

**NOTES ON THE LIFE HISTORY OF THE VAPOURER MOTH  
(*NOTOLOPHUS ANTIQUA BADIA*) ON VANCOUVER ISLAND  
(Lepidoptera, Liparidae)**

GEORGE A. HARDY  
Provincial Museum, Victoria, B.C.

**INTRODUCTION.**—The swiftly erratic gyrations of *Notolophus antiqua badia* Hy. Edw. have been abundantly evident to the most casual observer in Victoria during the autumn of 1944. While personal investigations were confined to the grounds of the Legislative Buildings and the Empress Hotel, the moths were reported to be equally common throughout the city and suburbs as well as at up-island points.

Considering the extraordinarily large numbers of the male adults it is remarkable that no prognostication of their appearance in the Victoria area was indicated by the presence of the larvae earlier in the year, which by all the signs should have amounted to a small plague at least. After a search in likely places, about a dozen cocoons of females were obtained, each with its batch of eggs, but not one from which a male could have emerged.

**THE MOTH.**—The vapourer moth is a member of the family Liparidae to which belong such notorious species as the gypsy and satin moths. It is of wide distribution and was originally described by Linnaeus in 1758 as *antiqua* from Europe. The American species was known by this name until in 1874 Hy. Edwards designated the western representative as the race *badia*.

The vapourer is a small brown moth with a conspicuous white dot on each of the forewings; the middle third of the latter has a lighter band of bay-brown, while the under side of the forewings and both surfaces of the hindwings are of an ochreous-brown colour. As already intimated the flight is very erratic, and it is about as easy to catch as a windblown leaf on a gusty day. It alights as unpredictably as is its course in flight; suddenly dodging up to the underside of a leaf where it reposes with wings held flat, the forewings concealing the hind pair in such a manner as to give a triangular outline to the resting moth. The long hairy fore-legs from

which the insect will sometimes alone depend, simulating a withered leaf, are extended straight out in front. The males were flying during the end of August reaching their maximum number in September and finally dwindling to zero by the end of October.

No females were seen at large. The female averages 12 mm. in length and 5 mm. in width with the vestigial fore and hind wings measuring 3 and 1 mm. respectively. These are flattened sacs, like the collapsed finger of a glove; they, together with the rest of the body are clothed with fine hairs. In shape the newly emerged female resembles a fat grey grub tapering equally at each end and with a lateral band of pale yellow dividing the grey upper and lower surface. The eyes are well developed, antennae relatively short and mouthparts rudimentary. She does not move from the fabric of the cocoon but holds her body at about an angle of 45 degrees until fertilized; the dark chitin-tipped genitalia pulsates rhythmically in telescopic action. Egg-laying begins immediately after copulation. Firmly grasping a portion of the cocoon with her legs and using this as the centre of an arc the eggs are deposited in orderly fashion, the forceps-like ovipositor carefully exploring the place for each egg, feeling out the angle between two other eggs, never laying them off the fabric of the cocoon. When all the space within reach of her ovipositor is covered with the eggs in a single layer, she moves ahead or around the cocoon, anchors herself again and continues until all the eggs are laid. The egg-laying accomplished, she lingers on for a few days and dies without ever leaving the surface of the cocoon.

Eggs were laid at intervals of from 5 to 30 seconds, much depending on how promptly the ovipositor found the exact spot for deposition. In one case 90 eggs were laid within two hours after mating.

What with changing position and an occasional rest the complete batch of from 225 to 300 eggs was disposed of in 4 or 5 hours. The batch is not covered with froth or scales as in some species that lay overwintering eggs.

**THE EGG.**—The egg is shaped somewhat like a squat barrel, flattened above and below, smooth in texture and of a light beige colour with a central dot and shoulder ring of a darker shade. When first laid it is a pale jade-green, assuming its final colour almost immediately after, in 4 or 5 seconds.

The eggs from which this life-history was worked out were collected at large in September and kept at ordinary room temperature, where they hatched and the larvae were reared. Ova under observation in natural out-door conditions do not hatch nor are expected to until spring-time vegetation is available.

**THE LARVA.**—The caterpillars were reared on various species of rose, the leaves of *R. nutkana* being relished most. Although the food plant was past its prime and at times difficult to obtain, individuals came through their metamorphosis in perfect condition.

