

## SOME PRELIMINARY OBSERVATIONS ON THE LIFE-HISTORY OF *CUTEREBRA TENEBROSA* COQUILLET<sup>1</sup>

T. K. MOILLIET<sup>2</sup>

Livestock Insect Laboratory, Kamloops, B. C.

On August 23, 1934, E. P. Venables, Vernon, B. C., captured a large, dark blue oestrid in a cabin at Sugar Lake, near Vernon, B. C. The writer has since compared this fly with specimens of warble flies of various rodents, in the reference collection established at Kamloops by the late Eric Hearle, and identified it as a female of *Cuterebra tenebrosa* Coq. During the next two days the fly laid over 400 eggs in its cardboard container, and on September 10 Mr. Venables sent the two largest egg masses, numbering 395 eggs in all, to the Kamloops laboratory in the hope that some rearing could be attempted.

The eggs had been laid in two patches covering unevenly about four or five square inches. No particular care seems to have been taken in their arrangement by the female, except that each was securely cemented, along its entire ventral surface, to the cardboard and overlapping of the eggs had been almost entirely avoided. The colour of eggs and adhesive material is light yellow. As in most oestrids, the egg is equipped with a "lid" which the larva forces open like a trap door when ready to emerge.

The eggs were kept in the laboratory at 70°F. and about 25 per cent relative humidity. By September 20 no hatching had occurred. On September 27 several eggs had hatched. Some half-dozen of the tiny maggots, 1¼ mm. in length, were seen erect upon the cardboard and egg-shells, waving their heads to and fro. The larvae are very quick to stick to any object with which they come in contact, and are able to move about by looping, as both head and tail appear to be sticky. The larva is transparent except for series of black spines on each segment. When an egg was opened with a needle it was observed that the larva usually squirmed out, although in many cases when not

sufficiently developed it either died or waited a day or two before emerging.

By October 31, 43 eggs had hatched, about half of these artificially. During the next two weeks about one-quarter of the remaining eggs hatched. Natural hatching reached its peak about the second week of November and practically ceased by the middle of December, when about 80 per cent of the eggs had hatched. One larva, which emerged naturally on December 3, lived until December 13 at an average room temperature of 60°F. and a relative humidity as low as 15 per cent.

To determine whether or not the eggs would survive below-freezing temperatures, the larger egg mass was placed out of doors between December 11 and 31, during which period temperatures went considerably below freezing. The minimum recorded temperature was -5.5°F. on December 25. On December 31, eight of these eggs were opened at room temperatures. At first the grubs were inactive, but after exposure to the warmth of a desk lamp for 30 minutes, six showed normal activity which was maintained for an hour, when they were placed on a host. Eggs opened at this time from the uncooled mass yielded active larvae. On February 8, 1935, five eggs from the previously cooled mass were opened. Two immediately yielded normal, active larvae, which lived three days in an incubator at 75°F. and 70 per cent relative humidity. By February 9, 90 per cent of all the eggs had hatched and 4 per cent had shrivelled.

**Infestations:** The following is an account of such rearings as have been attempted up to the time of writing (1935). To infest an animal, the maggots were simply lifted with a needle and placed on the hair of the back and sides of rats. Chloroform was used to quiet the rats because of the danger of infection from rat bites.

**Rat No. 1** (brown female, half-

<sup>1</sup> Contribution No. 2634, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada.

<sup>2</sup> Resigned 1936.

grown). — This rat was infested on September 28 with 12 larvae from eggs mechanically opened. The animal was very uneasy and scratched herself incessantly the same day. By October 5 the rat was hiccoughing continually and was little interested in food (oats). Weakness and distress increased and by October 14 the animal had gnawed half its tail away and was paralyzed in one hind leg. On October 15 the rat was in a coma all day and died about 5 p.m.

Necropsy was made at 11 p.m. Emaciation was extreme; several matted patches of hair when pulled off revealed holes in the skin one mm. in diameter. Skinning revealed ten such holes, and eight grubs, varying in length from one-quarter to one-half of an inch, were removed from the muscles of the legs, back, and diaphragm. In some cases they had pierced into the coelom. These grubs do not form true cysts, as do ox warbles, but lie between the layers of muscle.

**Rat No. 2** (brown female, mature). — This rat was infested on October 16 with four artificially hatched grubs. On October 21 she was scratching herself and seemed in pain. On October 23 it was apparent that one grub had established itself on the neck, just in front of the left shoulder. On November 16 the grub was nearly full-grown, and in anticipation of its dropping the rat was isolated. The rat was found dead on November 17 and the grub was cut out from under the skin and placed in a jar of damp earth, in which it immediately buried itself.

**Rat No. 3** (white female, mature). — This rat was infested on October 16 with four grubs, two naturally and two artificially hatched. When the rat was examined under chloroform on October 31, no grubs were found. Three very small scabs on the neck may have been caused either by fighting or by ineffectual entry of the maggots.

