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SHORT COMMUNICATION

Diversity of ants in Aarey Milk Colony, Mumbai, India

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Abstract: Aarey Milk Colony (AMC) is 16km^2 of forested area, acts as a buffer to the Sanjay Gandhi National Park, Mumbai. It has gardens, lakes, recreation spots, and a nursery. It also harbors 32 cattle farms, animal husbandry centers. Apart from urbanization and forest degradation, this forest harbors great biodiversity which includes the leopard as a top predator and also lesser-known species of amphibians, reptiles, and arthropods. Considering ants as important bio indicators and the vulnerability of AMC to development plans, a study on the diversity of ants was conducted from January 2016 to May 2016. Four methods were used for data collection of ants—pitfall trap, line-transect, quadrate, and all-out search. A total of 35 species under 24 genera under six subfamilies– *Myrmicinae, Formicinae, Ponerinae, Dolichoderinae, Pseudomyrmecinae*, and *Cerapachyinae* were recorded during this study. The Simpson's diversity index (0.88) for the pit fall trap indicates that the diversity of ants in the AMC is fairly high. This increases the importance of this forest land which is presently facing a mass destruction of trees.

Keywords: Bio indicator, data collection, Maharashtra, Sanjay Gandhi National Park.

Aarey Milk Colony (AMC) was notified in 1949 which covers an area of 16km^2. It is situated on the southwestern boundary of Sanjay Gandhi National Park, Mumbai. The colony acts as a buffer zone for the densely forested national park. The colony faces heavy anthropogenic pressure such as illegal encroachment, change in land use, which converted it into a garden, nursery, picnic spots, restaurants, and milk processing units.

Among invertebrates, insects are the most abundant and diverse organisms on Earth, as most of the insects are highly mobile, their presence in an ecosystem may be temporary which limits their use to detect environmental changes (Khot et al. 2013). On the other hand, the ants being more local than other insects they can be efficiently used as a bio-indicator (Stephens & Wagner 2006; Underwood & Fisher 2006; Jonathan et al. 2007; Abril & Gomez 2013).

Andersen et al. (2002) suggested that ants can provide valuable information about the environment in which they occur and considerably more than could traditional wildlife (vertebrate) surveys. According to Wilson (1990) and Gadagkar et al. (1993), the biomass of ants is approximately four times greater than the biomass of all of the vertebrates. Due to their abundance, high species richness, occupancy of high topographic level and being highly responsive to environmental changes ants are considered as excellent bio-indicators (Jonathan 1983). According to Bharti (2011), there are 652 species/subspecies that are known to occur in India. Khot et al. (2012) recorded 28 species representing six subfamilies from Maharashtra Nature Park and Quadros et al. (2009) recorded 19 species of ants from IIT Bombay campus;

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163 species of ants, in 52 genera, were reported by Mathew & Tiwari (2000) from Meghalaya. Kharbani & Hajong (2009) recorded 28 species from 18 genera from the West Khasi hills, Meghalaya. Bharti et al. (2009) recorded 40 species of ants from eight genera from Punjab Shivalik.

The forest of AMC is of mixed moist deciduous type and is dominated by *Tectona grandis*, *Bombax ceiba*, *Butea monosperma*, *Pongamia pinnata*, *Cassia fistula*, *Ziziphus* sp., heavily intermixed with exotic/invasive species such as *Eucalyptus*, *Gliricidia sepium* as well as *Delonix regia* and *Lantana* sp. (Mirza & Sanap 2010). According to Mirza & Sanap (2010) the faunal diversity of AMC includes 13 species of amphibians, 46 species of reptiles, 76 species of avifauna, 16 species of mammals, 86 species of butterflies, five species of scorpions, and 19 families of spiders. There is no reported work on the ants of this area.

AMC (Image 1) is under immense anthropogenic pressure. Hence the study on ants might be helpful in throwing some light on the diversity of invertebrates that are about to get lost or displaced.

