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Biodiversity of aquatic insect of Sitadwar lake of Shravasti, U.P.

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Abstract
The present study examines the diversity and distribution of aquatic insects in the wetland ecosystem of Sitadwar Jheel, located in the Shravasti District, over a period from March 2024 to August 2024. A total of seven insect orders were identified: *Hemiptera*, *Coleoptera*, *Odonata*, *Diptera*, *Ephemeroptera*, *Lepidoptera*, and *Trichoptera*. Among these, *Hemiptera* constituted the largest population (31.94%) in the wetland ecosystem, followed by *Coleoptera* (25.13%), *Odonata* (18.58%), *Diptera* (10.21%), *Ephemeroptera* (7.07%), *Lepidoptera* (4.71%), and *Trichoptera* (2.36%). Diversity indices were also calculated to assess species distribution. The dominance of *Hemiptera*, *Coleoptera*, and *Odonata* suggests that the Sitadwar Jheel is relatively less polluted.

Keywords: Biodiversity, insect fauna, wetland, conservation, bioindicators

Introduction

Biodiversity is considered the "foundation of human life" on Earth, as each organism contributes significantly to maintaining a creative and steady ecosystem (Verma and Prakash, 2020) [20]. Climate changes have profoundly affected biodiversity dynamics in the past centuries and will continue to be a key driver of their distribution in the future (Prakash and Srivastava, 2019) [8]. Biodiversity performs a crucial role in environmental functioning by offering essential services. These include nutrient and water cycling, soil formation and retention, resistance to invasive species, plant pollination, climate regulation, and the control of pests and pollution (Verma and Prakash, 2018) [17].

Aquatic insects are organisms that spend part of their life cycle in water and are among the most diverse groups in freshwater environments, including lakes, ponds, rivers, streams, and reservoirs. They play a crucial role in ecosystem functioning due to their abundance, taxonomic diversity, and important position as a key link in the structure of many food chains (Prakash and Verma, 2019) [11]. Making up 3-5% of all entomofauna, aquatic insects are highly diverse and vital for maintaining ecosystem stability, particularly in nutrient cycles (Prakash and Yadav, 2016) [12]. They are an essential component of the food chain and energy flow in freshwater ecosystems, comprising a significant portion of the biomass. At their larval stage, aquatic insects serve as the primary food source for fish and are integral to the processing and dynamics of nutrients, as they belong to various eating groups, including filter feeders, deposit collectors, and predators (Prakash and Verma, 2020) [9]. They also serve as vectors of pathogens to both humans and animals.

Moreover, aquatic insects are excellent bioindicators of water quality, helping assess both short- and long-term pollution events. Changes in their populations offer valuable information into the extent of environmental impact and its potential effects on other organisms. They are also characterized by remarkable features, such as their cyclicity of occurrence, life history, and adaptability to environmental stress. The presence or absence of aquatic insects' species can indicate the health status of an ecosystem, with their decline often signaling pollution. In this way, aquatic insects serve as important bioindicators of anthropogenic impact on freshwater ecosystems. Thus, bio-monitoring of aquatic insects and their varying responses to stimuli in their aquatic habitat helps assess the quality of the environment (Majumder *et al*., 2013) [6].

A wetland ecosystem is a body of standing water that supports a wide variety of fauna, including fish, crustaceans, insects, and amphibians, offering food and shelter to organisms that thrive in these environments. Wetlands are found where the water table is at or near the land's surface, or where the land is submerged by water. They rank among the world's most productive ecosystems (Verma and Prakash, 2018) [17]. Wetlands are particularly suitable for assessing the effects of climate change on the population dynamics of aquatic insects.

Approximately 45,000 insect species worldwide inhabit various freshwater ecosystems. In India, inland wetlands provide a habitat for over 500 species of aquatic insects, primarily belonging to the orders *Ephemeroptera* (mayflies), *Odonata* (dragonflies), and *Trichoptera* (caddisflies) (Subramanian and Sivaramakrishnan, 2007) [13]. Among these, *Ephemeroptera*, Plecoptera, and *Trichoptera* are recognized as pollution-sensitive groups and are extensively used in aquatic insect biomonitoring programs (Prakash and Verma, 2018) [10].

