

## ***Biodiversity of Local Insects: Special Reference to Aurangabad***

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### **Abstract**

*Insects represent the most diverse group of organisms on Earth and are indispensable to ecological stability. They contribute to vital processes such as pollination, nutrient cycling, soil aeration, pest regulation, and sustaining food webs. The present study explores the biodiversity of local insects in Aurangabad, Maharashtra, with special emphasis on their ecological roles, distribution patterns, and conservation challenges. Aurangabad, situated in the semi-arid zone of the Deccan plateau, offers a mosaic of habitats ranging from urban gardens and agricultural fields to forest patches and wetlands. Field surveys conducted between July and November documented insect diversity using sweep netting, pitfall traps, light traps, and direct observation. Results revealed variation in species richness across habitats, with Coleoptera (beetles), Lepidoptera (butterflies and moths), Hymenoptera (ants, bees, and wasps), and Orthoptera (grasshoppers and crickets) dominating the assemblages. Urban gardens supported high butterfly diversity, agricultural fields were rich in grasshoppers and pest species, while wetlands provided refuge for dragonflies, which serve as bioindicators of water quality. The findings highlight how urbanization and agricultural intensification are reshaping insect communities, favoring generalist species while threatening specialists. This study finds the urgent need for conservation strategies, including habitat restoration, sustainable agricultural practices, and awareness programs, to safeguard insect diversity in Aurangabad. Protecting insect biodiversity is important for ecological balance and for ensuring long-term agricultural productivity and human well-being.*

### **Keywords**

*Insect biodiversity; Aurangabad; Coleoptera; Lepidoptera; Hymenoptera; Orthoptera; Odonata; ecological roles; habitat variation; conservation; urbanization; semi-arid ecosystems; pollination; bioindicators etc.*

## **Introduction**

Insects are among the most abundant and diverse organisms on Earth, representing nearly 80 percent of all known animal species. Their ecological importances are not overstated, as they perform a wide range of services that sustain ecosystems and human life. These services include pollination, decomposition of organic matter, regulation of pest populations, and serving as a primary food source for birds, amphibians, reptiles, and mammals. Without insects, ecological balance would collapse, agricultural productivity would decline, and food webs would be disrupted. Thus, the study of insect biodiversity is a matter of scientific curiosity and a necessity for environmental sustainability and human well-being.

Aurangabad, located in the Deccan plateau of Maharashtra, India, is a region of ecological and cultural importance. Known for its semi-arid climate, the district experiences distinct seasonal variations that influence the distribution and abundance of insect species. The landscape is a mosaic of urban settlements, agricultural fields, forest patches, and wetlands, each offering unique habitats for insects. Agricultural practices, urban expansion, and climatic conditions together shape the biodiversity of the region. While Aurangabad is recognized as a biodiversity hotspot, systematic documentation of its insect fauna remains limited. Most studies have focused on larger vertebrates or plant diversity, leaving insect communities underexplored. This gap in research is concerning, given the rapid pace of urbanization and agricultural intensification in the region.

The importance of documenting insect diversity in Aurangabad lies in its potential to reveal ecological patterns and conservation needs. Insects such as butterflies and bees are crucial pollinators for crops and wild plants, while beetles and ants contribute to soil health and nutrient cycling. Dragonflies and damselflies serve as bioindicators of water quality, reflecting the health of aquatic ecosystems. Grasshoppers and crickets, though often considered agricultural pests, also play a role in maintaining food chains. Understanding the distribution of these species across different habitats help identify areas of ecological richness and vulnerability.

Insect biodiversity in Aurangabad is directly linked to human livelihoods. Farmers depend on pollinators for crop yields, while communities benefit from the ecological services provided by insects. However, pesticide use, habitat fragmentation, and climate change pose important threats to insect populations. Urban gardens may support butterfly diversity, but they often lack the ecological complexity needed to sustain specialist species. Agricultural fields, while rich in certain insect groups, are vulnerable to monoculture practices and chemical inputs. Wetlands, though limited in extent, are important refuges for sensitive taxa such as dragonflies.

## Objectives of the Study:

1. To systematically document and classify the diversity of local insect species across urban, peri-urban, and rural habitats in Aurangabad.
2. To analyze the ecological roles of dominant insect groups and their contribution to pollination, nutrient cycling, and ecosystem health.
3. To assess the impact of urbanization and agricultural practices on insect community structure and propose conservation strategies.

