Research Article

Exploring Edible Insects: An Investigation in Kamrup District (Assam) and Ri-Bhoi District (Meghalaya), North-Eastern India

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ABSTRACT

In the ecological context, insects play a crucial role by establishing a connection between people's livelihoods and the assessment of sustainable practices. The exploration of edible insects as a food source necessitates consideration of various factors such as ecology, management, conservation implications, industrialization and marketing to foster their sustainable development. Through a survey conducted in selected areas, the study identified a total of 26 edible insect species across 9 Orders and 20 Families. Notably, Beltola Market yielded 14 species, while the USTM campus Forest area contributed 10 species. Among these, Orthoptera emerged as the most consumed edible insect species in Kamrup District (Assam) and Ri-Bhoi District (Meghalaya), comprising 27%, followed by Lepidoptera, Decapoda and Hymenoptera at 15% and Odonata and Coleoptera at 8%. Conversely, Isoptera, Hemiptera and Blattodea exhibited the lowest consumption rates, each at 4%. The survey also highlighted that 46% of the insects categorized as omnivorous, 37% as herbivorous, 13% as carnivorous and only 4% as detritivores. The traditional knowledge of entomophagy, deeply rooted in indigenous practices, is gradually diminishing due to evolving socio-economic conditions and dietary habits. Recognizing this trend, there is a pressing need to assess insect biodiversity and explore the role of ethno-entomophagy, particularly in northeastern India, to conserve this invaluable natural resource, along with its traditional knowledge and potential commercial applications.

Keywords: Edible insects, Kamrup, Ri-Bhoi, Entomophagy, Biodiversity, Traditional knowledge.

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INTRODUCTION

Arthropods (Insects), the largest phylum among all animal kingdoms, making up to more than eighty percent of all animal species documented till date contains between 5-10 million species across the globe. These Arthropods were one of the most successful and earliest groups of animals to evolve and survive all types of tragedies and disasters and adjust their life to better environment giving life to a great number of many species alive today. Insects are considered as a primary source of nutritional components which are commonly consumed in many parts of the world as a means of traditional food, occasional or festive food and various purposes like preparation of medicine, supplement and vitamins. It is also taken as a regular diet throughout the year depends upon availability in season. Nutritional value presents that edible insects have very high protein content and an abundant amount of fats, lipids, carbohydrates and minerals. Nonetheless, the nutritional content of these insects is subject to seasonality and relies on the quality of their feed. In the present day, the consumption of insects by humans is a traditional practice observed in numerous countries worldwide, including Asia, Africa, America, Australia, South America and Latin America. People derive significant nutritional benefits from consuming edible insects such as ants, beetles, worms, grubs, bees, crickets, flies, termites, caterpillars and more. The majority of

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these edible insects contribute substantially to meeting energy and protein requirements in the human diet.

