# MORPHOLOGY OF ALIMENTARY AND REPRODUCTIVE TRACTS OF THE RODENT BOT FLY, *CUTEREBRA TENEBROSA* (DIPTERA: CUTEREBRIDAE)[1]

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## ABSTRACT

The internal reproductive and alimentary structures of *Cuterebra tenebrosa* Coquillett were studied and compared to other calypterate flies. Well defined mouth parts are present. Paired lingual salivary glands extend horizontally almost to the abdomen; however, labial salivary glands were not found. The alimentary canal is complete in female flies, whereas males lack a crop. Females have three spherical spermathecae opening into the upper portion of the genital chamber. Male reproductive structures are similar to those in other flies. Tracheal air sacs fill one-third to one-half of the abdomen.

## INTRODUCTION

Little is known concerning the internal structure of *Cuterebra* bot flies. Townsend (1935) provided the earliest descriptions of *Cuterebra* alimentary and reproductive tracts but did not include illustrations.

In 1963, Catts described and illustrated the alimentary and reproductive tracts of *Cuterebra latifrons* Coquillett. A comparative study of the alimentary canal of several flies including *C. latifrons* was made by Singh and Judd in 1966. Various authors have described and illustrated the external genitalia of *Cuterebra* (Bennett 1955; Haas & Dicke 1958; Catts 1963; Graham and Capelle 1970; and Baird and Graham 1973). The purpose of the present paper is to report findings from dissections of *Cuterebra tenebrosa* Coquillett specimens and to provide illustrations of the structures.

## METHODS AND MATERIALS

Adult flies were obtained by rearing larvae in captive bushytailed wood rats *(Neotoma cinerea Ord.)*. Within five days after emergence, flies were injected with Kahle's solution to kill and fix them in an extended position. They were stored in the same preservative for several days and then transferred to 70% alcohol for permanent storage. Dissections were performed with standard insect dissection tools under a binocular microscope.

## OBSERVATIONS AND DISCUSSION

The use of Kahle's solution to kill adult flies proved a very useful technique since the solution perpeated all body areas and preserved the internal organs very well.

*Alimentary Tract*

No attempt was made to describe the mouth parts of *C. tenebrosa*. The mouth parts are typically muscoid in both sexes as described for *C. emasculator* (Bennett 1955) and *C. latifrons* (Catts 1963).

The paired racemose salivary glands are connected anteriorly by a common salivary duct which extends to the oral structures (Figure 1). Posteriorly, the glands are situated horizontally in the lower thorax and extend almost to the abdomen. Catts (1963) reported the salivary glands extending only into the prothorax of *C. latifrons*. Singh and Judd (1966), also working with *C. latifrons* found salivary glands extending into the abdomen. Townsend (1935) described salivary glands of *Cuterebra* as being atrophied or absent. These discrepancies may be due to age or to preservation method.

Lowne (1890) and Hewitt (1914) indicated that paired lingual salivary glands of *Calliphora* and *Musca*, respectively, were of a simple tubular type which ultimately terminated in the posterior of the abdomen. Hori (1972) also found tubular salivary glands extending into the abdomen of flies belonging to eight calypterate muscoid families. An additional difference between *Cuterebra* and other muscoid flies was that the labial salivary glands present in *Calliphora* and *Musca* (Lowne 1890; Hewitt 1914) were absent in *Cuterebra*.

The alimentary canal in *C. tenebrosa* is complete and basically similar to that in other muscoid families. An important difference is the apparent absence of a crop in male *C.*