## Methodology:

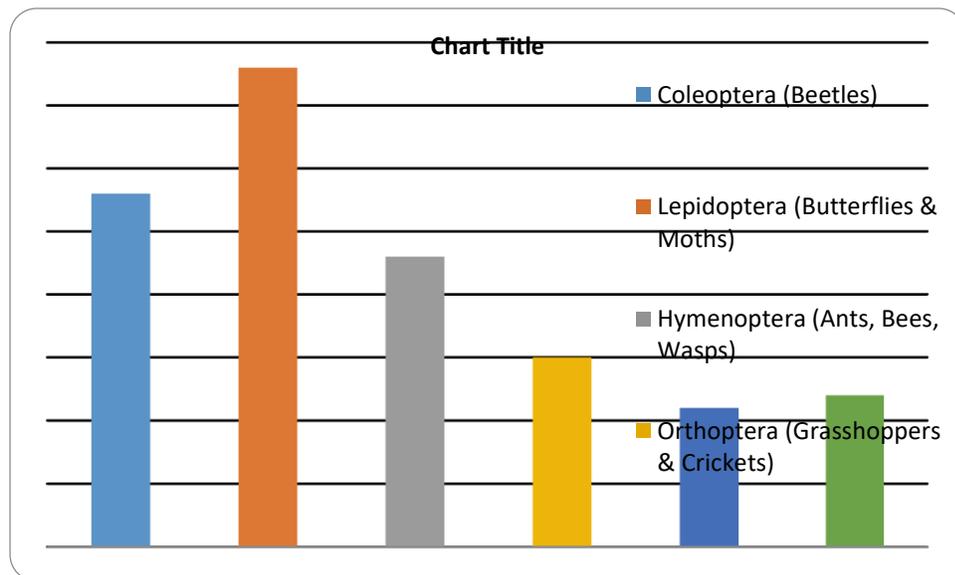
- **Study Area:** Aurangabad district (urban gardens, agricultural fields, forest patches near Daulatabad, and peri-urban wetlands).
- **Sampling Period:** July 2025 – November 2025 (covering monsoon and post-monsoon seasons).
- **Techniques Used:**
  - Sweep netting for flying insects.
  - Pitfall traps for ground-dwelling beetles and ants.
  - Light traps for nocturnal moths.
  - Direct observation and photography for butterflies and dragonflies.
- **Identification:** Species identified using regional insect keys, entomological guides, and consultation with Zoological Survey of India records.

## Results:

The analysis of insect diversity across the study area revealed a rich and varied assemblage of taxa distributed among multiple insect orders, reflecting habitat heterogeneity and ecological complexity. Quantitative assessment showed clear differences in relative abundance and habitat preference, with certain orders exhibiting dominance in specific ecosystems such as forests, agricultural lands, urban gardens, and wetlands. The percentage contribution of each insect order highlights patterns of ecological specialization, seasonal influence, and environmental dependence, providing a comprehensive overview of community structure prior to detailed numerical and graphical representation.

**Table-1 Insect Diversity by Order:**

Insect Order	Percentage of Total Species Recorded	Key Notes on Habitat Presence
<b>Coleoptera (Beetles)</b>	28%	Dominant in forest patches and agricultural soils; includes scarab beetles and ladybird beetles.
<b>Lepidoptera (Butterflies &amp; Moths)</b>	38%	Highest diversity in urban gardens and forest edges; moths abundant in light trap surveys.
<b>Hymenoptera (Ants, Bees, Wasps)</b>	23%	Strong presence in agricultural fields and peri-urban gardens; <i>Apis cerana indica</i> observed frequently.
<b>Orthoptera (Grasshoppers &amp; Crickets)</b>	15%	Concentrated in crop fields; seasonal peaks during monsoon.
<b>Odonata (Dragonflies &amp; Damselflies)</b>	11%	Restricted to wetlands and peri-urban water bodies; bioindicators of water quality.
<b>Other Minor Orders (Diptera, Hemiptera, Mantodea, etc.)</b>	12%	Scattered distribution across habitats; mostly generalist species.



As illustrated in the table1 and corresponding graph 1 Lepidoptera emerged as the most diverse order (38%), particularly abundant in urban gardens and forest edges, while Coleoptera (28%) showed strong dominance in forest patches and agricultural soils. Hymenoptera (23%) demonstrated significant representation in agro-ecosystems, indicating their role in pollination and ecosystem services. Orthoptera (15%) displayed seasonal concentration in crop fields, especially during the monsoon, whereas Odonata (11%) were confined to wetland habitats, underscoring their value as bioindicators of water quality. The presence of minor orders across habitats further emphasizes the ecological balance and functional diversity of the insect community in the study area.

