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ORIGINAL ARTICLE

Diversity and Distribution of Ants (Hymenoptera: Formicidae) in Different Parts of Wardha District, Maharashtra

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ABSTRACT

Ant diversity and species richness show considerable economic importance due to its cosmopolitan distribution. Wardha district shows the richness of ant fauna belonging to the endopterygota group.The sites covered under the study are Wardha city, Arvi, Deoli, Sewagram, Sawangi, Ashti, Pulgaon, and Talegao. The species diversity was highest in the locations situated in rural, followed by the urban habitats so the data listed here shows regional diversity and distribution in different habitats.The maximum ant population observed under six subfamilies, Formicinae, Myrmicinae, Ponerinae, Dorylinae, Dolichodorinae and Pseudomyrmicinae. An extensive list of ants found in different parts of Wardha district has been reported. The observation on the species richness of some ecologically important ants such as *Camponotus*, *Crematogaster, Solenopsis, Pheidole, Aphaenogaster* and *Leptogenys* in different parts have been emphasized.

KEY WORDS: Ant, Diversity, Endopterygota, Hymenoptera, Species richness

INTRODUCTION

Ants belong to the family Formicinae order Hymenoptera, is the third largest insect order of phylum Arthropoda. They thrive in variable habitats like forests and wetlands, bark of trees, dead organic matter, soil, rocks, human habitats and leaf litter. India represented 828 species and 100 genera under 10 subfamilies (Bharti *et al*., 2016). Ants are omnipresent in distribution and occupy almost all terrestrial ecosystem; many geographical areas reported maximum ant diversity and species richness in Maharashtra (Chavan & Pawar, 2011; Kadu, 2016). Ants are one of the mega diverse insects found in all terrestrial environments, and occur in great diversity, richness and abundance, acting at all tropic levels (Bolton, 2003 & 2011). Ants are cosmopolitan, an important part of animal biomass, and present at almost all levels of the terrestrial food web (Holldobler & Wilson, 1990; Andersen, 1997; Pfeiffer *et al*., 2013). Ants also perform the role of scavengers, pollinators, and nutrient cyclers (Del *et al*., 2009; Guenard, 2013). Among total 15000 species of ants (Andrade, 2007). Among them about 12 known subfamilies recognized as Indian ants such as, Dolichoderinae, Dorylinae, Myemicinae, Ponerinae, Formicinae, Pseudomyrmicinae, Aenictinae, Amblyoponinae, Cerapachyinae, Ectatomminae, Procerattinae, and Leptanillinae (Del *et al*., 2012; Guenard, 2013). The first checklist of Indian ants was published (Chapman & Capco, 1951). The catalog of southern Indian ants (Jerdon, 1851,1854) and later on the diversity of Indian ants and their state-wise distribution having 828 species and 100 genera grouped in 10 subfamilies have been published (Bharti, 2011; Bharti *et al*., 2016). About 35 species of ants belonging to 22 genera from 6 subfamilies reported from Nagpur city (Kadu, 2016). In Wardha district about 6 subfamilies, Formicinae, Myrmicinae, Ponerinae, Dorylinae, Dolichoderinae and Pseudomyrmicinae having total of 57 species belonging to the 30 genera have been listed (Badwaik, 2022). The main aim of conducting this study was to document more species diversity in the rural, urban, and industrial sites to study the diversity, richness and ecological importance of ant species in the Wardha district of Maharashtra India.

