Chapter 3

Species Inventory of Ants

The arboreal ant *Tetraponera rufonigra* foraging on tree trunk

Introduction

Species inventory of ants has been viewed as an important task in biodiversity and conservation studies (Agosti *et al.,* 2000). Ants have the potential to yield meaningful biodiversity data because of their ecological importance. The information required to understand their ecological roles and features that help them to monitor the ecosystems is provided by a species inventory. (Hashimoto *et al.,* 2001).

The primary objectives of an inventory are to record as many of the species present at a site as possible and to characterize community patterns in a site. Based on the data from an inventory it is possible to evaluate sampling methods with respect to the number of species collected, sampling efficiency, and community characterization. Further, an inventory can also be used to determine the best combination of sampling methods, which, by minimal sampling effort, could provide adequate results for estimating the species number and characterizing the total ant fauna at a site.

Objectives of providing the species inventory are:

- To record the number of species present in Vadodara .
- To provide necessary information about the functional morphological characters of ants.
- To design identification keys for all the subfamilies, genera and species of ants of Vadodara.
- To evaluate the choice of sampling methods.

This chapter provides a pictorial identification key to ant subfamily of Vadodara. Technical and complete Identification keys to all ant genera of all parts of the world are available in Bolton (1994).

However, as only a subset of genera are found in each geographical region, to make a local ant inventory a regional identification key is made here. Along with the key ecological information, such as food habits, nest-site preference colony size, etc. of ants has also been provided.

Species account

Subfamily Formicidae

All ants belong to the single family Formicidae, suborder Apocrita and order Hymenoptera.

Ants are similar to other Hymenopterans (bees and wasps) in that the first abdominal segment fuses with the metathorax forming mesosoma (in bees and wasps) or the alitrunk (in ants). Another character which relates the ants to the bees and wasps is the ovipositor which has lost its function - to deposit eggs. The ovipositor is now adapted as a sting organ which primarily is a defence organ.

Ants are said to have evolved from wasps of the superfamily Vespoidea and they are thought to be tropical in origin.

The distinguishing features of ants are : the first abdominal segment fuses with the metathorax and is termed the propodeum. Sometimes there are spines on this part and they are called propodeal spines. The distal portion of the fused abdominal segment constricts to form the so-called petiole or waist which then articulates with the second abdominal segment.

The characters of ants which classify them as primitive are: retention of ovipositor as a defence organ and a pupal stage which is enclosed in a cocoon.

Classically ants have been divided into 9 subfamilies. More recently, however, they have been reclassed into 14 extant subfamilies.

They are Nothomymeciinae, Myrmeciinae, Ponerinae, Dorylinae, Aneuritinae, Aenictimae, Ecitoninae, Myrmicinae, Pseudomyrmecinae, Cerapachyinae, Leptanillinae, Leptandloidinae, Dolichoderinae, and Formicinae (Bolton, 1994).

In India the largest subfamily is Myrmicinae. This is also the case globally.

Formicidae contains 21 subfamilies, 358 genera, and more than 12,000 species worldwide (Bolton, 2003). In India, there are 12 subfamilies, 73 genera and 621 species (Bharti and Alpert, 2007).

Thus India has representatives of about 37% of its genera and about 5% of its species, though India covers less than 0.2% of the earth's land surface.

Functional morphological characters of Ants

Given below are morphological characters that are unique to ants and serving as important features distinguishing them from other insects. (See Glossary)

Head

The head of an ant contains geniculated (elbowed shaped) antennae. The joint between the scape and the flagellum is flexible allowing more movement. In ants, mode of communication is by antennal contact and movements. Ants use antennal language the way bees use dance language - the information relayed from one individual to another by means of variable frequency of touches and intensity between antennae of the two individuals.

The number of antennal segments in ants ranges from four to twelve.

Antennal sockets may be situated close to the clypeus (the posterior margin), or far from it. They may be exposed, especially if there are less developed frontal carinae. If the frontal carinae are well developed sometimes forming lateral emarginations, then the sockets will be fully concealed.

Many ants are polyphagous. They collect honeydew from honeydew producing insects, by their sucking mouthparts. Ants demonstrate tropholaxis - a term to describe the passing of food from one individual to another, by the process of regurgitation.

Ants generally have a well-developed pair of mandibles which are used for procuring or processing food. Ants of *Odontomachus and Strumigenys* genus use their long mandibles for capturing prey and also for defence.

Most ants have compound eyes. However, some are blind like the ants of *Aenictus* genus. Ants of subfamily Formicinae have very well developed compound eyes.

Thorax

A promesothoracic suture separates the prothorax from the other two thoracic segments. In some species the suture is not distinct and therefore the pronotum and mesonotum are fused. So is the case with the mesothorax and propodeum (fusion of metathorax and first abdominal segment).

Most ants have unsculptured thoracic segments. Some, like the *Polyrhachis* have spines, either on the pro-, meso-, and/or the propodeum. *Diacamma* spp. have strong striations on the thorax. *Polyrhachis* species have heavily textured thorax. *Cataulacus* have their notum in the shape of a plate with spines. *Meranoplus* spp. have hair on their thorax as well as gaster (abdomen). Spines, heavy sculpture, and hair on the thorax suggest a defensive role.

The position of mesothoracic and propodeal spiracles is used in classifying some genera. The position of the orifice of metapleural glands (whether exposed or concealed) is equally important for classification.

Waist

The posterior constricted region of the propodeum, articulates with the second abdominal segment in the shape of a node. Among ant subfamilies Ponerinae, Dorylinae, and Formicinae have a single node or petiole.

However, the subfamilies Pseudomyrmecinae and Myrmicinae have ants with two nodes, which are actually abdominal segments 2 and 3. In some genera such as *Polyrhachis* the petiole may be armed with spines of various length and shapes. The remaining part of the body is known as gaster. The general size and shape of nodes and their number are used as identification features ant groups.

Gaster (Abdomen)

Although the general shape of the gaster is globous, *Crematogaster* species have a heart-shaped gaster. In *Tetraponera* species the gaster is elongated.The most important feature on this body part is the function of

ovipositor. In more primitive subfamilies e.g. Ponerinae the ovipositor is formed into an exertile sting.

Sometimes venom is injected out from this structure causing a painful sensation to the victims. Species in the genus *Leptogenys* have painful stings which can last for days. In the Myrmicinae the sting is non-exertile and may not be useful.

In Dolichoderinae the sting is non-functional and metathoracic gland is useful.

Ants of genus such as *Dolichoderus* have phenolic compounds in their glands and as such *Dolichoderus thoracicus* is useful as an ant species that could keep pest such as *Helopeltis theobromae,* or *Conopomorpha cramerella* at bay. *Tapinoma*, the odourous ants have an offensive smell.

In Formicinae, which are the most advanced ants, the sting is non-functional. In these ants the last tergal and/or sternal sclerite fuses to form a cone-shape structure called the acidopore or the anal orifice through which formic acid from the poison gland is squirted out.

Legs and Wings

Workers and soldiers, all of which are females, are wingless. Many species of ants have winged reproductive females and males (alates). There are also apterous reproductive females and winged males. Ants have slim and agile long legs that ensure quick movement.

Species accounts are presented in the following manner:

The keys provided here are designed to identify workers only as they are the most commonly encountered caste of ants. Although most of the identifying characters of ants are easily observable, yet the use of a microscope has been made for identification as they are small in size.

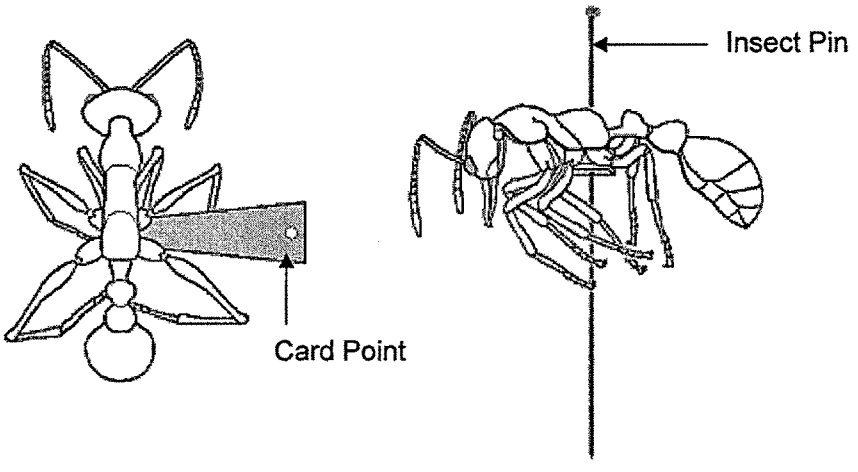
To make identification reliable, additional information like the diagnostic characters, biological information of taxonomic group, and the known distribution has also been studied and described.

Preparation and Preservation of Ant Specimens

Ants were preserved and prepared for identification in the laboratory. As they are usually too small to be pinned directly, the specimen is glued to a card point and the point is pinned through the broad end with a No. 3 insect pin.

Card points (little triangles) were cut from stiff paper and were 10 mm long and 5 mm wide. To mount the specimens on card points, white glue was used.

For this type of pinning the tip of the point is touched to the glue and then the point is attached to the platform formed by the middle and hind coxae, inserting the point from the right side (Line Diagrams 2.)



Line Diagrams : 2

Labelling

Specimens without data labels have no scientific value. Labels were made of thick paper so that they remained flat and did not rotate loosely on the pin. The size of the label was decided depending on size of the specimen.

Each label was given collection locality, day, month and year. For most ants, information about collecting or nesting site, such as soil, leaf-litter and tree, were recorded on additional labels.

Wet Specimen- Liquid Preservation

For duplication specimen storage, and also temporary storage of ant specimens, until they were mounted, liquid preservation of ants was done. 70-80% ethanol was used as preservation fluids. The specimens were kept in a small vial and then the vials were placed in a jar. Each vial was individually labelled with complete collection data. Labels were also placed on the outside of the jars to indicate the enclosed contents. Labels were written with lead pencil as typewritten ones cannot withstand the constant exposure to the alcohol. The jars were checked periodically to prevent alcohol evaporation.

