

A Study on Ant Diversity and Distribution Across Different Habitats of Anandwan, Warora, Maharashtra

Pranali Meshram¹, R.R Kamdi² and S. G. Yangandalwar³

Anandniketan College Anandwan, Warora,

District Chandrapur Email: dr_sachin.yangandalwar@rediffmail.com

Abstract

Ants (Hymenoptera: Formicidae) are important components of terrestrial ecosystems and contribute to soil modification, nutrient redistribution, predation, seed movement and other ecosystem processes. The present study was undertaken to document the species composition and ecological distribution of ants across different habitats of Anandwan, Warora, Maharashtra. Field sampling was carried out for twelve months, from January to December 2024, using hand collection and pitfall trapping. A total of 18 ant taxa were recorded in the supplied field checklist, representing six subfamilies of Formicidae. Formicinae was the most species-rich subfamily (7 species; 38.89%), followed by Myrmicinae (4; 22.22%), while Dolichoderinae and Pseudomyrmecinae contributed two species each (11.11% each), and Ponerinae and Dorylinae contributed one species each (5.56% each). The assemblage included arboreal, terrestrial and generalist ecological forms, suggesting that the heterogeneous landscape of Anandwan provides a range of microhabitats, nesting substrates and food resources. The species richness observed is comparable with several localized Indian ant surveys, although direct comparison is constrained by differences in sampling effort and habitat extent. The study provides baseline information for Anandwan and emphasizes the need for standardized seasonal abundance sampling and taxonomic verification of voucher specimens before using the checklist for formal biodiversity databases or publication.

Keywords: Ant diversity; Formicidae; Hymenoptera; species richness; habitat heterogeneity.

1. Introduction

Ants are among the most diverse and ecologically influential terrestrial insects. Their social organization, broad habitat tolerance and interactions with plants, soil organisms and other arthropods allow them to occupy a wide range of ecological niches. Classic synthesis has emphasized their importance in soil turnover, energy flow, predation and terrestrial ecosystem organization [1].

Ants also perform several ecosystem functions. Nest construction and foraging can modify soil structure, redistribute organic material and influence nutrient availability, while interactions with plants and other organisms contribute to seed dispersal, herbivore regulation and decomposition processes [3,6–9]. Ant nests can create localized nutrient-rich patches and influence plant performance, demonstrating that ant activity can extend beyond the colony itself to affect ecosystem processes [6].

Because ant communities respond to environmental conditions, resource availability and habitat disturbance, they have frequently been proposed as useful bioindicators. However, interpretation of ant community patterns is scale dependent, and sampling design strongly influences estimates of richness and community composition [4,5]. Standardized approaches combining complementary collection methods are therefore recommended when assessing ant biodiversity [2].

India has a rich and taxonomically diverse ant fauna. A major national checklist documented 828 valid species and subspecies names in 100 genera and 10 subfamilies, while also highlighting substantial geographical gaps and the importance of additional local surveys [10]. Recent regional studies have similarly demonstrated that ant richness varies among

rural, urban, forest and campus habitats [11–15]. Maharashtra in particular has produced several localized inventories, but fine-scale information remains uneven.

Anandwan, Warora, in Chandrapur district, Maharashtra, is a heterogeneous landscape containing agricultural areas, tree plantations, grassland-like open areas and residential or human-influenced habitats. Such habitat heterogeneity can create distinct nesting and foraging opportunities for arboreal and ground-associated ants. Despite this ecological potential, a systematic baseline inventory for Anandwan has been limited. Therefore, the present study aimed to document the ant species recorded from different habitats of Anandwan, quantify species richness at the subfamily level, and interpret the observed assemblage in relation to habitat heterogeneity and ecological roles.

2. Materials and Methods

2.1 Study Area

The study was conducted at Anandwan, Warora, Chandrapur District, Maharashtra, India. The study landscape includes agricultural fields, tree plantations, open/grassland habitats and residential or human-influenced areas. The region experiences a tropical seasonal climate with summer, monsoon and winter periods. Variation in vegetation cover, soil texture, litter accumulation and woody substrates provides multiple potential microhabitats for ants.

2.2 Study Duration

Sampling was conducted for twelve months from January 2024 to December 2024, allowing observations across different seasonal conditions.

2.3 Sampling Methods

Two complementary approaches were used. First, hand collection was conducted in accessible microhabitats including soil surfaces, leaf litter, beneath stones and tree bark. Second, pitfall traps containing ethanol were placed at ground level to sample actively foraging ground-dwelling ants. The combination of active hand collection and passive pitfall sampling follows the general principle of using complementary methods to improve representation of ground-associated ant assemblages [2].

