# Notes on the biology and rearing of the carrion fly *Prochyliza brevicornis* (Melander) (Diptera: Piophilidae)

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## ABSTRACT

I describe the first successful rearing of *Prochyliza brevicornis* (Melander) in the laboratory on a variety of media. The average developmental period from egg to adult for non-diapausing individuals was 42-47 days with a range of 32-74 days. Best survival of those that emerged as adults (16-32 % ) was on ox-tail bones and ground beef. The majority of the larvae in each generation remained quiescent or did not pupate for up to six months which probably indicates an obligatory overwintering diapause in this species.

**Key words:** Diptera, Piophilidae, British Columbia, forensic entomology, carrion

## INTRODUCTION

Piophilids, also known as carrion flies, are commonest in northern temperate areas (Danks 1980; McAlpine 1977, 1987). They grow and develop on proteinaceous substances such as animal carrion, bone and bone marrow, cheese, fish and cured meat (Simmons 1927), corpses (Oldroyd 1964, Nourteva 1977; Smith 1986), hoofs and horns (Bishop 1917), human excreta (Howard 1900) and in household garbage (McAlpine 1977).

Melander (1924) reviewed the family Piophilidae and described *Prochyliza brevicornis* (Melander) as a new species. It occurred usually in the months of July-August in some localities in Yellowstone Park, Montana and in Chicago, Illinois in the U.S.A. and in British Columbia, Canada. The revised classification of Piophilidae by McAlpine (1977) lists eight species under the genus *Prochyliza*.

Very little information is available on the biology and rearing of the members of this family except for a few species such as *Piophila casei* (L). Herein I report on some aspects of the rearing and biology of *Prochyliza brevicornis*. Adults of *P. brevicornis* emerging from a forensic sample of insects brought to Simon Fraser University from Sprott lake , B.C. were used to start a colony for rearing and observations. Their identification was confirmed by Dr. J. L. McAlpine at the Biosystematics Research Centre, Agriculture Canada, Ottawa.

## MATERIALS AND METHODS

I reared *P. brevicornis* for three successive generations at 26 ±1°C, 50% ±5% RH, with a 12L:12D photoperiod. Seventeen newly emerged adults serving as a starter colony were placed in 10x10x10 cm wooden cages with a clear acrylic plastic front and a Saran screen at the rear. For second and third generation rearing 40 and 8 adults were caged respectively. Sugar cubes and skim milk powder in a 5.0 cm diam petri dish were provided as food, and water was supplied in conical flask with dental cotton wicks. Ovipositional substrates such as uncooked ox-tail bones, ground beef, chicken wings were provided in a 5.0 cm diam. petri dish and placed inside the adult cage. For larval rearing the above three substrates as well as beef salami and processed cheddar cheese slices were used.

Larvae were reared in 4 l jars.The medium was on a layer of paper towels and was covered with facial tissue to provide dry surfaces for pupation.

## RESULTS AND DISCUSSION

Adults mated after emergence as soon as they were released inside the cage. Mating lasted from 15 sec to 15 min. Males mounted the females during copulation and made vigorous jerks from side to side. In some cases two males were *in copula* at the same time with one female.

**Table 1**

Development (in days) on ox-tail and ground beef of *P.brevicornis* for three generations at 26 ± 1°C, 50±5%R and 12L:12D.

| Developmental stage | Generation 1 | | | Generation 2 | | | Generation 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | Duration Mean±SE | Range | N | Duration Mean±SE | Range | N | Duration Mean±SE | Range |
| eggs | 150 | 1.5±0.3 | 1.0-2.0 | 200 | 1.5±0.3 | 1.0-2.0 | 150 | 1.5±0.3 | 1.0-2.0 |
| larvae | 36 | 36±6.2 | 23-65 | 79 | 33±4.4 | 28-40 | 129 | 38±2.8 | 33-43 |
| pupae | 24 | 8.3±0.9 | 7-13 | 48 | 7.7±1.2 | 4-12 | 49 | 7.5±0.6 | 6-8 |
| total | 24 | 41.9±5.9 | 32-74 | 48 | 42.4±1.4 | 37-47 | 49 | 47.5±2.4 | 43-51 |

During the course of rearing four females and eight males were found dead after such dual copulation. Under the dissecting microscope, the detached genitalia of one male were observed to be fused externally with the female genitalia. The other males died attached to females. This is evidence that dual mating with one female might be common in this species. Simmons (1927) reported a similar phenomenon for *Piophila casei* (L.) in which adults of advanced age can copulate but not separate in the laboratory and die *in copula.*

Eggs were laid singly or in clusters. Most oviposition occurred during 3-5 days after mating. Several ovipositional substrates, such as uncooked chicken wings, ground beef, cheese slices and ox-tail, were offered to mated females. Ox-tail appeared to be the preferred substrate for egg laying. Ox-tail bone dries rapidly when left at room temperature for 1-2 days and is much drier than chicken wings or ground beef. It is quite likely that the putrifying fat around the meat and bones stimulates egg laying. Eggs hatched in 24-48 h at 26°C.

Newly hatched larvae were 1.5-2.0 mm long, and were very soft and fragile. Second instar larvae were 2-3 mm long, and could be distinguished by their prominent slender mouth hooks. The final instars were 5-6 mm long, and could be readily recognized by the presence of strong mouth hooks and their skipping behavior. The larva skips by bending its body in the shape of a ring and hooks its oral claws over the sharp angle formed by the ventral edge of the posterior beveled truncation. It then pulls hard and the hold is suddenly released resulting in snap throwing of the insect in the air (Simmons 1927). Larvae grew well on ground beef or ox-tail bones. Some trials were made by placing second and third instar larvae on beef salami, chicken wings and cheese in Petri dishes. No development occurred on beef salami and all larvae either died or were overtaken by mould or bacterial growth. Similarly development on chicken wings or cheese slices resulted in only a few pupae.

The larvae reared on ox-tail bones grew well up to the third instar and slowly started disappearing. There was no sign of escape from jars but a close examination of the ox-tail pieces revealed that larvae had entered the bones and hard ligaments. No attempt was made to extract them. Larvae on ground beef were given fresh portions of ground beef every two weeks. A froth would appear the next day on the fresh meat where larvae congregate. This could be a result of bacterial activity. Most of the larvae growing either on ground beef or ox-tail bones did not pupate and remained quiescent for up to six months, after which the cultures were either discarded or observations terminated. Simmons (1927) reported that retarded growth of piophilid larvae was caused by low temperature or starvation as a result of desiccation of food. Because none of these two factors could have occurred in my cultures, the quiescent larvae had probably entered an obligatory diapause. The total larval period lasted from 23-65 days for those larvae which pupated (Table 1). Third instar larvae in their skipping stage wandered around apparently in search of dry places for pupation. The pupal period lasted 4-13 days.

The total developmental period from egg to adult of 121 insects that developed successfully was 32-74 days. The yield of the insects reared to adulthood was 16-32 % (Table 1).

In the field, Piophilids infest vertebrate cadavers at the decompositional stage when fatty acids are formed (Johnston and Villeneuve 1897, Nourteva 1977). Thus oxtail bones may be a more suitable substrate for development than fresh ground beef or chicken wings.

Piophilids have been used as forensic indicators to establish the season and year of their infestation of human remains ( Skinner *et al.* 1988; Smith 1986 ). In view of its prolonged and asynchronous larval development in the laboratory, and its apparent obligatory diapause, this insect would be a poor indicator of the elapsed time since death, especially if it were the only insect found on the remains.

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