MOISTURE AND FAT CONTENT IN THE AMBROSIA BEETLE *Trypodendron lineatum* (OLIV.)[1]

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Little is known about the metabolic changes that take place during the life cycle of the ambrosia beetle, *Trypodendron lineatum* (Oliv.) (Chapman, 1956). An understanding of the changes in the amount of fat in relation to certain physiological conditions and behaviour would be of fundamental value (Lees, 1955). Subjective ratings of the size of the fat body have been tried but were found to be inadequate as a means of studying changes in fat content. To increase our knowledge of the amount of water, fat, and dried matter in these beetles and to lay the basis for further studies of this subject a method was needed which would make it possible to determine these factors in individual beetles (Bursell, 1959). The small size of the beetles (2.5 - 4.5 mg.) makes this difficult, but we devised a simple method for making these determinations with sufficient accuracy and in a relatively short time.

Most of the data were secured in March 1964, with beetles collected from overwintering sites in bark during January and March 1964. After removal from the bark, the beetles were stored in moist bark flakes in a refrigerator until they were used. Some collected in the spring of 1963 and stored in a refrigerator were also used.

The first objective was to establish average values for fat, moisture, and dry weights for male and female beetles. Beetles used for the experiments were given a walking test to exclude those that were injured or did not appear to be normal. Groups of 25 beetles were killed with ethyl acetate fumes and weighed in a previously dried thimble (folded Whatman glass paper -GF/A- 9 cm.). They were then dried for 16 hours in an oven at 70° C with forced air circulation, cooled over anhydrous calcium sulfate and weighed. Additional drying did not cause any further change in weight. The thimble was put into a micro-soxhlet apparatus and extracted continuously with petroleum ether for six hours. An additional 6 hrs. extraction did not significantly alter the results. Next the thimble was air dried until the excess ether had evaporated and after oven drying overnight at 70° C it was placed in a desiccator over anhydrous calcium sulfate prior to weighing. Glass paper was used because it was non-hygroscopic. As the beetle remains did not absorb an appreciable amount of moisture, accurate and reproducible weighings were possible to within 0.01 mg.

It was first thought that the well developed sclerotization of these beetles would be an obstacle to efficient fat extraction from intact insects. However, crushing the beetles and repeated extraction did not result in significant change in weight.

The results of the determinations presented in Table I show that the female beetles were approximately 0.5 mg. heavier than the males, and that the fat content of females was usually greater. The average total weights of beetles that were stored since spring 1963 were about the same as those of the freshly collected beetles, but the weights of fat in the former were very small.

After making determinations using groups of beetles the same method was used for individuals. Small gelatin capsules perforated at both ends were used as in a recent study on

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TABLE I—Average Values in mg. of Moisture, Dry Weight, and Fat Content of **Trypodendron** ambrosia beetles in groups of 25.

Collection Date	Sex	Total wt/ beetle	Moisture /beetle	Dry wt. /beetle	Fat/ beetle after 3 hrs.	Fat/ beetle after 6 hrs.	% fat /dry wt
7/1/'64	F	3.65	2.01	1.64	.52		
	F	3.80	2.04	1.75	.57		
	F	3.71	2.05	1.66	.49	.54	32.6
	F	3.81	2.08	1.73	.51		
	M	3.22	1.87	1.34	.36		
	M	3.24	1.83	1.41	.38		
	M	3.27	1.81	1.46	.37	.40	27.7
25/3/'64	F	3.70	2.04	1.66	.54	.56	34.1
	F	3.70	2.04	1.66		.57	34.1
	M	3.27	1.84	1.43	.39	.42	29.2
	M	3.11	1.76	1.35		.37	27.2
Spring '63	F	3.68	2.40	1.29		.14	11.1
	M	3.19	2.08	1.11		.07	6.1

uptake of water by *Trypodendron* (Nijholt and Chapman, 1964). These capsules stood the heat used for drying fairly well and were not affected by warm petroleum ether. Each beetle was weighed separately after it had been killed with ethyl acetate fumes, and placed inside a capsule with a numbered piece of paper. After drying overnight the capsules were cooled in a desiccator. Then the beetles were removed, weighed individually with as little exposure to the air as possible and returned to their capsules. Ten to twelve beetles in their capsules were then placed in a micro-soxhlet extractor with a glass wool plug to hold them in position. After 6 hrs. of continuous extraction in petroleum ether the capsules were blotted with filter paper and dried overnight at 70° C. The beetles were then taken from their capsules and weighed so that the fat content could be calculated on the basis of dry weight.

