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Aquatic insects in freshwater habitats of Lumding, Assam, Northeast India

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Abstract
Aquatic insects are important components of freshwater ecosystems and serve as valuable bioindicators of water quality. The present study was conducted from December 2024 to June 2025 in a freshwater body of Lumding, Hojai District, Assam. Aquatic insects were collected using mesh nets, sweeping nets, and hand-picking methods, and identified using standard taxonomic keys and literature. A total of 13 species belonging to 6 families and 4 orders (Hemiptera, Coleoptera, Odonata, and Orthoptera) were recorded. Hemiptera was the dominant order with six species, followed by Coleoptera with four species, while Odonata and Orthoptera were represented by one species each. The most abundant species were *Abedus herberti*, *Abedus indentatus*, *Hydrophilus piceus*, and *Ranatra varipes*. The study provides baseline information on the aquatic insect diversity of Lumding and highlights their importance in freshwater biodiversity assessment and biomonitoring.

Keywords: Aquatic insects, freshwater ecosystem, biodiversity, Hemiptera, Lumding, bioindicators, Assam

Introduction

Freshwater ecosystems, including ponds, lakes, rivers, streams, springs, swamps, wetlands, and marshes, occupy only a small proportion of the Earth's surface but support an exceptionally high level of biodiversity and provide numerous ecological services essential for both humans and wildlife (McCafferty & Provonsha, 1981; Cheng, 1985; Strayer & Dudgeon, 2010). These ecosystems harbour a wide variety of organisms, including phytoplankton, zooplankton, aquatic macrophytes, insects, fishes, amphibians, reptiles, birds, and mammals, all of which contribute to ecosystem stability and productivity (Kumbhar & Mhaske, 2020; Verma & Prakash, 2020). Among these organisms, aquatic insects constitute one of the most diverse and ecologically significant groups of freshwater invertebrates and represent an essential component of freshwater biodiversity (McCafferty & Provonsha, 1981).

Aquatic insects inhabit almost every type of freshwater habitat, ranging from temporary puddles and ponds to lakes, rivers, streams, marshes, wetlands, and springs, occurring in both lentic (standing water) and lotic (flowing water) ecosystems (Cheng, 1985; Daly *et al*., 1998) [6]. Although they account for only about 3–5% of the total known insect fauna, they exhibit remarkable taxonomic diversity and possess several structural and physiological adaptations, including tracheal gills, plastron respiration, and cutaneous respiration, enabling them to survive under diverse aquatic conditions (Thorpe, 1950; Dijkstra *et al*., 2014) [13, 18].

Aquatic insects perform numerous ecological functions that are fundamental to the maintenance of freshwater ecosystems. They contribute to the decomposition of organic matter such as leaves and detritus, facilitate nutrient cycling by releasing essential nutrients including nitrogen and phosphorus, regulate aquatic food webs, and promote energy transfer within ecosystems (Daly *et al*., 1998[6]; Bouchard, 2004; Das *et al*., 2014; Elango *et al*., 2021). These insects also occupy different trophic levels as herbivores, detritivores, predators, and scavengers and serve as an important food source for fishes, amphibians, reptiles, birds, and other aquatic organisms, thereby maintaining ecosystem productivity and ecological stability (Tachet *et al*., 2003; Subramanian & Sivaramakrishnan, 2007) [17]. In addition, certain aquatic insects, particularly some species of midges and caddisflies, contribute to the pollination of aquatic and riparian plants, thereby enhancing plant reproduction and maintaining genetic diversity in freshwater ecosystems (Jackson & Resh, 1989).