(1) First Instar.—Eggs hatched on November 6th. Length about 2 mm. when first emerged increasing to about 5 mm. as growth proceeded. The general colour is a translucent blackish in the initial phase. Towards the end of this instar the three thoracic and the fifth abdominal segments assume a much lighter shade. The whole body is covered with long black hairs, as long as, or longer than the body. The larvae are very active, crawling rapidly and dropping readily at the slightest touch, supported by a silken thread which serves the double purpose of breaking their fall and as a guide to regain their original position. The first meal is made of the greater part of the egg-shell.

(2) Second Instar.—First moult November 21st. Length about 6 mm. Apart from size the most marked development at this stage is the intensification of the light coloured segments to a pale yellowish tinge and the appearance on each of the dorsal

surfaces of the sixth and seventh abdominal segments of an orange-coloured gland.

(3) Third Instar.—Second moult December 6th. Length about 10 mm. In addition to the uniform black hairs covering the body of the preceding instars the characteristic tufts now make their appearance. Two pencil-like ones on first thoracic directed forward, one of the same kind on the eighth abdominal pointing backward, all of black hairs. On the first and second abdominal segments the thick shaving-brush-like tufts or tussocks appear in black, while similar though shorter ones adorn each of the third and fourth abdominals but are of a white or greyish colour. Orange tubercles as before.

(4) Fourth Instar.—Third moult December 11th. Length about 15 mm. Approaching maturity is accompanied by an increasing intensity of colour and perfection of structural detail. The most conspicuous change is in the four tussocks which are now equal in size and of shades of yellow varying from gold to lemon. Most of the body hairs are of a yellowish grey colour.

(5) Full - Grown Larva.—Length 27 mm. The head is a shining jet black, the general colour a smoky drab; a broad dorsal stripe is velvet black edged with broken lines of yellow; the thoracic and fifth abdominal has a further spotting of yellow. The spiracles are black with a whitish dot just to one side of them. Until examined closely this dot could be mistaken for the spiracle itself. The body hairs grow from little raised pads, eight pads to a segment, two above and two below the spiracular line on each side; that immediately above is of an orange colour, the remainder are dusky. The longer central hairs of each pad are black, the rest yellowish.

All the hairs are barbed; on the long body hairs the barbs are short and dispersed over the greater part of their length; on the hairs of the dorsal tufts the barbs are longer and more closely disposed; while on the hairs composing the anterior and posterior "pencils" the barbs are arranged in such a manner as to give a spatulate outline to the tip of each hair.

The tubercles of the repugnatory glands are thin-walled evaginations of the body wall, thicker on the sides but very thin and membranous at the apex. They are distended by an influx of the body fluid through which the regular pulsations of the heart action can be observed. When alarmed the larva flips up the posterior segments, the tops of the glands collapse and are drawn down below the thicker side walls. In a few seconds they are re-distended. No spray could be seen, but the very moist appearance of the outer surface suggests a slight exudation of fluid that may serve some defensive purpose.

The caterpillars are not gregarious, but go their own independent ways. The restlessness of the newly hatched larvae suggests that this habit ensures a rapid dispersal away from the nursery and each other.

**THE COCOON.**—The cocoon is fashioned in the angle of a projecting ledge or coping or in the crevice of rough bark; sometimes among the twigs of bushes. It is a light transparent structure; the greyish silk being tinged with yellowish from the incorporation into its mesh of the larval hairs. This admixture of hairs is accidental as far as the larva is concerned and is the result of much twisting and turning during the process of cocoon making, further aided mechanically by the barbed nature of the hairs themselves. About two days elapsed between the beginning of the cocoon and the assumption of the pupal garb.

**THE PUPA.**—First pupation December 22nd. The pupa averages 10 mm. by 4 mm. in the male, 10 by 5 in the female, with wing sheaths in proportion. It is a shining jet black in colour, sparsely greyish hirsute on the dorsal surface. In addition the dorsum of the first three abdominal segments has a small dense patch of short greyish scale-like hairs.

The first imago, a male, emerged on January 18th; from then on emergences continued until all had completed their metamorphosis by February 1st, 1945. The proportion of the sexes was about equal.

**SUMMARY.**—The eggs are normally

laid during the early autumn months, remaining dormant until the following spring. A batch of ova brought indoors under the influence of the higher temperature prevailing there hatched on November 6th. The larvae were fed on the leaves of *Rosa nutkana*, completing their metamorphosis in 70 days in one case, averaging 78 days for those reared through to the perfect insect.

The time required to complete each stage was observed in one case to be as follows: First instar, 15 days; second instar, 14 days; third instar, 6 days; fourth instar, 10 days; pupal stage, 25 days.

