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A case study on sensory dependent response variation of some terrestrial arthropods during winter at Barasat, West Bengal

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Abstract
A total 2282 number of individuals were collected solely from experimented (bait) samplings, whereas, only 7 individuals were encountered from the control pits. As most of the arthropod groups depend on their sensory triggered responses, they are significantly found with the experimental bait. The study indicates that sensory dependent activity evolved within the arthropod groups, have a significant role in their foraging activity.

Keywords: Insect, sensory dependent response, foraging activity, sensory system.

1. Introduction
Insect plays diverse role in ecosystem services (Gill *et al.* 2016) [1]. Sensory system guides them to collect food; it also helps in the assessment of habitat, searching for potential mates and other behavioural activities. Therefore, sensory system is crucial for its survival. It is important to understand the sensory dependant foraging behaviour of insect which plays a significant role in its evolutionary and developmental history (Stephens and Krebs, 1986) [2]. The antennae of insects bearing olfactory receptors varying a lot in shape and size between species. The principal termination sites within the insect brain of olfactory neurons housed in the antennae are the antennal lobes, structures that bear a strong morphological resemblance to vertebrate olfactory bulb (Masson and Mustaparta., 1990; Boeckh and Tolbert, 1993) [3, 4]. The onset of winter has a large impact on insect population. Insects are ectothermic; regulation of their body temperature depends upon the environmental thermal condition. A minute changes in climatic condition can highly affect not only on their assemblages but also in their activity, range, phenology and survival. This study is aimed to determine the ability of sensory dependent response variation in some terrestrial arthropods.

2. Materials and Methods
The experiment described in this study was performed at Barasat, West Bengal, located in the Ganges Brahmaputra delta region in the district of North 24 Parganas (Coordinates 22.7228° N, 88.4806° E). The climate is tropical, with an annual mean temperature ranging between 10°C to 40°C and annual rainfall 1579 mm. The study area was divided into 4 different sampling sites that are Grassland (GS), Cropland (Cr), Wasted land (Ws) and Garden (Gr).
Insect samples were collected by using pitfall trap method (Abensberg-Traut, M & Steven, D, 1995) [5]. The experiments were conducted at two times in a twelve hours' cycle of a day for each site. At each sampling site four pitfall traps were settled, among which two were given with baits, as the experimental samples and the remaining two were treated as controls with no bait at a distance of one and half meter from each other. One cardboard lid was placed above each pit to avoid external atmospheric conditions *viz.* dewdrop etc. by which the bait can be contaminated. The collection vials were same in size and dug into the ground in such a way that top of the pit and surface of the ground were in the same level. Traps were checked regularly and the insects inside it were collected into the different glass vials according to their taxa. Then collected materials were kept in 70% alcohol for identification. The collected insects were identified based on standard literature. Statistical analysis was performed by MS-Excel and PRIMER (Ver 6.1.18).

3. Results and Discussion

As a result, a total of 2289 number of insect specimens were collected belonging to hymenoptera, homoptera, coleoptera, dermaptera, dictyoptera and araneae. Only from hymenoptera *viz. Tapinoma indicum* Forel, 1895, *Camponotus compressus* (Fabricius, 1787), *Camponotus sericeus* (Fabricius, 1798), *Solenopsis geminata* (Fabricius, 1804), *Meranoplus bicolor* (Guerin-Meneville, 1844) were recorded during study.

In respect of abundance (%) *Tapinoma indicum* Forel 1895, *Solenopsis geminata* (Fabricius, 1804), *Paratrechina longicornis* (Latreille, 1802) were widespread and abundant, collectively providing 72.4% of total experimental samples. Coleoptera and *Tapinoma indicum* Forel were only two that constitute the total control samples. In control samples Coleoptera (57.1%) shows highest abundance followed by *Tapinoma indicum* Forel (42.9%).

In grassland habitat *Tapinoma indicum* Forel (35.32%) shows the highest abundance followed by *Solenopsis geminate* (Fabricius) (20.84%), *Paratrechina longicornis* (latreille) (17.73%) while Araneae (0.54%) has the lowest abundance in this habitat type.

In cropland *Tapinoma indicum* Forel (59.03%) exhibit the highest abundance followed by *Solenopsis geminata* (Fabricius) (31.52%), *Camponotus compressus* (Fabricius) (3.81%) and homoptera (0.2%) shows the lowest abundance.