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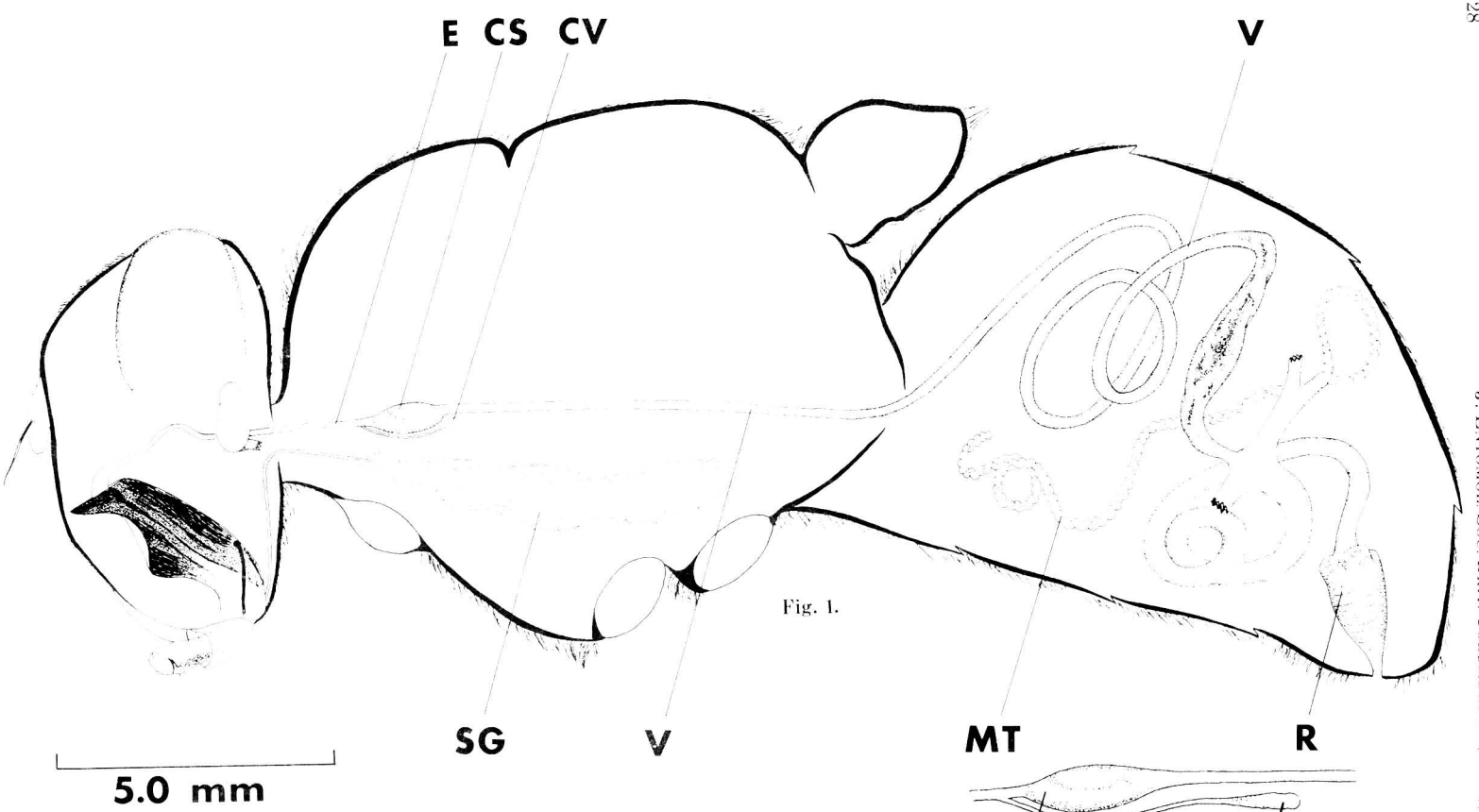


Fig. 1.

Fig. 2.

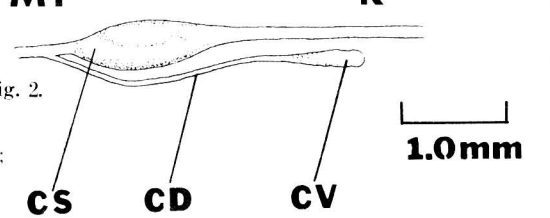


Fig. 1. Alimentary tract of **Cuterebra tenebrosa**. E, esophagus; CS, cardiac sac; CV, crop vestige; SG, salivary gland; V, ventriculus; MT, Malphighian tubules; R, rectum

Fig. 2. Enlarged view or cardiac sac. CS, cardiac sac; CD, crop duct; CV, vestigial crop

Fig. 3.