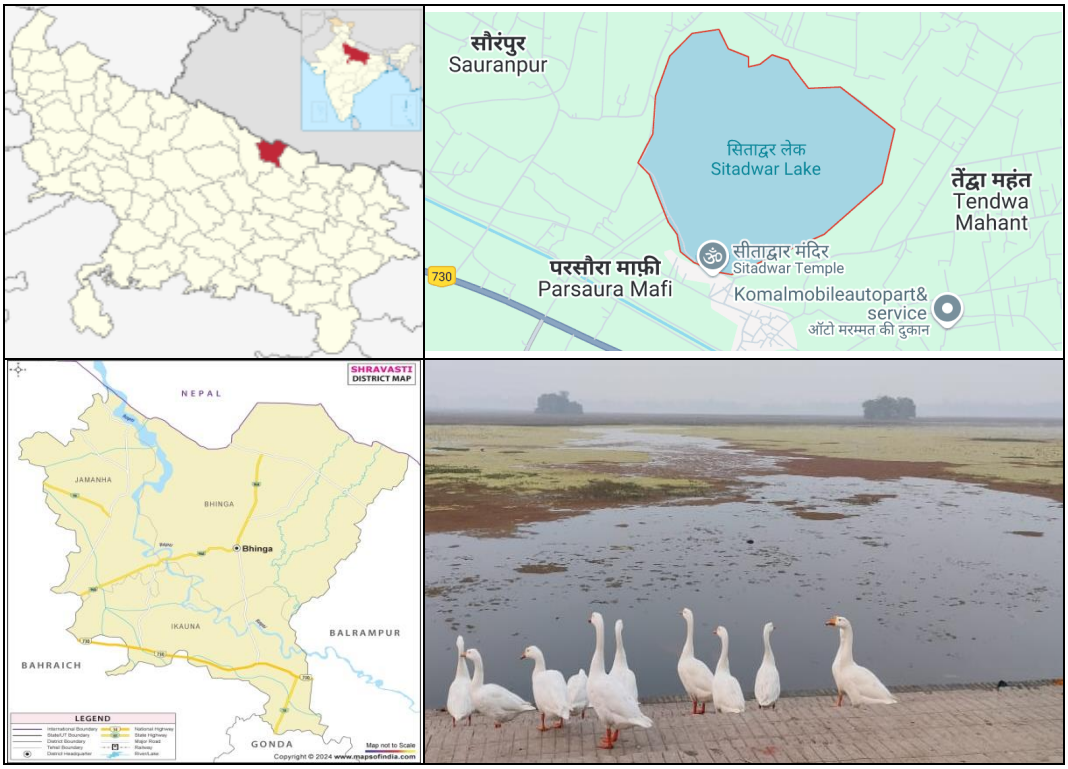
Aquatic insects are widely recognized as bioindicators of water quality in a given ecosystem. By analyzing a sample of these insects distinguishing between sensitive and tolerant species one can effectively assess the health of waterbody. However, there is limited literature on the population dynamics of aquatic insects in the wetlands of eastern Uttar Pradesh. Therefore, this study was conducted to examine the diversity of aquatic insects in Sitadwar Taal, a wetland located in the Tarai region of eastern Uttar Pradesh.

Materials and Methods

Sitadwar Jheel (latitude:27.5348365°N, longitude: 81.9118952°E) located on the Buddhist circuit, 7 km away from the tehsil headquarters Ikauna of Shravasti district of

U.P. It is a somewhat shallow freshwater lake having floating and emergent aquatic vegetation such as *Ipomea carnea*. It is a site of religious pilgrimage and festivals. Several years ago, this lake was a winter haven for migratory birds but due to due to administrative negligence and local indifference led to its severe deterioration. The lack of proper maintenance led to silt accumulation on the lake bed, and water hyacinth spread across its surface. Additionally, illegal encroachment has significantly reduced the lake's area from 500 acres to just 150 hectares. Anthropogenic activities, including hunting and increasing pollution levels, have further disrupted the ecosystem, forcing migratory birds to abandon their seasonal refuge.