MATERIALS AND METHODS

Study Area

Wardha district is a municipal council located in Eastern Maharashtra in India, situated at 20°44'30"N

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Table 1: Distribution and diversity of Ant species in different areas of Wardha

Subfamily	Genus	Wardha City	Sewagram and Sawangi	Ashti	Arvi	Talegaon	Pulgaon	Deoli
Myrmicinae	*Creamatogaster*	2	4	6	5		6	
	Pheidole		2	2	1	1		3
	Aphaenogaster	1	1	1	1			
	Trichomyrmex		2	2			2	1
	Monomorium	1	1	1	1	1		2
	Solenopsis	1	1	1				2
	Lophomyrmex					1	1	
	Tetramorium			1	1	1		1
	Messor					1	1	
	Meranoplus			1		1		1
	Cardiocondyla	1	1				1	1
Formicinae	*Lepisiota*	1	1	2	3	1		
	Camponotus	6	7	9	8	4	5	3
	Oecophylla			1	1	1		1
	Polyrachis			2	1	1	1	
	Paratrechina			1	1	1		
Dolichoderinae	*Iridomyrmex*	1	1					
	Technomyrmex				2			1
	Tapinoma	1	1	2	2		2	
	Dolichoderus					1		
Ponerinae	*Mesoponera*						1	
	Odontoponera			1				1
	Platythyera					1		1
	Brachyponera						2	1
	Dicamma			1		1	1	
	Leptogenys			3	1			2
Dorylinae	*Cerapachys*				1			
	Dorylus	1	1	1			1	
Pseudomyrmicinae	*Tetraponera*			2	1	1	1	2
	#Genus	10	12	19	15	15	13	15
	#Species	16	23	40	30	18	25	23

78°36'20"E and has an elevation of an average of 234 m (768 ft). Agricultural and industrial fields with temperature surrounding the district ranged from 26 to 35°C daytime, humidity of 47% to 48% with an average rainfall of 700-800 mm. The collection of species is done from 8 selected sites in Wardha district such as Wardha City, Sawangi, Sewagram, Arvi, Ashti, Talegaon, Deoli, and Pulgaon (Fig. 1). The diversity of ant species within the specified study area was calculated by using the Shannon-Weaver diversity index (Shannon, 1949) and Simpson's Index (Simpson, 1949). The present study is based on the comparative taxonomy of generic diversity and species richness in different habitats such as rural agricultural fields, urban habitats, industrial areas and grassland habitats.

Shannon-Wiener Diversity (Shannon, 1949) Index=H' = - Σ [(ni / N) ln (ni / N)] and

$$H' = -\sum_{i=1}^{k} pi \ln pi$$

Whereby H'= Shannon's Index, ni= Number of species, N = Total number, S = species richness, Pi = proportion of total sample belonging to the i^{th} species; ln = natural log

Simpson's (Simpson, 1949) Diversity Index = D = 1-Σ [ni (ni-1)] / N(N-1)

Whereby D = Simpson's Index; ni=Number of species; N = Total number of Individual

Sample Collection

Samples sites have been selected as different ecological habitats such as agricultural, industrial, and urban residential areas in different places of Wardha district. Selection of study sites in this manner ensured that these sites represented habitats under different environmental conditions and level of disturbance Gadagkar *et al.* (1993). Samples collected using different methods such as sugar bait trap, hand picking and the honey trap, brush and forceps. The collected species were

Table 2: Diversity of Ant Species in Agriculture Rural Areas(ARA), Urban Residential Area(URA) and Industrial Core Area(ICA) in Wardha