The presence, abundance, and diversity of aquatic insects are widely recognized as reliable indicators of water quality and environmental health because different taxa exhibit varying degrees of tolerance to pollution and habitat disturbance (Rosenberg & Resh, 1995; Barbour *et al*., 1999). Sensitive insect groups, especially members of the orders Ephemeroptera, Plecoptera, and Trichoptera (EPT), are extensively used in freshwater biomonitoring programmes due to their rapid response to environmental degradation and changes in water quality (Niemi & McDonald, 2004; Bonada *et al*., 2006[4, 10]; Merritt & Cummins, 2008; Hadicke *et al*., 2017). The composition and distribution of aquatic insect communities are strongly influenced by physicochemical parameters such as dissolved oxygen, pH, water temperature, turbidity, alkalinity, water velocity, and substrate composition (Sharma *et al*., 2008) [16]. Consequently, alterations in aquatic insect assemblages provide valuable information regarding the ecological integrity of freshwater ecosystems and are widely applied in biodiversity assessment and environmental monitoring (Prommi & Payakka, 2015) [14].

Freshwater ecosystems are increasingly threatened by anthropogenic activities such as urbanization, industrialization, agricultural runoff, habitat destruction, pollution, overexploitation, and hydrological alterations, leading to habitat degradation and biodiversity loss (Sala *et al*., 2000; Dudgeon *et al*., 2006; Satterthwaite *et al*., 2010). Such disturbances often reduce the abundance of pollution-sensitive taxa while favouring pollution-tolerant species,

thereby affecting the ecological functioning and resilience of freshwater ecosystems (Takhelmayum & Gupta, 2011). Therefore, documentation of aquatic insect diversity has become increasingly important for ecological monitoring, conservation planning, and the sustainable management of freshwater resources (Prommi & Payakka, 2015) [14].

Globally, approximately 45,000 species of aquatic insects have been described, while nearly 5,000 species are estimated to inhabit the inland freshwater ecosystems of India (Amaravathi *et al*., 2018; Rao *et al*., 2020). India, one of the world's megadiverse countries and home to four global biodiversity hotspots, supports an exceptionally rich diversity of freshwater organisms (Jeena & Gopalakrishnan, 2012). Wetlands, ponds, lakes, rivers, and streams across the country provide suitable habitats for numerous aquatic insect groups, including Ephemeroptera, Odonata, Hemiptera, Coleoptera, Diptera, and Trichoptera, which contribute significantly to ecosystem functioning and biodiversity conservation (Subramanian & Sivaramakrishnan, 2007[17]; Verma & Prakash, 2018). Despite this remarkable diversity, many freshwater habitats in different regions of India remain inadequately explored with respect to aquatic insect diversity.

Several studies have documented the diversity and ecological importance of aquatic insects in different parts of India. Jana *et al*. (2009) [8] investigated the community structure of aquatic insects in freshwater ponds of West Bengal. Barman and Baruah (2013) [2] reported the diversity of aquatic insects in Kapla Beel, Assam, while Abhijna *et al*. (2013) [2] demonstrated the influence of seasonal and environmental factors on aquatic insect assemblages in Kerala. Choudhury and Gupta (2015) [5] documented the aquatic insect community of Deepor Beel, a Ramsar wetland of Assam, and highlighted their ecological significance. More recently, Payra *et al*. (2025) [11] reported the diversity and composition of aquatic insects from perennial rural ponds of Ramnagar-I Block, West Bengal, emphasizing the importance of pond ecosystems in supporting aquatic insect biodiversity.

Assam possesses an extensive network of freshwater ecosystems, including rivers, beels, ponds, marshes, and wetlands, which support a rich assemblage of aquatic flora and fauna (Das, 2012; Gogoi *et al*., 2015) [3]. However, comprehensive information on the diversity, abundance, and distribution of aquatic insects from many regions of the state remains limited. Lumding, situated in Hojai District of Assam, contains several natural and man-made freshwater habitats that provide favourable conditions for diverse aquatic insect communities but have received little scientific attention.

Therefore, the present study was undertaken to assess the diversity, species composition, abundance, and distribution of aquatic insects of Lumding, Hojai District, Assam. The findings of this study are expected to provide baseline information on the aquatic insect fauna of the region and contribute to biodiversity assessment, freshwater ecosystem monitoring, conservation planning, and the sustainable management of aquatic ecosystems in northeastern India.

