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Key relocation leaders in an Indian queenless ant

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ABSTRACT

Division of labor is a central feature in social insects, wherein, simple individuals come together in groups to perform tasks that could be quite complex. It is generally believed that individuals who perform a specific task are themselves simple, interchangeable units. However, the variances in the performances of these individual insects need to be explored in greater detail. In this study, individual specialization in the context of colony relocation was examined in the Indian ponerine ant *Diacamma indicum*. One ant termed the maximum tandem leader (Max TL) was found to have a key role. Max TL performed 24% of the adult relocation in the colony and recruited more tandem leaders than other leaders thereby contributing to the organization of the relocation. The Max TL's role in the relocation process was further examined by comparing control relocations with experiments in which the Max TL was removed during the relocation process. Even though all the colonies relocated successfully, the relocation dynamics was significantly altered in the absence of the Max TL. We find that a single individual, the Max TL, takes up roles of a performer, organizer and catalyst during the colony relocation process, which challenges the norm that all workers are equal.

1. Introduction

A central theme in organized societies is the division of labor (Wilson, 1971). In social insect colonies division of labor is considered as the means by which work efficiency can be increased by allowing individuals to specialize on fewer tasks (Oster and Wilson, 1978). While morphological differences generally accompany specialization of reproductive and non-reproductive castes within the colony, morphological differences are not so common among the non-reproductive castes (Anderson and McShea, 2001). Division of labor among non-reproductive workers is brought about by age, context or genetic predisposition and is considered to be more flexible (Wilson, 1976; Lenoir, 1987; Robinson, 1992; Stuart, 1997). Even though individuals themselves are not very complex, they achieve very complex tasks by following simple principles of self organization (Fresneau and Dupuy, 1988; Jeanne, 1988). For example pattern formation in the context of foraging, construction of pillar and distribution of brood within social insect colonies like honeybees has been examined by means of experiments and simulations to understand the self organizing processes involved (Deneubourg and Goss, 1989; Deneubourg et al., 1990; Bonabeau et al., 1997; Camazine et al., 2001).

There is prior evidence indicating that individuals forming the worker caste are not necessarily simple interchangeable homogenous units (Gordon, 1996; Calabi and Traniello, 1989; Langridge et al., 2007; Dornhaus et al., 2008; Sumpter, 2006). Furthermore, there is a disparity in the proportion of individuals involved in the task and the proportion of work they contribute (Lindauer, 1952; Herhers, 1983; Schmid-Hempel, 1990). Individuals that showed exceptionally high levels of activity as compared to other members within the same age-size cohorts were defined as "elites" (Oster and Wilson, 1978). In an attempt to make this definition more functional and quantitative, Robson and Traniello (1999) defined behaviorally specialized individuals as those who perform a given behavior far more frequently than others of similar age or group engaged in the same activity. Some studies have found individual specialization in ant colonies. In the context of colony emigration, transport specialists have been recorded in *Temnothorax albipennis* (Dornhaus et al., 2008), *Tapinoma erraticum* (Meudec, 1977), *Formica sanguine*, *Formica fusca* and *Camponotus sericeus* (Moglich et al., 1974). In the context of foraging, the ponerine ant *Ectatomma ruidum* Roger has been recorded to have 31% foragers specialized in collecting honey and 15.4% specialized in collecting protein sources (Schatz et al., 1995). In the harvester ant *Pogonomyrmex rugosu*,

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