2.4 Preservation and Identification

Collected specimens were preserved in 70% ethanol and labelled with date, habitat and locality

information. Identification was undertaken using standard taxonomic literature and identification resources, and specimens were assigned to genus and subfamily. Voucher-based verification is recommended for all species records, especially unusual distributional records.

2.5 Data Analysis

The supplied checklist was used to calculate species richness and the proportional representation of each subfamily. Percentage contribution was calculated as: (number of species in a subfamily / total recorded species) $\times$ 100. The present dataset contains occurrence/checklist information rather than standardized individual-abundance counts for each species and habitat. Therefore, abundance-based Shannon–Wiener, Simpson, Pielou and Berger–Parker indices were not reported as numerical results. This avoids treating species occurrence as equivalent to individual abundance. Future sampling with standardized counts can support these indices.

3. Field Observations and Photographic Documentation



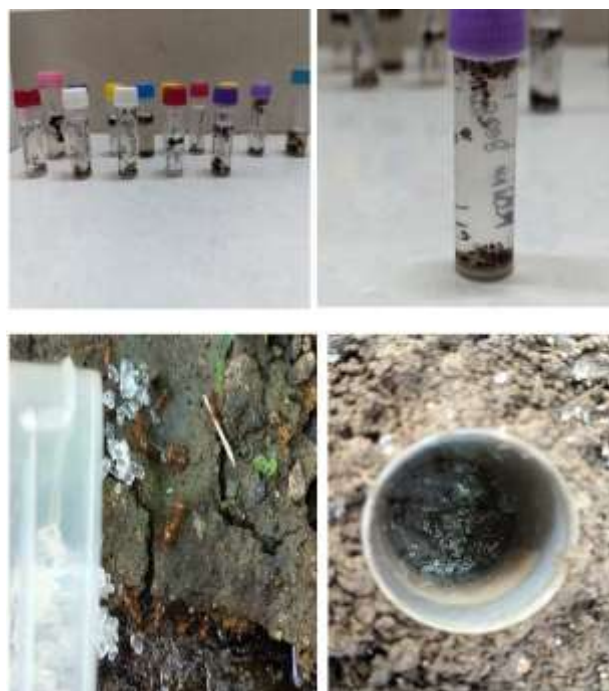
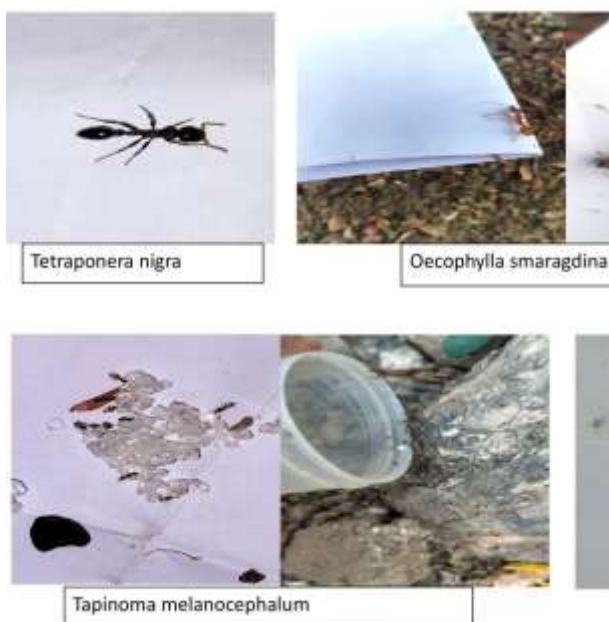


Image A – Collection of Sample from Site.



Image B – Varieties of Sample and Species Identification with Scientific Name



3. Results

The investigation documented 18 ant species in the supplied Anandwan checklist, all belonging to the family Formicidae under the order Hymenoptera. The recorded taxa represented six subfamilies and multiple genera, indicating a taxonomically heterogeneous assemblage. The checklist included arboreal-associated taxa such as *Oecophylla* and *Tetraponera*, terrestrial or ground-associated forms including *Camponotus*, *Monomorium*, *Tetramorium* and *Solenopsis*, and ecologically distinctive taxa such as *Dorylus* and *Tapinoma*.

The total richness of 18 species is lower than the 35 species reported from Periyanaickenpalayam, Tamil Nadu, and the 31 species recorded from Periyar Tiger Reserve, Kerala; however, those studies differed in sampling duration, area and methods [11,12]. The total is also broadly comparable with localized campus and regional surveys, including 21 species reported from VSK University campus, Ballari [13]. Recent work in Wardha District also confirms that rural and urban habitats in Maharashtra can support substantial ant richness and multiple subfamilies [15]. These comparisons should be interpreted cautiously because sampling effort and taxonomic coverage are not standardized among studies.