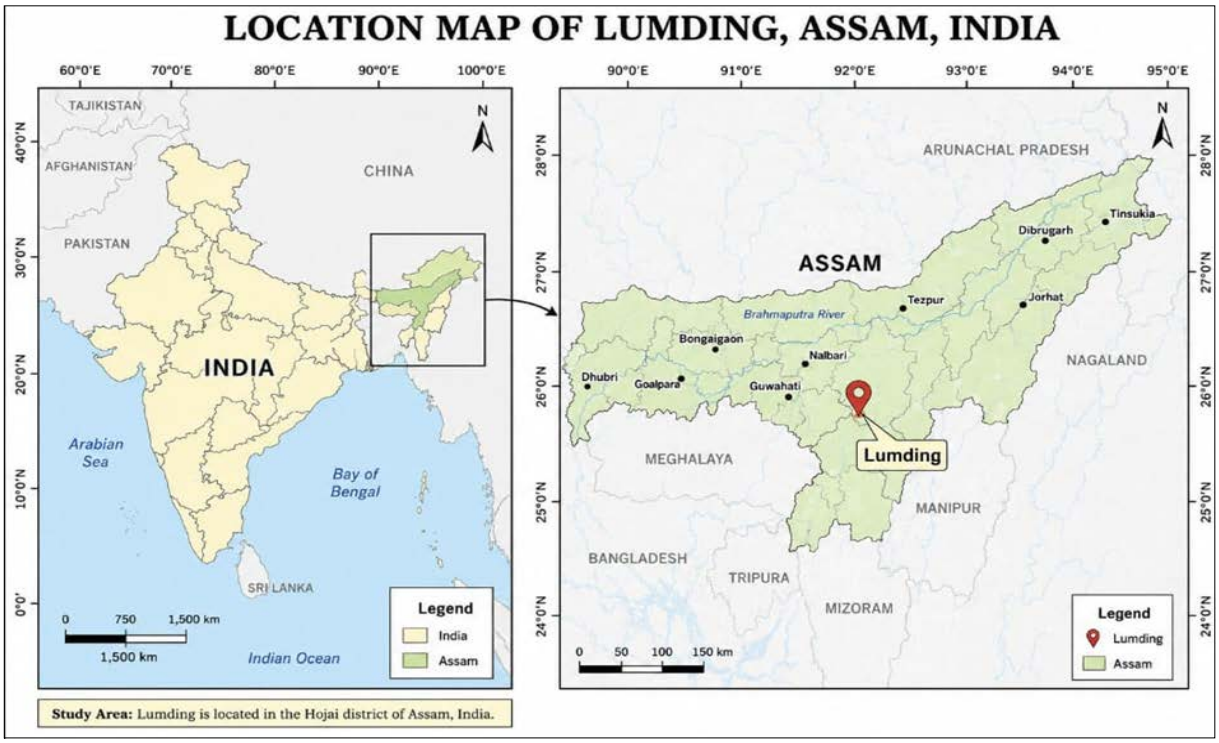
Materials and Methods

The study was carried out between December 2024 and June 2025. Aquatic insects were collected using mesh nets, sweeping nets, and hand collection from selected freshwater habitats. Three to four sweeps were made at each sampling site during every collection.

Collected insects were transferred to glass containers, sorted, counted, and preserved in 70% ethyl alcohol. Identification was carried out using standard taxonomic literature, field guides, and authenticated online resources. Photographs of all recorded species were also taken for documentation.

Study Area

The study was conducted in Lumding, Hojai District, Assam, India (Latitude 25.7516° N, Longitude 93.1729° E). A pond at Shree Ram Nagar Lane, Bidhan Pally, and Lumding was the study site. This water body support fish farming and provide habitats for various aquatic organisms.



Collection and Identification

Aquatic insects were collected with the assistance of local fishermen using mesh nets, sweeping nets, and hand collection methods. The collected specimens were preserved in 70% ethanol and transported to the laboratory for sorting and identification.

Species identification was based on external morphological characteristics with the help of taxonomic keys, published literature, and authenticated photographs available online.

