

# Comparison of Adult Longevity of *Chrysomya rufifacies* (Macquart) and *Cochliomyia macellaria* (Fabricius) (Diptera: Calliphoridae)

Sam Shook and Dr. Adrienne Brundage

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**Abstract:** *Chrysomya rufifacies* (Macquart) and *Cochliomyia macellaria* (Fabricius) are two important insects in the field of forensic entomology. Due to their tendency to immediately colonize a corpse after death, a comparison of sample flies taken off of a corpse and estimates of the duration of different parts of their life cycle is a valuable tool for determining the post-mortem interval (PMI) of a body. In order to accurately determine the PMI, the estimate for the duration of all of the insects' life stages must be as accurate as possible. *Chrysomya rufifacies* larvae, in addition to feeding on carrion, are also facultative predators of other insects, including *C. macellaria* larvae. This predator-prey interaction of these species on a corpse in the wild could affect the development time of one or both species, and one factor that could affect their interactions is the relative adult longevity of each species. *Chrysomya rufifacies* were observed to have a larger adult body size than *C. macellaria*, and this study was performed to determine if *Ch. rufifacies* also has a greater adult longevity than *C. macellaria*. The flies of both species, born of wild caught specimens, were reared in a laboratory, and the adult lifespans of the flies were measured. It was found that the *C. macellaria* adults had a mean lifespan of 27.133 days, and the *Ch. rufifacies* adults had a mean lifespan of 23.426 days, which is a significant difference ( $p < 0.05$ ).

*Keywords:* *Chrysomya rufifacies*, *Cochliomyia macellaria*, longevity, adult

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A post-mortem interval (PMI), the minimum time elapsed from death to examination, is found by sampling the carrion feeding insects on the corpse, determining their stages of development, and comparing that information to the duration of those stages of development as determined by studies of laboratory colonies (Owings 2012). Flies in the family Calliphoridae, also known as blow flies, are usually the first ones to colonize a corpse. That small gap between death and oviposition makes them very valuable for

calculating a PMI that is as close to the actual time since death as possible (Byrd 1998).

*Cochliomyia macellaria* (Fabricius) and *Chrysomya rufifacies* (Macquart) are the two species of blow fly that dominate in the warm months in Texas, so understanding their life cycle is important to any forensic work that takes place during that time (Tenorio et al. 2003). While *C. macellaria* larvae only feed on carrion, *Ch. rufifacies* larvae are facultatively predaceous, often feeding on *C. macellaria* larvae (Rosa et al. 2006). This is

an issue for forensic entomologists, because predation by *Ch. rufifacies* can cause *C. macellaria* larvae to abandon the carrion and mature early, which changes their development time (Wells and Greenburg 1994). These interactions need to be understood, so that their effects on the insects can be quantified, and the prediction of a PMI can account for that effect. In order to understand how these species interact with each other, it is necessary to be able to compare different aspects of their biology. The researchers involved in this study noted that *Ch. rufifacies* adults tend to be larger than *C. macellaria*, and hypothesized that this may correlate to the *Ch. rufifacies* adults also having a longer lifespan. This study was conducted in order to measure the adult longevity of both species, and determine which is greater.

### **Materials and Methods**

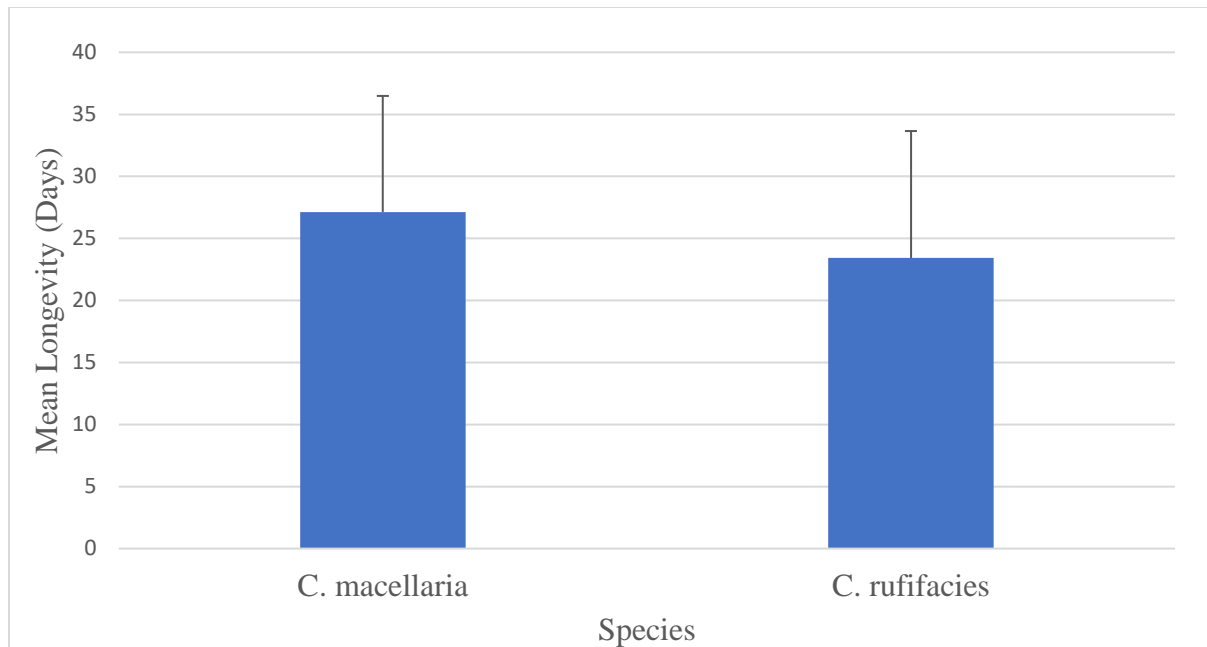
*Chrysomya rufifacies* and *Cochliomyia macellaria* larvae were taken from carrion found in College Station, TX, USA. These maggots were then placed on food grade beef liver (Spring Hill Farms, Anderson, TX) until they pupated, whereupon the pupae were placed in a 30.5 x 30.5 x 30.5 cm collapsible cage (Bioquip Products, Rancho Dominguez, CA) and allowed to emerge.