Identification Keys

Taxonomic keys used for identification are of many types; all are dichotomous and are based on a series of choices.

The taxonomic keys designed in this thesis are based on externally observable diagnostic characters and have a choice of two alternative characters at each point. This set of two alternatives is called a 'couplet' and half of a couplet is called a 'lug'.

To read these keys, first the specimen to be identified is compared with morphological characters in each lug of couplet 1, then, after finding out which lug the specimen matches with, the couplet number given at the end of the lug is followed. This process is repeated till the lug or couplet with the scientific name of the taxon is found.

All identifications till genus level have been made using the identification keys given by Bolton (1994).

The identification keys for different subfamilies, genera and species given here have been designed on the basis of collection of ants in Vadodara, Gujarat. Since these taxonomic keys are based on few species, they may not contain much information about relationships between different groups. However, as identifying features for a given taxon, a combination of characters has been given as diagnostic characteristics. All keys are based on **worker castes**.

Ants of six subfamilies of Formicidae are being reported in this study.

They are- Dolichoderinae, Dorylinae, Formicinae, Myrmicinae, Ponerinae Pseudomyrmecinae, and (Table 7).The largest family in terms of species richness and abundance is Formicinae followed by Myrmicinae.

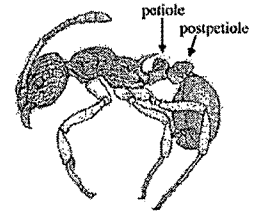
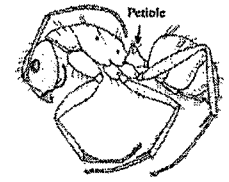
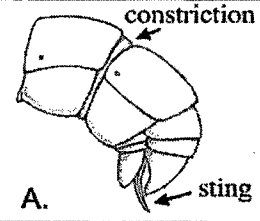
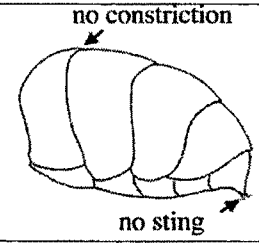
Smaller subfamilies are: Pseudomyrmecinae, Dolichoderinae and Dorylinae, all represented by one genus each. Since there is only one genus each under these subfamilies, key to genera is not given.

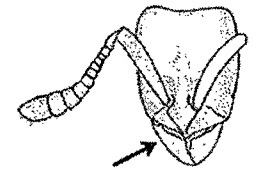
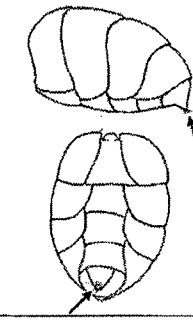
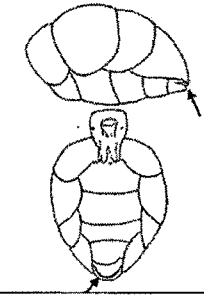
A key to the six subfamilies of Formicidae in Vadodara is presented.Table 6, (Line Diagrams 3)

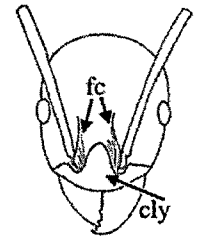
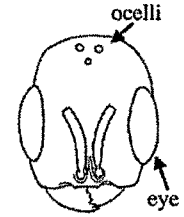
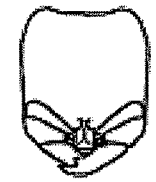
Then each section following this key is divided by subfamily and presented in phylogenetic order. A key to the genera in each subfamily is included.

For each genus, a diagnostic description is given with notes on the general biology and the number of global (if available) and Indian species as given in internet site www.antdiversity.com.

Following each Generic Diagnosis is a key to the species found in Vadodara. For each species a profile is presented that details taxonomic characters in form of identification notes. The General notes describe the foraging and nesting ecology along with its distribution (Figure 5 to Figure 24).

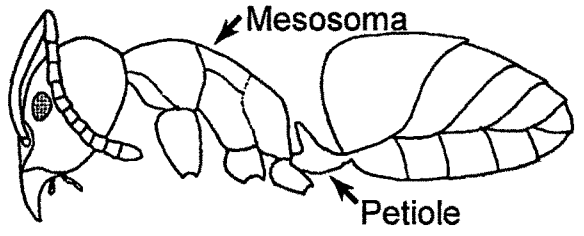
Table 6. Key to Subfamilies of Formicidae in Vadodara (based on workers) (modified from Creighton (1950) and Bolton (1994))			
1	Alitrunk (Mesosoma) attached to gaster with one distinct segment, the petiole	**2 & 7**	
1'	Alitrunk attached to gaster with two distinct segments, the petiole and postpetiole	**5**	
2	Gaster usually with a definite constriction between the first and second segments or mandibles long, linear, inserted in the middle of the anterior margin of head with 2 or 3 teeth present apically; sting present and usually conspicuous	**3**	
2'	Gaster without a constriction between the first and second segments; sting absent or extremely reduced, never visible externally	**4**	

3	Head and body not covered by deep grooves; mandibles lacks teeth , the clypeus is elongate and triangular and the head and body does not have deep grooves	**Ponerinae**	
4	The apex of the gaster with a semicircular to circular acidopore formed from the hypopygium, this structure often projecting as a nozzle with a fringe of setae	**Formicinae**	
4'	The apex of gaster with hypopygium lacking an acidipore	**Dolichoderinae**	

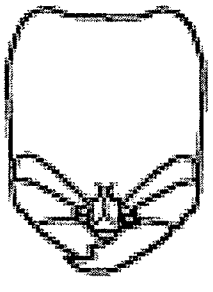
5	Frontal carinae not close together, often covering the base of the antennae; clypeus usually prolonged back between the frontal carinae	**Myrmicinae**	
6	Eyes large, reniform, or subelliptical, about half long as the side of the head; ocelli usually present	**Pseudomyrmecinae**	
7	Seen in full face view, the frontal lobes extend well beyond the anterior clypeal border, which is entire; antenna invariably 11-segmented	**Dorylinae**	

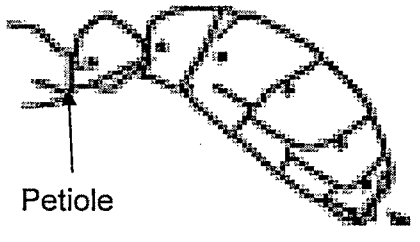
Line Diagrams 3 : Ant Subfamilies

Subfamily Dolichoderinae

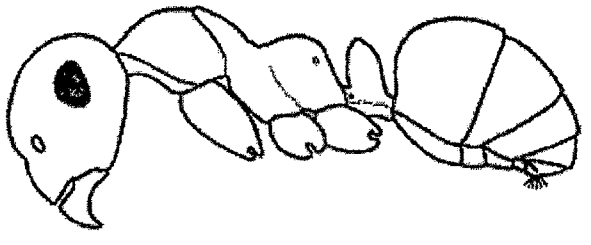


Subfamily Dorylinae



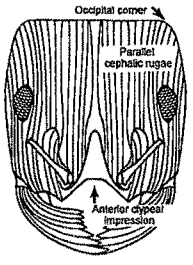


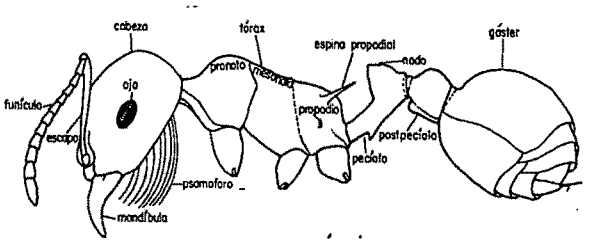
Subfamily Formicinae



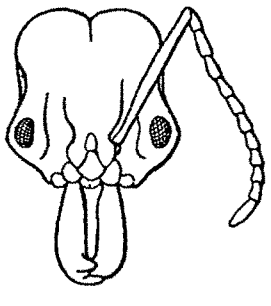
Line Diagrams 3 : Ant Subfamilies Contd...

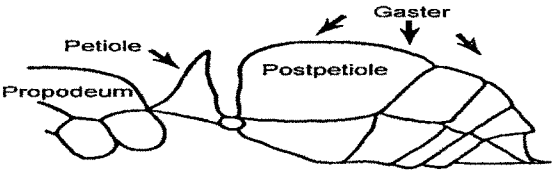
Subfamily Myrmicinae



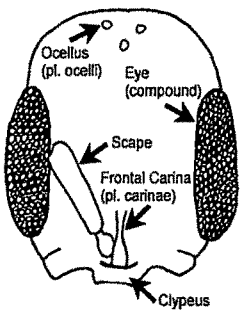


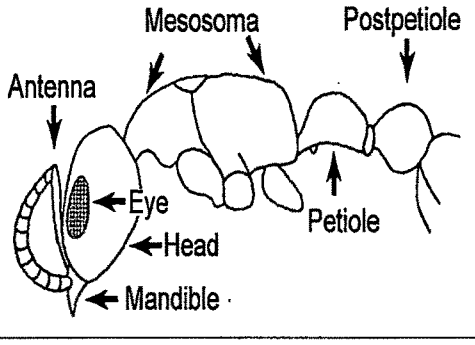
Subfamily Ponerinae





Subfamily Pseudomyrmecinae





Subfamily Dolichoderinae

Overview

Ants of this family are found all over the world, mainly in disturbed areas. They are aggressive but do not sting.

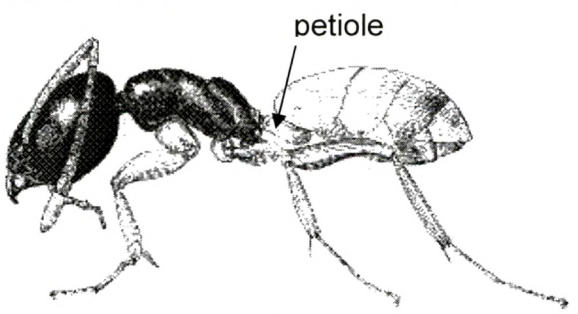
Distribution

Worldwide, this subfamily is represented by 28 genera and 1000 species. In India nearly 23 species and 8 genera of Dolichoderines are found. Only one genus *Tapinoma* and one species of this genus *T. melanocephalum* are found in Vadodara,Gujarat.