Data Analysis

The collected specimens were grouped according to their orders, families, and species. Species richness and abundance were determined for each taxonomic group. Relative abundance was calculated using the following formula:

Relative Abundance (%) = (Number of individuals of a species or family ÷ Total number of individuals collected) × 100

The diversity of aquatic insects was summarized using tables and charts showing the distribution of orders, families, and species.

Results and Discussion

The present study documented the diversity and relative abundance of aquatic insects in the freshwater ecosystems of Lumding, Hojai District, Assam, during the study period (December 2024–June 2025) [7]. A total of 13 aquatic insect species belonging to 6 families and 4 orders (Hemiptera, Coleoptera, Odonata, and Orthoptera) were recorded. The checklist of recorded species is presented in Table 1.Among the recorded orders, Hemiptera was the most dominant, comprising 7 species (53.85%), followed by Coleoptera with 4 species (30.77%), while Odonata and Orthoptera were each represented by 1 species (7.69%).

A total of 52 individuals were recorded during the study. *Ranatra varipes* and *Lethocerus indicus* were the most abundant species, with 9 individuals each (17.31%), followed by *Hydrophilus piceus* with 7 individuals (13.46%), *Abedus herberti* with 6 individuals (11.54%), and *Abedus indentatus* with 5 individuals (9.62%). *Nepa cinerea, Laccotrephes sp., Diplonychus rusticus, Hydrophilus pistaceus, Cybister chinensis, Dytiscus marginalis* (larva), *Tholymis* (larva), and *Neocurtilla hexadactyla* were each represented by 2 individuals (3.85%). The relative abundance of all recorded species is presented in Table 1.

Table 1: Checklist of Aquatic Insects Recorded During the Study

Sl. No.	Common name	Scientific name	Family	Order	No. of species	No. of individuals	Relative Abundance (%)
1	Water Scorpion	*Nepa cinerea*	Nepidae	Hemiptera	3	2	3.85
2	Water Stick Insect	*Ranatravaripes*	Nepidae	Hemiptera		9	17.31
3	Water Scorpion	*Laccotrephes sp.*	Nepidae	Hemiptera		2	3.85
4	Toe Biter	*Abedus herberti*	Belostomatidae	Hemiptera	4	6	11.54
5	Ferocious Water Bug	*Abedus indentatus*	Belostomatidae	Hemiptera		5	9.62
6	Water Bug	*Diplonychus rusticus*	Belostomatidae	Hemiptera		2	3.85
7	Giant water bug	*Lethocerus indicus*	Belostomatidae	Hemiptera		9	17.31
8	Great Silver Water Beetle	*Hydrophilus piceus*	Hydrophilidae	Coleoptera	4	7	13.46
9	Water Scavenger Beetle	*Hydrophilus pistaceus*	Hydrophilidae	Coleoptera		2	3.85
10	Golden Edge Diving Beetle	*Cybister chinensis*	Dytiscidae	Coleoptera		2	3.85
11	Great Diving Beetle	*Dytiscus marginalis (larva)*	Dytiscidae	Coleoptera		2	3.85
12	Old World Twister	*Tholymis (larva)*	Libellulidae	Odonata	1	2	3.85
13	Northern Mole Cricket	*Neocurtilla hexadactyla*	Gryllotalpidae	Orthoptera	1	2	3.85
Total					13	52	100%