Material and Methods

The survey was carried out from January 2016 to May 2016.

Four sampling methods were deployed as follows.

1. Pitfall trap (n= 52): Transparent plastic glasses having 7.5 cm diameter and 7.5 cm height were used for pitfall traps buried at ground level. In each trap four plastic glasses were kept at the corner of 4 x 4 m quadrate. The traps were set up for 24 hr. The total area covered was 832 m^2. The trap was observed regularly to avoid predation on ants, if any. Ants were released from the trap after photo documentation.

2. Line transect (n= 9): Line transects of 100 m were plotted in the study site so that maximum area and different habitats were covered. This method was used three times a day (morning, afternoon, and evening). The total area covered by line transects was 1,800 m.

3. Quadrat method (n= 13): Four quadrates of 4 x 4 m were placed in the selected study site. Each quadrat was observed for 10 min.

4. All-out search method (n= 30): This method was used to collect data opportunistically.

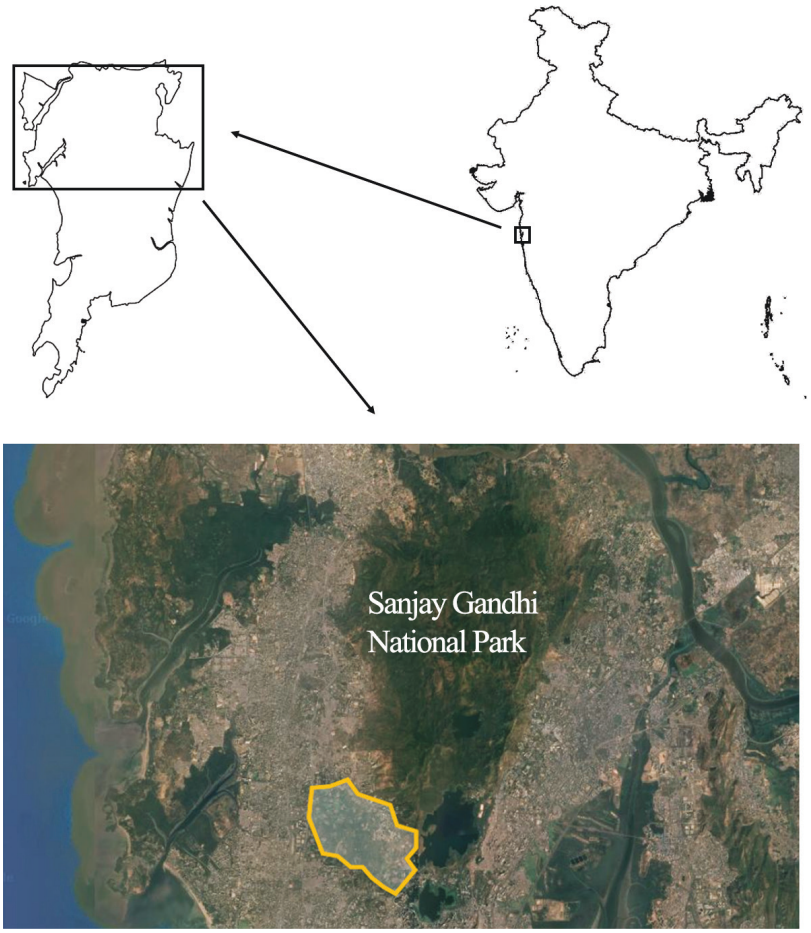

Image 1. Location of Aarey Milk Colony highlighted. (Courtsey: Google)

All the individuals recorded by the above four methods were photographed using Canon 600D camera body with a 90mm macro lens and identified using Bingham (1903), Narendra & Kumar (2006), antweb (http://antweb.org/), and antwiki (http://www.antwiki.org/wiki/).

To have a basic idea of richness, pit fall trap data was utilized for calculating Simpson's diversity index.