Genus *Tapinoma* Förster, 1850

General Biology

Tapinoma ants are highly adaptable in nesting habits. It nests readily outdoors or indoors. Colonies may be moderate to large in size containing numerous reproducing females .Generally, the colonies occupy local sites that are too small or unstable to support entire large colonies. The sites include moist grass, plant stems, and cavities beneath detritus in open and rapidly changing habitats, mainly urban habitats . Indoors, the ant colonizes wall void or spaces between cabinets and baseboards. It is also found nesting in potted plants in all urban residential sites of this study. Hölldobler and Wilson (1990) report that these 'ghost ants' are opportunistic nesters in places that sometimes remain habitable for only a few days or weeks. In India, 23 species of *Tapinoma* have been found (www.antdiversity.com) (Line Diagram 4).



Line Diagram 4

Diagnostic description

Petiole is reduced to a simple, flattened strip when seen in profile, never with a standing scale or node; the length of the propodeal dorsum is much shorter than the propodeal declivity; the first gastral segment projects over the petiole, and the petiole not usually visible from above when thorax and gaster are in the same plane. Anal opening is slit like.

Only 4 gastral tergites are visible in dorsal view, the fifth tergite is reflexed below the fourth and is visible in ventral view.Anal and associated orifices are directed ventrally; no erect hairs are present on dorsum of alitrunk; concolorous dark brown to blackish brown or with gaster, legs, and antennae are also whitish colored.

***Tapinoma melanocephalum* (Fabricius, 1793)**

Identification Notes

Ghost ant workers can be easily identified by their extremely small size and coloration. Workers are monomorphic and are only 1.3 to 1.5 mm in total length. They are bicolored with the head and mesosoma being dark brown to blackish brown and the appendages, petiole, and gaster being milky white. They have 12-segmented antennae with the segments gradually thickening towards the tip. Antennal scapes surpass the occipital border. They have a spineless thorax, stinger is absent. The petiole is often hidden by the gaster, which may overlap it. The gaster (swollen part of abdomen) has a slit-like anal opening which is hairless. These minute ants are difficult to spot because of their size and partial light coloration.

General Notes

Tapinoma melanocephalum , commonly called the 'ghost ant', is an exotic tramp species thought to have originated in either Afro tropical regions or Asia (Smith, 1965). Colonies of *T. melanocephalum* are reported from such isolated locations as the Galapagos Islands (Clark *et al.,* 1982). As the ant is a tropical species either of African or Oriental origin (Wheeler, 1910) in temperate latitudes, the ghost ant is reported established only in greenhouses and other buildings with favourable conditions. Ghost ant populations and infestations are

reported from all over the world. However, this introduced ant species is so widely distributed by commerce that it is impossible to determine its original home (Smith 1965). In Vadodara this species has been found in all Urban study sites.

Subfamily Dorylinae

Overview

The workers of this subfamily do not have eyes, this is what distinguishes them from ants of other subfamilies like Ponerinae, Dolichoderinae and Formicinae.

Only one genus *Dorylus* and one species *Dorylus labiatus* is recorded from Vadodara.

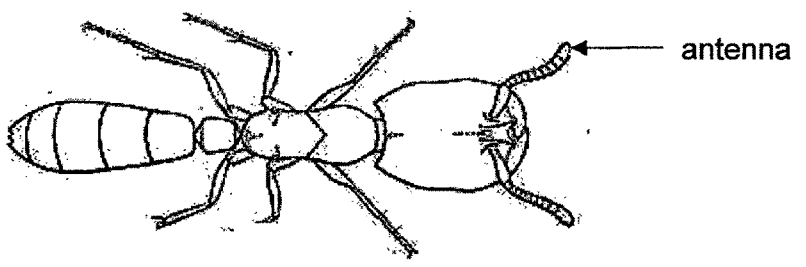
Genus *Dorylus* Fabricius, 1793

General Biology

The army ant genus *Dorylus*, also known as driver ants, safari ants, or siafu, are found primarily in central and east Africa, though the range extends to tropical Asia. Each colony can contain over 20 million individuals. There is a soldier class among the workers, which is larger, with a very large head and pincer-like mandibles. They are capable of stinging, but very rarely do so, relying instead on their powerful shearing jaws. In India, only 3 species of *Dorylus* have been found (www.antdiversity.com).

Diagnostic description

Eyes are absent. The frontal lobes extend well beyond the anterior clypeal border, which is entire. The antennae are 11-segmented (Line Diagram 5).



Line Diagram : 5

***Dorylus labiatus* Shuckard, 1840**

Identification Notes

The male, female and workers differ considerably in appearance. The male is elongate and wasp-like with prominent eyes and ocelli. They are brownish yellow and are 30-33 mm in length. Major workers are 6-8mm and are yellowish, highly polished and shining. The head thorax and abdomen are with minute scattered punctures.

Minor workers are lighter in colour and are 2.5-4 mm in length. Head excluding the mandibles and antennae is black . Legs are darker than the body and coxae are cataneous brown.

General Notes

The Asian *Dorylus* form very large colonies.

D.labiatus has been found in three agricultural sites and Urban Community Garden sites of Vadodara, Gujarat.

Subfamily Formicinae

Overview

The members of subfamily Formicinae retain some primitive features such as the presence of cocoons around pupae, the presence of ocelli in workers, and little tendency toward reduction of palp or antennal segmentation in most species. Some members show considerable evolutionary advancement in behaviors such as slave-making and symbiosis with root-feeding homopterans. All formicines have a very reduced sting and enlarged venom reservoir, with the venom gland, specialized (uniquely among ants) for the production of formic acid.

These are some of the most common ants in India and can be found everywhere, often in large numbers. Although Formicines like *Camponotus* spp. seem to feed principally upon nectar and other plant exudates, directly or indirectly via Homoptera, some may be largely predaceous (eg.*Oecophylla smaragdina*) or general scavengers (e.g. *Camponotus, Prenolepis, Paratrechina, Polyrhachis* etc.) . They were seen foraging on the ground or on vegetation, and were found at all times of the day and night. They are generally active and fast moving and many will defend their nests vigorously, attacking intruders with their large mandibles and formic acid spray. Workers range from small and cryptic to large and obvious. Nests are fairly large, many species nest in soil or in dead or rotting wood (e.g. *Formica* sp.), on or near the soil (e.g. *Camponotus* spp.,*Lasius* sp., etc.). However, there is a substantial minority of truly arboreal species (eg. *O. smaragdina*).

Distribution

The subfamily Formicinae is world-wide in distribution and second only to the Myrmicinae in numbers of species. Over 3700 described species and subspecies and 49 genera have been reported. It is dominated by the very large and complex cosmopolitan genus *Camponotus.*

In this study 7 genera and 9 species of subfamily Formicinae have been found in Vadodara.

Key to the Genera of Subfamily Formicinae (Adapted from Bolton, 1994)		
1	Alitrunk in profile evenly convex and continuous. Antennae inserted well above the dorsal border of the clypeus. Metapleural gland orifice absent.	***Camponotus***
1'	Alitrunk in profile not evenly convex and continuous. Antennae inserted at or near the dorsal border of the clypeus. Metapleural gland orifice present.	**2**
2	Antennal sockets situated close to posterior clypeal margin.Metapleural orifice present below the level of propodeal spiracle.	**3**
2'	Antennal sockets situated far behind the posterior clypeal margin or metapleural orifice in the position described above or both.	**4**
3	Frontal carinae short but distinct. Propodeal spiracle elliptical to broadly oval. Gaster in ventral view with the first sternite having a conspicuous transverse sulcus behind the helcium.	***Formica***
3'	Frontal carinae indistinct or absent. Propodeal spiracle circular to subcircular. Gaster in ventral view with the first sternite without a transverse sulcus behind the helcium.	**5**
4	Mandible with 10 or more teeth or denticles in total. Petiole reduced to an elongate low node. Palp formula 5-4.	***Oecophylla***
4'	Mandible with 5-7 teeth. Petiole erect node or scale. Palp formula 6-4	**7**

5	With head in full face view, the eyes at or in front of the midlength of the sides of the head.Head and alitrunk with stout, coarse setae arranged in distinct pairs.	***Paratrechina***
5'	With head in full face view the eyes are distinctly behind the midlength of the sides of the head. Setae on head and alitrunk, not distinctly paired.	**6**
6	Mandible with 6 teeth ,very rarely with 7. Anterior face of first gastral segment broadly transversely concave throughout its height. Antennal scapes relatively very long, when laid straight back from their insertions at least half of their lengths project beyond the occipital margin. Mesothorax constricted immediately behind pronotum.	***Prenolepis***
6'	Mandible with at least 7 teeth ,usually more than 7. Anterior face of first gastral segment not broadly transversely concave but with small concave area immediately above helcium. Antennal scapes much shorter, when laid straight back from their insertions with much less than half their lengths project beyond the occipital margin. Mesothorax not constricted immediately behind pronotum.	***Lasius***
7	Tergite of first segment large, accounting for at least half the length of the gaster in dorsal view or in profile,the first tergite distinctly much longer than spines or teeth present on pronotum, propodeum, petiole or on two or on all of these.	***Polyrhachis***

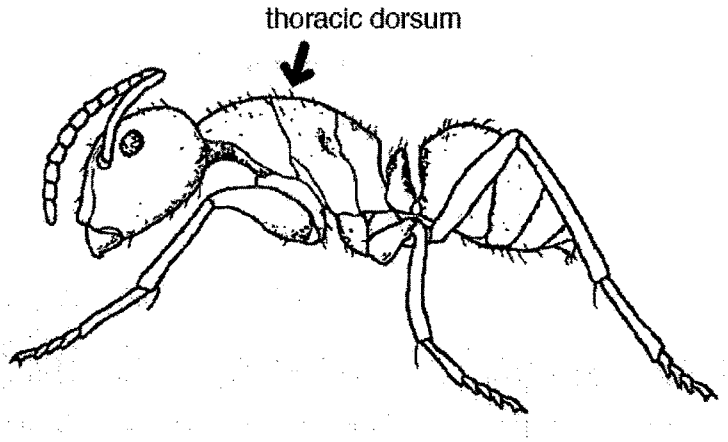
Genus *Camponotus* Mayr, 1861

General Biology

Camponotus is the largest, most common and widespread groups of ants with 1500 species and subspecies (Shattuck, 1999) worldwide. These ants can be found in essentially all habitats and areas. Nests are found in a wide range of sites including in soil with or without coverings, between rocks, in wood, among the roots of plants and in twigs on standing shrubs or trees. Foraging times vary among species, with some found only during the day and others found only at night while others will forage at all times (Line Diagram 6).

