International Journal of Zoology Studies
www.zoologyjournals.com
ISSN: 2455-7269
Received: 05-08-2024, Accepted: 04-09-2024, Published: 19-09-2024
Volume 9, Issue 3, 2024, Page No. 39-42

Extent of entomophagy in Assam: A comprehensive review

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Abstract
A significant portion of the diets of several ethnic groups in the northeastern Indian states are composed of insects. They heal a variety of physical illnesses and offer nutritional security. States differ in how many edible insects their people eat based on their terrain. The Karbis and Rengma Naga tribes are the biggest bug feeders, consuming about 32 different species depending on which ones are available at any particular time of year. The ethnic people of Assam, on the other hand, consume about 40 different types of insects. The edible insects are selected by people of different tribes based on their taste preferences, traditional beliefs, and seasonal and geographical availability. This chapter lists the different bug species that different tribes consume, along with how these insects are associated with social and cultural beliefs and how important they are to these states' economies and medical systems.

Keywords: Entomophagy, Assam, karbis, rengma naga trbies, traditions, cultures

Introduction

Entomophagy is the term for the practice of humans consuming insects for food (Greek work). Insects are regarded as traditional food in many cultures across the world. Human evolution has a lengthy history of entomophagy (Fontaneto *et al.,* 2011) [1]. The dietary significance of insects for human nutrition has been extensively described in African, Asian, and Latin American literature (Bodenheimer 1951; De Foliart 1991; Paoletti and Bukkens 1997) [2, 3, 4]. Over 300 ethnic groups across 113 nations were found to ingest 1,700 different species of insects, according to Mac Evilly (2000) [5]. Although there are about 1,600 bug species that humans eat, the culture varies from actively avoiding them to occasionally consuming significant amounts of them (Raubenheimer and Rothman 2012) [6]. There are at least 52 edible species spread throughout 45 genera, 26 families, and 10 orders in South and Central Asia, which includes India, Nepal, Pakistan, and Sri Lanka. According to Gope and Prasad (1983) [7], 47 of these have been taxonomistically identified. According to Durst and Shono (2010) [8], insects are a vital source of critical minerals and proteins for people of different ethnic backgrounds, particularly in poor nations. For developing country rural populations, traditional meals are affordable, environmentally friendly, and nutritionally beneficial (Van 2003) [9]. Research findings indicate that insects possess abundant amounts of protein, amino acids, fat, trace elements, and vitamins in their bodies (Alamu *et al.* 2013) [10]. Nonetheless, the location, season, and vegetation they eat may alter the nutritional content and chemical makeup. Many Indian communities include insects in their diets. The eating of insects, or entomophagy, is a widespread habit among the ethnic populations of Northeastern India, particularly among the tribes of Arunachal Pradesh, Assam, Manipur, and Nagaland. To some extent, the tribes of Mizoram and Meghalaya also consume insects. Studies have shown that various Indian tribes consume close to 255 distinct insect species. Coleopteran species account for the largest portion (34%) of these consumptions. Odonata (8%), Lepidoptera (4%), Isoptera (2%), Orthoptera (24%), Hemiptera (17%), Hymenoptera (10%) and more edible insects found in India (Sangma *et al.,* 2016) [11]. In this communication the extent of entomophagy in the state of Assam which lies lies between 24°13' and 28°00' N latitudes and 89°46' to 96°04' E longitude has been discussed briefly.

Edible Insects from Assam

The Karbi Anglong district tribes in Assam eat roughly 40 different species of insects. The greatest insect consumers are the Karbis and Rengma Naga tribes, who eat about 32 different species depending on which ones are available at any given time of year. These 32 species are members of the orders Hymenoptera, Coleoptera, Orthoptera, Hemiptera, and Odonata, among other families. Many tribes in the Karbi Anglong district much favor the edible silkworms raised on castor (*Samia ricini*) and red ants (*Myrmica rubra*) (Ronghang and Ahmed 2010) [12]. One of the particular Bihu delicacies consumed by many Assamese communities during the Bohag Bihu celebration is red ants, or *Myrmica rubra*. According to Doley and Kalita (2011) [13], eating this insect within the first two days of the celebration is required. Fish feed, specifically wings-termite (Reticulitermes flavipes) and queen termite (Reticulitermes spp.), isopteran insects that the Ahom, Adivasi, Boro, Dimasa, Karbis, Kachari, Rengma Nagas, and Thengal tribes utilize to promote fish growth. The detailed list of edible insects of Assam has been mentioned in Table 1.