The consumption of insects as a food source is termed Entomophagy, a practice recognized globally.[1] However, the prevalence of this practice varies among different ethnic groups and communities. The role of Edible Insects in preserving biodiversity emphasizes that the extensive variety of habitats supporting insect species as traditional foods presents numerous opportunities for recognizing and managing insect resources.[2] This not only enhances human nutrition but also contributes to the preservation of diverse habitats for other forms of life. The investigation of Edible Insects (Entomophagy) in Karbi Anglong District, found that ethnic tribes in the region consume up to 40 species of edible insects.[3] Among them, the Karbis and Rengma Nagas stand out as the most avid consumers, incorporating all 32 species, with preferences for specific families. Notably, Eri Silkworm and Red Ants are highly favored among the majority of tribes in Karbi Anglong District, serving not only as a dietary staple but also as a source of income. The traditional uses of insects in medicine and food among the Mishing tribe in Dhemaji District, revealing 15 edible insect species with medicinal properties.[4] The study highlights the significance of insects like Giant water bugs, Eri Silkworm, Muga Silkworm and House Cricket in the Mishing tribe's diet. Research studies on Entomophagy practices among ethnic communities in Manipur, reported 41 insect species as food items.[5] The study underscores the potential for integrating scientific validation with traditional wisdom to establish the comparability of edible insects with conventional food products. Entomophagy and Entomotherapeutic practices among six tribes in Eastern Arunachal Pradesh, revealed 51 insect species accepted as food.[6] The research study found considerable variations in the number and species used as food or therapeutically among different tribes. Research in Northeastern regions indicates that around 298 species of edible insects are utilized as a significant food source by various tribes and communities. The Kamrup District in Assam, particularly the Beltola Market, emerges as a key hub for insect trade, reflecting the high demand for edible insects. The dietary preferences of different tribes in the region vary, with Coleoptera being the most consumed, followed by Orthoptera, Hemiptera, Odonata, Lepidoptera, Isoptera and Ephimeroptera. Beyond their nutritional value, insects are also recognized for their health-enhancing properties and medicinal values, as acknowledged by the 2004 FAO report. Entomophagy remains an age-old practice globally, with over 2,000 insect species serving as food. The study in Dimoria development Block of Assam reveals the consumption of 18 species of edible insects, with Orthoptera being the most prevalent.[7] Popular insects among the ethnic groups include *Lethocerus indicus*, *Samia ricini*, *Antherea assama*, *Acheta domesticus* and the larva of *Oecophylla smaragdina*. The study stresses the importance of assessing edible insect diversity and the role of Entomophagy in the context of conservation strategies. Additionally, other studies underscore the appeal and benefits of edible insects, attracting entrepreneurs globally, regardless of their inclusion in local diets. The focus of these studies lies in identifying edible insects, understanding their beneficial values and observing traditional knowledge in the selected areas.[8,9] Thus, this research has been conducted to identify the important edible insect species available in this North-Eastern region of India and study their edibility behaviour, seasonal abundance of the insects.

MATERIALS AND METHODS

Study sites

The primary focus of the study was on the Beltola Market and the USTM (University of Science and Technology, Meghalaya) campus forest area (Figure 1). Situated in Guwahati, within the Kamrup District of Assam state, India, the expansive Beltola Market serves as a significant location for the research. The area lies between 26.114098ºN Latitude, 91.789956ºE Longitude. The area has a maximum temperature of about 38.5ºC and a minimum temperature of about 6-7ºC. The Climate has Sub Tropical region with semi dry season and cold during winter. It undergoes an annual rainfall of around 1500 mm to 2600mm. The majority of the inhabitants in the area (District) belong to local tribal community. Another study area (USTM) which is not very far away from Guwahati (Kamrup) is located in Meghalaya state (Ri-Bhoi District) of Northeast India. Geographically it lies within the area between 26.1013ºN Latitude and 91.8477ºE Longitude. The study was conducted mainly from Beltola Market of Kamrup District located in lower Assam (Guwahati). The collection of data was started from January 2019 and continues till February 2020. It was studied by visiting the market which was on a setup term of bi-weekly basis on Thursday and Sunday, following strict timing and maintaining discipline during the marketing hours.[10] The data was collected by visiting the Beltola Market usually 3-4 times a month. While doing so, the Market Vendors and the Entomophage were questioned as to how the insects were harvested, seasons of collection, mode of consumption, Habitat,

way of cleaning up before cooked, parts to be eaten and parts to be discarded, its usefulness and benefits in terms of health as well as the positive role played by insects in the Environment. The informants in midst of collecting the data were also asked about which insects being most preferred and favourable to the consumers supplied to them in the Market. The information given by the indigenous vendors and local people revealed that the Insects larvae, nymphs and the pupae are most preferred and have higher market demand as they contain more nutrients content than that of matured and adult ones.

Figure 1: Study area map (Source-Google Earth).

Data's were also collected from USTM Campus Forest Area by visiting the campus and nearby campus forest area frequently during the allotted time given for a maximum 1-2 hr. With the help of an entomological net and a small container with 10% alcohol and 20% of water in it provided by Department of Zoology Laboratory USTM in-order to preserved the collected specimens for further identification. During data collection a Digital camera is importantly used to photographs the insects for better information and identification of the insects found. It is also useful to know and understand its overall details like their behaviour, morphological characters and life stages.

