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Aquatic insect community on sonduba beel, Morigaon district, Assam, India

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Abstract
A study on aquatic insect diversity of Sanduba beel, Morigaon, Assam was conducted in different sites of the beel during the month of May to August 2023. The beel is situated on the southern part of river Brahmaputra. In the enumeration 16 species of 10 families and 5 orders was documented and among them 8 species form 5 families belongs to the order Hemiptera and other 5 species and 2 families are from order Coleoptera. Inland waters cover less than one percent of Earth's surface, but anchorage more than 6% of all insect species: nearly 100000 species from 12 orders spend one or more life stages in freshwater. Freshwater habitats are exceptionally susceptible to environmental change and exhibit marked ecological gradients. The amphibiotic lifestyles of aquatic insects result in complex contributions of extinction and allopatric and non-allopatric speciation in species diversification.

Keywords: Aquatic insect, sanduba beel, Morigaon district

Introduction

Arthropoda is the largest group of phylum of Animal Kingdom in earth and widely distributed [1]. The organisms belonging to Arthropoda can be both aquatic and terrestrial in respect to habitats. Aquatic biodiversity is very essential to maintain the characteristic and stability of aquatic ecosystem it helps the system to adapt with any environmental change [2, 5]. Aquatic insects an important link for the proper management of aquatic ecosystem. Their primary function is to act as a nutritive fauna to maintain, control and regulate the food chain and web of aquatic ecosystem. Aquatic insects encompass a diverse and important group of animals, both taxonomically and ecologically [6]. In the processing and cycling of nutrients aquatic insect play an active role. There are several specialized feeding groups like shredders, filter feeders, depositor collectors and predators and these groups helps the whole category to act as a recycler of aquatic system [7, 8].

Now a days aquatic insects are also used as a bio tool to assess physico chemical water quality and pollution depending on the species abundance in a particular water body [9, 10]. The abundance of aquatic insect community in a water body indicates the environmental status and potential danger for living organism too [11].

Human wellbeing is highly contributed by wetland and beel ecosystems. Together with energy and nutrients, water focuses for the delivery of eco- system services to humankind. The freshwater ecosystem services *i.e.,* nature's works free of cost are particularly valuable to the inhabitants who are poor and entirely depend on nature's services directly for their livelihoods [12, 13].

Human activity gradually damage either aquatic and terrestrial niches or habitats. They introduce biotic pressures like pollution (soil, water, air), over-exploitation, deforestation, introduce exotic species, rapid urbanization etc. Those activities will rapidly decline aquatic biodiversity after few years [14, 15, 16].

If we talk about India, there is a diverse insect community found here comparing the other countries all over the world. Officially 4 out of 36 biodiversity hotspots in the world present in India, *i.e.,* The Himalayas, the Western Ghats, the Indu-Burma region and the Sunderland. North-eastern region come under the Indu-Burma biodiversity hotspot which ranks 6th. About 60% forest area covered under the N.E. states [17]. The Brahmaputra and Barak River system along with their tributaries and flood plain wetlands locally knows as beels provide very conducive habitant. Assam and other parts of N.E. region are recognized as one of the hotspots of fresh water biodiversity [18]. The biodiversity of the northeast is a genetic treasure of various forms of plants and animals. This region comprises of 3624 species of insects, 236 fishes, 541 birds, 160 mammalian species etc. making it rich in the diversification of species. But that region of India has less documented on aquatic insect compared to the other regions [19, 20].

Methodology

Study area

Field survey was conducted in the study area, *i.e.,* different sites of Sanduba beel in the month of May-August,2023. The location of the beel is 16 Km away north from Morigaon Town and considered as a prime wetland of middle Assam in Brahmaputra valley. The sites which were selected for field survey was Garapar Hari Mandir ghat, Besamari ghat and nearby area of the both side wetlands of the beel.

Collection and identification of insects*:* Generally collection was done by morning and evening time by using different gear for catching insect samples. Observation was done by based on morphological characters. Large numbers of Arthropoda found in aquatic habitats but observed carefully it is insects or not, only insect were collected. Aquatic insect samples were collected by using various methods such as 'all out search methods' using Thela jal. After collection, samples were stored and preserved,

applying dry methods and kept in a container and naphthalene ball as a preservative.

To sort, count and identify the collected insect, standard keys were used. Family and species level relative abundance were calculated.