In wasted land *Solenopsis geminata* (Fabricius) (41.43%) observed as highly abundant taxa followed by *Paratrechina longicornis* (latreille) (21.22%), dictyloptera (12.78%) while *Camponotus compressus* (Fabricius) (0.2%) seems as the weakest taxa in this habitat.

Tapinoma indicum Forel (37.5%) encountered as the most abundant taxa from garden followed by *Paratrechina longicornis* (latreille) (15.1%), *Myrmicaria brunnea* (Saunders) (13.8%) and the taxa *Monomorium monomorium* Bolton (0.2%) as the inferior one.

nMDS plot showing significant difference between control samples with that of experimental types. 2D stress for the nMDS plot was 0.01. Most of the control samplings are scattered; very few experimental samples having the affinity with the control. Arthropods collected from the experimental samples during the study was observed very similar faunal assemblage and very centrified.

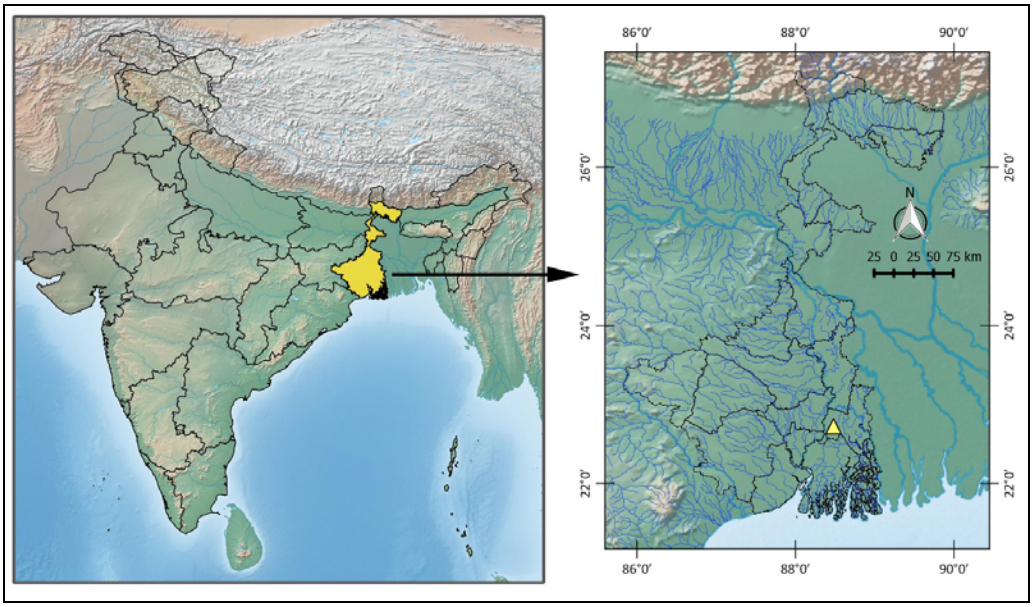

Fig 1: Map representing the study site

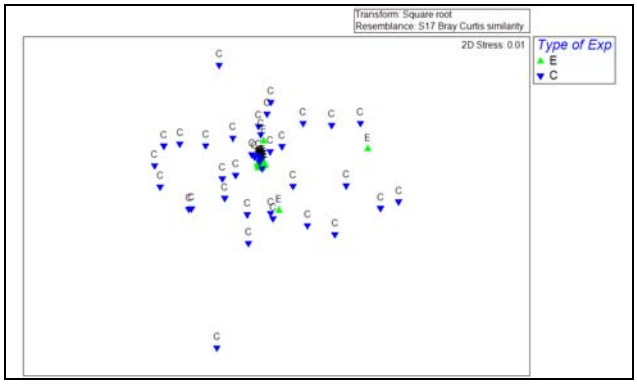

Fig 2

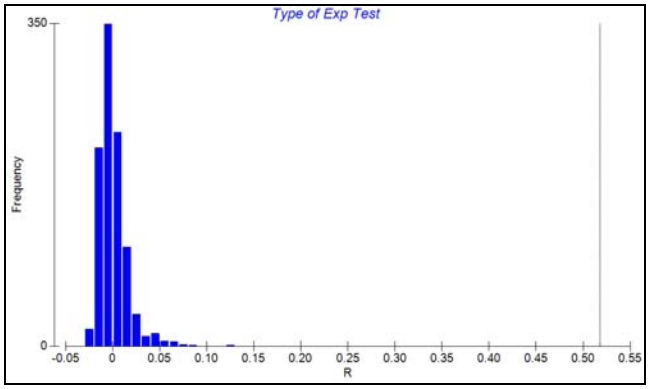

Fig 3

ANOSIM (Analysis of Similarity) shows the significance of the control samples (R = 0.518, P=0.1%). From global R value getting after 999 independent random permutations, 50% of them showing well distributed and organized data.