RESULTS

Table 1: (a) Lists of edible insects found in the study area along with the description of edibility behaviour and importance.

Sl. No.	Scientific name	Order	Family	Local name	English name	Seasonal availability	Part used	Mode of intake	Place / area of data collected
1	*Philosamia ricini*	Lepidoptera	Saturniidae	Polu (Assamese).	Eri Silkworm.	Found throughout the year.	Larva	Cooked/ Roast/ Fried.	Beltola Market.
2	*Philosamia ricini*	Lepidoptera	Saturniidae	Leta (Assamese).	Eri Silkworm.	Found throughout the year.	Pupa	Cooked/ Roast/ Fried.	Beltola Market.
3	*Chrysobothris femorata*	Coleoptera	Buprestidae	Kholerii (Mao tribe) Manipur.	Wild Apple Wood borer.	Mostly found in Winter.	Larva	Cooked/ Roast/ Fried.	Export from Mao Manipur.
4	*Telchin licus*	Lepidoptera	Castniidae	Oviikhe (Mao tribe) Manipur.	Banana stem borer.	Found in all Season.	Larva	Cooked/ Roast/ Fried.	Export from Mao Manipur.
5	*Xenocatantops humilis*	Orthoptera	Acrididae	Foring (Assamese).	Grasshhopper (Brown).	Mostly adults are found from June-November.	Adult	Roast/ Fried.	USTM Forest Campus.

6	*Oxya hyla*	Orthoptera	Acrididae	Foring (Assamese).	Grasshopper (Green).	Found in all Seasons.	Adult	Roast/ Fried/ Smoked	USTM Forest Campus.
7	*Dysticus marginalis*	Coleoptera	Dystiscidae	Karia puka (Assamesse).	Diving Beetle.	Found throughout the seasons.	Both larva and Adult.	Roast/ Fried.	Beltola Market.
8	*Microtermes macronotus*	Isoptera	Termitidae	Ui Puka (Assamese).	Termites	Found in all Seasons.	Both	Roast/ Fried	Kiling Road, USTM.
9	*Lasius niger*	Hymenoptera	Formicidae	Porua (Assamese).	ants	Found in all Seasons.	adult	Roast/ Fried.	Kiling Road, USTM.
10	*Oecophylla smaragdina*	Hymenoptera	Formicidae	Ronga Porua (Assamese).	Weaver ants	Found in all Seasons.	adult	Cooked/ Roast/ Fried	Kiling Road, USTM.
11	*Apis indica*	Hymenoptera	Apidae	Mou (Assamese).	Honey Bee	Found in all Seasons.	Eggs, Larva and Adult.	Cooked/ Roast/ Fried.	Beltola Market.
12	*Anaciaeschna donaldi*	Odonata	Aeshnidae	Jiya (Assamese).	Dragonfly	Found in all Seasons.	Adult	Cooked/ Roast/ Fried.	USTM Campus
13	*Anaciaeschna donaldi*	Odonata	Aeshnidae	Jiya (Assamese).	Dragonfly nymphs	Found in all Seasons.	nymphs	Cooked / Roast/ Fried.	Beltola Market
14	*Fennero-penaeus indicus*	Decapoda	Panaeidae	Misamas (Assamese)	Prawns	Found in all Seasons.	Both Larva and Adult	Cooked / Fried.	Beltola Market
15	*Varuna litterata*	Decapoda	Cancridae Brachyura	Ovo (Mao tribe) Manipur.	Crab	Mostly found in October-March.	Eggs and Adult.	Cooked	Beltola Market.
16	*Gryllotalpa orientalis*	Orthoptera	Gryllotalpidae	Kumoti (Assamese).	Mole Cricket	During the month of July to October.	Eggs Nymph and Adult.	Cooked/ Roast/ Fried	Beltola Market
17	*Mecapoda elongate*	Orthoptera	Tettigoniidae	Guma Khufri (Assamese).	Long horned Grasshopper.	Found mostly in Summer during May -September.	Adult	Cooked/ Fried/ Smoked.	USTM Forest Campus area.
18	*Teleogryllus emma*	Orthoptera	Grylllidae	Kumoti (Assamese).	Field Cricket	August -November.	Adult	Cooked/ Fried	USTM Forest Campus area
19	*Melanoplus femurrubrum*	Orthoptera	Acrididae	Foring (Assamese).	Red-legged Grasshopper (Brown).	Found throughout the seasons.	Adult, Nymph.	Cooked/ Fried	USTM Forest Campus area.
20	*Laccotrephes ruber*	Hemiptera	Nepidae	Pani Puk (Assamese).	Water Scorpion	Found throughout the Seasons.	Adult	Cooked / Fried	Beltola Market.
21	*Polistis humilis*	Hymenoptera	Vespidae	Borol (Assamese).	Wasps	Found in all seasons.	Larva and Adult	Cooked/ Fried	Beltola Market
22	*Pandalus borealis*	Decapoda	Pandalidae	Misamas (Assamese).	Shrimp (pink)	Found in all seasons.	Adult and Larva.	Cooked / Fried	Beltola Market.