Results

A total of 35 species under 24 genera and six subfamilies were recorded from the study area (Table 1). Table 2 represents the dominance of the subfamilies. Myrmicinae (9 genera and 13 species) and Formicinae (6 genera and 11 species) were the most dominant subfamilies followed by Poneriane (5 genera and 6 species); Dolichoderinae (2 genera and 2 species), Pseudomyrmicinae (1 genus and 2 species), and Cerapachynae (1 species).

Pitfall trap, line transects, quadrate, and all-out search methods were used to collect this data (Table 3). *Solenopsis geminata, Crematogaster subnuda, Crematogaster ransonneti, Monomarium pharaonis, Camponotus compressus, Paratrechina longicornis, Polyrachis lacteipennis, Diacama rugosum*, and *Tapinoma melanocephalum* were recorded from all four sampling methods. *Oecophylla smaragdina, Anochetes graffei, Platythyrea sagei, Leptogenys chinensis, Leptogenys processionalis,* and *Cerapachys longitarsus* were recorded only by one of the methods.

A comparison of sampling methods (Table 4) suggests that the pitfall method was the most productive yielding 27 of 35 species recorded. All-out search method was the second most productive yielding 24 of 35 species which was high probably because a larger area was covered in opportunistic visits. Pitfall and all-out search methods shared 16 species in common. The line transact was substantially productive in terms of recording the number of individuals. This can be attributed to the foraging habits of the ants.

The Simpson's diversity index for pitfall trap data.

$D = 1 - \sum n(n-1)/N(N-1) = 1 - \sum 29292/250500 = 0.88$

The Simpson's diversity index of 0.88 indicates the diversity of ants on the higher side. Further, a long time assessment and detailed analyses of different sampling methods might reveal more comprehensive results.

Aarey colony is under pressure from human developmental activities hence further study is required so as to use ant as an effective indicator for highly disturbed forest habitats.

Table 1. Ant diversity in Aarey Milk Colony, Mumbai, Maharashtra.

	Species	Subfamily	Figure number
1	*Aphaenogaster beccarii*	Myrmicinae	2
2	*Cardiocondyla nuda*	Myrmicinae	3
3	*Cataulacus taprobanae*	Myrmicinae	4
4	*Crematogaster ransonneti*	Myrmicinae	5
5	*Crematogaster subnuda*	Myrmicinae	6
6	*Meranoplus bicolor*	Myrmicinae	7
7	*Monomorium criniceps*	Myrmicinae	8
8	*Monomorium pharaonis*	Myrmicinae	9
9	*Myrmicaria brunnea*	Myrmicinae	10
10	*Pheidole watsoni*	Myrmicinae	11
11	*Solenopsis geminata*	Myrmicinae	12
12	*Tetramorium smithi*	Myrmicinae	13
13	*Tetramorium walshi*	Myrmicinae	14
14	*Camponotus angusticollis*	Formicinae	15
15	*Camponotus compressus*	Formicinae	16
16	*Camponotus irritans*	Formicinae	17
17	*Camponotus parius*	Formicinae	18
18	*Camponotus sericeus*	Formicinae	19
19	*Oecophylla smaragdina*	Formicinae	20
20	*Paratrechina longicornis*	Formicinae	21
21	*Polyrhachis exercita*	Formicinae	22
22	*Polyrhachis lacteipennis*	Formicinae	23
23	*Polyrhachis rastellata*	Formicinae	24
24	*Camponotus angusticollis*	Formicinae	25
25	*Anochetus graeffei*	Ponerinae	26
26	*Brachyponera lutipes*	Ponerinae	27
27	*Diacamma rugosum*	Ponerinae	28
28	*Leptogenys chinensis*	Ponerinae	29
29	*Leptogenys processionalis*	Ponerinae	30
30	*Platythyrea sagei*	Ponerinae	31
31	*Tapinoma melanocephalum*	Dolichoderinae	32
32	*Technomyrmex albipes*	Dolichoderinae	33
33	*Tetraponera rufonigra*	Pseudomyrmicinae	34
34	*Tetraponera allaborans*	Pseudomyrmicinae	35
35	*Cerapachys longitarsus*	Cerapachyinae	36

Table 2. Family-wise diversity of ant species.