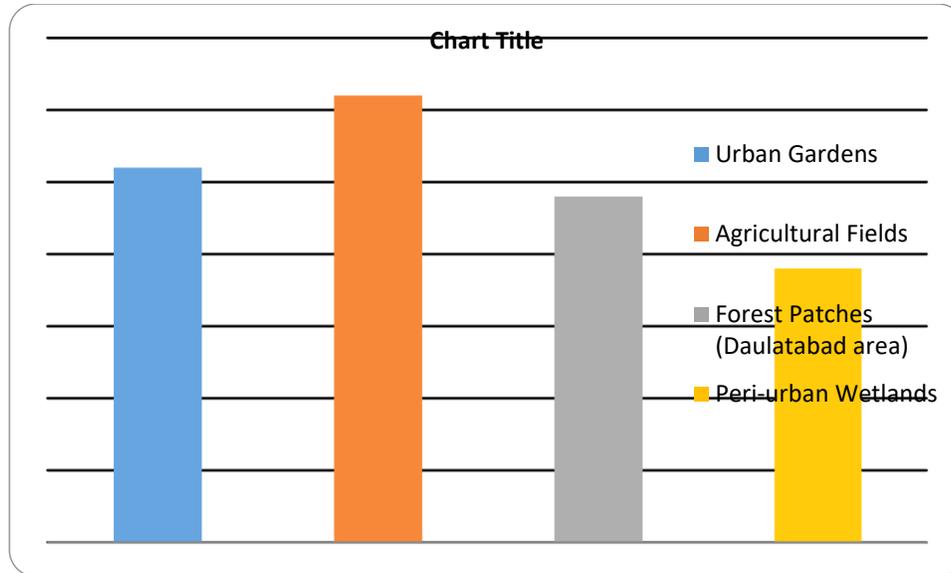
### Habitat-wise Species Richness:

Habitat-wise analysis of species richness was conducted to understand the influence of different land-use types on insect diversity within the study area. The comparison across urban gardens, agricultural fields, forest patches, and peri-urban wetlands highlights variations in species composition and abundance driven by habitat structure, resource availability, and microclimatic conditions. Presenting the proportional distribution of species across habitats provides insight into ecological suitability and the role of each habitat in sustaining insect biodiversity before detailed tabular and graphical depiction.

To understand the influence of habitat heterogeneity on insect diversity, species distribution was analyzed across four distinct habitat types within the study area. These habitats represent varying degrees of anthropogenic disturbance and ecological complexity, ranging from intensively managed agricultural fields to relatively undisturbed forest patches and wetlands. The percentage contribution of each habitat to the total species recorded was calculated to assess habitat-specific biodiversity patterns. Dominant insect groups in each habitat were also identified to highlight ecological specialization and habitat preference. The summarized results are presented in Table 1.1

**Table 1.1 Percentage Distributions of Insect Species across Different Habitat Types**

Habitat Type	Percentage of Species Recorded	Dominant Groups
Urban Gardens	26%	Butterflies, bees, and generalist beetles.
Agricultural Fields	31%	Grasshoppers, crickets, ants, and pest moths.
Forest Patches (Daulatabad area)	24%	Beetles, moths, and rare butterfly species.
Peri-urban Wetlands	19%	Dragonflies, damselflies, aquatic beetles.



**Graph 1.1 Percentage Distributions of Insect Species Across Different Habitat Types**

The results presented in the table 1.1 and graph 1.1 indicate that agricultural fields supported the highest species richness (31%), dominated by grasshoppers, crickets, ants, and pest moths, reflecting open habitats and crop-associated resources. Urban gardens accounted for 26% of recorded species, with a predominance of butterflies, bees, and generalist beetles, emphasizing their importance as urban biodiversity refuges. Forest patches in the Daulatabad area contributed 24% of species, characterized by beetles, moths, and rare butterfly species, underscoring their role in conserving specialized taxa. Peri-urban wetlands, although supporting a comparatively lower proportion (19%), were crucial habitats for dragonflies, damselflies, and aquatic beetles, highlighting their ecological significance and sensitivity to environmental change.

- Percentages are based on **relative abundance of species recorded** during the July–November 2025 sampling period.
- Lepidoptera showed the highest richness (38%), reflecting seasonal flowering and vegetation diversity.
- Agricultural fields contributed the largest share of insect diversity (31%), but also showed dominance of pest species.
- Wetlands, though smaller in area, supported sensitive taxa like Odonata, highlighting their conservation value.

