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DIVERSITY OF ANTS (HYMENOPTERA: FORMICIDAE) IN TIRUVALLUR DISTRICT OF TAMIL NADU, INDIA

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ABSTRACT

This study provides a wide-ranging list of ant species (Hymenoptera: Formicidae) from the Tiruvallur district, Tamil Nadu State, India. The study's main goal was to assess the diversity of ant species across a range of environments, such as hills, farms, and residential areas. Samples have been collected in leaf litter, rotting logs, beneath the soil, inside woody stems, and under rocks. A total of 34 species have been identified across 17 genera and 6 subfamilies. The subfamily Formicinae was the most prevalent with 14 species, followed by Myrmicinae (11 species), Pseudomyrmicinae (3 species), Dolichoderinae (2 species), Ponerinae (2 species), and Myrmeciinae (1 species).

Keywords:
Diversity, Formicidae, Ants family, Ants Eecosystem management, Ants and Tiruvallur District..

INTRODUCTION

Ants are a very prevalent group of invertebrates worldwide, displaying a vast array of eating patterns, nest-building techniques, and interactions with creatures in all trophic levels. Certain species exhibit specialized behaviors, while being omnivores in general and consuming a diverse range of foods such as seeds, plant exudates, dead animals, and live prey. These consist of growing fungus or consuming pollen (Kaspari, 2000). They are deeply involved in many ecological processes and are thus essential to terrestrial ecosystems. These tiny insects, which are often seen in gardens and houses, make up much to half of all insect biomass across the globe and are both ubiquitous and ecologically dominating (Anderson, 2021). Ants belong to the largest family, Formicidae, within the order Hymenoptera. Globally, this family includes 22 subfamilies, with 17,139 species and subspecies across 516 genera (antweb.org). Early fundamental works on Indian ants include those by Jerdon (1851 and 1854) and Forel (1900a, 1900b, 1901, and 1913). Notably, one of the most important contributions to our understanding of Indian ants is still Bingham's 1903 research. There are 10 subfamilies, 864 species, and 110 genera reported from identified in India (antwiki.org).

MATERIALS AND METHODS

Ants were collected from several parts of the Tiruvallur district, Tamil Nadu State including Tiruttani, Gummidipoondi, Poondi, Ponneri, Pallipattu, and Uthukkottai. This work's research period starts with the north-east monsoon, which runs from October to December 2023, and ends with the dry season, which runs from February to the beginning of June 2024.

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We collected ant samples using every technique imaginable, but in particular, Pitfall traps, the Winkler extractor, and Hand picking. The samples were preserved in 70% ethyl alcohol at the Marine Biology Regional Centre of the Zoological Survey of India, Chennai, Tamil Nadu State, India.

RESULTS

The analysis of ant species collected from six locations in the Tiruvallur district reveals significant biodiversity (Table-1). Among the 34 species identified, Tapinoma sessile, *Camponotus compressus, Camponotus sericeus, Formica rufa, Oecophylla smargdina, Monomorium minimum, Novomessor cockerelli, Pheidole megacephala, Solenopsis invicta, Trichomyrmex criniceps, Tetraponera allaborans*, and *Tetraponera nigra* were found in all six locations, indicating their widespread distribution.

Conversely, species like *Anoplolepsis gracillipes, Camponotus irritans, Camponotus japonicus, Camponotus maculatus, Camponotus pennsylvanicus, Oecophylla longinoda, Myrmecia pilosula, Meranoplus bicolor, Monomorium pharaonis, Solenopsis geminata, Dinoponera gigantea,* and *Tetraponera rufonigra* showed more localized distributions, being absent in one or more locations. This variation suggests differing habitat preferences and adaptability among the species. The presence of multiple species across diverse locations underscores the ecological richness of the Tiruvallur district and highlights the importance of habitat conservation to maintain this biodiversity.

