



**An investigation on edible insects and their role in Socio-economic  
development of rural communities: A case study on Edible insects of  
Dhemaji District of Assam (India)**

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## **Abstract**

The following edible insects viz. *Lethocerus indicus* L.&S, *Hydrochera rickseckeri*, *Acheta domestica* L., *Dorylus orientalis*, *Philosomia ricini*, *Antheraea assama* W., *Apis indica*, *Vespa orientalis* L., *Odontotermes obesus* R., *Heiroglyphus bannian* F., *Schistocerca gregaria* F., *Bombyx mori* L., *Pomponia imperatoria*, *Eumenes petiolatus* exist in natural habitat in the Dhemaji District ( 94°12'18" E and 95°41'32"E longitude and 27°05'27"N and 27°57'16"N latitudes) of Assam. The district covers an area of 3237 sq. Km. and is basically plain area lying at an altitude of 104m above the MSL. North –eastern (NE) region of India ( 22-29° N latitude and 90-97°E longitude ), a prime hot spot of bio-diversity ( out of 25 hot spots declared in the world ) harboring rich endemism. The ethnic tribes like Mishing, Bodo-Kacharis, Sonowal-Kacharis, Deori, Rabha and Lalung of Dhemaji District mainly based on Agriculture, Fishing, Sericulture and Driftwood. The ethnic groups consumed different species of

edible insects and earned economy from them. Besides eating the insects were utilized in different aspects like – in medicine, in industries, in pollination, in culture and in animal feeding. This rich wealth of edible fauna exists in diverse forms and is thriving because of available naturally habitat areas. These habitats occur in diverse bioecology of tropical to temperate (temperature: 5.9-24 ° C to 23-39.9°C, RH: 73-90%, rainfall: 2600 mm-3200 mm, soil type: alluvial and laterite, rich in humus and soil pH: 4.9-7.95), heterogeneous physiography with mountainous border (9 reserved forests and 5735 nos. ponds and beels, 10 nos. Swampy area, 33 nos of low laying area) and the plains of Brahmaputra (MSL104 m). Insect species and raw materials used for various diseases by different ethnic tribes of the country. The insect resources used as medicines by the tribals consisted of honey and honeybee, termite, wasp, ants, cricket and black beetle. Many species of edible insects are sold at village markets in the district. The best selling insects include larvae and pupae of *Antheraea assama*, *Philosomia ricini*, *Bombyx mori*, honey of *Apis indica*, eggs and immaturated *Vespa orientalis*, adult *Lethocercus indicus* and eggs and immaturated *Dorylus orientalis*. The present paper presents the nos. of edible insects within the study areas and role played on socio-economy of rural communities.

**Key Words:** Edible insects, Diversity, Rural communities, Socio-economy.

## **INTRODUCTION**

Edible insects constitute a very important food source in many developing countries. They are good source of high content of proteins, fats, carbohydrates, minerals and vitamins (Ene 1963, Ashiru 1988, De Foliart 1989, 1992). More than 200 genus and 70 families of insects are eaten up by people from different corners of the world (De Foliart 1989). An estimated 2000 insects species are consumed around the world and people do not just eat insects , they relish them as delicacies (Fromme,2002). According to a 2004 United Nations Food and Agriculture Organization (FAO) report , caterpillars of many species are rich in Potassium, Calcium, Magnesium, Zinc and Iron, as well as B-Vitamins(Fromme,2002).In some African regions, children fight malnutrition by eating flour made out of dried caterpillars . Pregnant and nursing women as well as anemic

