



A preliminary study on Aquatic insect diversity in selected water bodies of Chirang district, Assam, Northeast India

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Abstract

Aquatic insects are highly diverse and abundant in freshwater ecosystem, and essential for maintaining the food chain. The present study was carried out to record the aquatic insect diversity in two selected water bodies of Chirang district, Assam, Northeast India. Altogether 22 species belonging to 5 orders and 13 families were reported during the month of December 2023 to July 2024. The specimens were collected by using sweep net, bare hand, jars and other standard methods respectively from two water bodies. During the survey period, aquatic insect was abundant from order Hemiptera (10 species), followed by Odonata (5 species), then the order Coleoptera (4 species), and followed by Diptera (2 species) then Ephemeroptera exhibited the least (1 species). Hemiptera showed highest diversity and dominant order of aquatic insect represented by 6 families and Order Ephemeroptera revealed less visual abundance from the study site. Water body in rural site showed high species richness in contrast to urban site water body. Overall results revealed high aquatic insect diversity in the present study area. This preliminary study will provide insights into aquatic ecosystem for future work.

Keywords: Aquatic insects, freshwater, chirang, Assam

Introduction

Aquatic insect belongs to phylum Arthropoda, and considered ecologically important organisms of freshwater ecosystem. They serve significant roles in maintaining the biodiversity in the ecosystem. These insects are also useful for monitoring of aquatic health due to their sensitive response towards different habitat stimuli and quality of that particular environment (Merritt *et al.*, 2008) [14]. They have particular habitat preferences in the environment. Aquatic insect biodiversity act as an important characteristic for maintaining stability and balance in aquatic ecosystem (Adu and Oyenyi, 2019; Vinson and Hawkins, 1998) [1, 24]. Despite of these, aquatic insects form a crucial link in the aquatic food chains, serving as source of food for aquatic animals along with other wildlife. Some aquatic insects are consumed as edible insects by people. Studies on aquatic insect biology contribute to understand their roles in ecosystem functioning, water quality, bio-indicator and community structure.

Currently, more than 88,500 species of aquatic insects were recorded under approx 13 orders (Huryn *et al.*, 2019; Dijkstra *et al.*, 2014) [11, 6]. Globally, about 4656 species belonging to 326 genera and 20 families constitute freshwater bugs (Polhemus and Polhemus, 2008) [15]. Although, around 45000 species of aquatic insects are found in freshwater ecosystem (Balaram, 2005) [2], many insects are also found in different habitat as well. However, globally these ecosystems are considered most threatened due to growing anthropogenic stress including industrial discharge, agricultural intensification and urbanization (Dudgeon *et al.*, 2006) [7]. Understanding the diversity and distribution of aquatic insect groups reveals insights into interpreting the functional dynamics of community structure and also provides baseline information which is helpful for formulating conservation and management strategies for freshwater ecosystems (Wakhid *et al.*, 2020) [25]. World Conservation Monitoring Centre identified North-eastern region of India as a biodiversity hotspot (WCMC, 1998) [26]

and several studies on aquatic insects have been recorded from this region including Assam. Previous studies on high diversity and abundance of aquatic insects in India (Das and Gupta, 2012; Dutta, 2013 and Sarma *et al.*, 2018) [5, 8, 16] highlighted their role in monitoring environmental changes and ecological importance. Similarly, the abundance of these insects in a particular water body also reveals potential risk to other living organisms. Studies on aquatic insect fauna were found less documented from Northeastern Part of India in contrast to the aquatic insect diversity studies carried out in peninsular India (Sivaramakrishnan and Job, 1981; Sivaramakrishnan *et al.*, 1996 and Sivaramakrishnan *et al.*, 1995) [17, 18, 19]. An attempt was performed to study the aquatic insects from two selected water bodies of Chirang district, Assam. The aim of the present work is to record the survey on aquatic insects found near in and around these selected regions and compare them based on more or rare visual abundance. Findings of this preliminary study will provide baseline information for further studies on these insects from Chirang district.