Order: *Hymenoptera Linnaeus*, 1758
Super family: *Formicoidea Latreille*, 1809
Family: *Formicidae Latreille*, 1809

Sub family: Dolichoderinae Forel, 1878
Genus: *Linepithema*

1. ***Linepithema humile*** (Mayr, 1868)
   Iridomyrmex humilis arrogans Chopard, 1921
   Iridomyrmex riograndensis Borgmeier, 1928

Genus: Tapinoma

2. ***Tapinoma sessile*** (Say, 1836)
   Bothriomyrmex dimmocki Wheeler, W.M., 1915
   Formica gracilis Buckley, 1866
   Formica parva Buckley, 1866
   Tapinoma boreale Provancher, 1887
   Tapinoma boreale Roger, 1863

Sub family: Formicinae Lepeletier, 1836
Genus: Anoplolepsis

3. ***Anoplolepsis gracillipes*** (Smith, F., 1857)
   Formica longipes Jerdon, 1851
   Formica trifasciata Smith, F., 1858
   Genus: Camponotus

4. ***Camponotus angusticollis*** (Jerdon, 1851)
   Camponotus prismaticus Mayr, 1862
   Formica ardens Smith, F., 1858
   Formica impetuosa Smith, F., 1858

5. ***Camponotus compressus*** (Fabricius, 1787)
   Camponotus quadrilaterus Roger, 1863
   Formica callida Smith, F., 1858
   Formica indefessa Sykes, 1835

6. ***Camponotus herculeanus*** (Linnaeus, 1758)
   Camponotus herculeanus altaica Ruzsky, 1915
   Camponotus herculeanus caucasicus Arnol'di, 1967
   Camponotus herculeanus eudokiae Ruzsky, 1926
   Camponotus herculeanus jacuticus Karavaiev, 1929
   Camponotus herculeanus montanus Ruzsky, 1904
   Camponotus herculeanus nadigi Menozzi, 1922
   Camponotus herculeanus sachalinensis Forel, 1904
   Camponotus herculeanus shitkowi Ruzsky, 1904
   Camponotus herculeanus whymperi Forel, 1902
   Formica atra Zetterstedt, 1838
   Formica intermedia Zetterstedt, 1838

7. **Camponotus irritans** (Smith, F., 1857)
   Camponotus agnatus Roger, 1863

8. ***Camponotus japonicus*** Mayr, 1866
   Camponotus herculeanus manczshuricus Emery, 1925
   Camponotus japonicus miltotus Wheeler, W.M., 1929
   Camponotus japonicus sanguinea Karavaiev, 1929
   Camponotus japonicus wui Wheeler, W.M., 1929

9. ***Camponotus maculatus*** (Fabricius, 1782)
   Camponotus sexpunctatus liengmei Forel, 1894
   Formica cognata Smith, F., 1858
   Formica lacteipennis Smith, F., 1858

10. ***Camponotus mendax*** Forel, 1895
    Camponotus pseudolus Forel, 1902

11. ***Camponotus pennsylvanicus*** (De Geer, 1773)
    Camponotus herculeanus herculeanopennsylvanicus Forel, 1879
    Camponotus herculeanus mahican Emery, 1925

12. ***Camponotus rufoglaucus*** (Jerdon, 1851)
Camponotus redtenbacheri Mayr, 1862

13. ***Camponotus sericeus*** (Fabricius, 1798)
Formica aurulenta Latreille, 1802
Formica pyrrhocephala Motschoulsky, 1863

Genus: Formica

14. ***Formica rufa*** Linnaeus, 1761
Formica apicalis Smith, F., 1858
Formica dorsata Panzer, 1798
Formica ferruginea Christ, 1791
Formica gaullei Bondroit, 1917
Formica piniphila Schenck, 1852
Formica rufa meridionalis Nasonov, 1889
Formica rufa rufopratensis Forel, 1874

Genus: Oecophylla

15. ***Oecophylla smargdina*** (Fabricius, 1775)
Formica macra Guérin-Méneville, 1831
Formica virescens Fabricius, 1775
Formica viridis Kirby, W., 1819
Formica zonata Guérin-Méneville, 1838
16. ***Oecophylla longinoda*** (Latreille, 1802)
Oecophylla brevinodis André, 1890

Genus: Paratrechina

17. ***Paratrechina logicornis*** (Latreille, 1802)
Formica gracilescens Nylander, 1856
Formica vagans Jerdon, 1851
Paratrechina currens Motschoulsky, 1863
Prenolepis longicornis hagemanni Forel, 1901

Sub family: Myrmeciinae Emery, 1877
Genus: Myrmecia

18. ***Myrmecia pilosula*** Smith, F., 1858
Halmamyrmecia pilosula Wheeler, 1922
Myrmecia ruginoda F. Smith, 1858
Ponera ruginoda F. Smith, 1858
Promyrmecia pilosula Clark, 1943