The samples were collected monthly from March 2024 to August 2024 during early morning and afternoon hours by using aquatic net, hand net and hand-picking methods. Collected samples were washed by tap water then transferred into trays for picking the aquatic insects using forceps and brush. The collected insect was preserved in 90% ethyl alcohol and brought to the laboratory for further analyzed the species diversity. Before preserving natural colour of insects were noted. The collected samples were analyzed under a dissecting microscope and identified using the reference book entitled " Aquatic insect of India- A field Guide" and "A guide to the study of fresh water biology" written by Subramanian & Sivaramakrishnan (2007) [13] and Needham and Needham (1962) [7] and other standard literature Vazirani, 1970; Tonapi, 1980; Douwe *et al*., 2014; Choudhary and Ahi, 2015; Chauhan and Verma, 2016) [3, 4, 5, 14, 15] and other standard taxonomic keys.



Location, Google Map and Photograph of Sitadwar Jheel of Uttar Pradesh

Result and discussion

Freshwater ecosystems perform a crucial part in conserving aquatic biodiversity. Aquatic insects are essential to aquatic ecosystems, providing both ecological and economic benefits. (Choudhary and Ahi, 2015) [3]. The presence of 27 genera of aquatic insects belonging to 7 orders and 24 families in the Sitadwar Jheel indicates that this wetland is rich in aquatic insect fauna (Table 1). 20 genera of aquatic insects representing to 6 orders and 19 families were reported in Semara Taal (Prakash and Verma, 2018) [17], 21 species of aquatic insects representing to 6 orders and 21 families were reported in Baghel Taal (Prakash and Yadav, 2016) [12] and 32 species of aquatic insects belonging to 5 orders and 24 families were found in the Guthia Taal (Prakash and Verma, 2019) [11]. In the current investigation following 7 orders of aquatic insects were collected in this wetland as *Hemiptera* (31.94%), *Coleoptera* (25.13%), *Odonata* (18.58%), *Diptera* (10.21%) *Ephemeroptera* (7.07%), *Lepidoptera* (4.71%) and *Trichoptera* (2.36%) (Fig. 1). High species richness was found in insects belonging to the orders *Hemiptera*, *Coleoptera*, and *Odonata* (Table1). The freshwater *Hemiptera* commonly known as 'aquatic bugs' are secondarily adapted to aquatic ecosystems (Basu and Subramanian, 2017) [2].

The population of order *Hemiptera* is dominant and contains 10 species belonging to 9 families compared with other orders. Aquatic *Coleopteran* constitutes an important part of the macroinvertebrates of freshwater habitats (Arumugam and Athikesavan, 2021) [1]. In present investigation, *Coleoptera* was the second dominant order and contains 4 species belonging to 4 families with compared others whereas *Odonata* was the third dominant order and contains 3 species belonging to 2 families with compared others. *Hemipteran* and *Coleopteran* insect dominance indicated that the wetland habitat is comparatively less contaminated (Prakash and Verma, 2018) [10]. Odonates are characterized as an excellent bioindicator of water pollution in aquatic habitats. In the current investigation, the presence of pollution sensitive groups (Odonta, *Ephemeroptera* and *Trichoptera*) indicates that health status of wetland was not healthy (Prakash and Verma, 2018; Arumugam and Athikesavan, 2021) [1, 17].

Table 1: Aquatic insects collected from Sitadwar Jheel, a wetland during the study period