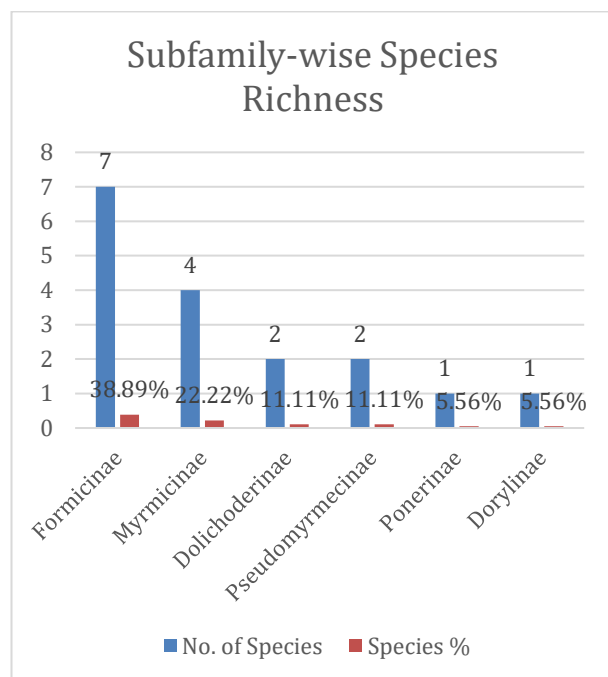
3.1 Species Checklist

S r. N o.	Order	Famil y	Subfamily	Com mon nam e	Scientifi c name
1	Hymenoptera	Formicidae	Formicinae	Yellow crazy ant	Anoplolepis gracilipes
2	Hymenoptera	Formicidae	Formicinae	Black crazy ant	Paratrechina longicornis
3	Hymenoptera	Formicidae	Myrmicinae	Little black ant	Monomorium minimum
4	Hymenoptera	Formicidae	Formicinae	Carpenter ant	Camponotus compressus
5	Hymenoptera	Formicidae	Formicinae	Weaver ant	Oecophylla smaragdina
6	Hymenoptera	Formicidae	Formicinae	Carpenter ant	Camponotus vagus
7	Hymenoptera	Formicidae	Ponerinae	Asian needle ant	Brachyponera chinensis
8	Hymenoptera	Formicidae	Formicinae	Field ant	Formica selysi
9	Hymenoptera	Formicidae	Formicinae	Sugar ant	Camponotus consobrinus
10	Hymenoptera	Formicidae	Dorylinae	Driver ant	Dorylus laevigatus
11	Hymenoptera	Formicidae	Myrmicinae	Acrobat ant	Crematogaster cerasi
12	Hymenoptera	Formicidae	Myrmicinae	Pavement	Tetramorium

				ant	immigratum
13	Hymenoptera	Formicidae	Myrmicinae	Red fire ant	Solenopsis invicta
14	Hymenoptera	Formicidae	Pseudomyrmecinae	Black slender ant	Tetraponera nigra
15	Hymenoptera	Formicidae	Pseudomyrmecinae	Bicolored arboreal ant	Tetraponera rufonigra
16	Hymenoptera	Formicidae	Dolichoderinae	Ghost ant	Tapinoma melanoccephalum
17	Hymenoptera	Formicidae	Dolichoderinae	Black house ant	Ochetellus glaber
18	Hymenoptera	Formicidae	Formicinae	Black garden ant	Lasius niger

3.2 Subfamily-wise Species Richness

Subfamily	No. of species	Percentage (%)
Formicinae	7	38.89
Myrmicinae	4	22.22
Dolichoderinae	2	11.11
Pseudomyrmecinae	2	11.11
Ponerinae	1	5.56
Dorylinae	1	5.56



Formicinae was the most species-rich subfamily, with 7 species (38.89%), followed by Myrmicinae with 4 species (22.22%). Dolichoderinae and Pseudomyrmecinae each contributed 2 species (11.11%), whereas Ponerinae and Dorylinae each contributed 1 species (5.56%). Thus, Formicinae and Myrmicinae together accounted for 11 of the 18 recorded species (61.11%). The unequal representation among subfamilies indicates that species richness was concentrated in a subset of the recorded taxonomic groups.

3.3 Ecological Representation

The checklist contained species associated with both vegetation and ground-level microhabitats. *Oecophylla smaragdina* and *Tetraponera* spp. represent arboreal-associated forms, whereas *Camponotus*, *Monomorium*, *Tetramorium* and *Solenopsis* include terrestrial or ground-associated taxa. The coexistence of these forms suggests a habitat mosaic containing foliage, woody substrates, soil surfaces and litter resources.

The occurrence of ecologically distinctive ants is also consistent with the broader ecological literature, which recognizes ants as organisms capable of modifying soils and mediating resource redistribution [3,6–9]. The present study, however, records occurrence rather than measuring the magnitude of these ecosystem functions.

