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Ecological modelling, *Myrmica rubra* as a Ecosystem Engineers, Predators and Anthills as hotspots of Nutrients

Dr.Grace Beena Paul
Department of Zoology, Reddy College,Narayanaguda, Hyderabad- 500007, Telangana, India.

ABSTRACT

Man-made or Man-Engineered Ecosystems are other names for artificial ecosystems. The majority of the world's biodiversity is made up of insects. In terms of numbers, insects are valuable guides for regions with a high diversity of species. Qualitatively, they are also significant, whether as tools for identifying biotic areas with high endemism or as the conservation subjects themselves. Nematodes that are both free-living and plant-pathogenic are crucial to plant health. It is believed that the rainy season is the ideal time to study insects. The current study emphasizes how important it is to protect the biodiversity of plants and animals in order to maintain the ecosystem's natural equilibrium in an artificial ecosystem.Mealy bugs were the most dominant species.. Crop-specific infestations caused by soil texture have an impact on nematode communities and are correlated with crop suitability. Changes in the nematode community, which are a reflection of soil and ecological processes, are reflected in the nematode fauna's indicators. Knowing how worms function in these processes is essential to comprehending the interactions between soil nematode communities and plants Crop yields and global agricultural production have not grown as quickly in recent years. This has stoked concerns that the globe could not be able to produce enough food and other goods to meet the needs of future generations. The purpose of this study is to highlight the important role that anthills may play in sustainable farming practices. Global agricultural production and crop yields have not increased as rapidly in recent years. This has increased worries that there may not be enough food and other resources produced worldwide to meet the requirements of next generations. The purpose of this essay is to highlight how important anthills may be to sustainable farming practices.

KEYWORDS- Engineered Ecosystems, Conservation, Ecological Processes, Species richness

INTRODUCTION

According to Ajay (2007), one of the biggest biophysical barriers to agricultural productivity in India and around the world is low soil fertility. Anthill soils are thought to reduce nutrient losses and function as a kind of manure that keeps the texture and moisture of the soil in place (Africa Farm News, 2014) Similarly, in Zimbabwe, farmers use soil from the anthill to enhance soil fertility (Bellon et al., 1999). The relationships that have developed between other insects and ants range from informal facultative partnerships to compulsory dependency. Arthropods, which include insects like termites, ants, bees, and wasps, fiercely protect their nests against both invaders and predators.

Arthropod diversity in the soil fauna can reach up to 20% in terms of species richness. They make up a significant amount of the soil's meso- and macrofauna. Five major groups are represented in the litter/soil system. the most numerous and diverse are Collembola, Acari, Myriapoda, Isopoda, and Insecta. Arthropods function on two of the three primary layers of the soil food web hierarchy as either ecosystem engineers or plant litter transformers.The Formicidae family of ants, which belongs to the order Hymenoptera, is the dominant arthropod in the majority of terrestrial settings.There are 288 genera, 20 subfamilies, and over 12,000 species that have been described. Every species is sociable, just like termites are. Ants are adept at utilizing food sources, and their success can surely be attributed to the evolution of cooperative foraging. While certain species of ants are specialized in cultivating fungi for food, most ants are generalist hunters and scavengers.

Myrmica rubra

Originally from Europe, red stinging ants are now an invasive species in many regions of the world, including Asia and North America.Red stinging ants are found in the soil, beneath stones, and in wastelands, gardens, and meadows.Smaller insects are consumed by red stinging ants. They also cultivate aphid honeydew. The red stinging ant, or Myrmica sp., is known to exist in about 200 different species.It is often referred to as the European fire ant and is distinguished by its sting resembling nettles and scarlet color. When disturbed or approached, these aggressive ants will launch an attack. However, they are unable to harm people in any significant way.Red stinging ants are polygn meaning they have multiple queens within a colony**,** this can increase the colonies growth rate.

Colony size

There have been reports of established red stinging ant colonies with up to 250,000 worker ants and numerous queens. Workers measure 4-5mm, dark red.

Queen:

The normal size of a red stinging ant queen is 8 to 9 mm, she is dark red, and her colony has many queens. They can live up to fifteen years, according to reports. The normal size of a red stinging ant queen is 8 to 9 mm,

she is dark red, and her colony has many queens. They can live up to fifteen years, according to reports. Ants are agents of bioturbation through their nesting practices; they mix soil layers and create pathways for the exchange of gases and water through the tunnels and chambers that make up their architectural nests.

Myrmica rubra As An Ecosystem Engineer

An organism that modifies its surroundings to meet its requirements is known as an ecosystem engineer, and it has a significant impact on the distribution, abundance, and spatial organization of other species. These actions produced soil and changed the biotic, physical, and chemical characteristics of the soil. (Greek élaion "oil", sóma "body") are fleshy structures found on the seeds of a wide variety of plants. The elaiosome can have a variety of shapes and is high in lipids and proteins. Ants are drawn to the elaiosomes found in many plants, and they carry the seed to their nests where their larvae eat the elaiosome Mineralization is the process by which its organic nutrients are changed into more easily assimilated inorganic molecules that are utilized by plants.The hydrology, mineral and organic matter composition, and soil structure are all modified by ecosystem engineers.Ants are adept at taking use of food sources.The majority of ants are predators.

