Entomology

First distributional record of ant species (Hymenoptera: Formicidae) from Botanical Garden, Puducherry, India

Gowri K[1]* and Sankaraiyah K[2]

[1] Research Scholar, Department of Zoology, Kanchi Mamunivar Government Institute for Postgraduate Studies and Research, Lawspet, Puducherry, India

[2] Assistant Professor, Department of Zoology, Kanchi Mamunivar Government Institute for Postgraduate Studies and Research, Lawspet, Puducherry, India

Correspondence Author: Gowri K

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Abstract

The current study examines the ant distribution at the Botanical Garden in the Union Territory of Puducherry, India, as there are still no prior ant diversity reports from this site. Ant community is an essential unit of any ecosystem because they serve as ecosystem engineers. But the field of myrmecology has received very little attention in India. During the investigation, 12 ant species from four subfamilies were identified, including Myrmicinae, Ponerinae, Formicinae, and Pseudomyrmicinae. This work is the first report on the distribution of ant species from this location.

Keywords: ant diversity, botanical garden, union territory, Puducherry, India

Introduction

Puducherry is a union territory that has a long history and unique environmental factors. Geographically, Puducherry lies at 11° 42’ to 12° 30’ North latitude and 76° 36’ to 79° 53’ East longitude. It covers 290 sq. km and the weather is mostly hot and humid. The present study was conducted to record the distribution of ant species from the Botanical Garden located in the Union Territory of Puducherry, India, as there are no previous records of ant diversity from this location. Globally, it has been predicted that about 8.7 million species [10]; only about 1.7 million species have been identified and described as on date [9]. Continuous attempts are being made to identify and describe various species of organisms of different localities of geographical realms. Arthropods form a top component of animal distribution and hymenoptera is one of the major orders. Ants are an important part of the ecosystem because they serve as animal biomass and ecosystem engineers [6]. They occupy almost all regions of the earth except Antarctica, Greenland and Iceland [8]. The family Formicidae of this order has great importance to mankind. Ants are the most successful arthropod fauna for studying the ecology of a specific region because they can withstand adverse environmental conditions [7]. They play an immeasurable role as soil turners, seed dispersers, pollinators, predators, etc. There are about 15000 species of ants grouped under 16 subfamilies [5]. A compiled up-to-date checklist of ant species for twenty-eight Indian states and two Union Territories was provided by Himender Bharti which includes a total of 828 extant species belonging to 100 genera and 10 subfamilies [1]. India is a biodiversity hotspot, yet the area of myrmecology in this oriental part has received little attention. Most of the ant species have been reported from the Northern and Western parts of India. There are very few reports on ant diversity from the Southern parts of Tamil Nadu and Puducherry have been found in the literature. In this background, the study was conducted to document the various species of ants present in this location.

Materials and methods

Study area

The Botanical Garden of Puducherry (11°55’ N, 79°49’ E) is a protected area of 11 hectares of land containing more than 290 species of plants; some of the trees are more than 200 years old. It was established in 1826 by the French Government and this garden harbours many exotic and endangered species of plants. It is located close to the seashore, the temperature ranges from 27˚C to 38˚C. The annual rainfall is estimated to be 1200 mm, humidity ranges between 60 to 80 percent. The insect fauna of this garden may be peculiar due to its age and flora. With this background, we surveyed to document the myrmecofauna of the Botanical Garden of Puducherry.

Method of collection

Ants were collected from January 2021 to July 2021 by All Out Mearch method. Sample collection was made with the help of cotton hand gloves, brush and forceps. The collection of ants using cotton gloves was very much effective as it helped in the quick grasping of ants without damaging their parts.

Preservation

The collected ant specimens were preserved in 70% ethanol in plastic vials in the laboratory. Specimens were pinned and kept in airtight insect wooden boxes.

