



Traditional consumption and therapeutic applications of edible insects among the Tiwa Community of Morigaon, Assam, India with special emphasis on the medicinal uses of *Oecophylla smaragdina* (Red Ant)

Utpol Dutta^{1*}, Dreemi Deka¹, Selchi Devi², Dr. Dhananjay Kusre²

¹ Department of Zoology, Morigaon College, Morigaon, Assam, India

² Associate Professor, Department of Zoology, Assam Science Technology and Environment Council, Morigaon College, Morigaon, Assam, India

Abstract

Insects are an effective bunch with extensive distribution, high reproductive capacity, adaptability to harsh environments and essential parts of traditional diets and medical regimens worldwide. The present study was conducted in the Tiwa community of Morigaon district, Assam. The Tiwa are one of the ethnic communities of Assam that enlists the diversity of edible insects and the medicinal use of the Red ants (*O. smaragdina*), representing a deeply rooted cultural practice. It was found that 15 species of insects belonging to various orders, viz. Hemiptera, Coleoptera, Orthoptera, Isoptera, and Hymenoptera, etc. The present study investigates the diversity, mode of intake, and therapeutic significance of the Red ant among the Tiwa people. It also reveals various insect species, including the Red ant, that have emerged as a prominent food source and treatments for ailments such as cough, digestive issues, and skin infections. Further investigation into these traditional approaches is required since it may eventually lead to the creation of new, more powerful drugs.

Keywords: Insect diversity, therapeutic significance, food security, biodiversity conservation, alternative protein sources

Introduction

Insects are the major animal group on Earth and belong to the phylum arthropoda, which is the largest phylum of the animal kingdom as it comprises more than 80% of all known species (Kaur, G., *et.al.*, 2023) [8]. Among all these species, Insecta are one of the most diverse and successful groups of animals in the World. They are incredibly rich in biodiversity and make up a significant portion of biomass. Insects have been used in traditional medicine worldwide due to their therapeutic properties, leading to the development of the term “ENTOMOPHAGY” in entomological literature (Rahman *et.al.*, 2018) [13]. Entomophagy refers to the practice of using insects as a part of the human diet. Insects are an excellent addition to vegetarian diets, as plant-based meals often lack essential nutrients, making them a suitable alternative. They are rich in protein, fats, carbohydrates and essential minerals like Phosphorus (P), Calcium (Ca), Magnesium (Mg), and Iron (Fe). They also contain vitamins and antioxidants; they provide advantageous fats, such as omega-3 and omega-6 fatty acids, which are important for brain function, inflammation regulation, and overall heart health.

Assam is home to a diverse range of migrant groups, caste-based communities and indigenous tribes. The principal ethnic groups, including Ahoms, Bodos, Rabhas, Tiwas, Karbies, Mishings, etc, consume insects and bring in money by selling them. The Tiwa communities in Morigaon district utilize natural economies by gathering edible insects for food, distributing them among their families and selling excess in certain situations. They have a lot of beneficial nutrients and, if they become better known, they could help alleviate malnutrition to some degree. The traditional knowledge of entomophagy among the Tiwas is rich but confined because it was orally passed through generations after generations. The Tiwa people use a variety of insects,

including *Lethocerus indicus*, *Dytiscus marginalis*, *Laccotrephes ruber*, *Anaciaeschna donaldi*, *Batocera horsefieldi*, *Mantis inornate*, *Chondracris rosea*, *Eupreponotus inflatus*, *Gryllotalpa africana*, *Apis indica*, *Oecophylla smaragdina*, etc. Weaver ants (*O. smaragdina*) form an important part of the diet of the local populace during the months from February to May. Both eggs and larvae are consumed in some seasons. The peak harvest period is when the ants are and their eggs are readily available for collection. During this time, they often gather the trees and the nests are commonly observed in trees with broad leaves like Mango (*Mangifera indica* L.), Jamun (*Syzygium spp.*), Loring (*Careya arborea* Roxb.), Narlong (*Cassia siamea* Lam.), Rain tree (*Samania saman*) and other plants. Sometimes these ants choose bamboo leaves to make nests. Beyond consumption, they are also utilized in traditional medicine to treat ailments like cough and malaria. Additionally, their larvae also serve as fish bait and are used in biological pest control in orchards.

In the Morigaon district, where half of the Tiwa people reside, socio-cultural and economic limitations often prohibit the use of more readily accessible protein sources, such as pig, beef, poultry, milk, and eggs. However, edible insects are readily available to be consumed by rural residents, making them potentially an essential source of protein. Therefore, the current study's objective was to explore edible insects as a sustainable food source and therapeutic applications in the Morigaon district, Assam. It analyzes nutritional and cultural aspects, identifies local insect species, and proposes solutions for sustainable food systems.