people also eat caterpillars species high in protein, calcium and iron (Fromme, 2002). Edible insects are a natural renewable resource that provides food to many ethnic groups in many countries like Mexico, Latin America, Colombia, Venezuela, Zaire, Angola, Congo, South Africa, Zambia, Nigeria, Zimbabwe, Sudan, Kenya, Malawi, Uganda, Australia, North America, Japan, Thailand, Malaysia, Burma, Korea, China and India. (Elorduy, 2006, Srivastava, 1996). The traditional use of insects as food is widespread in tropical and subtropical countries as they provide a significant nutritional, economical and ecological benefit for rural communities. In the northeastern region of India, particularly the tribal communities of Manipur, Assam and Nagaland, use silkworms' late instar larvae and pupae, chiefly the *Philosomia ricini* (eri silkworm) and *Bombyx mori* (mulberry silkworm) as food. For the tribes of this region, the pupa of the eri silkworm is so highly regarded as food delicacy that the cocoon is more or less a byproduct (Hazarika, 2008). In a research study carried out by Gope and Prasad in 1983, it was revealed that insects represent the cheapest source of animal protein in Monipur. Most of tribal people of Assam are also habituated with the consumption of *Lithocercus indicus* (Giant water bug), an aquatic insect ; cricket,locusts,honey bee brood,especially late instar larvae and pupae, wasp,grasshopper,ant larvae and pupae , etc ( Hazarika ,2008).In some lower Assam areas the silkworm larvae and pupae and aquatic insect *Lithocercus indicus* have a high market demand ( Hazarika,2008).Edible insects such as *Dorylus orientalis*, *Acheta domestica*, *Lethocerus indicus*, *Odontotermes obesus*, *Apis indica*, *Vespa orientalis*, *Hydrochara rickseckeri*, *Heiroglyphus bannian*, *Neoconocephalus palustris*, *Philosomia ricini*, *Anthera assama* and *Bombyx mori* are consumed in Assam by different ethnic groups (Borkakati,2005). The inhabitants of the villages of Dhemaji District have a natural economy and use some 14 species of insects as food .The indigenous people gathered edible insects for consumption, sharing it among their families and selling the surplus on certain occasions. About 15 nos. of edible insects were sold at the various public markets in Khon Kaen, a major city of northeastern Thailand (Watanabe and Satrawaha, 1984). These edible insects were used as medicine by different ethnic groups in curing various diseases (Wilsanand et. al 2007, Ranjit Singh et. al 2004 and Dixit et. al 2010) and also used for animal feeding (Chuanhui et. al 2010).

## **MATERIALS AND METHODS**

Extensive and intensive survey was conducted in the natural habitat of the edible insects in the different rural villages of Dhemaji District of Assam. The district lies between  $94^{\circ}12'18''E$  and  $95^{\circ}41'32''E$  longitudes and  $27^{\circ}05'27''N$  and  $27^{\circ}57'16''N$  latitudes. Survey work was conducted in 62 villages under Sissiborgaon, Dhemaji, Jonai and Gogamukh revenue circle respectively. It covers a total geographical land area of 3237 Sq.Km<sup>2</sup> and basically plain area lying at an altitude of 104 m above the MSL. The District was originally inhabited by various indigenous tribes like Mising, Sonowal Kachari, Bodo Kachari, Deori and Lalung. In addition to this different tribes e.g. Ahom, Rabha, Tai-Khamti, Konch, Keot, Koiborta, Brahman, Kayastha, Kalita etc. were migrated during different moments of time span (DIO, 2005). The climate of the district is Per-humid characterized by high rainfall, mild summer and winter and falls under cool to warm per-humid thermic-agroecological subzone. The annual rainfall of the district ranges from 2600mm to 3200mm. Rainfall generally begins from April and continues till the end of September. On an average there are about 200 days with 3.5 mm or more rain in a year. The relative humidity varies from 90 to 73 %. The temperature varies between  $39.9^{\circ}C$  in summer and  $5.9^{\circ}C$  in winter (DIO, 2005). The forest in the district is either deciduous or mixed evergreen scattered in the foothill areas. There are 9 reserved forests covering an area of 53,224.11 hectares (DIO, 2005) and 139 nos. of wetlands covering 3960.00 areas (ha) (ASTEC 2008). Survey and historical review of the edible insects reveal that the insects are collected every year by the tribes for food and sold in the market for other needs. Questionnaire and direct interaction with different communities for information and collection of specimens. Visited different market places for collection of specimens and informations. On the basis of the information different species of insects were collected from the fields and wetlands and were identified with the help of available literatures and books. Aquatic edible insects (*L.indicus*, *H.ricseckeri*) were collected from diverse ponds, beels, slow moving streams, swampy areas by sweeping into an insect net. The aquatic edible insects are colonized on the littoral and limnetic zones of ponds, beels, slow-flowing rivers and backwaters. Terrestrial edible insects (*D.*

