Kaslo (Jones, 1951); elsewhere it occurs in the coastal states south to California (Dyar, 1902) and east to Montana (Cook, 1930). Farther east it is replaced by closely allied species.

**Ovum.** A female taken at light on June 30, 1954, at Braefoot, Saanich, Vancouver Island, laid a batch of 40 eggs on July 4. They were deposited in a compact layer adherent to the bottom of the container. Size 0.9 by 0.7 mm., orbicular, slightly flattened from above with about 30 strongly marked vertical ribs, reticulate in the micropylar area; colour, pale cream changing through vinaceous pink to a dark pinkish-red at hatching time.

### **Larva**

**1st Instar.** July 14, length 3 mm. Head pale brown. Body colourless with large black tubercles, about eight to each segment. The larva eats the egg shell and is very restless, not feeding until about twenty hours later. It nibbled at *Agropyron repens*, *Lathyrus nuttallii*, and *Rumex crispus* the last of which it much preferred and on which it was reared to maturity. When alarmed it rears up, bending the head and fore part of the body downwards in a question-mark-like attitude.

**2nd Instar.** July 30, length 7 mm. Head pale brown, body pale greenish or in some individuals a fuscous colour with bluish dorsal and subdorsal lines, a broad whitish spiracular line edged with black along the upper side. Underside honey-colour, third and fourth pairs of claspers more strongly developed than the first and second. One larva was observed to forcibly remove an obstinate pellet with its jaws.

**3rd Instar.** Length 16 mm. Head pale brown with two vertical dark brown bars, body fuscous or brown, the longitudinal lines a pale lemon colour, spiracular line white to yellow edged above with dark brown.

**4th Instar.** August 17, length 25-28 mm. Head as before, body a dark chocolate colour, all the stripes, including the spiracular, a pale lemon colour each finely edged with black.

**5th Instar.** August 26. Length 35 mm. Head pale brown with four vertical fuscous bars, body chocolate with strongly contrasting black-edged yellow dorsal, subdorsal and spiracular lines. In some cases body colour is black between dorsal and subdorsals, vinaceous between subdorsals and spiracular, underside vinaceous, shading into beige. Length when full-fed 40 mm.

As the larva grew older it rested quietly, when not feeding, extended along a leaf-stalk or on the mid-rib

on the underside of a leaf, the yellow stripes of the larva tending to blend it into the leaf or stalk. If touched it rolled into a ring and dropped to the bottom of the container.

**Pupa.** Pupated September 7 and 8. Pupa 17 mm. x 5 mm., slender, thorax with fine transverse rugosities or wrinkles, abdominal segments coarsely punctate except for a smooth central band on the first three; colour dark mahogany brown; cremaster a stout dorso-ventrally flattened process terminating in two parallel spines, the whole 1 mm. long. The larva made a cocoon of earthen particles cemented together with silk, just beneath the surface of the ground.

**Summary.** Ovum, July 4 - 14 (10 days). Larva July 14 - September 8 (57 days). Pupa September 8 - May or June (8-10 months). Total days from egg to adult approximately 365 days.

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#### Insect Population in Pigeon Manure

On February 16, 1954, a citizen brought me about a gallon of pigeon manure from the belfry of an old church in Vancouver, stating that it was a sample from some two tons that had accumulated over the years. A farmer had contracted to remove the manure. Finding certain insect larvae in it, he wondered if the insects would be detrimental to his greenhouse crops and asked his friend to have the material examined.

The manure was fairly solid and compressed, damp and heavy with odd sticks and feathers and the remains of a dead bird incorporated into it; the surface, of recent deposition, was dry and flaky. There was relatively little smell to it.

Picked over bit by bit, it yielded:—

1. Scores of larvae of *Tenebrio molitor* L., the yellow meal worm, in all sizes and instars from very small to mature—but no pupae or adults; there was one elytron.
2. Many dead adults of *Sitotroga panicea* L., the drugstore beetle, but no larvae.

3. Two adult *Pinus fur* L., the white-marked spider beetle, and one larva, all alive.
4. Several small Staphylinid beetles.
5. Moth larvae of two distinct species, one fully  $\frac{3}{8}$  inch long, active, and non-silk spinning.
6. A few empty cases of *Tinea pellionella* (L.), the case-making clothes moth.
7. A number of full grown, thin, thread-like larvae of *Scenopinidae*, window flies. These maggots have distinct heads and are predacious.
8. Many predacious, small Hemiptera, two adults and the rest nymphs. I have not identified them yet.
9. Two half grown, living *Lepisma saccharina* L., or silver fish,
10. Two empty puparia of, probably, blow flies.

To my surprise, there were no mites and no larvae of muscoid Diptera; none of the insects was of much nuisance value.—G. J. Spencer, University of British Columbia.