



## A Simple Classroom Experiment on Food Lure Behaviour in Dipteran Insects

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Dipteran insects like houseflies, fruit flies and mosquitoes are well known for their strong attraction towards different odours and food sources in the environment. Fruit flies generally prefer fermenting, sugary and fruity materials, while houseflies are attracted to decaying organic matter, sweets and a variety of human foods. Mosquitoes, on the other hand, are classically known to locate their hosts using cues like body heat, exhaled carbon dioxide, lactic acid and specific skin odours rather than solid food items like chocolates. However, many studies also show that both male and female mosquitoes regularly feed on plant nectar and other sugar sources for energy, indicating a strong basic requirement and attraction towards sugar in their ecology.

### Introduction

To demonstrate the concept of food lures in insect pest management and to create curiosity about insect behaviour among students, a simple classroom experiment was conducted in 3<sup>rd</sup> year B.Sc. (Hons.) Agriculture on 01 September 2025. Two commonly available chocolates with students, Alpenliebe butter caramel and Alpenliebe strawberry flavour, were used as food baits and kept openly in the classroom for 30 minutes. After this exposure period, the observation was that one *Drosophila* (fruit fly) and one mosquito were attracted towards the Alpenliebe butter caramel chocolate (Fig. 1), while two houseflies were attracted towards the Alpenliebe strawberry flavoured chocolate (Fig. 2). Usually, attraction of Dipteran flies to sweet foods is a common and expected phenomenon, but observing a mosquito directly visiting chocolate was a surprising and scientifically interesting event. Mosquitoes are typically reported to be guided towards humans by body temperature, CO<sub>2</sub>, lactic acid and specific skin-derived volatiles rather than confectionery items. The present classroom observation therefore raises two scientific questions:

- 1) Why was a mosquito attracted towards a butter caramel chocolate?
- 2) When both chocolates were sweet, why did houseflies prefer strawberry flavour while *Drosophila* and mosquito visited butter caramel?

### Classroom observation

All insects are belong to order Diptera, but their habitats and food habits are normally very different. Fruit flies are associated with fermenting fruits and sugary sources, houseflies with filth and a wide range of human food, and mosquitoes mainly with nectar and vertebrate blood. Yet, in this small experiment, they responded differently to the two sweet baits,

indicating that subtle differences in smell and flavour profile of the chocolates may be influencing their behaviour.



Fig 1. Drosophila and mosquito on butter caramel



Fig 2. Houseflies on strawberry flavour

### Sugar feeding in mosquitoes

Both male and female mosquitoes need sugar (from nectar, plant juices, fruit, etc.) as an energy source, blood is mainly for egg production in females (Marsha, 2013). Field and lab studies show that a large proportion of *Aedes* sp. mosquitoes feed on plant/fruit derived sugars within 24 hours, and sugar meals can change their survival, blood feeding frequency and activity (Elina and Matthew, 2020). Research on fruit scents shows that *Aedes aegypti* mosquitoes prefer some fruits (mango, guava, banana, peach) over others, and these preferences depend on the exact combination and proportion of volatile compounds in the scent. This means, mosquito attraction is not only blood and CO<sub>2</sub>. Mosquitoes are naturally attracted to certain sweet plant and fruit odours, and their olfactory system can distinguish between different scent blends (Melissa *et al.* 2025).

### Sweet taste and food odours in Drosophila

*Drosophila melanogaster* and related fruit flies are strongly attracted to fermenting and sugary substrates, guided mainly by fruit and yeast volatiles (Paul *et al.* 2012). Fruit flies have many gustatory receptors specifically tuned to sugars, activation of these sweet neurons triggers proboscis extension and feeding behaviour (Jesse Slone, 2007). Experimental studies show that food derived volatiles (for example, apple cider or specific esters) significantly increase feeding on sugar solutions and help flies accept even slightly bitter food, showing that smell strongly modulates feeding (Juan Huang and Larry, 2021). So, for *Drosophila*, both sweetness and the quality of smell (which chemicals, which concentration) decide their attraction (Carolina and Kristin, 2019).

### Houseflies and preference for fruity strawberry aroma

Houseflies (*Musca domestica*) are generalist feeders and can respond to a wide range of food odours, including sweet, fruity and decomposing materials (Juan and Larry, 2021). Strawberry flavour chocolates contain fruit like volatile esters that mimic the aroma of ripe strawberry, and scientific work on strawberry fruits shows that strawberry volatiles, especially esters, are major determinants of fruit aroma and insect attraction (Rayne *et al.* 2022). Research on fruit flies and other Dipterans has demonstrated that different volatile blends from strawberry cultivars and ripening stages can significantly affect attraction and ovipositional choices, with sweeter, more aromatic fruits often preferred (Guillermo *et al.* 2023). Thus, the two houseflies choosing the strawberry flavoured chocolate may reflect a higher attractiveness of its fruity volatile blend compared to the relatively heavier, buttery caramel odour for these generalist flies.

## Possible reasons of observation

Caramel or “toffee” flavours usually contain volatile compounds with caramelized, butter and fruity notes (for example lactones, esters, aldehydes) which can resemble some natural plant or fruit odours (Lauren, 2013). Some attractant odours for mosquitoes have been described as smelling like caramelized chocolate or fruity sweets, and these compounds can activate mosquito olfactory neurons in a way similar to CO<sub>2</sub> related or host related cues (Alyssa, 2013). Strawberry flavour, on the other hand, is often dominated by a few synthetic fruity esters that may or may not match the preferred odour profile for drosophila or mosquitoes (Paul *et al.* 2012). Mosquito and Drosophila olfactory systems are highly sensitive to proportion of individual compounds, even small change in a single compound can convert an attractive odour into a neutral one (Melissa *et al.* 2025). Therefore, it is scientifically reasonable that, Butter caramel Alpenliebe may be emitting a volatile blend that fits better with the innate “attraction template” of both insects. Strawberry Alpenliebe may be sweet in taste, but its volatile profile is less attractive or even neutral for these species.

## Educational significance of the observation

This simple classroom activity demonstrates several important scientific and extension messages for agriculture and entomology students. Different dipteran insects, though belonging to the same order, show different preferences (Fig. 1 & 2) to food lures based on their ecology, olfactory systems and nutritional needs. Subtle changes in volatile chemical composition (caramel vs strawberry aroma) can change species wise attraction, which is the basic principle behind designing species specific food lures and attract-and-kill strategies. Even casual, low cost experiments using locally available materials can generate new questions and curiosity about insect behaviour, encouraging students to think like researchers. For future work, the same experiment can be repeated under more controlled conditions with multiple replications, measured distances and maybe more flavours, and the number and type of insects recorded systematically to draw stronger conclusions.

## Conclusion

The classroom observation of one drosophila and one mosquito visiting Alpenliebe butter caramel chocolate, and two houseflies visiting Alpenliebe strawberry flavour, provides a simple but thought provoking example of food lure behaviour in Dipteran insects. Scientific studies clearly show that Drosophila and other fruit flies are strongly guided by food derived volatiles from fruits and sweets, while mosquitoes, though famous for blood feeding, also depend heavily on sugar sources and respond to plant and fruit odours. The differential choice of chocolates suggests that differences in volatile blends and spatial odour plumes, together with individual insect physiology, can lead to species specific attraction even when both baits are sweet. Such simple experiments in B.Sc. (Hons.) Agriculture classrooms not only demonstrate the practical principle of food lures in pest management but also open new questions about insect sensory ecology and behaviour, motivating students towards scientific enquiry.

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