Identification

The collected ants were identified up to species level using Magnus MSZ-TR Trinocular stereozoom microscope and photographed with the help of canon EOS 1500D camera. Species-level identification of the ants was made based on morphological and morphometric characters using the taxonomic keys of Wilson (1990) and Barry Bolton (1994) up to genus level. Species-level identification was carried out using keys published by Himender Bharti [1-4] in his various publications. Ant specimens were deposited in PUAC (Punjab University Ant Collection), Patiala. Species identification was confirmed by Dr. Himender Bharti, Department of Zoology and Environmental Sciences, Punjabi University, Patiala.

Results and discussion

Table 1: List of ant species collected from Botanical Garden, Puducherry

Subfamily	Ant species	Tribe	Common name
Myrmicinae	*Meranoplus bicolor* (Guérin-Méneville, 1844)	Meranoplini	Shield ant
	Myrmicaria brunnea (Saunders, 1842)	Myrmicariini	-
	Crematogaster subnuda (Mayr, 1879)	Crematogastrini	Acrobat ant/saint valentine ant
	Solenopsis geminata (Fabricius, 1804)	Solenopsidini	Tropical fire ant
Ponerinae	*Leptogenys chinensis* (Mayr, 1870)	Ponerini	Procession ant
	Diacamma ceylonense (Emery, 1897)	Ponerini	Asian bullet ant
	Anochetus obscurior (Brown, 1978)	Ponerini	Trap-jaw ant
Formicinae	*Oecophylla smaragdina* (Fabricius, 1775)	Oecophyllini	Weaver ant
	Camponotus serecius (Fabricius, 1798)	Camponotini	Golden-backed ant
	Paratrechina longicornis(Latreille, 1802)	Plagiolepidini	Crazy ant
	Anoplolepis gracilipes (Smith, 1857)	Plagiolepidini	Yellow crazy ant
Pseudomyrmicinae	*Tetraponera rufonigra* (Jerdon, 1851)	Pseudomyrmecini	Arboreal bicoloured ant

Taxonomy

Keys and diagnostic characters of the worker ants collected from the Botanical Garden are given below:

Key to the sub-families

1. Presence of single petiole between alitrunk and gaster……2
   Presence of two reduced or isolated segments between alitrunk and gaster……..3
2. Presence of acidopore and sting absent…….Formicinae
   Acidopore absent and sting present. Presence of peg-like teeth or short spines either on the pygidium or hypopygidium ……..Ponerinae
3. Promesonotal suture present and pectinate spur seen on hind tibia....Pseudomyrmecinae
   Promesonotal suture absent and only a simple spur seen on hind tibia…. Myrmicinae.

Key to the genera of myrmicinae

1. Antennae with less than 12 segments……2
   Antennae with 12 segments……6
2. Antennae with 11 segments and presence of heart-shaped gaster on dorsal view…...*Crematogaster*
   Antennae with less than 11 segments. Gaster is not heart-shaped and postpetiole attached to the middle or ventral surface of the gaster……3
3. Antennae with 10 segments and club formed of two segments…….*Solenopsis*
   Antennae with less than 10 segments……4
4. Antennae with 9 segments and antennal scrobes present. Palp formula 3, 3……..*Meranoplus*
   Antennae with 7 segments and antennal scrobes absent. Palp formula 5, 3.....*Myrmicaria.*

***Crematogaster subnuda* (Mayr, 1879)**

Diagnostic characters

Body reddish-brown in colour and gaster is brownish-black. Head is smooth with small striations and roughly oval-shaped. Mandible is provided with 5 teeth and longitudinal striations. Clypeus is convex and lined with setae on the lateral side. Eyes are large, situated laterally, slightly more to posterior. 11 segmented flagellum forming 3 clubs at the apex. Scape reaches the top of the head. Thorax and apex of gaster with sparse pubescence. Pronotum is flat on its top, rugulose; weak pro-mesonotal suture and clear meso-metanotal suture. Propodeum is striate dorsally, narrow anteriorly and provided with acute spines posteriorly. Petiole is semicircular with a small sub-petiolar process. Gaster is elongate, cordate, and covered with hairs.

