

# The Use of Bloodmeal as A Substitute for Fresh Blood in Forensically Important Fly Research

Macy Strain, Dr. Adrienne Brundage

*Texas A&M University*

Editor: Miriam Torres

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**Abstract:** In the field of forensic entomology, it is incredibly important to be researching the impact that different environmental and bodily factors have on forensically important flies and their growth, development, and colonization of decaying remains. The evidence that these insects provide could be the difference between someone walking free and remaining in prison for the rest of their lives, so it is imperative that the science behind time of colonization calculations is up-to-date and accurate. Blood is often needed in research relating to forensically important flies, but it is often inconvenient and difficult to obtain, especially for researchers with few resources, such as undergraduate students. Blood meal, a form of dried blood, could be a breakthrough in overcoming these challenges, as it is a lot easier to obtain and store. If properly rehydrated, it could be used as an attractant for adults, a food source for larvae, and chemical additives could be put in it to study the effects of different chemicals on the attraction or growth rate of forensically important flies without having to worry about obtaining and using fresh blood.

**Keywords:** Blood, flies, forensic, larvae, time of colonization

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Insect evidence at a crime scene is crucial to criminal investigations, especially in instances of homicide, neglect, and abuse (Amendt et al. 2011). Often, the insects that give the most information at a crime scene are the flies, deemed forensically important flies. These flies mostly belong to the families *Calliphoridae* - blow flies, *Sarcophagidae* - flesh flies, and *Muscidae* - house flies (Joseph et al. 2011). These flies are attracted to decaying matter and lay their eggs on such (Tomberlin 2016), so in homicide investigations, this means they are attracted to the cadaver at a crime scene. These eggs hatch into larvae, and the larvae feed on the decaying matter until they are ready to pupate. Crime scene technicians can collect these larvae and send them to a forensic

entomologist, who can determine an interval for how long the larvae have been on the cadaver based on their larval instar (Brundage 2020). This interval can give investigators an estimate as to when a person may have died. Different environmental factors and conditions of the body can affect the access and development of these forensically important flies and their larvae, such as temperature (Ames and Turner 2003), season, toxins in the body at the time of death (Goff et al. 1994), and whether the body was inside or outside (Reibe and Madea 2010). There have also been studies on cadavers found in suitcases and how this impacts insect colonization (Bhadra 2014). Studying the effects of these different conditions on colonization and development is important to

ensure accuracy of time of colonization calculations, as this evidence could be the difference between someone walking free and spending their life in prison in court. Experiments researching the impact of different conditions of the body may require fresh blood, which, especially for researchers with less access to resources, can be difficult to obtain and store for the duration of the experiment. Bloodmeal, a form of dried blood usually used for gardening (Carol 2006), is much easier to obtain and store than fresh blood. If a method could be developed to be able to use blood meal in this research instead of fresh blood, it could make research in this field much easier in the long run. Because blood meal is simply a dried form of fresh blood and contains all the nutrients and hemoglobin that fresh blood would contain (Ciavatta et al. 1997), I think both adult flies and fly larvae would have no preference for fresh blood over blood meal and, if prepared in the right way, it could be used as a substitute for fresh blood.

### **Materials and Methods**

To test whether forensically important fly larvae would eat bloodmeal as opposed to fresh blood, a blood gelatin could be made and used as a medium for raising fly larvae. To do this, powdered, unflavored gelatin mix, water, and bloodmeal could be obtained to create a solid substance for the larvae to eat. Gelatin is usually made by mixing gelatin powder with boiling water, stirring until dissolved, and then adding more room-temperature water to the bowl and letting it set in the fridge for several hours. To make gelatin with the bloodmeal, you could add bloodmeal to the boiling water, stir it, and then dissolve gelatin powder in the boiling water and bloodmeal mixture. Then, pour the room-temperature water into the hot water like normal and let it set in the fridge for several hours. To obtain fly eggs, cans of wet

cat food or liver could be set out for several hours. Forensically important flies will lay eggs on these things, and they can be collected to rear during the experiment. Once fly eggs have been obtained and the bloodmeal gelatin has set in the fridge, a bin could be created to raise the fly larvae in. To do this, a large bin could be filled with sand and three 3' by 3' squares of bloodmeal gelatin could be placed in the bin. Then, the collected fly eggs could be added to the bin and the bin could be placed inside a pillowcase to keep it covered. After a couple of days, the bin could be checked to see if the hatched fly larvae have been eating the bloodmeal gelatin.

### **Discussion**

If bloodmeal could successfully be used as a substitute for fresh blood in forensic entomology research, it could have many potential applications. If it is determined that fly larvae will eat bloodmeal as opposed to fresh blood, this technique could be used with additives, such as glucose or alcohol, to study the effects of different chemicals on the growth and survival rate of forensically important fly larvae. If a technique could be developed to rehydrate this form of dried blood, it could also be used as an attractant for adult flies to study the attractancy or deterrence of adult flies to different chemical additives. The use of bloodmeal could be a more convenient substitute for fresh blood, which requires the immediate slaughter of an animal to obtain and is difficult to store. This could be a simple solution for researchers with less access to materials, such as undergraduate students. All these potential uses for bloodmeal could help to better the accuracy of time of colonization calculations used in forensic investigations, which ultimately, could allow us as a society to be a bit more confident in the decisions of the justice system.

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