Order / Number of insects (% Age)	Family	Genus	Common Name
Hemiptera / 122 (31.94%)	Nepidae	*Ranatra sp.*	Water Scorpion
	Belostomatidae	*Belostoma sp.*	Giant water Bug
	Notonectidae	*Enithares sp.*	Back swimmers
	Corixidae	*Corixa sp.*	Water Boatman
		Sigara sp.	Water Boatman
	Notonectidae	*Notolecta sp.*	Pygmy water boatman
	Hydrometridae	*Hydrometra sp.*	Water measurers
	Gerridae	*Gerris sp.*	Water striders, Pond skaters
	Mesoveliidae	*Mesovelia sp.*	Water treader or Pond weed bug
	Pleidae	*Neoplea sp.*	Pygmy back swimmer
Coleoptera/96 (25.13 %)	Hydrophilidae	*Berosus larva*	Water Scavenger beetle
	Dytiscidae	*Hyphydrus sp.*	Diving Beetles
	Gyrinidae	*Dineutus sp.*	Whirligig Beetles
	Hygobiidae	*Hygrobia sp.*	Screech Beetles
Odonata/71 (18.58%)	Libellulidae	*Leucorrhinia sp.*	Dragonflies
		Sympetrum sp.	Dragonflies
	Coenagrionidae	*Ischnura. sp.*	Damselfly
Diptera/39 (10.21%)	Chironomidae	*Chironomus Larvae*	Non-Biting Midges
	Ceratopogonidae	*Culicoides sp.*	Biting Midges
	Syrphidae	*Eristalis sp.*	Drone fly
Ephemetoptera/27 (7.07%)	Baetidae	*Baetis sp.*	Olive mayfly
	Baetidae	*Beatis sp.*	Mayfly
	Siphlonuridae	*Ameletus sp.*	Comb-mouthed minnow mayfly
Lepidoptera/18 (4.71%)	Pyralidae	*Ostrinia sp.*	Asian corn borer
		Nymphula sp.	Aquatic Moth
	Hydropsychidae	*Hydropsyche sp.*	Caddisfly
Trichoptera/9 (2.36%)	Philopotamidae	*Gunungiella sp.*	Caddisfly
Total number of aquatic insects collected during the study period = 382; Total species identified = 27			

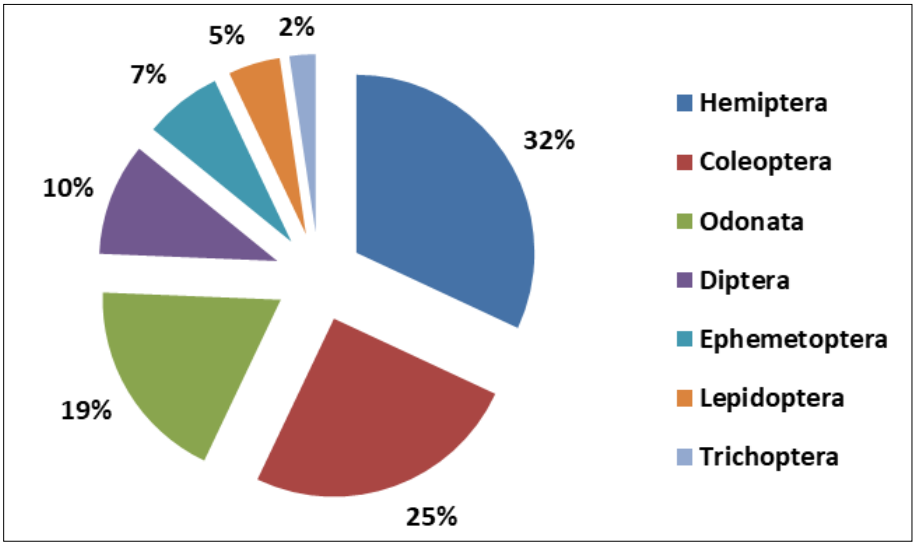


Fig 1: Percentage composition of Aquatic insect order collected from Sitadwar Jheel

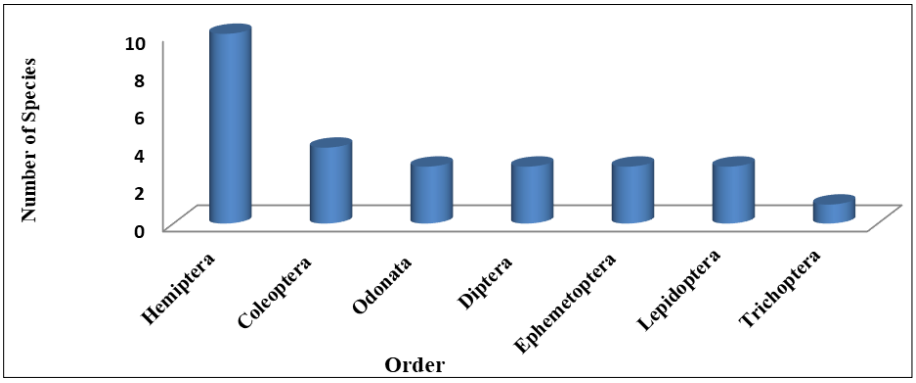


Fig 2: Diversity of aquatic insects in various orders of class Insecta

Conclusion

Aquatic insects exhibit different levels of sensitivity to pollution and play a significant role in assessing water quality. Therefore, biomonitoring of aquatic ecosystems using aquatic insects is essential. A proper study of the diversity of aquatic insects can help determine the status of wetland ecosystems. This study reports that the Sitadwar Jheel hosts a highly diverse and widely distributed range of aquatic insect orders, indicating potential water pollution. The findings suggest the need for effective and stringent biomonitoring programs.

