A study of Ants as a Suitable Learning Cycle to Investigate for Studies through Observations

Pokale S. S.
Department of zoology
Dr.B.N. Purandare Arts, Smt. S.G. Gupta Commerce and Science College, Lonavala - 410403. Maharashtra, India

ABSTRACT

This activity capitalizes on the interest that animal behavior can generate to introduce and reinforce student understanding of the scientific method. Specifically, our activity highlights the general utility of the scientific method and uses this method to examine ant social behavior, with emphasis on generating and testing hypotheses. Furthermore, this activity introduces the idea of animal societies and encourages students to apply the concepts they learn to other species, including humans. By collecting ants, this experience situates learning in the context of students' own communities.

Field observation is an important tool for generating interest for undergraduate learners in the subject of Zoology. Such observations with respect to environmental adaptations, foraging, nesting and territorial behavior can be recorded without causing any damage to the organisms under study. The ants as one of the commonly occurring insects offer good opportunities for observational studies. An example of observational study of observation, ants can be effectively used to generate subject interest and inculcate research aptitude among the learners.

Keywords: Ants, Observations.

INTRODUCTION

In biological science, field observation is considered as an effective tool to understand diversity, similarity in the habitats and general behavioral patterns of organisms. These

observations allow learners to test hypothetical ideas and provide opportunity to develop scientific methodology as well as logical reasoning. Insects are the most diverse and successful group of organisms. Among these, ants (Order- Hymenoptera, Family- Formicidae) are eusocial insects (Gadagkar et al, 1993). At least few types of ants can be recorded in different habitats like houses, gardens, green patches in urban areas, agricultural areas, forests etc. Most species are carnivorous, omnivorous, predators and some species are pests on economical important crop plants. Andersen (2000) described nest site availability, food supply, microhabitat structure, resource capture and low temperature as important factors for ant variability.

Here we discuss an example of observational study based on foraging activities of ants carried out near agricultural area. Ants deserve a special place in the study of ecology, including behavior; given their species richness, social habits and high densities contributing much of the animal biomass on earth (Gadagkar et al, 1993).

MATERIAL AND METHODS

This learning unit can be adapted to meet the needs of educators and their classrooms, regardless of direct access to native ant species in the college or local community. This learning unit was specifically designed to help students develop their observational and deductive skills, and following this lesson, students would be able to apply these observational skills when examining other social animals – even humans.

Harvesters are preliminarily seed collecting ants. About thirty nests were observed. These nests are1 to 2-year-old, suggesting mature colony. Most ant nests are made in damp soil and can be several feet in depth and circumference. The present study was carried out in an agricultural area in Maval . Observations with respect to movements of harvester ants (foragers) near the nest entrances were recorded for short time intervals (three minutes) at various hours spread out during the entire day. The study was carried out during post monsoon season of 2015.

OBSERVATION

It is observed that ants are especially attracted to seeds that have food bodies known as elaiosomes. These food bodies are generally rich in fatty acids, amino acids and sugars and other nutrients. They can be easily removed and digested by the ants and are often laced with a chemical attractant that stimulates collecting behavior.

The food body usually differs in shape and color to the main body of the seed in such a way that it is easier for the ant to carry the entire seed. The ants grip the food body with their mouthparts and carry the seed back to the nest. The food body is then removed and fed to the larvae. The remainder of the seed due to its size, unwieldy shape or hard coating is usually left intact in the nest.

About 27% of the observed nests showed heaps of husks indicating active seed collection. The intensity was lower during the period of direct sunlight. However, during cooler time of the day, the activity of foragers showed marked increase. So, period of direct sunlight influenced the working. Though large number of workers entered the nest in given time interval, the percentage of successful return of workers with seeds was 11.38%. The changes in availability of seeds occur in seasonal manner. At least 4 to 5 different types of seeds were recorded. So, this success of seed selection must be dependent on seed production by plants in the area. It was observed that about 14.31 % of outgoing workers also carried husk or other material. It may be related to drying requirement or rejection.