Subfamily	Ants		Habitats		
	Genus	Species	ARA	URA	ICA
Myrmicinae	*Crematogaster*	*C.diffusa* (Jerdon, 1851)	+++	+	-
		C.ebenina (Forel, 1902)	+	+	-
		C.aberrans (Forel, 1892)	+	+	+
		C.wroughtonii (Forel, 1890)	+++	++	-
		C.perelegans (Forel, 1902)	+	-	-
		C.rothney civa (Forel, 1902)	+++	++	+
	Pheidole	*P. megacephala* (Fabricus, 1793)	+++	++	+
		P.noda (Smith, 1874)	+	-	-
		P.indica (Mayr, 1879)	++	+	-
		P.parva (Mayr, 1865)	-	+	-
	Aphaenogaster	*A.beccarii* (Emery, 1887)	++	+	-
	Trichomyrmex	*T.wroughtoni* (Forel, 1902)	+	-	-
		T.glaber (Andre, 1883)	+	-	+
		T.criniceps (Mayr, 1879)	+	+	-
	Monomorium	*M.indicum* (Forel, 1902)	+++	++	+
		M.indica (Weber, 1950)	+++	++	+
	Solenopsis	*S.geminata* (Fabricus, 1804)	+++	+++	+
		S.molesta (Buren, 1972)	+	+	+
	Lophomyrmex	*L.quadrispinosus* (Jerdon, 1851)	+	+	-
	Tetramorium	*T.mayri* (Forel, 1912)	++	+	+
	Messor	*M.instabilis* (Smith, 1858)	+	-	-
	Meranoplus	*M.bicolor* (Guerin-Meneville, 1844)	+	-	-
	Cardiocondyla	*C.wroughtonni* (Forel, 1890)	++	+	+
		C.carbonaria (Forel, 1907)	+	+	-
Formicinae	*Lepisiota*	*L.sericea* (Forel, 1892)	+	-	+
		L.bipartite (Smith, 1861)	++	+	-
		L.fraunfeldi (Mayr, 1855)	+	-	-
	Camponotus	*C.gigas* (Nylander, 1856)	+	+	-
		C.pogonomyrmex barbatus(Smith, 1858)	++	+	-
		C.barbatus taylori (Forel, 1892)	++	+	-
		C.angusticollis (Jerdon, 1851)	+	+	-
		C.sericeus (Fabricius, 1798)	+++	++	-
		C.compressus (Fabricius, 1787)	+++	+++	+
		C.irritans (Smith, 1857)	++	+	+
		C. dolendus (Forel, 1892)	+	-	-
		C.variegatus (Smith, 1858)	+	+	-
		C.rufoglaucus (Jerdon, 1851)	+++	+	-
	Oceophylla	*O.smaragdina* (Fabricus, 1775)	+++	++	+
	Polyrachis	*P.exercita abtusisquama* (Forel, 1902)	+	+	-
	Paratrechina	*P.longicornis* (Latrelle, 1802)	++	+	-
Dolichoderinae	*Iridomyrmex*	*I.anceps* (Roger, 1863)	+++	+	+
	Technomyrmex	*T.brunneus* (Forel, 1895)	+	+	-
		T.albipes (Smith, 1861)	++	+	-
	Tapinoma	*T.indicum* (Forel, 1895)	++	+	+
		T.melanocephalum(Fabricius, 1793)	++	+	-
	Dolichoderus	*D.sundari* (Mathew and Tiwari, 2000)	+	-	-
Ponerinae	*Mesoponera*	*P.manni* (Viehmeyer, 1924)	+	-	-
	Odontoponera	*O.denticulata* (Smith, 1858)	+	-	-
	Platythyrea	*P.sagei* (Forel, 1900)	+	-	-
	Brachyoponera	*B.luteipes* (Mayr, 1862)	+	+	-
		B.jerdonii (Forel, 1900)	+	-	-
	Diacamma	*D.rugosum* (Le Guillou, 1842)	++	+	-
		D.ceylonese (Emery, 1897)	+	-	-
	Leptogenys	*L.processionalis* (Jerdon, 1851)	+	-	-
		L.diminuta (Smith, 1858)	+	-	-
		L.chinesis (Mayr, 1870)	+	+	-
Dorylinae	*Cerapacys*	*C.longitarsus* (Mayr, 1879)	+	-	-
	Dorylus	*D.orientalis* (Westwood, 1853)	++	+	-
Pseudomyrmecinae	*Tetraponera*	*T.rufonigra* (Jerdon, 1851)	+++	++	+
		T.nigra (Jerdon, 1851)	+++	+	+