The adults were maintained in the same cages, with sugar (C&H, Crockett, CA), and water soaked cotton balls (Medline Industries, Northfield, IL) *ad libitum*. Three days after eclosion, the adults were given beef liver as a protein meal, and five days after eclosion the adults were allowed to oviposit on another batch of beef liver.

The eggs were left on the liver, and the liver was placed on beds of sand in 1 pint mason jars (Ball Canning, Broomfield, CO). Additional liver was added as the maggots needed it. After the maggots pupated, they were gathered and weighed individually. Then, each pupa was placed in an individual 2-ounce portion cup with a lid (Diamond, Fishers, IN) at room temperature and allowed to emerge. The adults were fed 0.05 cc of 10% sugar water every day until they died. The data was analyzed with a T-test in SPSS (SPSS Statistics, IBM Corp., 2013).

### **Results**

The *C. macellaria* adult lifespan (M: 27.133 SD: 9.353) was found to be significantly longer than that of the *Ch. rufifacies* adults (M: 23.426 SD: 10.228) ( $p = 0.0467 < 0.05$ ) (Figure 1)



**Fig. 1.** Mean adult longevity of *C. macellaria* and *C. rufifacies* in days.

### Discussion

The adult *C. macellaria* have a significantly greater longevity than adult *Ch. rufifacies*, which contradicts the hypothesis posed at the beginning of this study. There are several reasons why this may be the case, beyond basic physiological differences that would be impossible to predict without further research. While it is possible that body size does correlate positively to longevity, the statement that *Ch. rufifacies* adults are larger than *C. macellaria* adults was based on personal observations, and does not have any support from other research. This means that they may not actually be larger at all, and these results don't give any conclusions about how size and longevity are related. In another study comparing *C. macellaria* to a related species *Ch. rufifacies*, *Chrysomya megacephala*, the *Ch. megacephala* were found to have a significantly greater adult lifespan and size in comparison to *C. macellaria* (Barbosa et al. 2016). This suggests that *Ch. rufifacies* could be larger, although it isn't definitive as there could be a significant size difference between two species in a genus. Future research could be done to measure the relative size of the two *Chrysomya* species. If they are of similar size, then researchers need to find what causes the differences in longevity.

*Chrysomya rufifacies* larvae often feed on other insects present on carrion, including *C. macellaria* larvae (Rosa et al. 2006), and it is possible that this could explain the differences in longevity found in this laboratory setup. While the larvae don't need prey to reach adulthood, insect prey may provide a valuable resource that they have difficulty synthesizing themselves or extracting from carrion. They would still get enough to survive, but the relative lack of it would negatively impact the health of the resulting adult fly, and thus decrease its lifespan. Further research could determine whether or not this is the case by studying the relative lifespan of *Ch. rufifacies* larvae that are raised on only carrion versus those that are also given other insects as food.

If *C. macellaria* actually do live longer, then this could lead to differences in the timing of their life cycle from *Ch. rufifacies*. If a predator and prey's period of maximum population, in this case when the population of the larvae of a species on a carcass peaks, don't match up, then this can have an effect on the health and behavior of both species (Durant et al. 2005). For example, if a majority of *C. macellaria* larvae develop during a time when there are few *Ch. rufifacies* larvae present, then they won't abandon the carcass early like they would otherwise; this then increases their time spent as larvae (Wells and Greenburg 1994). Conversely, fewer *C. macellaria* present during the development of *Ch. rufifacies* means that less prey is available, which could have a negative impact on their health.

Any change to the development time that results from these interactions must be accounted for when calculating the post-mortem interval (PMI) of a corpse. In forensics, an accurate timeline of events is important to determining the facts of a case. The time of death is a central point of that timeline, and the PMI is a tool commonly used to estimate it (Owings 2012). When calculating a PMI, it is necessary to account for any factors that could influence the resulting estimate. This includes the way the species of insect involved interact with each other. This study has helped quantify one factor that may affect the outcome of those interactions, but further research is needed to gain a complete picture.

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