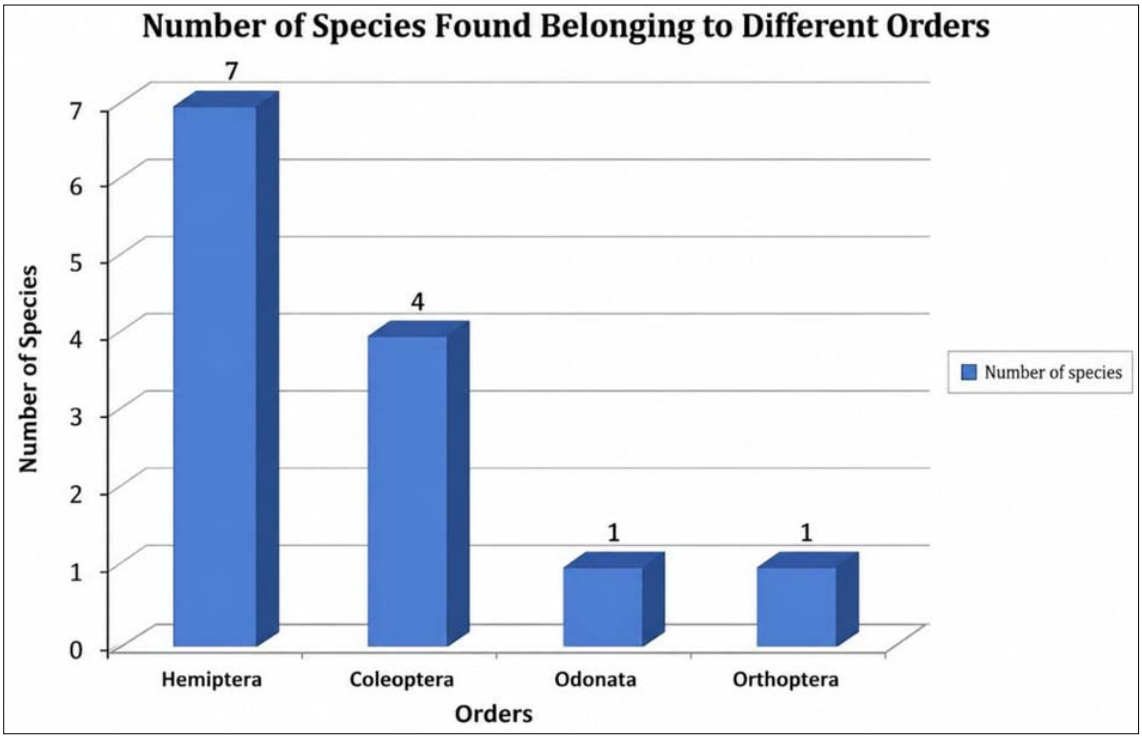
The dominance of Hemiptera in the present study may be attributed to their specialized respiratory adaptations, such as plastrons and siphons, which enable them to utilize atmospheric oxygen and survive in waters with low dissolved oxygen (Thorpe, 1950[18]). Similar dominance of Hemiptera has been reported by Barman and Baruah (2013) [2] from Kapla Beel, Assam, and Abhijna, Ratheesh and Kumar (2013) [2] from Vellayani Lake, Kerala. Coleoptera was the second dominant order, represented by four species belonging to the families Hydrophilidae and Dytiscidae. These aquatic beetles play important roles as predators and scavengers, contributing to nutrient recycling and ecological balance in freshwater ecosystems (Priyanka and Prasad, 2012; Prommi and Payakka, 2015[14]). Most aquatic insects were collected during the post-monsoon season, when favourable conditions such as higher dissolved oxygen, lower temperature, and reduced turbidity supported their abundance (Sharma, Sharma and Anthwal, 2008[16]; Takhelmayum and Gupta, 2011; Barman and Baruah, 2018).

Aquatic insects are important bioindicators of freshwater ecosystem health. According to Rosenberg and Resh (1993) [15], pollution-sensitive groups such as Ephemeroptera, Plecoptera, and Trichoptera (EPT) indicate good water quality. These groups were absent in the present study, possibly due to the dry winter season and limited rainfall during the sampling period.