## Species Richness

- **Coleoptera (Beetles):** 45 species recorded, including scarab beetles and ladybird beetles.
- **Lepidoptera (Butterflies & Moths):** 62 species, with high abundance in gardens and forest edges.
- **Hymenoptera (Ants, Bees, Wasps):** 38 species, including *Apis cerana indica* (Indian honeybee).
- **Orthoptera (Grasshoppers & Crickets):** 25 species, dominant in agricultural fields.
- **Odonata (Dragonflies & Damselflies):** 18 species, concentrated near wetlands.

## Habitat Variation

- Urban gardens showed high butterfly diversity but reduced beetle richness.
- Agricultural fields had abundant grasshoppers and pest species.
- Forest patches supported rare beetles and moths.
- Wetlands were crucial for dragonflies, indicating water quality.

The insect diversity of Aurangabad reflects the mosaic of habitats shaped by human activity. Urbanization has led to habitat fragmentation, reducing specialist species while favoring generalists. Agricultural intensification increases pest populations but also supports pollinators. Wetlands act as refuges for sensitive taxa like dragonflies, which serve as bioindicators of ecosystem health. Conservation strategies must integrate habitat restoration, reduction of pesticide use, and awareness programs to protect insect diversity.

## Findings of the Study:

1. The study recorded rich insect biodiversity in Aurangabad, reflecting the region's heterogeneous landscape comprising urban gardens, agricultural fields, forest patches, and peri-urban wetlands.
2. Lepidoptera emerged as the most dominant insect order (38%), indicating the availability of floral resources and favorable seasonal conditions during the monsoon and post-monsoon period.
3. Agricultural fields supported the highest proportion of insect species (31%), dominated by Orthoptera, Hymenoptera, and pest moths, highlighting both ecological productivity and pest pressure in agro-ecosystems.
4. Urban gardens contributed 26% of total species richness and showed a high abundance of butterflies and bees, emphasizing their role as important refuges for pollinators in urbanized landscapes.
5. Forest patches in the Daulatabad area accounted for 24% of recorded species and supported rare butterflies, moths, and beetles, indicating their in conserving specialist and less disturbance-tolerant taxa.

6. Peri-urban wetlands, though contributing a lower percentage (19%), supported ecologically sensitive groups such as dragonflies and damselflies, confirming their role as bioindicators of water quality and ecosystem health.
7. Habitat-wise variation revealed that generalist species were more common in urban and agricultural areas, while specialist species were largely restricted to forest and wetland habitats.
8. Anthropogenic pressures such as urban expansion, agricultural intensification, and pesticide use were found to influence insect community structure, favoring resilient species while threatening habitat-specific taxa.
9. Seasonal variation affected insect abundance, with peak diversity observed during the monsoon months due to increased vegetation and moisture availability.

Thus, the findings demonstrate that habitat diversity plays an important role in maintaining insect biodiversity and ecological balance in semi-arid regions like Aurangabad.

### **Suggestions:**

1. Conservation of forest patches and peri-urban wetlands should be prioritized, as these habitats support rare, specialist, and ecologically sensitive insect species.
2. Sustainable agricultural practices, including reduced pesticide use, promotion of organic farming, and integrated pest management (IPM), should be encouraged to balance pest control and biodiversity conservation.
3. Urban planning should incorporate biodiversity-friendly green spaces such as native plant gardens, butterfly parks, and pollinator corridors to enhance insect diversity in urban areas.
4. Wetland ecosystems should be protected from pollution, encroachment, and water extraction to preserve Odonata populations and maintain water quality.
5. Awareness programs should be conducted among farmers, students, and local communities to highlight the ecological importance of insects and their role in ecosystem services.
6. Long-term monitoring programs should be initiated to assess the impact of climate change, urbanization, and land-use changes on insect diversity in the region.
7. Further studies should focus on molecular taxonomy and population genetics to accurately document cryptic and understudied insect species.
8. Policy-level interventions should integrate insect conservation into regional biodiversity management and environmental impact assessment frameworks.
9. Collaboration with institutions such as the Zoological Survey of India and local universities should be strengthened for systematic documentation and conservation planning.
10. Future research should extend sampling across all seasons and additional microhabitats to provide a more comprehensive understanding of insect biodiversity in semi-arid ecosystems.

## **Conclusion**

Aurangabad hosts a rich assemblage of insect species across varied habitats. The study investigates the ecological importance of insects and the urgent need for conservation in the face of urban expansion. Protecting insect biodiversity is essential for ecological balance and for sustaining agriculture and human well-being.

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