Materials and Methods

Study area

The survey was carried out in Chirang district, Assam in the month of December 2023 to July 2024. Chirang district lies under the Lower Brahmaputra valley agro-climatic zone. It is located 90°21' East to 90°56' East Longitude and 26°33' North to 26°54' North Latitude and covered by an area of 1,923 km² (Swargiary *et al.*, 2019) [21] and surrounded with forest, small water bodies and vegetation. The Chirang district shares international boundary with Bhutan on north, Kokrajhar district in west, Barpeta and Bongaigaon district on south and Baksa district to the east side respectively. This study site comes under BTR, Assam, possesses biodiversity along with a plain topography. However, pre and post- monsoon months are very unpredictable and sometimes experience erratic rainfall too.

Sample collection and Identification

Specimens were collected with the help of sweep nets, jars, hand pick, and other methods with outmost care from three selected water bodies such as- Water body A and Water body B water bodies from study site. Water body A is located in the rural region and Water body B is located near the city region. However, insect collection was done during the time of morning and evening. Collected samples were identified based on standard keys of classification (Subramanian and Sivaramakrishnan, 2007) [20], some standard books, and references. After the identification, specimens were released in the environment with proper care. Mostly larger-sized aquatic insects were identified based on morphological characters through the naked eye.

Results and Discussion

In the present study, a total of 22 species belonging to 5 orders and 13 families recorded from selected two water

bodies (Water body A and B) of Chirang district, Assam as shown in Table 1. Order Hemiptera was abundant throughout the survey period and recorded 6 families (Gerridae, Belostomatidae, Nepidae, Pleidae, Mesoveliidae and Notonectidae), followed by Odonata with 2 families (Coenagrionidae and Libellulidae), then Coleoptera represented by 3 families (Hydrophilidae, Dytiscidae and Gyrinidae), followed by 1 family each in the order Diptera (Chironomidae) and Ephemeroptera (Baetidae) (Fig. 1). Out of all these order, Hemiptera reported highest diversity and most dominant order of aquatic insects (10 species), then Odonata (5 species), Coleoptera (4 species), Diptera (2 species) and Ephemeroptera (1 species) respectively. Species composition of the recorded order was represented in fig. 2. Most of the aquatic insects were present in Water body A as compared to Water body B.

Table 1: List of collected aquatic insects from two water bodies of the study area

Sl. No.	Order	Family	Species	Water body A (Rural)	Water body B (Urban)
1	Odonata	Coenagrionidae	<i>Ceriagrion sp.</i>	+	-
2			<i>Ischnura sp.</i>	+	+
3		Libellulidae	<i>Orthetrum sp.</i>	+	+
4			<i>Urothemis sp.</i>	+	-
5			<i>Pantala sp.</i>	+	+
6	Hemiptera	Gerridae	<i>Gerris sp.</i>	-	+
7			<i>Limnogonus sp.</i>	+	-
8			<i>Lethocerus sp.</i>	+	-
9		Belostomatidae	<i>Belostoma sp.</i>	+	-
10			<i>Diplonychus sp.</i>	-	+
11		Nepidae	<i>Ranatra sp.</i>	+	-
12			<i>Nepa sp.</i>	+	-
13		Pleidae	<i>Plea sp.</i>	-	+
14		Mesoveliidae	<i>Mesovelia sp.</i>	-	+
15		Notonectidae	<i>Anisops sp.</i>	+	+
16	Coleoptera	Hydrophilidae	<i>Hydrophilus sp.</i>	+	-
17		Dytiscidae	<i>Cybister sp.</i>	+	-
18			<i>Hyphydrus sp.</i>	+	-
19		Gyrinidae	<i>Laccophilus sp.</i>	+	-
20	Diptera	Chironomidae	<i>Chironomous sp.</i>	-	+
21			<i>Culex sp.</i>	-	+
22	Ephemeroptera	Baetidae	<i>Cloeon sp.</i>	+	-

