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A Study Of The Diversity And Ecology Of Insects And Mites Acari In Some Forest Areas Of Telangana

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Abstract:
Acari, which includes both insects and mites, play an important role in the functioning of forest ecosystems. They are extremely important in the processes of pollination, the cycling of nutrients, and the breakdown of organic materials. The current study intends to investigate the diversity of insects and mites as well as their ecological relationships in some forested regions of West Bengal, India. For the purpose of the study, a total of ten different forest locations were chosen, and a number of different sampling approaches were used to capture insects and mites. After the specimens had been gathered, conventional taxonomic keys were utilised in order to identify them, and then their ecological factors were examined. According to the findings of the research, the sections of forest that were selected all exhibited a high level of acaridiversity, with a total of 2,500 species that belonged to a total of 232 families and 20 orders. The orders Hymenoptera, Diptera, and Coleoptera were the most numerous and numerous overall. The study also revealed that there was a significant positive correlation between the kind of forest and the amount of vegetation cover and the quantity and variety of acari. This study gives significant information on the variety and ecology of acari in forest ecosystems and underscores the necessity for conservation and management of forest areas for the preservation of the biodiversity of those forest ecosystems.

INTRODUCTION

Forest ecosystems are groups of wild flora and fauna that interact with the environment (Slocombe, 1993). In prosperous countries, a forest is an area with a tree crown cover or stand density of at least 20%, while in undeveloped countries, it is at least 10%. (FAO, 1997). The FAO estimates that forests encompass 31% of Earth's landmass, or 4 billion hectares. Tropical forests preserve biological variety on land despite covering less than 10% of the earth. Genetic and environmental diversity (Mayauxet ah, 2005). Its ecological and economic

importance is high. Tropical forests fix atmospheric carbon as biomass and soil-organic carbon, controlling the global carbon cycle. They also affect the regional climate by cycling water between the land and the atmosphere through evapotranspiration and by absorbing a large part of incoming solar radiation, which reduces albedo and controls regional temperature. Finally, tropical trees minimise soil erosion, floods, and landslides. Tropical forests produce over half of the world's standing timber, food, and pharmaceuticals (Thomas and Baltzer, 2002). Fuel wood, dyes, tannins, lac, silk, fibre, edible fruit, flower and seeds, essential oils, and pharmaceuticals make up 55% of India's forestry sector's employment. This estimate excludes firewood and minor wood sales (Gupta and Guleria, 1982).

The tropics, between the Tropics of Cancer and Capricorn, receive the most solar radiation (Thomas and Baltzer, 2002). 23°N–23°S are the tropics.

Since over half of India's geography is tropical, the UN Food and Agricultural Organization considers it as a tropical nation.

India, the seventh largest nation, is at the intersection of the Afro-tropical, Indo-Malayan, and Paleo-Arctic regions. Its latitude is 8 degrees 4 minutes north to 37 degrees 6 minutes south, and its longitude is 68 degrees 7 minutes east to 97 degrees 25 minutes east. India's northern, north-eastern, eastern, western, and southern borders are the Great Himalaya, the Telangana, the Arabian Sea, and the Indian Ocean. It covers 3,287,263 km2. Each of its ten biogeographic zones and twenty-six biotic provinces has a distinctive ecology (Rodgers, Panwar, and Mathur, 2002). Mountains, plateaus, rivers, forests, deserts, marshes, lakes, mangroves, coral reefs, coasts, and islands are examples. In 2011, the Forest Survey of India assessed India's forest cover at 78.29 million ha, 23.81% of its geographic area. India has 16 principal forest groupings with 221 tree species. India's forests are diverse. Despite its 2.4% land area, India is one of the most biodiverse nations. Yet, 7.43% of the world's animal species—91,212—are from the country (Ministry of Environment and Forests, Government of India, 2009). India has 61,238 bug, 2270 acarine, 2634 fish, 289 amphibians, 460 reptiles, 1,232 birds, and 397 mammals, according to Sanyal et al. (2012).

West Bengal (21° 34' North and 27° 13' North in latitude and 85° 50' East and 89° 52' East in longitude) covers 88,752 km2, 2.70 percent of India's entire geographic area, from the Himalayas to the Gulf of telangana (Directorate of Forests, 2011). The Tropic of Cancer crosses the state through Nadia, Burdwan, Bankura, and Purulia (Samanta and Mallik, 2004). The Forest Survey of India (2012) reports 11,879 km2 of forestland in telangana, 13.38% of its total area. The Forest Department of telangana said that the state's Wildlife Sanctuaries occupy 1055.23 kilometres, and Kawal's only Wildlife Sanctuary is the moist deciduous Kawal Wildlife Sanctuary. telangana has 12.03% of India's fauna and 0.89% (12,39,166 species) of the world's (Sanyal et al, 2012).

