



## Trapping analysis of ants (Hymenoptera, Formicidae) in Kurunthamalai, Coimbatore, Tamil Nadu, India

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**ABSTRACT:** Ant species were collected from three different methods bait trapping (BTM), all-out search method (AOSM), and pitfall trapping method (PTM) method. A total of 14 species belonging to the eight genera and four subfamilies are listed in the Palamalai region. *Monomorium indicum*, *Solenopsis germinata*, *Trichomyrmex crinieiceps*, *Trichonymex glaber*, *Camponotus mendax*, *C. guticollis*, *C. irritans*, *C. parius*, *C. rufoglaucus*, *Oecophylla smaragdina*, *Diacamma indicum*, *Leptogenys chinensis*, *Tetraponera rufonigra* and *Tetraponera* spp were reported. Shannon Wiener, Simpson diversity, Dominance, Evenness, Menhinick, Margalef, Fisher alpha and Berger- Parker calculations and diversity richness are reported.  
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**KEYWORDS:** Myrmecology, Shannon Wiener, Simpson diversity, dominance, evenness

Ants are progressively more used for biodiversity studies, and comparison of habitats in different ecosystems (Andersen and Majer, 2004). Sabu *et al.* (2008) estimated the diversity of forest litter inhabiting ants along elevations in the Wayanad region of the Western Ghats. Bharti and Sharma (2009) carried preliminary investigations on diversity and abundance of ants along an elevational gradient in Jammu-Kashmir Himalaya. The environmental significance and bio diversity of ants have lead the ecologists and Myrmecologists to study patterns of ants distribution and species composition throughout the world (Narendra *et al.*, 2011). In the tropics level ants play an important ecological role in both natural and agricultural habitats (Delabie *et al.*, 2007). The present work was aimed to conduct a survey of ant species inhabited in residential site, industrial site and agricultural site and assess the

three different trapping methods *viz.*, bait trapping (BTM), all-out search method (AOSM), and pitfall trapping method (PTM).

Kurunthamalai region, Coimbatore district, is a part of biodiversity hotspot of Western was chosen as ideal site for the study during January 2021 to December 2021 (7.00 am till 7.00 pm). Kurunthamalai region with 11.2503 Latitude and 76.9183 Longitude, is in Karamadai road, Coimbatore district, Tamil Nadu. The survey of insects was undertaken with three different transects (All-out search method, pit fall trap method and bait trap method). In all-out search method (AOSM) ant survey sheet was used. Pit fall trap method (PTM), the pit-fall traps were made by using the 0.4 L plastic cup with an opening of 11 to 12 cm in diameter, covered at ground level. One

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pit-fall trap was placed in each one of the five randomly selected 25m x 25m quadrates of one hectare plots in Kuruthamalai, Palamalai and Maruthamalai of Kurunthamalai. Each glass carried 20–25 mL of diluted ethanol (70%) mixture. The traps were set up between 7 am to 7 pm and the ants were collected after 2- 3 days. Four bait types: egg yolk, fried coconut, sugar or candies, raw rice and chicken waste were used in B and placed in three different areas (bare area, agriculture land and road sides) in Kurunthamalai. The collected samples were kept in the research laboratory, Department of Zoology, Kongunadu arts and Science College, Coimbatore. The collected ants were identified with key (Bingham, 1903; Bolton, 1994, 1995, 2003; Rastogi, 1997; Tiwari, 1999; Varghese, 2004, 2009) and further confirmed by Dr. Himender Bharti, Department of Zoology and Environmental science, Punjabi university, Patiala, Punjab. Diversity indices were worked out as-

**Shannon diversity** -  $H' = - \sum P_i \ln(P_i)$

$P_i = S/N$ ; S= Number of individuals of one species;  
N= Total number of all individuals in the sample.

**Simpson diversity** -  $D_s = N(N-1) / \sum n_i(n_i-1)$

$n_i$  (number of individuals)=total number of a organisms of a given species; N (total number) = Total number organisms of all species.