23	*Penaeus monodon*	Decapoda	Penaeidae	Misamas (Assamese).	Prawn	Found in all seasons.	Adult and Larva	Cooked/ Fried.	Beltola Market.
24	*Periplaneta americana*	Blattodea	Blattodae	Poitasura (Assamese).	Cockroach	Found in all Seasons.	Adult and Nymph.	Cooked/ Fried.	Beltola Market .
25	*Stenacris vitreipennis*	Orthoptera	Acrididae	Foring (Assamese).	Glassy winged toothpick) grasshopper.	Found in all Seasons.	Adult	Cooked / Fried	USTM Forest Campus area.
26	*Bombyx mori*	Lepidoptera	Bombycidae	Pat polu (Assamese).	Mulberry Silkworm.	Mostly found during early Spring and late Autumn.	Adult and Larva	Cooked/ Fried	Beltola Market.

Table 1: (b) Orders of edible insects found in the study area.

Total number of Orders found in the study (9)	Total number of insect species found (26)
Lepidoptera	4
Coleoptera	2
Orthoptera	7
Isoptera	1
Hymenoptera	4
Odonata	2
Decapoda	4
Hemiptera	1
Blattodea	1

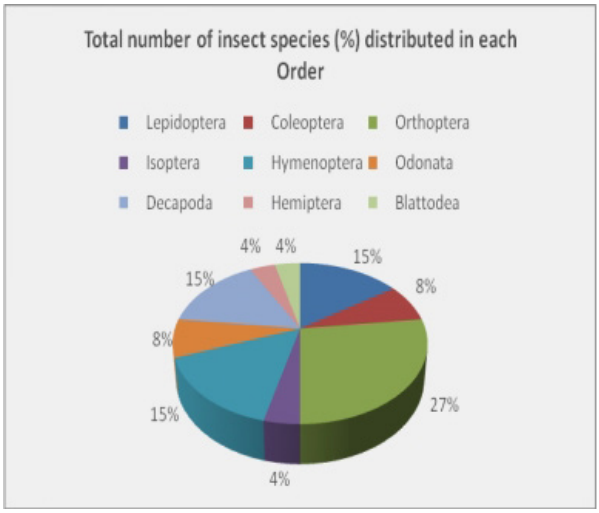

Figure 2: Species distribution of edible insects found in the study area.

Table 1: (c) List of edible insect / crustacean families in the study sites.

