Longevity of Male *Chrysomya rufifacies* (Diptera: Calliphoridae) (Macquart) and Male *Cochliomyia macellaria* (Diptera: Calliphoridae) (Fabricus) Adults

J. C. Shodrock & Dr. Adrienne Brundage
Texas A&M University, Department of Entomology
Edited by: Vivian Chen

Abstract: There are certain morphological features and individual characteristics that are special to varying species that affect their lifecycle through every phase. Certainly, not every species will live for the same amount of time from emergence to death. In our case, there are two species of interest for our experiment. These two species are *Chrysomya rufifacies* (Diptera: Calliphoridae) (Macquart) and *Cochliomyia macellaria* (Diptera: Calliphoridae) (Fabricus). Both fly species have a detrimental impact on the livestock industry. They enjoy feeding on dead tissue after a sustained injury and are the cause of myiasis presence in several livestock species. For this reason, and many more, they are a concern economically. Through general observations, we have noticed that adult *Chrysomya rufifacies* appear to be much bigger than *Cochliomyia macellaria* adults are, and wondered if this meant there would be a distinction in longevity of adult life and if the variation in size is indicative of adulthood longevity. Wild maggots were obtained and raised on food-grade bovine liver. The adults were given a sugar water mixture daily until death, in which the number of days lived by each adult was recorded. The data was analyzed using a T-test in SPSS. Analyzing the data this way allowed us to obtain and compare measurements of mean, standard deviation, standard error, and the P value. Our results indicate that *Cochliomyia macellaria* (p=.0467) adults live much longer than *Chrysomya rufifacies* adults do, and that size is not indicative of longer life. Further research is needed to evaluate varying results for these two species, as well as conduct new experiments with other forensically important insect species.

Key Words: *interval, adult, forensic, Chrysomya rufifacies, Cochliomyia macellaria*

Both *Cochliomyia macellaria* and *Chrysomya rufifacies* belong to the family Calliphoridae. They are similar in many ways, but do differ in appearance and other factures of physical extremities. *Cochliomyia macellaria* is referred to as the Secondary Screwworm and has a large impact on the livestock industry. As of recently, they are focused on as another species that is a good indicator of post-mortem intervals as they feed on decaying matter and damaged tissue (Byrd 2014). They are located throughout the United States, but are especially abundant in the southeastern United States year around. Their body is a metallic green-blue with three dark stripes on the dorsal side of the thorax.

Chrysomya rufifacies is known as the Hairy Maggot Blow Fly, metallic green in appearance, and is a significant species in forensic entomology for establishing accurate post-mortem intervals. The genus *Chrysomya* itself, is composed of multiple species and is known as the Old-World screwworm. *Chrysomya rufifacies* is located on a large geographical scale and prefers warmer weather. They would rather inhabit a large carcass animal as opposed to a small carcass animal (Byrd 2014).

Both species of flies are of critical importance in the medical, economic, and forensic fields. Their impact in these fields individually affects the other fields in an adverse manner. Massive economic losses result from myiasis and disease transmission from infesting the tissue of animals and/or humans. After an injury occurs, the secondary screwworm will invade the dead tissue (Byrd 2014).

The purpose of this experiment was to determine just how long the adults of the two species in question will live. With this information, we can better estimate as to how long the two species can live as an adult and will ultimately allow us to be more accurate with our post-mortem interval identification. Longevity studies also provide us with the ability to differentiate factors that allow species to grow at different rates compared to other species (Byrd and Butler 1996). Examples of these factors include temperature, inclement weather, the food source abundance level, etc. (Byrd 1995).