Acknowledgements

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References

1. Arumugam S and Athikesavan S. Diversity and Distribution of Aquatic Insects in Pond Ecosystem in Cheyyar, Thiruvannamalai District of Tamil Nadu, India. Uttar Pradesh Journal of Zoology,2021:42(9):10-15.
2. Basu S, Subramanian KA. Insecta: *Hemiptera* (Aquatic Bugs), Chapter 23. In: Kailash Chandra, Gopi KC, Rao DV, Valarmathi K, Alfred JRB (eds.) Current Status of Freshwater faunal diversity in India, Zoo. Surv. Ind, 2017, 357-378.
3. Choudhary A, Ahi J. Biodiversity of freshwater insects – A review. Int. J. Engeen. Sci,2015:4:25-31.
4. Chauhan A, Verma SC. Distribution and diversity of aquatic insects in Himachal Pradesh, India: A review. Int. J. Curr. Microbio. App. Sci,2016:5:273-281.
5. Douwe KB, Dijikstra, Monashan MT, Pauls SU. Freshwater biodiversity and aquatic insect diversification. Ann. Rev. Entomol,2014:59:143-163.
6. Majumder J, Das RK, Majumder P, Ghosh D, Agarwala BK. Aquatic Insect Fauna and Diversity in Urban Fresh Water Lakes of Tripura, Northeast India. Middle-East Journal of Scientific Research,2013:13(1):25-32.
7. Needham JJ, Needham PR. A Guide to the study of freshwater Biology, Charles Cthomas Publisher, USA, 1962.
8. Prakash S, Srivastava S. Impact of Climate change on Biodiversity: An Overview. International Journal of Biological Innovations,2019:1(2):60-65. DOI: https://doi.org/10.46505/IJBI.2019.1205
9. Prakash S, Verma AK. Diversity of aquatic insects in relation to physico-chemical parameters of two fresh water bodies of Balrampur District (U.P.), India. International Journal of Entomology Research,2020:5(4):24-28
10. Prakash S, Verma AK. Diversity of aquatic insects in Semara Taal, a wetland of district Siddharthnagar, U.P. International Journal of Fauna and Biological Studies,2018:5(1):248-250.
11. Prakash S, Verma DR. Preliminary Studies on Diversity of Aquatic Insects in Guthia Taal, a Wetland of district Bahraich, U.P. International Journal of Biological Innovations,2019:1(2):78-82. DOI: DOI: https://doi.org/10.46505/IJBI.2019.1208
12. Prakash S, Yadav DK. Diversity of aquatic insect fauna in Baghel Taal, a wetland of Bahraich district, U.P. International Journal of Applied Research,2016:2(12):822-824
13. Subramanian KA, Sivaramakrishnan KG. Aquatic insects of India-A Field Guide. Ashoka Trust for Ecology and Environment (ATREE), Bangalore, India, 2007, 62.
14. Tonapi GT. Freshwater Animals of India. Oxford & IBH Publ. Co., New Delhi, 1990, 341.
15. Vazirani TG. Fauna of Rajasthan, India. Pt.5 Aquatic beetles (Insecta: *Coleoptera*: Dytiscidae) Rec. Zool. Surv. India, Calcutta,1970:62(1-2):29-50.
16. Verma AK, Prakash S. Status of Animal Phyla in different Kingdom Systems of Biological Classification. International Journal of Biological Innovations,2020:2(2):149-154. https://doi.org/10.46505/IJBI.2020.2211
17. Verma AK, Prakash S. Qualitative and quantitive analysis of macrozoobenthos of Beghel Taal, a wetland of U.P. Indian Journal of Biology,2018:5(2):127-130