Sl. No.	Total number of Families found in the study (20)	Total number of Insect species (26)
1.	Saturniidae	2
2.	Buprestidae	1
3.	Castniidae	1
4.	Acrididae	4
5.	Dysticidae	1
6.	Termitidae	1
7.	Formicidae	2
8.	Apidae	1
9.	Aeshnidae	2
10.	Panaeidae	1
11.	Cancridae	1
12.	Gryllotalpidae	1
13.	Tettigoniidae	1
14.	Gryllidae	1
15.	Nepidae	1
16.	Vespidae	1
17.	Pandalidae	1
18.	Penaeidae	1
19.	Blattodea	1
20.	Bombycidae	1

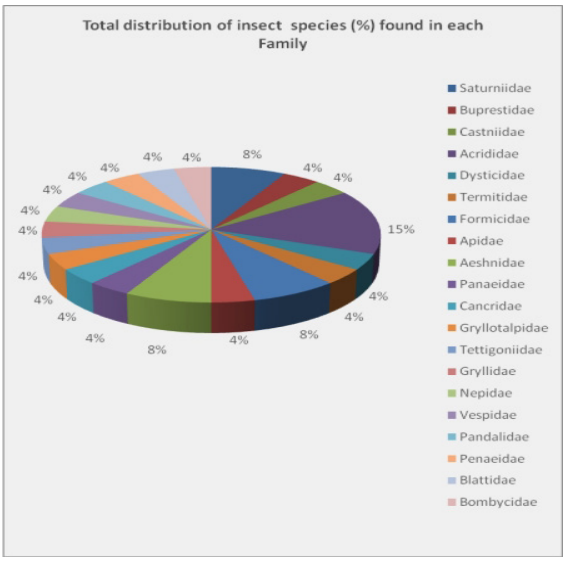

Figure 3: Distribution of edible insect families in the study area.

Table 2: (a) Lists of edible insects/crustaceans and their feeding habits.

Sl. No.	Insect species	Specific mode of diet intake	Dietary food habits /Feeding food plants
1	*Philosamia ricini* (Eri Silkworm).	Herbivores	Castor, Kesseru, Papaya, Tapioca etc.,
2	*Chrysobothris femorata* (Wood borer).	Herbivores	Feeds on fruit trees. Ex. Orange trees.
3	*Telchin licus* (Banana stem borer).	Herbivores	Banana stems, corn and root.
4	*Xenocatantops humilis* (Brown Grasshopper).	Herbivores	Grasses, soft plants, clover, wheat etc.,
5	*Oxya hyla* (Green Grasshopper).	Herbivores	Plants, crops, wheat ,,barley, green leaves etc.,
6	*Dysticus marginalis* (Diving beetles).	Carnivores	Small aquatic insects and Amphibian larvae.
7	*Microtermes macronotus* (Termites).	Detrivores	Dead plants, decayed trees and fallen timbers.
8	*Lasius niger* (Ants).	Omnivores	Dead invertebrates, small insect eggs, fruits, grains, soil etc.,
9	*Oecophylla smaragdina* (Weaver Ants).	Omnivores	Small insects like Aphids, Moths, Bugs, Honey dew etc.,
10	*Apis indica* (Honey Bee).	Omnivores	Flower nectar and pollen, Sweet fruits, microbes etc.,
11	*Anaciaeschna donaldi* (Dragonfly).	Carnivores	Mosquito larvae, worms ,tadpoles, moths etc.,
12	*Fenneropenaeus indicus* (prawns).	Omnivores	Plant tissues, small crustaceans, detritus and diatoms, worms, small fishes etc.,
13	*Varuna littera* (Crabs).	Omnivores	Algae, small plants, sand, debris etc.,
14	*Gryllotalpia orientalis* (Mole Cricket).	Omnivores	Grassroots, soil, small worms etc.,
15	*Mecapoda elongata* (Long-horned Grasshopper).	Herbivores	Plants, green leaves, weeds, fruits etc.,
16	*Teleogryllus emma* (Field Cricket).	Omnivores	Alive and dead small insects, small flies, larvae and pupae of Moths and Butterflies.
17	*Melanoplus femurrubrum* (Red-legged Grasshopper).	Herbivores	Grains, soybeans, wheat, green leaves, barley etc.,
18	*Laccotrophes ruber* (Water Scorpion).	Carnivores	Insects larvae, water fleas, worms, tadpoles etc.,
19	*Polistes humilis* (Wasps).	Omnivores	Small insects larvae, worms, centipedes, fruits etc.,
20	*Pandalus borealis* (Shrimp) .	Omnivores	Decaying organic matter, vegetables and microorganisms.
21	*Peneaus monodon* (Prawns).	Omnivores	Small fishes, worms, Plants tissues etc.,
22	*Periplaneta americana* (Cockroach).	Omnivores	Decaying matter, meats, books, sweets etc.,
23	*Stenocris vitreipennis* (Toothpick Grasshopper).	Herbivores	Grasses, vegetables, corns, grains etc.
24	*Bombyx mori* (Mulberry Silkworm).	Herbivores	Mulberry plant.

