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Diversity and Distribution of Aquatic Insects in Water Bodies of Bhuwasa and Lasada Pond, Banswara

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Abstract: *The study aimed to study and identify the diversity and distribution patterns of aquatic insects, a highly ignored aspect of the Bhuwasa and Lasada ponds. Following the standard procedures, monthly samples were collected from aquatic habitats from October 2021 to May 2022. A total of 1239 and 1435 individuals belonging to 6 orders were captured. Dipterans were the most abundant, while the lowest was observed for Coleoptera. Twelve insect families were identified, among these, five were reported under Diptera, followed by Hemiptera, while single families represented Coleoptera, Trichoptera, Odonata, and Ephemeroptera. This study observed the diversity patterns of aquatic insects from the Bhuwasa and Lasada ponds.*

Keywords: *entomo-fauna, biodiversity, distribution, Bhuwasa and Lasada ponds, water bodies.*

I. Introduction

Biodiversity is often highly underestimated by societies and organizations responsible for conserving biodiversity. Rapid population growth, urbanization, economic development, industrialization and environmental concerns about water stress have emerged as a real threat to aquatic insects in Bhuwasa and Lasada ponds. Enormous construction activities have resulted in the disappearance of many coastal and inland habitats (Dietz and Adger, 2003; Richer, 2008), resulting in declining aquatic insect biodiversity. These insects serve as food for amphibians, have a critical role in the stability of the ecosystem and are water quality indicators (Barros, 2001). Using aquatic insects to assess water quality provides the necessary information to take action regarding environmental management (Hossain et al., 2015). Anthropogenic activities, especially climate change and urbanization, continuously threaten the aquatic ecosystem, affecting insect diversity (Lundquist and Zhu, 2018).

Aquatic insects can be found in almost all aquatic habitats, including lakes, heavy streams, coastal water, groundwater, saline pool and even pools of unrefined petroleum leaking. Though the total makeup of aquatic insects is between 3 to 5% among all insect species (Chainey, 2004; Abhijna et al., 2013), their role is critical, as they serve as an indicator of the human impact on the aquatic ecosystem. Moreover, Aquatic insects are especially appropriate for environmental impact assessment, have a long convention in checking the water quality, and provide a range of responses to disturbance effects at several levels by organisms. Ephemeroptera, Plecoptera and Trichoptera are the most sensitive to natural disturbance, anthropogenic influences and pollution and are considered an important component of accumulations of aquatic insects (Cíbik et al., 2021).

Urbanization in Bhuwasa and Lasada ponds has affected the insect fauna in the past few decades, particularly mosquitoes and other aquatic insects. Development in the rapid transport system, trade links, tourism and human-environmental changes are expected to affect the species composition in Bhuwasa and Lasada ponds. In most parts of the State with favourable climatic conditions, development has created more permanent and temporary breeding sites for mosquitoes. However, the region has thoroughly investigated aquatic insects (Alkhayat et al., 2020). However, there is minimal knowledge of freshwater fauna in Bhuwasa and Lasada pond, and there is no detailed study on aquatic insects. The main purpose of this study is to the diversity and distribution of insects thriving in the aquatic habitats of Bhuwasa and Lasada ponds.

II. Materials and Methods

a. Study area

Bhuwasa is situated in Banswara District, Rajasthan. Bhuwasa, with Latitude - 23°44'38.0"N Longitude-74°15'31.2"E and the village of Lasada, is situated in Banswara District. Lasada pond's Latitude is 23°46'56.9"N and its longitude is 74°10'14.4"E. Most of its catchment area is

populated.Mostofitsboundariesarecoveredagriculturalyields.Thecatchmentareaofthis

pond is 2.80 sq. mile, and the average annual rainfall is 35", gross storage capacity is 39.98 Mcft, live storage capacity is 33.98 Mcft and dead storage capacity is 6.00 Mcft.

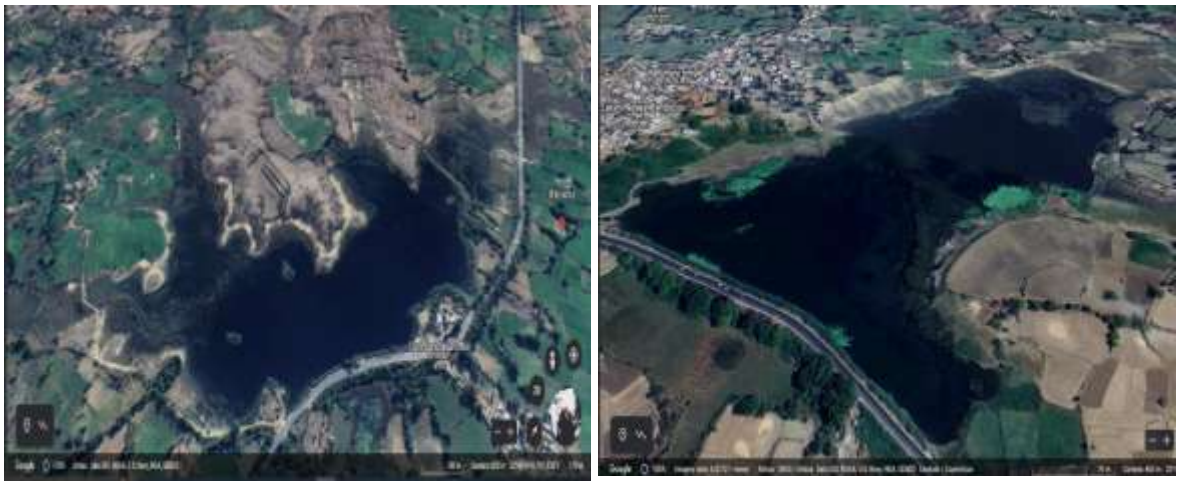

Fig. 1. Study sites Bhuwasa and Lasada Ponds.

