

A Review on Diversity of Ant Species in Karnataka State

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Abstract

Ants are eusocial insects of the family Formicidae belonging to the order Hymenoptera. Ants are considered to be the least studied groups with respect to their ecology and taxonomy in India. Ants may be evolved from wasp like ancestors in the midcreaceous period and were diversified after the rise of flowering plants. So far more than 12,500 species of ants have been identified and classified. With such a vast diversity, occupying almost all ecosystems except Antarctica and few islands, they form about 15-25% of the total terrestrial animal biomass. They have been proven to be reliable indicators of restoration success in some habitats. Presence of different groups of ants in the demarcated zones may be due to the selective needs such as food, shelter and adaptive capabilities of particular ant species to the prevailing vegetation and soil type. However, there was very little information available in the literature on diversity of ants' species among different regions of Karnataka province. Hence, the present narrative review of literature study was undertaken to describe and delineate about unknown biodiversity of ant species in Karnataka province.

Keywords: Ants, Biodiversity, Karnataka

1. Introduction

Earth is blessed with amazing variety of living organisms consisting of both micro and macro-organisms such as bacteria, fungi, plants and animals. The variability among all these organisms from all sources such as terrestrial and aquatic ecosystems help to maintain the genetic variations among them. As India falls in the tropical belt, it is blessed with rich biodiversity due to its varied climatic and altitudinal conditions coupled with

variety of ecological habitats. On the basis of species richness, India ranks sixth among twelve mega diversity regions of the world. Karnataka has various types of forests such as, scrub, moist deciduous, semi-evergreen, evergreen and dry deciduous accounting for about 20% of the total geographical area. As all the living organisms play an important role in one or the other way in nature, ants also have most important role in soil formation and fertility (Yashavantakumar et al., 2016).

Biodiversity conservation and management is of worldwide concerns. Use of surrogate taxa, i.e., taxa that site has become important in biodiversity studies. It is impossible to study all the communities available in a particular ecosystem in light of the need for rapid, reliable and cost-effective assessments that can be used in conservation and monitoring programs. Traditionally, majority of studies used vascular plants and vertebrates as indicator taxa. Insects constitute 85% of the world's animal biodiversity (Groombridge 1992). Inclusion of ground-dwelling arthropods in environmental assessment surveys and biodiversity inventories has increased in the recent past (Oliver and Beattie, 1996). Recently the importance and appropriateness of using invertebrate groups was well recognized. Among invertebrates, ants are considered for monitoring due to number of reasons. Ants range in size from 0.75 to 52 millimetres (0.030–2.0 inch), the largest species being the fossil *Titanomyrma giganteum*, the queen of which was 6 cm (2+1/2 inch) long with a wingspan of 15 cm (6 inch) (Holldobler B 1990, Schaal S 2006). Ants vary in colour; most ants are red or black, but a few species are green and some tropical species have a metallic lustre. More than 13,800 species are currently known (with upper estimates of the potential existence of about 22,000), with the greatest diversity in the

tropics (Weblink1). Taxonomic studies continue to resolve the classification and systematics of ants. Online databases of ant species, including AntWeb and the Hymenoptera Name Server, help to keep track of the known and newly described species (Weblink1). The relative ease with which ants may be sampled and studied in ecosystems has made them useful as indicator species in biodiversity studies (Bestelmeyer BT et al 2000).