**Evenness** -  $E = H'/S$

Where, H= Shannon Weiner diversity; S= Total number of species in a sample

**Margalef** -  $D = (S-1) / \ln N(2)$

Where S = Number of species in sample; N= total individual in data

**Menhinick** -  $D_{Mn} = S / \sqrt{N}$

The number of species (n)/ square root of the total number of individuals (N)

Results of the study indicated prevalence of 14 ant species. A total of 3,005 individual ants, under four subfamilies (Formicinae, Myrmicinae,

Pseudomyrmicinae and Ponerine) were collected from the different sampling sites. Totally fourteen species were observed in the study area. *Monomorium indicum*, *Solenopsis geminate*, *Trichomyrmex crinieiceps* and *T. glaber* were recorded under Myrmicinae (3 genera and 4 species), followed by Formicinae (*Camponotus mendax*, *C. augusticollis*, *C. irritans*, *C. parius*, *C. rufoglaucus* and *Oecophylla smaragdina*. Rajagopal *et al.* (2005) reported 25 species in Virudhunagar, Tamil Nadu. Anu and Sabu (2007) documented that Wayanad district, they also documented dominance subfamily is formicine. Subedi *et al.* (2020), documented 48 genera and 128 ant species under eight subfamilies (Amblyoponinae, Dolichoderinae, Dorylinae, Formicinae, Leptanillinae, Myrmicinae, Ponerinae and Pseudomyrmicinae), in Kurunthamalai region Coimbatore, Tamil Nadu. *Solenopsis geminate* (fire ants) was found in human habituated areas. Ponerinae (with *Diacamma indicum* and *Leptogenys chinensis*), and Pseudomyrmicinae (with *Tetraponera rufonigra* and *Tetraponera* spp), Ponerinae and Pseudomyrmicinae were less in diversity. *Camponotus mendax* predominated in May (summer season), followed by *C. augusticollis* and *C. parius*, both were abundant in May. Species *C. rufoglaucus* and *C. irritans* were predominant in April. The ant species reported from different location are in different numbers. Varghese (2009) documented 226 species belonging to 63 genera and 11 subfamilies from Karnataka, Bharti (2012, 2016) reported 40 ant species from Punjab, Azhaguraj (2017) ten species, Sornapriya and Varunprasath (2018) 36 species from Tamil Nadu.

Different species were noted in AOSM, PTM and BTM. Ant collections were rich (n=519) in AOSM (Table 1). *Monomorium indicum* was commonly present in BTM. In pit fall trap (n=433) and bait trap (n=400) compared to the all-out search method, they're less in number because in the trapping some of other insects also trapped like beetles, bugs and some moths. But with the all-out search method, we only concentrated on the ant samples. In three different methods, the all-out search method (AOSM) was (n=519) highly rich

Table 1. Ant species trapped in the different methods

Species	AOSM	PTM	BTM	Total
<i>Monomorium indicum</i> Forel, 1895	57	48	49	154
<i>Solenopsis germinata</i> F., 1894	79	69	89	237
<i>Trichomyrmex crinieiceps</i> Mayr, 1875	59	60	71	190
<i>Trichomyrmex glaber</i> Andre, 1883	45	55	65	165
<i>Camponotus mendax</i> Forel, 1895	80	71	92	243
<i>C. angusticollis</i> (Jerdon, 1851)	74	55	36	165
<i>C. irritans</i> (Smith, 1857)	56	69	95	220
<i>C. parius</i> (Emery, 1889)	80	100	90	270
<i>C. rufoglaucus</i> (Jerdon, 1851)	85	87	88	260
<i>Oecophylla smaragdina</i> F., 1775	72	52	49	173
<i>Diacamma indicum</i> (Santschi, 1920)	48	29	10	87
<i>Leptogenys chinensis</i> Mayr, 1870	80	84	79	243
<i>Tetraponera rufonigra</i> (Jerdon, 1851)	68	66	30	164
<i>Tetraponera spp*</i>	76	86	96	258

AOSM - All out search method

PTM - pitfall trap method

BTM - bait trap method

in our study area. During the all- out search method, we had taken with ant survey sheet.