A great variation in the rate of development was evident, especially in the early stages. While all the eggs hatched in two days there was a spread of 23 days between the first and last date of pupation. On the other hand only 13 days elapsed between the first and last emergences of the imagines.

**CONCLUSIONS.**—The possibilities of this species becoming a serious pest could only become a fact in the absence of an active and persistent check such as appears to be the case from the known parasitic infestation. Some such reason may account for its abnormal abundance in 1944.

The number of eggs in a batch is sufficient to quickly populate any given area with larvae. Old egg masses examined showed a 100 per cent viability. Hence the means of rapid increase are present; it only needs a plentiful food supply, mild weather and freedom from parasites or disease to enable their number to reach nuisance-proportions.

**LATER NOTE.**—In the field, ova hatched on May 25, 1945. Thereafter the larvae were kept in confinement in a cool room. The first adult emerged July 24 making a total period of 60 days to complete the metamorphosis as against 71 days for the first emergence in the material reared last fall. In addition an extra instar appeared with the full fed larva measuring 35 mm., as against 27 mm. in the former lot; apart from size there was no radical change in appearance.

Evidently the fresh young rose leaves

with their higher nutritive qualities as compared with the old faded leaves of the fall and early winter not only provided the means of quicker growth but a shortening of the time to complete development. Milder temperature also has some influence for the pupal period was 11 days

as against 25 days in the fall rearing.

A condensed summary of the changes from egg to adult in the spring and summer is as follows: First instar, 5 days; second instar, 9 days; third instar, 7 days; fourth instar, 15 days; fifth instar, 13 days; pupation, 11 days; total, 60 days.

## A PRELIMINARY LIST OF THE FLESH FLIES OF BRITISH COLUMBIA (Diptera: Sarcophagidae)

E. R. BUCKELL and G. J. SPENCER

Dominion Entomological Laboratory, Kamloops, B.C.

In the course of efforts to unravel the problems of natural control factors of grasshoppers, it was necessary to rear sarcophagid maggots that were killing hoppers and to make field collections of the flies. A paper on these flies is in course of preparation, but in the meantime it seems advisable to record the species that have been captured and those that have been reared from their acridiid hosts in the Chilcotin, near Lytton, and on the Lac du Bois ranges at Kamloops. The nomenclature is according to Aldrich's Monograph "Sarcophaga and Allies", Thomas Say Foundation, 1916, brought up-to-date through the kindness of Dr. A. R. Brooks, Division of Entomology, Ottawa.

\*Indicates species recorded in literature as parasites of grasshoppers in North America.

†Indicates species reared in this Province from *Melanoplus mexicanus mexicanus* Saus.

*Wohlfahrtia meigenii* Schiner  
 \**Agria affinis* Fallen  
*Sarcophahrtia ravinia* Parker  
 †*Sarcophaga sinuata* Meigen  
*Sarcophaga latisterna* Parker  
 \**Sarcophaga atlanis* Aldrich  
 †*Sarcophaga hunteri* Hough  
 †*Sarcophaga opifera* Coquillett  
 \**Sarcophaga caridei* Brethes  
 †*Sarcophaga falciformis* Aldrich  
 †*Blaesoxiphothea coloradensis* (Aldrich)

*Sarcophaga eleodis* Aldrich  
 †*Acridiophaga aculeata* (Aldrich)  
 †*Acridiophaga aculeata* var. *gavia* (Aldrich)  
 †*Acridiophaga aculeata* var. *taediosa* (Aldrich)  
 †*Sarcophaga reversa* Aldrich  
 †*Sarcophaga rapax* Walker  
 †*Sarcophaga tuberosa* var. *harpax* Pandelle  
 †*Sarcophaga tuberosa* var. *sarracenioides* Aldrich  
 †*Sarcophaga tuberosa* var. *exuberans* Pandelle  
*Sarcophaga sulculata* Aldrich  
*Sarcophaga bullata* Parker  
*Sarcophaga nearctica* Parker  
*Sarcophaga planifrons* Aldrich  
*Sarcophaga lherminieri* R.-D.  
*Sarcophaga insurgens* Aldrich  
 †*Sarcophaga kellyi* Aldrich

A large number of female flies which key out to the *aculeata* triplet has been reared from maggots emerging from grasshoppers; without males it is impossible to assign them to a variety: males have been reared only of *S. aculeata*. Female flies of the species *Sarcophaga planifrons* and *S. lherminieri* have been frequently captured, pursuing flying grasshoppers and apparently larvipositing on them; it is possible that they also will prove to be parasites of these insects.