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# Effect of aroma on foraging behaviour of *Drosophila* sp. : An experimental approach

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**Abstract**

Aromatic compounds play an important role to switch on/off the chemosensory based signalling pathway related to physiological functioning and behavioural strategies of organisms. Plants or plant products serve as a natural source of aromatic compounds. Further, several reports on *Drosophila* sp. model has been used as an important tool for detecting the basis of differential behavioural study globally. Therefore, in this study different plant/ plant products were used as micro nutritional additives over natural food source to seek any minor changes in the foraging behaviour and food preference in *Drosophila* sp. Results reveal that food items mixed with tulsi and apple separately were preferred significantly over other experimental set of food items and control. However, camphor mixed food was negatively preferred. Thus, this preliminary study shows that aromatic compound(s) may have important role in switching on/off genes related to foraging physiology and behavioural action.

**Key words:** Aromatic compounds, *Drosophila* sp., foraging behaviour, phyto-product.

## Introduction

Foraging involves a balance between foods energy content and the cost of obtaining it. The costs and benefits of foraging behaviour suggest that they are shaped by means of natural selection over time and thus directly influence the energy intake and individual fitness. The optimal foraging theory therefore not only addresses the behavioural choices that enhance the rate of energy gain but also suggests that the availability of food varies greatly over time and space. According to optimal foraging theory, natural selection favours individuals having highest energetically efficient foraging behaviour. In other words, animals tend to feed on prey that maximizes their net energy intake per unit of foraging time (Danchin et al., 2008; Krebs, 2013; Kumar & Mina, 2016).

Foraging affects an animal's ability to survive in all type environmental condition

and reproduce successfully. Further, the foraging behaviour in insects fulfils two basic goals: first is to gain enough energy which may support growth, development, maintains physiological activity and reproduction; and the second is to gain the right type of nutrients (macro as well as micro) which necessitate the attainment of their first goal. The profitability of food item to a foraging animal thus depends on the net energy value of the food and the time invested in obtaining and processing the food (Danchin et al., 2008; Krebs, 2013; Kumar, 2016).

Quite often it has been well observed that various factors intend to change the selection of food being variedly preferred by different insects. Several reports reveals that vertebrate and invertebrate organisms show striking similarities in their structural organisation and behavioural functioning of the chemosensory system. *Drosophila* sp. may serve the purpose of being a very useful model to dissect the genetic basis of feeding behaviour. *Drosophila* sp primarily sense sugar moiety using Gustatory Receptor Neurons (GRNs) (Ishimoto & Tanimura, 2003). located on tarsi of mouthparts. Direct contact of the desirable sugars through the tarsi drives proboscis extension, while stimulation of gustatory neurons on the labium promotes the acceptance of food particles and then ingestion. Therefore, the sense of aroma or smell of food items might play a key role in modulating the foraging behaviour in them, i.e., some food may act as chemo-attractant while others serve as chemo- repellent.

Several plant or plant products have been reported vastly to have effects on bacteria and fungus. Further, plants like tulsi (*Ocimum sanctum*), eucalyptus, etc. have been reported as a chemo repellent against insect. However, reports on the chemo-attractive nature of these plant or plant products are scanty. Thus, this project is an effort to elucidate some of the novel objectives: i. to assess whether there is any selective preference of aromatic compound containing food / food additives over natural food item, ii. to evaluate the link between the chemo-attractive efficacy of the best found aromatic compound containing plant/ plant product mixed with natural food with that of foraging behaviour.

