

Sexual Dimorphism of Pupal Size in Calliphorid Carrion Feeders (Diptera:Calliphoridae)

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Abstract:

Chrysomya rufifacies (Macquart) (Diptera:Calliphoridae) and *Cochliomyia macellaria* (Fabricius) (Diptera:Calliphoridae) are two Calliphorid carrion feeding species of significant importance in forensic investigations. Pupal weight was predicted to be an effective indicator of sex and species identification between the two related species when reared in a laboratory. In order to test the effectiveness in the field, wild maggots of both species were reared and the pupae of their offspring were weighed and sexed. There was no significant weight difference found between male and female pupae of both species. However when each species was compared to the other, it was observed that male and female pupae of *Ch. rufifacies* weighed significantly more than their *C. macellaria* counterparts. These results could simplify the identification of species at the pupal stage, thereby expediting research involving the two species.

Keywords: *Chrysomya rufifacies*, *Cochliomyia macellaria*, pupal weight

Chrysomya rufifacies and *Cochliomyia macellaria* are two Calliphorid species that are especially useful in forensic investigations. *Cochliomyia macellaria*, or the "Secondary Screwworm," is generally regarded as a carrion feeder (Hall 1948), though it can also be found in live animals as an agent of myiasis (Harrison 1968). *Chrysomya rufifacies* larvae also feed on carrion; however, when dead flesh is scarce, the larvae become predators of the other carrion feeders located on the carcass, including *C. macellaria* (Wells 1992). *Ch. rufifacies* is also an agent of myiasis in both humans and livestock, which occurs when the female Diptera deposit their eggs into open wounds and the larvae then feed on flesh (Gagne 1982). Both species are particularly

useful in determining the post-mortem interval in forensic investigations (Goff 1988). *C. macellaria* are usually the primary colonizer, arriving quickly after death (Tomberlin 1998). *Ch. rufifacies* is the secondary colonizer, and competes with the established *C. macellaria* for food (Wells, 1992). The composition of insects on the dead body along with the development of the maggots helps to identify the time of death.

Rearing of these species in a laboratory setting is of particular importance in these fields of forensics and entomology. This is usually accomplished by collecting wild larvae from carrion and then initiating colony formation. The intent of this experiment is to determine whether or not pupal weight is a reliable indicator of species

and sex between these two calliphorid species.

Materials and Methods:

Wild maggots were collected from carrion on the side of a roadway in College Station, Texas. The maggots were then reared on food grade bovine liver until pupation. Adult flies were placed in a 12x12x12 Bioquip (Rancho Dominguez, CA) cage and fed sugar and water for three days. The flies were then given bovine liver as a protein meal and two days later were given more liver for oviposition.

After oviposition, eggs were left on the liver. The liver was placed in one pint Ball brand mason jars (Daleville, IN) and the maggots were allowed to hatch. The maggots were given additional bovine liver to feed on ad libitum. After pupation, each pupa was weighed individually, and then placed in a 2 oz Diamond brand cup (Daleville, IN). The pupae were kept at room temperature, and were sexed after emergence.

Upon completion of the weighing and sexing, a T test was performed in order to determine the significance of the data.

Results:

After rearing multiple groups of flies, it was observed that the *Ch. rufifacies* pupae were generally larger than those of *C. macellaria* and that the females of both species were larger than the males. The average weight of a male *C. macellaria* pupa was 0.0433 grams and the average female pupa weighed 0.0426 grams. For *Ch. rufifacies*, the average male pupa weighed 0.0652 grams whereas the average female pupa weighed 0.0619 grams.

In order to determine the significance of the difference between groups, a T test was performed, comparing the groups. When

comparing the male and female pupae of *C. macellaria*, the difference in weights was not significant ($p=0.68$). When doing the same for *Ch. rufifacies*, the difference was also not significant ($p=0.22$). There was no observed significant difference between the pupal weights when comparing the sexes.

When comparing the male pupae of *Ch. rufifacies* to the males of *C. macellaria*, the P value observed was significantly less than 0.01. When doing the same for the female pupae of the 2 species, the observed P value was also less than 0.01. Based on these values there is a significant difference in pupal weight between the 2 species.

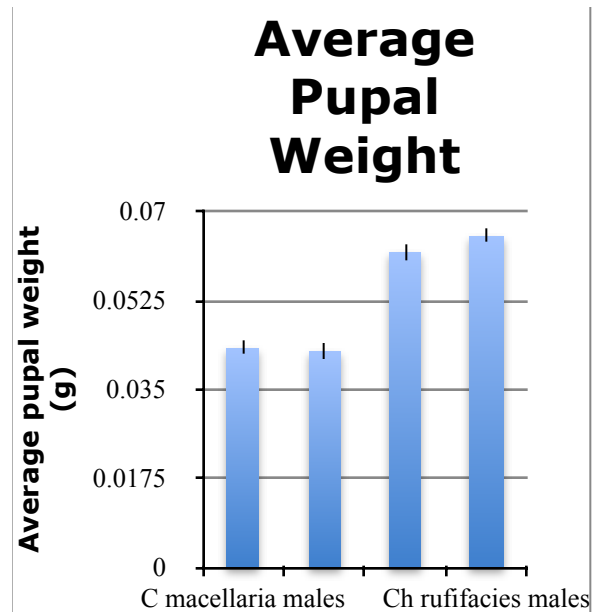


Figure 1. The average pupal weights.

Discussion:

The differences in pupal weight between male and female pupae of both species are not statistically significant. The initial assumption was that adult females tend to weigh more, presumably because of the added weight of the female reproductive system. This was proven to be false by the observed data.

As was predicted, the *Ch. rufifacies* weighed significantly more than the *C. macellaria*. The observed larval difference also extended to the pupa in this instance. As a result, it can be concluded that pupal size could be used as an indicator of species when differentiating between *Ch. rufifacies* and *C. macellaria*. It can also be concluded that pupal size can not be used as an effective differentiating factor between the sexes amongst either of these species.

These results can help to expedite research involving laboratory rearing of *Ch. rufifacies* and *C. macellaria*. If identification time can be shortened, results of other

experiments can be achieved at a faster pace allowing for more advancements in forensic investigations and myiasis prevention.

The results also could expedite forensic investigations. The composition of species located on a corpse is one of the primary indicators of time of death. Since these two species are usually the first insects to arrive at a body, understanding the relative proportion of *C. macellaria* and *Ch. Rufifacies* is of importance to forensic examiners. By using the pupal weight to differentiate between species, investigators would conceivably be able to determine the death interval more quickly.

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