They are general scavengers and predators and will collect nectar and plant secretions and tend Hemiptera for honeydew. They have been seen in mutualistic associations with Hemiptera in their nests during the day, protecting them from predators. At night workers carry their guests into trees and shrubs and allow them to feed, thus producing honeydew which is collected by the ants.

These ants are also known from Oligocene (35-25 million years before present) and Miocene (25-5 million years before present) fossils. 51 species of Camponotus have been reported from India (www.antdiversity.com).



Line Diagram : 6

Diagnostic Description

Camponotus species vary greatly in size and shape, ranging from about 2.5mm to 14mm in overall length. They are also polymorphic and show considerable size variation within single species.

Their mandibles have 8 teeth. The scale of the petiole is usually upright and with an angular or rounded top, but when low the forward and top faces are always separated by a distinct angle. The upper plate of the first segment of the gaster (first gastral tergite) covers less than one-half the total length of the gaster. The area above the hind leg is smooth and lacks a small opening. The mesosoma and petiole lack spines or teeth on their upper surfaces

Key to the Species of Genus *Camponotus*

1	Petiole is rounded and knob like. Silky pubescence on the abdomen	*sericeus*
1'	Petiole is conical. No pubescence on the abdomen	2
2	Black and opaque body in both major and minor workers	*compressus*
2'	Head and gaster in major workers are dark reddish brown and shining	*irritans*

***Camponotus compressus* Fabricius, 1787**

Identification Notes

The body is black and opaque. Mandibles and legs are reddish-brown in colour. Polymorphism is distinct with easily distinguishable worker castes. Mesosoma is narrower than head. Eyes are placed frontally. Legs are long, tibiae are shaped like prisms. Gaster is massive.

General Notes

This is the most common black ant found in India. These ants establish monodomous terrestrial nests. They are polymorphic, often seen foraging solitarily and never establishing trails. Nests are also constructed at the base of several trees and at the junction of roots. They are often seen feeding on nectar of plants. They tend to Homopterans such as aphids, coccids and mealybugs as also reported by Bingham (1903)

***Camponotus irritans* Smith, 1857**

Identification notes

Head and gaster in major workers are dark reddish brown and shining. Minor workers are smaller and have a honey yellow coloured head and mesosoma. The node of petiole is conical.

General Notes

These are ground dwelling ants that construct their nests in soil or cracks and crevices. They are generalist predators and scavengers.

***Camponotus sericeus* Fabricius, 1798**

Identification notes

There is distinct polymorphism with major and minor workers in the colony. Two morphs are seen: one morph is completely black in colour while the other more common morph has a black body with a blood red head. Both have silky (golden) pubescence on the abdomen. Petiole is rounded and knob like.

The morph more commonly seen in agricultural sites of Vadodara is the red headed one.

General notes

This species nests in soil.They forage individually and show a characteristic tandem running behaviour .They tend aphids for honey dew and are seen collecting nectar from flowers and extrafloral nectaries.

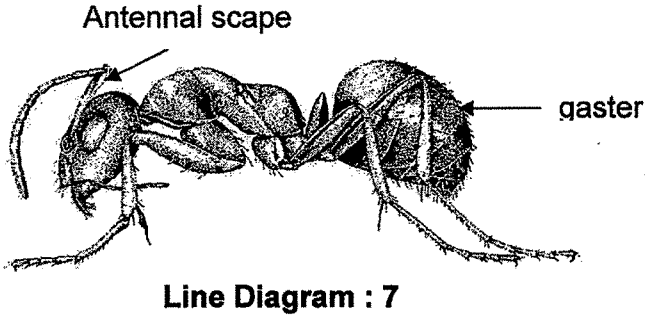
Genus *Formica* Linnaeus, 1758

General Biology

Formica species are found in a wide range of habitats from cities to seasides; grasslands to swamps and forests .They are also called 'wood ants' as they live and thatch their mounds in wooded areas. However, sunlight is important to most *Formica* species, and colonies rarely survive in deeply shaded, dense woodland. *Formica* nests are of many different types from simple shaft-and-chamber excavations in soil with a small crater or turret of soil above to large mounds, under stones or logs, or in stumps. None are arboreal.*Formica* are notable for their parasitic and slave making behaviour. Wood ants typically secrete formic acid.

Diagnostic Description

The body measures about 4-7.5 mm. Abdomen is grey or dark brown. The petiole is narrow in profile with a moderately sharp apex. Gaster is covered with dense, gray, appressed pubescence. Antennal scapes are without erect hairs except for those at extreme tip, rarely a few scattered suberect hairs on inner surface near tip (Line Diagram 7).



Line Diagram : 7

Formica rufa* Linnaeus, *1761

Identification Notes

F. rufa workers can reach a maximum length of around 10 mm. They have large mandibles.

General notes

Mound building, forest dwelling *F. rufa* often have a considerable effect on their environment. Workers show considerable polymorphism and it has been noted that larger individuals forage further away from the nest.They maintain large populations of aphids on whose secretions they feed, and the ants defend them from other predators. They also prey on other insects. *F. rufa* can squirt the acid from its acidopore several feet if alarmed, a habit which may have given rise to the archaic term for ant pismire, and by analogy its American equivalent piss-ant.

Genus *Lasius* Fabricius, 1804

General Biology

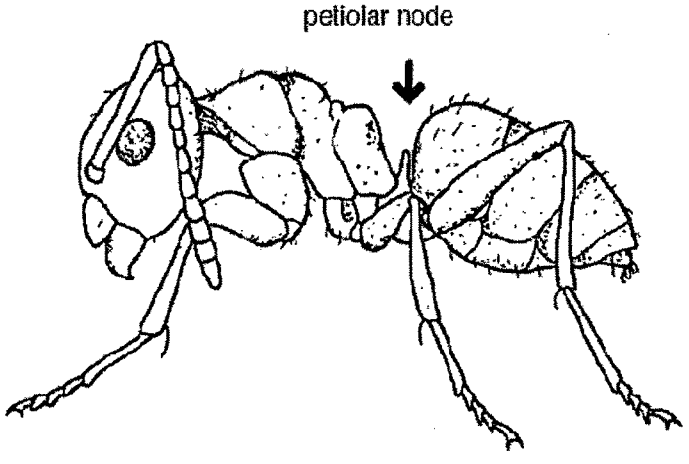
Lasius ants have monogynous (single queen) colonies .Their colonies can reach in size up to an average of around 4,000-7,000 workers.

They farm aphids for the honeydew they excrete by bringing them inside the nest and bringing them back out again when necessary. The ants also eat ripe fruits, especially fruits like strawberries that lack a thick protective skin. Often they can be found on discarded chewing gum. *Lasius* also feed on insects and spiders, and other small invertebrates.

Diagnostic Description

The head and alitrunk are rather smooth, only finely reticulate. Antennae 12-segmented with short antennal scapes, when laid straight back from their insertions with much less than half their lengths project beyond the occipital margin. Eyes are relatively large. Gaster is smooth, Propodeum is without

spines. Stinger lacking and acidopore present. Mesothorax not constricted immediately behind pronotum (Line Diagram 8).



Line Diagram : 8

The species of Lasius has not been identified.

Genus *Oecophylla* Smith, F., 1860

General Biology

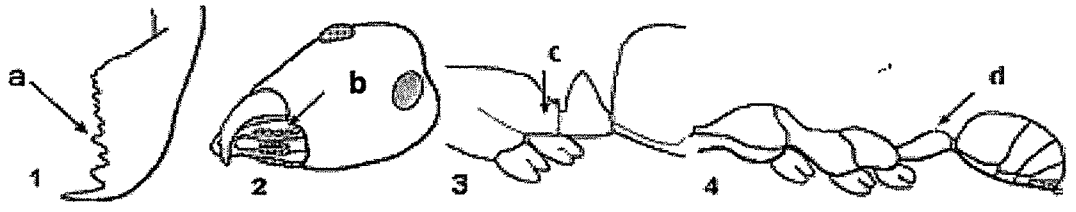
Oecophylla always nests in trees or shrubs. Its nests are constructed by attaching leaves together with silk produced by their larvae. Individual colonies can become very large with many separate nests spread over several trees. They are very aggressive and vigorously attack intruders. Foraging takes place both on vegetation and on the ground, and they are predaceous. Due to their large population sizes and predacious habits, these ants have been used as biological control agents (Way and Khoo, 1992).

Fossil representatives of these ants are known from the Eocene (60-35 million years before present), Oligocene (35-25 million years before present) and Miocene (25-5 million years before present).

Diagnostic description

The mandibles have 10 or more teeth (Fig.1a), the palp formula is 5:4 (the outer or maxillary palps with 5 segments, the inner or labial palps with 4 segments)

(Fig. 2b), the area above the hind leg is smooth and without a small opening (the metapleural gland opening) (Fig. 3c) and the scale of the petiole is low and rounded and without distinct front, top or rear faces (Fig. 4d) (Line Diagrams 9)



Line Diagrams : 9

Oecophylla has a single species in India (*O. smaragdina*), which is the well-known 'Weaver ant'. This species has been found in all study sites - urban and agricultural, except those agricultural sites where no large trees like *Mangifera indica* were present.

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

Identification Notes

This species is highly distinctive and can be recognised by their elongate, pale yellow bodies, numerous (10 or more) mandibular teeth and the reduced number of palp segments (5:4 palp formula).The area above the hind leg is smooth and without the metapleural gland opening. The scale of the petiole is low and rounded.

