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Biodiversity of butterflies in Jintur forest region

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Abstract
The Butterflies belong to the order Lepidoptera. It is one of the mega orders of the class Insecta, which occur throughout the world. Butterflies are visible and colorful insects. Due to their attractiveness, they have acquired a niche in the prose and poetry of various cultures. Therefore, they have made an excellent subject for natural history observations and scientific studies. Due to increasing population, man has exploited and destroyed wildlife habitats. Habitats are reduced due to urbanization, industrialization, agricultural development, vegetation manipulation, and shifting cultivation. Natural habitats such as forests, grasslands, deserts, wetlands, mangroves, etc., are under tremendous pressure due to increasing activities of human beings. Butterflies pollinate the crop plants grown worldwide for food, beverages, fibers, condiments, spices, and medicines. The paper reveals the species of butterflies in the Jintur forest region.

Keywords: Butterflies, pollinators, Jintur forest

Introduction
The Jintur forest, located in a mixed deciduous region, is home to a diverse range of flora, including trees such as teak, pals, khair, and babool. The Jintur hill range, part of the Sahyadri mountain system, features a crest line with flat tops that stand at an average elevation of 533.75 meters above mean sea level. While the scarp sides of this range are designated as reserve forest areas, they are often more like scrublands than dense forests, with scattered trees. The flat tops, which are suitable for agricultural activities, are occasionally included within these reserved forests. However, they are frequently encroached upon by the surrounding human population to meet the demands of growing settlements.

The increasing human population has led to the exploitation and degradation of natural habitats, particularly those of butterflies, which are heavily impacted by habitat loss, fragmentation, and transformation. These changes are largely driven by shifts in land use, such as urbanization, agricultural expansion, vegetation manipulation, and the introduction of non-native species. The destruction of these natural habitats, including forests and grasslands, has had severe consequences for the wildlife that depends on them.

Among the most critical relationships in nature is the one between pollinators and flowering plants. Pollinators-such as butterflies, bees, and other insects-play an essential role in the fertilization of plants, including those that provide food, beverages, fibers, spices, and medicinal products. They are also necessary for the successful proliferation of native plant species, maintaining the balance of ecosystems. Unfortunately, pollinators are facing significant declines due to the loss, fragmentation, and alteration of their habitats caused by human activities. The extensive use of pesticides, which kill both pests and pollinators, as well as the replacement of native plants and wildflowers with monoculture pastures, are major contributors to this decline.

These combined challenges highlight the urgent need for better land use practices and conservation efforts to protect both pollinators and the natural habitats on which they depend.

Materials and Methods
The study on species diversity and distribution patterns of butterflies in the Jintur forest was conducted from June 2023 to August 2024. The study area was thoroughly explored to identify potential sites for observation, and sampling sites were selected based on the area's accessibility and butterfly occurrence. Since butterflies exhibit seasonal variations in their abundance, the study was designed to assess their diversity throughout the year.

The year was divided into three distinct seasons: pre-monsoon (February to May), monsoon (June to September), and post-monsoon (October to January).

For each season, five sites within the Jintur forest selected for the survey. The study was conducted twice per season to capture seasonal fluctuations in butterfly populations. Field surveys were primarily conducted between 07:30 hrs and 12:30 hrs.

Butterflies were observed, identified, and captured using various methods for systematic and diversity studies. The following materials were employed to facilitate the survey and research

Materials

1. **Insect Net:** An insect net was used to collect butterflies from the field. It had an aluminum handle approximately 18 inches in length, with a circular metal ring of 9-inch diameter. The collecting bag, made of ordinary nylon mosquito netting cloth, was 30 inches in depth and attached to the metal ring. This design allowed for efficient capturing of butterflies during field surveys.
2. **Insect Boxes:** Standard insect boxes of various sizes were used for the preservation of butterflies. The boxes consisted of a basal wooden portion for securely pinning insects, with soft wood added for pinning. The top of the box was perforated with glass, and the rest of the sides were made of wooden material to ensure proper ventilation.
3. **Spreading Board:** The spreading board was used for pinning butterflies in a proper, systematic manner to preserve their structure and appearance for further examination and classification.
4. **Oven:** An oven was employed to dry insects after capture to prevent decomposition and preserve their physical condition for identification.
5. **Butter Paper Envelopes:** Butter paper envelopes (size 4" X 5") were used to store preserved butterflies. Each envelope was labeled with the name of the field collector, place, locality, date, and time of collection. These envelopes were then kept in transparent plastic boxes with naphthalene balls to protect the preserved butterflies from pests like ants.
6. **Magnifying Glass:** A magnifying glass was used to observe the identification marks on both the upper and lower sides of the forewings and hindwings of the butterflies to assist in accurate species identification.
7. **Insect Pins and Brushes:** Insect pins were used to pin butterflies to the spreading board for proper preservation. Brushes were employed for careful handling of butterflies, ensuring minimal damage to delicate specimens during collection and identification.

