

Diversity and ecological assessment of insect fauna in the Jaisamand Lake Region, Alwar, Rajasthan, India

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Abstract

This research of Alwar district of Rajasthan presents a detailed taxonomic assessment of insect biodiversity in Jaisamand Lake area. This study aimed to assess insect biodiversity, as well as water quality, ecological distribution and environmental significance. I did this research work in November 2024-December 2024, February 2025- March 2025 and May - June 2025 on Saturday, Sunday and Thursday from 7:00am to 11:00 am and 4:00 pm to 6:00 pm. Insects are one of the most important biological barriers to terrestrial and water ecosystems, Species of insects belonging to six major orders were identified during the study period and 350 specimens of entomofauna of 40 species from 18 families were collected. Order Lepidoptera was observed maximum abundant followed by order coleoptera, Hymenoptera, orthoptera Diptera and Hemiptera, Maximum species richness was observed from 15 families.

Nymphalidae (03 species order - Lepidoptera), Pieridae (05 species order Lepidoptera), Erebidiae (05 species order - Lepidoptera), Crambidae (06 species order - Lepidoptera), Pyralidae (02 species order - Lepidoptera), Geometridae (2 species order - Lepidoptera), Boarmiini (2 species order - Lepidoptera), Scarabidae (2 species order - Coleoptera), Dytiscidae (2 species order - Coleoptera), Pentatomidae (2 species order - Hemiptera), Single species from family Gryllidae (order - orthoptera), Hydrometridae (order - Hemiptera), Apidae (order- Hymenoptera), Musca domestica (order - Diptera), Aphidiidae (order - Hemiptera), Tridactylidae (order - Orthoptera), Danaus Chrysippus, Aloa Lactinea, Melipotis cellaris, Two spotted bug and Apis dorsata are the abundance species.

Keywords: Insect diversity, biodiversity indices, Jaisamand Lake, relative abundance, bioindicators, taxonomic identification

Introduction

Insects are the largest and most diverse group of organisms of Earth. They are found in (almost) all terrestrial and freshwater habitats and perform crucial ecological functions essential for ecosystem stability and environment sustainability. Studying the aquatic biodiversity of Alwar district, known for its unique geographical location and historic lakes is highly relevant to environment conservation. Insects play a vital role in pollination, nutrient cycling, decomposition of organic matter, biological control of pests, soil aeration, and maintenance of food chains. Due to their ecological sensitivity and rapid response to environmental changes, insects are considered important bioindicators of ecosystem health and environmental quality.

Insects play key roles in energy transfer, nutrient cycling and as indicators of water quality. Freshwater ecosystems and their surrounding habitats support distinctive insect communities because they provide food resources, breeding sites, vegetation cover, and suitable microclimatic conditions. Wetlands and marsh habitats are particularly important for the conservation of aquatic and terrestrial insects. Environmental conditions such as pollution, habitat loss, urbanization, and climate change directly affect insect diversity and ecological distribution.

Southwood (1978) ^[4] emphasized ecological methodologies in insect population studies and highlighted the importance of insects in ecosystem functioning, nutrient cycling, and environmental monitoring. His work established the foundation for biodiversity assessment techniques widely used in modern ecological investigations. Wilson (1987) ^[7] described insects as "The little things that run the world"

because of their immense ecological significance in maintaining ecosystem stability and productivity. He emphasized that insects regulate food chains, pollination systems, decomposition processes, and biological interactions in terrestrial ecosystems.

Kumar *et al.* (2010) ^[1] documented insect biodiversity in Rajasthan and reported that semiarid habitats harbor significant insect diversity despite harsh climatic conditions. Their study emphasized the ecological significance of freshwater ecosystems in sustaining biological productivity in arid regions.

Verma *et al.* (2019) ^[6] applied biodiversity indices for ecological assessment and concluded that Shannon-Wiener and Simpson diversity indices are reliable indicators of ecological stability and environmental quality. Yadav *et al.* (2021) ^[8] reviewed the role of insect as bioindicators and highlighted their ecological sensitivity to pollution, urbanization, habitat degradation, and climate change. Their findings suggested that insect diversity assessment is essential for long term.

Mangurran (2004) discussed methods for measuring biological diversity and emphasized the importance of biodiversity indices in evaluating ecological stability and habitat quality. She highlighted that species richness and abundance distribution are essential indicators of ecosystem productivity. Triplehorn and Johnson (2005) ^[5] contributed extensively to insect taxonomy and systematic classification. Their work provided detailed taxonomic descriptions and identification methodologies for major insect orders and families.

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The Jaisamand Lake area, Located in the Alwar district of Rajasthan, is an ecologically important semi-arid ecosystem that includes freshwater habitats, surrounding vegetation, grasslands and agricultural landscapes, The diversity of these insects in areas like Jaisamand Lake not only reflects the health of the environment but also helps maintain the balance of the entire ecosystem.