General Notes

These ants are very aggressive foragers and prey on essentially any small animals they come across. They are conspicuous, foraging on vegetation as well as the ground, often in large numbers and forming distinct trails. They don't sting, but inflict a painful bite followed by a squirt of formic acid from the tip of their gaster – a very effective deterrent for those invading their territory. One of the most distinctive features of this ant is the way it constricts its nest, and is the reason for the common name 'weaver ant.' They create nests by pulling

living tree or shrub leaves together and stitching them with silk produced by special glands found in their larvae (adult ants do not produce silk).

Oecophylla smaragdina is found in forested areas and in mango orchards throughout South-east Asia and westward to India.

Genus *Paratrechina* Motschulsky, 1863

General Biology

Species of *Paratrechina* nest in soil under stones and debris, or in rotten wood on the ground. They can be locally abundant and easily found. They forage on the ground as well as on vegetation, feeding on a range of invertebrates as well as plant fluids such as nectar and honeydew collected from Hemiptera.

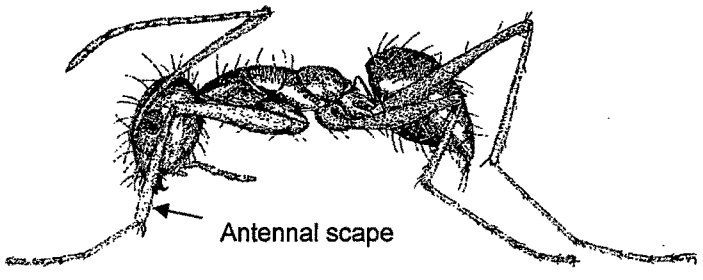
One species (*P. longicornis*) is a widespread tramp in many tropical countries, being introduced through human activity; it can sometimes be a household pest.

There are 7 species reported from India (www.antdiversity.com)... One species *P.longicornis* has been found in Vadodara, Gujarat.

Diagnostic Description

They are recognisable by the large, stout pairs of erect hairs on the upper surface of the mesosoma, on the pronotum and mesonotum. The overall body size is small to medium (between 1.2 and 2.5mm) (Line Diagram 10).

Paratrechina has a single species in India (*Paratrechina longicornis*), which is also known as 'Crazy ant'. This species has been found in all urban and agricultural sites of Vadodara, Gujarat



Line Diagram : 10

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

Identification Notes

These ants measure around 3.5 mm in length. Body color is weakly shining black or gray with bluish reflections with sparse, short, and barely visible pubescence. Antennae 12 segmented, with a long scape. The legs are also very long. There are no spines or teeth on the body. This ant is usually associated with human dwellings and urban areas.

General notes

This species is found in a range of habitats from moderately arid to moist and from natural to disturbed. It is highly invasive and has been spread by human activity throughout the world's tropical regions. While it is likely to have been introduced into India at many sites it behaves similarly to native species and is not obviously a pest or invasive species while at other sites it expands and dominates the local fauna as is commonly seen with other invasive ants.

Genus *Polyrhachis* Smith, 1857

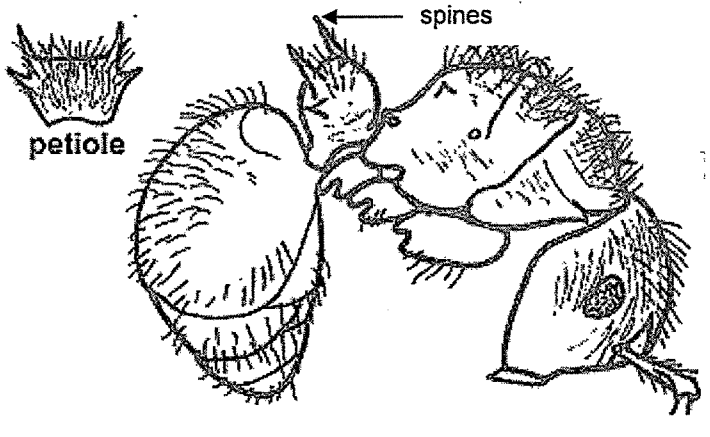
General Biology

Polyrhachis is one of the common groups of ants. They nest in open soil or in soil under rocks and logs, in holes in standing trees . A few tropical species form arboreal nests made of plant fibres (carton) and larval silk. Some species are omnivorous and collect nectar. Most are fairly timid and retreat when disturbed.

Many are nocturnal, especially in arid areas, while others forage during the day. 40 species of *Polyrhachis* have been reported from India (www.antdiversity.com).

Diagnostic Description

They are black, moderately large (5 to 10 mm), and can be easily identified by the spines or ridges on the mesosoma and spines on the top of the petiole. Additionally, all species of *Polyrhachis* have the first upper plate of the gaster elongate and comprising more than on(Spines al length of the gaster. The area above the hind leg is smooth and lacks the metapleural gland opening. The mandibles have 7 teeth. The scale of the petiole is upright and has an angular or rounded top which almost always has two or more teeth or strong angles (Line Diagram 11).



Line Diagram : 11.

***Polyrhachis lacteipennis* (F. Smith, 1858)**

Identification Notes

Body is black in colour. Three pairs of spines present- one long curved pair on the petiole that curves to the shape of the gaster, one long pair on the propodeum with tips curved outwards and two short, thick divergent spines on

the anterior part of the pronotum. The head and mesosoma are finely punctured and have a granular surface. Gaster is short and oval.

General Notes

Polyrhachis lacteipennis is found in both urban and agricultural areas of Vadodara, Gujarat. It constructs carton nests at the base of trees by cementing twigs with their salivary exudates.

***Prenolepis* Mayr, 1861**

General Biology

It is somewhat similar in appearance to *Lasius* and *Paratrechina* species, but differs from *Lasius* by having a constriction between the promesonotal area and the propodeum and from *Paratrechina* species by its lack of thick, dark colored paired macrochaetae on the body. The color of this ground nesting species is variable between light and dark brown. The antennae and legs are long in proportion to the body. Only one species of *Prenolepis* has been reported from India so far (www.antdiversity.com)

Diagnostic Description

The total length of workers is about 2 mm. The colour of the whole body is blackish brown. They have abundant, long, fine, sub erect hairs everywhere. Eyes are large, about 1/4 as long as head; their anterior margins situated at midlength of head. Petiole is low and long, strongly inclined anteriorly. The anterior surface of first gastral segment is concave, so as to receive the petiole. Mesothoracic constriction is less conspicuous than in other congeneric species.

Subfamily Myrmicinae

Overview

These large, conspicuous ants are most abundant and diverse . Myrmicines range greatly in size, with the smallest about 1 mm long and the largest up to 10 mm. While many species are generalist predators, others are important seed harvesters. Workers forage at all times of the day and night, sometimes in large numbers. Nests can be found in almost any suitable location from deep in the soil to the upper branches of trees. Colonies are generally small with a few hundred to a few thousand workers, although some species can have huge nests with many thousands of workers while others form very small nests with fewer than 50 individuals.

Morphologically, these ants are very diverse. Many groups are highly modified with unusual mandibles, elongate spines, elaborate hairs or unique structures not seen in any other ants. This subfamily includes some of the largest ant genera, such as *Crematogaster*, *Pheidole*, *Tetramorium*, *Monomorium*, and *Solenopsis*.

Distribution

Myrmicines occur throughout the world in all major habitats (except arctic and antarctic regions). They are the largest subfamily of ants with over 6700 species and subspecies and 155 genera worldwide. India has over 350 species placed in 41 genera. In Vadodara, Gujarat, 5 genera and 12 species have been collected. They have been found in all habitats ranging from urban to agricultural.

Key to genera of subfamily Myrmicinae

1	Propodeum with a pair of spines or teeth	**2**
1'	Propodeum unarmed, without spines or teeth.	**4**
2	Antennae with 9 segments	***Meranoplus***
2'	Antennae with 10 -12 segments	***3***
3	Antennae with the last three segments forming a club	***Pheidole***
3'	Antennal segments not forming a club	***Crematogaster***
4	Antennae 10 segmented with 2 segmented club	***Solenopsis***
4'	Antennae 12 segmented with 3 segmented club	***Monomorium***

Genus *Crematogaster* Lund, 1831

General Biology

Crematogaster ants are recognised easily by their heart shaped gaster. Workers are moderately aggressive and attack when disturbed. Disturbed workers hold their gaster in upheld position, often small white droplets of defensive compounds can be seen at the tip of the gaster.

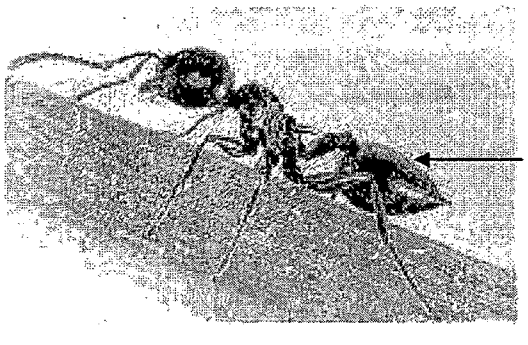
Nests are found in a range of sites including soil, in cracks in rocks, in dead wood and arboreally in trunks and twigs. Individual colonies are often composed of several small nests a few metres apart and may contain more than one queen. Additionally, some ground nesting species will form small satellite nests under bark on trees to protect and guard the Hemiptera from which they collect honeydew.

Ants of *Crematogaster* genus forage on the ground as well as on low vegetation and trees. They are generalist predators as well as tending Hemiptera and the caterpillars of several butterflies.

39 species of this genus have been reported from India (www.antdiversity.com).

Diagnostic Description

The antennae are 10 - 12 segmented (including the scape). The petiole is low and rounded and lacks a node on its upper surface. The postpetiole is attached to the upper surface of the gaster. The nature of the attachment of the postpetiole to the gaster is highly distinctive and will separate these ants from all others Line Diagram 12.



Line Diagram : 12

Key to Species of *Crematogaster*

Shining black coloured ant. Antennae short, with scape barely reaching the top of the head.Pronotum short and rounded posteriorly; propodeal spines are thick at the base and divergent.