Methods

1. **Observation and Identification:** The butterfly species were observed in the field using visual identification techniques. Various physical characteristics such as wing patterns, colors, and markings on the forewings and hindwings were used to identify the species. In some cases, a magnifying glass was used to examine fine details for accurate identification.
2. **Capture and Release Method:** Butterflies were captured using insect nets and released back into their natural habitats after identification to minimize disturbance to the local population. This method allowed for non-invasive study of species diversity without significantly impacting the butterfly population.
3. **Collection and Preservation Method:** Specimens of butterflies were collected during field trips and preserved for further study. Specimens were pinned and stored in insect boxes, and dry specimens were placed in butter paper envelopes, labeled with essential information about the collection. This method allowed for proper long-term preservation and facilitated the identification of species based on physical characteristics.

Observation and Identification

During field visits, butterflies were observed by walking through various habitats, including fields, roadsides, gardens, streams, ghats, grasslands, hillsides, forests, nursery gardens, and public gardens. A typical observation route covered a distance of approximately half to one kilometer in different directions. Observations were made from a distance of one to two meters to closely examine the butterflies. Identification was primarily based on morphological features, including wing patterns, size, and coloration. In cases where identification was difficult by direct observation, unidentified species were photographed and later identified using field guides and identification keys.

Capture and Release Method

Some butterflies were challenging to identify by visual observation alone. In such cases, they were carefully captured using an insect net, then transferred to a transparent plastic box for closer inspection. Once in the box, the butterflies were identified using various field guides and relevant literature. After identification, the butterflies were safely released back into their original environment to minimize the impact on their population and ensure conservation.

Collection and Preservation Method

Butterfly specimens were collected from the study areas using an insect collecting net. As part of a conservation policy, the collection of species listed in Schedule I, II, and IV of the Wildlife Protection Act was avoided. Upon collection, butterflies were killed in an insect killing jar. Afterward, the specimens were pinned using insect pins on a spreading board to maintain their natural structure. The pinned butterflies were then dried in an oven at 60 °C to preserve them. Once dried, the specimens were stored in insect boxes or butter paper envelopes for further study. These preserved specimens were carefully examined for their size, shape, and distinctive wing markings, which were recorded for systematic study. The specimens were preserved for future reference and comparative analysis of morphological traits.

Table 1: Butterfly species distribution by family and seasonal variation in Jintur forest

Family	Number of Species found			Locality
	Pre-Monsoon	Monsoon	Post Monsoon	
Family: Papilionidae				Jintur forest
Common Rose - *Atrophaneura aristolochiae* (Fab.)	15	32	24	
Comonmomon – *Papilo polytes* (Linnaeus)	17	29	20	
LimeButterfly – Papilio demoleus (Linnaeus)	16	31	24	
Family: Pieridae				
Common Grass Yellow – *Eurema hecabe* (Linnaeus)	13	22	14	
Common Emigrant - *Catopsilia lemon* (Fab.)	10	17	11	
White orange tip	16	35	25	
Family: Nymphalids				
Common Evening Brown - *Melanitis leda* (Linnaeus)	11	16	16	
Great Eggfly – *Hypolimnas bolina* (Linnaeus)	14	19	17	
Joker *Byblia ilithyia* (Drury)	12	15	15	
Stripted tiger	21	40	31	

Results and Discussion

Butterflies, as living ecological components, play an important role in understanding biodiversity and ecosystem health. In the present study, three families of butterflies were recorded in the Georai region. A comprehensive checklist of the species identified is provided below.

Among the butterflies, the Swallowtails (Papilionidae) are a prominent group. India hosts about 105 species of Swallowtails, which constitutes a significant portion of the global diversity of these butterflies, as there are roughly 700 species worldwide. In the study area, 8 species of Swallowtails were identified, contributing to the rich butterfly fauna of the region.

Seasonal variation in butterfly population

The butterfly population in the Jintur forest region exhibited significant seasonal variation, which appears to be strongly influenced by climatic conditions and the availability of food sources. The peak density of butterflies was observed during the monsoon months, particularly from July to August, which is the period of maximum rainfall over the three years of the study. During these months, the region experiences an abundance of shrubs and vegetation, which are primary food sources for butterflies, particularly for species of Swallowtails.

The favorable climatic conditions, including moderate temperatures, high humidity, and abundant rainfall, provide an ideal environment for butterflies to thrive. Consequently, butterfly numbers were at their highest during the monsoon, especially in areas with a dense presence of host plants.

However, as the monsoon season subsides and the weather transitions into the cooler months of November and December, there is a notable decline in the butterfly population. This decrease is attributed to a reduction in the availability of food sources, such as shrubs and nectar-rich plants, which become scarce as the vegetation dies back or becomes dormant in response to the changing season. This lack of food resources, combined with the lower temperatures and reduced rainfall, leads to a decline in the density of butterflies in the study areas.

Conclusion

The data from this study underscore the crucial role of climatic factors, particularly temperature, humidity, and rainfall, in influencing butterfly populations. The monsoon months, with their favorable conditions, support a higher density of butterflies, while the dry months lead to a decline in numbers due to reduced food availability. These findings highlight the ecological interdependence between butterflies and the plant life in their habitats, as well as the significant role of climate in shaping the distribution and abundance of these species in the Georai region.

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