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A SURVEY ON DIFFERENT KINDS OF ANTS IN AND AROUND GANDHIGRAM

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ABSTRACT

Ants were observed by humans since the down of history, the behavior of ants has been documented and the subject of early writings and fables passed from one century to another. Those using scientific methods. Myrmecologists, study ants in the laboratory and in their natural conditions. Their complex and variable social structures have made ants ideal model organisms. Ultraviolet vision was first discovered in ants by Lubbock in 1881. Ant colonies may be studied by rearing or temporarily maintaining them in formicaria, specially constructed glass framed enclosures. (Lubbock,1881) and (Kennedy, 1951). Survey was carried out to document the ants species 10 of in and around Gandhigram, various kinds of morphology and behavior of ants in this studied.

Introduction

Classification:

Kingdom	:	Animalia
Phylum	:	Arthropoda
Class	:	Insecta
Order	:	Hymenoptera
Family	:	Formicidae

Ants belong to social category. It means that the ant would be unable to survive on its own. But colonies of ants can exhibit remarkable co-ordination of activities between the individuals. This co- ordination does not stem from a 'center of control' rather it is self-organizing when ants search for food they initially perform a random walk search in this local neighborhood. As the ants more they deposit a chemical substance is perceived by other ants, helping them to make decision on their next move. This way a solution is constructed in an incremental fashion. The amount of pheromone laid is proportional to the number of ants that used in the route. Some examples are building an ant nest, brood pits ant foraging food. Camazine *et al* (2001). The communication between the agents during the search process is not direct instead they communicate indirectly by modifying the – environment faced by each other. There is single 'Ant model' rather there exit a family of ant behavior. These models include those inspired by: i) Ant foraging behavior ii) Brood – sorting behavior iii) Cemetery formation behavior & iv)Co- operative transport. Ant colonies show high degrees of parallelism, self-organization and fault tolerance. This character is essential for the computer systems Jain and Murty and Flynn, (1999).

Ant history:

Ants are one of the most interesting and diverse group of insects. All known species of ants are eusocial. The branch of science which deals with the study of ants is called as "Myremecology". Ants are social insects of the family Formicidae and, along with the related wasps and bees belong to the order Hymenoptera. Ants are evolved from wasp-like ancestors in the mid- cretaceous period between 110 and 130 million years ago and diversified after the rise of flowering plants. (Carc.D Dorigo *et al*., 1998). Ants are super organism, elegant ants under our feet unaware of the fact that these creatures are an important and indispensable part of our ecosystem. The tiny creatures have been on earth much before the arrival of human race, Ants originated 145 million years ago and were witness to the extinction of dinosaurs'. Since their orgin ants have evolved to become the most dominant creatures in terrestrial ecosystem. They constitute 25% of the total animal weight in the tropics. Because of their great adaptations, they creatures have occupies, dug underground tunnels, made nest in rotten logs, crevices, etc. & braved the freezing temperatures of high altitudes to be part of high altitude ecosystem.

During the cretaceous period, a few species of primitive ants ranged widely on the lauresian super – continent (the northern hemisphere). They were scarce in comparison to the populations of other insects, representing only approximately 1% of the entire insect population. Ants become dominant after adaptive radiation at the beginning of the Paleocene period. By the Oligocene and Miocene and had come to represent 20-40% of all insects found in major fossil deposits of the species that lived in the Eocene epoch, approximately one in the genera survive to the present. Genera surviving comprise 56% of the genera in Baltic amber fossils (early Oligocene), and 92% of the genera in Dominican amber fossils (apparently early miocen) Gmaldi and Agosti (2001). Ants range in size from 0.75to 52 millimeters (0.030-2.0) inch the largest species being the fossil Titanomyrma giganteum, the queen of which was 6 centimeters (2.4) inch long with a wingspan of 15 centimeters (5.9)inch Ants vary in colour, most ants are red or block, but a few species are green and some tropical species have metallic lustre. More than 12,000 species are currently known (with upper estimates of the potential existence of about 22,000) with greatest diversity in the tropics, Taxonomic studies continue to resolve the classicification and systematic of ants. Schaal, and Stephan (2006).