In every day sample collection during the method of AOSM the ant survey sheet played important role in the present study. Myrmicinae ants dominated in the months of March, May and June followed by the Formicinae ants in May. Species

diversity and differentiation were higher in AOSM as compared to PTM and BTM, because of trapping make disturbed another some insects, in the site. Gary *et al.* (2010) documented 42 ant species with 15 genera and five subfamilies (Amblyoponinae, Dolichoderinae, Formicinae, Myrmicinae, and Ponerinae) during the survey of Acadia National Park and reported Tuna baits yields

22 species and all other collection methods yielded 15 species or less. Boomsma and Isaaks (1982) estimated that factors like CaCO<sub>3</sub>, total organic matter, moisture content, temperature of air and soil pH and salinity play an essential role in distribution pattern of ants. Azhagu Raj *et al.* (2017) suggested that AOSM, BTM and PTM were related in ant species differentiation diversity and species abundance in the study area. Lal (1988) used egg yolk, chicken waste and candies in BTM.

Table 2 Diversity indices in different trap methods

Diversity indices	AOSM	PTM	BTM
Individuals	959	931	939
Dominance (D)	0.07385	0.07665	0.08288
Simpson (SID)	0.9261	0.9233	0.9171
Shannon (H <sup>''</sup> )	2.621	2.601	2.542
Evenness (e <sup>^</sup> H/S)	0.9824	0.9625	0.9079
Menhinick	0.4521	0.4588	0.4569
Margalef	1.893	1.902	1.899
Fisher alpha	2.324	2.337	2.333
Berger-Parker	0.08863	0.1074	0.1022

ASOM - All out search method

PTM - pitfall trap method

BTM - bait trap method

Dominance, Simpson, Shannon, evenness, Menhinick, Margalef, fisher alpha and Berger parker indices were noted. The Shannon wiener (H<sup>''</sup>) index was highest in ASOM (2.621). ASOM had SID and H<sup>''</sup> as 0.9261, 2.621 respectively, it was followed by PTM (SID - 0.9233; H<sup>''</sup> - 2.601). In PTM SID was 0.9171 and H<sup>''</sup> was 2.542. The individual and dominance of ant species were arranged in the ascending order AOSM (n=959) with dominance

0.07985, BTM (n=939) accompanied by D=0.08288 and PTM (n=931) including D=0.07665. The ant species evenness (e<sup>^</sup>H/S) ranged from 0.9079 to 0.9824. Menhinick varied from 0.421-0.4588. The Margalef index arranged with descending order 1.893; 1.899 and 1.902. Fisher alpha (S) ranged 2.324 to 2.337 and Berger-parker ranged 0.08863 - 0.1074 (Table 2). Ramesh *et al.* (2010) reported that diversity in DAE campus Kalpakam, the sample size of five different habitats were compared and Fishers alpha diversity and Shannon diversity indices were calculated as a measure of diversity within the habitat. The calculated values in DAE campus, Kalpakam is Shannon diversity riparian woods area is 2.62, Jungle 2.53, monoculture 2.36, sandy area 2.35 and building area 4.98. In coastal Odisha (Dash *et al.*, 2017) reported 27 ant species and Simpson index of diversity and Shannon wiener during the month of April – May 2014 (SID - 0.84 and H - 2.01) and January – February 2015 (SID - 0.90 and H - 2.63). It is concluded that, different type of traps were very useful for ant collection and notice the behaviour of ants.

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## REFERENCES

- Andersen A.N. and Majer J.D. (2004) Ants show the way down under: Invertebrates as bio indicators in land management. *Frontiers in Ecology and the Environment* 2: 291–298.
- Anu A. and Sabu T.K. (2007) Biodiversity analysis of forest litter ant assemblages in the Wayanad