*orientalis*, *A.domestica*, *V. orientalis*, *O.obesus* etc.) were collected by insect net, sweep net, beating tray, water traps, digging and hand picked. Rearing edible insects such as *A.assama*, *P. ricini*, *B. mori* were recorded house wise. Culturing insects (*A. indica*) were recorded hive wise. *Eumenes petiolatus* are recorded hivewise and *P.imperatoria* is collected by light trap.

## **RESULTS**

Edible insects collection and information data revealed the occurrence of 14 species belonging to 12 families and 14 genera consumed by the ethnic tribes of the District. Hymenopterans order shared with maximum number of 4 species followed by Lepidopterans by 3 species, Orthopterans by 3 species, Hemipterans by 2 species, Coleopteran by 1 species and Isopteron by 1 species respectively. (Table-1). The data analysis in terms of availabilities of edible insects indicated the occurrence of hymenopterans between April-October and Orthopterans between August-November. April-September was found to be ideal for collection of aquatic edible insects such as – *Lethocercus indicus* and *Hydrochera rickseckeri* and Isopteron insect on April-June. Rearing edible insects such as *Philosomia ricini*, *Antherea asaamensis* and *Bombyx mori* were available during rearing seasons. The insects collected by the community are been consumed fried, raw, freshly and roasted. Besides eating, rural people of the district selling these insects for income generation in the village markets has been documented. During the survey work, pupa and larva of insects *Philosomia ricini*, *Antherea assama* and pupa of *Bombyx mori*, adult *Lethocercus indicus* and honey from *Apis indica* were available in the village market at different cost. It has been observed that the pupa and unspining larva of *Philosomia ricini*, *Antherea assama* are sale at the local market @ Rs. 40/500gm and honey of *Apis indica* @ Rs. 150-200/750 ml.

Table-1 Edible insects consumed by indigenous tribes and other communities.

<b>Scientific Name</b>	<b>Order</b>	<b>Family</b>	<b>Availability</b>	<b>Parts used</b>	<b>Mode of Consumption</b>
<i>Lethocercus indicus</i>	Hemiptera	Belostomatidae	April-Sep.	Whole body	Fried/Roasted
<i>Hydrochera rickseckeri</i>	Coleoptera	Dytiscidae	April-Sep.	Whole body	Fried/Roasted
<i>Acheta domestica</i>	Orthoptera	Gryllidae	August –Nov.	Whole body	Fried/Roasted
<i>Dorylus orientalis</i>	Hymenoptera	Formicidae	April-June	Egg/Immatured	Fried
<i>Philosomia ricini</i>	Lepidoptera	Saturniidae	5-6 generations/yr.	Pupa/Larva	Fried /Freshly
<i>Antherea assama</i>	Lepidoptera	Saturniidae	5-6 generations/yr.	Pupa/Larva	Fried /Freshly
<i>Vespa orientalis</i>	Hymenoptera	Vespidae	April-June	Egg/Immatured	Fried/Chatni
<i>Apis indica</i>	Hymenoptera	Apidae	April-oct.	Honey/Egg/ Immatured	Raw/Fried
<i>Bombyx mori</i>	Lepidoptera	Bombycidae	1-2 generation/yr.	Pupa	Fried/Freshly
<i>Odontotermes obesus</i>	Isoptera	Termitidae	April-June	Adult	Fried
<i>Heiroglyphus bannian</i>	Orthoptera	Acrididae	August-Nov.	Whole body	Fried/Roasted
<i>Schistocerca gregaria</i>	Orthoptera	Acrididae	August-Nov.	Whole body	Fried/Roasted
<i>Pomponia imperatoria</i>	Hemiptera	Cicadidae	Periodical	Whole body	Fried
<i>Eumenes petiolatus</i>	Hymenoptera	Eumenidae	April-Oct.	Egg/Immatured	Fried/Freshly

