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Biodiversity assessment of ant species in chincholi wildlife sanctuary, Karnataka, India

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Abstract
Ants (Formicidae) are environmentally important insects that play crucial roles in ecosystem functioning. They provide us with many ecological services including soil aeration, seed dispersal, biological control and nutrient cycling. This study presents a preliminary inventory of ant species in Chincholi Wildlife Sanctuary, a unique dry deciduous forest ecosystem in Kalyana Karnataka. A total of 14 ant species belonging to 9 genera and 3 subfamilies were recorded, highlighting their distribution and ecological status. Among these, *Tetraponera rufonigra*, *Tetraponera allobarans*, and *Monomorium subopacum* were classified as rare, while the rest were common. The presence of rare and arboreal ant species underscores the ecological heterogeneity and conservation significance of the area.

Keywords: Ants, chincholi, kalyana Karnataka

Introduction
Ants (family Formicidae) are one of the most ecologically successful groups of insects, comprising over 14,000 described species globally (Bolton, 2024) [5]. They play significant roles as predators, scavengers, and mutualists, making them essential bio-indicators of ecosystem health (Del Toro *et al*., 2012; Holldobler & Wilson, 1990) [6, 9]. They are said to act as ecosystem engineers by altering chemical and microbial properties of the soil in which they are present (Holec and Frouz, 2006) [8]. Due to their ubiquity, species richness, and functional diversity, ants are increasingly used in biodiversity assessment and conservation planning (Underwood & Fisher, 2006) [12]. Ants are said increase the crop yields in mango orchards by acting as biocontrol agents (Offenberg *et al*., 2013; Thurman *et al*., 2019) [10, 11].
There are more than 800 species of ants known to exist in India, which has diverse habitats (Bharti & Sharma, 2011) [3]. However, there is still a lack of data from a number of protected areas, particularly in the semi-arid regions of the Deccan Plateau and Kalyana Karnataka region. The sole dry deciduous forest in the Kalyana Karnataka area is Chincholi Wildlife Sanctuary, which is located in the Kalaburagi district of the state. Insect diversity especially that of ants is not well recorded here, despite its ecological significance.
This study aims to document ant species in Chincholi Wildlife Sanctuary, record their ecological status, and contribute to the baseline understanding of insect biodiversity in this understudied region.

Materials and Methods
1. Study Area
Chincholi Wildlife Sanctuary (CWS), located in the northeastern part of Karnataka (Kalaburagi district), spans approximately 134.88 km² and is characterized by dry deciduous and thorn forests interspersed with scrub and grassland. It is divided into three major forest sections: Chandrampalli, Konchavaram, and Shadipur. Five different blocks - Chincholi forest, Sangapur forest, Bhonsapur forest, Magdumpur forest, and Shadipur forest which were selected as study sites.

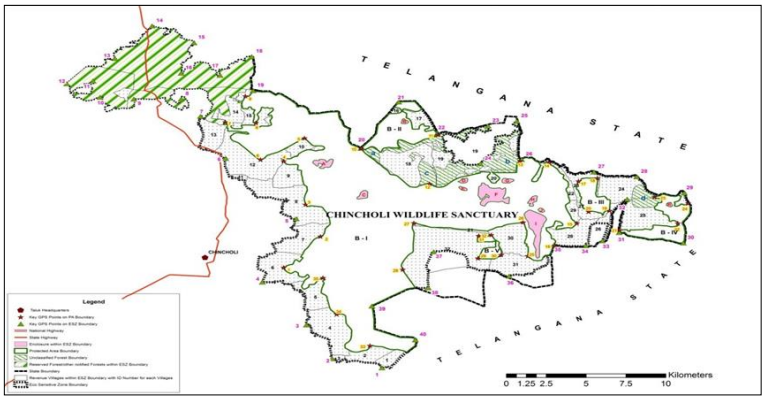

Fig 1: Map showing chincholi wildlife sanctuary area

2. Sampling Technique
The study to understand the diversity of ants was conducted for two years from 2022-2024. Standardized sampling methods were employed to comprehensively document ant diversity across different microhabitats in Chincholi Wildlife Sanctuary. The study followed established protocols for ant inventory (Agosti *et al*., 2000) [1], combining multiple techniques to maximize species detection.
Pitfall trapping: was conducted using 8 cm diameter plastic cups filled with a preservative solution (70% ethanol with a drop of

detergent to reduce surface tension). Ten traps were deployed at 10-meter intervals along 100-meter transects in each habitat type (dense forest, scrubland, and transition zones). Traps remained active for 48 hours during dry weather conditions to avoid flooding artifacts (Bestelmeyer *et al*., 2000) [2]. This passive collection method effectively sampled ground-dwelling and nocturnal ant species.