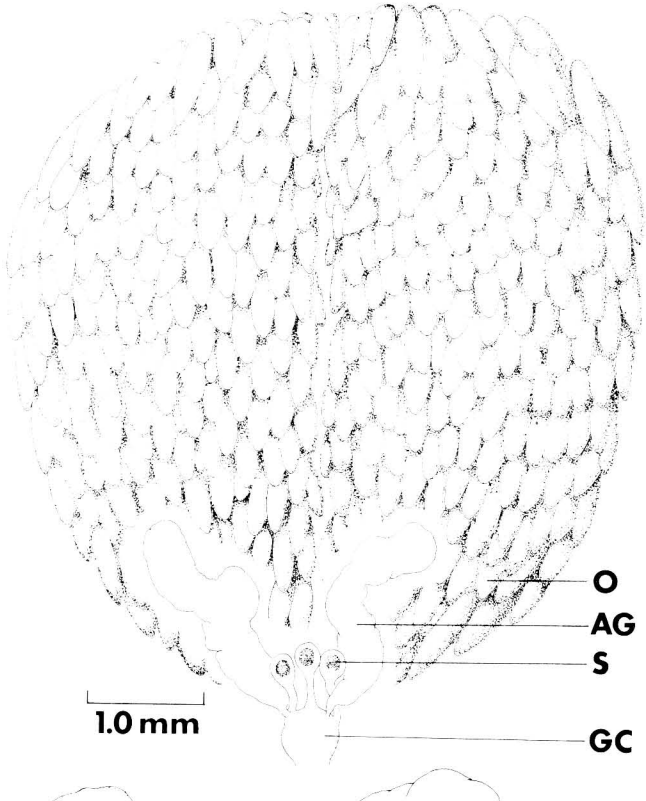


Fig. 3. Female reproductive organs. O, ovary; AG, accessory gland; S, spermatheca; GC, genital chamber

Fig. 4.

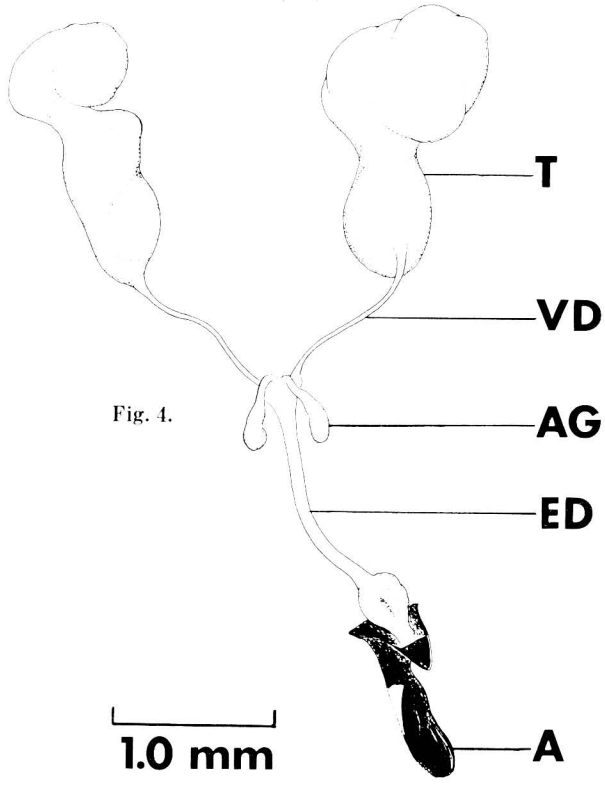


Fig. 4. Male reproductive organs. T, testis; VD, vas deferens; AG, accessory glands; ED, ejaculatory duct; A, aedeagus

*tenebrosa* specimens. Only one of five males had a crop, whereas all four females had small crops (Figure 1, Figure 2). Studies with *C. latifrons* present conflicting results: Catts (1963) reported a vestigal crop, whereas Singh and Judd (1966) described a crop proportional in size to that of other muscoid Diptera.

The ventriculus begins with a typical cardiac sac. This organ is termed the proventriculus by Lowne (1890), Hewitt (1914), Hori (1972), and the cardia by Singh and Judd (1966). The remainder of the *C. tenebrosa* ventriculus is tubular and of the same diameter throughout. This agrees with findings for *C. latifrons* by Catts (1963) and Singh and Judd (1966). Food remnants were found in the ventriculus and intestines of three male *C. tenebrosa* specimens. This must certainly be material held over from larval feeding since the flies had no opportunity to feed as adults. At the ventriculus-intestine junction, two Malpighian ducts are present. Each duct gives rise to two moniliform Malpighian tubules which extend among the organs of the abdomen. The rectum is similar in shape to that of other flies; four rectal pads are present on the anterior portion. Catts (1963) and Singh Judd (1966) reported similar observations for *C. latifrons*. Large tracheal air sacs extend from one-third to one-half of the length of the abdomen of *C. tenebrosa*. Townsend (1935) made no mention of air sacs in his studies of *Cuterebra* specimens.