***soror* Forel, 1902**

Chestnut brown ant with black gaster. Antennae slender, with a long scape reaching beyond the top of the head. Pronotum huge and rounded anteriorly; propodeal spines short and pointed.

***subnuda* Mayr, 1979**

***Crematogaster soror* (Forel, 1902)**

Identification notes

It is a shining black coloured ant about 3.5 mm in length. The antennae are short, with scape barely reaching the top of the head. The pronotum is short and rounded posteriorly. Pro-mesonotal suture distinctly marked. Propodeal spines are thick at the base and divergent. Gaster is short and heart shaped.

General Notes

This is a rare ant known from a few densely vegetated regions of Southern and Western India (Narendra and Kumar, 2006). These ants construct carton nests. When intruded they raise the gaster in alarming posture .In Vadodara, it has been sighted in all urban and agricultural sites.

***Crematogaster subnuda* (Mayr, 1979)**

Identification notes

Body is chestnut brown, with a dark, nearly black gaster. It is 3 - 3.5 mm in length .The antennae are 12 segmented with a distinctive club formed by the last three segments. They are slender with a long scape reaching beyond the top of the head. Pronotum is huge and rounded anteriorly, followed by a small mesonotum and a sloping propodeum. Propodeal spines are short and pointed.

Petiole has a flat top and anteriorly semi-circular in front. Post petiole is grooved longitudinally.

General Notes

A very common ant widely distributed throughout India (Narendra and Kumar, 2006).They nest in branch intersections of large trees. Gaster is raised during foraging but is raised further on intrusion. It has been collected from all urban study sites of Vadodara, Gujarat.

Genus *Meranoplus* _Smith, F., 1854

General Biology

This is a common ground nesting genus. Nest entrance is on ground level with a small crater surrounding it. It moves very slowly and forages on the ground.
5 species of Meranoplus have been reported from India(www.antdiversity.com).

Diagnostic description

This genus has a characteristic shield like mesosoma and 9 segmented antennae. Propodeum is armed with spines. Petiole is sessile (without an elongate, bar like anterior peduncle between the articulation with the alitrunk and the node). Promesonotum is sharply marginate laterally, margins are expanded and equipped with spines. Frontal lobes are widely separated, the median portion of the clypeus where it projects between them is broad and convex in full face view

***Meranoplus bicolor* (Guerin-Meneville,1838)**

Identification Notes

These are reddish ants with a black abdomen and length 5mm.The whole body is covered with long abundant hairs. Head, thorax and gaster are heavily sculptured. Head is trapezoidal in shape. It is deeply grooved just above the eye, for the antennae to fold back and rest. Antennae 9 segmented, with three anterior segments forming a club. Mesosoma has short and acute angles and is posteriorly equipped with sharp and elongate backwardly pointed spines. Propodeum is also armed with two backwardly pointing spines.

General Notes

It is a slow and sluggish ant. It nests in the ground, in loose soil, in the shade of small shrubs or in the open. It feeds on floral nectar and harvest grass seeds. During rainy season elevated chimney like nest entrances are seen (Rastogi *et al.*,1997). It has been found in few urban and agricultural sites of Vadodara,Gujarat.

Genus *Monomorium* Mayr, 1855

General Biology

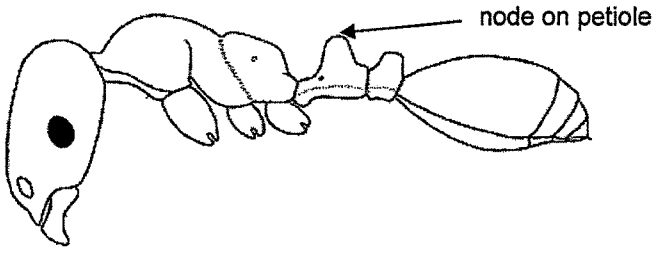
Ants of genus Monomorium are very diverse in size and habits, ranging from very small generalist scavengers to large, polymorphic seed harvesters. They nest in small colonies under rocks or in large, low mounds. A few species have been seen nesting arboreally under bark or in rotten wood either on trees or on the ground.

Colonies contain multiple queens (are polgynous) and often consist of a series of individual nests (are polydomous). Foraging is primarily during the day. Some species, especially those introduced through human activity, can be significant pests as they forage in houses and buildings. In this study this ant has been found in all urban and agricultural study sites.23 species of Monomorium have been reported from India (www.antdiversity.com).

Diagnostic Description

They are monomorphic or polymorphic, minute to moderately large in total length. Mandibles have 4 to 5 teeth and Maxillary palps 2 to 4 segments. Median clypeal seta is present, sometimes displaced or absent. Median portion of clypeus raised, longitudinally bicarinate, the carinae rarely effaced. Frontal carinae absent.The antennae have 10 to 12 segments (including the scape) and a 3 segmented club. Antennal scrobes are absent. The front margin of the clypeus just above the mandibles has a single central elongate hair or seta.

The upper surface of the head is smooth and lacks grooves or depressions to receive the antennal scapes. The petiole, and generally the postpetiole, have distinct, arched nodes on their upper side. Sting is functional (Line Diagram 13)



Line Diagram : 13

Key to Species of *Monomorium*

Body shiny black; Mesopleuron smooth and shining

***minimum* Buckley,1857**

Body colour varies from golden yellow to reddish brown; Head and thorax deeply punctuate

***pharaonis* Linnaeus,1758**

***Monomorium minimum* (Buckley, 1857)**

Identification Notes

Body is shiny black, 1/16 inch in length (monomorphic). Antennae have 12 segments with a 3-segmented club.

General Notes

Workers prey on insects and feed on honeydew produced by plant sucking insects such as aphids. Nests can be found in the soil in open areas of lawns or under objects such as stones, bricks, wood and logs. In buildings, they nest in woodwork, wall voids, masonry, and under carpets. At high population densities, little black ants may become widely dispersed throughout a structure and invade nearly every crack and crevice. They are highly visible on established foraging trails, particularly when they invade food cabinets and pantries

***Monomorium pharaonis* (Linnaeus,1758)**

Identification Notes

These ants are also called 'Pharaoh ant', or "sugar ant" .Body length is 1/12 to 1/16 inch long (monomorphic) .Body coloration varies from golden yellow to reddish-brown. They have 12-segmented antennae that end with a 3-segmented club .

General Notes

Monomorium pharaonis form large colonies consisting of many nests, which colony members move freely between, without any antagonism. Colonies vary greatly in size. Some colonies may have only a single queen with a few hundred workers, whereas other colonies may have hundreds of queens with several thousand workers. Nests are rarely found outdoors but can be found almost anywhere indoors (including light sockets, potted plants and wall cracks or crevices). They typically nest close to sources of warmth and water.

It is classified as a "generalised Myrmicine" because it has generalised food and nesting requirements (McGlynn 1999). In addition, *M. pharaonis* is known as a "tramp" species, which means it is particularly reliant on human-mediated

dispersal and has a close association with humans. It frequently nests inside human structures but rarely displaces native species outside urban environments (McGlynn 1999). *M. pharaonis* is a pest in many populated areas of the world.

Monomorium pharaonis is native to West Africa. It has been introduced into Asia (including Japan, India and Saudi Arabia), Australia, Europe, and North, Central and South America.

It has been found in all urban and agricultural study sites of Vadodara, Gujarat.

Genus *Pheidole* Westwood,1840

General Biology

The genus Pheidole was erected by Westwood in 1840 based on the type-species *Atta providens* (Sykes, 1835) from India. This genus is one of the largest genera of ants, including more than 400 species. It occurs from the tropics to the temperate zone of the world. 56 species have been found in India (www.antdiversity.com).

Diagnostic description

This is a genus with very diverse habits, it is extremely common. *Pheidole* ants are polymorphic with discrete castes. Antennae are always 12-segmented with 3-segmented club. Propodeum has a pair of teeth. Promesonotum lacks spines or dorsally-directed tubercles. Propodeal suture is always present. Mandibles are always triangular; mandibular dentition irregular, often with diastema between teeth. Sculpture and pilosity is highly variable.

Worker caste dimorphic with the major worker (soldier) and the minor one (worker), usually not connected by intermediates.

Soldier: Head massive, occipital margin impressed in the middle forming two occipital lobes. Mandible large, stout, and strongly curved, with two apical teeth and one basal tooth. Palp formula with 2 maxillary and 2 labial. Antenna 12-segmented; club 3-segmented. Pronotum and mesonotum raised. Mesonotal propodeal groove deeply impressed. Propodeum with a pair of spines dorsally.

Petiole emarginate above. Postpetiole broader than petiole, with rounded node. Gaster truncate.

Worker: Occipital margin of head shallowly emarginate or rounded. Mandible usually with two or three apical teeth followed by a row of uneven denticulae.

Palp formula and antenna as in soldier. Trunk as in soldier but less raised pro and mesonotum. Petiole and postpetiole more slender than in soldier.

***Pheidole megacephala* (Fabricius,1793)**

Identification Notes

Workers are dimorphic (major and minor workers); minor workers are approximately 2mm long and major workers are 3-4mm long. The front half of the major's head is sculptured, while the back half is smooth and shiny. Body colour ranges from a pale yellow to a very dark brown. The antenna is twelve-segmented with a three-segmented club. The first antennal segment (scape) of the minor workers far exceeds the top of the head, and is covered in many long hairs. There are no spines on the front of the body (pronotum), but two very small spines on the rear of the body (propodeum) facing almost directly up. There are many small punctations on the rear side of the body, and side of the head, but remaining body areas are smooth and shiny. The petiole (waist) of both worker forms is two-segmented and the post-petiolar node is conspicuously swollen . There is usually a dark spot on the underside of the gaster.The entire body is covered in many sparse, long hairs. The second waist segment (post petiole) is conspicuously swollen. The entire body is covered with sparse, long hairs.

General Notes

The bigheaded ant , *Pheidole megacephala*, is a very successful invasive species that is sometimes considered a danger to native ants and has been nominated as among 100 of the "World's Worst" invaders (Hoffman 2006). More often these ants leave piles of loose sandy soil. Homeowners are annoyed by these "dirt piles" and by ants foraging in bathrooms, kitchens, around doors, and windows, as well as on exterior paved or brick walkways or

driveways. This species is a cosmopolitan pest thought to have arisen in Africa and is now found throughout the temperate and tropical zones of the world.