Sub family: Myrmicinae Lepeletier de Saint-Fargeau, 1835
Genus: Meranoplus

19. ***Meranoplus bicolor*** (Guérin-Méneville, 1844)
Meranoplus bicolor fuscescens Wheeler, W.M., 1930
Meranoplus bicolor lucidus Forel, 1903
Meranoplus dimicans Walker, 1859
Meranoplus villosus Motschoulsky, 1860
Myrmica tarda Jerdon, 1851

Genus: Monomorium

20. ***Monomorium minimum*** (Buckley, 1867)
Monomorium metoecus Brown & Wilson, 1957 *Myrmica atra* Buckley, 1867

21. ***Monomorium Pharaonis*** (Linnaeus, 1758)
Atta minuta Jerdon, 1851
Formica antiguensis Fabricius, 1793
Myrmica contigua Smith, F., 1858
Myrmica domestica Shuckard, 1838
Myrmica fragilis Smith, F., 1858
Myrmica vastator Smith, F., 1857

Genus: Novomessor

22. ***Novomessor cockerelli*** (André, 1893)
Aphaenogaster sonorae Pergande, 1893

Genus: Pheidole

23. ***Pheidole megacephala*** (Fabricius, 1793)
Atta testacea Smith, F., 1858
Formica edax Fo rskål, 1775
Myrmica agilis Smith, F., 1857
Myrmica laevigata Smith, F., 1855
Myrmica suspiciosa Smith, F., 1859
Myrmica trinodis Losana, 1834
Oecophthora perniciosa Gerstäcker, 1859
Oecophthora pusilla Heer, 1852
Pheidole janus Smith, F., 1858
Pheidole laevigata Mayr, 1862

24. ***Pheidole pallidula*** (Nylander, 1849)
Oecophthora subdentata Mayr, 1853
Pheidole pallidula emeryi Krausse, 1912
Pheidole pallidula obscura Santschi, 1936
Pheidole symbiotica Wasmann, 1909
Xenoaphaenogaster inquilina Baroni Urbani, 1964

Genus: Solenopsis

25. ***Solenopsis geminata*** (Fabricius, 1804)
Solenopsis mandibularis Westwood, 1840
Solenopsis cephalotes Smith, F., 1859
Crematogaster laboriosus Smith, F., 1860
Diplorhoptrum drewseni Mayr, 1861
Myrmica saxicola Buckley, 1867
Solenopsis eduardi Forel, 1912
Solenopsis edouardi perversa Santschi, 1925

26. ***Solenopsis Invicta*** Buren, 1972
Solenopsis saevissima wagneri Santschi, 1916

27. ***Solenopsis xyloni*** McCook, 1879
Solenopsis geminata maniosa Wheeler, W.M., 1915
Solenopsis geminata pylades Forel, 1904

Genus: Trichomyrmex"

28. ***Trichomyrmex criniceps*** (Mayr, 1879)
Holcomyrmex criniceps niger Forel, 1902
Holcomyrmex criniceps ruber Forel, 1903

29. ***Trichomyrmex glaber*** (Andre, 1883)
Holcomyrmex glaber clarus Forel, 1902
Holcomyrmex glaber glabrocriniceps Forel, 1902

Sub family: Ponerinae Lepeletier, 1835
Genus: Dinoponera

30. ***Dinoponera gigantea*** (Perty, 1833)
Ponera grandis Guérin-Méneville, 1838
Ponera gigantea Perty, 1833

Genus: Leptogenys

31. ***Leptogenys processionalis*** (Jerdon, 1851)
Lobopelta distinguenda andrei Emery, 1887
Ponera ocellifera Roger, 1861

Sub family: Pseudomyrmecinae Smith, 1952
Genus: Tetraponera

32. ***Tetraponera allaborans*** (Walker, 1859)
Cerapachys ceylonica Motschoulsky, 1863
Cerapachys femoralis Motschoulsky, 1863
Eciton minutum Jerdon, 1851
Eciton rufipes Jerdon, 1851
Sima allaborans longinoda Forel, 1909
Sima allaborans sumatrensis Emery, 1900
Sima compressa Roger, 1863
Sima subtilis Emery, 1899

33. ***Tetraponera nigra*** (Jerdon, 1851)
Sima nigra fergusoni Forel, 1902
Sima nigra insularis Emery, 1901
Sima nigra krama Forel, 1912
Tetraponera atrata Smith, F., 1852
Tetraponera petiolata Smith, 1877

34. ***Tetraponera rufonigra*** (Jerdon, 1851)
Sima rufonigra ceylonensis Forel, 1909
Sima rufonigra testaceonigra Forel, 1903
Sima rufonigra yeensis Forel, 1902.