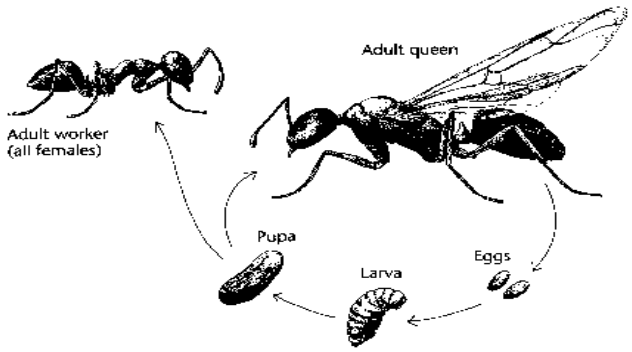
Ant morphology:

Ants are distinct in their morphology from other insects in having elbowed antennae, metapleural glands and a constriction of their second abdominal segment into a node –like petiole. The head mesosoma, and metasoma are the three distinct body segments. The petiole forms a narrows waist between their mesosoma (thorax plus the first abdominal segment, which is fused to it) and gaster (abdomen less the abdominal segment in the petiole). The petiole may be formed by one or two nodes (the second alone or the second and third abdominal segments). Borror, Triplehorn & Delong (1989). Ants pass through four stages of development egg, larvae, pupa, and adult. After mating with males, queens lay eggs that hatch into blind, legless larvae. The larvae are fed and cared for by worker ants. At the end of the larval stage they turn into pupae which do not feed. After a short period of the time adult ants emerge from their pupal stage and become worker ants.

Ant structure:

Head:

An ants head contains many sensory organs like most insects, ant have compound eyes made from numerous tiny lenses attached together. Ant eyes are good for acute movement, detection. But do not offer a high resolution image. They also have three small ocelli (simple eyes) on the top of the head that detect levels and polarization. Compared to vertebrates, most ants have poor-to-mediocare and a few subterranean species are completely blind some ants such as Australia bulldog ant, however, have excellent vision and are capable of discriminating the distance and size of objects moving nearly a meter away.



Two antennae (feelers) are attached to the head, these organs detect chemicals, air currents, and vibrations they also are used to transmit and receive signals through touch, the head has two strong jaws, the mandibles used to carry food, manipulate objects, construct nests, and for defense. In some species a small pocket (infrabuccal chamber) inside the mouth stores food. So it may be passed to other ants or their larvae.

Legs:

All six legs are attached to the mesosoma ("thorax") a hooked claw at the end of each leg helps ants to hang onto surfaces.

Wings:

Only reproductive ants, queens and males, have wings queen shed the wings after the nuptial flight leaving visible stubs a distinguishing feature of queens wingless (ergatoids) and males occur in a few species, however.

Metasoma:

The metasoma ("the abdomen") of the ant houses important internal organs, including those of the reproductive, respiratory (tracheae), and excretory systems workers of many species have their egg-laying structures modified into stings that are used for subduing prey defending their nests.

Ant behavior & characteristics:

