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Foraging Behaviour Following Food Contact in the Ants Pheidole Roberti

Khokan Naskar^{1*} & Srimanta K. Raut²

^{1*}Ecology and Ethology Laboratory, Department of Zoology, University of Calcutta, 35, Ballygunge Circular Road, Kolkata- 700019, India
²Ecology and Ethology Laboratory, Department of Zoology, University of Calcutta, 35, Ballygunge Circular Road, Kolkata- 700019, India
^{*}Corresponding Author

Abstract

The ants *Pheidole roberti* were offered 10 sugar cubes (25-55 mg in weight) at 10 different sites in their foraging ground at Garia, Kolkata, India to note the foraging behaviour after their contact with the sugar cubes. It is revealed that the forager ant did not inform the colony members for collection of the sugar cubes from the supplied site rather it preferred to carry a sugar cube to the nest individually. The sugar cubes were left at the sites for a considerable length of time after detecting the same by the foragers. All the sugar cubes were carried by *P. roberti* depending upon the chance of contact by the subsequent foragers within 1-286 (average 13.8 ± 1.9 SE) minutes to the nest.

Key words: Ant Pheidole roberti, Food contact, Foraging behaviour.

1. Introduction

Ants forage at large in their foraging ground. In the first step they try to come in contact of the food occurring in their foraging area while in the next step, following examinations of the available food they apply befitting strategies to ensure procurement of these food matters. The food-carrying strategy varies with the quality, quantity and characteristics of the food matters (Orians and Pearson ,1979 Goss et al., 1989a,b; Traniello, 1989; Beckers et al., 1990; Crist and Macmahon, 1991; Portha et al., 2002; Buhl et al., 2009; Sengupta et al., 2010; Prabhakar et al., 2012; Loreto et al., 2013; Scultheiss and Nooten, 2013; Hashimoto and Yamane, 2014; Li et al., 2014; Naskar and Raut, 2014a, b, c, 2015a, b, c, d). It is an established fact that a foraging ant in case of availability of large amount of food invites the fellow members of the nest for collection of the same by developing trail (Beckers et al., 1992; Jackson et al., 2004; Mailleux et al., 2005; Vittori et al., 2005; Evision et al., 2008; Loreto et al., 2013). However, in nature there exists every probability of getting foods at varying quantity at different sites. If a forager finds a food source where procurement process needs cooperation of many more foragers, then customarily, it returns to the nest to inform the nest mates so as to ensure collection of the same. But, it is not known what kind of strategy is usually in practice in respect to availability of food in different volumes. If the amount of food is limited then what should be the strategy of the forager ant ? Would it return to the nest to inform the nest mates or simply it would left the site by taking one food particle to the nest. Since in any foraging ground there exists every possibility of occurrence of other foragers belonging to the same species or different species the first visitor would exercise its intelligency to capture all the food matters present at the site. Actually, what happens in practice is a matter of great interest. Accordingly, we designed experiments by offering 10 sugar cubes at different sites in the foraging ground of the ants *Pheidole roberti* on twenty two sunny days during July-August 2011 at Garia, Kolkata, West Bengal, India and the findings are presented.

2. Materials and Methods

The ants *P. roberti* were offered 10 sugar cubes (25-55 mg in weight) at each of the ten different sites in a trial set, of a domestic room, 5 m in length, 4 m in width and 3 m in height locating at the ground floor of a house in Garia, Kolkata, West Bengal, India. The selected sites were locating within the said room but at different locations (Table 1). Table 1. Information regarding the ten sites selected for experimental studies.

Site No.	Description of the site	Distance (m) from site 1	Height (m) from the
			ground
1	Floor of the room (east side)	-	-
2	Floor of the room (towards the centre of	1.50	-
	the room)		
3	In front of the printer locating at the	2.40	-
	southern side of the room)		
4	At the base of east-facing window	2.97	0.76
5	On the table	3.40	0.76
6	At the base of south-facing window	2.20	0.76
7	At the railing of west side	5.90	0.76
8	On the floor at the west side	5.90	-
9	At the railing of north side	5.16	0.76
10	At the base of the door	2.40	-

Sugar cubes were offered between 07:17 and 09:32 hr. in these sites daily on all the 22 days of experimental trials during July-August 2011. The sugar cubes were left undisturbed and due attention was paid to note the time of arrival of

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the ant in contact of the sugar cube as well as the time required by the ants to displaced these sugar cubes from the site on way of carrying the same to the nest. As per programme we noted the time when the last sugar cube (of the supplied 10) was taken away by the ant. The length of time between the first contact with the sugar cube and the removal of last sugar cube from the site by the ant with a view to carry the same to the nest was considered as the time period the ants left the sugar cubes as such at the site prior to collection of the same. Data obtained on such time lengths were pooled to calculate the mean and standard error (\pm SE) to present the same in the text. Also one-way analysis of variance (ANOVA) was applied (Campbell, 1989) to ascertain the effect of sites on the time required by the ants to exhaust the sugar cubes supplied at the sites.

3. Results

The ants *P. roberti* come across the supplied sugar cubes at different times at different sites after supplying the same at these sites. The forager who came in contact of the sugar cubes first was seen to examine few sugar cubes and then to carry a sugar cube to the nest. Subsequently there appeared many more ants at the site of course, one after another or 2-5 individuals at a time. They were seen to carry the sugar cubes from the concerned site to the nest. The first forager ant was never seen to move to the nest to inform the nest mates regarding the foods locating at the site which it touched first on way of searching food. These sugar cubes, irrespective of sites were left as such by the first foragers for a period of 1-286 (average 13.8 ± 1.9 SE) minutes as these were carried by the regular forager ants on way of contact with the same in course of foraging movement. The time required to procure all the sugar cubes varied with the sites (Table 2).