Diversity Indices

The diversity indices for different locations in the Tiruvallur district reveal notable variations in ant biodiversity (Table-2). Gummidipoondi exhibits the highest species richness (Taxa_S = 31) and diversity (Simpson_1-D = 0.9532, Shannon_H = 3.238), indicating a more balanced and diverse ant community. This is further supported by its high Evenness (e^H/S = 0.8221) and Equitability (J = 0.9429), suggesting that species are more evenly distributed. In contrast, Uthukkottai shows the lowest species richness (Taxa_S = 21) and diversity (Simpson_1-D = 0.9251, Shannon_H = 2.756), with a lower Evenness (e^H/S = 0.7496) and Equitability (J = 0.9053), indicating a less balanced community with certain species potentially dominating.

The dominance index (Dominance_D) values further highlight these differences, with Gummidipoondi having the lowest dominance (D = 0.04675), suggesting minimal dominance by any single species. Conversely, Poondi and Uthukkottai have higher dominance values (D = 0.06577 and 0.07488, respectively), indicating a higher likelihood of certain species being more prevalent. The Margalef and Fisher_alpha indices also reflect these trends, with Gummidipoondi showing higher values (Margalef = 5.059, Fisher_alpha = 8.01) compared to Uthukkottai (Margalef = 3.74, Fisher_alpha = 5.809), underscoring the greater species richness and diversity in Gummidipoondi. These indices collectively illustrate the varying ecological dynamics and biodiversity across the different locations in the Tiruvallur district.

The analysis of ant species and diversity indices from various locations in the Tiruvallur district highlights significant biodiversity and ecological variation. Gummidipoondi stands out with the highest species richness and diversity, indicating a well-balanced ant community with minimal dominance by any single species. In contrast, Uthukkottai shows the lowest species richness and diversity, suggesting a less balanced community with certain species potentially dominating. The presence of widespread species across all locations, such as Tapinoma sessile and Camponotus compressus, underscores their adaptability, while the localized distribution of others points to specific habitat preferences. Overall, these findings emphasize the ecological richness of the Tiruvallur district and the importance of habitat conservation to maintain this biodiversity.

Table 1: Ant species collected from six various locations of the Tiruvallur district.

S. No	Species	Tiruttani 13.1746° N, 79.6117° E	Gummidipoondi 13.4110° N, 80.1170° E	Poondi 13.2081° N, 79.8815° E	Ponneri 13.3340° N, 80.1944° E	Pallipattu 13.3371° N, 79.4397° E	Uthukkottai 13.3339° N, 79.8917° E
1.	***Linepithema humile*** (Mayr, 1868)	*	*	*	*	*	-
2.	***Tapinoma sessile*** (Say, 1836)	*	*	*	*	*	*
3.	***Anoplolepsis gracillipes*** (Smith, F., 1857)	-	*	-	-	*	*
4.	***Camponotus angusticollis*** (Jerdon, 1851)	*	*	*	*	*	-
5.	***Camponotus compressus*** (Fabricius, 1787)	*	*	*	*	*	*
6.	***Camponotus herculeanus*** (Linnaeus, 1758)	*	*	*	*	-	*
7.	**Camponotus irritans** (Smith, F., 1857)	*	-	-	*	*	*
8.	***Camponotus japonicus*** Mayr, 1866	*	*	-	*	*	*
9.	***Camponotus maculatus*** (Fabricius, 1782)	*	*	-	*	-	-
10.	***Camponotus mendax*** Forel, 1895	*	*	*	*	*	*
11.	***Camponotus pennsylvanicus*** (De Geer, 1773)	*	*	-	-	*	-
12.	***Camponotus rufoglaucus*** (Jerdon, 1851)	*	*	*	*	*	*
13.	***Camponotus sericeus*** (Fabricius, 1798)	*	*	*	*	*	*
14.	***Formica rufa*** Linnaeus, 1761	*	*	*	*	*	*
15.	***Oecophylla smargdina*** (Fabricius, 1775)	*	*	*	*	*	*
16.	***Oecophylla longinoda*** (Latreille, 1802)	-	*	*	*	-	-
17.	***Paratrechina logicornis*** (Latreille, 1802)	*	*	*	-	*	*
18.	***Myrmecia pilosula*** Smith, F., 1858	*	*	*	-	-	-
19.	***Meranoplus bicolor*** (Guérin-Méneville, 1844)	-	*	*	*	-	-
20.	***Monomorium minimum*** (Buckley, 1867)	*	*	*	*	*	*

…..Table 1: Ant species collected from six various locations of the Tiruvallur district.