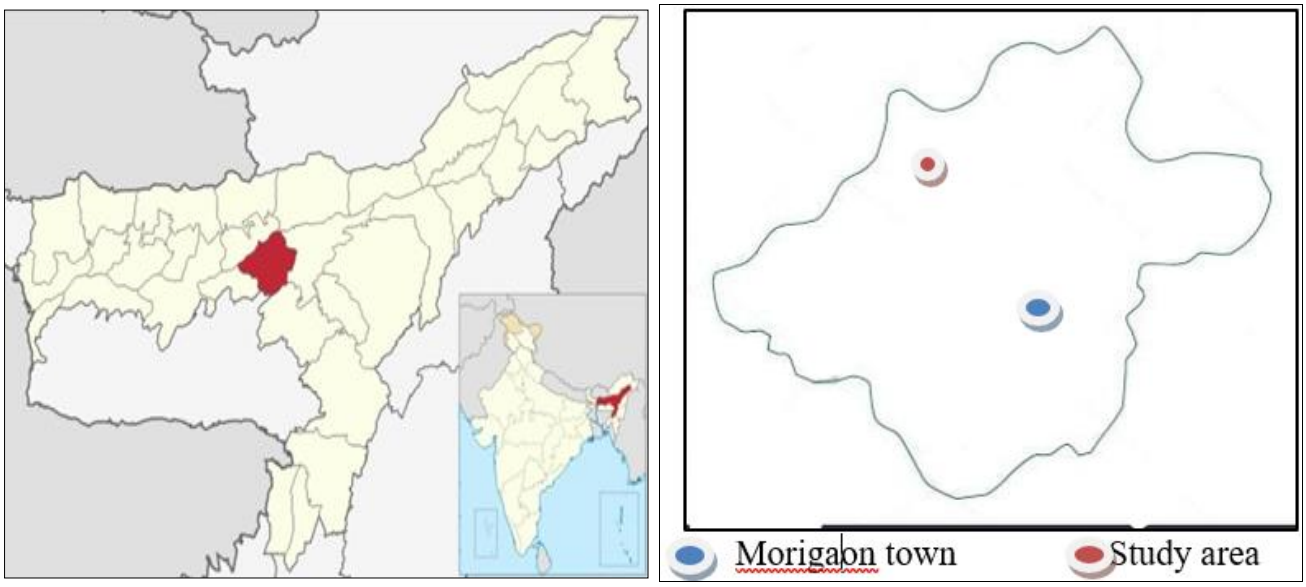


Fig 1: Map of the study area

Results and discussion

In the field study, aquatic insects from 4 different orders (Hemiptera, Diptera, Coleoptera and Odonata), 10 different families (from order Hemiptera, Corixidae, Nepidae, Notonectidae, Gerridae, Belostomatidae) (from order Odonata, Libellulidae, Coenagrionidae) (from order Coleoptera, Hydrophilidae, Dytiscidae) and (from Diptera, Chironomidae), and 16 species has been recorded. They were represented by 8 species of order Hemiptera, 5 species of order Coleoptera, 2 species of order Odonata and 1 species of order Diptera. In order Hemiptera highest number of species has been found, followed by order Coleoptera and Odonata have only one species.

Similar study has been conducted in two different lentic ecosystem in Gauhati University and 14 different aquatic insect species was found [3]. 12 and 10 aquatic insect species belonging to Hemiptera in two ecosystem *viz* rain pool and agricultural field has been recorded in a n another study conducted in Cachar district [1]. In a similar study in the same district was conducted and found 14 species of Hemiptera. The insect collection was done in a Temple pond [2]. 5 species of Hemiptera from Phulbarianua was also listed in a separate survey [4]. The number of different aquatic insect species that was collected and documented in the present study proves that Sanduba beel have a very rich diversity in respect to aquatic insect diversity.

Table 1: Collected aquatic insects from order Hemiptera

Order	Family	Species
Hemiptera	Belostomatidae	(1) *Diplonychusrusticus* (Fabricius, 1781) (2) *Lethocerusindicus* (Lepeletier& Serville, 1825)
	Corixidae	(1) *Corixapunctata* (Illiger, 1807)
	Gerridae	(1) *Limnogonusnitidus* (Myar, 1865) (2) *Gerrislacustris* (Fabricius, 1794)
	Nepidae	(1) *Nepacinerea* (Linnaeus, 1758) (2) *Ranatraunicolor* (Scott, 1874)
	Notonectidae	(1) *Anisopsbreddini* (Kirkaldy, 1901)

Table 2: Collected aquatic insects from order Coleoptera

Order	Family	Species
Coleoptera	Dytiscidae	(1) *Laccophilus* sp. (Leach, 1817) (2) *Cybistertripunctatus* (Olivier, 1795)
	Hydrophilidae	(1) *Laccobius* sp. (Erichson, 1837) (2) *Hydrophiluspiceus* (Linnaeus, 1758) (3) *Berosus* ap. (Leach, 1817)