- region of Western Ghats using taxonomic and conventional diversity measures. *Journal of Insect Science* 7: 1–13.
- Azhagu Raj R., Sathish R., Prakasam A., Krishnamoorthy D. and Balachandran M. (2017) Diversity and distribution of Ant species (Hymenoptera: Formicidae), in Pachaiyappa's College, Kanchipuram, Tamil Nadu, India. *Journal of Entomology and Zoology Studies* 5(1): 459–464.
- Bharti H. (2012) Ants as Pest. [http://www.cleanindiajournal.com/ants\\_as\\_pest/](http://www.cleanindiajournal.com/ants_as_pest/)
- Bharti H. and Sharma Y.P. (2009) Diversity and abundance of ants (Hymenoptera: Formicidae) along an elevational gradient in Jammu-Kashmir Himalaya-1. *Halteres* 1: 10–19.
- Bharti H., Benoit G., Meenakshi Bharti Evan and Economo P. (2016) An updated checklist of the ants of India with their specific distribution in India strates (Hymenoptera: Formicidae). *Zoo keys* 55: 1–83.
- Bingham C.T. (1903) *The Fauna of British India, Hymenoptera*. Taylor and Francis, London.
- Bolton B. (1994) *Identification Guide to the Ant Genera of the World*. Harvard University Press, Cambridge, Massachusetts.
- Bolton B. (1995) *A new general catalogue of the ants of the world*. Cambridge, Massachusetts: Harvard University Press.
- Bolton B. (2003) Synopsis and classification of Formicidae. *Memoirs of the American Entomological Institute* 71: 251–409.
- Boomsma J.J. and Isaaks J.A. (1982) Effects of inundation and salt on the survival of ants in a sandy coastal plain. *Ecological Entomology* 7: 121–130.
- Dash S., Patnaik H.P. and Tarai R.K. (2017) Diversity and species richness of ants in coastal Odisha. *International archive of applied sciences and technology* 8(1): 17–21.
- Delabie J.H.C., Jahyny B., Do Nascimento I.C., Mariano C.S.F., Lacau S., Campiolo S., Philpott S.M. and Leponce M. (2007) Contribution of cocoa plantations to the conservation of native ants (Insecta: Hymenoptera: Formicidae) with a special emphasis on the Atlantic forest fauna of southern Bahia, Brazil. *Biodiversity Conservation* 16: 2359–2384.
- Gary D.O., Francis A.D., Bethchoate and Eleanor groden (2010) Ant diversity and distribution in acadia national park, Maine. *Environmental entomology* 39(5): 1447–1456.
- Lal R. (1988) Effects of macro fauna on soil properties in tropical ecosystems. *Environmental Science; Agriculture, Ecosystems & Environment* 24: 101–116.
- Narendra A, Gibb H and Ali TM. (2011) Structure of ant assemblages in Western Ghats, India: role of habitat, disturbance and introduced species. *Insect Conservation and Diversity* 4: 132–41.
- Rajagopal T., Sevarkodiyone S.P. and Manimozhi A. (2005) Ant diversity in some selected localities of satturtaluk, Virudunagar district, Tamilnadu. *ZOOS print* 20(6): 1887–1888.
- Ramesh T., Jahirhussain K., Satpathy K.K., Selvanayagam M. and Prasad M.V.R. (2010) Diversity, distribution and species composition of ants fauna at department of atomic energy (DAE) campus Kalpakkam, south India. *World Journal and Zoology* 5(1): 56–65.
- Rastogi N., Nair P., Kolatkar M., William H. and Gadagkar R. (1997) Ant fauna of The Indian Institute of Science Campus Survey and some preliminary observations. *Journal Indian Institute of Science* 77: 133–140.
- Sabu T.K., Vinesh P.J. and Vinod K.V. (2008) Diversity of forest litter inhabiting ants along elevation in the Wayanad region of the Western Ghats. *Journal of Insect Science* 8: 69.
- Sornapiya J. and Varunprasath K. (2018) Diversity and abundance of Ants in Periyanaickenpalayam village of Coimbatore district, Tamil Nadu. *Journal of Entomology and Zoology Studies* 6(3): 1378–1384.
- Subedi I.P., Budha P.B., Bharti H. and Alonso L. (2020) An updated checklist of Nepalese ants (Hymenoptera, Formicidae). *ZooKeys* 1006: 99–136.
- Tiwari R.N. (1999) Taxonomic studies on Ants of a

- Southern India (Insecta: Hymenoptera: Formicidae). *Memories* 18: 1–96.
- Varghese T. (2004) Record of *Strumigenys emmae* (Emery) (Formicidae: Myrmicinae) from Bangalore, Karnataka and a key to Indian species. *Journal of the Bombay Natural History Society* 101:170-171.
- Varghese T. (2009) A review of extant subfamilies, tribes and ant genera in India. *Biosystematica* 3(2): 81–89.

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