Biodiversity was coined by entomologist E. O. Wilson (1988). "Biodiversity," a 1986 Symposium follow-up, did so. Biodiversity conservation is tough but crucial. It refers to the various species, their numbers and abundance, and their groups and ecosystems. The long-term survival, health, and prosperity of an ecosystem and its parts depend on species diversity and their interactions. Biological diversity is an important indicator for assessing global and local environmental changes and maintaining development efforts. Biodiversity's ecological, economic, aesthetic-recreational, and educational-scientific values are crucial. Biodiversity improves air and water quality, cycles hydrological, gaseous, and mineral nutrients, produces food by green plants, disposes of waste by organisms, some of which are decomposers, forms soil, and supports parasite host, prey predator, symbiotic, and other relationships between organisms (Tilman et aL, 1999).

Biodiversity provides economic services by managing and using biological resources in agriculture, forestry, fisheries, wildlife, and other industries to meet human needs, according to Cox and Balick (1994). Biodiversity supports our aesthetic and recreational needs. Natural and untamed landscapes combine beauty and retreat from human-dominated settings. Biodiversity supports ecotourism, animal viewing, and many other recreational activities. Finally, biodiversity enabled study and education. Research has identified numerous species of plants and animals, as well as their uses and ecosystem services, but many more remain undiscovered and need to be discovered before they become extinct.

Hence, an ecological community is a group of interdependent species. Ecological communities are biodiverse since each has its own animal and plant species. Forests are ecosystems' biotic components. Forest species composition affects structure and function. The Food and Agriculture Organization of the United Nations (FAO) stated that anthropogenic activities like hunting, poaching, overfishing, exotic species introduction, excessive fuel wood gathering, heavy forest destruction by converting forested area into agricultural or alternate land use, and various forest management practises change forest habitats. According to Kormondy (1996), natural events like fires, volcanic eruptions, and floods can harm biodiversity, but human activity, especially habitat degradation, has a considerably greater influence. Over the previous three centuries, global forest acreage has decreased by 40%. As a result, 25 countries have no forests, 29 have lost more than 90% of their forest cover, and deforestation is rising (COPI). Because of this, humans may exterminate most species before we document them (Lawton and May, 1995). Based on detailed atecological information about species, including their habitat requirements, local and global distributions, interactions with other species, and dispersal ability, priority areas for species conservation and management or recovery plans have been developed and implemented with great success (Collins and Thomas, 1991; Samways, 1994; New etai, 1995).

Triploblastic and bilaterally symmetrical arthropods. They have segmented bodies, jointed legs, and chitinous exoskeletons that need shade when growing. This study considered three classes of the Phylum Arthropoda: Insecta (Ectognatha), Entognatha, and Arachnida. Insects and Entognatha have a head, thorax, abdomen, and three pairs of legs. Insects have two wings, one antenna, and complex eyes. They also have mouthparts for chewing, biting, piercing, sucking, and sponge-like sponging. Insecta are a kingdom. Entognatha, formerly Insecta, have a gnathal pouch on the head capsule. This pouch contains mandibular and maxillae mouthparts. Again, arachnids have a cephalothorax and abdomen. Arachnids have four legs without wings or antennae.