Materials & Methods

Wild maggots were collected from carrion on the side of Highway 2818 in College Station, TX, USA. These maggots were raised on food-grade bovine liver, and the adults were placed in a 12 x 12 x 12 cage from Bioquip (Bioquip, Gardena, California). The adults were fed a mixture of sugar (Great Value, Dallas/Fort Worth, Texas) and water. Bovine liver was administered to the adults when they were three days old for a protein meal, and at five days on which to oviposit. Eggs were left on the liver which allowed the maggots to grow. The liver was placed on beds of sand in 1 pint mason jars (Ball, Muncie, Indiana). Extra liver was added as needed. During pupation, the pupae were gathered and weighed individually. Pupae were placed in two ounce individually portioned cups (Diamond, Cedar Hill, Texas) at room temperature until emergence took place. After emergence, the adults were sexed. Adults were fed 0.05 cc of 10% sugar water (mixture of sugar with reverse osmosis water) daily until the adults perished. The days lived by each adult were recorded for further analysis. The data was analyzed by using a T-test in a Statistical Package for the Social Sciences (SPSS) (IBM 2017).

Results

Our results prove that *Cochliomyia macellaria* adults live significantly longer than *Chrysomya rufifacies* adults and that size is not a factor in living longer. For *Cochliomyia macellaria*, the mean was 27.13 days, the standard deviation was 9.35 (see Figure 1), the standard error was 1.68, and p=0.0467. These values bested the values gathered for *Chrysomya rufifacies* in every category. The values for *Chrysomya rufifacies* were as follows – the mean was 23.43 days, the standard deviation was 10.23, the standard error was 1.90, and the P value was not determined to be relevant as *Cochliomyia macellaria* were determined to have greater longevity.

Table 1. Longevity (Days) of Adult Male *C. rufifacies* and Adult Male *C. macellaria*

Adult Longevity (Days)

Commented [VC1]: I am kind of confused as to what the numbers in each little row represents. Are they the number of alive adults for each day? If it is, I would suggest labeling the table clearer because this table took few minutes for me to figure it out.

Male C. rufifacies		Male C. macellaria	
7	12	1	32
7	12	32	35
8	12	7	42
7	4	29	32
8	29	17	32
7	17	38	31
22	29	40	
7	29	25	
17	13	26	
22	29	40	
29	47	29	
12	32	7	
26	39	32	
13	28	35	
26	45	20	
10	39	22	
12	35	9	
12	20	41	
12	46	32	
9	32	39	
13	31	32	
10	38	29	
4	38	20	

Discussion

The purpose of this experiment was to obtain an average number of days lived for the *Cochliomyia macellaria* and *Chrysomya rufifacies* fly species to better understand their life cycles. In the real world, we as entomologists can apply this and will be able to better identify post-mortem interval points when one, or both, of these fly species are present on a decaying carcass. This will greatly benefit the forensic field and will provide accurate information in court cases where there was a murder, which will help identify the correct suspect.

I believe that the reason *Cochliomyia macellaria* adults live longer than *Chrysomya rufifacies* adults do is due to an evolutionary trait. When *Cochliomyia macellaria* colonize a resource within a day or two after *Chrysomya rufifacies*, a 20-70% decrease of survivorship, pupal weight, and fecundity occurs (Brundage 2014). Arriving early on a resource and developing quickly has evolved over time and has allowed the population to sustain itself, considering the third instar of *Chrysomya rufifacies* is a facultative predator of the *Cochliomyia macellaria* larvae (Brundage 2014).

Commented [VC2]: Were both species feeding and laying their eggs on the same bovine liver at the same time? Or did C. rufifacies eggs arrived on it first then C. macellaria came since we see the decrease of male adults of C. macellaria in the first two days?

One major weakness of this experiment is that only bovine liver was used as a protein source and ovipositional medium. Other animal meat and flesh from decaying carcasses should be used to add validity to the findings. This would provide a real-world simulation as to how these fly species would survive and reproduce on a realistic carcass, and a great focal point for future research endeavors. The greatest strength of this experiment is that we now have a realistic mean of the maximum amount of days a portion of these fly species would live. As mentioned before, this information is pivotal in the forensic field.

Further research should be conducted to attempt to gather similar results for these two species, as well as conduct new experiments with other forensically important insect species. This will enhance our knowledge of the life cycles of these insects, which will only ease the post-mortem interval identification process. The world of forensic entomology is constantly evolving. As we better understand how to apply the unique features of some profound insect species, our world, and the way we live will be simplified. If we continue to press the bounds of entomology, and seek answers to questions we have, insects can be major players in our daily lives.

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