	Sub-families	Species	Percentage (%)
1	*Myrmicinae*	13	37
2	*Formicinae*	11	31
3	*Ponerinae*	6	17
4	*Dolichoderinae*	2	6
5	*Pseudomyrmicinae*	2	6
6	*Cerapachyinae*	1	3
	Total	**35**	100

Table 3. Sampling methods deployed for collecting data on ants. PT—Pitfall trap | LT—Line transect | Q—Quadrate | AO—All-out search.

	Species	PT	LT	Q	AL
1	*Aphaenogaster beccarii*	+	-	-	-
2	*Cardiocondyla nuda*	-	-	-	+
3	*Cataulacus taprobanae*	-	+	-	+
4	*Crematogaster ransonneti*	+	+	+	+
5	*Crematogaster subnuda*	+	+	+	+
6	*Meranoplus bicolor*	-	-	-	+
7	*Monomorium criniceps*	+	-	+	-
8	*Monomorium pharaonis*	+	+	+	+
9	*Myrmicaria brunnea*	+	-	+	-
10	*Pheidole watsoni*	+	+	+	+
11	*Solenopsis geminata*	+	+	+	+
12	*Tetramorium smithi*	+	-	-	+
13	*Tetramorium walshi*	-	+	+	-
14	*Camponotus angusticollis*	+	+	-	+
15	*Camponotus compressus*	+	+	+	+
16	*Camponotus irritans*	+	+	-	+
17	*Camponotus parius*	-	+	-	+
18	*Camponotus sericeus*	+	-	-	+
19	*Oecophylla smaragdina*	-	-	-	+
20	*Paratrechina longicornis*	+	+	+	+
21	*Polyrhachis exercita*	-	-	-	+
22	*Polyrhachis lacteipennis*	+	+	+	+
23	*Polyrhachis rastellata*	+	-	-	+
24	*Camponotus angusticollis*	+	+	-	+
25	*Anochetus graeffei*	+	-	-	-
26	*Brachyponera lutipes*	+	-	-	+
27	*Diacamma rugosum*	+	+	+	+
28	*Leptogenys chinensis*	+	-	-	-
29	*Leptogenys processionalis*	+	-	-	-
30	*Platythyrea sagei*	+	-	-	-
31	*Tapinoma melanocephalum*	+	+	+	+
32	*Technomyrmex albipes*	+	+	-	-
33	*Tetraponera rufonigra*	-	+	+	+
34	*Tetraponera allaborans*	+	+	-	+
35	*Cerapachys longitarsus*	+	-	-	-
	Total	**27**	**18**	**14**	**24**

Table 4. Species and total individuals recorded in sampling methods.

	Trapping method	Species recorded	Individuals recorded
1	Pitfall trap	27	501
2	Line transect	18	889
3	Quadrate	14	225
4	All-out search	24	534

Image 2. *Aphaenogaster beccarii* (Emery, 1887). © Akshay Gawade

Image 3. *Cardiocondyla nuda* (Mayr, 1866). © Akshay Gawade

Image 4. *Cataulacus taprobanae* (Smith, 1853). © Akshay Gawade

References

Abril, S. & C. Gomez (2013). Rapid assessment of ant assemblages in public pine forests of the central Iberian Peninsula. *Forest Ecology and Management* 293: 79–84.

Andersen, A., B.D. Hoffman, W.J. Muller & A.D. Griffiths (2002). Using

Image 5. *Crematogaster subnuda* (Mayr, 1879). © Akshay Gawade

Image 6. *Crematogaster ransonneti* (Mayr, 1868). © Akshay Gawade

Image 7. *Meranoplus bicolor* (Guerin-Meneville, 1844). © Akshay Gawade

Ants as Bioindicators in Land management: Simplifying Assessment of Ant Community Responses. *Journal of applied Ecology* 39(1): 8–17.

Bharti, H., Y.P. Sharma & A. Kaur (2009). Seasonal patterns of ants (*Hymenoptera*: *Formicidae*) in Punjab Shivalik. *Haltere* 1: 36–47.

Bharti, H. (2011). List of Indian Ants. *Halteres* 2: 79–87.

Bingham, C.T. (1903). *The Fauna of British India, including Ceylon and Burma. Hymenoptera, Vol. ll. Ants and Cuckoo-wasps.* London: Taylor and Francis, 506pp.

Gadagkar, R., P. Nair, C. Chandrashekhara & D.M. Bhat (1993). Ant species richness and diversity in some selected localities in Western Ghats, India. *Hexapoda* 5(2) : 79–94.

http://antweb.org/ (visited June 2016; Revisited 20th June 2020)

http://www.antwiki.org/ (visited June 2016; Revisited 20 June 2020)

Jonathan, D.M. (1983). Ants: Bio-indicators of minesite rehabilitation, land-use, and land conservation. *Environmental Management* 7(4): 375–383.

Jonathan, D.M., G. Oraby & L. Bisevac (2007). Ants (*Hymenoptera: Formicidae*) pass the bioindicator scorecard. *Myrmecological News* 10: 69–76.

Kharbani, H. & S.R. Hajong (2013). Seasonal patterns in ant (Hymenoptera: Formicidae) activity in a forest habitat of the West Khasi Hills, Meghalaya, India. Asian Myrmecology 5: 103–112.

Khot, K., G. Quadros & V.U. Somani (2013). Ant diversity in an urban garden at Mumbai, Maharashtra, pp. 121–125. Proceedings of the National Conference of Biodiversity: Status and Challenges in Conservation.

Mathew, R. & R.N. Tiwari (2000). *Insecta*: *Hymenoptera*: *Formicidae* Zoological Survey of India, State Fauna Series 4: Fauna of Meghalaya Part-7: 251–409pp.

Mirza, Z. & R. Sanap (2010). Biodiversity of Aarey Milk Colony and Film City (2007–2009). A report submitted to the Government of Maharashtra and the Forest Department of Maharashtra, 51pp.

Narendra, A. & M.S. Kumar (2006). *On Trail with Ants. A Handbook of the Ants of Peninsular India.* Self published, 193pp.

Quadros, G., G. Gurav, K. Bhagat, A. Chorghe, A. Dhamorikar, K. Khot & M. Nagarkar (2009). Report on the Study of the Biodiversity of Indian Institute of Technology Bombay Campus. By WWF-India MSO for IIT Bombay, 158pp.

Stephens, S.S. & M.R. Wagner (2006). Using Ground Foraging Ant (Hymenoptera: Formicidae) Functional Groups as Bioindicators of Forest Health in Northern Arizona Ponderosa Pine Forests. *Environmental Entomology* 35(4): 937–949

Underwood, E.C. & B.L. Fisher (2006). The role of ants in conservation monitoring: If, when and how. *Biological conservation* 132: 166–182.

Wilson, E.O. (1990). Success and Dominance in Ecosystems: The Case of the Social Insects. In: Kinne, O. (Ed.). *Excellence in Ecology.* Vol. 2. Ecology Institute, Oldendorf/Luhe, Germany, 104pp+15figs.