Trial	Site									
Set No.	1	2	3	4	5	6	7	8	9	10
1	30	8	30	18	8	13	17	8	29	13
2	6	2	6	2	3	16	2	3	1	6
3	6	1	5	3	2	3	3	1	1	10
4	6	8	5	85	35	29	22	23	23	89
5	15	8	26	28	21	17	64	26	4	82
6	8	67	256	16	9	286	18	40	22	34
7	14	6	7	17	9	29	35	28	16	14
8	7	5	25	12	6	20	9	12	12	8
9	5	4	10	7	7	6	7	16	20	5
10	5	6	14	9	10	10	13	10	28	9
11	8	7	6	6	7	8	8	8	6	13
12	7	13	9	7	12	6	10	8	7	25
13	6	8	7	3	7	6	12	68	8	10
14	2	2	2	2	2	2	2	2	1	2
15	6	7	7	7	8	7	7	7	8	13
16	8	10	7	8	7	7	8	6	7	11
17	7	6	7	6	10	10	10	7	10	7
18	6	8	8	6	8	6	9	7	7	8
19	8	8	6	12	7	9	7	10	6	9
20	5	6	7	6	7	8	7	6	8	11
21	6	8	8	7	6	10	7	8	7	10
22	8	6	6	6	7	12	7	8	7	6

Table 2. Time (in minute) required by the ants *P. roberti* to procure 10 sugar cubes from the supplied sites, in different trials, following their contact (by the first forager) with the sugar cubes.

Though at sites 3 and 6 the ants took 256 and 286 minutes respectively to procure the supplied sugar cubes it is evident that, on average these sugar cubes were taken away by the ants within 8.17 ± 1.17 SE to 23.64 ± 12.3 SE minutes (Fig. 1) from the supplied sites. However, results of ANOVA tests clearly indicates (F = 0.8, df=9) that there exists no impact of the sites on the food (sugar cube) procurement process of the ants even after knowing the whereabouts of the food matters.



Fig.1. Time (mean \pm SE) taken by the ants *P. roberti* to collect the 10 supplied sugar cubes from the sites after coming in contact (by the first forager) of the same.

4. Discussion

Results of 220 observations indicate that the ants *P. roberti* need a varying length of time to collect the food materials from the sites where sugar cubes were offered experimentally for these creatures. As the first visitor foraging ant did not consider it fit to inform the nest mates for collection of these sugar cubes it is sure that the ants at least *P. roberti* are able to assess the food volume and the cost involved in collection of the same. Though the ants are habituated to develop trail to collect the food from the source (Beckers et al., 1992; Jackson et al., 2004; Mailleux et al., 2005; Vittori et al., 2005; Evision et al., 2008; Loreto et al., 2013) it is sure that such a behaviour in ants is nothing but the reflection of the assurance of occurrence of food in sufficient amount. Thus, it can be said that the ants are able to estimate the volume of food. Therefore, the present findings may be considered as an evidence in respect to queries of Mailleux et al., 2005). This sort of intelligency in ants play undoubtedly, a significant role in the decision making process regarding convey of information to the fellow members of the colony.

As foraging activity is energy dependent the ants are also adapted to assess the cost-benefit effect in connection with the procurement of food materials from different sources. Because, in the present study the ants had the chance of getting 10 sugar cubes from the site but they did not consider it wise to exercise their ability to collect those. It may so happen that the nest of these ants is locating at a distant place and in that case there exists every possibility of wastage of energy if the first visitor forager moves to the nest to inform the nest-mates for procurement of these sugar cubes leaving the opportunity of other foragers to procure these in the mean time. Under such a situation invited foragers would fail to get the sugar cubes of course, at the expense of their stored energy. As a consequence colony health would have been decreased more and more that may lead to shrinkage of colony size. Perhaps, to avoid such hazards harvest ants *Pogonomyrmox barbatus* have developed individual foraging behaviour to collect the scattered seeds from their foraging area (Prabhakar et al., 2012). It seems that foraging behaviour in ants is very much influenced by the type of food on which the ant species usually live on. This could be substantiated from the fact of individual foraging activity exhibited by the ants *Pachycondyla apicalis* (Goss et al., 1989b) and other ant species (Orians and Pearson, 1979).

It is well evident that the ants *P. roberti* in cases of availability of small amount of food (10 sugar cubes) have considered it beneficial to follow the individual foraging instead of colony foraging. Because of this strategy they have left the food matters (sugar cubes) as such at the sites for a considerable length of time. Of course, the strategy is effective as their colony members were able to procure these from the offered sites at different times, even after 286 minutes of detection.

Though the sugar cubes were supplied at different sites and even at certain height from the ground the ants procured these successfully in due course of time. As the ants were successful to collect the sugar cubes from all the sites it is apparent that they move almost everywhere in course of foraging and thus, contact with the food is a matter of chance. Depending upon the chance of foragers' contact with the sugar cubes, offered sugar cubes were taken to the nest by the ants *P. roberti*. Thus, the time required to collect the sugar cubes after locating the same by the first forager, by the ants (subsequent foragers) is a subject of coincidence of contact by an individual forager with a sugar cube lying at the site.

5. Conclusion

Foraging behaviour in *P. roberti* after contact with the food by the first forager is determined by the amount of food locating at the site of contact. If the quantity/volume of the food is small then individual foraging behaviour is exhibited by the ants *P. roberti*.

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