It was observed that the five nests varied in foraging activity and its success. The average number of outgoing foragers is significantly large, noticed p value is 0.029 at 5% of significance level as per test statistics. A small number of outgoing foragers were observed to leave the nest with husk or other material. Exact material could not be identified in some ants as it required disturbing the ant to collect that material for further observations. The number of successful foragers returning with food differed from nest to nest. Returning foragers are expected to positively influence the rate at which the outgoing foragers will leave to access the food. Gordon

et al (2013) has described that the route which foragers have to travel to the food source affects the forager activity. As all these nests are located near to a common paddy field and wild grass patch, there is less possibility that foragers from different nests have considerable difference in the length of route to access food sources.

Other than their interesting biology and behavior, there are numerous benefits of working with locally abundant insects in the classroom. Specimens are usually free, are easy to acquire, and include a certain amount of flexibility compared to working with vertebrate animals, a process that generally requires specific permits. Ants, in particular, are ideal organisms for classroom studies of animal behavior because ant colonies exhibit a wide array of interesting behaviors and are easily maintained in captivity. Their large numbers also allow students to create and test novel hypotheses, as well as repeat important components of their behavioral studies.

Students were encouraged to consider the field of animal behavior as a potential career option as experience suggests that this unit can be highly effective in engaging student interest and eliciting critical thinking related to the scientific process. JJ Behavioral ecologists study animal behaviors to gain a better understanding of the way the natural world works. From wolves hunting in packs (Post et al., 1999) to bees communicating with elaborate dances (Gould, 1975) to peacocks showing off their tail feathers to attract mates (Petrie & Halliday, 1994), animals perform interesting, impressive, and exciting behaviors. This section is designed to introduce some of the fascinating insights that humans have learned from behavioral ecologists over the past century and use these insights as a jumping-off point for the remainder of this animal-behavior-driven lesson. Before implementing this unit, teachers should familiarize themselves with several important concepts about animal behavior. First, it is important to understand that there are many ways to survive and thrive in the world, and natural selection has produced a great deal of variation in morphology and physiology among different species, even those occupying similar niches. For example, birds and bats that fly and eat insects have drastically different body plans. So, it is with behavior. Some animals feed on abundant food sources that need not be monopolized and,

consequently, show very little aggression toward other members of their species. Other animals rely on finite resources and must fight aggressively to defend these resources from other animals, including conspecifics. Second, the behaviors that animals exhibit are just as important as their physical bodies. Both are adaptive and help the animal survive. It is critically important for students to realize traits that help animals survive or reproduce (i.e., adaptations) can include the behaviors they perform. Third, animals behave in different ways depending on both internal and external factors. A hungry shark is going to swim faster to catch a fish, a sick lion is going to conserve energy by resting, and a mockingbird in the middle of the breeding season is going to spend more time singing. Animal behaviors are also sensitive to external factors such as time of day, climate, and predation risk.

In the study area 30 harvester nests were observed near the paddy field. Activity of five nests was recorded depending on accessibility for close observations. The number of raised soil walls or circles of individual nest varied between3 to 8. Though most of the nests did not show vegetation growth within their areas, some of the nests were completely covered with grasses. The distance between the neighbouring nests varied from 2.2 meters to 11.6 meters. The observations with respect to average number of foragers entering or going away from the nest, with seeds or without seeds and husk is presented.

Result and Discussion

Aggression, when members of one colony were made to stay with those from another colony. Cooperation between ants when limited food was provided. To study ant behavior when they're taken away from their colony, and introduced into a completely new environment with stranger ants (from other colonies). - Procedure: Worker ants were collected in a falcon from 3 different places, and were placed in soil from the same three places. This apparatus was placed in a bigger tumbler, which had water filled till the brim (to ensure they don't escape). Observations were taken as to whether the ants from different colonies were being aggressive to each other, and

about their foraging behavior in the presence of other ants. Chocolate crumbs were provided as food. Interaction between ants from different colonies was scored after one-hour intervals. Instead of the expected aggressive behavior between ants from different colonies, they were seen to be sharing food. No aggression was observed.