Table 2: (b) List of Insect found according to their nutritional modes.

Insects mode of diet intake	Total number of insects
Herbivores	9
Carnivores	3
Detritivores	1
Omnivores	11

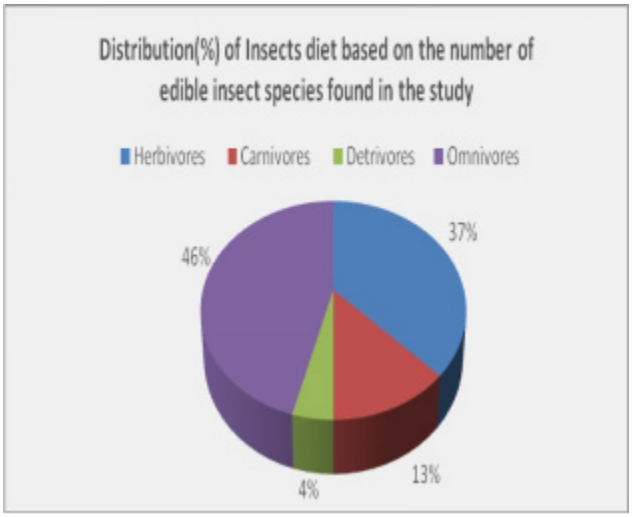

Figure 4: Insect found according to dietary behaviour.

The weight of an edible insect species is recorded as shown in (Table 3) provided the information taken during the survey. The insect species found in the Market varies depending on their seasonal availability and suitability of climatic conditions. The quantity of the insect species also determines the abundance in species diversity. During the study, the insect species belonging

to order Lepidoptera were found to have higher demand in the Market followed by the insects belonging to order Decapoda, Hymenoptera, Coleoptera, Hemiptera, Orthoptera and least by the insects belonging to order Blattodea (Figure 5a, 5b, 6a, 6b, 7a, 7b, 8a, 8b, 9, 10, 11).

Table 3: Weight of selected edible insects in the market weekly basis per month.

Sl. No.	Insect species / crustaceans	Stage	Approximate weight per Week	Approximate weight per Month
1	*Philosamia ricini*	Larva	15-20 Kgs	45-55 Kgs (varies)
2	*Philosamia ricini*	Adult	15-20 Kgs	45-55 Kgs (varies)
3	*Bombyx mori*	Larva, Pupa	10-15 Kgs	30-45 Kgs (varies)
4	*Fenneropenaeus indicus*	Adult	10-15 Kgs	30-45 Kgs (varies)
5	*Penaeus monodon*	Adult	10-15 Kgs	30-45 Kgs (varies)
6	*Pandalus borealis*	Adult	10-15 Kgs	30-40 Kgs (varies)
7	*Apis indica*	Honey	10-15 Kgs	30-40 Kgs (varies)
8	*Apis indica*	Larva	5-10 Kgs	15-20 Kgs (varies)
9	*Polistes humilis*	Larva	5-10 Kgs	15-20 Kgs (varies)
10	*Dysticus marginalis*	Adult	3-5 Kgs	10-12 Kgs (varies)
11	*Laccotrophes ruber*	Adult	3-5 Kgs	10-12 Kgs (varies)
12	*Gryllotalpa orientalis*	Adult	2-4 Kgs	7-10 Kgs (varies)
13	*Anaciaeschna donaldi*	Nymph	2-3 Kgs	4-5 Kgs (varies)
14	*Periplaneta americana*	Adult, Nymph	1-2 Kgs	3-4 Kgs (varies)

PHOTO PLATES:

Figure 5: (a) *Phylosamia ricini* (larva).