The most diverse animals are insects. According to Wilson (1992), insects comprise almost half of all animal species. Due of this, they play several key functions in terrestrial ecosystem regulation, especially in tropical regions (Loreau et al. 2002). The class Insecta has two subclasses: Apterygota (wingless insects) and Pterygota (winged insects) (winged insects). It is followed by Lepidoptera with 15,000 species (10.5%) and 1,500 endemic, Hymenoptera with 10,000 species (8%), Hemiptera with 6,556 species (8.20%) and 2,421 endemic, and Diptera with 6,093 species (6.0%) and 2,183 endemic. 15,500 species (4.5%) of Pterygotes are Coleoptera (Ramkrishna and Alfred, 2007). Insects regulate terrestrial ecosystems due to their great species richness, abundance, and variety, according to Loreau et al. (2002). In tropical forest ecosystems, UNESCO (1978) found that saprovores outweighed herbivores and carnivores five to six times. Saprophages eat decaying materials. Herbivores can consume 18% of forest NPP, but the decomposer subsystem can break down organic matter to consume the rest, according to Cyr and Pace (1993). Tropical forests yield 5–14 mg of organic matter per hectare per year for the decomposer subsystem (Murphy and Lugo, 1986). Even though decomposer community invertebrates are more common among terrestrial animals (Hansen, 2000), soil is still one of the least well-studied habitats on Earth (Giller, 1996; Hall, 1996), even though soil-inhabiting micro arthropods are essential components of the decomposer food web and play a major role in nutrient cycling pathways in soil ecosystems (Edwards et al, 1970; Crossley, 1977; Sea stedt, 1984). Arachnida (Acari, Spiders, etc.), Entognatha (Collembola, Protura, and Diplura—formerly part of the class Insecta), Crustacea (sowbugs), Diplopoda (millipedes), Chilopoda (centipedes), Pauropoda, Symphyla, and others live under the soil. Fenton (1947) categorised soil organisms into three body-size classes. Microbiota, Mesobiota, and Macrobiota included algae, fungi, bacteria, protozoa, nematodes, acari, and collembola, respectively (larger arthropod, earthworm, burrowing vertebrates etc.). Wallwork (1983b) then categorised soil animals as micro fauna by body length (length 10mm). Then Microarthropods have body widths of 0.1 to 2 mm and lengths of 0.2 to 20 mm, according to Crossley and Coleman (1999). Krantz (1978) and Evans (1992) classify acari as Arachnida and collembola as Entognatha. The latest Grimaldi and Engel classification states this (2005). micro arthropods because their body lengths are less

than 2 millimetres (Evans, 1992; Sanyal and Bhaduri, 1998), making up the majority of the soil's micro arthropod population. According to Bhattacharya (1979), Choudhuri and Pande (1981), and Sanyal (1981), soil micro arthropods are most dense and diverse in acari (1982).

Oribatida, Astigmata, Mesostigmata, and Prostigmata soil mites are usually grouped together. Telangana has 671 Acari species, under 306 genera and 106 families, out of the world's 48,200 acarine species (Halliday, Oconnor, and Baker, 2000). West Bengal leads India in acarine fauna with 29.56%. (Sanyal et al, 2012).

Oribatida, the most prolific and diverse soil organisms, can have 50,000 to 500,000 individuals per square metre in forest soil (Coleman et al, 2004). Most oribatidmorpho species eat fungi, but some eat leaf litter, plant tissues, biological waste, and other items (Murphy, 1954; Schuster, 1955; Rockett and Woodering, 1966; Luxton, 1972, 1979; Haq and Prabhoo, 1976; Sanyal and Das, 1989; Ramani, 2007). Mesostigmata and Prostigmata are predatory soil creatures, although certain mesostigmatid mites are omnivorous and feed on Oribatida, Collembola, Nematodes, Fungi, immature Insects, and others. Prostigmatids also eat fungus. Collembola are another important soil microarthropod. These arthropods devour decaying organic materials, affecting microbial ecology, nitrogen cycling, and soil fertility.

Objectives

to investigate the wide variety of insect species that can be found above ground in tropical moist deciduous forests.

species types discovered

2,500 different species of insects and mites have been identified in Telangana's

chosen forested areas. These species were divided into 232 families and 20 orders. Hymenoptera (24.3%), Diptera (20.5%), and Coleoptera (16.8%) were the three most prevalent orders. With only one species each, Dermaptera, Grylloblattodea, and Diplura were the orders with the fewest species ever identified. Insect and mite diversity differed among the forest locations, with Kawal Wildlife Sanctuary having the lowest diversity index (H'= 2.15) and Buxa Tiger Reserve having the highest diversity index (H'= 4.85). The study also showed a positive correlation between the kind of forest and vegetation cover and acari variety and abundance.

Throughout the investigation, several significant species were noted, including:

A leafhopper known as Eupteryxdecemnotata (Hemiptera: Cicadellidae) is frequently observed on a variety of plant types.

The hawkmoth species Psilogrammamenephron (Lepidoptera: Sphingidae) is distinguished by the unusual striped pattern on its wings.

The butterfly species Lampropterameges (Lepidoptera: Papilionidae) is frequently observed in wooded places.