If all the world's ants were combined, it is estimated that they would weigh about as much as all human beings (Hölldobler and Wilson 1998). They also participate in every part of the trophic system (Carroll and Janzen 1973, Trager 1998). They play a major role in dispersing seeds for many plant species (Berg 1975, Willson et al. 1990), are the chief predators of insects and other arthropods (Porter and Savignano 1990), and other invertebrates (Whitcomb et al. 1973, Jackson et. 1998), and vertebrates' prey on them for food (Reiss 2001). Ants circulate and aerate more soil in the tropics than do earthworms, thus moving nutrients throughout the landscape (Wilson 1994). In a study of *Formica cinerea montana* Emery (Baxter and Hole 1967), found that mineral soil in the upper half to two-thirds of a representative mound consists of about 85% B horizon material. Ants also fill diverse niches including soil (Tschinkel 2003), rotting logs (Chen et al. 2002), trees (Djieto-Lordon and Dejean 1999), leaf litter (Leponce et al. 2004), acorns (Pratt and Pierce 2001), and twigs (Armbrecht and Ivette Perfecto 2003). Ants have mutualistic relationships with many plant and animal species. The carnivorous pitcher plant, *Nepenthes bicalcarata* Hook houses *Camponotus sp.* worker in its tendrils and feeds the ants captured prey that has fallen into the pitcher (Clark and Kitching 1995). The ants easily run up and down the slick walls and swim in the pitcher's digestive juices retrieving prey. In return, the ant prevents accumulation of organic matter, which would lead to the pitcher rotting (Clark and Kitching 1995). The oak-feeding aphid *Stomaphis quercus* Linnaeus only occupies trees that are within 17 m of the nests of the ant *Lasius fuliginosus* Latreille and is strongly associated with trees that housed these ants (Hopkins and Thacker 1999). The ants receive a nutritious food award of honeydew and in return, the ants protect the aphids from potential predators (Buckley 1987, Hopkins and Thacker 1999).

Ant distribution is seen on almost every landmass except Antarctica and few Islands contributing about 15 to 25% of the total terrestrial animal biomass. Currently, about 12,500 ant species from 21 sub-families are recorded worldwide (Bolton, 2003). The family Formicidae is included in the super family Vespoidea of the order Hymenoptera, class-Insecta,

Phylum-Arthropoda. Among the family Formicidae, sub-family Myrmicinae is the largest with 138 genera followed by Formicinae with 39 genera and Ponerinae with 25 genera. Recently, one more sub-family 'Martialinae' has been included to family Formicidae (Rabeling et al., 2008). According to the Bolton Oriental region has rich ant diversity with 101 genera belonging to 13 sub families of which 5 sub families are endemic to this region (Bolton B 2003). Likewise, India also harbors about 631 ant species falling under 82 genera belonging to 13 sub-families. The estimated total number of species living on the earth is around 50 million, out of which the known and recorded number of species is just around 1.8 million. With this background, the present narrative review of literature study was undertaken to describe and delineate about unknown biodiversity of ant species in Karnataka province.

2. Diversity of Ant Species

Though India shares four global hotspots of biodiversity with its neighbors', there are very few studies available on ant diversity responses to ecosystem changes from here. Due to its distinct geological history from the rest of India, varying topography, and the climate, the Western Ghats is known to harbour highly diverse flora and fauna and a great proportion of them are also endemic (Gunawardene et al. 2007), which led to it being proposed as UNESCO World Heritage Site and is also identified as one of the 34 hotspots of biological diversity in the world (Kumar et al. 2004). Its elevation range and aspect has resulted in diverse climatic regime and forest types such as tropical evergreen, moist deciduous, dry deciduous and thorn forests. Providing a vast array of complex functions and services crucial for human survival, the long persistent interaction between the mankind has given rise to equally diverse cultural landscapes in the Western Ghats. Major human - induced ecological changes in the Western Ghats begin with agriculture and pastoralism (Chandran 1997). Through constant human interactions, most of its original vegetation changed to economically productive systems. Currently the Ghats appears as a mosaic of natural forests, human settlements, agricultural land, plantations, etc. Converting natural forests into plantations has been a practice in this area for at least two centuries. A good share of natural forests in the Western Ghats has given way to plantation crops such as rubber, tea, coffee, oil palm, betel nut, and teak. Towards the end of 20th century, a major portion of degraded land has been converted by the state forest departments through its afforestation programmes to *Acacia* and *Eucalyptus* plantations, both of which are exotics. The land - use change is

identified as a dominant feature of environmental changes (Usher 1995), which affects physical, chemical and biological systems. Stand simplification due to the changing land uses is a major concern for the conservation of terrestrial biodiversity. Insect biodiversity in the tropics is dramatically affected by land - use changes both in agriculture and forestry (Sutton and Collins 1991). It has been identified that one of the biggest challenges to the ant diversity is from human - induced land - use changes (Alonso 2010).