Animals may be more likely to communicate with sound if they are nocturnal, more likely to communicate with visual signals if they have good vision and are active during the daytime, etc. the instructor should try to ensure that the students understand that there are a diversity of behaviors that both humans and ants use to interact with strangers (e.g., ignoring, making quick contact and then moving on, taking the time to become familiar with an individual, attacking, etc.). Once these points are established, leading the students to question the function of each of these behaviors will allow students to discuss issues such as what it means to be a stranger and, conversely, part of a group, and how group membership and dynamics can change with time. Some of these points may be first made with humans.

Some ants are considered as generalist feeders (Narendra Ajay and Kumar Sunil, 2006) whereas harvesters are known to store the seeds (Narendra Ajay and Kumar Sunil, 2006). Many plants actively encourage ants to disperse their seeds with chemical attractants and nutritional benefits. The ant gains a reward for dispersing the seed and thus the plant ensures a greater chance of survival. This partnership is referred to as myrmecochory.

It is possible that this difference in number of foragers is related to the strength of each nest in terms of individuals. The storage of food inside the nest may also be responsible for the extent to which foragers were employed. These trials were carried out randomly during a day. Certain nests may have higher foraging activity during a specific time interval, which needs to be further investigated.

These simple field observations can lead to further study with respect to competition between foragers, use of slave workers from other nests, types of collected seeds and distance of

resource availability, period of seed drying, relationship between ages of colony with employed number of foragers. The study shows the ecological roles of ants as seed consumer

Fig 1

Fig 2

CONCLUSION

However, since they live in and under fallen logs, they may be more difficult to collect – although, unlike harvester ants, these ants do not sting. Fire ants, however, should not be used, because they bite and sting, and care should be taken to avoid contact with these species.. However, it is important to note that ants purchased through suppliers should not be released into the environment at the end of the activity, because they have originated from a different geographic area and could be damaging to the locally established ant communities. Once the discussion of ant observation unfolds, the instructor and students may attempt to collect ants from a natural or seminatural setting.

FUTURE WORK:

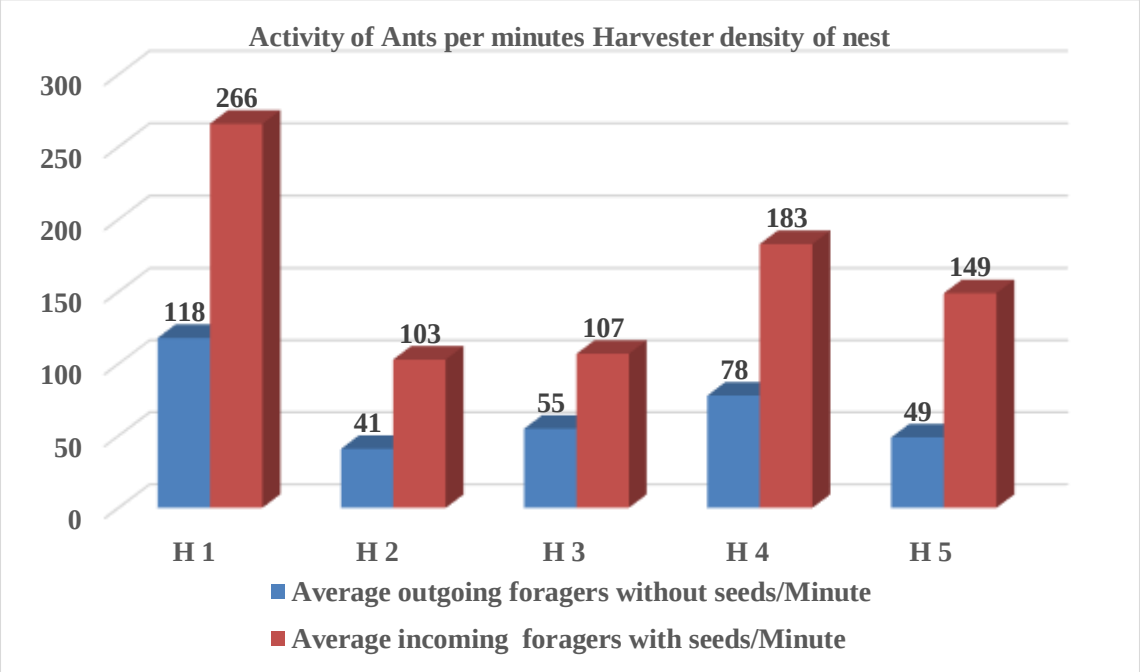
Repeat the above experiment for higher sample numbers. The sample space of the experiment was only one. We observed the experimental sample for only 2 hours. This is not enough for the smell of deodorant to go away. We didn't observe what happens after the smell goes off. Characterize the behavior of the very first ants that approach the dead ant Table :1 Density of ants per minute of incoming foragers with seed and incoming foragers without seed harvester nest numbers.