***Solenopsis geminata* (Fabricius, 1804)**

Diagnostic characters

Body is reddish yellow with brown borders on the mandible and gaster. The head is nearly square, with minute striations on the anterolateral sides. Ten segmented antennae with 2 clubs. The mandible is short and shining, with four teeth and a finely striate masticatory margin. Pronotal, mesonotal and propodeal spines are absent. Gaster is oval.

***Meranoplus bicolor* (Guérin-Méneville, 1844)**

Diagnostic characters

Body covered with abundant hairs and ferruginous red, abdomen is black. Eyes are laterally placed. The head is trapezoidal with coarse sculpture. Antennae with 9 segments and forming 3 clubs. A deep antennal furrow is seen on the lateral side. The mandibles are finely striate with four teeth. Clypeus is convex with two small teeth on its anterior side. Head and promesonotum are reticulate and rugulose on the dorsal side. Promesonotal shield is provided with a pair of acute mesonotal spines posteriorly which are larger than the

propodeal spines. Petiole triangular, post-petiole is globose and striate. Gaster is slightly reticulate and brownish-black in colour.

***Myrmicaria brunnea* (Saunders, 1842)**

Diagnostic characters

Body is brownish-black in colour and covered with long brown to black setae Eyes are laterally placed. The head is short and roughly rounded with longitudinal striations. Antennae with 7 joints. Head and mandibles are finely longitudinally striate with four acute teeth at the masticatory margin. Reticulate mesosoma. Convex pronotum; pro-mesonotal suture defunct and deep mesometanotal suture. Pedicel node conical; anterior petiolar peduncle long and post-petiole short. Propodeal spines are slanting and acute. Gaster subglobose, smooth and oval.

Key to the genera of ponerinae

1. Mandibles long with a vertical series of 2 or 3 arranged apically…….*Anochetus*
   Mandibles linear to triangular with a vertical row of apical teeth……2
2. Petiole armed with a pair of spines on its dorsal surface, pretarsal claws of hind leg unarmed without any teeth…….. *Diacamma*
   Petiole without spines, pretarsal claws of hind leg pectinate ……*Leptogenys*

***Anochetus obscurior* (Brown, 1978)**

Diagnostic characters

Body is blackish and covered with bluish opalescence. Eyes are large. The head is slightly longer than broad with a concave posterior margin. Antennae with 12 segments. The mandibles are linear with three teeth at the apex. Pronotum convex. Mesonotum is provided with transverse striations. Petiole is thick with a subtriangular subpetiolar process. Petiolar node is rounded at the anterodorsal margin. In profile view, slope of node is convex anteriorly. Tergite of the first gastral segment with punctate-rugulose sculpture; posterior half is more or less shining and smooth.

***Diacamma ceylonense* (Emery, 1897)**

Diagnostic characters

Body is greyish black and covered with small erect hairs. Eyes are large and slightly placed above the midline of head. Antennae with 12 segments. Antennal club absent. Pronotal, mesonotal and propodeal Spines are absent. Petiolar spines present. Mandibles are triangular. Petiole is roughly cubical with a pair of short spines on the posterodorsal side.

***Leptogenys chinensis* (Mayr, 1870)**

Diagnostic characters

Body is black, slender and elongated. Dorsum of the head is smooth and shinning without striations. Eyes are large and laterally placed at the midline. Antennae with 12 segments. The length of the third antennal segment is less than or equal to twice the second one. Mandibles are long with acute teeth at the apex. The anterior margin of clypeus is sinusoid laterally and dentate apically. Thoracic sutures are distinct. Pedicel is laterally compressed and posteriorly vertical. Gaster is long with an exerted sting at the apex.