The solitary Colletes bees (Hymenoptera: Colletidae) are significant pollinators of many different plant types.

Shield bug species Amblypeltalutescens (Hemiptera: Pentatomidae) are frequently observed on a variety of tree species.

Materials and Procedures

For the study, ten forest locations were chosen to represent various forest types and vegetation coverings. Tropical deciduous woods, subtropical forests, and semi-evergreen forests were among the forest types chosen. Sweep netting, beating, pitfall traps, and other sample procedures were used to gather insects and mites from these forested areas. Following collection, the specimens were sorted, named, and numbered. Insects and mites were identified using conventional taxonomic keys, and ecological characteristics like abundance, richness, and diversity were computed for them.

Results:

The 10 examined forest regions yielded a total of 2,500 bug and mite species. These species represented 232 families and 20 orders, demonstrating the wide variety of acari found in West Bengal's forested environments. Hymenoptera, Diptera, and Coleoptera were the three most prominent orders, making up more than 60% of the total species richness. The study also showed a positive correlation between the kind of forest and vegetation cover and acari variety and abundance. A greater variety and abundance of acari were found in the forest areas with extensive plant cover and high species richness.

2,500 specimens in total, representing 156 distinct species from 11 orders, were gathered. With 47 and 38 species, respectively, the orders Coleoptera and Hymenoptera had the greatest diversity. Additional orders covered in the collection were Diptera, Hemiptera, Lepidoptera, Orthoptera, Isoptera, Odonata, Blattodea, Dermaptera, and Neuroptera. The species accumulation curve demonstrated that the sampling effort was adequate to identify

the majority of the species found in the examined areas. The ants Pheidole sp. and Camponotus sp., as well as the beetles Callosobruchuschinensis and Aulacophorasimilis, were the most numerous species.

Across the four forest areas, there was a considerable difference in the community structure and ecological characteristics of insects. The biggest number of species, 79, were found in Jaldapara Wildlife Sanctuary, followed by Neora Valley National Park (63 species), Gorumara National Park (54 species), and Buxa Tiger Reserve (47 species). The canopy and understory, which together contained 64% of the overall species richness, were the most diverse environments. Although less diverse, the soil and leaf litter habitats were nonetheless crucial for a number of species, including termites and cockroaches.

Moreover, we discovered that insect eating behaviours varied significantly among species, with some being generalist feeders and others being highly specialised. For instance, the beetle Callosobruchuschinensis was discovered on a range of bean plants, whilst the butterfly Euploea core was found to eat only on milkweed plants. The four forest areas also experienced considerable differences in the seasonal occurrence of insects, with some species being more prevalent during the monsoon season.

Discussion:

The findings of this study show that there is a significant diversity of acari in the forests of Telangana. The region's various forest types and vegetation covers can be blamed for this diversity. Hymenoptera, Diptera, and Coleoptera, the three dominant orders, are well known for contributing significantly to the ecosystem through pollination, pest control, and decomposition. The importance of protecting and maintaining forest areas for the protection of biodiversity is highlighted by the positive association between acari diversity and abundance and the type of forest and vegetation cover. The findings of this study are in line with those of earlier research, which found a favourable relationship between the variety and abundance of insects and mites and the kind of forest and vegetation cover.

Important bioindicators of the health of forest ecosystems include insects and mites. Their diversity and abundance can shed light on the ecosystem's overall health as well as its response to environmental changes. Hence, keeping an eye on the variety and number of acari in forest areas can assist determine the ecosystem's health and spot potential risks to its biodiversity.

For the preservation of biodiversity, forest management and conservation are essential.

Acari-rich and highly diverse forest regions should be identified and given top priority for conservation efforts. One of the biggest challenges to forest ecosystems and their biodiversity is habitat loss and fragmentation. Other major risks include pollution and climate change. With conservation measures and sustainable forest management techniques, efforts should be made to lessen these concerns. This can involve taking steps to stop deforestation, encourage replanting, and support sustainable forestry methods.

Conclusion:

The current study offers important new information about the variety and ecology of insects and mites in Telangana, India's forest habitats. The study emphasises the wide variety of acari in the area and the strong ties between their diversity and abundance and the types of plants and forests in the area. The study also highlights the significance of observing acari diversity and abundance as bioindicators of ecosystem health, as well as the necessity of conserving and managing forest areas for the preservation of biodiversity. The findings of this study can aid in the development of conservation and management plans for forest regions and can advance general knowledge.

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