Active hand collection: complemented pitfall trapping by targeting microhabitats that traps might miss. Each sampling plot was surveyed for 30 minutes, with particular attention to: (1) leaf litter (processed using Winkler extractors for cryptic species), (2) tree trunks up to 2 meters height, and (3) subcortical spaces under bark and fallen logs. Time-constrained manual sampling ensured representation of arboreal and thermophilic species (Fisher, 1999) [7].

Baiting stations: using protein (tuna flakes) and carbohydrate (honey) baits were established to assess foraging activity. Baits were placed on 10×10 cm white index cards and monitored at 30-minute intervals for 2 hours. All attracted ants were collected to document resource preferences and competitive interactions among species (Andersen, 1997).

Beating vegetation: Ants foraging on vegetation were sampled by beating the vegetation to dislodge ants from plants onto sheets. Ants were collected using a beating tray every two hours per site within an area of 100 m on both sides of the transect.

Statistical analyses were also carried out using past software to assess species richness, diversity and dominance patterns among forest blocks, thereby providing insights into the structure and composition of ant communities.

3. Identification and data analysis

Specimens were preserved in 70% ethanol and identified using standard identification keys (Bingham, 1903; Bharti *et al*., 2016) [4] and online databases (AntWeb, AntWiki). The ecological status of each species was determined based on frequency and abundance across sampled locations. Species were categorized as "Common" or "Rare". Further authentication of species was done at NCBS Banglore.

Results

A total of 14 species of ants representing 9 genera and 3 subfamilies (Formicinae, Myrmicinae and Pseudomyrmecinae) were documented from Chincholi Wildlife Sanctuary (Table 1). Most species belonged to the subfamily Myrmicinae (57%), followed by Formicinae (29%) and Pseudomyrmecinae (14%).The diversity analysis across the five forest blocks revealed variation in species richness and diversity indices. Shadipur exhibited the highest species richness (12 species) along with the highest Shannon-Weiner diversity index (2.39), indicating a relatively diverse and evenly distributed ant community. Correspondingly, Shadipur had the lowest Berger-Parker dominance index (0.154), suggesting minimal dominance by any single species. Bhonsapur and Sangapur blocks showed intermediate values of species richness (10 and 9 species respectively) and diversity, with Shannon indices of 2.23 and 2.13, and Berger-Parker indices of 0.164 and 0.166, indicating moderately diverse communities with slightly higher species dominance than Shadipur.

In contrast, the Chincholi and Mogdampur blocks showed lower species richness (7 species each) and correspondingly lower Shannon diversity indices (1.87 and 1.89). Their higher Berger-Parker indices (0.215 and 0.202) indicate greater dominance by fewer species, suggesting less even communities. The Simpson indices followed a similar pattern, with Shadipur exhibiting the highest evenness (0.90) and Chincholi the lowest (0.84). Overall, the data suggest that Shadipur forest block harbors the most diverse and balanced ant community, while Chincholi and Mogdampur exhibit relatively lower diversity and higher species dominance. These patterns likely reflect variations in habitat quality, resource availability, or disturbance levels among the forest blocks.

Discussion and Conclusion

The analysis of ant diversity across the five forest blocks revealed notable differences in species richness and community structure, with Shadipur forest block showing the highest diversity and evenness, indicating a well-balanced and resource-rich habitat. In contrast, Chincholi and Mogdampur forest blocks exhibited lower diversity and higher species dominance, suggesting environmental constraints or habitat degradation that limits species coexistence. Intermediate diversity levels in Bhonsapur and Sangapur blocks further reflect varying habitat quality across the landscape. These findings underscore the influence of habitat heterogeneity, resource availability, and disturbance on shaping ant communities. Maintaining and improving habitat conditions, especially in less diverse blocks, is essential for conserving ant biodiversity and ecological stability in the region.

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Table 1: Checklist of Ants documented in Chincholi Wildlife Sanctuary.