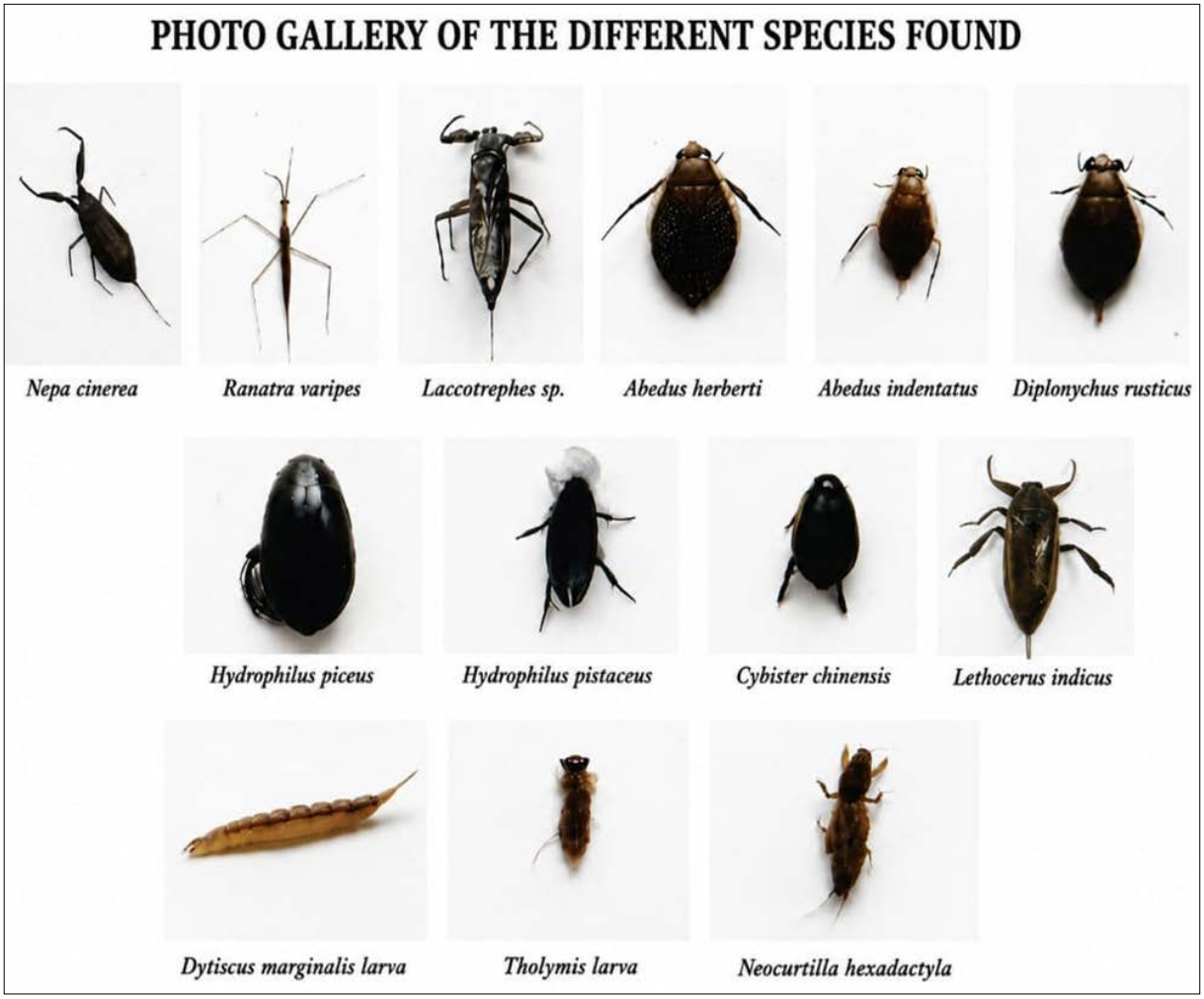
The Shannon–Wiener Diversity Index (H′ = 2.35) indicated a relatively high diversity of aquatic insects. Although the community was dominated by *Ranatra varipes, Lethocerus indicus, Hydrophilus piceus, Abedus herberti, and Abedus indentatus,* the presence of other species contributed to good species richness and evenness.

Table 2: Shannon–Wiener Diversity Index of Aquatic Insects

Diversity index	Value
Shannon-Wiener index	2.35



The present study provides baseline information on the diversity and composition of aquatic insects in the freshwater ecosystems of Lumding, Assam. The findings contribute to the understanding of aquatic insect distribution and diversity and can serve as a reference for future ecological studies, biomonitoring, and freshwater conservation. Further long-term monitoring is recommended to assess the effects of seasonal and environmental changes on aquatic insect communities.