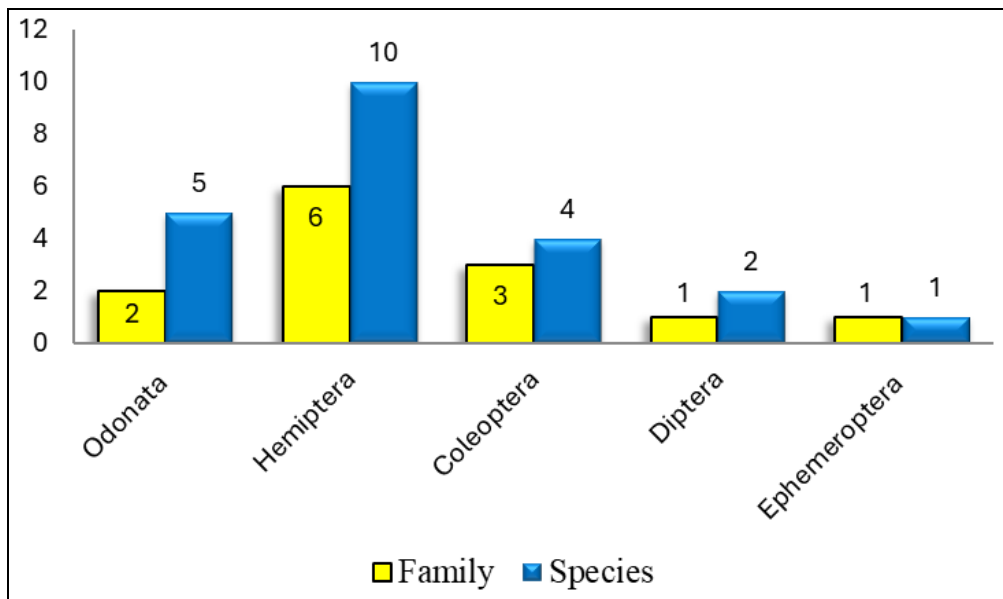


Fig 1: Order wise representation of Aquatic insect diversity in the survey

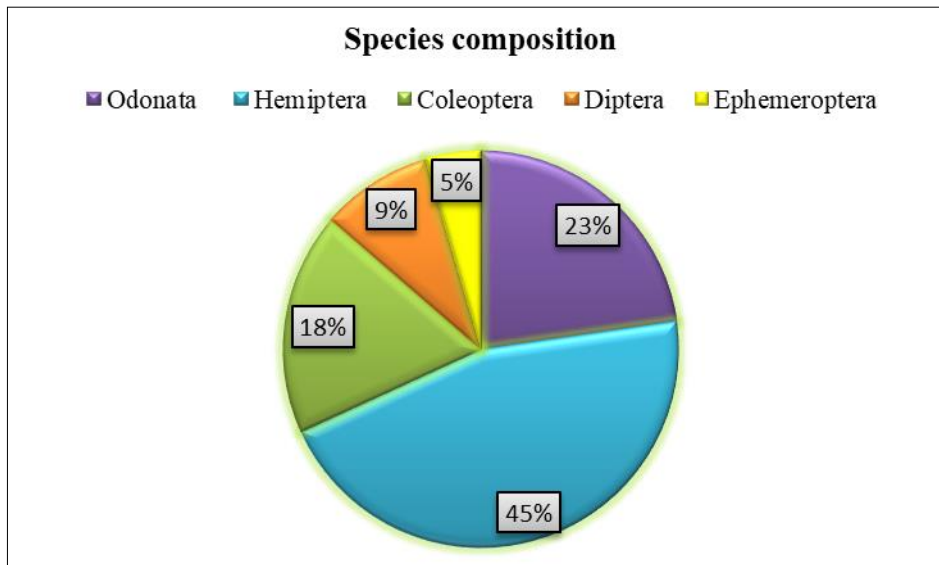


Fig 2: Percentage species composition of different orders in the study area

Collectively, the current finding reveals that aquatic insects under Hemiptera are the most dominant and possess highest diversity while Ephemeroptera exhibits least diversity among all the orders. This is similar with the survey carried out by Hasan *et al.*, (2016) [9] in Guwahati, Assam, which reported Hemiptera as the most diverse order represented by 15 species and least aquatic insect species under Ephemeroptera. Choudhury *et al.*, (2015) [4] also worked on aquatic insect community of Deepor beel (Ramasar site) in the state Assam, found most abundant aquatic insect species under the order Hemiptera as compared to Coleoptera. Recently, a study was conducted by Borkataki *et al.*, (2021) [3] and reported 7692 number of aquatic insects belonging to 6 orders and 19 families from Majuli river island located in Assam, which also confirms that Hemiptera has high abundance in aquatic bodies. Many researchers have documented similar results from different parts of the world including Northeast India (Huang *et al.*, 2010; Takhelmayum *et al.*, 2013 and Jaiswal and Banerjee, 2023) [10, 22, 12]. Moreover, the present study recorded high species richness of aquatic insects Water body A (16 genera), indicating better water quality in rural pond (Wollman, 2001) [27]. Whereas Water body B showed less species richness (10 genera), may be because of habitat disturbance, water pollution, eutrophication and change in aquatic ecosystems (Varma and Pratap, 2006) [23]. Additionally, occurrence of some particular species- Culex, Chironomus and Plea in Water body B also indicates its poor water quality and pollution, as they are commonly live in polluted water bodies. Moreover, many same aquatic insect species under Odonata and Hemiptera are recorded in both water bodies from the study site. This results is similar to work documented by Kalita and Ray (2015) [13].

Conclusion