Where: indicates presence of ant **+++** =Abundant, **++** =Maximum, **+** = Moderate, **-** = indicates absence of ants (Number of Species/Site =10)

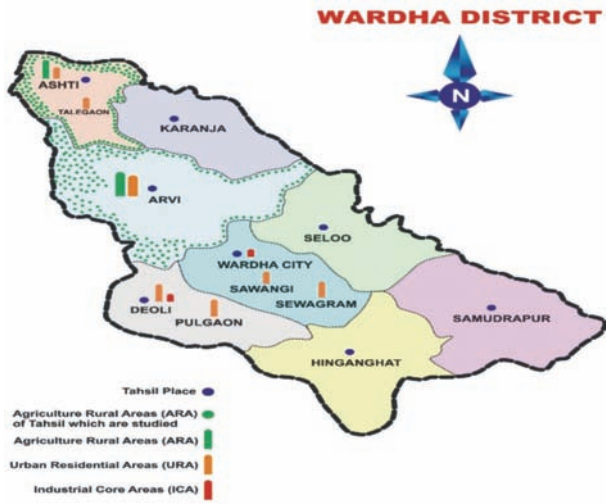

Fig.1a Map of Wardha having Agriculture Rural Areas (ARA), Urban Residential Area (URA) and Industrial Core Area (ICA) habitats in District Wardha.

Fig.1b Ant species abundance at different Tahsil in Wardha district

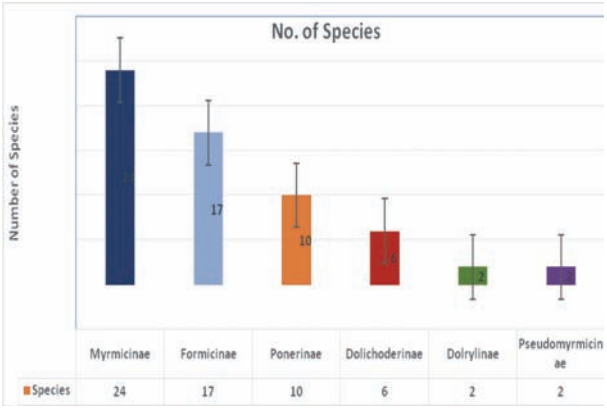

Fig.2 Ant Species recorded in Wardha district

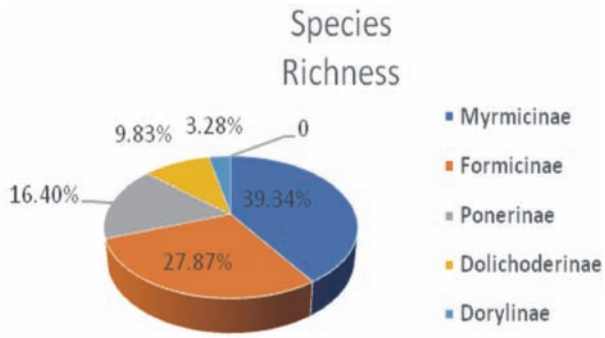

Fig. 3. Ant species richness and their composition observed from Wardha district

preserved in 70% alcohol and observed under the Zoom Stereo Binocular Microscope in the Department of Zoology, Science College, Nagpur. Ants species were identified according to the keys described by Bolton (1994, 2011) and the checklist of the ants of India (Appendix 1) by Bharti *et al.* (2016).

RESULTS AND DISCUSSION

Taxonomic study of Ant species

The ant species identified based on the key described by Bolton (1994) and total 61 species of 29 genera belonging to 06 subfamilies have been recorded from the study sitesin the district, Wardha. These species belonged to six subfamilies, Myrmicinae, Formicinae, Dolichoderinae Ponerinae, Dorylinae and Pseudomyrmicinae. Among these six subfamilies, in different parts of Wardha District Ant genera belonging to Myrmicinae are most abundantly found subfamily with the highest number 24 species from 11 genera, followed by subfamily Formicinae with 16 species of 05 genera, in subfamily Dolichoderinae si species of 4 genera, Ponerinae with10 species of 06 genera, Dorylinae and Pseudomyrmicinae with 02 species each from 02 genera each (Fig. 2a,b; Table 1).