Ants are form colonies that range in size from a few dozen predatory individuals living of in small natural cavities to highly organized colonies consist of "workers" "soldiers" or other specialized groups. Nearly all ant colonies also have some fertile male called "drones" some fertile females called "queens". Ants have colonized almost every landness on earth. They only places lacking indigenous ants are antartica and few remote or inhospitable islands. Ants thrive in most ecosystems and may from 15-25% and terrestrial animal biomass has been attributed to their social organization and their social long co-evolution with other-species has led to mimetic relationships. Schultz (2000). Ants are found on all continents except antartica and only a few large islands such as Greenland, Iceland part of Polynesia and the Hawaiian Islands lack native and species. Most species are omnivorous genenalists. But a few are specialist feeders. Their ecological dominance may be measured by their biomass and estimates in different environments suggest that they contribute 15-20% (on average and nearly 25% in the tropics) of the total terrestrial animal biomass, which exceeds that of the vertebrates. Schultz (2000). The life of an ant starts from an egg. If the egg is fertilized, the progeny will be female (diploid). If not, it will be male (haploid). Ants develop by complete metamorphosis with the larva stages passing through a pupal stage before emerging as an adult. The larva is largely immobile and cared for by workers. Food is given to the larvae by trophalloxis a process in which an ant regurgitates liquid food held in its crop. This is also how adults share food stored in the "social stomach" larvae may also be provided, with solid food such as tropic eggs. Pieces of prey, and seeds brought back by foraging workers and the larvae may even be transported directly to captured prey in some species.

The larvae grow through a series of moults and enter the pupal stage. The pupa has the appendages free and not fused to the body as in a butterfly pupa. The differentiation into queens and workers, (when they exist) is influenced in some species by the nutrition the larvae obtain.

Genetic influences and the control gene expression by the developmental environment is complex and the determination of caste continues to be a subject of research. Larvae and pupae need to be kept at fairly constant temperatures to ensure proper development and so, often are moved around among the various brood chambers within the colony. Holldobler and Willson (1990). A new worker spends the first few days of its adult life caring for the queen and young. She then graduates to digging and other nest work, and later to defending the nest and foraging. These changes are sometimes fairly sudden and define what are called temporal castes, an explanation for the sequence is suggested by the high casualties involved in foraging making it an acceptable risk only for ants that are older and are likely to die soon of natural causes.

A wide range of reproductive strategies have been noted in ant species females of many species are known to be capable of reproducing asexually through they to kous parthenogenesis. And one species, *Mycocepurus smithii,* is known to be all-female. Ant colonies can be long-lived. The queens can live for upto 30 years and workers live from 1-3 years males, however, are more transitory. Being quite short-lived and surving for only a few weeks. Ant queens are estimated to live 100 times larger than solitary insects of a smaller size. Ants are active all year long in the tropics, but, in cooler regions, they survive the winter in a state of dormancy or inactivity. The forms of inactivity are varied and some temperate species have larvae going into the inactive state, (diapauses), while in others, the adults alone pass the winter in a state of reduced activity.

Ant types:

Ants occupy a great variety of habitats, with about 12,000 known worldwide. Their biomass exceeds that of all vertebrates combined. Their social organization is orchestrated by intricate chemical communication. As central players in many ecosystems their species composition gives an indication of ecosystem health and functioning. While some are plurists reliant on undisturbed ecosystems, other are weeds or even invasive. (Hollobler and Wilson 1990). Currently there are abou12, 571 extends ant species as per the information given in ant base. Org as on 26/8/09. As per the recent classification, all ants are grouped into 21 subfamilies Recently one more subfamily is added to the family Formicidae under the name Martialinae. All of these fall into a single family the Formicidae. The family Formicidae is included in the super family Vespoidea of the order Hymenoptera, which is placed in the class

Insecta. The largest subfamily is Myrmicinae with 138 genera followed by Formicinae having 39 genera and Ponerinae having 25 genera.

Ant role:

Their abundance and varied ecological roles make them influential in agricultural ecosystems around the world. Amid growing concern about biodiversity loss, some ant species and communities are at risk of disappearing. Some even appears on the IUCN Red List, while some invasives contribute to the extention of other creatures. Improved understanding of ants, how to identify them, where they live, what they do is therefore a vital taste in sustainably developing our world perhaps the best befitting tribute to these has been paid by Holldobler and Wilson (1990).

