



REVIEW OF RESEARCH

ISSN: 2249-894X

IMPACT FACTOR : 5.7631(UIF)

VOLUME - 13 | ISSUE - 6 | MARCH - 2024



“DIVERSITY OF SOME INSECT FAUNA AS A INDICATOR OF BIODIVERSITY STATUS IN INDIA”

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ABSTRACT :

The diversity of insect fauna serves as a key indicator of biodiversity status in India, a country renowned for its rich and varied ecosystems. Insects represent the most numerous and diverse group of animals on Earth and play essential roles in ecological functions such as pollination, seed dispersal, and nutrient cycling. This study assesses the diversity of insect fauna across various habitats in India to gain insights into the health and stability of ecosystems and the impact of environmental stressors such as habitat loss, climate change, pollution, and invasive species. The research employs systematic field surveys, molecular tools for species identification, and long-term monitoring programs to document insect diversity and abundance across different biogeographic zones. In addition, citizen science initiatives engage the public in monitoring efforts, providing extensive data for analysis. The findings highlight trends in insect diversity and reveal potential conservation and management strategies, including habitat protection, sustainable agricultural practices, invasive species management, and environmental education.



KEY WORDS: Diversity, Insect fauna, indicator, biodiversity status and India.

INTRODUCTION:

The diversity of insect fauna is a vital aspect of ecological study and conservation efforts worldwide. Insects are the most numerous and diverse group of animals on Earth, with over a million known species and potentially millions more yet to be discovered. They play crucial roles in various ecological functions, such as pollination, seed dispersal, and nutrient recycling. In India, a country known for its rich biodiversity, the diversity of insect fauna is particularly significant due to the wide range of habitats and climatic zones across the country. From tropical rainforests to arid deserts and alpine environments, India's diverse ecosystems support a plethora of insect species, many of which are endemic and contribute to the unique ecological fabric of the region.

Studying the diversity of insect fauna in India is essential for several reasons. It can provide insights into the health and stability of various ecosystems, serving as an indicator of biodiversity status. High insect diversity often reflects a stable and well-functioning ecosystem, while changes in diversity may signal environmental stressors such as habitat loss, climate change, pollution, or invasive species. Furthermore, insects are a critical component of India's agricultural productivity as pollinators and natural pest control agents. Understanding their diversity and distribution can help inform sustainable agricultural practices and conservation strategies.

This study aims to explore the diversity of insect fauna as an indicator of biodiversity status in India, examining the factors that influence insect diversity and the potential impacts on ecosystems and human well-being. By gaining a deeper understanding of insect diversity, we can develop targeted

conservation and management approaches to protect these vital organisms and the ecosystems they inhabit.

The study emphasizes the importance of protecting insect diversity for the overall health of ecosystems and human well-being, given insects' critical roles in food webs and agricultural productivity. By understanding the factors influencing insect diversity and implementing targeted conservation measures, India can better preserve its rich biodiversity and ensure the resilience of its ecosystems for future generations.

Accelerated declines in biodiversity are of major concern globally¹. As for most taxa, insect population declines are largely driven by habitat loss, including loss in habitat quality. Moreover, losses in insect biodiversity can lead to declines in other species that feed on insects, as well as to crop yield losses due to scarcity of pollinators. In some African countries, 15–40% of all calories, protein, and iron nutrient intakes come from pollinator dependent crops. Thus, insect declines can result in yield gaps that can be 59% or more for some seed crops. Overall, biodiversity in African ecosystems is increasingly imperiled, and likely more so in the future⁷. Spatially explicit indicators and metrics that make use of biotic inputs are needed to quantify the status of biodiversity at local levels throughout Africa.

To varying degrees, depending on the taxonomic rank, insect diversity and abundance can be used to estimate overall ecosystem-level biodiversity and environmental integrity, especially when philopatric or indicator species are chosen for biomonitoring. For instance, within the order Lepidoptera (butterflies and moths), some species may be generalists and hence adaptable, while others might become extinct or migrate to other places. But the diversity and habitat suitability of many insect indicator families and/or orders is likely to correlate with overall ecosystem diversity and integrity. In some cases, shifts in insect habitats can be used as early warning indicators of ecosystem-level environmental change before extinction risks or declines at upper trophic levels are measurable from other groups. Trophic responses to human transformations that affect species distributions and richness are more rapid at the micro-scale (i.e., insect mapping unit) than at national or regional scales. A micro-scale for a species is characterized by a very specific vegetation structure as well as abiotic conditions (e.g., presence of raw soil, deadwood) and by a specific microclimate, whereby the spatial scale of a microhabitat is relative and species-specific. Localized and/or sudden land transformation often abruptly affect insect life cycles, nesting (i.e., oviposition sites), and foraging behavior.