## Materials and methods

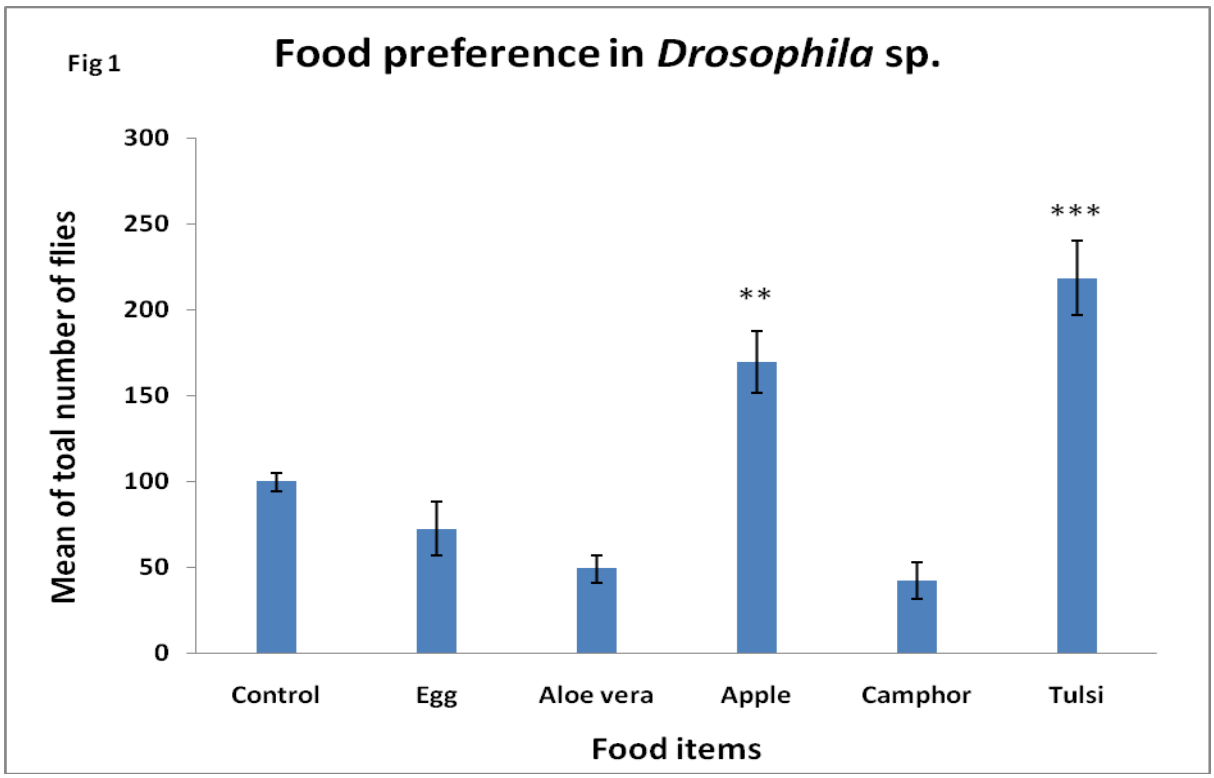
### *Components and Food items*

The glass jars, necessary things and food items like Banana, Apple, Egg, Camphor, Tulsi, Aloe vera, pen, pencil, mortar pastel, tissue paper, etc were purchased from the local market, fruit markets and grocery shops.

### *Experimental procedure*

250ml clean jars were taken for placing six food items including control and placed at a site resembling the natural habitat for insects, inside the premises of Dum Dum Motijheel College, Kolkata, India. The pre collected smashed bananas (2 each) were placed in each jar as main nutrient. Experimental set of different jars were prepared except one jar containing banana only which served as control set. Except control, in each jar along with banana, different aromatic compound and protein items were mixed properly for investigating the role of additional aromatic compound on foraging behaviour and foraging physiology. Control (SET 1. CONTROL) and additional five experimental sets (SET 2: TULSI, SET 3: ALOE VERA, SET 4: EGG, SET 5: APPLE, SET 6: CAMPHOR) were kept in natural environment for a duration of 8 hours for 6 days. The data were collected with tally mark at 1h interval.

**Fig. 1. Graphical representation of food preference in *Drosophila* sp.**




***Statistical analysis***

All the data thus collected and the summation of food preferences in individual food items were statistically analyzed using Student's t-test after conducting three independent experiments and deducing their mean values.

**Results**

The number of flies feeding on several food items was found to be different from each other. Results of the study clearly shows that amongst all the food items, *Drosophila* sp. preferred Apple (**p<0.01) and Tulsi (***p<0.001) and rejected Camphor almost altogether (Fig. 1) when compared to control set.

**Discussion and conclusion**

The overall result of the present piece of our experimental work clearly shows that Tulsi and Apple mixed food item were mostly preferred by the fruit flies over other food items and control. Further, camphor was not preferred in relation to control. Therefore, the maximum efficacy to act as a chemo attractant was noted in Tulsi and Apple while Camphor served as a strong chemo repellent agent. Thus food items rich in high aromatic fragrance due to the presence of aromatic compounds like flavonoids and other phytochemicals (Hyson, 2011) as in apple and phenylpropanoids (eugenol), terpenes and essential volatile oil (Cohen, 2014) as in tulsi might play a pivotal role to activate the chemo sensory receptors or neurons for detecting the specific aromatic molecules and thereby promote the selection of profitable food source to gain maximum energy as well as additional nutritive benefits in order to support the optimum growth and

development of the larvae. Additionally the anti fungal and anti bacterial properties of the plant product might serve as an enhance tool for infection free nurturing of the brood of the fruit flies.

Therefore, this preliminary study further opens up a link between the organism growth and genetic constitution of the flies to detect and prefer/ reject aromatic compounds to switch on/ off their chemo-tactic efficacy in their daily life for protection against various infections in their lifestyle.

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**Conflict of interest**

None to declare

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