Ants provide many services free of cost which ensure the survival of our race. They are the major soil turners, channelers of energy, pollinators, scavengers, biological control agents and to sum up the ants are important component of food chain. More recently they are being used as indicator organisms. In developed nations like Australia this concept has already been used effectively. In India too, for the first time this potential of these tiny creatures is being put to practice for assessing the health of Himalayan mountain systems which is deteriorating due to growing human activies. The ants are a group of social insects belonging to the order Hymenoptera, phylum Arthropoda. As truly social animals, they are termed as "eusocial". Ants are particularly distributed in the subtropical and tropical regions and ants are one of the most important soil insects the efficiently decompose also.

Ant gradation as being developed by us involves the use of appropriate species of ant in exsitu or insitu reactors. Apart from others an aspect, a very important consideration is that ant gradation at any place must be based only on species already established at that place. This is to ensure that the process does not lead to the introduction of invasive species. This consideration, preference of different species, necessitates, the development of a repertoire of locally established species and the types of waste they prefer to feed upon. Ants are known to be ecologically significant invertebrates in many ecosystems (Holldobler and Wilson 1990). They positively physical and chemical soil properties, plant and animals distribution and forest health. Some species (e.g.) carpenter ants [camponotus spp] attain direct pest status because they may cause indirect damage to plants by tenating aphids and scale insects. Ants serve as important

food for many vertibrates,including woodpeckers and both grizzly and black bears, found that the ant season was found to occur from mid to late July, when berries began to ripen. Ants and ant larvae were the main food items observed to be eaten by bears during this season.

Ant survey & studies by others:

The nature inspired methods like ant -based clustering techniques have found success in solving clustering problems. They have received special aftention form the research community over the recent years. It is because these methods are particularly suitable to perform in this field –the research nowadays concentrates on improving performance stability. Convergence speed robustness and other key features that would allow us to apply these does not focus on strict models of the natural processes, it merely focuses on using the best ideas to improve the convergence and accuracy of such methods. In the early 1990's ant colony optimization (ACO) was introduced by M.Dorigo and Colleagues as a novel nature-inspired Metaheuistics for the solution of hard combinational optimization (co) problems. ACO belongs to the class of metaheuristics which are approximate algorithms used to obtain good enough solutions to hard CO –problems in a reasonable amount of computation time. Other examples of metaheuristics are tabu search, simulated annealing and evolutionary computation the inspiring source of ACO is the foraging behavior of real ants.

When searching for food, ants initially explore the area surrounding their nest in a random manner. As soon as an ant finds a food source, it evaluates the quantity and the quality of the food and carries some of it back to the nest. During the return trip the ant deposites a chemical pheromone trail on the ground. The quantity of pheromone deposited, which may depend on the quantity and quality of the food source. As it has been shown in indirect communication between their nest and food sources. This characteristic of real ant colonies is exploited in artificial ant colonies in order to solve Co-problems.

Recently researchers have been dealing with the relation of ACO algorithms to other methods for learning and optimization. One example is the work presented in (Alba, 2005) that relates ACO to the fields of optimat control and reinforcement learning. A more prominent example is the work that aimed at finding similarities between ACO algorithms such as stochastic gradient ascent (SGA). And the cross - entropy (CE) method. Meculeau and Dorigo have shown in that the pheromone update as outlined in the proof- of- concept application to the

TSP (ref) is very similar to a stochastic gradient ascent in the space of pheromone values. Based on this observation the authors developed an SGA- based type of ACO algorithm whose pheromone update describes a stochastic gradient ascent. This algorithm can be shown to converge to a local optimum with probability.

In the last twenty years, the research community has been searching for new optimization techniques that are able to improve over the traditional exact ones, whose large computational requirements often make them useless for solving complex, real –life optimization problems is acceptable times. In this context, nature inspired metaheuristics methods have emerged as flexible and robust tools for solving NP-hard optimization problems, exploting their ability to compute accurate solutions in moderate execution times (Blum and Roli, 2003) Ant colony optimization (ACO) is a swarm intelligence population- based Metaheuistics inspired in the social behavior of ant colonies, which applies the key concepts of distributed collaboration, self-organization, adaptation, and distribution, found in ant communities in order to efficiently solve real-life optimization problems. (Dorigo *et al*.,1992).