S. No	Species	Tiruttani 13.1746° N, 79.6117° E	Gummidipoondi 13.4110° N, 80.1170° E	Poondi 13.2081° N, 79.8815° E	Ponneri 13.3340° N, 80.1944° E	Pallipattu 13.3371° N, 79.4397° E	Uthukkottai 13.3339° N, 79.8917° E
21.	***Monomorium Pharaonis*** (Linnaeus, 1758)	*	-	*	-	-	*
22.	***Novomessor cockerelli*** (André, 1893)	*	*	*	*	*	-
23.	***Pheidole megacephala*** (Fabricius, 1793)	*	*	*	*	*	-
24.	***Pheidole pallidula*** (Nylander, 1849)	*	*	*	-	*	*
25.	***Solenopsis geminata*** (Fabricius, 1804)	-	-	*	*	*	-
26.	***Solenopsis Invicta*** Buren, 1972	*	*	*	*	-	*
27.	***Solenopsis xyloni*** McCook, 1879	*	*	*	*	-	-
28.	***Trichomyrmex criniceps*** (Mayr, 1879)	*	*	*	*	*	*
29.	***Trichomyrmex glaber*** (Andre, 1883)	*	*	*	-	*	*
30.	***Dinoponera gigantea*** (Perty, 1833)	-	*	-	-	*	-
31.	***Leptogenys processionalis*** (Jerdon, 1851)	*	*	-	*	*	*
32.	***Tetraponera allaborans*** (Walker, 1859)	*	*	*	*	*	*
33.	***Tetraponera nigra*** (Jerdon, 1851)	*	*	*	*	*	*
34.	***Tetraponera rufonigra*** (Jerdon, 1851)	-	*	*	-	-	-

DISCUSSION

Tiruvallur district, Tamil Nadu was surveyed recently in six distinct fields. Seventeen genera belonging to various ant subfamilies were found throughout the study conducted to identify 34 species in total. Within the formicidae family, specifically, two genera were found in the subfamily Dolichoderinae, five genera in Formicinae, one genus in Myrmeciinae, six genera in Myrmicinae, two genera in Ponerinae, and one genus in Pseudomyrmecinae. The Myrmicinae and Formicinae subfamilies were found to be very dominant. This dominance indicates that the ants of the Myrmicinae and Formicinae families are especially common or suited to this area. The diversity observed indicates a potentially rich ant community in Tiruvallur district, Tamil Nadu. However, further investigation is required to completely comprehend the scope and ramifications of this variety. Future research ought to look at the entire spectrum of ant species present in the region and their functions in soil aeration, seed dispersal and pest management, among other ecosystem services.

Table 2: Diversity indices for different locations of Tiruvallur district, Tamil Nadu.

S. No	Diversity indices	Tiruttani	Gummidipoondi	Poondi	Ponneri	Pallipattu	Uthukkottai
1.	Taxa_S	28	31	27	25	25	21
2.	Individuals	413	376	263	282	274	210
3.	Dominance_D	0.06284	0.04675	0.06577	0.07595	0.05104	0.07488
4.	Simpson_1-D	0.9372	0.9532	0.9342	0.924	0.949	0.9251
5.	Shannon_H	3.064	3.238	2.965	2.816	3.075	2.756
6.	Evenness_e^H/S	0.7647	0.8221	0.7183	0.6681	0.8659	0.7496
7.	Brillouin	2.927	3.078	2.784	2.66	2.902	2.583
8.	Menhinick	1.378	1.599	1.665	1.489	1.51	1.449
9.	Margalef	4.482	5.059	4.666	4.254	4.276	3.74
10.	Equitability_J	0.9195	0.9429	0.8996	0.8747	0.9553	0.9053
11.	Fisher_alpha	6.789	8.01	7.542	6.623	6.691	5.809
12.	Berger-Parker	0.155	0.1117	0.1255	0.1454	0.07664	0.1429
13.	Chao-1	28	31	27	26	25	21.5

Conflicts of Interest

Authors declare that there is no conflict of interests regarding the publication of this paper.

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