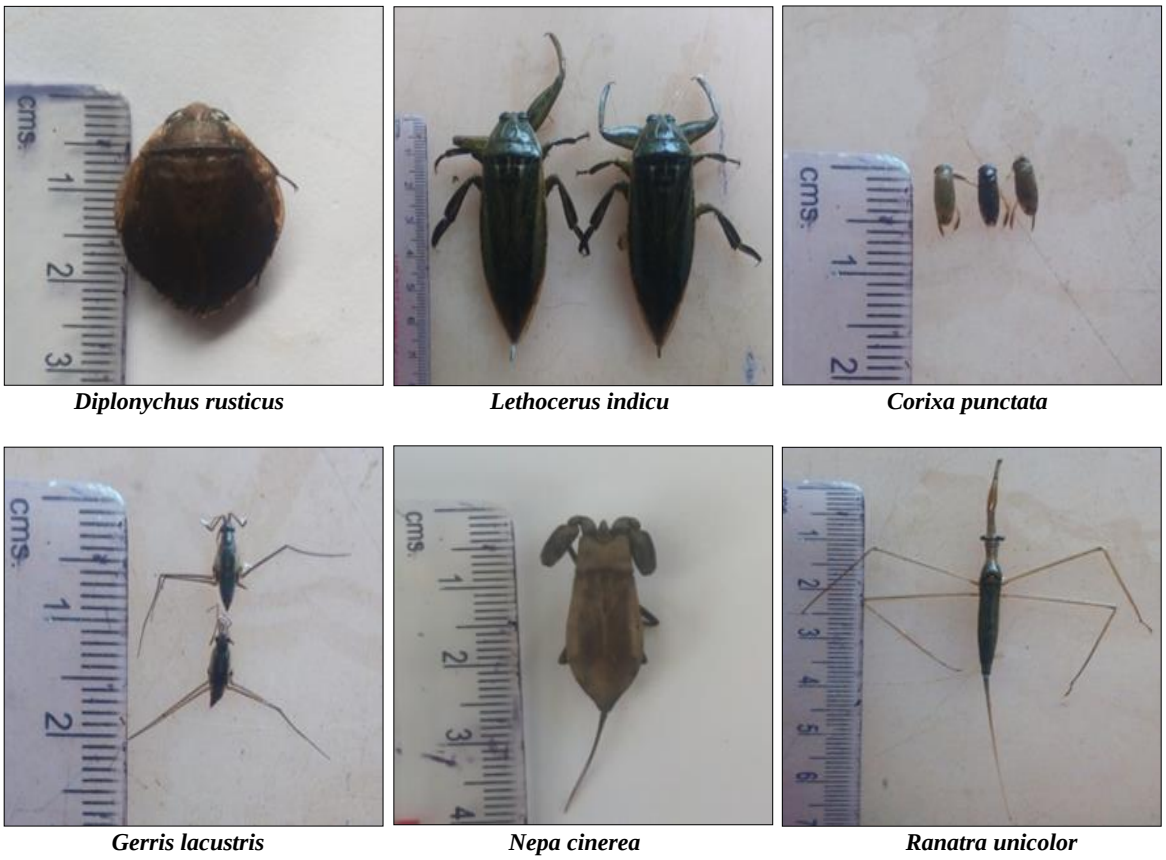
Table 3: Collected aquatic insects from order Diptera and Odonata

Order	Family	Species
Odonata	Libellulidae	(1) *Neurothemis* sp. (Brauer, 1867)
	Coenagrionidae	(1) *Pseudagrion* sp. (Selys, 1876)
Diptera	Chironomidae	(1) *Chironomus* sp. (Megien, 1803)

Table 4: Collected aquatic insects and their identifying characters recorded in the study area

Sl no	Species name	Family	Identifying Characters
1	*Diplonychus rusticus*	Belostomatidae	Body: Oval, egg-shaped, Body length:2.0-2.5 cm; Colouration: Medium brown colour Special character: Very small anterior tarsal claws.
2	*Lethocerus indicus*	Belostomatidae	Body: Oval Body length: 6.5-8cm,

