

A Comparison of Longevity Between Sexes of *Cochliomyia macellaria* (Fabricius) (Diptera: Calliphoridae)

Dr. Adrienne Brundage and Valerie Holmes

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Texas A&M University, Department of Entomology

Abstract: Comprehension of the lifecycle and life expectancy of *Cochliomyia hominivorax* Coquerel and *Cochliomyia macellaria* Fabricius, the primary and secondary screwworm, respectively have historically been of the utmost concern to researchers in medical, livestock and entomological research fields. *C. hominivorax* is a highly damaging agricultural pest because it is a prominent cause of myiasis in both humans and livestock, and attacks both living and necrotic tissue on the organism it infests. *C. hominivorax* has been eradicated in the United States, and the less dangerous *Cochliomyia macellaria* has taken the place of *C. macellaria* for research purposes given that the two species share similar life histories. In order to ensure that the use of *C. macellaria* as a model organism is valid, any potential differences in life history between the two species must be explored. This experiment was designed to determine lifespan differences between the sexes of *C. macellaria*, and results obtained showed no significant difference between the lifespans of males and females when exposed to laboratory conditions. Given this information, researchers can logically deduce that similar lifespans between the sexes are most conducive to maximized efficiency of *C. macellaria*. This information can then be taken and compared to similar studies in *C. hominivorax* to determine whether models of the life history of *C. hominivorax* based on *C. macellaria* are valid as they are, or if they need to be adjusted.

Keywords: *Cochliomyia macellaria*, *Cochliomyia hominivorax*, longevity, sex, life history

The Primary Screwworm, *Cochliomyia hominivorax* Coquerel was, until it was eradicated in the United States, as serious health risk to both humans and animals. Unlike other flies, *C. hominivorax* maggots will feed on living tissue, rather than solely on carcasses or necrotic tissue on a living organism. Due to this, pest control programs in the past have focused on them, and so *C. hominivorax* has been eradicated from the United States (Bowman 2006). *Cochliomyia macellaria* Fabricius maggots will also infest living organisms, but only eat necrotic tissue and so are considered less dangerous. Otherwise, their life histories are considered to be very similar, and so *C. macellaria* is commonly used as a model for *C. hominivorax* in studies performed in the United States (Chaudhury

and Skoda 2013). However, there are aspects of the life cycles of both species that are not yet well explored, and could create discrepancies between the data from *C. macellaria* and the actual life history of *C. hominivorax*. Across species, it has long been noted that one sex will tend to outlive the other within a species. In polygamous species, this is generally believed to be the result of intense male interspecies competition for mating privileges which in turn limit necessity of extended lifespan in males. Magnitude of variation of longevity in the sexes of different species is consequently related to the magnitude of sex differences in the duration of time taken to achieve effective breeding in vertebrate animals (Clutton-Brock and Isvaran, 2007). Similarly, trends toward

female favored population dynamics are notable in the mantid *Iris oratoria* L. (Mantodea: Mantidae) (Maxwell, M. R., 1998). While this tendency has been assessed in a variety of vertebrate and invertebrate species, it has not been assessed in the secondary screwworm *Cochliomyia macellaria*. If there is a difference in longevity between sexes in *C. macellaria* and not *C. hominivorax*, then that could affect any comparisons between the life histories of the two species. This study was designed to determine whether a statistically significant difference (SPSS) exists between male and female *C. hominivorax*, which may later be used to assess continued appropriateness of *C. macellaria* as a representative species for *C. hominivorax* in scientific research.

Materials and Methods

Maggot specimens were collected from carrion found in College Station, TX, USA. The maggots were then reared to adulthood on food-grade bovine liver (Texas A&M Meat Science Center, College Station, TX), and were placed in a 30.5 x 30.5 x 30.5 cm cage (BioQuip Products Inc., Compton, CA) upon reaching adulthood. Adults were fed sugar (US Sugar Co., Inc., Buffalo, NY) and water, with bovine liver provided as a protein meal three days following adult eclosion. Bovine liver was provided again on day five following eclosion as an oviposition substrate. After females were allowed to oviposit, the eggs and liver were removed from the fly enclosure and maggots were allowed to mature. Liver and maggots was placed on sand (US Silica, Kosse, TX) beds in one-pint jars (TMs Ball Corporation, Fishers, IN), and extra liver was added as necessary until the maggots pupated. The pupae were then individually weighed and placed in portion cups (Dixie Consumer Products LLC, Atlanta, GA) and allowed to emerge. Upon emergence, the adult flies were sexed. Adults were then allowed to feed ad libitum on 0.05 cc of 10% sugar water (mixture of reverse osmosis water and table

sugar) until all adults were deceased. Exact adult lifespan was recorded and data was analyzed using a T-test in SPSS.

Results

Mean life expectancy of female flies was approximately 26.51613 days, while male average life expectancy was approximately 27.7931 days. Standard deviation for male and female data was 9.2803 and 10.9622, respectively. There was no significant difference between male and female life expectancy ($p=0.627$) (Fig 1).



Fig. 1 Captive male vs. female life expectancies in days

Discussion

Sexual dimorphism within a species has been assessed in a variety of species, and this study attempted to assess this principal in the case of *Cochliomyia macellaria*. It was determined that in *C. macellaria*, there was no statistically significant difference in the lifespan of males when compared with females reared in identical situations. Upon comparison to other research of a similar nature, it was determined that collected data is dissimilar to the lifespan of opposite sex *Drosophila melanogaster*. In *D. melanogaster*, females subjected to dietary restriction lived up to 60% longer than did male test subjects exposed to similar dietary circumstances (Magwere, Chapman and Partridge, 2003). While this study was aimed exclusively at consideration of lifespan of *C. macellaria* in laboratory conditions, future research could expand to consider the inclusion of dietary constraint as a limiting factor between sexes of *C. macellaria* lifespan, i.e. impact on lifespan of male versus female

flies in starved, rationed and ad libitum feeding conditions. Lack of consideration of feeding situation limits the scope of the study, but otherwise experimental limitations were minimal. Historically, *C. macellaria* has been used in research laboratories as a means by which to study *Cochliomyia hominivorax*, the primary screwworm, after it was eradicated from the United States. *C. macellaria* has proved a useful model for research involving *C. hominivorax* as the two species share largely common life histories and the secondary screwworm causes less damage to humans and livestock due to only feeding on dead tissue (Bowman 2006). This study provides an ad libitum feeding life expectancy model for both male and female *C. macellaria*, which theoretically could hold true for *C. hominivorax* as well. Data collection of a similar nature for *C. hominivorax* is required to determine applicability of these data to both species. With further research, conducted in a country where *C. hominivorax* is still present, these findings can be applied not only to advancement of information on *C. macellaria* but also *C. hominivorax*. This could potentially eliminate discrepancies in comparisons between research on *C. macellaria* and research on *C. hominivorax*. Given that male and female *C. macellaria* have statistically insignificant differences in lifespan under experimental conditions, control methods (potentially for both species) can theoretically be implemented with minimal consideration for life history differences between sexes. This could also be interpreted to suggest a reproductive advantage toward such similar life histories; breeding can occur at any point in either sex's life cycle, increasing the amount of time for successful matings. Human intervention of reproductive life cycle could thus reduce reproductive potential of the species. If this also applies to *C. hominivorax*, then this could be used to design a pest control program to be implemented in areas where it is still a medical and agricultural pest. Development of a considerable knowledge base for both species

and a comparison thereof is vital to continued research on both species, and knowledge of lifespan is of considerable importance to control of both species.

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