Myrmica rubra

Anthill

Plant-Insect Interactions

Insects and plants are engaged in thousands of mutualisms, which can be categorised in two major groups: dispersal and defence mutualisms.

As the predominant animal group in the terrestrial ecosystem, ants have a great potential to protect plants against herbivores because they are common predators.

• Ants can become more prevalent and more capable of serving as defenders when plants offer them food sources or places to build nests.

• High degrees of reciprocal specialization are reached in obligate ant–plant mutualisms. • Ants can also carry seeds, aiding in the dissemination process.

ANT – SOIL INTERACTION

Ants churn and aerate the soil to allow water and oxygen to reach plant roots. Ants transport seeds into their tunnels in order to eat the nutrient-rich elaiosomes that are a part of the seed. These seeds often sprout and become new plants (seed dispersal).Myrmica bring seeds into their tunnel so they can consume the nutrient-rich Elaiosomes. The tiny structures known as elaiosomes that are present on the outside of seeds that ants scatter draw ants and are consumed by them. The seeds do not suffer when ants consume these elaiosomes; in fact, after the elaiosome is gone, the seeds germinate more readily. Plant-Ant interactions are in a stable state.

METHOD OF STUDY

Direct sampling : The collectors moved to the chyrsalis park area and vegetable garden of St.Pious X Degree & PG College for Women, sampled all Myrmica found in their visual sphere the observer used a pair of forceps and buccal aspirators.

A comparative analysis of anthills soil and other soil samples for chemical composition was carried out. The samples were dried at 45◦C for 2days and later ground and passed through a 2mm sieve.

Conservation Area	Habitat Area	Soil type	Soil pH	Soil Surface Temp
Chrysalis Park	Ornamental garden	Medium sandy loam	7.41	28°C.
Vegetable Garden	Cultivation area	Medium sandy loam	7.24	28.2°C.

Table-1 Soil and Habitat data

S/No.	Name of the plant	Morphometric and morpho-anatomical characters of vegetables	Before adding soil from Anthill	After adding the soil from Anthill
1	Solanum lycopersicum, Tomato	Stunted growth	27cms(stunted)	78 cms(Normal)
2	Spinach	Leaf Chlorosis Stunted growth	Yellow	Green
3	Abelmoschus esculentus Lady's Finger	Necrotic leaf margins Curling of leaves	Yellow	Green and healthy
4	Brassica oleracea var. Capitata Cabbage	Excessive wilting	Purple colour of the Leaves	Green and healthy

Table -2 Production of Vegetables after adding soil from Anthill

Results

The nutrient-rich experimental field was sprayed with Anthill soil after it was gathered. Both of the sites' soils revealed a significant acidic character, yet the control sample's soil had a lower pH than the soil from the anthill's borders. Ants also affect the soil's ability to contain essential nutrients. According to the study's findings, the soil samples had extremely low potassium levels and very high phosphorus levels. A comparison of soil samples taken from the anthill's border with control samples shows that the amount of accessible forms of potassium and phosphorus increased as a result of the ant activity.

REFERENCES

1.Del Toro, I., Ribbons, R., Pelini, S., 2012. The little things that run the world revisited: a review of ant-mediated ecosystem services and disservices (Hymenoptera: Formicidae). Myrmecological News 17, 133–146.

2.Farji-Brener, A.G., Werenkraut, V., 2017. The effects of ant nests on soil fertility and plant performance: a meta-analysis. Journal of Animal Ecology 86, 866–877.

3.Food and Agriculture Organization of the United Nations, 2015. World Reference Base for Soil Resources 2014, Update 2015. International Soil Classification System for Naming Soils and Creating Legends for Soil Maps. World Soil Resources Reports No. 106.

4.Frouz, J., Jilková, V., 2008. The effect of ants on soil properties and processes (Hymenoptera: Formicidae). Myrmecological News 11(11), 191-199.

5.Kłyś, M., Malejky. N., 2017. Gleba – środowisko życia wielu organizmów. Edukacja Biologiczna i Środowiskowa 4, 41-46.

6.Kovar P., Vojtisek P., Zentsova I., 2013.Ants as Ecosystem Engineers in Natural Restoration of Human Made Habitats. Journal of Landscape Ecology 6(1), 18-31.

7. Turan, M., Gulluce, M., von Wirén, N., and Sahin, F. (2012). Yield promotion and phosphorus solubilization by plant growth-promoting rhizobacteria in extensive wheat production in Turkey. *J. Plant Nutr. Soil Sci*. 175, 818–826. doi: 10.1002/jpln.201200054