

Exploration of Aquatic Edible Insects from the Wetlands of Majuli River Island, Assam, India

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Abstract

Aquatic insects have very rich species diversity, though aquatic insects represent only 10% of the insect species and only include 12 orders and they share some of the same orders with terrestrial insects taxonomically. Edible insects have great potential to be human food; among them, aquatic insects have unique characteristics and deserve special attention. Human beings have a very long and rich history of entomophagy, especially in Africa, Asia, and Latin America. Aquatic insect are composed of around 76000 specie, found in wide range of aquatic, semi-aquatic habitats from springs , ponds, beels, and lakes to large river. Over 2000 insect species are eaten, edible aquatic insects account for about 15% of the total number. The species belongs to eight orders, namely Coleoptera, Odonata, Hemiptera, Diptera, Tricoptera, Megaloptera, Ephemeroptera and Plecoptera. Among them Coleoptera, Odonata and Hemiptera contribute over $\frac{3}{4}$ of the number of species and they are all predatory. Wetlands of Majuli are permanent, having water throughout the year. Wetland ecosystem provides wide range of environmental as well as socio-economic functions. The resources of these wetlands are important or human nutrition and the state's economy as they provide a habitat for number of endemic aquatic flora and fauna including edible aquatic insects, fishes, migratory birds and indigenous birds. There are more than 106 nos. of registered and unregistered wetlands are in Majuli river Island. Traditional knowledge of capturing aquatic edible insects along with fishes is rich among the local people of Majuli. Edible aquatic insects are collected both by conventional and nonconventional fishing gears. The present paper highlighted about the aquatic edible insects from wetlands of Majuli and consumed by local people.

Keywords: Aquatic edible insects, Wetlands, Majuli River Island.

Introduction

A large number insect species are readily consumed in most parts of the world. At least a 1000 species of insects are eaten worldwide, mainly in developing countries. They would form a whole new class of foods made to order for low-input small-business and small-farm production. International trade in edible insects would almost certainly increase (*DeFoliart, 1992*). The use of insects as medicine is known from all parts of the globe, including Africa and China. Insects are consumed as food and medicine by some tribal communities in India (*Kumari and Kumar, 2009*). All the tribes of Kerala use honey of *Apis indica* for the treatment of headache, mouth ulcer, burns, cough, asthma, chest infection, throat pain, body pain, fungus infection and or health (*Wilsanand, Varghese and Rajitha, 2007*). The current statistics reflects the identification of over 2100 edible insects species with over billions of humans engaged in entomophagy. The most common orders include Coleoptera (31%), Lepidoptera (18%), Hymenoptera(14%), Orhoptera (13%), Hemiptera (10%), Blattodea(3%), Odonata (3%) and Diptera (2%) (*Klaus et al., 2021*). Edible aquatic insects contribute about 15% of the total edible insects species (2000). Six of the 12 orders of aquatic insects have suitable specie for food and feed viz., Coleoptera (beetles), Odonata (dragonflies/damselflies), Hemiptera (true bugs), Diptera (true flies), Tricoptera (caddisflies) and Ephemeroptera (mayflies). Of which Coleoptera, Odonata and Hemiptera are the major population of the number of species (*Bhateja et al., 2023*). In India, entomophagy is practiced mostly in North-eastern states because a large number of ethnic tribes who possesses vast traditional knowledge and wisdom on edible and therapeutic insects are inhabitants in these region. Aquatic insects become more abundant in various water bodies in these region during the rainy season (*Sarmah et al., 2022*). Aquatic insects such as giant water bugs and water beetles are collected from the wild and sold in the markets, especially in Indian states of Manipur, Nagaland, and Assam. Similarly, aquatic insects such as giant water bugs, water striders, and backswimmers, are

