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### Comparative assessment of foraging strategies in ants: A preliminary experimental study

Pritha Chakraborty<sup>#</sup>, Anushka Sengupta<sup>#</sup>, Aditya Mojumder<sup>#</sup>, Antara Biswas<sup>#</sup>, Shrayashi Mazumder<sup>#</sup>, Megha Biswas<sup>#</sup>, Mousumi Halder<sup>#</sup>, Sayani Cakraborty<sup>#</sup>, Srijita Dey, Asmita Samadder, Prantik Ghosh\*

Department of Zoology, Dum Dum Motijheel College, Kolkata-700074, West Bengal, India

<sup>#</sup>Equal authorship

\*Corresponding author: prantik79@gmail.com

#### Abstract

The study of foraging behaviour in ants is a special challenge to entomologists and insect biologist as they usher a lot of distinct phenomenon modulations like food preferences, competition, bait monopolization, memory of trail track, etc. Therefore, in this study a short experimental method was used to check and verify the different types of ants present in the surroundings of the college premises and the type of food these varied types of ants preferred. Further, competitive strategies were also evaluated during the course of the study. Results clearly revealed that five different types of ant species were found of which the most abundant and dominant species being *Camponotus compressus* followed by *Solenopsis geminata*, *Paratrechina longicornis*, *Diacamma sculpratum* and *Tetraponera rufonigra* showing strong inter-specific competition. Further, the monopolization of *C. compressus* was also noted for honey and avoidance for neem extract by all types of ants was addressed in the course of this work. Thus, this preliminary work calls upon further research for evaluating the inter-relationship of genes regulating monopoly and food preferences in foraging ants in future.

**Keywords:** Ant, competition, food items, foraging behavior.

#### Introduction

The study on foraging behaviour and physiology in ants is one of the greatest supports for the survival-of-the-fittest mechanism which reflects their collective intelligence. Today it has become an utmost field of research for insect biologists and entomologists. Ants do take a great challenge everyday in search of food. Each foraging process can also be named as a learning process as these small animals gather the experience and knowledge from their prior foraging activities to guide their next foraging act. Synchronized

physical abilities and self organization are two important wings of successful foraging act of ants for profitable food source (Lixiang et al., 2014). Therefore, the success story for optimum and beneficiary foraging depends upon different strategies taken up by different ants like competition, monopolization, selection of particular nutrient enriched food items, etc. Thus, this present piece of work was undertaken with certain objectives like: i) to assess the variety of ants present in the college premises; ii) to identify

whether there occurs any preferences for food source by any of the ant species; iii) to detect whether the ants use any particular mechanism for their struggle for existence and survival.

### **Materials and methods**

Banana leaves (for lading down the baits), egg albumins (protein source), honey (carbohydrate source), neem (*Azadirachta indica*) extract (as a conventional insect repellent), ethyl alcohol (70%), glass jar, test tube, simple microscope, and mobile phone camera (Samsung Galaxy J7™) were used for the purpose of the study. This work was conducted by following the method of Perna et al., (2012), with slight modifications. The baits with ants were observed for 5 consecutive days. All the set i.e., control and experimental set were settled outside the college building within the botany ground. The baits were placed on flat surface of banana leaves and the food material (egg albumin, honey and neem extract) was placed on it. Two adjacent baits were placed at a distance of 10ft. diagonally to minimize the instances of overlapping gathering of the forager ants. The observed behaviours were photo documented by mobile phone camera (Samsung Galaxy J7™). Representative from the ant species were collected and preserved in 70% ethanol and brought forward to the laboratory where the specimens were microscopically examined for identification.

All the data were recorded in tabular form and compiled using MS-Office™ Word and Excel software and statistically analysed using Student t test.

### **Results**

#### **Aggregation behaviour of ants at the baits**

The overall results show that there exists five different species of ants of which the most abundant and dominant species being *Camponotus compressus* followed by *Solenopsis geminata*, *Paratrechina longicornis*, *Diacamma sculpratum* and *Tetraponera rufonigra* (Fig. 1). This

data clearly shows that a strong inter-specific competition exists among the ants for during food gathering procedure.

#### **Food preference and avoidance behavior of ants at the baits**

The results reveal that honey was preferred among the other two types of food items by all the types of ants found during the tenure of our experiment (Fig. 2). Further, it was also noted that neem extract was avoided by most of the species except for *Camponotus sp.* suggesting the efficacy of neem extract to act as a food repellent for ants.