**Rat No. 4** (white female, half-grown). — This rat was infested on October 18 with six grubs, three naturally and three artificially hatched. It was examined under chloroform on October 31 and no grubs were found. The rat

was re-infested on December 3 with six artificially hatched maggots. It was examined under chloroform on December 20 and found to have two grubs, one behind each front leg. The rat was chloroformed on January 7 and the grub removed from under the left front leg. That under the right shoulder dropped on January 11, but was lost and perished. In this case the grub, unable because of a hard scab to leave its host through the breathing hole, bored its way out head first about half an inch in front of the original hole.

**Rat No. 5** (brown and white male). — This rat was infested on December 4 with six grubs. By December 20, five grubs were embedded, four in the back and one on the right side of the breast. The rat died on December 31, and three well-grown grubs were removed from the body, which was already badly decomposed in the areas of infestation. One grub was found in the tray, as well as the remains of another which had been bitten out by the rat. The live grubs were placed in a jar of damp sand for pupation.

**Rat No. 6** (white female, mature). — This rat was infested on December 4 with five grubs which hatched from eggs opened the previous day. The rat was examined under chloroform on December 20 and no infestation was found.

**Rat No. 7** (brown male, half-grown). — This rat was infested on January 8 with four grubs artificially hatched. It was examined under chloroform on January 20 and only a small black spot was noted on the back. By January 30 it was noticeable that two well-grown grubs were established in the back; these were nearly mature by February 8.

**Rat No. 8** (brown female, mature). — This rat was infested on January 8 with three grubs artificially hatched from the egg mass which had been subjected to below-freezing temperatures. The rat was examined under chloroform on January 20; there was no sign of infestation.

From these rearings no information was secured on the duration of the pupal stage. One of several fairly well matured

larvae taken by the writer at Nicola, August 25, 1932, in a pack rat, was allowed to pupate in earth in the out-of-doors insectary at Kamloops, and emerged in mid-August, 1933.

**Conclusions:** Some of the foregoing observations suggest the following deductions regarding the habits of *C. tenebrosa*.

It is usually assumed that the female fly lays her eggs on the hair of the host animal. The extreme viability of the egg and the longevity and motility of the unfed maggot are specializations which would seem unnecessary were the above assumption true. It seems, therefore, more probable to suppose that the eggs are laid among the rocks, logs, nests, or burrows frequented by pack rats, chipmunks, and ground squirrels, the commonest hosts. In support of this, H. B. Leech has told the writer that he captured in 1929 a female of this species in the mouth of a burrow of a ground squirrel or groundhog at Vernon, B. C.

The growth in the host is amazingly rapid, little over a month being required for larval development. The pupal stage, on the other hand, is extraordinarily long and may last a year, but in order for the life-cycle to be completed in a year, the average duration of this stage cannot be more than 10 or 11

months. A two-year cycle, however, does not seem impossible when the viability of the eggs, even in cold weather, is considered. It may have been because of room temperatures, about 70°F., that so many eggs hatched within three months, although the humidity of the room, about 20 per cent, may have been an adverse factor. According to our records of grubs taken from rodents, flies of this group thrive best in localities such as Nicola, Salmon Arm, and Vernon, which have a relatively heavy snowfall. They are rare at Kamloops.

The mortality of rats in the foregoing experiments suggests that this fly may cause the death of small mammals in nature in certain localities, although a general infection may be induced by the grubs less easily in mountain rats than in those used in the laboratory. If they do constitute a factor in reducing populations of wild rodents, then they become a factor in the control of wood ticks, and deserve further study.

**Acknowledgments.** — The writer is indebted to E. P. Venables, Vernon, B. C., for the material for these experiments. Thanks are also due to H. B. Leech, California Academy of Science, San Francisco, for his record, and to George J. Spencer, University of British Columbia, for reading this manuscript.

## ADDITIONAL NOTES ON THE LIFE-HISTORY OF CUTEREBRA TENEBROSA COQUILLET<sup>1</sup>

J. D. GREGSON

Livestock Insect Laboratory, Kamloops, B. C.

At the 1935 meetings of the Entomological Society of British Columbia, T. K. Moilliet read a paper entitled "Notes on the life-history of *Cuterebra tenebrosa* Coquillet." In that paper, which is being published concurrently with this one, he reported his observations on some 400 eggs laid by a fly captured on August 23, 1934. Larvae commenced hatching from these eggs on September 27, reaching a peak in November. Some

of the remaining unhatched eggs yielded active larvae when mechanically opened in February. Numbers of these larvae were used to infest rats, in which they matured in about a month. Since none of these were followed through their pupal period to emergence of adults, the following notes may prove of value in further studies of this parasite.

The material for these subsequent observations was provided by a batch of 850 eggs deposited by a fly on July 26, 1943. The first of these hatched on

<sup>1</sup> Contribution No. 2635, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada.