



BIODIVERSITY AND MORPHOLOGY OF ANTS (FORMICIDAE) IN HABITING ON MANGO TREES FROM SINDH, PAKISTAN

JAWAID A. KHOKHAR, TAHIRA JABEEN URSANI, ASIF RAZA SOOMRO AND IMDAD ALI CHANNA

Department of Zoology, University of Sindh, Jamshoro

ARTICLE INFORMATION

Article History:

Received: 30th October 2019

Accepted: 28th June 2020

Published online: 1st September 2020

Author's contribution

JAK conducted the experiment TJU finalize the manuscript, ARS collected the samples & IAC complied and analysis the data.

Key words:

Biodiversity; Morphology; Formicidae; Inhabiting; Mango trees, Sindh

ABSTRACT

Biodiversity refers to all the members species of the five kingdoms (Monera, Prokaryote, Fungi, Plantae and Animalia) living on the Earth. It is very essential to know the actual habitat of each species and morphology for the best output of the research. To study the biodiversity regarding Ants (Hymenoptera: Formicidae) is of great importance due to their abundance, versatile functions and diversity. It is also very important due to diversity of insect fauna and known recoded species are insect then other animal. In this effort 10256 specimens were collected during the year 2018-2019 from five Districts (Tando Allahyar, Matiari, Mirpurkhas, Sanghar and Nuashahro feroze) of Sindh Province. In these five districts the mango are grown in great quantity. Five sites of each District were also selected for twice visits. The ants were collected by using different baits like chicken visceral, sweet, insects and worms. The 10256 specimens was sorted out into five sub families of ants (formicinae, Myrmicinae, Ponerinae, Pseudomyrmicinae and Dolichoderinae), six genera (*Camponotus*, *Anochetus*, *Oecophylla*, *Meranooplus*, *Polyrhachis* and *Tetraponera*) and ten species. This research carried out for the first time from Sindh, Pakistan.

1. INTRODUCTION

Study of ants is called myrmecology and these insects belong to Hymenoptera (order) and Formicidae (family) is the largest group of social and common insects. There are 21 sub-families of formicidae accounted from the world, among 21, 17 subfamilies are living (extant) and 4 are fossils (extinct), including 306 genera and 22000 species [1, 2].

The ants are universal having with multipurpose life modes, occupations and significant component of terrestrial biosphere [3, 4,5,6]. Additionally, disparate many other fauna, their population framework and consistency is unique. Ants frequently sustain and raise biomass in agro cultivated and non-cultivated environments of land and consequently perform a key role in these ecosystems [7]. Ants have versatile adaptations for foraging like omnivorous, herbivorous, predators, scavengers and opportunistic feeders [8]. They also actively influence on animal food chain and webs due to their diverse nutritional ravenousness, mutuality associations with other fauna and flora. Associations of these ants are fundamental for

Corresponding Author: khokharjawaid@gmail.com

Copyright 2017 University of Sindh Journal of Animal Sciences

agriculture [9]. Like earth worm is famous for the soil fertility, bees with pollinations, mantids and spiders with pest control, house fly cleanses of debris etc in the same way the ants perform all roles (Predators, Scavengers, Pollinators, Soil turners mean soil fertility and sometimes pests also) in the ecosystem [27]. This ant fauna is the considerable and significant element of land environment, they share a huge part in the animal biomass but also they act as ecosystem engineers. These are important in below ground process through the fluctuation of the physical and chemical environment and through their effect on plants, microorganisms, and other soil organisms [12, 13].

This study is based on the biodiversity of ants associated with mango trees grown in Sindh. Ants live in colonies containing one or several queens, and dozens to millions of workers. Queens specialize in reproduction; the wingless workers are responsible for all other tasks, including brood care, nest maintenance, foraging and defense. Ants can be omnivores, herbivores and opportunist feeders. Ants often maintain or even some times increase biomass and species richness in agricultural systems and therefore retain a key role in the ecosystems. Successive workers like [14-26] have made valuable contribution to the ant's fauna.

2. MATERIALS AND METHODS

Sindh is the famous agricultural province of Pakistan, it is situated at 26° 21' 0" N, 68° 51' 0" E, it is the third largest province of Pakistan by area. It is main mango grower province of Pakistan. Through the extensive survey under this project total numbers of 10256 specimens were collected during the year 2018-2019, in January to December months from five districts (Tando Allahyar, Matiari, Mirpurkhas, Sanghar and Nuashahro feroze) of Sindh Province (Table.1). In these five districts the mango are grown in great quantity. Five sites of each District were also selected for twice visits. The ants were collected by using bait like chicken visceral, and hand picking because these are live in colonies under soil or on trees (figure.1-7). Some of the ant's species are very small, that's why the different baits were used. After the identifications of species were preserved into seventy-five percent ethyl alcohol along with 10 drops of glycerin for small ant's

species while others were stores in entomological boxes. Identification was done while using keys given by [3, 4,5]. The collection was made in three different time's morning, evening and night, appropriate to their activeness. This is the first reported research work from Sindh, Pakistan. Photographs captured by digital camera.



Figure. 1 Bait (chicken visceral) used for collecting ants.



Figure. 2 Another bait source (sweet) used for collecting ants.



Figure.3 Another source as bait (worms and insects) used for collecting ants which gave best result.



Figure. 4 Collection of ants from branches of Mango trees.

Formicidae in habiting on mango trees



Figure. 5 collection of ant specimens from ground of mango.



Figure. 6 Samples collection at night along with supervisory team.



Figure. 7 Mr. Asif Raza Soomro Ph.D Scholar working while using stereoscopic binocular microscope at Advanced Research Laboratory of Arachnology and Entomology.

3. RESULTS AND DISCUSSION

Under this project total numbers of 10256 specimens were collected during the year 2018-2019, in January to December months from five districts (Tando Allahyar, Matiari, Mirpurkhas, Sanghar and Nuashahro feroze) of Sindh Province. In these five districts the mango are grown in great quantity. Five sites of each District were also selected for twice visits. The ants were collected by using bait like chicken visceral, and hand picking because these are live in colonies under soil or on trees. Some of the ant's species are very small, that's why the different baits were used. The sample of 10256 specimens

was sorted out into five sub families of ants (formicinae, Myrmicinae, Ponerinae, Pseudomyrmicinae and Dolichoderinae), six genera (*Camponotus*, *Anochetus*, *Oecophylla*, *Meranooplus*, *Polyrhachis* and *Teteraponera*) and ten species namely *Camponotus compressus*, *Camponotus confucii*, *Camponotus sericeus*, *Camponotus maculates*, *Meranoplus bicolor*, *Polyrhachis hogsoni*, *Lioponera longitarsus*, *Pheidole neineri* and *Solenopsis germinates*, these are reported first time from Sindh, Pakistan.

FORMICINAE REMARKS:

It is a largest and flourishing sub-group; contain 3030 known species, dispersed mostly all parts of the land. It consist of wood ants and their allies members species examples carpenter ants (*Camponotus*), weaver ants (*Oecophylla*), and honey pot ants (*Myrmecocystus*). This group has assorted range of 50 another genera. In this group females like workers and gynes are renowned from all other ants due to presence of acidopore, at seventh abdominal sternum which is used to spray formic acid. The abdominal segments 4 to 6 are huge comparative to sternites, the mesosoma is close to gaster by a single separate fragment called petiole. The gaster is smooth, without constrictions between the segments.

PONERINAE REMARKS:

The remarkable characters of this sub-group include the mesosoma which is close to gaster with a particular divergent section called petiole. The gaster frequently has a somewhat small but divergent inkling among the first and second segments of the abdomen. The gaster is smooth and uniform in a few other species of this group, except at this juncture jaws or mandibles extend or elongated somewhat in a straight line, with dentine only at tip, and attached close jointly alongside of face edge of the head. The upper surface of the tip of the gaster (the pygidium) is rounded and lacks a row of bristles or dentine.

MYRMICINAE REMARKS:

The members of myrmicines vary in size, from the smallest species is recorded 1 mm long and the largest up to 10 mm mostly these species are predator's specific generalist. Workers can be found feeding often every times, day and night. Colonies are generally small with a few hundred to a few

thousand workers, even though a few species have enormous nests or colonies with many thousands of workers while others form very small nests with fewer than 50 individuals residing on trees including mangoes and in the deep soil.

PSEUDOMYRMECINAE REMARKS:

The ant subfamily Pseudomyrmecinae is a pantropical group of arboreal, twig-dwelling ants. A few species occur in warm temperate regions, but most are confined to tropical forests, woodlands, and savannas. Pseudomyrmecine ants typically nest in preformed cavities in dead plant tissue, such as hollow dead twigs or grass culms that have been excavated by other insects. But a substantial number of species (about 20% of the estimated 300 species) are obligate inhabitants of specialized ant-plants. These ants occupy live plant cavities, such as the swollen thorns of certain acacia species or the swollen leaf petioles of Mango trees and on dead branches.

DOLICHODERINAE REMARKS:

It contains argentine ants, erratic ants and the famous odorous home ants. It has the supreme variety in speciation in all over the world. The members of this sub-family live in building, homes, stores etc. It is studied and described from varied biogeographically terrestrial ecosystems like Australian, Neotropical and Palearctic of the world. The members of this family are dissimilar due to the single petiole and a slit like organ known as orifice, from where they release the pheromones are chemical compounds. They do not have the stings and generally are scavengers and predators.

4. CONCLUSION

The biodiversity of ants shows that the ant's fauna of Sindh is richest in term of their diversity occurring in mango gardens, their association has great impact on the mango garden due to their role as carnivore, pollinator, scavenger, predator, decomposer, soil aerator and Gardner of the mango trees. Ants have a outstanding worth in the terrestrial environment, they regarded as sustainer and in past time, many people use ants as the indicator of climate or ecosystem for knowing weather changings in environment, like rain, in rainy season ants leave their colonies and move to eminent places for fortification along with

all castes and eggs in a row, due to this people consideration that rain will be coming.

CONFLICT OF INTEREST

All authors have declared that there is no conflict of interest regarding publication of this article.

REFERENCES

- [1] Watanasit 87-194., S. and Bickel, T.O., 200. "Diversity of Ants from Ton Nga chang Sancturay, Songkhla, Thailand". Pp: 1
- [2] Andrade, T., Marques, G. D. V., & Del-Claro, K. (2007). Diversity of ground dwelling ants in cerrado: an analysis of temporal variations and distinctive physiognomies of vegetation (Hymenoptera: Formicidae). *Sociobiology*, 50(1), 121-134.
- [3] Ward, P. S. (2007). Phylogeny, classification, and species-level taxonomy of ants (Hymenoptera: Formicidae). *Zootaxa*, 1668(1), 549-563.
- [4] Bolton, B. (1995) A new general catalogue of the ants of the world.. Harvard University Press, Cambridge, MA. 504pp.
- [5] Sheela, S, Ghosh, S.N, 2008. A new species of *Lophomyrmex* Emery (Hymenoptera: Formicidae) from India with a key to India species. *Biosystematica* 2, 17-20.
- [6] OGATA, K., 1992. The out fana of oriental region: An overview (Hymenoptera: Formicidae). *Bull. Inst. Trop. Agric. Kyushu Univ.*, 15:55-74.
- [7] Vandmeer, J., D Lawrencee.A Symstad, and S.Hobbie.2002.Effect of biodiversity on ecosystem functioning in managed ecosystems. Pages 209-220.
- [8] Anderson AN. 1990. The use of ant communities to evaluate change in Australian terrestrial ecosystems: a review and a recipe. *Proceedings of the Ecological Society of Australia* 16, 347-357.

Formicidae in habiting on mango trees

- [9] Bharti, Hanzawa et al., 2011. Ants of India. <http://www.antdiversityindia.com/home>
- [10] Ness, J., Mooney, K., & Lach, L. (2010). Ants as mutualists. *Ant ecology*, 97-114.
- [11] White, P. S. (1985). Natural disturbance and patch dynamics: an introduction. In 'The Ecology of Natural Disturbance and Patch Dynamics'. (Eds STA Pickett, PS White) pp. 1–13.
- [12] Folgarait, P. J. (1998). Ant biodiversity and its relationship to ecosystem functioning: a review. *Biodiversity & Conservation*, 7(9), 1221-1244.
- [13] Philpott, S. M., & Armbrecht, I. (2006). Biodiversity in tropical agroforests and the ecological role of ants and ant diversity in predatory function. *Ecological Entomology*, 31(4), 369-377.
- [14] Agosti, D., J. Majer, L. Alonso, and T.R. Schultz (eds.) (2000) *Ants: Standard method of measuring and monitoring biodiversity*. 280pp. Smithsonian Institution Press.
- [15] Brener, A. G. F., & Ruggiero, A. (1994). Leaf-cutting ants (*Atta* and *Acromyrmex*) inhabiting Argentina: patterns in species richness and geographical range sizes. *Journal of Biogeography*, 391-399.
- [16] Hoffmann, B. D., & Andersen, A. N. (2003). Responses of ants to disturbance in Australia, with particular reference to functional groups. *Austral Ecology*, 28(4), 444-464.
- [17] Bestelmeyer, B. T., & Wiens, J. A. (1996). The effects of land use on the structure of ground-foraging ant communities in the Argentine Chaco. *Ecological Applications*, 6(4), 1225-1240.
- [18] LaSalle, J., & Gauld, I. D. (1993). *Hymenoptera: their biodiversity, and their impact on the diversity of other organisms*. Hymenoptera and biodiversity., 1-26.
- [19] Agosti, D., Majer, J., Alonso, L. E., & Schultz, T. (2000). *Ants: standard methods for measuring and monitoring biodiversity*. Smithsonian Institution Press.
- [20] Yanoviak, S. P., & Kaspari, M. (2000). Community structure and the habitat template: ants in the tropical forest canopy and litter. *Oikos*, 89(2), 259-266.
- [21] Lucky, A., Trautwein, M. D., Guenard, B. S., Weiser, M. D., & Dunn, R. R. (2013). Tracing the rise of ants-out of the ground. *PLOS one*, 8(12).
- [22] Bharti, H., Guénard, B., Bharti, M., & Economo, E. P. (2016). An updated checklist of the ants of India with their specific distributions in Indian states (Hymenoptera, Formicidae). *ZooKeys*, (551), 1.
- [23] Wilsey, B. J., & Potvin, C. (2000). Biodiversity and ecosystem functioning: importance of species evenness in an old field. *Ecology*, 81(4), 887-892.
- [24] Phipps, S. J. (2006). Biodiversity of ants (Hymenoptera: Formicidae) in restored grasslands of different ages (Doctoral dissertation, University of Missouri--Columbia).
- [25] Bhoje, P. M., Kurane, S. H., Desai, A. S., & Sathe, T. V. Research Paper Zoology Biodiversity of Ants (Hymenoptera: Formicidae) of Amba Reserve Forest of Western Ghats, Maharashtra.
- [26] Lach, L. (2008). Argentine ants displace floral arthropods in a biodiversity hotspot. *Diversity and Distributions*, 14(2), 281-290.
- [27] Jawaid Khokhar (2019) Importance of Ants (formicidae) Published in Daily Sindhi news paper .

Table. 1 Name of Districts, Sites, Geographical location and number of Ants specimens.

S#	Name. Districts	Name of Sites	Geographical locations of Districts	Sample
01	Tando Allahyar	Massan, Khuwaja Stop, Tando ALLahyar, Sultanabad.	25° 28' 0" North, 68° 43' 0" East.	2530
02	Matiari	Matiari, Hala, Nasarpur, Bhattshah, Odero Station	25° 36' 0" North, 68° 27' 0" East	1984
03	Mirpurkhas	Kot Ghullam Muhammad, Hussain Bux, Mataro Khaskheli, Khadim Ali shah and Mirpurkhas	25° 33' 2" N, 69° 0' 11" E	2057
04	Sanghar	Sanghar Rura Tando Adam, Jam Nawaz Ali, Khipro and Shehdadpur.	26° 2' 0" North, 68° 57' 0" East	2265
05	Nuashahro feroze	Moro, Nushahro Feroze, Bhiria, Kandiaro and Mehrabpur	26° 50' 0 N 68° 7' 0 E	1420

Table 2. Showing the sub families of family formicidae recoded from Sindh.