*Reproductive Tract*

Figures 3 and 4 illustrate the internal reproductive system of female and male *C. tenebrosa*, respectively. They are similar to descriptions of other *Cuterebra* provided by Townsend (1935) and Catts (1963), although *C. tenebrosa* females have spherical spermathecae in contrast to the sausage-shaped spermathecae of *C. latifrons*.

According to Hori (1972), the majority of calypterate muscoid flies have three spermathecae, although several genera within Stomoxydinae (Muscidae) have but two. In the lower flies, the number of spermathecae ranges from zero to four. *C. tenebrosa* specimens have spermathecae arranged one on the upper left side of the genital chamber, one on top, and one on the upper right side of the chamber (1:1:1). In contrast, most other muscoid genera have two left and one right (2:1) or one left and two right (1:2) (Lowne 1890; Hewitt 1914; Hori 1972). A variety of spermathecal shapes were illustrated by Hori (1972) for muscoid flies; however, within genera the shapes were fairly consistent.

*C. tenebrosa* males are basically similar to other muscoid flies in the internal reproductive structures. One difference between *C. tenebrosa* and *C. latifrons* (Catts 1963) is that the accessory glands are smaller in relation to the testes in *C. tenebrosa*. This may be a function of the age of the fly, however, as Hori (1972) stated the shape of the testes of male muscoid flies correlated closely to the age.

## CONCLUSIONS

The alimentary tract of *Cuterebra tenebrosa* is basically similar to other muscoid Diptera. The two main differences are the reduced or absent crop in males and the racemose salivary glands in *C. tenebrosa*.

In early *Cuterebra* literature, these bot flies were described as being without mouth parts. Although more recent work has shown the true nature of their mouth parts and alimentary system, no one has reported *Cuterebra* flies feeding or drinking. Apparently there is no food requirement for oviposition. In rearing several hundred *Cuterebra* flies in recent years, we have maintained them from eclosion to oviposition (usually five days) with no opportunity to feed. In most cases the resulting eggs have had a high fertility, although most females laid only 50-75% of their complement of eggs before dying.

## ACKNOWLEDGEMENTS

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# *EURRHYPARA HORTULATA* L. *(URTICATA* L.) ON THE PACIFIC COAST (LEPIDOPTERA: PYRALIDAE)

This attractive little moth, which can hardly be confused with anything else in the North American fauna, is native to Europe and temperate east Asia. It ranges from Ireland to the Amur-Ussuri region and Manchuria. It was established in Nova Scotia by 1907 at MacNab's Island and Truro. At present it has a wide range in the Northeast, extending from Newfoundland to Ontario and southward. The moth flies mainly in July, at night, is attracted to light and in the daytime is easily flushed. The main food-plant in Europe is nettle, *Urtica dioica* L., and other plants such as *Marrubium vulgare* L., *Stachys* sp., *Mentha* sp., *Calystegia sepium* Br. and *Ribes* sp. Probably it has other plant hosts also. Little is known about its food plants in North America.

Until now there were no records of *E. hortulata* having been collected on the Pacific coast. There are no specimens from this area in local collections or in the Canadian National Collection at Ottawa.

On 18 June, 1977 a perfect female specimen was seen resting on the ceiling of a living room in East Vancouver. It was in such immaculate condition that it was obvious that it was freshly emerged. Unfortunately, in my excitement, the specimen was somewhat damaged during capture. Four days later, another perfect specimen, a male, was flushed in the garden and collected. Another was observed in the garden on 23, 26 and 27 June but no further specimens were collected in order to give the species a chance to survive and become established in Vancouver. How the moth arrived in Vancouvr will remain a mystery. Most likely the first specimens were introduced last year, deposited eggs and produced moths this year. The host-plant here remains unknown. There are no nettles growing in the vicinity and the nearest place known to me where nettles grow in Vancouver is near the seawall in Stanley Park. There are other possible plant hosts, however, cultivated in our garden, such as *Stachys recta*, at least three different species of *Mentha*, *Calystegia sepium* and *Ribes* sp. The moth may have selected one of those plants on which to lay eggs.

In Europe the larva rolls the leaves or spins them together. The cocoon is spun in a sheltered place, usually under the bark, in autumn. Hibernation takes place as a prepupal larva which pupates in the spring. There is one generation per year. Next June or July should show whether the moth will establish itself in Vancouver or not. Unlike horticulturists and the Plant Protection Division, I hope it will.

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