#### **Aggressive behavior of ants at the baits**

The results of our study showed that most of the homo-specific chasing was observed in *Camponotus sp.* on the 1<sup>st</sup>, 2<sup>nd</sup> and 4<sup>th</sup> day of the experiment conducted. Additionally, on 4<sup>th</sup> day of the experiment such behaviour was also exhibited by *Solenopsis sp.* and *Paratrechina sp.* both possessing same number of individuals but lower than that of *Camponotus sp.* However, due to lack of consistency of similar data this data failed to be analyzed statistically analyzed and thus could not be presented here and repetition of experiments is warranted for future.

#### **Discussion and conclusion**

From this present study it was clear that the main forager caste of the ant colony is the workers. Our study further states that the soldiers (especially for the sub family Myrmicinae) were mainly engaged for aggression and trail protection. Ants are keen to chemo sensation and they follow a fixed trail for foraging (Sudd, 1959). Bait finding ability is very good and accurate (Czacczkes et al., 2013). This result corroborated with the findings of Tian and Zhou, (2014) which made us keen to verify any inter-specific competition amongst them for food preferences.

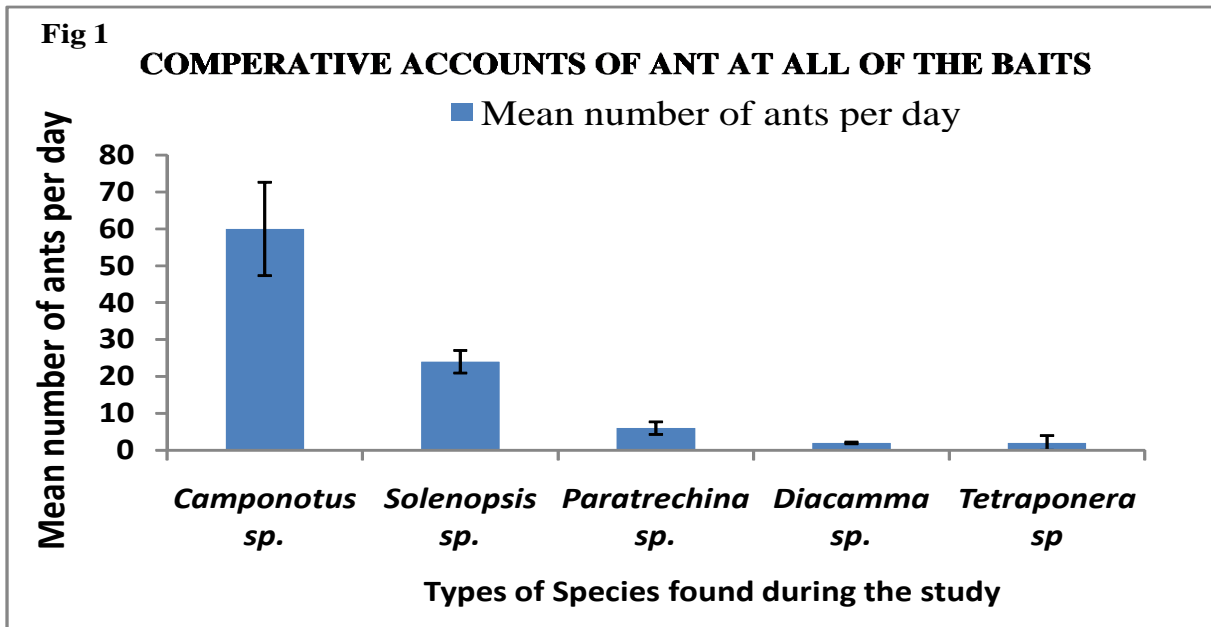


Figure 1. Graphical representation of comparative assessment of mean of different species of ants at different baits.