Table 1: Insects consumed by Various Assamese tribal groups and communities

Sl. No.	Common Name	Scientific Name	Family	Order	Edible stage	Tribes who consumed	Mode of consumption
1.	Scarab beetles	*Analeptes trifasciata*	Scarabaeida	Coleoptera	Grub	Bodo	Fried/ roasted
2.	Water beetles	*Hydrochera rickseckeri*	Dytiscidae	Coleoptera	Grub	Rengma Nagas, Karbis	Fried/ roasted
3.	Woodboring beetles	-	Cerambycidae	Coleoptera	Grub	Rengma Nagas, Karbis	Fried/ roasted
4.	Powder-post beetles	*Hydrochera rickseckeri*	Lyctidae	Coleoptera	Grub	Rengma Nagas, Karbis	Fried/ roasted
5.	Termites	*Odontotermes obesus, Macrotermes natalensis, Macrotermes sp.*	Rhinotermitidae, Termitidae	Isoptera	Winged adults, queen	Boro, Dimasa, Karbis, Rengma Nagas	Fried
6.	Ants	*Dorylus orientalis, Atta spp.*	Formicidae	Hymenoptera	Grub and adult	Dimasa, Rengma Nagas, Karbis, Bodo	Fried/ cooked
7.	Common red ant	*Myrmica rubra*	Formicidae	Hymenoptera	Egg and grub	Ahom and others	Fried/cooked
8.	Red weaver ant	*Oecophylla smaragdina*	Formicidae	Hymenoptera	Egg and grub	Ahom and others	Fried/cooked
9.	Wasp	*Vespa orientalis*	Vespidae	Hymenoptera	Egg and grub	Rengma Nagas, Karbis, Bodo	Fried/chutney
10.	Honey bees	*Apis indica*	Apidae	Hymenoptera	Egg and grub	Tribes of Dhemaji district	Raw/fried
11.	Crickets	*Acheta domestica, Brachytrupes spp., Bombina orientalis*	Gryllidae	Orthoptera	Adult	Dimasa, Rengma Nagas, Karbis, Bodo	Fried/roasted
12.	Grasshopper	*Cytacanthacris aeruginosus unicolour, Hieroglyphus banian, Schistocerca gregaria, Chondracris rosea*	Acrididae	Orthoptera	Adult	Bodo, Dimasa, Rengma Nagas, Karbis	Fried/roasted/chutney
13.	Mole crickets	*Gryllotalpa africana, Gryllus campestris*	Gryllotalpidae	Orthoptera	Adult	Rengma Nagas, Karbis, Bodo	Fried/roasted/chutney
14.	Praying mantis	*Mantis religiosa*	Mantodea	Dictyoptera	Adult	Rengma Nagas, Karbis, Bodo	Fried/roasted
15.	Giant water bugs	*Lethocerus indicus*	Belostomatidae	Hemiptera	Adult	Rengma Nagas, Karbis, Bodo, Dimasa	Fried/roasted
16.	Cinnamon bug	*Ochrophora montana*	Pentatomidae	Hemiptera	Adult	Rengma Nagas, Karbis, Bodo, Dimasa	Fried
17.	Cicada	*Pomponia imperatoria*	Cicadidae	Hemiptera	Adult	Rengma Nagas, Karbis, Bodo	Fried
18.	Dragonfly	*Crocothemis servilia*	Aeshnidae, Libellulidae	Odonata	Adult	Rengma Nagas, Karbis, Bodo	Fried
19.	Eri Silkworm	*Philosoma ricini*	Saturniidae	Lepidoptera	Larva and pupa	Rengma Nagas, Karbis, Bodo	Deep fried in oil, cooked fresh
20.	Muga Silkworm	*Antheraea assamensis*	Saturniidae	Lepidoptera	Larva and pupa	Rengma Nagas, Karbis, Bodo	Deep fried in oil, cooked fresh
21.	Mulberry silkworm	*Bombyx mori*	Bombycidae	Lepidoptera	Pupa	Tribes of Dhemaji district	Deep fried in oil, cooked fresh
22.	Notodontid larvae	*Anaphe infracta, A. reticulata, A. venata*	Notodontidae	Lepidoptera	Larva	Bodo	Fried

Source: Sangma *et al.*, 2016 [11]

Seasonal Variations in Edible Insect Availability

The year-round availability of edible insects is accompanied by seasonal variations in their concentrations and diversities due to the availability of host plants. Pre-monsoon and monsoon seasons are when the most edible coleopterans are found. Termites, or *Odontotermes* sp., are abundant during the monsoon season, especially in May and June. In the summer (May–June), Odonata and Orthoptera (such as mole crickets and crickets) are abundant and can be collected at night. Certain insect species belonging to the orders Hemiptera and Hymenoptera are only found in the winter, from November to February. These species are not present all year round. In certain regions of Assam, eating red weaver ants, or *Oecophylla smaragdina* Fabricius, also known as Amroli Porua (Assamese local name), is a long-standing custom during the Bihu festival. This species of ant occurs from March to May. The praying mantis (*Mantis religiosa*) and locust species (*Schistocerca gregaria*), which consume rice plants, are harvested in November and December. Some insects, such as beetles and ants, are present all year round (Chakravorty *et al*., 2011, Sangma *et al.*, 2016) [11, 14]. In addition to finding and gathering these bug species, the indigenous people rely on the common sense of the area to identify which insects are edible. The

traditional, time-tested strategies and techniques for finding and seizing these insects are inherited from the ancestors and passed down through the generations. However, in the recent past, when the communities' social and economic standing and eating patterns changed, the native knowledge which has been passed down are gradually deteriorating. Eating deadly insects that have been misidentified rarely or rarely results in poisoning. Depending on the behaviours and habitat of an insect species at a given period, the ethnic groups use various collection strategies. To gather edible insects, common techniques include using baskets, fabric nets, and manual handpicking. The majority of insects eaten come from natural sources (Sangma *et al.*, 2016) [11].