Arthropods collected from different sites show no significant relation of arthropod availability with different sites (nMDS 2D stress = 0.01.)

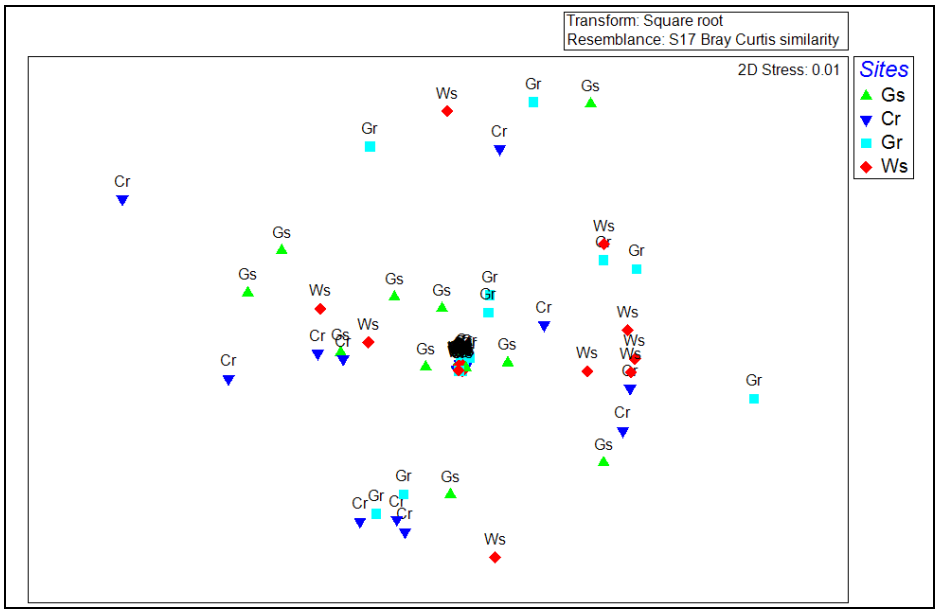

Fig 4

There was no significant difference between day and night samplings. Except few night samplings, rest of the arthropods fauna collected from experimental condition showing significant assemblages (3D stress 0.01).

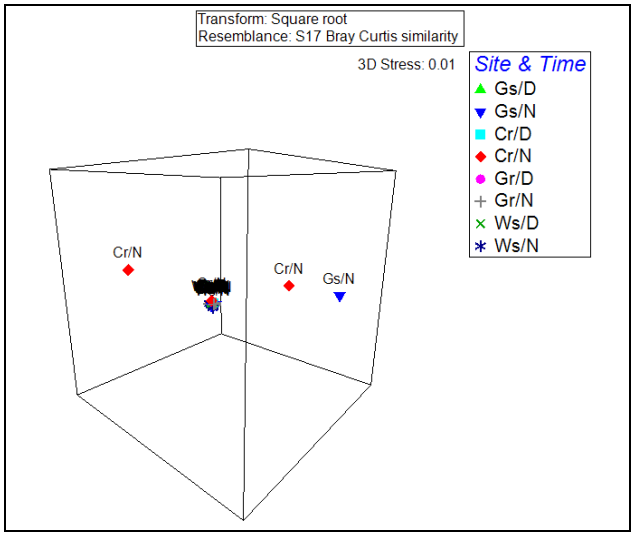

Fig 5

4. Conclusion

Arthropod availability in day and night samples showing no difference but there is very significant assemblage with the experimental condition. Arthropods collected from different localities (Grassland, Cropland, wasted land, Garden) did not show any affinity with sites. A total 2282 number of individuals were collected solely from experimented (bait) samplings, whereas, only 7 individuals were encountered from the control pits. As most of the arthropod groups depend on their sensory triggered responses, they are significantly found with the experimental bait. Therefore, it can be concluded that sensory dependent activity evolved within the arthropod groups, have a significant role in their foraging activity.

5. References

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