It is a serious threat to biodiversity through the displacement of native invertebrate fauna and is a pest of agriculture as it harvests seeds and harbours phytophagous insects that reduce crop productivity. *Pheidole megacephala* are also known to chew on irrigation and telephone cabling as well as electrical wires.

Effects on plants and horticultural crops can be direct through the likes of seed harvesting, or indirect through the likes of harbouring phytophagous insects which reduce plant productivity. It is known to facilitate the invasion of introduced plant species.

P.megacephala is omnivorous, feeding on sweet liquids such as honeydews, dead insects, and soil invertebrates. Foragers will quickly recruit nest mates to a food source. Foraging tunnels having numerous entrances can be seen along the soil surface. Arthropod prey are dissected by workers and brought back to the nest.

***Pheidole watsoni* (Forel, 1902)**

Identification Notes

These are polymorphic ants with major workers measuring about 4mm and minor workers about 1.5 mm in length. The majors have a reddish brown mesosoma, while the gaster is brown. Their antennae and legs are yellow. Body is covered with short erect hairs. The head is rectangular, longer than broad and has longitudinal striations. Propodeal spines are short, erect and pointed, but not club shaped. The postpetiole is wider than the petiole. Minors are pale yellow with darker head and brownish gaster

General Notes

A common ant found all over India , often seen in urban regions. They are terrestrial and make nests in corners of junctions of wall-soil.

P.watsoni has been collected from all urban and agricultural sites of Vadodara,Gujarat.

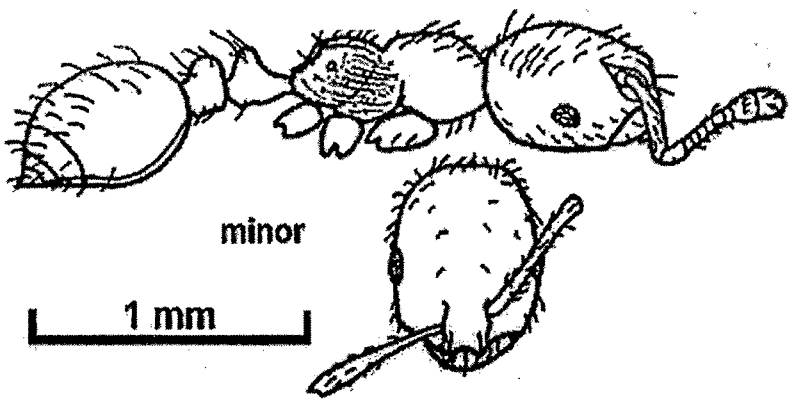
Genus *Solenopsis* Westwood, 1840

General Biology

Also known as 'Fire Ants they nest in large mounds in open areas, and feed mostly on young plants, seeds, and sometimes on crickets. These ants bite to get a grip and then sting (from the abdomen) and inject a toxin. Colonies are founded by small groups of queens or single queens. Even if only one queen survives, within a month or so the colony can expand to thousands of individuals. Some colonies may be polygynous (having multiple queens per nest).

Diagnostic description

The anterior clypeal margin has a single, long, anteriorly projecting median seta at the midpoint of the margin. Propodeum is always unarmed and rounded. Antenna has 10 segments (Line Diagram 14).



Line Diagram : 14

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

Identification Notes

The sides of the head are sub parallel; the emargination of the posterior border on the head deep and extending toward the frons as a median rugose furrow. A distinct carinae is present on propodeum originating near the junction of the propodeal dorsum and the declivity and extending forward toward the anterior edge of the propodeum. The subpetiolar process is small and rarely flange-like.

General Notes

Solenopsis geminata inhabits the tropics worldwide. Fire ants tend honeydew producing homoptera, especially mealybugs. This increases pest populations and the incidence of disease vectored by homoptera. This is also one of a number of ant species that damage plastic drip irrigation tubing by chewing new holes and enlarging the existing ones (Chang and Ota, 1990).

Fire ants get their name from the fiery pain caused by their stings. Fire ants are ground nesting ants, preferring sunny, open areas or partially shaded ones. In sugarcane, they move their nests to the perimeter of the field when the canopy closes and shades the ground (Chang and Ota, 1990).

***Solenopsis invicta* (Buren,1972)**

Identification Notes

The pedicel, or "waist" consists of two segments. Workers consist of many sizes (polymorphic) between 2.4 to 6 mm. The mandible has four distinct teeth and the antennae are 10-segmented, ending in a two-segmented club. A sting is present at the tip of the gaster. Body color is usually red to brown in color with a black gaster.

General Notes

Mounds are built of soil. When a mound is disturbed, ants emerge aggressively to bite and sting the intruder. The diet of foraging workers consists of dead animals, including insects, earthworms, and vertebrates. Workers also collect honeydew and forage for sweets, proteins, and fats in homes. It has been found in most of the urban and agricultural study sites of Vadodara, Gujarat.

Subfamily Ponerinae

Overview

Members of this subfamily are characterized by a constriction between the basal 2 segments of the abdomen and by the unmodified powerful sting. The body is more or less elongate and cylindrical, especially the abdomen. The pedicel is one jointed. Most of the members are black and are of moderate to large size. Workers belonging to this subfamily are monomorphic.

Key to the genera of Ponerinae

Pretarsal claws of hind leg on the inner curvature behind the apical point, pectinate .

***Leptogenys* Roger, 1861**

Pretarsal claws of hind leg on the inner curvature behind the apical point, unarmed, not pectinate.

***Diacamma* Mayr, 1862**

Genus *Diacamma* Mayr, 1862

General Biology

They can be easily identified by a combination of characters, i.e., size, colour, external morphology, majestic walk and by their characteristic nests. This is a monomorphic species. Species of *Diacamma* nest in loose debris on the ground's surface or less commonly in soil with a mound around the entrance or in tree cavities. Colony sizes are moderate, ranging from as few as 20 workers to about 500. The usual queen caste is lacking and instead mated workers produce brood. 10 species of Diacamma are found in India (www.antdiversity.com).

Diagnostic Description

The sides of the mesosoma above the front legs and just below the upper surface with conspicuous pocket-like pits on each side (Fig 1 a). The petiole is armed with a pair of spines on its upper surface (Fig 1 b). These large, black ants are immediately recognisable by the pit on the side of the mesosoma and the spines on the upper surface of the petiole (Line Diagram 15).

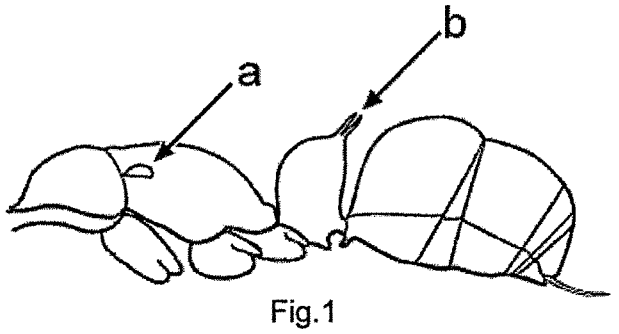


Fig.1

Line Diagram : 15

Key to the Species of Genus *Diacamma*

About 12 mm in length,Striations on the petiole are as concentric arches on the anterior angles while they are divergent in the middle. The whole body is covered with a thick greyish pubescence.

***ceylonense* Emery,1897**

About 8 mm in length. The striations on their petiole are as concentric arches from back to front. The whole body is covered with a characteristic yellowish pubescence.

***rugosum* LeGuillou, 1842**

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

Identification Notes

Members of this species have an average length of 11 mm. It is greyish black and shiny in appearance. Mandibles, tips of legs and abdomen are dark reddish brown. Head, thorax, petiole and the first two gastral tergites are deeply striated. They have a pair of comma like structures pointed backwards on their petiole. Entire body is covered with dense pubescence and sparse erect hairs. This is a monomorphic species. Males are reddish brown in colour.

General notes

These ants are found in parks, gardens and wooded areas. It builds nests usually with characteristic mound, with a small, single entrance . Immediate vicinity of the nest entrance and a portion of the mound is always decorated with an admixture of dried leaves, slender dry twigs, bird feathers, dead ants (mainly *Leptogenys* sp.), caterpillar skins etc. This kind of nest is characteristic of this ant.A single nest can contain as many as 600 individuals.

D. ceylonense has been collected from two agricultural sites and all urban sites excluding Residential sites of Vadodara, Gujarat.

***Diacamma rugosum* (Le Guillou, 1842)**

Identification Notes

Body is about 8 mm in length with distinct concentrically arranged striae from their head to first gastral segment. The striations on their petiole are as concentric arches from back to front. The whole body is covered with a characteristic yellowish pubescence. They have a pair of comma shaped structures pointed backwards on their petiole.

General Notes

These ants nest in soil and also occupy small cracks in concrete structures, pavements and also crevices in trees. This ant has been found in only one agricultural site and all urban sites excluding Residential sites of Vadodara, Gujarat.

Genus *Leptogenys* Roger, 1861

General Biology

Leptogenys is a large genus. They make nest in loose soil on ground, in soil or under objects on the ground and in rotten wood. Members of this group have the habit of changing their nesting sites quite frequently. Some species forage singly while others forage in distinct trails. Colonies contain from a few dozen to hundreds of thousands of individuals. Foraging occurs throughout the day and night, with workers foraging either singly or in well formed and distinct foraging trails. A few species specialise on pill bugs (isopods) while others show a preference for termites. Workers are predaceous and have a powerful sting. 27 species of *Leptogenys* have been reported from India (www.antdiversity.com).

Diagnostic description

The body is long and slender. The most important identification character for this genus is the pectin ate nature of the tarsal claws (claws have a series of small teeth on their inner surface). The upper plate of the second gastral tergite is only weakly arched and located in the middle of the gaster. Petiole has distinct front, top and rear faces (Fig.2aa), its attachment to the gaster narrow, slender and involving only the lower surface of the petiole, and with the petiole and gaster separated by a distinct impression (Fig.2bb); Mandibles with the only1-3 teeth; Frontal lobes distinct and expanded towards the sides so they cover and hide at least the inner part of the antennal sockets (Fig.3aa). Eyes generally large and distinct (Fig.3bb) (Line Diagram 16).