Table 1 Density of ants per minute harvester nest number of activity of ants

Sr.No.	Nest No.	Incoming foragers (with seed)	Incoming foragers (without seed)
1	Trial 1	13	35
	Trial 2	56	144
	Trial 3	49	87
	Total	**118**	266
2	Trial 1	21	52
	Trial 2	09	19
	Trial 3	11	32

	Total	**41**	103
3	Trial 1	16	49
	Trial 2	19	23
	Trial 3	20	35
	Total	**55**	107
4	Trial 1	21	78
	Trial 2	26	59
	Trial 3	31	46
	Total	**78**	183
5	Trial 1	14	39
	Trial 2	19	48
	Trial 3	16	62
	Total	**49**	149

Graph 1; - Graphical representation of density of ants per minute harvester nest number of activity of ants at various sites of Maval region is presented below



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References

1. Anderson, A. N. (2000). The Ants of Northern Australia: A guide to the monsoonal fauna (p. 106). Collingwood: CSIRO.
2. Chemical signals associated with life inhibit necrophoresis in Argentine ant, Dong-Hwan Choe et al, PNAS(2009doi:10.1073/pnas.0901270106.
3. Colburn, A. & Clough, m.P. (1997). Implementing the learning cycle. Science Teacher, 64(5), 30–33.
4. Gadagkar, R.P., Nair, K. Chandrashekhar and Bhat, D.M., (1993). Ant species richness in some selected localities in Western Ghats, India. *Hexapoda*, 5: 70-94.
5. Gordon DM, Dektar KN, Pinter-Wollman N (2013) Harvester Ant Colony Variation in Foraging Activity and Response to Humidity. PLoS ONE 8(5): e63363. doi: 10.1371/journal.
6. Narendra Ajay and Kumar Sunil. (2006) On a Trail with Ants.A Handbook of the Ants of Peninsular India. Pp, 1-193.
7. Necrophoresis in two Indian ant species, Camponotus compressus (Fabricius) and Diacamma agans (Smith)(Insecta: Hymenoptera: Formicidae), Sarmistha Banik et al, Proc. zool. Soc. (2010) 63 (2) : 87–91 ISSN No. 0373-5893.
8. New york, Ny: Norton. Petrie, m. & halliday, T. (1994). experimental and natural changes in the peacock's (Pavo cristatus) train can affect mating success. Behavioral Ecology & Sociobiology, 35, 213–217.
9. Post, e., Peterson, R.O., Stenseth, N.C. & mclaren, B.e. (1999). ecosystem consequences of wolf behavioural response to climate. Nature, 401, 905–907