

# A longevity comparison in forensically important male flies (Fabricius) (Diptera:Calliphoridae)

Jakalynne Gosnell and Dr. Adrienne Brundage

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**Abstract:** Blowflies (Diptera: Calliphoridae) are a family of much importance to the fields of forensic and medical entomology. Blowflies can find decomposing flesh within minutes and are an important species used by forensic entomologists in determining a post-mortem interval (PMI). PMI may be used to estimate a time of death for a given individual and is a very common practice in the field of forensics. This study measured the differences in longevity between adult male *Chrysoma rufifacies* and *Cochliomyia macellaria* flies. Maggots were reared in a laboratory in order to properly measure their lifespan. A t-test was done to determine a p-value for the given data. It was found that *C. macellaria* adult male flies ( $M=27.7931$ ;  $SD= 10.962$ ) experience a greater longevity than *Ch. rufifacies* adult male flies ( $M=21$ ;  $SD=12.8027$ ). This information can be applicable in determining post-mortem intervals in future forensic entomology cases and for use in secondary myiasis in medical settings.

Keywords: *Cochliomyia macellaria*, *Chrysoma rufifacies*, forensic entomology, Calliphoridae longevity, post-mortem interval (PMI)

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Blowflies (Diptera: Calliphoridae) are an important family of flies in terms of medicine, veterinary medicine, and forensic science. There are many important species within this family, two of which were examined more closely in this study; *Cochliomyia macellaria* (Fabricius) and *Chrysoma rufifacies* (Macquart). These two fly species have been previously studied and are a competing species due to their commonality in food requirements, temperature tolerances, and seasonal behavior (Wells 1992). These two species are the most common summer-active fly species in central Texas (Mohr & Tomberlin 2014) and are among the first few species to arrive at decomposing carcasses (Campobasso

2001). These necrophagous species are important in forensic entomology because they are among the few species to actively participate in cadaver breakdown that directly speeds the rate of decay. Calliphoridae and Sarcophagidae are the dominant and first species to feed strictly on decomposing tissues. They are often followed by predators or parasites of secondary importance, which include Stratiomyidae flies and more Calliphoridae flies, more specifically *Chrysoma* spp. whose larvae are predaceous in their last stages of development (Campobasso, 2001). With this information, it is common practice for forensic entomologists to use *C. macellaria* and *Ch. rufifacies* in determining a post-

mortem interval. Post-mortem interval (PMI) is an estimate used in forensics that is synonymous with time of death. Investigators use a PMI as a minimum estimate since a death has occurred; never as an absolute time of death (Adair 2012). A post-mortem interval has two equally important components: the period of isolation, which is the time between death and the measurable arrival of any forensically important arthropods, and the time since colonization, which is the estimated age of insects collected off of a body (Adair 2012). This study attempted to evaluate the differences in longevity between *C. macellaria* and *Ch. rufifacies* males in order to understand differences in the biology amongst the two species. This information is useful to the field of forensics in that it can help to better determine a post-mortem interval with more in-depth knowledge of the main necrophagous species, which colonize earliest. This may also help in determining if a first or second generation is present upon time of examination.

In terms of medical importance, *C. macellaria* and *Ch. rufifacies* are some of the chief participants in secondary myiasis, the consumption of dead tissue. The practice of maggot debridement therapy (MDT) is used all over the world to treat dead and decayed tissue on living individuals and to promote healing. This use of larval treatment has been very safe, simple, and successful in treating a variety of chronic wounds under proper monitoring and supervision (Sherman 2000). A few common uses for maggot therapy are pressure ulcers, venous stasis ulcers, and neurovascular ulcers such as diabetic foot wounds, post-surgical wounds, and burns

(Sherman 2000). The species that is shown to have greater longevity may possibly be a better choice to rear in labs and could possibly live longer and in turn have more time to produce additional larval offspring to be used in maggot therapy. The hypothesis is that adult male *Cochliomyia macellaria* flies will experience greater longevity in comparison to adult male *Chrysoma rufifacies* flies. The null hypothesis is that adult male *Cochliomyia macellaria* flies will not experience greater longevity than adult male *Chrysoma rufifacies* flies.

## **Materials and Methods:**

*Cochliomyia macellaria* and *Chrysoma rufifacies* maggots were collected off of carrion found on the roadside in College Station, TX, USA. These maggots were used for the establishment of fly colonies for this study.

### *Fly rearing*

The maggots were raised on a diet of beef liver (Grant Park Custom Meats, Franklin Park, IL) until pupation occurred. The pupae were then moved into collapsible 12x12x12" (30.5 cm) insect cages for flies (Bioquip Inc., Compton, CA). The fly populations were fed dry table sugar (Sweeteners Plus, Lakeville, NY) and water to drink, ad libitum. Adult flies were given beef liver as a protein source at three days old and once they had reached five days old they were given beef liver as a place in which to oviposit.

### *Fly Development and Pupation*

Following oviposition, eggs remained on beef liver and maggots were allowed to grow. Beef liver was then placed on beds of sand (U.S. Silica, Frederick, MD) in 1-pint mason jars (Ball Co., Broomfield, Co). Beef liver was added as required by the maggots. After pupation, pupae were gathered and weighed one at a time and then placed in 2 oz. individual portion multi purpose cups with lids (Diamond, Jarden Co., Rye, NY). The cups were placed at room temperature and adults were allowed to emerge.