			Cody colour: Dark brown. Special character: Flattened body and4 segmented antennae. raptorial, prehensile forelegs and middle and hind legs having natatory, hair fringe on tibia. Abdomen with 2 retractile apical appendages forming a respiratory tube, associated with spiracle of 6th abdominal segment.
3	*Corixa punctata*	Corixidae	Body length: 5-6mm. Special character:Long hind legs, enclosed in tiny hairs. They help the insect to float on the water surface.
4	*Limnogonus nitidus*	Gerridae	Body length: 6.0-8.0mm Special character:Segmented antennae, 1st and 4th segments are the longest and sub-equal while shortest segments are 2nd and 3rd segments, they are sub-equal in length. Antennae having pronotal lobe without yellow median line, connexinum terminating into fairly prominent spine.
5	*Gerris lacustris*	Gerridae	Body length: 1.0-1.5cm Special character: Dorsal inner margins of eyes sinuate, pronotum hinny with a single central stripe or no apparent margin, hind tibia not more than 3.2 times length of first tarsal segment.
6	*Nepa cinerea*	Nepidae	Body: Elongated sub oval and flattened with long pronotum. Special character: Tubercle is round at the base of each anterior femora; anterior coxae is very short
7	*Ranatra unicolor*	Nepidae	Body length: Adult is generally 2-6cm long Special character: Front legs are strong and it has grasping capacity to catch pray. The siphon is typically almost the same size but varies from less than half the body length to somewhat longer.
8	*Anisops breddini*	Notonectidae	Body: Convex dorsal body, Special character: Head concealed into prothorax, having large eyes with 4 segmented antennae, short rostrum with 3-4 segment. Forelegs- raptorial, hind legs- without claws, long oar-like natatory modified for swimming. Apile of hydrofuge hair on the lateral sides of abdomen.
9	*Laccophilus* sp.	Dytiscidae	Body length: Adult body is about 1-4mm long. Colour: Shiny black or brownish-black and having marked dull yellow, green or bronze marking. Special character: 11 segmented antennae which are thread like and very long. Widely separated 2nd and 3rd leg and having very large hind coxae. In *Laccophilus* sp. the spines of hind tibiae divided at tip, usually 3 to 6 mm long, widely distributed and common.
10	*Cybistertri punctatus*	Dytiscidae	Body: Large, dorso-ventrally flattened, oval, Colour: black, brown or green in colors Feeding habit: carnivorous. Special character: Antennae – filiform; Hind legs – natatorial functioning as swimming organs, flattened and fringed with large hairs. Elytra store air beneath them.
11	*Hydrophilus piceus*	Hydrophillidae	Body: Small or large and Oval Colour: Black or dull colored oval, flattened and predaceous beetles. Special character: Antennae – short 6-9 segmented with hairy terminal clubs, tarsi of forelegs modified into clinging organs to hold female. Mid and hind legs are fringed with setae. Elytra enclose dorsal air reservoir and ventral hairy tracts which hold air film.
12	*Laccobius* sp.	Hydrophillidae	Body: Adults are small, about 4mm in length; Special character: Maxillary pulpi shorter than antennae; elytra without striae; arcuate hind tibiae; tarsi are 5 segmented with mid and hind tarsi having natatory setae.
13	*Berosus* sp.	Hydrophillidae	Body: Adults are small in size about 2-7mm long. Body colour: Brown to yellowish- brown coloration Special character: Discontinuous pronotum with elytra; scutellum longer than wide; meso and metasternum without a ventral keel produced into a posterior spine; Having a well-developed middle and hind tibiae and tarsi fringe of long natatory setae, basal tersomere shorter than second.
14	*Neurothemis* sp.	Libellulidae	Special character: Having converge paraprocts. Protruded eye from anterior and lateral side; Length of lateral spine on abdominal segments nine shorter than mid dorsal length of segment; Epiproct is little shorter than paraprocts.
15	*Pseudagrion* sp.	Coenagrionidae	Special character: Having caudal gills and it is shorter than the abdomen; antennae have 3 segments, 3-5 premental setae are usually situated on either side of the midline of the mentum. The posterior corners of head are flared having about 6 palpal setae per labial palp; Uniform caudal gills uniform and rounded at the ends; nodal spine on media caudal gill similar to those on lateral caudal gills.
16	*Chironomus* sp. (Larva)	Chironomidae	Special character: Having two eyespots, normally separate and arranged one above the other. Abdominal segments are 8 in number with fingerlike ventral tubules; body is less than 30mm long. Shorter ventral tubules than length of eighth abdominal segment; The Seventh abdominal segment does not have posterolateral tubule. Their habitat is lentic in nature.



Diplonychus rusticus *Lethocerus indicu* *Corixa punctata*

Gerris lacustris *Nepa cinerea* *Ranatra unicolor*

Fig 2: Photo representatives of collected aquatic insect in Sanduba beel

Conclusions

According to the study Sanduba beel, the aquatic insect diversity is very rich**.** Very few information has been found regarding the abundance of fresh water insect community in Morigaon district, Assam. That is why vigorous investigation is needed to understand the variety of aquatic insect and their role in maintaining stable ecosystem in this study area is highly neededThis kind of research may help the scientific community and the taxonomist to make a base on ecosystem conservation. and environmental to monitor and assess environment, aquatic insects are common subjects of ecological research. They can act as a food for fish, amphibians and any other wildlife. They are important contributors to energy and nutrient cycling, including capturing nutrients and returning them to terrestrial ecosystems and purifying water and also playing an important role for transmission of human and animal diseases. These insects also are important for biological control. Therefore, ecological study on aquatic insects can provide information about ecology of insects in an area for any decision making.

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