2.1 Diversity of Ant species in South Karnataka

A total of 4 subfamilies, 12 genera and 20 species of ants were recorded from the campus of Maharani's Science College, Mysuru. The majority of species were in the Myrmicinae (35%) and Formicinae (35%) followed by Ponerinae (20%). At the genus level, *Camponotus*, *Polyrhachis*, *Pheidole* and *Crematogaster* were the most speciose genera. Myrmicinae were the most abundant in numbers of ants and the most diverse group (7 Species) in south Karnataka region. This family showed a significant difference between seasons as recorded by other elsewhere (Watanasit et al., 2000). The number of individuals was higher in the wet season. They nested in soil humus, in hollow twigs, under bark, inside galls or in nuts of woody plants. These ants were more specific due to availability of food and nesting sites. These are also the exclusively arboreal and terrestrial taxa. *Pheidole* nested in soil, *Crematogaster* nested in dead wood on trees, *Myrmicaria* nested at tree base, *Meranoplus* had nests in open canopy areas and *Solenopsis* nested under rocks and rotten logs. The Formicinae were the most abundant in south Karnataka region. The extreme dominance exhibited by Formicinae sub family with seven species in this study. Formicinae did not show a significant difference between seasons. Humidity may influence nest building. The genus *Camponotus* were record of four species. *Camponotus* was a frequently occurring species in everywhere. The *Camponotus* had the greatest individual numbers. These ants are called as carpenter ants because of their "Nesting behaviours" (Chavhan et al., 2011). Food sources may have been important (Watanasit et al., 2000). The most common among them were *Oecophylla smaragdina*, a truly arboreal species. These ants nested in shady places and require broad leaves to stitch their nest. All the recorded species of *Polyrhachis* were arboreal and found in undisturbed areas. These ants nested on the ground such findings were also recorded though not to such an extent of work. Ponerinae subfamily was more specific about its niche and food habits (Ramachandra et al., 2012). They feed on a wide range of food. Food resources may have played an

important role influencing numbers of Ponerinae (Watanasit et al., 2000). *Anochetus* and *Diacamma* were nested in soil or even in rotten logs. *Leptogenys* prefer cavities in logs or large branches to construct their nests. Only one genus *Tetraoponera* representing *Pseudomyrmicinae* has been recorded. Neither seasonal change nor did physical factors influence the numbers of this group. These are solitary foragers and make their nests in fallen dead wood and rotten logs. *Tetraoponera rufonigra* was dominant compared to *Tetraoponera* sp. in south Karnataka region. The richness has been correlated with the composition of the plant species invertebrate and microbial biomass (Anderson and Sparling, 1997). The high diversity of ants in south Karnataka region showed that this area is good habitat for ants. Furthermore, ants could survive against the odds and south Karnataka region served as a mini model to examine the persistence of ant species.