The Jaisamand Lake area provides suitable ecological conditions for various insect communities including butterflies, hornets, mosquitoes, ants, bees, grasshoppers and moths. Scientific analysis of insect diversity in the Jaisamand Lake ecosystem is essential for understanding ecological interactions, habitat quality and biodiversity conservation. The present study investigates the diversity, distribution and taxonomy of the community found around Jaisamand lake Alwar.

Materials and Methods: November 2024 to December 2024, February 2025 to March 2025 and May 2025 to June 2025.

Study Area: The present investigation was conducted in the Jaisamand Lake region located in Alwar district of Rajasthan, India. The region is characterized by semi-arid climatic conditions with moderate rainfall, heterogeneous vegetation, marshy habitats, grasslands, and freshwater ecosystems. The study area supports diverse floral and faunal communities and provides suitable ecological conditions for insect diversity.

Time and Days: I used to catch insects on Saturday, Sunday and Thursday from 7:00 am to 11: 00 am and from 4: 00 pm to 6 : 00 pm.

Sampling Methods: Field investigations were conducted during daytime surveys using standard entomological techniques.

Sweep Netting: Sweep nets were used for collecting flying and vegetation- associated insects from grasslands and shrub vegetation.

Pitfall Trapping: Pitfall traps were installed for collection of ground-dwelling insects including beetles and orthopterans.

Hand Collection: Visible insect specimens were collected manually from vegetation, rocks, soil surfaces, and surrounding habitats.

Preservation and identification: Collected insect specimens were preserved using standard entomological preservation techniques. Identification was carried out using standard taxonomic keys and scientific literature. Final taxonomic verification was authenticated through the Insect Identification Service, Division of Entomology, ICAR-Indian Agricultural Research Institute (IARI), New Delhi.

Result 1: Identify by Insect Identification Service Division of Entomology IARI, New Delhi.

Annexure: A total of 80 individual Lepidoptera specimens were trapped, curated and successfully processed through ICAR-IARI. The taxonomic profile yielded 20 distinct specimen classifications spread across 9 separate families.

Specimen II	Family	Species	Number of Speimcns
1.	Nymphalidae	Danaus chrysippus (Linnaeus, 1758)	5
2.	Pieridae	Pieris brassicae (Linneus. 1758)	3
3.	Pieridae	Eurema hecabe (Linnaeus. 1758)	7
4.	Erebidae	Aloa lactinea (Cramer, 1777)	4
5.	Crambidae	Spoiadea recurvalis (Fabricius, 1775)	1
6.	Crambidae	Cnaphalocrocis medinalis (Guenée. 1854)	1
7.	Pieridae	Lxias marianne (Cramer, 1779)	1
8.	Pieridae	Belenois aurota (Fabricius, 1793)	7
9.	Erebidae	Melipotis Cellaris (Guenée, 1852)	3
10.	Noctuidae	Euxoa sp.	1
11.	Noctuidae	Sesamia Inferens (Walker, 1856)	1
12.	Crambidae	Chilo Partellus, (Swinhoe, 1885)	1
13.	Lycaenidae	Pseudozizeeria Maha (Kollar, (1844))	26
14.	Boarmiini	–	7
15.	Erebidae	Oleparicini (Fabricius, 1775)	1
16.	Lycaenidae	Cigaritis sp.	1
17.	Crambidae	Herpetogramma sp.	4

2: Insect Diversity and Relative Abundance Jaisamand Lake Region

S.No.	Family	Order	Species Name	Number of Individuals	Relative Abundance (%)
1.	Coccinellidae	Coleoptera	Coccinella Septempunctal, (Linnaeus, 1758)	12	6.52
2.	Tenebrionidae	Coleoptera	Tenebrio Molitor (Linnaeus, 1758)	9	4.89
3.	Scarabaeidae	Coleoptera	Scarabaeus (Linnaeus, 1758)	7	3.80
4.	Muscidae	Diptera	Musca domestica (Linnaeus, 1758)	18	9.78
5.	Culicidae	Diptera	Aedes Aegypti (Fredrik Hassel qvist. 1757)	10	5.43