Aquatic fauna including the aquatic insects are integral components of aquatic ecosystem. Presence and absence of insects reflects their preferred conditions of aquatic habitat. In conclusion, the presence of diverse insect groups in water bodies reveals that Chirang district possesses high aquatic fauna diversity. The current documentation gives insights into the aquatic fauna of rural as well as urban water bodies respectively. It is preliminary study which will provide a baseline data for the future research.

References

1. Adu BW, Oyeniyi EA. Water quality parameters and aquatic insect diversity in Aahoo stream, southwestern Nigeria. *J. Basic Appl. Zool.*,2019;80:2-9.
2. Balaram P. Insect of tropical streams. *Curr. Sci.*,2005;89:914-922.
3. Borkataki SB, Bhattacharyya BK, Medhi, Bhagawati S. Impact of water quality parameters on aquatic insect fauna of Majuli river island, Assam, India. *J. Environ. Biol.*,2021;42:333-342.
4. Choudhury D, Gupta S. Aquatic insect community of Deepor beel (Ramasar site), Assam, India. *Journal of Entomology and Zoology Studies*,2015;3(4):182-192.
5. Das K, Gupta S. Aquatic insect diversity and water quality of wetlands of Assam, India. *Journal of Environmental Biology*,2012;33(1):45-52.
6. Dijkstra KDB, Monaghan MT, Pauls SU. Freshwater biodiversity and insect diversification. *Annu. Rev. Entomol.*,2014;59:143-163.
7. Dudgeon D, Arthington AH, Gessner MO, Kawabata Z I, Knowler DJ, Leveque C. Freshwater biodiversity: importance, threats, status and conservation challenges. *Biological Reviews*,2006;81(2):163-182.
8. Dutta P. Diversity and distribution of aquatic insects in freshwater habitats of Assam. *Indian Journal of Entomology*,2013;75(2):123-130.
9. Hasan I, Haloi DJ, Chetri S, Begum S. Biodiversity of aquatic insect population in three permanent ponds of Guwahati, Assam, India. *International Journal of Fisheries and Aquatic Studies*,2016;4(4):271-275.
10. Huang TH, Lock K, Chi Dang K, De Pauw N, Goethals PLM. Spatial and temporal patterns of macroinvertebrate communities in the Du river Basin in Northern Vietnam. *J Freshwater Ecol*,2010;25:637-647.
11. Hurn AD, Wallace JB. Habitat, life history, secondary production, and behavioral adaptations of aquatic insects. In *An Introduction of Aquatic Insects of North America*, 5th ed.; Merritt, R.W., Cummins, K.W., Berg, M.B., Eds.; Kendall Hunt Publishing Company: Dubuque, IA, USA, 2019, 65-116.
12. Jaiswal D, Banerjee S. A faunistic survey of the aquatic and semi-aquatic bugs (Hemiptera, Heteroptera) of the