Cultural Practices Associated with Edible Insects

The indigenous population living in the state eats various phases of development of edible insect species. Both the larval and pupal stages of silkworms are consumed. These people choose which species to eat when based on their traditional knowledge. They do concur, though, that insects need to be healthy and treated right away. Ethnic tribes in this area typically consume both young and adult insects (Sangma *et al.*, 2016) [11]. While many ethnic groups (Bodo, Garo, Naga, Khasi, Mishing, Rabha, Kachari, etc.) prefer to consume the silkworms in the prepupal stage, the Assamese Ahom community prefers to eat them when they are fully grown pupae (Sarmah 2011) [15]. When the cocoons are fully developed, the prepupae are removed to provide a nutritious delicacy. While the majority of odonata species are eaten when they are still juvenile, hemipteran and orthopteran insect species are consumed after they are fully grown. The orthopteran insects that the tribes of Karbi Anglong consume are grilled, roasted, or smoked. Many delicious delicacies are made from the insects by the Karbis and Rengma Nagas tribe. Certain insects are consumed simply fried and salted, such as short-horned grasshoppers. These tribes believes that hanging beehives or eri-silkworm cocoons at door seals will keep evil spirits like Chekema (Karbi) away. To ward off evil spirits, people who are ill or suffering from ailments apply the ashes of burnt eri-silkworm cocoon all over their bodies. By stretching the praying mantis's forelegs, the Karbis predict the yield or harvest of their paddy. A larger yield is indicated by more leg stretching. Rengma Nagas put on the eri-silkworm cocoon ring on their finger with the hope of warding off evil spirits (Sangma *et al.*, 2016) [11].

Medicinal Use of Insects

Insects are used by different Indian tribes as a daily remedy for a variety of physical illnesses. From age to generation, people have been using insects as a means of treating illnesses. The Odonata species of dragonflies, *Aeshna mixta*, and red grasshawk dragonflies, *Neurothemis fluctuans*, are used by the Karbi tribes of Assam to treat urinary disorders in young infants. Lip cracking can be treated with the whole body or body oil of Schistocerca gregaria. Human fertility can be increased by using the larvae and pupae of *Myrmica rubra*. *Apis mellifera indica* honey is commonly used for face use as well as for treating colds and coughs (Solanki and Chutia, 2008; Ronghang and Ahmed, 2010) [12, 16].

Industrial Use of Insects

Northeast India is regarded as a center for both traditional silk manufacturing and a hub for several insects that produce silk (Peigler & Nauman, 2003) [17]. About 90% of Muga silk and 65% of Eri silk are produced in Assam (Talukdar, 2009) [18]. Lepidopteran insects in the families Saturniidae and Bombycidae naturally produce silk fiber. The state of Assam is home to five significant varieties of natural silks that are generated by several silkworm species includes mulberry, tasar, oak tasar, eri, and muga. The production of honey is also a profitable enterprise. In the upcoming years, honeybee research will have a wealth of opportunities to uncover and characterize new bee species in Northeast India's unexplored forest areas. With an annual production of 1.20 metric tonnes of honey, Assam surpasses all other northeastern states in terms of honey production (Pradhan *et al.*, 2022) [19]. With the exception of *Z. mauritiana* and *F. religiosa*, Karbis employed eight naturally occurring host plant species for lac culture (rearing of lac insects, *Kerria lacca Kerr*), either in home gardens or woodlands. Lac has historically been utilized for binding agents, natural dye, medicinal, and polishing earthenware pots. Compared to conventional and other traditional host plant species, the lac output from F. religiosa and F. benghalensis trees was found to be much greater. It was discovered that lac culture provided the Karbis with around 25% of their household income (Borah and Garkoti, 2020) [20].

Conclusion

Since insects are discovered to represent a significant portion of the diet in certain Assamese tribal communities, entomophagy ought to be strongly encouraged. We gain from insects in many ways, such as their high nutritious content, speedy reproduction, low maintenance requirements, and capacity to raise off trash. Insect pest species can also help address the widening protein gap in the world. Many people use insects as a source of revenue for their livelihood, either by selling the insects' byproducts (silk, honey) or by directly harvesting and selling the insects for food. Certain bug species are kept and transported to other nations for medical use. Therefore, more study should be done on artificially rearing insects so that they can play a significant role in our food. The potential for economic prosperity that these bio-resources have should likewise be acknowledged. In fact, both humanity and the country as a whole stand to gain from maintaining and restoring the current entomophagy.

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