Key to the genera of formicinae

1. Antennae with 11 segments…….*Anoplolepis*
   Antennae with 12 segments……2
2. Antennal sockets close to the posterior margin of clypeus…….5
   Antennal sockets are placed at some distance from the posterior clypeal margin….*Camponotus*
3. Head and alitrunk provided with erect setae arranged in distinct pairs, palp formula 6, 4 …… *Paratrechina*
   Head and alitrunk without erect setae and petiole reduced to an elongate low node…..*Oecophylla*

***Anoplolepis gracilipes* (Smith, 1857)**

Diagnostic characters

Body light orange-yellow in colour, with erect yellow hairs scattered on the mesosoma and abdomen. Head is oval with large eyes. Antennae with 11 segments. Clypeus is convex with an arched anterior margin. The mandibles are narrow with acute dentations. Mesosoma narrow with emarginated meso-metanotal suture. Metanotum gibbous, rounded with elongate constrictions. Petiole conical and rounded on top. Legs are long. Gaster is slightly brown and oval.

***Camponotus sericeus* (Fabricius, 1798)**

Diagnostic characters

Body is black except for the red head. Antennae with 12 segments. Clypeus is convex and its anterior side is emarginated in the centre. Mandibles provided with 5 teeth. Meso-metanotal suture emarginated. Propodeum is margined and provided with side teeth apically. Pedicel node rounded. Gaster is broad, globose and covered with appressed golden silky pubescence.

***Paratrechina longicornis* (Latreille, 1802)**

Diagnostic characters

Body is slender, dull black, covered with abundant erect hairs; antennae, mandibles and legs are pale. Head is oval with large eyes. The mandibles with 5-6 teeth. Clypeus is convex and arched at the anterior margin. Antennae 12-segmented with a long scape that extends beyond the head. Thoracic sutures are distinctly visible. Pronotal, mesonotal, propodeal and petiolar spines are absent. Legs are long. Gaster is small, oval and gibbous anteriorly.

***Oecophylla smaragdina* (Fabricius, 1775)**

Diagnostic characters

Body is slender, opaque, yellowish red and covered with appressed minute hairs. Subtriangular head with large eyes placed at the midline. Antennae 12-segmented with long scape. Mandibles with acute and curved apical teeth. Clypeus is broad and convex. Mesonotum narrow and metanotum rounded dorsally. Petiole is elongated. Gaster is oval. It builds the nest in trees by stitching leaves together with silk thread produced by its larvae, hence called weaver ant.

Subfamily Pseudomyrmecinae

***Tetraponera rufonigra* (Jerdon, 1851)**

Diagnostic characters

Body bicoloured. Head post-petiole and gaster black, mesosoma and petiole orange-brown in colour. The head is densely punctate with three distinct ocelli. Antennae with 12

segments. Clypeus with longer and smooth median lobe. Thorax elongate. Pronotum is provided with angulate humeral corners. Gaster is oval with exerted sting.

Fig 1: Documentation of identified ant species from Botanical Garden

Conclusion

The present study recorded 12 species of ants from Botanical Garden of Puducherry, which shows first distributional report from this location. Puducherry remains one of the undersampled regions of India, and there is a lack of surveys on myrmecofauna. In the present study, a total of 12 species of ants belonging to 4 subfamilies were recorded. The subfamilies included Myrmicinae, Ponerinae, Formicinae, and Pseudomyrmicinae. The subfamilies Myrmicinae and Formicinae comprise 4 species each, subfamily Ponerinae comprises 3 species and subfamily Pseudomyrmicinae comprises one species. Species such as *Meranoplus bicolor*, *Myrmicaria brunnea*, *Solenopsis geminata*, *Paratrechina longicornis* and *Tetraponera rufonigra* were observed to be dominant during the study. *Anoplolepis gracilepis*, *Paratrechina longicornis* and *Solenopsis geminata* are considered to be exotic species [1]. This study was performed to record as many species as possible in order to add to the existing knowledge of ant diversity in the Puducherry region.

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