Parallel implementations become popular in the last decade in order to improve the efficiency of population- based metaheuristics. By splitting the population into several processing elements, parallel implementations of metaheuristics allow reaching high quality results in a reasonable execution time. Even when facing hard to solve optimization problems. Parallel algorithms not only take benefit of using several computing elements to speed up the search, they also introduced a new exploration pattern that is often useful to improve over the result quality of the sequential implementations. In the paper present study, survey of ant in and around Gandhigram rural Institute- Deemed University, Gandhigram. The survey was carried out by using transect method also. This ensures area on computer the representativeness of the coverage and eliminates bias in the observations were made with following objectives to survey different kinds of ants in Gandhigram, to observe their morphology, like, eyes, legs, wings and to document the various kinds of Ants.

Materials and Methods

For the survey and documentation of different kinds of ants, intensive exploration visits were conducted twice in the beginning and once in a week for the thorough observations of ants in and around Gandhigram Dindigul District, Tamil nadu, India.

Field observation and records:

The ant morphology like, Head eye, legs, size, wings and behavior like, mound formation, and colonization, and storaging the food were observed and recorded and identified by using standard procedures. "Hymenoptera name server. Formicidae species count." Ohio state university.

Results

There were 12 types of Ants collected and their common name, scientific name, work and size, colour, are given in table 1.

Table 1

S.No	Common Name	Scientific Name	Work and Size	Colour
1n	Argentine Ant	Linepithema humile(Mayr)	Monomorphic workers,1/8 in (3.5 mm) long	Brown: some light brown
2	Carpenter Ant	Camponotus pennsylvanicus(De Geer)	Polymorphicworkers,1/4-1/2 in (7-13mm) long	Black: (other camponotus species may be dark brown, dark red or combination of these colors.)
3	Crazy Ant	Paratrechina longicornis(latreille)	Monomorphic workers, 1/16-1/8 in(2-3.5mm)long	Black
4	Odorous house Ant	Tapinoma sessile(Say)	Workers,1/8 in (3.5mm) long	Dark body, usually Black: pale yellow tarsi at ends of legs.
5	Big -Headed Ant	Pheidole spp.	Workers,1/16-1/8 in (2-3.5mm) long: all species have two different sized workers.	Light brown to dark reddish brown.
6	Little Black	Monomorium	Monomorphic workers very	Black

	Ant	minimum(Buckley)	small, 1/16 in (2mm) long.	
7	Pharaoh Ant	Monomorium pharaonis(Linnaeus)	Monomorphic workers, very small, 1/16-1/12 in (2.0-2.1 mm) long.	Pale yellow to reddish body with black shading on the top, rear portion of the abdomen
8	Red imported Ant	Solenopsis invicta(Buren)	Polymorphic workers, very small,1/16-1/14 in (2-7mm)long.	Reddish brown with darker abdomen.
9	Thief Ant	Solenopsis (Diplorhoptom)spp.	Monomorphic workers, very small, 1/16 in (2mm) long.	Pale yellow to light or dark brown
10	Carpenter Ant	Camponotus (spp)	Polymorphicworkers,1/4-1/2 in (7-13mm) long	Pale yellow
11	Carpenter Ant	Camponotus (spp)	Polymorphicworkers,1/4-1/2 in (7-13mm) long	Black: Head and abdomen, thorax red color
12	Carpenter Ant	Camponotus (spp)	Polymorphicworkers,1/4-1/2 in (7-15mm) long	Black