## **DISCUSSION**

The above investigation documented a list of 14 insect species belonging to the different families which is no means exhaustive. The scientific investigation on its chemical contents will further provide reliable source of nutrition to the people for better health, because of their nutritive value and ubiquitous presence, insects present a potential sustainable food source for human ( Kato et.al.,2009). The eating of insects (entomophagy) are an inexpensive substitute for meat in many developing countries (Lyon, 1996). Detailed investigation on their rearing prospect in traditional way will prove reward and traditional system of rearing and cultivation will be beneficial for natural conservation of insect fauna. Some of the useful insects like *Apis indica*, *Lethocercus indicus* etc. are getting depleted in their natural habitat due to indiscriminate

exploration of other faunal group and habitat destruction especially by forest cutting, road construction, using chemicals like insecticides, pesticides which are detrimental to the enthomofaunal diversity of the insect habitat. The most common edible insects belong to order Hymenoptera and Hemiptera, which are consumed in the larval and adult stage (Kato et.al, 2009). In Arunachal Pradesh, over 39 coleopteran insect species used as indigenous food by various ethnic tribes of Arunachal Pradesh (Singh et.al, 2009). The ethnic tribe of Arunachal Pradesh consumed as many as 26 species of Orthopterans Insects species (Chakravorty, 2009). The ethnic Nishi tribe of Arunachal Pradesh consumed 50 edible insects' species belonging to 45 genera, 38 families and 11 orders as a part of their diet (Chakravorty, 2009). Similarly, in Thailand, over 50 species of insects are edible and consumed throughout the year. The most popular are silk worm pupae, bamboo worms, beetles, crickets, red ants, and other insects (Chakravorty, 2009). Since the exploration on entomology in the district is very less and there is an imperative need to systematically study and document the ethnozoological knowledge and practices of the ethnic people, before more faunal resource disappear from the country and cross boundary migration.

## **EDIBLE INSECTS AND SOCIO-ECONOMY OF THE RURAL COMMUNITIES**

The economy of Dhemaji is generally agro-based. Sericulture, fishing and driftwood business are practiced in smaller scale. In Dhemaji district, about 98% of the total population lives in the rural areas. As per 1991 census, 45% of the populations are workers, while 55% of the populations are non-workers (DIO, 2005). Agriculture is the principal occupation and more than 85% of the total population depends on its. Most families rear pigs, goats and poultry, however lack of adequate veterinary facility and knowledge of scientific breeding has left the livestock with poor gene pool. Fish drying is another practice carried out during the monsoon season, mainly by people living near the rivers. There are no significant small –scale industries and not a single big industry in the entire Dhemaji district (DIO). Products from edible insects like *Antheraea assamensis*, *Philosomia ricini*, *Bombyx mori* etc. plays a very vital role in the socio-economic

development of the weaker section of the rural population .Three kinds of silks –*Pat*, *Muga* and *Eri* -which have a very high demand in the national and international markets. The pupa and larva of *Antheraea assamensis* ,*Philosomia ricini* ,*Bombyx mori* and the adult *Lethocercus indicus* are sale in the village markets like- Simen chapori , Kulibazar, Dimow etc. @ Rs 60-90/ Kg. and Rs. 40-50 /Kg. respectively and earn economy from them. The honey extract from edible insect *Apis indica* is selling at different village markets of the district @ Rs. 150-200/750 ml. *Acheta domestica* is one the most collecting edible insect by the children from village areas. The children from indigenous communities selling this insect @ Rs. 40-50/Kg at village markets like Kuli bazaar, Telam and Simen Chapor.