- Tiger Reserves in Telangana, India. *Journal of Insect Biodiversity and Systematics*,2023:9(4):775-790.
13. Kalita GJ, Ray SD. Studies on the diversity and habitat preference of odonates in Deepor Beel Bird Sanctuary, Kamrup, Assam. *J. Ento. Zool. Studi.*,2015:3:278-285.
 14. Merritt RW, Cummins KW, Berg MB. An introduction to the Aquatic insect of North America. 4th Ed, 2008, 1158.
 15. Polhemus JT, Polhemus DA. Global diversity of true bugs (Heteroptera; Insecta) in freshwater. *Hydrobiologia*,2008:595:379-391.
 16. Sarma D, Das S, Deka P. Aquatic insect assemblages as indicators of freshwater health in northeast India. *Ecological Indicators*,2018:95:675-684.
 17. Sivaramakrishnan KG, Job SV. Studies on mayfly populations of Courtallam streams. Proceedings of a Symposium on Ecology of Animal Populations, Zoological Survey of India, Calcutta,1981:105-116.
 18. Sivaramakrishnan KG, Morgan HJ, Vincent RH. Biological assessment of the Kaveri river catchment, South India, and using benthic macro invertebrates: Applicability of water quality monitoring approaches developed in other countries. *International journal of Ecology and Environmental Science*,1996:32:113-132
 19. Sivaramakrishnan KG, Venkataraman K, Sridhar S, Marimuthu M. Spatial patterns of benthic macroinvertebrate distributions along river Kaveri and its tributaries (India). *International Journal of Ecology and Environmental Sciences*,1995:21:141-161.
 20. Subramanian KA, Sivaramakrishnan KG. Aquatic insects for bio monitoring freshwater ecosystems - A methodology manual. Ashoka Trust for Res. in Ecol. Env, 2007, 33.
 21. Swargiary A, Roy MK, Daimari M. Survey and Documentation of Ethnobotanicals Used in the Traditional Medicines System of Tribal Communities of Chirang district of Assam Against Helminthiasis. *Biomed Pharmacol J*, 2019, 12(4).
 22. Takhelmayum K, Gupta S, Singh NR. Diversity and Density of Aquatic Insects in the Lower Reach of River Moirang, Manipur, North East India. Proceedings of the National Academy of Sciences, India Section B: *Biological Sciences*,2013:83(4):575-584.
 23. Varma MC, Pratap R. Haematology and Ecotoxicology,2006:1(1):13-20.
 24. Vinson MR, Hawkins CP. Biodiversity of stream insects: Variation at local, basin and regional scales. *Ann. Rev. Entom*,1998:43:271-293.
 25. Wakhid Rauf A, Krisanti K, Sumertajaya IM, Maryana N. Aquatic insect assemblages in four urban lakes of Bogor, West Java, Indonesia. *Biodiversitas*,2020:21(7):461.
 26. WCMC. Freshwater Biodiversity. A preliminary Global Assessment. A document prepared for the 4th Meeting of the Conference of the Practices to the convention of Biological Diversity, World Conservation Monitoring Centre, 1998.
 27. Wollmann K. Corixidae (Hemiptera, Heteroptera) in acidic mining lakes with pH \leq 3 in Lusatia, Germany. *Hydrobiologia*,2001:433(3):181-183.