The data for individual beetles (Table II) show that females varied more than males. Three females appeared normal but had extraordinarily low fat contents of 8.3%, 7.0% and 10.6%. These influenced the average value.

TABLE II—Moisture, Dry Weight, and Fat Content in mg. of 20 male and 20 female **Trypodendron** ambrosia beetles determined individually.

	Total fresh wt	Moisture wt	Dry wt	Total fat after 6 hrs*	% fat/ dry wt
MALES					
Range	3.90-2.42	2.16-1.36	1.93-1.05	0.62-0.17	33.3-15.6
Average	3.26	1.87	1.40	0.35	24.6
Standard deviation	0.369	0.186	0.243	0.127	4.937
FEMALES					
Range	4.43-2.76	3.03-1.56	2.16-0.86	0.88-0.06	40.7- 7.0
Average	3.59	2.06	1.25	0.45	26.9
Standard deviation	0.552	0.332	0.380	0.813	10.494

* After extraction over an additional period of 6 hours the average total fat for males was 0.36 mg. and for females 0.47 mg.

Summary

A method is described to determine the amount of moisture, fat, and dry matter in groups and individuals of adult ambrosia beetles, *Trypodendron lineatum* (Oliv.), using standard laboratory equipment. Average and individual values for fat extracted by petroleum ether are given for beetles of both sexes taken during overwintering. The results show that females have a greater variability in weight and a larger percentage fat based on dried weight.

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NOTES ON THE LIFE HISTORIES OF THREE MOTHS FROM SOUTHERN VANCOUVER ISLAND (LEPIDOPTERA: PHALAENIDAE AND GEOMETRIDAE)

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Orthosia ferrigera Sm.

Eight species of the genus *Orthosia* are recorded for British Columbia, all of which occur on Vancouver Island.

O. ferrigera has a wingspread averaging 35 mm and is of a general rusty colour with the veins on the primaries indicated by a darker colour. It is scarce in my experience, being taken about once a year.

A specimen taken by day on a grass stem in April, 1963 laid 60 ova on the sides of the box in small groups of from 1 to 25, in a single layer. The resultant caterpillars died because I did not know the correct food plant. Another one taken at light in late March, 1964 laid 47 ova. It was found that Garry Oak (*Quercus garryana*) was avidly eaten, but to get the caterpillars started it was necessary to cut open the swelling buds for the trees were not in leaf at the time.

Ovum

Size 1 mm by 0.75 mm. Hemispheric, finely ribbed with about 40 ribs and cross-ribbed, having the effect of quadrangular reticulations since the height of the ribs and cross-ribs is equal; white slightly tinged with green, soon acquiring a pale orange dot on the micropyle and a ring of orange on the shoulder. A light lead grey at maturity. Hatched April 19.

Larva—1st Instar

Length 4 mm. Head smooth, translucent, with a pale brownish tinge. Body translucent with a bluish cast; both head and body heavily dotted with black; a short hair on each dot.

2nd Instar

April 25. Length 7 mm. Head as described. Body somewhat translucent, pale greenish with white dorsal, subdorsal and spiracular lines, the last-named being the widest; conspicuous black tubercles.

3rd Instar

May 1. Length 10 mm. Head smooth, semi - transparent, sordid white with a faint bluish tinge, conspicuously dotted with widely spaced black dots. Body smooth, yellowish green tinged with fuscous on sides and venter, with thin yellow dorsal, subdorsal and supraspiracular lines, the spiracular band yellow, interruptedly threaded with broad fuscous dashes on the centre of each segment; tubercles conspicuous and black, each bearing a minute black hair; a short, thin, slightly raised transverse bar on dorsum of A. 9; legs and claspers sordid.

4th Instar

May 8. Length 15 mm. Head a pale sordid flesh colour, sparsely dotted with black; plate tinged with blue, with three white lines as extensions of the dorsal and subdorsal lines. Body smooth, general colour russet,

[1] Provincial Museum, Victoria, B.C. (Rtd.)