6.	Culicidae	Diptera	Anopheles Stephensi (George Michael James Criles. 1901)	8	4.35
7.	Apidae	Hymenoptera	Apis Cerana (Fabricius, 1793)	14	7.61
8.	Formicidae	Hymenoptera	Camponotus (Mayr, 1861)	13	7.07
9.	Vespidae	Hymenoptera	Vespa orientalis (Linnaeus 1771)	6	3.26
10.	Acrididae	Orthoptera	Locusta migratoria (Linnaeus, 1758)	9	4.89
11.	Gryllidae	Orthoptera	Oxya hyla hyla	7	3.80
12.	Acrididae	Orthoptera	Oxya hyla hyla (Serville 1831)	5	2.72
13.	Pentatomidae	Hemiptera	Plautia Crossota (Dallas, 1851)	8	2.08
14.	Apidae	Hymenoptera	Apis dorsata (Fabricius, 1793)	10	4.12

Water Quality Analysis

Water Sample Analysis: Water quality analysis was conducted through PHED Laboratory, Alwar. Physicochemical parameters analyzed included :

- p^H
- Chlorides
- Nitrates
- Fluorides
- Total Dissolved Solids (TDS)
- Total Hardness

water quality analysis of the Jaisamand Lake ecosystem was conducted through the PHED Laboratory, Alwar, Rajasthan. Physicochemical characteristics of freshwater ecosystems directly influence insect diversity, abundance, breeding behaviour, and ecological distribution.

The analysis revealed moderate alkalinity, acceptable p^H , suitable hardness, and balanced dissolved solids, indicating favourable ecological conditions for sustaining biological productivity and insect.

Table 1: Water Quality Parameters of Jaisamand Lake Region

S.No.	Parameter	Observed Value
1.	p^H	7.3
2.	Turbidity	Clear
3.	Total Alkalinity	80 mg/L
4.	Total Hardness	240 mg/ L
5.	Calcium	52 mg/ L
6.	Magnesium	27 mg/L
7.	Chlorides	80 mg/ L
8.	Sulphates	0 mg/ L
9.	Nitrates	32 mg/ L
10.	Fluorides	0.42 mg/ L
11.	Total Dissolved Solids (TDS)	448 mg/ L

The observed physiochemical parameters were within ecologically acceptable limits and indicated suitable environmental conditions for sustaining insect diversity within the lake ecosystem.

Discussion

The present investigation revealed considerable insect diversity in the Jaisamand Lake ecosystem. The dominance of Lepidopteran species indicates favourable vegetation structure, suitable climatic conditions, and ecological stability within the study area. Butterflies are highly dependent on host plants and flowering vegetation; therefore, their abundance reflects ecological productivity and habitat quality. The occurrence of pollinator species and vegetation-associated insects suggests active ecological interactions and balanced ecosystem functioning. Moderate abundance of dipteran species indicates the presence of moist microhabitats and organic matter accumulation around freshwater zones. Water quality analysis indicated

acceptable physicochemical conditions suitable for sustaining biological communities. Moderate alkalinity, acceptable p^H , and balanced dissolved solids contribute positively to ecosystem productivity and biodiversity maintenance. The result obtained in the present investigation are consistent with previous studies conducted by Sharma *et al.* (2015), Verma *et al.* (2019)^[6], and Yadav *et al.* (2021)^[8], who reported positive relationships between habitat quality and insect diversity. Gupta and Sharma (2020) Studies environmental gradients and insects diversity in freshwater ecosystems and reported that physiochemical characteristics of water directly influence insect abundance and species distribution

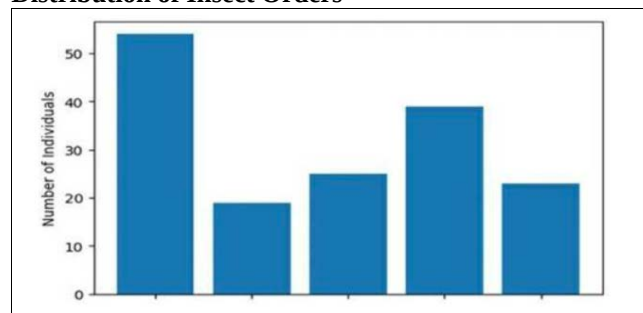
Conclusion

The present study successfully documented insect diversity in the Jaisamand Lake region of Alwar, Rajasthan. A total of five insect orders and twenty species were recorded during the investigation, indicating considerable biodiversity within the ecosystem. Lepidoptera emerged as the dominant insect order, reflecting favourable vegetation and suitable ecological conditions. Biodiversity indices indicated moderate to high diversity and ecological stability within the study area. Water quality analysis further supported the ecological significance of the Jaisamand Lake ecosystem and provide valuable baseline information for biodiversity conservation, ecological monitoring, and environmental management. Long-term ecologic monitoring programs should be implemented to assess the impacts of habitat disturbance, pollution, and climate change on insect diversity in semiarid ecosystems of Rajasthan. This study contributes to the scientific assessment of the region's biodiversity provides fundamental information for future conservation strategies.

Declaration and References

The research work is original and based on scientific observations and standard methodologies.

Distribution of Insect Orders



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