Table: 2 Edible Insects in Village markets of Dhemaji district.

<b>English Name</b>	<b>Assamese/ Local name</b>	<b>Scientific name</b>	<b>Order,Family</b>
Eri Silkworm	Eri Polu	<i>Philosomia ricini</i>	Lepidoptera ,Saturniidae
Muga silkworm	Muga Polu	<i>Antherea assama</i>	Lepidoptera ,Saturniidae
Mulberry Silkworm	Pat polu	<i>Bombyx mori</i>	Lepidoptera, Bombycidae
Honey ( Honey Bee )	Mou	<i>Apis indica</i>	Hymenoptera, Apidae
Giant water Bug	Jebangkori	<i>Lethocercus indicus</i>	Hemiptera, Belostomatidae
Field Cricket	Uisiringa	<i>Acheta domestica</i>	Orthoptera, Gryllidae

The rural communities of the district use edible insects for the treatment of various kinds of diseases also. The edible insects of medicinal importance are – *Odontotermes sp.* *Apis indica*, *Eumenes sp.* *Vespa orientalis* and *Bombyx mori*.

Table: 3 Edible Insects in Medicinal use by rural communities of Dhemaji district.

Zoological name	Common name	Parts used	Aliments	Communities
<i>Odontotermes sp.</i>	Winged termite	Termite	Ulcer	Mishings
<i>Apis indica</i>	Honey bee	Honey	Mouth ulcer,burns,cold asthma,chest infection, throat pain etc.	Mishings, Bodo, Ahom & others.
		Bee eggs	Back pain, chest pain, chest infection.	Mishings, Bodo, Ahom & others.
		Bee hive	Bee poison	Mishings, Bodo, Ahom & others.
<i>Eumenes sp.</i>	Potter wasp	Wasp nest	Headache burns.	Mishings, Bodo & other tribes.
<i>Bombyx mori</i>	Silkworm	cocoon	Rejuvenating tonic	Tribals

The study reveals that some of the edible insects, used by rural communities of Dhemaji district for their ailments. Disruption of forest ecosystem and biodiversity results in the degradation of the natural habitat of indigenous people and their culture. The rural communities have a vital role in environmental management and development because of their knowledge and traditional identity.

## REFERENCES:

1. Ahinnawo O.O, Abatan M.O. and Ketiku A.O. : Toxicological study on the Edible larva of *C. forda*, Westwood, African Journal of Biomedical, Vol. 5 No. 1-2, Jan & May, 2002, pp 43-46.
2. Borkakti Rudranarayan, Uttar Purbanchalar Manuhar Priya Kadhyapatang, Prntik, 16th July, 2005 pp.-33-35.
3. Bordoloi B.N.,Sharma Thakur G.C., Saikia M.C. Tribes of Assam, Part-I Popular Series, Tribal Research Institute,Assam ,1987 pp.99-118.
4. Chakravorty Jharna, Entomophagy, An ethnic cultural attribute can be exploited to control increased insects population due to global climate change: A case study 2009, Centre of Biodiversity, Deptt. Of Zoology, Rajiv, India.Gandhi University Rono Hills, Arunachal Pradesh.
5. Dixit A.K, Kadavul K. Rajalakshmi S.and Shekhawat M.S., Ethno-medico-biological studies of South India. Indian Journal of Traditional Knowledge, Vol. 9 (1), January 2010,pp. 116-118.
6. Fromme Alison, Edible Insects, The Food Insects Newsletter, VIII, No.2, July 1995.

