

Adult Longevity of *Chrysomya rufifacies* (Macquart) (Diptera: Calliphoridae) by Sex

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Abstract: *Chrysomya rufifacies* (Macquart) (Diptera: Calliphoridae) is a species of blow fly with significance to the field of forensic entomology due to its use in establishing post mortem intervals. The species also plays a large role in medicine through maggot debridement therapy (MDT). Knowing the lifespan of *Ch. rufifacies* is vital to determining post mortem interval. To better understand *Ch. rufifacies* lifespans, this study seeks to determine if the adult lifespan of male *Ch. rufifacies* differs significantly from the lifespan of female *Ch. rufifacies*. Wild *Ch. rufifacies* maggots were collected and allowed to pupate. After emergence, the adults were sexed and the number of days the adults lived were recorded. The resulting data was analyzed using a T-test in the SPSS statistics program. Results showed males to have a significantly longer lifespan than females.

Keywords: *Chrysomya rufifacies*, Calliphoridae, forensic entomology, longevity, sex

The activity of insects is of value during forensic investigations. Blow flies (Diptera: Calliphoridae) are often among the first species to colonize a carcass. They play a major role in the process of decomposition. Female blow flies oviposit on a suitable recently-dead carcass in soft tissues such as the eyes and mouth, in areas of moisture, in open wounds, and in pooling blood (Johansen et al 2014). Maggots then develop in the body and pupate in the soil (Catts et al 1992). Due to their predictable life cycles, blow flies can provide a reliable method of calculating a minimum post-mortem interval (mPMI) in forensic death investigations (Acikgoz et al. 201). The post-mortem interval is defined as the colonization success of an insect on a human or animal carcass (Joy et al 2006).

Using this calculation, they can then determine a time of death.

Along with mPMI, blow flies can aid in determining the locations of trauma on a body. Because blow flies feed on injured tissue, fly larvae are seen at sites of pooled blood and sizable tissue openings, indicating injury (Johansen et al 2014). In addition, blow flies are one of the first in a succession of arthropod species that decompose a carcass (Tabor et al 2004). Starting with the blow flies and other immediate carrion-feeding arthropods, a carcass will be broken down by a predictable sequence of decomposers (Tabor et al 2004).

Chrysomya rufifacies is a species of blow fly commonly known as the hairy maggot blow fly (Baumgartner et al 1993). The species has

a relatively short lifecycle, and prefers warm weather, however, in recent years, the species has spread over much of the United States (Baumgartner et al 1993). The species plays a large role in medicine through maggot debridement therapy (MDT) (Brundage 2016). Blow fly maggots are capable of secreting antimicrobial particles that kill bacteria and debride the wound (Brundage et al 2016). Once the wound is disinfected, they stimulate the growth of new healthy tissue (Brundage et al 2016). *Ch. rufifacies* have a huge impact on both the forensic entomological and medical worlds.

Many species of these important blow flies have differing lifespans between males and females. To better understand *Ch. rufifacies*, this study seeks to determine if the adult lifespan of male *Ch. rufifacies* differs significantly from the lifespan of female *Ch. rufifacies*.

Materials and Methods

Maggot Rearing. Wild *Ch. rufifacies* maggots were collected from carrion outside of 1300 Harvey Mitchell Parkway S, College Station, TX, USA. The maggots were raised on 50 g of food-grade cow liver (Wayne Food Co, Juneau, AR) and allowed to pupate. Pupae were maintained in collapsible adult fly cages measuring 12" x 12" x 12" (BioQuip, Rancho Dominguez, CA) under a 12:12 L:D cycle. Adult flies were fed dry sugar (Domino Foods, Inc., Brooklyn, NY) and reverse osmosis water, *ad libitum*. At three days old, the adult flies were given 50 g food grade cow liver for a protein meal. At five days old, the adult flies in the colony

were given 10 g of fresh cow liver on which to oviposit.

Eggs were left on the liver, and the maggots were allowed to develop. The liver and the maggots were moved to a one pint mason jars (Ball Corporation, Broomfield, Colorado) and placed on top of sand (Quikrete International, Inc., Atlanta, Georgia). Additional beef liver was provided to the maggots, *ad libitum*.

Maggots were allowed to pupate. The pupae were gathered and weighed one at a time. The pupae were then placed into a two oz individual portion cups with lids (Diamond Foods, Inc., Stockton, California) and placed at room temperature to emerge.