Sub Families	Genera	Species Found
Formicinae	<i>Camponotus</i>	4
Formicinae	<i>Oecophylla</i>	2
Myrmicinae	<i>Meranoplus</i>	1
Ponerinae	<i>Anochetus</i>	1
Pseudomyrmicinae	<i>Tetraponera</i>	1
Dolichoderinae	<i>Solenopsis</i>	1

Table 3. The site wise collection of Ants (Formicidae) from Nausharo Feroz

S#	SITE NAME	NUMBER OF SPECIMENS
01	Bhiria	342
02	Moro	213
03	Naushahro feroze	113
04	Kandiaro	431
05	Mehrabpur	321
TOTAL SPECIMENS		1420

Table 4. The site wise collection of Ants (Formicidae) from Mirpurkhas

S#	SITE NAME	NUMBER OF SPECIMENS
01	Mirpurkhas	473
02	Hussain Bux	331
03	Khadim Ali Shah	235
04	Kot Ghulam Muhammad	567
05	Mataro Khaskheli	451
TOTAL SPECIMENS		2057

Formicidae in habiting on mango trees

Table 5. The site wise collection of Ants (Formicidae) From Matiari

S#	SITE NAME	NUMBER OF SPECIMENS
01	Matiari	544
02	Hala	315
03	Odero station	333
04	Bhit Shah	591
05	Nasarpur	501
TOTAL SPECIMENS		1984

Table 6. The site wise collection of Ants (Formicidae) From Tando Allahyar

S#	SITE NAME	NUMBER OF SPECIMENS
01	Masan	612
02	Khuja Stop	453
03	Tando Allahyar	385
04	Tando Adam	555
05	Sultan Abad	525
TOTAL SPECIMENS		2530

Table 7. The site wise collection of Ants (Formicidae) From Sanghar

S#	SITE NAME	NUMBER OF SPECIMENS
01	Rural Sanghar	542
02	Tando Adam	413
03	Jam Nawaz Ali	353
04	Khipro	477
05	Shahdadpur	480
TOTAL SPECIMENS		2265

Table.8 Ants (Formicidae) recorded from five Districts of Sindh

Name. Districts	Name of sub families	No. of Genera	No. of Species
Tando Allahyar	Ponerinae	02	02
Matiari	Myrmicinae	04	04
Mirpurkhas	Formicinae	03	01
Sanghar	Pseudomyrmicinae	01	02
Nuashahro feroze	Dolichoderinae	02	02

Table 9. Summary of Habitats of ants from major sites from Sindh

Name of Species	TM	TA	MT	OST	OV	MK	TJ	TA	NF
<i>Camponotus compressus</i>	+	+	+	+	+	+	+	+	+
<i>Camponotus confuccii</i>	+	+	+	+	+	+	+	+	-
<i>Camponotus minor</i>	+	+	+	+	+	-	-	+	+
<i>Camponotus sericeus</i>	-	+	+	+	+	+	+	+	-
<i>Camponotus maculatus</i>	-	+	-	+	+	-	-	+	+
<i>Meranoplus bicolor</i>	+	-	+	+	-	+	+	-	-
<i>Polyrhachis hogsoni</i>	+	+	+	-	+	+	+	-	+
<i>Lioponera longitarsus</i>	+	+	+	+	-	+	+	+	+
<i>Pheidole neineri</i> ,	+	+	-	+	+	+	+	+	+
<i>Solenopsis germinates</i>	+	+	+	+	-	+	+	-	+

Note: Plus (+) sign indicates presence of species and Minus (-) sign indicates absence of species. (*) sign indicates new records from Sindh

Abbreviations used:

TM	Tando Mohammad Khan	OST	Odero Station
TA	Tando Allah Yar	OV	Oder Village
MT	Matiari	MK	Mirpur Khas
TJ	Tando jam	NF	Nausharo Feroze
TAD	Tando Adam		