7. Fenemore P.G., Applied Entomology , Chapter-19, New Age International (P) Ltd. Publishers, pp.253-265
8. Gullan P. J.and Cranston P.S., The Insects an outline of Entomology, Deptt. of Entomology,University of California,Davis,USA ,3<sup>rd</sup> edition, Blackwell Publishing
9. History of Dhemaji district of Assam by District Information Officer, Dhemaji district, Assam.
10. Hazarika Rabindra,Peculiar Palate,Horizon,The Assam Tribune, Saturday, May 24, 2008.
11. Kumari Bandana and Kumar Sudhanshu Kumar, An insight into the Ethnozoology of Panch Paraganas area of Jharkhand, India, Journal of Threatened Taxa, August, 2009, 1 (8): 441-43.
12. Kato Dagyom and G.V.Gopi, Ethnozoology of Galo tribe with special Reference to edible insects in Arunachal Pradesh, Indian Journal of Traditional Knowledge, Vol. 8 (1), January 2009, pp.81-83.
13. Lyon William F, " Small energetic group of entomologists, farmers and Chefs" (Microlivestock), Insects as Human Food,Wall Street Journal, HYG-2160-96, January 2, 1996.
14. Lohani Usha,Rajbhandari Kishor and Shakuntala Katre, Need for systematic ethnozoological studies in the conservation of ancient knowledge systems of Nepal- a review, Indian journal of Traditional Knowledge, Vol. 7(4), October 2008, pp. 634-637.
15. McGavin, George.C.,INSECTS Spiders and other terrestrial Arthropods,Dorling Kindersley Ltd. 9 Henrietta Street,London WC 2E 8PS.
16. Ramos-Elorduy Julieta, Moreno Jose Manuel Pino and Camacho Victor Hugo Martinez, Edible aquatic Coleopteran of the World with an emphasis On Mexico,Journal of Ethnobiology and Ethnomedicine 2009, Mexico.
17. Ranjit Singh A.J.A and Padmalatha C. Ethno-entomological practices in Tirunelveli district, Tamil Nadu. Indian Journal of Traditional Knowledge,Vol. 3 (4) , October 2004,pp. 442-446.
18. Srivastava S.K., Babu Naresh and Pandey Hema,Traditional insect bioprospecting- As human food and medicine, Indian Journal of Traditional Knowledge, Vol.8, Oct. 2009, pp. 485-494.

19. Srivastava K.P., A textbook of Applied Entomology, Vol.II, Kalyani Publishers, Ludhiana 2004, pp.36-49.
20. Singh Tarun Kumar O., Chakraborty J., and Kato D., Coleopterans as Food: A case study of ethnic tribes in Arunachal Pradesh, N-Eastern India, National Seminar on Recent Advances in Life Sciences, Deptt. of Life Sciences, Manipur University, Imphal-795003 on March 23<sup>rd</sup> & 24<sup>th</sup>, 2007.
21. Sharma Monisha and Das Nilkamal, Asomor Adrabhumir Samuhar Bikaye Janu Aha, Amar Bigyan, Environmental Division, ASTEC, 2008, Assam. Taid Prof. T.R., Glimpses, 2007.
22. Teffo Leah Snow, Nutritional and Medicinal value of the edible stinkbug, *E. delegorguei* Spinola consumed in the Limpopo Province of South Africa and its host plant *D.viscosa* J. var.*angustifolia*, Phytomedicine Programme, Deptt. Of Paraclinical Sciences Faculty of Veterinary Sciences, University of Pretoria, December 2006.
23. Wilsanand V., Varghese P. and Rajitha P. Therapeutics of insects and insect products in South Indian traditional medicine, Indian Journal of Traditional Knowledge, Vol. 6 (4), October 2007, pp. 563-568.
24. YI Chuanhui, HE Qiuju, Wang Lin and Kuang Rongping . The Utilization of Insect-resources in Chinese Rural Area, Journal