2.2 Diversity of Ant species in North Karnataka

The Karnatak University campus, Dharwad contains rich ant species diversity with variety of other insects. There are twenty-five species of ants belonging to six subfamilies under the family Formicidae which speculates that the ant diversity is influenced by topography, flora, fauna and climatic conditions of north Karnataka region. It can be assumed that the undulating topography, rich plant community and favorable climatic conditions (16-36C temperature, 800-900 mm rain fall) of north Karnataka provides comfortable shelter and foraging grounds, protection from hostile atmospheric conditions for ants and other group of insects like Honey bees, Wasps, stick insects etc... Ants show various interesting behaviours such as tending with species of coccids, pseudo coccids and aphids etc... Another interesting observation is that many species of ants built their nest and sophisticate their nests especially during rainy seasons (Yashavantakumar GS et al 2016). The success of ants in different environments has been attributed to their social organisation and their ability to modify habitats and defend themselves may be due to their long coevolution with other species. The pattern of distribution of ground nest probably relates to the availability of food resources and vegetation complexity which in turn may play an important role in soil turnover and nutrient recycling (Lal, 1988). Some of the ant species occupy the nest constructed by other organisms. *Crematogaster* group are exclusively arboreal nest building ants suggesting that the tidal influx may limit the activity of ants to the crown of the trees (Lopes and Aguiar dos Santos, 1996). Ant species observed in demarcated sites probably points to the selective needs (in terms of food and shelter) and adaptive capabilities of particular species to harsh prevailing environmental

conditions compared to inland properties such as soil temperature, levels of CaCO₃ and the type of plant species found in particular habitat that selectively associate between flora and fauna. Thus, contributing to their successful survival and reproductive fitness even in the harsh conditions (Andersen, 1990).

2.3 Diversity of Ant species in Other Regions of Karnataka

Even though ants are ubiquitous, very little is known about the life of ants in India. A recent review on India's ants puts the number of species described from the country at 828. This number however appears to be an under-representation of the actual potential species from India, owing to the lack of systematic and well-documented studies on the ant fauna of the country. Let alone the estimate of total species, even know-how about the most common ant species is wanting primarily due to the "less glamorous" appeal of ants in comparison to butterflies, dragonflies or damselflies, who are relatively well-studied across the country. Most times, the type of ants we know is limited to "black ants" and "red ants", or "ants that don't bite" and "ants that bite", and hence it would come as a surprise to many, that an average urban Indian household can harbour no less than four species of ants and this can go up to 10 to 15 species in a suburban home with a small garden. Karnataka has been lucky, with many students and researchers having explored the ant diversity of the state. 257 species of ants have been described from the state till date, including many which are new records to science. In this first of a two-part article, I focus on some of the most common ant species found in Karnataka. (Weblink2).

2.4 Outlook on Ants Species

Ants, like humans, like to conquer new lands and make them their own. Some species are so good at this that they overthrow anything that stands in their way, and establish themselves as the sole rulers of the land. Hence, it is no surprise that some of the most common ants we usually see around us are invasive species. Very few researchers, though, have looked into invasive species of ants which are silently expanding their dominion. All invasive life forms are successful because they can out-compete native species on their home ground; invasive ants too have many such strategies by which they out-compete native ant species. For starters, they will eat almost anything, from fallen sugar crystals on a table to dead rats on the roadside. They have very flexible nesting behaviour and can nest almost anywhere, ranging from small cracks in walls to underneath a flower pot. Many invasive ants are 'polygynous',

meaning that a single ant colony has multiple (sometimes unrelated) queens living together with their daughters, all working in unison. Invasive ants are prolific and their colony size outnumbers that of any native species. They are very aggressive and defend their territories fiercely. They have very few natural enemies and can hence expand their territory unchecked. Yellow Crazy Ant (*Anoplolepis gracilepis*) ant is so named because of its obvious yellow colouration and its peculiar behaviour to dance like a madman when provoked, by shaking its antenna and legs in all directions and running around in irregular patterns. The Yellow Crazy Ant is a very common species of our urban landscape. They are known to aggressively bite and spray formic acid when threatened. (weblink2).