Materials and Methods

Study Area: The present study was conducted in the Morigaon district of Assam, India. The district lies between

26°31'3 and 26°53' north latitudes and 91°59'3 and 92°35'3 longitudes. The Morigaon district, Assam, is one of the 35 districts in Assam of north-eastern India. The district covers an area of 1551 sq. km, comprising 1525.5 sq km rural and 25.5 sq km urban, and it has a total population of 957,423 (as per the 2011 census). The district has different tribes, among them, half of the Tiwa community resides.

Survey: A Survey was conducted in 3 villages, viz. Konabori, Oujari, Manipur, from January to May. At first, the people were asked about the type of insects they use as food and their therapeutic uses. An interaction with local people through a questionnaire was developed, such as types of edible insect people consumed, their local names, seasons of their availability, mode of consumption, therapeutic applications, whether insects are collected by themselves or from local markets and the importance of Red ants in their communities, etc. Interviewees were classified into four age groups: (1) above 60 years; (2) between 40 and 60 years; (3) between 20 and 40 years; and (4) below 20 years. Direct communication and a questionnaire provided a wealth of information about the edible insects that were devoured and aided in the gathering of insect specimens.

Collection and Identification: During the survey period, edible insects were collected from paddy fields, vegetable gardens and grasslands with the help of local fishermen and other people. It is found that both terrestrial and aquatic insect species. Terrestrial edible insects were collected using entomological nets, a beating tray, water traps, and hand-picking. The majority of aquatic insects were captured using local customs in addition to a net, equipment from many aquatic habitats, such as saloni and jakoi. Specimens of

Oecophylla smaragdina (eggs, larvae and adults) were collected manually with the help of local people using handpicking and gentle brushing techniques. Their nests were located on tree canopies and leaves. The most preferred plant of the Red ant is mango trees (*Mangifera indica*); besides that, they also build their nest in other plants like jamun (*Syzygium spp*). Collected specimens were identified on the spot with the help of available literature and books providing standard taxonomic keys, illustrations, picture guides, and the internet. Apart from it, some are identified by the local people. For preservation of specimens, all hard-bodied insects were preserved by using paper envelopes and pinning of insects. Dry preservation is mainly made by Sun drying. In the case of Red ants, dry preservation is also done by sun-drying.

Analysis of Proximate composition: The three macronutrients, viz. Protein, Carbohydrates and lipids were assessed by the proximate analysis. The Protein content of insect samples was quantified following the Lowry assay as described by (Lowry, O., et.al. 1951) [10]. Estimation of Carbohydrate was done by following the Anthrone method (Sadasivam and Manickam, 2008) [14]. The total lipid was estimated using the Folch method (Folch, J., et.al., 1957) [6].

Results

Diversity of species: In light of that aforementioned information, a total of 15 edible insect species were collected from various locations in the study area. These species belonged to multiple orders, including Hemiptera, Coleoptera, Orthoptera, Hymenoptera, Lepidoptera, Isoptera and Blattodea. Proximate composition analysis is done on Red Weaver ants (*Oecophylla smaragdina*).

Table 1: Name of the edible insects found in Tiwa village along with their Scientific name, English name, Local name, order, family, Consumption pattern and Availability period

| Sl. No | Scientific name | English name | Local name | Order | Family | Availability period | Parts used/Mode of intake |
|--------|-------------------------------|--------------------------|---------------|-------------|----------------|----------------------------|--|
| 1 | <i>Oecophylla smaragdina</i> | Red ant | Amroli porua | Hymenoptera | Formicidae | April-June | Egg, immature body, adult. Fried, roasted, curry |
| 2 | <i>Lethocerus indicus</i> | Giant water bug | Dagla bori | Hemiptera | Belostomatidae | Whole year | Adult. Wings and head are discarded. Fried, roasted, curry |
| 3 | <i>Chondracris rosea</i> | Short-horned grasshopper | Kakoti Foring | Orthoptera | Acrididae | May-September | Adult. Wings are discarded, fried, and smoked. |
| 4 | <i>Mantis inornate</i> | Praying mantis | Gagini | Orthoptera | Mantidae | June-August | Adult, roasted, fried or smoked |
| 5 | <i>Macrotermes natalensis</i> | Termite | Ui puka | Isoptera | Termitidae | April-June | Larvae stage, roasted, fried or smoked |
| 6 | <i>Philosamia recini</i> | Eri silkworm | Eri polu | Lepidoptera | Saturniidae | Whole year;5-6 generations | Larvae, pupa. Fried, roasted, boiled |
| 7 | <i>Apis indica</i> | Honey bee | Mou makhi | Hymenoptera | Apidae | April-October | Larvae, immature. Fried, roasted |
| 8 | <i>Antherea assamensis</i> | Muga silkworm | Muga polu | Hymenoptera | Saturniidae | Whole year;5-6 generations | Larvae, pupa. Fried, roasted, boiled. |
| 9 | <i>Bombyx mori</i> | Mulberry silkworm | Pat polu | Lepidoptera | Bombycidae | Whole year;1-2 generations | Larvae, pupa. Fried, roasted, boiled. |
| 10 | <i>Dytiscus marginalis</i> | Diving beetle | Khoipuk | Coleoptera | Dytiscidae | Whole year | Adult. Wings and head are discarded. Fried, roasted, curry |
| 11 | <i>Periplaneta americana</i> | Cockroach | Poita chura | Blattodea | Blattidae | May-September | Whole body used, roasted, |
| 12 | <i>Vespa affinis</i> | Potter wasp | Borol | Hymenoptera | Vespidae | Apr-Oct | Egg, larva Raw, roasted, oil fried |
| 13 | <i>Anaciaeschna donaldi</i> | Dragon fly | Hata puk | Odonata | Aeshnidae | March-Oct | Nymph, Oil fried |
| 14 | <i>Hieroglyphic banian</i> | Grass hopper | Foring | Orthoptera | Acrididae | June-Oct | Adult June-Oct Oil fried, smoked, roasted |
| 15 | <i>Eupreponotus inflatus</i> | Short horned grasshopper | Tel Foring | Orthoptera | Acrididae | May-Sept | Adult May-Sept Oil fried, smoked, roasted |