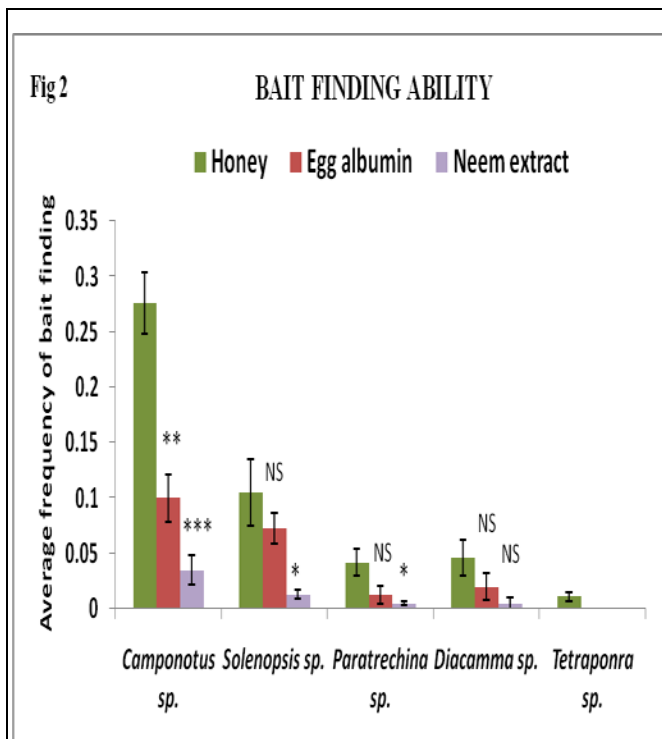


Figure 2. Graphical representation of bait finding ability of different ants with particular emphasis to type of food items preferred during their foraging. \* $p < 0.05$  vs honey; \*\* $p < 0.01$  vs honey; \*\*\* $p < 0.001$  vs honey; NS= non significant vs honey.

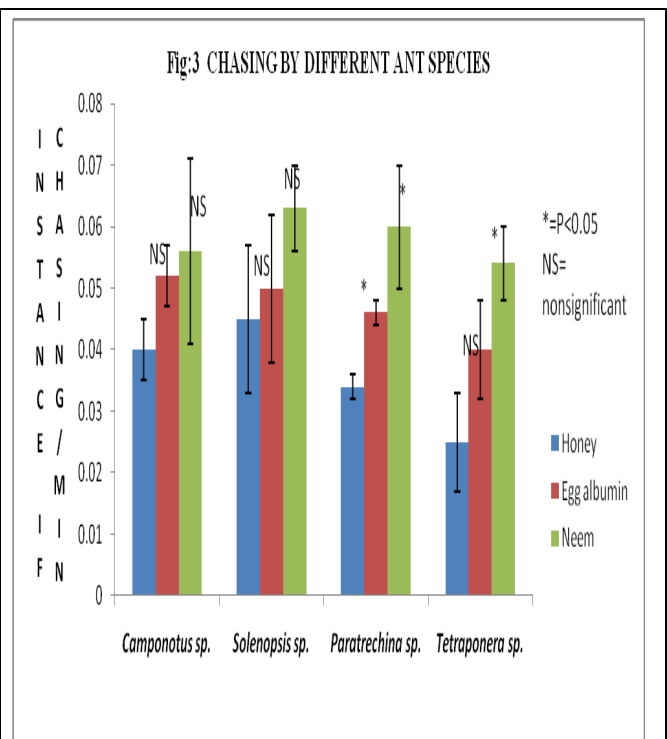


Figure 3. Graphical representation of chasing behaviour emphasizes significant homospecific chasing between *P. longicornis* and *T. rufonigra* \* $p < 0.05$ .

The study also points that the post monsoon season makes the soil moist which assists in the aggregation of the large sized ants like *Camponotus sp.* However, the tree dwelling ants like *Tetraponera sp.* were hardly noticed to gather food in soil. The number of small sized ants like *Paratrechina sp.* and *Solenopsis sp.* were always lower than *Camponotus sp.* population. Although, the population of *Diacamma sp.* occasionally came at the bait, however their number could not exceed that of *Camponotus sp.* and often was lower than the two major soil dwelling ant species *Camponotus sp.* and *Solenopsis sp.*

The results also reveal that except for *Diacamma sp.* which has a strong craving for protein food, due to its carnivorous nature, other ant species mostly preferred honey, which was rich in carbohydrate, in the bait. However, the findings of our study where bait avoidance activity for neem extract was found to be maximum also corroborated with the results of Mondal et al., (2017) for other insects.

Monopolisation of the bait was only shown by *Camponotus sp.* on certain days only accompanied with days having heterospecific aggressions thereby suggesting further study to ascertain the relation between the extent and type of aggression for food by a particular species for surviving in all circumstances.

Therefore, this present piece of work definitely opens a new pathway for entomologists to seek an insight to discover the genetics behind the modulation of the foraging behaviour in ants in future.

#### **Acknowledgement**

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#### **Conflict of interest**

None to declare

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