References

1. Abhijna UG, Ratheesh R, Kumar AB. Distribution and diversity of aquatic insects of Vellayani Lake in Kerala. Journal of Environmental Biology,2013:34(3):605–611.
2. Barman A, Baruah BK. Aquatic insects of Kapla Beel, a flood plain wetland of Barpeta District of Assam, India. Clarion: International Multidisciplinary Journal,2013:2(2):27–31.
3. Barman B, Gupta S. Aquatic insects as bio-indicator of water quality: A study on Bakuamari Stream, Chakrashila Wildlife Sanctuary, Assam, North East India. Journal of Entomology and Zoology Studies,2015:3(3):178–186.
4. Bonada N, Prat N, Resh VH, Statzner B. Developments in aquatic insect biomonitoring: A comparative analysis of recent approaches. Annual Review of Entomology,2006:51:495–523. https://doi.org/10.1146/annurev.ento.51.110104.151124
5. Choudhury D, Gupta S. Aquatic insect community of Deepor Beel (Ramsar Site), Assam, India. Journal of Entomology and Zoology Studies,2015:3(1):182–192.
6. Daly HV, Doyen JT, Purcell AH. Introduction to insect biology and diversity (2nd ed.). Oxford University Press, 1998.
7. Ghosh P, Parui S, Kushwaha RK, Wani I, Sonali S, Debnath A, et al. New distribution records of terrestrial and aquatic beetles from Anjaw District, Arunachal Pradesh, India. Uttar Pradesh Journal of Zoology,2025:46(7):79–103. https://doi.org/10.56557/upjoz/2025/v46i74865
8. Jana S, Pahari PR, Dutta TK, Bhattacharya T. Diversity and community structure of aquatic insects in a pond in Midnapore Town, West Bengal, India. Journal of Environmental Biology,2009:30(2):283–287.
9. Machahary B, Das B, Khangembam BK. A study on the diversity, marketing and conservation status of different aquatic food fauna in Kokrajhar, Assam, India. Journal of Fisheries,2023:11(2):112201. https://doi.org/10.17017/j.fish.454
10. Niemi GJ, McDonald ME. Application of ecological indicators. Annual Review of Ecology, Evolution, and Systematics,2004:35:89–111. https://doi.org/10.1146/annurev.ecolsys.35.112202.130132
11. Payra P, Bhanja A, Kandar P. Diversity and composition of aquatic insects in three perennial rural ponds of Ramnagar-I Block, East Midnapore, West Bengal, India. International Journal of Ecology and Environmental Sciences,2025:51(3):297–309. https://doi.org/10.55863/ijees.2025.0619
12. 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. https://doi.org/10.46505/IJBI.2019.1208
13. Priyanka GL, Prasad G. Diversity of aquatic insects (Ephemeroptera, Plecoptera and Trichoptera) in Kallar Stream and its tributaries. Journal of Aquatic Biology and Fisheries,2014:2:493–499.
14. Prommi T, Payakka A. Aquatic insect biodiversity and water quality parameters of streams in northern Thailand. Sains Malaysiana,2015:44(5):707–717. https://doi.org/10.17576/jsm-2015-4405-10
15. Rosenberg DM, Resh VH. (Eds.). Freshwater biomonitoring and benthic macroinvertebrates. Chapman & Hall, 1993.
16. Sharma RC, Sharma G, Anthwal S. Diversity of aquatic insects in relation to physicochemical characteristics of the Chandrabhaga headwater stream, Garhwal Himalaya, India. (Publication details to be verified), 2008.
17. Subramanian KA, Sivaramakrishnan KG. Aquatic insects for biomonitoring freshwater ecosystems: A methodological manual. Ashoka Trust for Research in Ecology and the Environment (ATREE), 2007.
18. Thorpe WH. Plastron respiration in aquatic insects. Biological Reviews,1950:25(3):344–390. https://doi.org/10.1111/j.1469-185X.1950.tb01245.x