

Foraging Strategies in the Ants *Myrmicaria brunnea* and *Diacamma ceylonense*-Some Preliminary Observations

Neelkamal Rastogi³, Padmini Nair¹, Milind Kolatkar¹ and Raghavendra Gadagkar^{1,2*}

¹Centre for Ecological Sciences, Indian Institute of Science, Bangalore-560012, India.

²Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bangalore-560064, India.

³Department of Zoology, Banaras Hindu University, Varanasi-221005, U. P., India.

Abstract: *Myrmicaria brunnea* forager communicates by means of chemical and/or acoustic signals so that other foragers present nearby can move towards it and find the bait sooner than they would on their own. However, this sort of communication seem to have not been present in *Diacamma* sp. foragers

The social organization of recruitment and food retrieving in ants and other social insects is an important component in the study of their ecology and sociobiology. In our preliminary survey of the ants of the campus of the Indian Institute of Science, Bangalore (Rastogi *et al.* 1997), we came across the following interesting phenomena.

In a series of experiments, we provided 10 *Corcyra cephalonica* (Saint.) (Lepidoptera: Pyralidae) larvae in a clump at one meter distance from the nests of *Diacamma ceylonense* and *Myrmicaria brunnea*. In the case of *D. ceylonense*, the bait was discovered by a forager within 15.7 ± 17.6 (n = 13) minutes and in the case of *Myrmicaria* it was discovered within 15.6 ± 11.2 (n = 8) minutes. In both cases, although, much more predictably in *Myrmicaria*, additional foragers moving around the bait also subsequently discovered the bait (Table 1 and 2).

In the experiment with *Myrmicaria brunnea* it was our impression that, once a first forager discovered the bait, other foragers arrived in relatively quick succession. If our impression is correct, it suggests that the forager arriving first, somehow communicates with other foragers searching nearby and makes it possible for them to reach the bait rapidly. To test if our impression was correct, we conducted the following analysis. If there was no communication between the forager which arrived first and those that arrived later, then the time taken by any forager to discover the bait should come from the distribution of the times taken by the first foragers to discover the bait. Using the distribution of times taken by the first foragers to discover the bait, we simulated

Table 1
Time taken by each *Diacamma ceylonense* foragers to reach the bait (in minutes).
For all foragers, time to reach the bait is calculated from the time the bait was provided.

Expt. No.	Foragers					
	1st	2nd	3rd	4th	5th	6th
1	12	100				
2	69	98				
3	9	12	40	50	89	100
4	20	60	78	91		
5	12	62	78			
6	2	28				
7	4	28				
8	6	32				
9	28	59				
10	6	10				
11	4	22	42	50	68	74
12	16	60	80			
13	16	28				

Table 2
Time taken by *Myrmicaria brunnea* foragers to reach the bait (in minutes).
For all foragers, time to reach the bait is calculated from the time the bait was provided.

Expt. No.	Foragers				
	1st	2nd	3rd	4th	5th
1	35	36	36	37	37
2	26	27	27	27	27
3	12	12.5	13	13	13
4	21	21.5	22	23	23
5	2	3	3	3	3
6	15	17	17	17	17
7	10	12	12	12	12
8	4	5	5	5	5

times required by 40 foragers (5 foragers at each of 8 baits as observed in the experiment) and computed the time intervals between the arrival of successive foragers at each bait. These time intervals between the arrival of successive foragers in the simulated data were compared with time intervals between the arrival of successive foragers in the observed data by a t-test. The simulation was repeated 10³ times and in all cases the time intervals between the arrival of successive foragers in the simulation were significantly higher than corresponding the values in the observed data (equivalent to $p < 0.001$). We suggest therefore that the first *Myrmicaria brunnea* forager

Table 3
Time intervals in the arrival of successive foragers

		Sample size	Min.	Max.	Mean	S.D.
<i>Myrmicaria brunnea</i>	Observed	32	0	2	0.37	0.58
	Simulated	32000	0	48.49	6.88 ¹	6.17
<i>Diacamma ceylonense</i>	Observed	25	3	88	23.76	17.76
	Simulated	25000	0	96.85	14.48 ²	19.80

¹In the case of *Myrmicaria brunnea*, in all 1000 simulations, the time interval between the arrival of successive foragers was significantly greater (t-test, $p < 0.05$) than in the observed data. Thus the null hypothesis that the time interval in the observed data is equal to that in the simulated data is rejected at $p < 0.001$.

²In the case of *Diacamma ceylonense*, in 131 out of 1000 simulations the time interval in the arrival of successive foragers was not significantly greater (t-test, $p < 0.05$) than in the observed data. Thus the null hypothesis that the time gap in the observed data is equal to that in the simulated data is accepted at $p > 0.13$.

communicates, perhaps by means of chemical and/or acoustic signals, so that other foragers present nearby can move towards it and find the bait sooner than they would on their own. When we conducted a similar simulation and analysis of the data on the rates at which *Diacamma ceylonense* foragers discovered baits, we found that in 131 out 1000 simulations (equivalent to $p > 0.13$) there was no difference between the observed and simulated time intervals in the arrival of successive foragers. Thus our data do not suggest that *Diacamma ceylonense* foragers communicate in a similar fashion. Descriptive statistics of observed and simulated time intervals between the arrival of successive foragers for *Myrmicaria brunnea* and *D. ceylonense* are given in Table 3. Remarkable as it is, the possible short-range communication performed by *Myrmicaria brunnea* is not surprising because some species of ants are known to use chemical and acoustic signals for similar short-range communication (Markl and Hölldobler 1978; Hölldobler *et al.* 1978; Hölldobler and Wilson, 1990).

ACKNOWLEDGEMENTS

This work was supported by grants from the Ministry of Environment and Forests, Government of India. Visit of Neelkamal Rastogi to Bangalore was supported by a visiting fellowship from the Jawaharlal Nehru Centre for Advanced Scientific Research.

REFERENCES

- Hölldobler, B., Stanton, R. C. and Markl, H. (1978) Recruitment and food retrieving behaviour in *Novomessor* (Formicidae, Hymenoptera). I. Chemical signals. *Behav. Ecol. Sociobiol.*, **4** 163-181.
- Hölldobler, B. and Wilson, E. O. (1990) *The Ants*. Springer-Verlag, Berlin.
- Markl, H. and Hölldobler, B. (1978) Recruitment and Food-retrieving behaviour in *Novomessor* (Formicidae, Hymenoptera). II. Vibrational signals. *Behav. Ecol. Sociobiol.*, **4**, 183-216.
- Rastogi, N., Nair, P., Kolatkar, M., William, H. and Gadagkar, R. (1997). Ant fauna of the Indian Institute of Science - survey and some preliminary observations. *J. Indian Inst. Sci.*, **77**, 133-140.