#### *Adult Emergence and data collection*

Once adults had emerged from pupae their sexes were individually determined. Adult flies were fed 0.05 cc of 10% sugar water (prepared by mixing sugar and reverse osmosis water) every day until they were deceased. The length of each adult's lifespan was recorded. Data was analyzed using a T-test. All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) (IBM, Armonk, NY, USA).

#### **Results:**

*Cochliomyia macellaria* males ( $M=27.7931$ ;  $SD= 10.962$ ) were shown to have a greater overall longevity than the *Chrysoma rufifacies* males ( $M=21$ ;  $SD=12.8027$ ) as shown by means and standard deviations. A T-test was performed using SPSS and a p-value of 0.02085 was found, this value is statistically significant for the given data.

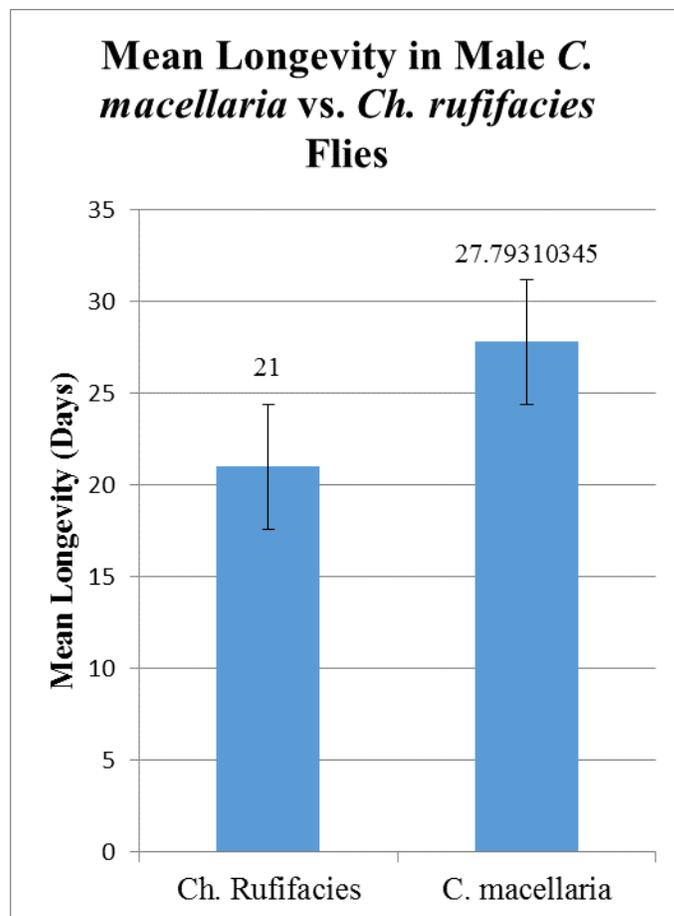


Fig. 1: A comparison of means for longevity in male *Cochliomyia macellaria* species and *Chrysoma rufifacies* species in Texas

#### **Discussion:**

In many species there is a trend of either the male or the female sex living longer than the other sex of that same species. This study disproved the null hypothesis that male *Ch. rufifacies* flies would live longer than male *C. macellaria* flies. Given the significance of the data recorded in this research it can be concluded that *C. macellaria* males would outlast *Ch. rufifacies* males in nature. In terms of forensic importance, the finding that *C. macellaria* males have a longer lifespan than *Ch.*

*rufifacies* males could be useful in situations where a corpse has been left to decompose for a longer amount of time. If *Ch. rufifacies* have a shorter average lifespan, then this species may have a lower population presence on a corpse by the time entomologists examine it and thus *C. macellaria* may be a more useful indicator in developing a minimum postmortem interval (PMI).

This information can be potentially important in terms of competition of resources between two of the most common and earliest arriving necrophagous species found on carrion and decaying flesh (Adair 2012) as well. This information can be useful especially in central Texas, where *Ch. rufifacies* and *C. macellaria* have been found to be the two main summer-active fly species found on carcasses. Carcass attendance patterns have been studied and differences are seen between species and sex of these two summer-active species (Mohr 2014). *Ch. Rufifacies* larvae are known to take longer to develop completely (Byrd 1997) than *C. macellaria* (Boatright 2010), this may indicate that *C. macellaria* is potentially more efficient at resource acquisition and utilization than *Ch. rufifacies* and thus may

possibly explain why they experience a greater average in longevity (Brundage *et. al*, 2014). Future research may also seek examine the longevity differences between *C. macellaria* and *C. homnivorax* species as well as between sexes to determine differences in primary myiasis producing flies and secondary myiasis producing flies, respectively.

The larvae of *C. macellaria* are one of the main species involved in secondary myiasis. In terms of veterinary and medical importance, we recognize that these flies feed on necrotic tissue and their presence can be managed with proper wound dressings and medical supervision. These species are valuable in the practice of larval therapy, which is also known as maggot debridement therapy (MDT) (Sherman 2000). Since it is known that *C. macellaria* outlive *Ch. rufifacies* they could possibly be a more competent species to use in this therapy. With that being said, it is important to know whether males or females live longer within species and future research could use this data to identify how these longevity differences impact reproductive cycles and mating between sexes within a given species.

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