b. Sampling and identification of aquatic insects

The samples were collected from the aquatic bodies between October 2021 to May 2022 monthly. The samples (larvae, pupae, nymphs, and adults) were collected from relatively small water bodies by standard dipper and large water bodies by plankton nets and D-frame aquatic kick net. Generally, 3, 5 and 10 scoops were taken at each breeding site depending on the habitat size and the insects were screened and sorted by placing them in white trays. The content of each aquatic site was shifted in plastic containers (500 ml) with some water from the same habitat. Containers were labelled with all the necessary information, placed in an ice container and transported to the laboratory for counting and identification. The insects were grouped into the main taxonomic groups, and the identification of some samples was made up to the family or subfamily levels and some members were identified up to the genera level through suitable taxonomic keys (Winterbourn and Gregson, 1981; Morse et al., 1994).

Descriptive analysis was done by using MS Excel 2019 software. The mean number of aquatic insects was observed per dip for each habitat by dividing the number of individuals of aquatic insects collected at such habitats (n) over the total number of dips (N), where Mean= n/N. The relative abundance (R.A.) of aquatic insect orders for the studied aquatic bodies was calculated. PAST 4.0 was used to calculate the species diversity for aquatic habitats; taxa (S), abundance, Simpson (1_D), Shannon-Weiner index (H), dominance (D), richness, Margalef's diversityindex
(d) and evenness.

III. Results

A total of 1239 and 1435 individuals belonging to 6 orders were captured. Dipterans were the most abundant, while the lowest was observed for Coleoptera. Twelve insect families were identified, among these, five were reported under Diptera, followed by Hemiptera, while single families represented Coleoptera, Trichoptera, Odonata, and Ephemeroptera. This study reported the patterns of the distribution and diversity of aquatic insects and provided a baseline for future studies from Bhuwasa and Lasada ponds (Table 1).

Table 1 – Shows aquatic insect diversity.

S.N.	Order	Family	Genus
1	Diptera	Chironomidae	Chironomus
2	Diptera	Chironomidae	Polypedilum
3	Diptera	Chironomidae	Cricotopus
4	Diptera	Ephydridae	Ephydra
5	Diptera	Syrphidae	Eristalis

6	Hemiptera	Corixidae	Sigara
7	Hemiptera	Notonectidae	Anisops
8	Hemiptera	Veliidae	Microvelia
9	Coleoptera	Dytiscidae	unidentified
10	Trichoptera	Philopotamidae	unidentified
11	Odonata	Libelullidae	Orthetrum sabina
12	Ephemeroptera	Baetidae	unidentified

Biodiversity indices were estimated for Diptera, Hemiptera and Odonata, which were identified to a generic level. Order Diptera showed higher species richness. However, the abundance of different aquatic insect groups showed that Diptera dominated the collections, followed by Hemiptera, while the lowest abundance was observed for Coleoptera.

Table 2 shows the taxa richness, diversity and dominance indices of specimens collected during the study period. Simpson index of biodiversity (1-D) was highest in flooded sewage pools (0.5) and was least in drainage water (0). The Shannon diversity index of both sites, 2.43 and 2.44, was noted in flooded sewage pools. Evenness values were recorded from both ponds at 0.95 and 0.96. At the same time, the Margalef diversity index for all water bodies investigated was 1.54 and 1.51.

Bhuwasa Pond		**Lasada Pond**
Taxa_S	12	12
Individuals	1239	1435
Dominance_D	0.0919	0.08978
Simpson_1-D	0.9081	0.9102
Shannon_H	2.432	2.443
Evenness_e^H/ S	0.9484	0.9594
Margalef	1.544	1.513
Equitability_J	0.9787	0.9833

Table 2 – Shows different index values.

IV. Discussion

The present study observed the distribution and diversity patterns of aquatic insects in different water dwellings in the Bhuwasa and Lasada ponds. The current study's findings showed that the aquatic insect fauna of the Bhuwasa and Lasada ponds consists of six orders, namely, Diptera, Hemiptera, Odonata, Trichoptera, Coleoptera, and Ephemeroptera, and most of the insects were collected and identified for the first time in few numbers.

Inthecurrentfindings,Dipteranwasthemostabundantinallthehabitats,andthefamily Chironomidae represented the 3 genera. This order's members are considered the most diverse and tolerant members of the aquatic habitat. Previous findings showed that different larvae of these genera were found in various habitats with the presence of organic material and were predators of mosquito larvae (Bouchard et al., 2004; Shaalan and Canyon, 2009). Chironomidae is the most abundant family and is considered widely distributed because of its high tolerance towards pollution (Çetinkaya and Bekleyen, 2017). This study's findings showed a value of 1.5 for Margalef's index, indicating heavy pollution by organic material in these habitats (Hanna and Shekha, 2015). The Highest Shannon index values were recorded for the flooded sewage pool (1.48) and the lowest was observed for the drinking water pool (0.67), which indicates the poor

diversity of aquatic insects. However, the diversity of aquatic insects in water bodies is favoured by the nutrients and environmental conditions of the habitat (Abhijna et al., 2013).

V. Conclusion

In this study, the aquatic fauna of Bhuwasa and Lasada ponds outlined the patterns of composition and distribution of different aquatic insects. Moreover, fluctuating diversity patterns of insects are expected with anthropogenic activities, which cause different habitats of disturbance or provide more opportunities. The findings of this study do not contribute and will not be conclusive to future in-depth investigations from the country. Further studies are needed to identify environmental changes' positive or negative impact on entomo-fauna.

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