

Characterization of Nest Architecture of an Indian Ant *Diacamma indicum* (Hymenoptera: Formicidae)

Kushankur Bhattacharyya¹ and Sumana Annagiri^{1,2,*}

¹Behaviour and Ecology Lab, Department of Biological Sciences, Indian Institute of Science Education and Research, Kolkata, Mohanpur, West Bengal-741246, India and ²Corresponding author, e-mail: sumana@iiserkol.ac.in

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Abstract

Nests are physical entities that give shelter to the inhabitants from natural adversities, predators and act as a platform for organization of tasks particularly in social insects. Social insect nests can range from simple structures consisting of a single entrance leading to a chamber to complex nests containing hundreds of connected shafts and chambers. This study characterizes nest architecture of a tropical ponerine ant *Diacamma indicum* (Hymenoptera: Formicidae), which has small colony sizes and is known to be a scavenger. We also examined if these nests vary seasonally. By examining the microhabitat in the vicinity of the nest, the nest entrance characteristics and casting 77 natural nests of *D. indicum* across a year, we found that this species occupies relatively simple nests consisting of a single entrance that leads to a single chamber. This chamber progressed to a secondary tunnel that terminated at a greater depth than the chamber. The nest volume was not correlated to the number of adult members in the colony. Even though the microhabitat around the nest and the entrance itself change across seasons, principle component analysis showed that the nest architecture remained similar. Only one parameter, the entrance tunnel showed significant difference and was longer during postmonsoon. Nests of colonies living in the immediate vicinity of human habitation were comparable to other nests. We conclude that *D. indicum* found in the Gangetic plains live in relatively simple nests that do not vary across seasons.

Key words: Ponerinae, seasonal variation, nest microhabitat, nest chirality, nest volume

A nest is a place or a specially modified structure serving as an abode for animals and especially during their immature young. Animal nests have fascinated us over the centuries with their monumental building efforts as well as their enigmatic architectural features (Hansell and Ruxton 2008). Nests are important to organisms that occupy them as they give protection from predators, environmental adversities, and provide a storage space for resources (Hansell 1993). Nests are also important for the establishment of territories and providing group identity and for the organization of work, particularly in the case of social insects (Robson et al. 1995). Nesting sites of ants are diverse and can range from subterranean soil nests to cavities in living trees or leaves stitched together forming arboreal chambers and occasionally even consist of living workers orienting themselves to form a chamber (Tschinkel 2015). The generalized architecture of subterranean ant nests consists of a vertical shaft connecting the entrance to a horizontal chamber. This unit can be repeated many times over to form complex structures such as those found in leaf cutter ant *Atta leviagata* nests, containing up to 7,800 chambers that extend as deep as 7 m underground (Moreira et al. 2004).

The impact of seasonal variation has been examined on life history traits like alate formation, brood production, and colony size,

but to the best of our knowledge, its impact on nest architecture in tropics is relatively unexplored (Tschinkel 1999a,b; Cristiano et al. 2019). What we do know is that as colony size increases the number of chambers as well as the volume of these chambers increase in case of *Pogonomyrmex badius*, *Phedole morrisi*, *Solenopsis invicta*, and some other species (Tschinkel 2015). Sometimes, the chamber edges become more lobed as the chamber grows (Tschinkel 2015). In the temperate ant *Odontomachus brunneus*, winter nests are twice as deep (up to 170 cm) as summer nests (up to 60 cm), even though colonies consisted of similar number of adults (Hart and Tschinkel 2012). When *Temnothorax rugatulus*, colonies were subjected to higher humidity and lower airflow, they built nests with thicker walls, indicating that colonies are potentially capable of adapting their nests to differences in their natural habitat (DiRienzo and Dornhaus 2017).

There are several methods to study the architecture of subterranean ant nests. Careful excavation of the nest, layer by layer, exposing one chamber at a time can give an idea about chamber size and depth, but fine structural details are lost. Casting of nests provides detailed information regarding the nest structure and is considered to be the best and most convenient option. Materials like