4. Discussion

The present study recorded 18 ant species from Anandwan, Warora, representing six subfamilies of Formicidae. This confirms that the study landscape

supports a heterogeneous ant assemblage. Ant communities are strongly influenced by habitat structure, resource availability, microclimate and disturbance, and their composition can therefore vary substantially over relatively small spatial scales [4,5]. The combination of agricultural, vegetated, open and human-influenced habitats at Anandwan provides multiple ecological opportunities for ants.

The dominance of Formicinae in the present checklist is noteworthy. Formicinae contributed 38.89% of the recorded species, while Myrmicinae contributed 22.22%. A similar prominence of Formicinae has been reported in the Periyar Tiger Reserve and in other Indian ant surveys [12,13]. Nevertheless, the national Indian checklist shows that Myrmicinae is the most species-rich subfamily at the country scale, followed by Formicinae [10]. The difference between the national pattern and the Anandwan local pattern illustrates why regional inventories remain important for understanding local community composition.

The occurrence of arboreal-associated *Oecophylla smaragdina* and *Tetraponera* spp. suggests that vegetation and woody substrates contribute to local ant habitat availability. *Oecophylla* is characteristically associated with trees and foliage, while the presence of ground-associated genera such as *Camponotus*, *Monomorium*, *Tetramorium* and *Solenopsis* indicates the importance of soil and litter environments. Thus, maintaining vegetation, litter and relatively undisturbed soil patches may help retain the structural heterogeneity required by different ant guilds.

Ants are also important ecosystem engineers. Nest construction can alter soil physical properties and create localized nutrient concentrations, while ant activity can affect decomposition and nutrient movement [6–9]. These functions provide an ecological context for interpreting the diversity recorded at Anandwan. The presence of multiple ecological forms does not by itself demonstrate differences in ecosystem function, but it identifies a community with potentially diverse functional roles.

The richness of 18 species is lower than the 35 species reported from Periyanaickenpalayam and the 31 species recorded from Periyar Tiger Reserve [11,12], but it is within the range reported by several localized Indian surveys. The Ballari campus study documented 21 species across five subfamilies [13], while a recent Wardha District survey reported substantial richness across rural and urban locations [15]. Maharashtra studies from Amravati and Nagpur likewise

demonstrate that ant communities can be diverse in human-influenced landscapes [14,16]. These comparisons support the value of Anandwan as a site for continued local biodiversity assessment, but they should not be treated as standardized measures of relative biodiversity because methods and sampling effort differ.

A major limitation of the current dataset is the absence of standardized individual-abundance data by species and habitat. Consequently, the present results establish species richness and checklist composition but cannot reliably quantify numerical dominance, evenness or habitat-specific abundance. Standardized pitfall trapping, litter sampling and timed hand searches across replicated habitat plots would allow robust comparisons and calculation of Shannon–Wiener, Simpson, Margalef, Berger–Parker and Pielou indices. Standardization is important because ant biodiversity estimates are sensitive to sampling effort and method [2,4,5].

Finally, taxonomic verification is essential before formal submission or deposition of the checklist in a biodiversity database. The supplied list contains several records that warrant confirmation against current Indian distribution databases and voucher specimens. In particular, *Formica selysi* is associated with the Palearctic and has a documented type locality in France, so its occurrence at Anandwan should not be treated as confirmed without specimen-level re-identification [10]. This verification step is especially important because Indian ant checklists explicitly identify misidentifications and erroneous distributional records as a recurring problem in the literature [10].

5. Conclusion

The present study provides a baseline inventory of ants recorded across different habitats of Anandwan, Warora, Maharashtra. Eighteen species were documented in the supplied checklist, representing six Formicidae subfamilies. Formicinae was the most species-rich group (38.89%), followed by Myrmicinae (22.22%), demonstrating an unequal distribution of species richness among subfamilies. The coexistence of arboreal and terrestrial forms indicates that habitat heterogeneity is likely to be an important component of local ant diversity.

The findings contribute to the limited regional information available on ant diversity in the Anandwan–Warora landscape and provide a useful baseline for future ecological monitoring.

Conservation of vegetation, leaf litter, woody substrates and relatively undisturbed soil microhabitats is likely to support the persistence of diverse ant communities. Future research should incorporate replicated, habitat-specific and seasonal sampling, individual abundance data, environmental variables and voucher-based molecular or expert taxonomic confirmation.

6. Data Availability

The species checklist and subfamily-level richness data used in this manuscript are derived from the supplied research dataset. Raw individual-abundance and replicate-level habitat data were not available in the supplied document.

7. Ethical and Taxonomic Note

All species-level records should be checked against preserved voucher specimens and current taxonomic databases before final journal submission. Any doubtful identification should be reported as 'cf.' or revised to genus level until confirmation is obtained.

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