popular delicacies in many South Asian Countries (Polhemus, 2008). The aquatic edible nymphs of *Sympetrum sp.* (Odonata: Libellulidae) has rich supplement of macronutrients such as potassium, sodium and phosphorus to human diet (Narzari et al., 2017). The people living in Manipur have distinct identity, culture and food habits. Five potentially aquatic edible insects *Lethocercus indicus* (Hemiptera: Belostomatidae), *Laccotrephes maculatus* (Nepidae), *Hydrophilus olivaceus* (Coleoptera: Dytiscidae), *Cybister tripunctatus* (Odonata: Libellulidae), *Crocothemis srivilia* (Odonata: Libellulidae) are intake by people of Manipur (Shantibala et al.,2014). *Lethocercus indicus* (Lep. &Ser.) is a widely used edible aquatic insect known for its aroma, flavour and therapeutic purposes by people from North East India (Devi et al.,2023). *Diplonychus rusticus*, *Cybister sp.*, *Lethocercus indicus*, *Laccotrephes sp.* and *Ranatra sp.* are aquatic edible insects collected from streams, ponds, rice fields and shallow water bodies from Majuli river island of Assam (Sarmah et.al.2022). *Hydrous sp.*, *Lethocercus indicus*, *Laccotrephes maculatus*, *Notonecta sp.*, *Diplonychus rusticus*, *Cybister sp.* are aquatic edible insects consumed by Meitei and Kom and Tanhkhul tribes of Manipur, NE India (Kom K.G. et al. 2020). The present paper is focussed on aquatic edible insects of wetlands of Majuli river island, Assam, India.

Materials and methods:

Study Area: The geographical coordinates of Majuli Island are 27°00' N Latitude and 94°13'E Longitude with an altitude of about 84.5 m above mean sea level. The Island is formed by the Brahmaputra River in the South and Kherkatia Huti and joined by the Subansiri River by the North. Majuli is a flat floodplain which is surrounded by over 20 islets, locally known as *chaponi* (Dutta et al., 2010). The islands receives an annual rainfall of aboit 2100 mm and temperature ranges from 7 to 37°C with high relative humidity varies from 54 to 86% which supports growth of diverse vegetation (Goswami et al.,2020). There are 106 nos. of registered and unregistered wetlands/beels/derelict water bodies in Majuli District. The present study was conducted in the 5 selected wetlands (beels) based on (table 1) on its fishery, agricultural potentials, ecological value and human interference. Survey was performed in seasonal basis in the selected wetlands during 2024-25.

Collection of data: During fieldwork, various methods of data collection were employed. To find out the information on socio-cultural life of the people, their ecological niche mode and pattern of insect consumption, different field techniques or methods were employed during study period-interview, observation and photography. Aquatic edible insects were collected from local fishermen, local villagers during fishing times by aquatic insect net, traditional fishing gears such as Chaloni (sieve like), Musarijial, Dolijal, Khewalijal, Gillnets, Jakoi etc. Specimens were taken to laboratory of Zoology Deptt., Majuli College, India, washed, identified using standard keys and preserved in 70%-80% ethanol.

Table 1: Geographical coordinates distribution and areas of selected wetlands

Selected wetlands	Area (ha.)	Location	Geographical Coordinates
Chakuli beel	1.5	Laholial	26.94460 N 94.14760 E
Bhugpur beel	0.9	Begnaatisatra	26.94730 N 94.20840 E
Jorbeel	23.7	Rangachahi	26.97910 N 94.20400 E
Kakorikata beel	70	Kakorikata	26.93510 N 94.11380 E
Bhuramora beel	3.0	Bhuramora	26.96730 N 94.20800 E

Results and Discussion:

During the study period in the selected beels of wetlands of Majuli the following 10 (ten) aquatic edible insects are recorded.

S l. n o.	Name of aquatic edible insects	Scientific name	Order	Family	Mode of Consumption
1.	Asian Giant Water Bug	<i>Lethocercus indicus</i>	Hemiptera	Belostomatida	Fried, roasted, Chutney
2.	Dwarf Spotted Water Scorpion	<i>Laccotrephes maculatus</i>	Hemiptera	Nepidae	Fried,roasted, Chutney

3.	Water Scavenger beetle	<i>Hydrophilus olivaceous</i>	Coleoptera	Hydrophilidae	Fried
4.	Predaceous diving beetle	<i>Cybister tripunctatus</i>	Coleoptera	Dytiscidae	Fried, roasted, Chutney
5.	Ruddy marsh skimmer	<i>Crocothemis servilia</i>	Odonata	Libellulidae	Fried
6.	Backswimmer	<i>Notonecta maculata</i>	Hemiptera	Notonectidae	Fried
7.	Water bug	<i>Diplonychus rusticus</i>	Hemiptera	Belostomatida	Fried, roasted, chutney
8.	Water stick insect	<i>Ranatra sp.</i>	Hemiptera	Nepidae	Fried
9.	Black darter	<i>Sympetrum sp.</i>	Odonata	Libellulidae	Fried
10.	Great diving beetle	<i>Dytiscus marginalis</i>	Coleoptera	Dytiscidae	Fried, roasted, Chutney