Distribution of Ant species

Distribution of ant species in the study sites suggested

that, Myrmicinae suabfamily representation was highest 39.34% among all the ant species followed by Formicinae 27.87%, Ponerinae 16.40%, Dolichoderinae 9.83%, Dorylinae 3.28% and Pseudomyrmicinae 3.28%. Bharti *et al*. (2016) reported 181 species belonging to 46 genera 06 subfamilies from Maharashtra state. Out of total 181 species, Myrmicinae 83 species (46%), Formicinae 43 species (24%) and Ponerinae 26 species (14%) have been dominant subfamilies while 15 species of Dorylinae (08%), 09 of Dolichoderinae (05%) and 05 species of Pseudomyrmicinae (03%) are studied and reported (Fig. 3).

In the present study it was observed that the highest number 40 species belong to 19 genera was found at Ashti, followed by 30 species belonging to 15 genera found in Arvi tahsil, Pulgaonrecorded with 25 species under 13 genera, in Sewa Gram 23 species of 12 genera and in Deoli, 23 species of 15 genera, in Talegaon 18 species belong to 15 genera and in Wardha City 16 species under 10 genera (Table 2, Fig. 1).

Distribution and diversity of Ant Species in different habitats

It was observed that the distribution of species with 29 genera at all the three types of selected habitats, Agriculture Rural areas (ARA), Urban Residential area (URA) and Industrial Core area (ICA). In all the tehsil places selected for the study, the common genera *Camponotus, Crematogaster, Pheidole, Monomorium, Lepisiota* and *Tetraponera*. In urban and residential areas *Camponotus, Solenopsis, Creamatogaster, Tetraponera, Cardiocondyla* and *Crematogaster* are mostly found in agricultural habitats than the Industrial core (Bharti, 2011). Ants 35 species belonging to 22 genera from 6 subfamilies reported from Nagpur city (Kadu, 2016). The present study also found a few predatory ant species like *Oecophylla, Pheidole, Solenopsis, Tapinoma* which feed on caterpillars, aphids, jassids and larvae of other commercial and insect pests and behave as predators and in some cases biological control agent. Some important species found are even ground-dwelling ants such as, *Camponotus, Solenopsis, Creamatogaster, Tetraponera* and, *Cardiocondyla* ants, they play important role and they are known as soil turners and increase the soils nutrients resulting in induced modification of soil (Kadu, 2021).

In Wardha district the most common genera *Camponotus, Crematogaster, Pheidole, Monomorium, Lepisiota* and *Tetraponera*. Among them, in urban residential area *Monomorium indicum* and *Monomorium indica* were the most common. The other species are more commonly found in almost all types of habitats found in Agricultural rural area.

CONCLUSION

Based on the present study it can be concluded that Wardha district is also rich in ant fauna in which about 61 species of 06 subfamilies with 29 genera have been observed (Chauhan & Pawar, 2011). The ant fauna is richest in agricultural regions and rural part of Wardha district as compared to residential and urban areas, where less ant species are observed (Badwaik, 2022). In most of the terrestrial area and fauna are ecologically important. The present study concludes that the selected portion in Wardha district show richness and diversity of ant fauna, are being used as indicator organisms which provide us clues regarding our deteriorating ecosystems (Kadu, 2021). The study revealed that ant species richness generally increases with an increase in vegetation and declines with an increase in industrialization and urbanization in cities (Kadu, 2014). The result of the present study generated baseline data about ant fauna in various parts of the Wardha district. The information may be helpful in inducing taxonomic studies on ant species and their seasonal availability role on the ecosystem and it impact on socioeconomic development in this region movement in future impact richness.

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