Figure 5: (b) *Phylosamia ricini* (pupa).

Figure 6: (a) *Chrysobothris* femorata.

Figure 6: (b) *Chrysobothris* femorata.

Figure 7: (a) *Telchin licus.*

Figure 7: (b) *Telchin licus.*

Figure 8: (a) *Xenocatantops humilis.*

Figure 8: (b) *Xenocatantops humilis.*

Figure 9: *Oxya hyla.*

Figure 10: *Dysticus marginalis.*

Figure 11: *Microtermes macronotus.*

DISCUSSION

The survey conducted on edible insects in the selected areas revealed the presence of a total of 26 species belonging to 9 Orders and 20 Families, as illustrated in Table 1a. Out of 26 species (Table 1b), 14 Edible Insect species are found from Beltola Market, 10 species from USTM campus Forest area and 2 species were exported from Mao (Manipur) apart from the study area. Among all the species found, the Edible Insect species belonging to Orthoptera was found to be the highest consumption

in Kamrup District of Assam and Ri-Bhoi District in Meghalaya with a maximum of 27%, followed by Lepidoptera, Decapoda and Hymenoptera with 15%, Odonata and Coleoptera 8% and least consumed in Isoptera, Hemiptera and Blattodea with 4% each (Figure 1b, Figure 3). In the study, the total distribution of edible insects found in each family comprise of 15% in Acrididae as the highest of all, 8% in family Saturnidae, Formicidae and Aeshnidae and the least 4% each in family Buprestidae, Castniidae, Dysticidae, Termitidae, Apidae, Cancridae, Gryllotalpidae, Tettigoniidae, Gryllidae, Nepidae, Vespidae, Pandalidae, Penaeidae, Blattodae and Bombycidae (Table 1c, Figure 2). The diets of the edible insects were also recorded based upon the different types of edible insect species found during the survey. It was found that, insects which belongs to the diet category in Omnivorous has 46% constituting a major group followed by Herbivorous insects with 37%, Carnivorous with 13% and least Detritivores insects with only 4% (Table 2b, Figure 4). During the study, it was observed that for the majority of the surveyed tribes, the consumption of insects constitutes a significant portion of their primary nutritional intake, aligning with the other researcher's findings [10].