The aquatic edible insects belong to Order Hemiptera (5), Coleoptera (3) and Odonata (2) and family Belostomatidae (2) Nepidae (2) Libellulidae (2) Hydrophilidae (1) Dytiscidae (2) and Notonectidae (1). The adult, naiad or larva is the main edible stage of aquatic insects. The details of insect species are as follows-

Hemiptera-Aquatic Hemiptera are crucial components of freshwater ecosystems, acting as predators of larvae and as prey for fish and birds. Often called true bugs, are a diverse group of mostly freshwater insects that inhabit water surfaces or submerged environments. *Lethocercus indicus*, *Laccotrephes maculata*, *Notonecta maculata*, *Diplonychus rusticus* *Ranatra sp.* are some of the important species as consumed by people of Manipur, Assam and other states North East India and abroad. Hemipterans consumed as fried, roasted and chutney.

Coleoptera-Aquatic Coleoptera constitute an important part of the macrozoobenthos of freshwater habitats. Small and temporary water bodies have more species than large and permanent ones. Aquatic Coleopterans have greatest abundance and diversity in temperate regions. Many of them especially Dytiscids and many Hydrophilids are greatly found in habitats of small shallow water bodies or on the margin of rivers and marshes. Globally about 22 species are edible. *Hydrophilus olivaceous*, *Cybister tripunctatus* and *Dytiscus marginalis* are important aquatic edible coleopteran by people from Manipur, Assam and other states of North East India. Consumed as fried, roasted & chutney.

Odonata- Among those, dragonflies and damselflies (Odonata) are considered as one of the best and nutritious edible insect resources (Jiang et al., 2017). At least 14 species of dragon flies are reported consumed by people by the India. In China commonly eaten dragonflies and damsel flies are *Anax parthenope*, *Crocothemis servilia*, *Gomphus cuneatus* and *Lestes praemorsa* (Siddiqui S.A. et al., 2024). Odonata *Crocothemis servilia* and *Sympetrum sp.* are consumed by people from Manipur, Bodo from Assam and other states of North East India. These are consumed as fried.

Conclusion: Aquatic edible insects are gaining recognition as a future food due to their exceptional nutritional density and ecological advantages over traditional livestock. While they represent about 15% of all edible insect species. Over 31 species of aquatic insects documented as edible in regions like Loktak, Manipur. *Lethocercus indicus*, *Diplonichus rusticus*, *Gerris sp.*, *Aquarius sp.*, *Limnognon sp.*, *Enithare sp.*, *Paranisops sp.*, *Cercomatus sp.*, *Libulla sp.*, *Sympetrum sp.*, *Leucorrhina sp.*, *Ischnura sp.*, *Pseudagrion sp.*, were present in the natural habitats of Loktak lake in Manipur (Devi et al., 2018). In Assam, several aquatic edible insects are traditionally consumed by various ethnic groups, particularly the Bodo, Rabha, Mishng and Tiwa Communities such as *Lethocercus indicus*, *Diplonichus rusticus*, *Cybister sp.*, *Laccotrephes sp.*, *Ranatra sp.*, *Sympetrum sp.*, *Hydrophilus olivaceous*, *Gerris sp.* etc. are common. Aquatic edible insects are highly effective biomonitors for water quality due to their extreme sensitivity to environmental changes, varied tolerance levels, and ability to integrate long term ecosystem shifts. The wetlands of Majuli are a vital ecological and socio-economic backbone of the region. There are 10 nos. of aquatic edible insects are recorded from the wetlands of Majuli so far. Despite their ecological and socio-economic importance, these

wetlands are under severe pressure such as soil erosion & shrinkage, hydrological blockage and human encroachment. Strengthening sustainable wetland management efforts through effective policies and legislations, improving institutional arrangements and supporting capacity building initiatives will gain momentum to conserve the wetlands.

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