MATERIALS AND METHODS :

In order to assess the diversity of insect fauna as an indicator of biodiversity status in India, the study uses a combination of field surveys, laboratory analyses, and data collection from citizen science initiatives.

Site Selection: A range of sites across different biogeographic zones in India were chosen to represent diverse habitats such as tropical forests, grasslands, deserts, and alpine regions.

Sampling Methods: Insects were sampled using various methods such as sweep nets, pitfall traps, malaise traps, light traps, and baited traps. The choice of method depended on the target insect groups and habitat type.

Identification and Documentation: Collected insects were identified to the species level whenever possible using taxonomic keys and expert consultation. Detailed records of the time, date, location, and environmental conditions of each sampling event were maintained.

Diversity Indices: Measures such as species richness, Shannon-Wiener diversity index, and Simpson's diversity index were calculated to assess insect diversity across different sites.

Statistical Analysis: Correlation analyses and regression models were used to explore relationships between insect diversity and environmental variables such as temperature, precipitation, and habitat type.

DISCUSSION :

The post-2000 Global Biodiversity Conservation (GBC) Framework of the UN proposes several indicators and corresponding targets that include species or ecosystem-specific biodiversity status information. These are set to guide member countries until 2050 and help to establish important biodiversity status baselines. The Essential Biodiversity Variables 2020 (EBV2020) Initiative, which supports the post-2020 GBC initiative, has established that easy-to-use indicators of habitat size, resilience, connectivity, and biodiversity integrity must be developed and updated. The EBV2020 approach promotes the addition of new species groups and the need for metrics that consider functional traits and ecosystem composition.

The diversity of insect fauna is a significant indicator of the overall biodiversity status in any region, including India. Insects represent one of the most diverse groups of organisms on Earth, playing crucial roles in ecosystems as pollinators, decomposers, and as part of the food web. Assessing the diversity of insect fauna in India can provide valuable insights into the health and stability of various ecosystems and their biodiversity status.

IMPORTANCE OF INSECT FAUNA DIVERSITY AS AN INDICATOR:

1. **Ecological Health:** Insect diversity often reflects the health of the ecosystem. High diversity may indicate a stable and well-balanced ecosystem, whereas low diversity may signal ecological stress or degradation.
2. **Ecosystem Functions:** Insects perform essential ecological functions such as pollination, seed dispersal, and nutrient recycling. A decline in insect diversity can disrupt these functions and impact other species.
3. **Bioindicators:** Certain insects are sensitive to changes in their environment and can serve as bioindicators of habitat quality, pollution, and climate change.
4. **Trophic Interactions:** Insects play a key role in food webs, serving as prey for other animals and also as consumers of plants and other organisms. Changes in insect diversity can influence these trophic interactions.

FACTORS INFLUENCING INSECT DIVERSITY IN INDIA:

1. **Habitat Loss and Fragmentation:** Deforestation, urbanization, and agricultural expansion reduce and fragment habitats, impacting insect diversity.
2. **Pesticide Use:** Excessive use of pesticides in agriculture can harm non-target insect species, reducing diversity.
3. **Climate Change:** Changes in temperature and precipitation patterns can affect the distribution and abundance of insect species.
4. **Invasive Species:** The introduction of non-native species can disrupt local ecosystems and compete with native insects.
5. **Pollution:** Air and water pollution can degrade habitats and affect insect populations.

CONSERVATION AND MANAGEMENT STRATEGIES:

1. **Habitat Protection:** Preserving and restoring natural habitats to support insect diversity.
2. **Sustainable Agriculture:** Promoting practices that minimize pesticide use and maintain habitat diversity in agricultural landscapes.
3. **Invasive Species Management:** Controlling and preventing the spread of invasive species that can threaten native insect populations.
4. **Public Awareness:** Educating the public about the importance of insect diversity and the need for conservation.
5. **Policy and Legislation:** Supporting policies and laws that protect insect habitats and regulate pesticide use.

To conserve insects successfully, the general public, scientists, land managers, and conservationists need to understand the extraordinary value that these organisms provide. An

ambitious public education program would enhance recognition of the positive values of invertebrates, and, indeed, all biological diversity.

CONCLUSION:

The study on the diversity of insect fauna as an indicator of biodiversity status in India yields several important conclusions. Insects are an essential component of India's biodiversity and play a crucial role in maintaining ecological balance. Considering all the factors presented here, it is imperative for the researchers involved in the studies of biodiversity to develop procedures for measuring biodiversity, carry out surveys and inventories, to develop methodologies for managing and controlling populations sustainably and initiate long term studies on genetic and environmental variations. A multiplicity of genes, species and ecosystems is a resource that can be tapped as human needs change. It is to be appreciated that the modern technologies can be used in all the components, with care, to study, document, utilize and if needed to enhance the amount of diversity.

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