Some edible and therapeutic insects in Tiwa villages



Oecophylla smaragdina

Dytiscus marginalis

Macrotermes natalensis

Philosamia recini

Chondracris rosea

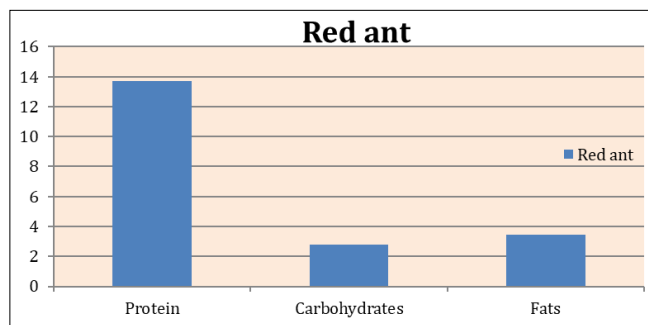
Gryllotalpa Africana

Table 2: Tiwa usage of insects in Medicine

| Insect scientific name | Therapeutic applications |
|------------------------------|--|
| <i>Oecophylla smaragdina</i> | Used in Rheumatism and gout, Asthma, Blood pressure control, Cough, Improves eye sight |
| <i>Apis indica</i> | Cold, Fever, Cough, Bee wax used in Back pain, Chest pain etc. |
| <i>Lethocerus indicus</i> | Health tonic and Protein supplement |
| <i>Philosamia recini</i> | Protect the liver |

Table 3: The Red ant’s nutritional value per 100 gms

| Sl. No. | Insect scientific name | Protein (gm) | Carbohydrates (gm) | Fat (gm) |
|---------|------------------------------|--------------|--------------------|----------|
| 1 | <i>Oecophylla smaragdina</i> | 13.7 | 2.8 | 3.42 |



(Vertical axis denotes amounts of nutrients per 100 g & Horizontal axis denotes Nutrients of red ants)

Discussion

Proximate analysis revealed that all the edible insects, especially red ants, were used as food by the Tiwa community, which is rich in various nutrients. This has

significant implications for food security, particularly in tribal and rural populations where conventional protein sources, such as poultry or dairy, are either too expensive or culturally restricted. The therapeutic uses of insects, especially the Red ant, are particularly noteworthy. They utilize various forms of it to treat ailments such as Rheumatism and gout, Asthma, Blood pressure control, Cough, and improve eyesight. The drug is believed to work due to its formulation of formic acid and other physiologically active substances, which possess antibacterial and anti-inflammatory properties. This could be one of the causes of many communities’ preference for eating insects.

The study highlights the Tiwa community of Morigaon’s use of edible insects, particularly Red ants, for medicinal purposes, highlighting their importance in sustainable living, healthcare, and cultural preservation. Further research should explore pharmacological characteristics and traditional knowledge integration.

Conclusion

This study sheds light on the deep-rooted entomophagic traditions of the Tiwa community in Morigaon district, Assam, with an emphasis on the therapeutic applications and modes of intake of edible insects, particularly the red ant (*Oecophylla smaragdina*). Out of the wide variety of insects that the Tiwa’s use, the red ant is notable for both its cultural significance and its important nutritional and medical value. This study will aid future research on edible insect diversity and traditional therapeutics, and also reveals that Morigaon is a heaven for a diverse range of insects. Therefore, one may anticipate that remarkable results will be obtained if the survey is conducted on a larger scale with extensive laboratory facilities. We hope that our findings

will inspire other scholars to start their own studies in Assam's Morigaon district.

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