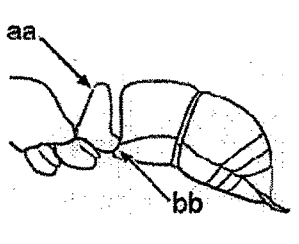


Fig.1

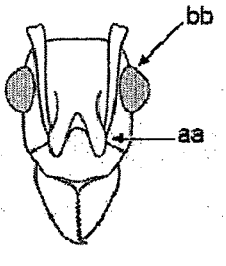


Fig.2

Line Diagram : 16

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

Identification Notes

The body is black, smooth, shining and elongated, about 10 mm in total length. Head is oval with large eyes. Mandibles long, thin and curved and are inserted at the outer corners of the front margin of the head. The front margin of the clypeus is strongly angular and projects forward between the base of the mandibles. The tibiae of the hind legs each with both a large and comb-like (pectinate) and a small spur at their tips. The node of the petiole is broad and rhomboid shaped.

General Notes

Bingham (1903) mentions that this species is distributed more or less throughout Continental India and Ceylon, except the drier portions of Central and Western India and Punjab. Ants of *Leptogenys* exhibit army ant behavior with the formation of massive raiding columns.

Subfamily Pseudomyrmecinae

Overview

These ants are easily recognisable due to their elongate, slender bodies and large, oval eyes, short antennae, combined with their arboreal habits. There is a well developed postpetiole and a well developed sting . Mandibles are triangular and relatively short. Eyes are large and conspicuous. The pronotum and mesonotum form separate plates which freely articulate with one another. They are most often confused with species in the subfamily Myrmicinae, but differ in the pronotum and mesonotum forming separate plates rather than being fused as in the Myrmicines.

The pseudomyrmecine larva has a trophothylax or "food pocket", a unique structure located on the ventral surface of the thorax, in which the workers place small food particles.

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.

Tetraponera is the Old World counterpart of the genus *Pseudomyrmex*. It is found in the Afrotropical (including Malagasy), Oriental and Australian regions.

The subfamily Pseudomyrmecinae is represented in Vadodara by a single genus, *Tetraponera.*

Genus *Tetraponera* Smith, F., 1852

General Biology

These ants are highly arboreal, nesting in hollow twigs or branches of trees or shrubs. They are almost always found on vegetation although they occasionally forage on the ground around the bases of trees or shrubs. Most species of workers have acute vision and will dart to the far side of twigs or branches when approached.

There are 7 known species and subspecies of *Tetraponera* found from India (www.antdiversity.com). An additional 6 species are known from fossil records (Bingham, 1903).

Diagnostic description

These ants are easily recognisable by their elongate, slender bodies and large, oval eyes. The flexible joint between their pronotum and mesonotum and the toothed claws on the tarsi separate them from species in the subfamily Myrmicinae.

Basal margin of mandible has 0-2 teeth; masticatory margin usually with 3-4 (rarely 5-6) teeth. Venter of mandible has a single weak ridge, which is continuous and broadly rounded behind the basal and masticatory margins. Palp formula is 6,4. Upper (anterodorsal) surface of median clypeal lobe is continuous and non-truncate. Frontal carinae are separated by more than basal scape width. Compound eyes are relatively large. Number of ocelli is 3. Median connection of the spiracular plates of the sting apparatus is membranous.

Key to species of *Tetraponera* (based on the worker caste)

Larger species; body predominantly black, although petiole, postpetiole and limb appendages may be lighter in color; propodeum typically low and broad; pronotal margin varying from sharp- to soft-edged and maximum width of the pronotum generally occurring below the margin

***allaborans* (Walker,1859)**

Bicolored, the dark head and gaster contrasting with the orange-brown mesosoma. Head with 3 distinct ocelli; in dorsal view pronotal humeri appearing subangulate; head densely punctate, and lacking extensive shiny interspaces between the punctures; standing pilosity common on the mesosoma dorsum.

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

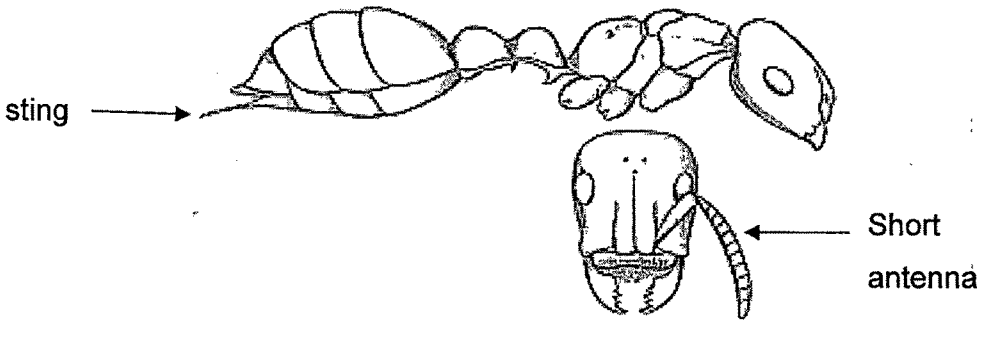
***Tetraponera allaborans* (Walker, 1859)**

Identification Notes

Larger species; body predominantly black, although petiole, postpetiole and limb appendages may be lighter in color; propodeum typically low and broad; pronotal margin varying from sharp- to soft-edged, and maximum width of the pronotum generally occurring below the margin (Line Diagram 17).

General Notes

Shiny black ants, with rufous coloured antennae and characteristic elongated eyes. These are arboreal, nesting often in rotting logs and dead wood. They are solitary foragers and usually seen foraging on the margins of leaf. This characteristic behaviour is mimicked by a *Myrmarachane* species of spider.



Line Diagram : 17

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

Identification Notes

It is a bicolored ant , the dark head and gaster and contrasting orange-brown mesosoma. Head have 3 distinct ocelli; in dorsal view pronotal humeri appear subangulate; head is densely punctate, and lacks extensive shiny interspaces between the punctures; standing pilosity is common on the mesosoma dorsum.

General Notes

They can be easily identified by their pronounced postpetiole, elongate eyes and cylindrical body. Their legs are short and ideal for arboreal life, as they forage with their entire body close to the foraging surface.

T. rufonigra is one of the most common *Pseudomyrmecines* found in India. These ants are aggressive predators and feed on other ants (alates especially), termites and small invertebrates. They often hunt solitarily, but hunt in small groups only when close to the nest. A *Myrmarachane* species of spider morphologically mimics this ant. A mimicry perhaps exhibited to keep predators away.

They often establish nests in dead and rotting wood. No distinct caste division is seen and all workers attack upon disturbance.

Table 7. Ant Species recorded from study area

Family Formicidae

Subfamily	Genus	Species
Dolichoderinae	*Tapinoma*	*Tapinoma melanocephalum* (Fabricius,
Dorylinae	*Dorylus*	*Dorylus labiatus* (Shuckard,1840)
Formicinae	*Camponotus*	*Camponotus compressus* (Fabricius, 1787)
		Camponotus irritans (Smith, 1857)
		Camponotus sericeus (Fabricius, 1798)
	Formica	*Formica rufa* (Linnaeus, 1761)
	Lasius	*Lasius* sp.
	Oecophylla	*Oecophylla smaragdina* (Fabricius, 1775)
	Paratrechina	*Paratrechina longicornis* (Latreille, 1802)
	Polyrhachis	*Polyrhachis lacteipennis* (F. Smith, 1858)
	Prenolepis	*Prenolepis* sp.
Myrmicinae	*Crematogaster*	Crematogaster soror (Forel, 1902)
		Crematogaster subnuda (Mayr, 1979)
	Meranoplus	*Meranoplus bicolor* (Guerin-
	Monomorium	*Monomorium minimum* (Buckley, 1857)
		Monomorium pharaonis (Linnaeus,1758)
	Pheidole	*Pheidole megacephala* (Fabricius,1793)
		Pheidole watsoni (Forel, 1902)
		Pheidole sp.1
		Pheidole sp.2
	Solenopsis	*Solenopsis geminata* (Fabricius, 1804)
		Solenopsis invicta (Buren,1972)
		Solenopsis sp2
Ponerinae	*Diacamma*	*Diacamma ceylonense* (Emery,1897)
		Diacamma rugosum (Le Guillou, 1842)
		Leptogenys chinensis (Mayr, 1870)
Pseudomyrmecinae	*Tetraponera*	*Tetraponera allaborans* (Walker, 1859)
		Tetraponera rufonigra (Jerdon, 1851)

Figure 5. Camponotus compressus (Fabricius, 1787)

Figure 6. *Camponotus sericeus (Fabricius, 1798)*

Figure 7.
Camponotus irritans (Smith, 1857)

Figure 8.
Dorylus labiatus (Shuckard,1840)

Figure 9.
Monomorium minimum (Buckley, 1857)

Figure 10.
Oecophylla smaragdina (Fabricius, 1775)

Figure 11. *Paratrechina longicornis* (Latreille, 1802)

Figure 12. *Polyrhachis lacteipennis* (F. Smith, 1858)

Figure 13.
Crematogaster soror (Forel, 1902)

Figure 14.
Crematogaster subnuda (Mayr, 1979)

Figure 15. *Monomorium pharaonis* (Linnaeus,1758)

Figure 16. *Pheidole megacephala* (Fabricius,1793)

Figure 17
Pheidole watsoni
(Forel, 1902)

Figure 18.
Solenopsis geminata
(Fabricius, 1804)

Figure 19.
Solenopsis invicta (Buren,1972)

Figure 20.
Diacamma ceylonense (Emery,1897)

Figure 21.
Leptogenys chinensis (Mayr, 1870)

Figure 22.
Tetraponera rufonigra (Jerdon, 1851)

Figure 23
Solenopsis invicta (Queen)

Figure 24
Camponotus compressus (Male)

Figure 25. Stages of the life cycle of *Pheidole watsoni*

Egg

Larva

Adult Worker (Major)

Adult Worker (Minor)