Discussion

The survey of ants was done in and around Gandhigram, Dindigul district, Tamil Nadu, India, 10 important ants were observed and listed in table 1. The ants were reported with common name, vernacular name, morphology, family name. This is the first attempt carried out a survey on ants in and around Gandhigram. The morphology, behavior, and role of ants were recorded in the last few decades by the number of workers. A preliminary study shows that the Indian Institute of Science Campus is a rich store of diverse ants. They have reported 70 species of ants from the Indian Institute of Science Campus, coming under 32 genera and 6 subfamilies. Later, some more species were added to their list and has given a revised list of ants of the Indian Institute of Science Campus. Subsequently prepared a database on the list of all ants preserved in the Insect Museum, Centre for Ecological Sciences. Ants show various interesting behaviors like tending many species of coccids, pseudo coccids, and aphids etc. Another interesting observation is that many species of ants enormously sophisticate their nests during rainy seasons. These ants

are doing various functions in the environment. The survey documentation of ants in each and every place is mandatory. Thus there is enormous scope for termite morphology, behavior, and their role in environment which are yet to be studied, and analyzed and documented. Past, there are about 12,571 extant ant species as per the information given in antbase.org as on 26/8/09. As per the recent classification, all ants are grouped into 21 subfamilies (Johnson et al., 2013; Jain et al.,1999; Johnson et al., 2007 and Jovanovic, 2010).

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References

Alba.E Parallel Metaheuristics: A New Class of Algorithms, Wiley-Interscience, 2005.

Blum.C, A, Roli, Metaheuristics in Combinatorial optimization meta –heuristic, in: D. Roli, K. Price (Eds,), New Ideas in optimization. Mc Graw-Hills, (1999).pp. 137-172.

Borror, Triplehorn & Delong (1989), p.737.

Camazine .S, J-L Deneubourg, N. R Franks, J. Sneydd, G. Thernaulaz and E. Bonabeau, "Self-Organization in Biological Systems", Princeton University Press, 2001.

Carc.D Dorigo.M, Ant Net: distributed stigmergetic control for communication networks: Journal of Artificial Intelligence Research 9 (1998) 317-365.

Dorigo.M optimization, learning and natural algorithms, P.hd thesis, Politecnico di Milano, Italy. (1992).

Gmaldi D, Agosti D (2001). "A formicine in New Jersey Cretaceous amber (Hymenoptera: Formicidae) and early evolution of the ants". *Proceedings of the National Academy of Sciences* 97 (25): 13678–13683. Moreau CS, Bell CD, Vila R.

Holldobler & Wilson (1990), pp. 619-629 "Pest Notes : Ants (Publication 7411)". University of California Agriculture and Resources. 2007. Archived from the original on 5 July 2008. Retried 5 June 2008. "Ant" Merrium – Webster Online Dictionary". Merrium – Webster. Retrieved 6 2008.

Jain.A.K, M.N.Murty and P.J. Flynn, 'Data clustering: a review,' ACM Computing Surveys, vol.31, 1999, pp.264-323.

Jain.A.K, M.N.Murty and P.J. Flynn, 'Data clustering: a review,' ACM Computing Surveys, vol.31, 1999, pp.264-323.

Johnson NF (2007). "Hymenoptera name server". Ohio State University. Archived from the original on 5 June 2008. Retrieved 6 July 2008.

Johnson, Brian R; Borowiec, Marek L; Chiu, Joanna C.; Lee, Ernest K.Atallah, Joel; Ward, Philip S. (2013). "Phylogenomics resolves evolutionary relationships among ants, bees, and wasps". *Current Biology* 23: 1–5.

Jovanovic.R, Tuba.M, Simian.D, Comparison of different topologies for island based multi-colony ant algorithms for the minimum weight vertex cover problem, WSEAS Transactions on computers 9(1) (2010) 83-92.

Kennedy CH (1951). "Myrm ecological technique. IV. Collecting ants by rearing pupae". The Ohio Journal of Science 51 (1): 17-20.

Lubbock, J. (1881). "Observations on ants, bees, and wasps. IX. Color of flowers as an attraction to: Experiments and considerations thereon". J. Linn. Soc. Lond. (Zool.) 16 (90): 110-112.

Schaal, Stephan (27 January 2006). "Messel". Encyclopedia of Life Sciences.

Schultz TR (2000). "In search of ant ancestors". *Proceedings of the National Academ of Sciences 97 (26).*