Sexing the Maggots. After emergence, the adults were sexed and fed 0.05 cc of 10% sugar water (created by mixing sugar with reverse osmosis water) daily until death. The number of days the adults lived were recorded and the resulting data was analyzed using a T-test in the SPSS statistics program.

Results

The resulting data revealed that male *Ch. rufifacies* have a significantly longer lifespan than females. Males were seen to have an approximated mean lifespan of 34.4 days, while the female population had an approximately mean lifespan of 23.7 days (Figure 1). The T-test performed in SPSS showed that the lifespan of males is significantly longer from the lifespan of females (P-value = 0.000499004).

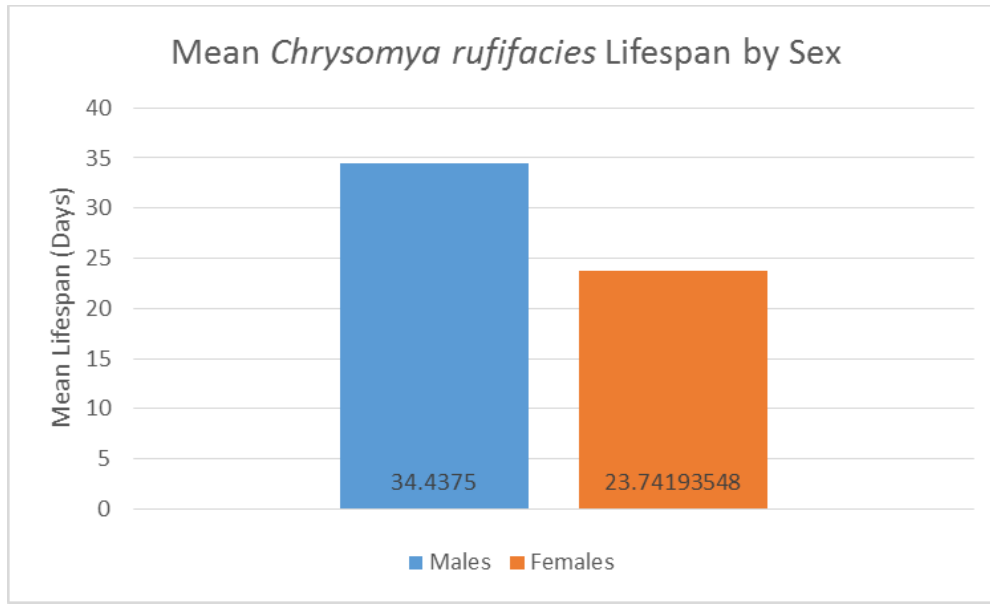


Fig. 1. Mean lifespan of male and female *Ch. rufifacies* (*P<0.01, SPSS t-test)

Discussion

Blow flies, as discussed previously, are vastly used in the medicocriminal entomological world (Joy 2006). Their decaying tissue inhabitation has become a great asset for humans from treating injuries to calculating times of death (Joy 2006). More knowledge on the blow flies used daily should be done to get to understand the insect and its full potential. Knowing the lifespan of *Ch. rufifacies* is helpful in better understanding the developmental patterns of these helpful creatures (Joy et al 2006).

Due to *Ch. rufifacies* status as an invasive species, the species is becoming increasingly dominant as a decomposer as the species spreads across the United States (Baumgartner et al 1984). Knowing that adult male *Ch. rufifacies* live significantly longer than the females will aid in forensic investigation and can possibly lead to better mPMI calculations.

Chrysomya rufifacies is also a species known to cause myiasis in humans and in animals (James 1947). The species is highly used in maggot debridement therapy (Bram et al 2000). Due to the medical importance of the species, knowledge of the developmental cycle is important.

Although results showed significant results, it is recommended to repeat this experiment in case of possible errors. The males and females could have been sexed incorrectly making the statistical analyses incorrect. Other possible errors could have been in identifying the *Ch. rufifacies* specimen. Because of possible errors, this experiment should be repeated for accuracy.

Besides repeating this experiment, further research could focus on narrowing down the developmental cycle of *Ch. rufifacies* to an even more exact timeline. Along with this, other research could potentially be studied to determine lifespan by sex of other blow fly species, as well as the lifespans of other forensically significant species.

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