The Insects are mostly consumed by the local communities of the ethnic groups of people inhabiting in the District and nearby residents of the Market area. The insect species comprise of various kinds of Grasshoppers (long, short-horned), Eri Silkworm (larvae, pupae), Honey Bees (honey, larvae, pupae), Dragonflies (adult, nymph), Banana stem borers, Mulberry Silkworm, Termites, Beetles, Wasps, Water Scorpion, Mole Crickets, Field Crickets, Prawns, Shrimps, Crabs, Ants, Wood borers and Cockroaches. The assortment comprises 4 Lepidoptera species, 2 Coleoptera species, 7 Orthoptera species, 1 Isoptera species, 4 Hymenoptera species, 2 Odonata species, 4 Decapoda species, 1 Hemiptera species and 1 Blattodea species. In general, these edible insects exhibit availability across various seasons, as detailed in Table 2a. However, it varies depending on their feeding habits and environmental conditions. Edible insects were made available in the Market and sold by indigenous communities of people living in the rural areas. It thus promotes them to enroll themselves in Marketing and Business by supplying and selling of edible insect species to the Markets and Bazaars which then provides a good site of income to earn their livelihood (Table 3). The current research records the prevailing understanding of entomophagy in the study area, suggesting promising marketing prospects for potential future food items as it is mentioned in previous studies.[11] Various insect species were consumed at different stages of their life cycles, with certain parts such as wings, legs, shells, antennae, etc., being discarded before the cooking process, as detailed in Table 1a. Some spices such as cloves, cardamom, ginger, garlic, etc are added to enhance better taste. Edible insects are mostly preferred by the indigenous/tribal as it contains a rich amount of nutrients, fats, proteins, vitamins, carbohydrates which are highly important for health in maintaining physical fitness, boost energy, mental health etc. Insects are also essentially used as a traditional health remedies which aids in healing and curing of various types of Diseases (Table 1a). In the northeastern region, ethnozoological medicines derived from vertebrates hold significant importance for tribes, primarily attributed to challenges such as restricted access to allopathic medicines, insufficient medical facilities and transportation issues, as noted by earlier researchers.[12] Insects such as Crickets, Termites, Beetles, Worms, Ants and Grubs play a crucial role in biodegradation and enhance soil fertility. Some Insects (Pollinators) such as Honey Bees, Wasps, Butterflies and Moths are responsible for pollinating of certain plants for reproduction. Some of the edible insects are even considered as a special food during occasions and Festivals following its old customs and traditions. It has been reported that cultural practices linked with the collection of edible insects reflect the reliance of ethnic communities on conventional local wisdom.[13] This traditional knowledge serves as a quick guide for identifying edible insects, understanding where to find them and mastering effective capture methods. These well-established skills have been handed down from one generation to the next. However, with evolving socio-economic conditions and dietary habits, this indigenous knowledge is gradually diminishing. Consequently, there is an imperative to evaluate insect biodiversity and explore the role of ethno-entomophagy, especially in India, to preserve this invaluable natural resource and safeguard the ancient traditional knowledge for future generations. The determination of the indirect effects, that the development of the insect production industry can cause on the market by substituting other technologies, is also an option for growing the edible insect industry commercially.[14] Hence, Insects being the largest groups among the Animals with their diverse species play different roles in various aspects leading to a successful positive attribute towards humans and nature.

CONCLUSION

The substantial variety of insect species consumed by the indigenous populations in Kamrup District (Assam) and Ri-Bhoi District (Meghalaya) underscores

the significant importance of insects as a crucial component of the essential diet. To understand and educate more about the insect species, one should focus and emphasize more on the knowledge of edible insect species and contribute more effort to increase its species diversity, which in turn can lead to more production of edible insects in the Market, more availability of commercial products, supplements, nutritional foods and many other therapeutic products which can have a high increase in Market's demand that will eventually grow in a commercialize and sustainable manner. Thus, North-eastern region of India being rich in its biodiversity of fauna and flora provides the essential basic foundation for all the Earth's needs. Cultural practices and reorganization programs should be done positively to ensure keeping their existence going on. If the rich diversity of the insects is utilized properly, it can have a great positive impact and enormous potential growth on the insect species and its environment thereby resulting in more interest in studies, surveys, research, etc. providing more education and logistic knowledge on edible insects.

CONFLICT OF INTEREST

There is no conflict of interest among all the authors of the manuscript.

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SUMMARY

This study emphasizes the crucial role of insects in the ecological context and their linkage to people's livelihoods. It explores the sustainable use of edible insects, considering factors such as ecology, management, conservation implications, industrialization and marketing. The survey conducted in selected areas reveals 26 edible insect species from 9 Orders and 20 Families. Among these, 14 species were found in Beltola Market and 10 in the USTM campus Forest area. Orthoptera was identified as the most consumed insect species in Kamrup District (Assam) and Ri-Bhoi District (Meghalaya), constituting 27% of the total, followed by Lepidoptera, Decapoda and Hymenoptera at 15% and Odonata and Coleoptera at 8%. In contrast, Isoptera, Hemiptera and Blattodea were the least consumed at 4% each. The study also highlights the dietary preferences of insects, with 46% being omnivorous, 37% herbivorous, 13% carnivorous and only 4% detritivores. The indigenous knowledge of entomophagy is decreasing due to changing socio-economic conditions and dietary habits, underscoring the importance of assessing insect biodiversity and ethno-entomophagy in northeastern India for conservation and commercial utilization of this valuable resource and traditional knowledge.

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