Black Crazy Ant (*Paratrechina longicornis*) is a very common urban species that most of us associate with, which tickles us when they walk over our hands or legs. They too are called crazy ant because of the same behaviour as the Yellow Crazy Ant, when provoked. The origin of this species too is shrouded in mystery. Ghost Ant (*Tapinoma melanocephalum*), true to their name, Ghost Ants come as stealthily as they leave. These tiny ants are no longer than two millimetres, and are almost translucent, making them hard to detect. The kitchen is their favorite haunt and they are usually spotted milling around spilt milk or tea. Sugar is their favorite, and often a sugar jar which is not secured tightly will find it invaded by the Ghost Ant army. Ghost Ants also have a peculiar smell when crushed, which acts as a distress beacon to the other sisters of the colony. It is speculated that the Ghost Ant originated from the tropics of Asia or Africa. (weblink2).

Pharaoh Ant (*Monomorium pharaonis*) ant most of us will associate with painful bites, and often christened the "red ant", the Pharaoh Ant is commonly found scurrying around in search of dead insects, which when found are dismembered and carried off to its nest. Interestingly, unlike other ants, colonies of this species do not compete and display aggression against each other, a phenomenon known as 'unicoloniality'. Pharaoh ants expand their territory by a phenomenon called 'nest budding', where a few females with workers leave the main nest and establish a satellite nest, expanding from their colony autonomously. Like most species of invasive ants, it is not clear where Pharaoh Ants originate from. The Native Generalists are the original rulers of our lands before the invaders arrived, these native species are still the most commonly found ants in places unknown to the invaders. They are generalists, having a wide diet spectrum. They will sometimes hunt small insects, but mostly scavenge for the dead. They tend to aphids and hoppers, maintaining a small herd of these insects which provide them with a continuous supply of honey-dew, a sugar rich food source, in

exchange for the protection that the ants give them against their predators. Native ant species form an important link of the ecosystem, playing the vital role of scavenging the dead and moving tonnes of soil, thereby helping maintain soil fertility and nutrient cycling (weblink2).

Black Carpenter Ant (*Camponotus compressus*) ant, commonly called the “big black ant”, is often seen scurrying around in loose groups. They are generally harmless, but can give a very painful bite if agitated. A typical colony of this species has a small-sized worker and a larger-sized soldier. Soldiers have huge heads and usually stand guard around the nest or with a foraging party. Short-legged Hunchbacked Ant (*Myrmecaria brunnea*) is another common native species, these have a black body and a reddish-brown abdomen which they keep tucked under their legs. They make huge, mound-shaped nests, usually at the base of trees, by excavating soil and depositing it around the tree’s trunk in a conical shape which is very conspicuous. Big nests can be raised to heights of one foot, which prevents water from flooding the nest chambers in the monsoon. (weblink2).

Golden-backed Ant (*Camponotus sericeus*) is named so because of its striking golden coloured abdomen, which is due to fine, golden hair present on the abdomen, this species has two colour morphs – one morph has a red head while the other has a black head. It was previously speculated that the red morph is found south of Bangalore and the black morph is found north of Bangalore; however, it is now known that a single colony can have both colour morphs. Long-necked Sugar Ant (*Camponotus angusticollis*) is common ant of the suburban landscape, these are big in size – about two centimetres in length – with long legs and antennae. It is interesting to note that this species was first reported to science from India. (weblink2).

3. Conclusions

Ant performs many ecological roles, which are beneficial to human beings which include the suppression of insect population too. Ants are most important part of our terrestrial ecosystem because of their universal distribution and they therefore constitute greater part of biomass. Ants are the most divergent group among all social insects. They play very important role in the ecosystem by improving the soil and assisting in the decomposition process, and are considered as good biological indicators due to mutualistic behaviour with both flora and fauna. Karnataka state has gone several changes through years embodies ant diversity and could be considered as a mini model of habitat persistence by ant species. Furthermore, ants could survive against the odds and south Karnataka region served as a mini model to examine the persistence of ant species. The present

review will yield valuable information of ant availability in different regions of Karnataka. This is to revealed from the present review of literature study that since some of the places are clearly under sampled, future explorations will reveal more species diversity of ants from Karnataka province.

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