Image 8. *Monomorium criniceps* (Mayr, 1879). © Akshay Gawade

Image 9. *Monomorium pharaonis* (Linnaeus, 1758). © Akshay Gawade

Image 10. *Myrmicaria brunnea* (Saunders, 1842). © Akshay Gawade

Image 11. *Pheidole watsoni* (Forel, 1902). © Akshay Gawade

Image 12. Solenopsis geminata (Fabricius, 1804). © Akshay Gawade

Image 13. Tetramorium smithi (Mayr, 1879). © Akshay Gawade

Image 14. *Tetramorium walshi* (Forel, 1890). © Akshay Gawade

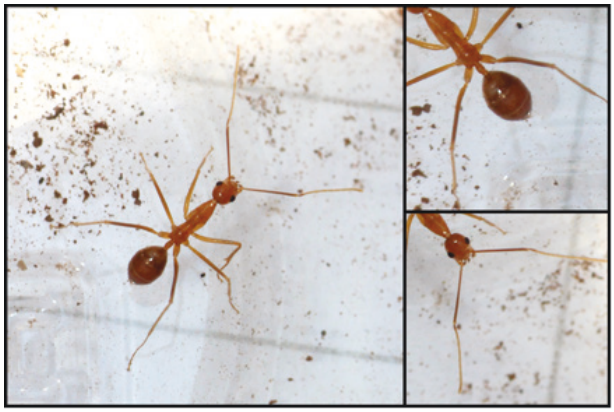

Image 15. *Anoplolepis gracilipes* (Smith, 1857). © Akshay Gawade

Image 16. *Camponotus angusticollis* (Jerdon, 1851). © Akshay Gawade

Image 17. *Camponotus compressus* (Fabricius, 1787). © Akshay Gawade

Image 18. *Camponotus irritans* (Smith, 1857). © Akshay Gawade

Image 19. *Camponotus parius* (Emery, 1889). © Akshay Gawade

Image 20. *Camponotus sericeus* (Fabricius, 1798). © Akshay Gawade

Image 21. *Oecophylla smaragdina* (Fabricius, 1775) (Queen). © Akshay Gawade

Image 22. *Paratrechina longicornis* (Latreille, 1802). © Akshay Gawade

Image 23. *Polyrhachis exercita* (Walker, 1859). © Akshay Gawade

Image 24. *Polyrhachis lacteipennis* (Smith, 1858). © Akshay Gawade

Image 25. *Polyrhachis rastellata* (Latreille, 1802). © Akshay Gawade

Image 26. *Anochetus graeffei* (Mayr, 1870). © Akshay Gawade

Image 27. *Brachyponera luteipes* (Mayr, 1862. © Akshay Gawade

Image 28. *Diacamma rugosum* (Le Guillou, 1842). © Akshay Gawade

Image 29. *Platythyrea sagei* (Forel, 1900). © Akshay Gawade

Image 30. *Leptogenys chinensis* (Mayr, 1870). © Akshay Gawade

Image 31. *Leptogenys processionalis* (Jerdon, 1851). © Akshay Gawade

Image 32. *Tapinoma melanocephalum* (Fabricius, 1793). © Akshay Gawade

Image 33. *Technomyrmex albipes* (Smith, 1861). © Akshay Gawade

Image 34. *Tetraponera allaborans* (Walker, 1859). © Akshay Gawade

Image 35. *Tetraponera rufonigra* (Jerdon, 1851). © Akshay Gawade

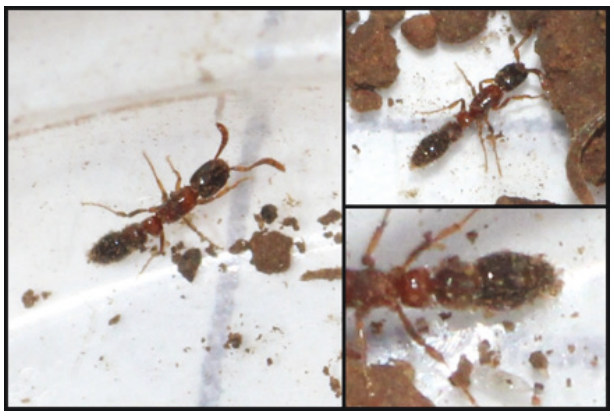

Image 36. *Cerapachys longitarsus* (Mayr, 1879). © Akshay Gawade

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