Sl No	Family	Common Name	Scientific Name	Sub-family	Ecological status
	Formicidae	Longhorn Crazy Ant	*Paratrechina longicornis*	Formicinae	Common
1.		Carpenter Ant	*Compnotus irrtans*	Formicinae	Common
2.		Indian Black Ant	*Componotus compresses*	Formicinae	Common
3.		Componotus Sp.	Componotus sp.	Formicinae	Common
4.		Cocktail Ants	*Crematogaster biroi*	Myrmicinae	Common
5.		Acrobat Ant	*Crematogaster subopacum*	Myrmicinae	Common
6.		Big Headed Ant	*Pheidole spathifera*	Myrmicinae	Common
7.		Groove Headed Fierce Ant	*Tetramorium simillimum*	Myrmicinae	Common
8.		Dormant Hunter	*Monomrium subopacum*	Myrmicinae	Rare
9.		Cataulus Sp.	Cataulus sp.	Myrmicinae	Common
10.		Myrmicaria Sp.	Myrmicaria sp.	Myrmicinae	Common
11.		Pheidole Sp.	Pheidole sp.	Myrmicinae	Common
12.		Bi-Coloured Arboreal Ants	*Tetraponera rufonigra*	Pseudomyrmecinae	Rare
13.		Slender Ants	*Tetraponera allobarans*	Pseudomyrmicinae	Rare

Table 2: Diversity Indices of Ant populations in different forest Blocks of Chincholi Wildlife Sanctuary.

Forest Block	Species Richness	Shannon-Weiner Index	Simpson Index	Berger-Parker Index
Shadipur	12	2.39	0.9008	0.154
Bhonsapur	10	2.226	0.8855	0.1642
Sangapur	9	2.127	0.8745	0.1659
Chincholi Block	7	1.868	0.8366	0.2148
Mogdampur	7	1.885	0.8414	0.2021

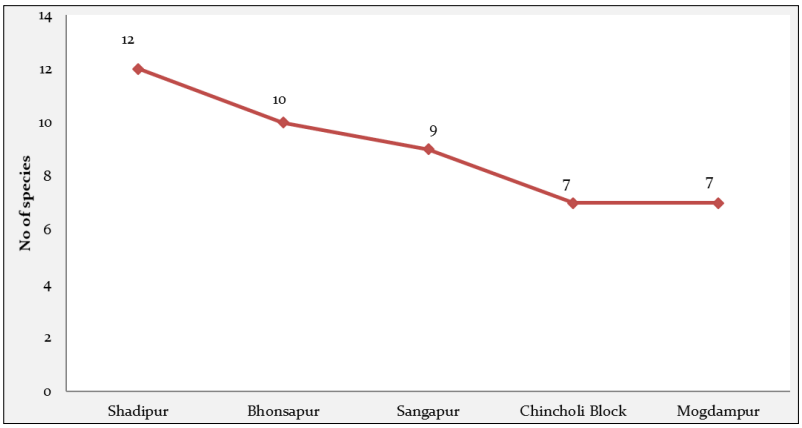

Fig 2: Showing species richness of ants in different sub sites of the study area

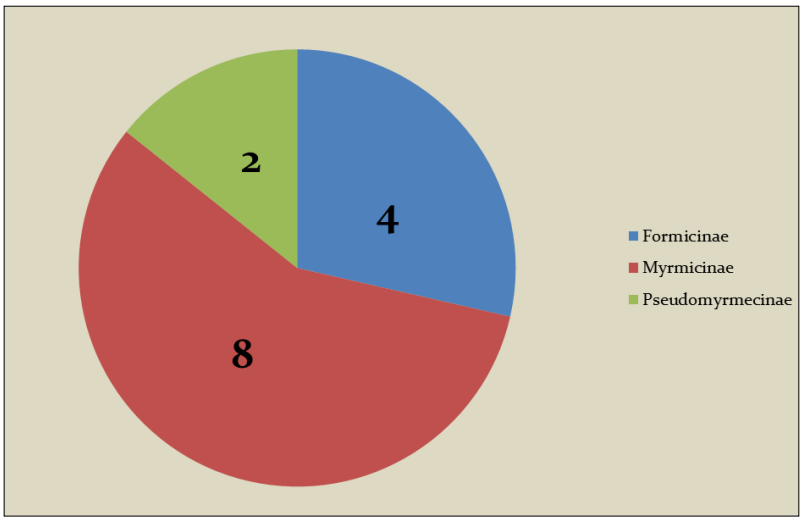

Fig 3: Pie Chart Showing sub-family wise distribution of Ants in the study area

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