
A Zoological Study of Edible Insects: With Special Emphasis on Northeast India

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Abstract

A field experiment was conducted in Karbala Governorate/Tawrij District in 2024 on a silty clay soil to investigate the role of the chisel plow in loosening the hardpan layer and promoting crop growth. A New Holland TD80 tractor was used in this experiment. Two components were examined: operating speed (2.80, 4.65, and 6.15 km/h-1), and plowing depth (50 and 65 cm). Mechanical unit technical metrics such drawing force, slippage percentage, fuel usage, and maize plant output were examined. The experiment used a three-replicate Randomized Complete Block Design (RCBD). The lowest slippage percentage was 6.90% and the lowest traction force was 618.11 kg at 2.80 km/h-1. The lowest fuel usage was 9.99 L/ha and the maximum plant output was 8.05 t/ha at 6.15 km/h-1. A 50 cm plowing depth yielded the lowest pulling force (613.21 kg), slippage (7.57%), and fuel usage (11.91 L/ha). The maximum plant output was 6.76 t/ha at 65 cm. All attributes were significantly affected by the speed-plowing plot interaction. Operating speed, traction force, plant productivity, slippage, Chisel Plow.

Keywords: Edible insect, northeast India, Himalaya, protein, mineral, culture, nutrition.

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Introduction

The rising global population is driving increased food demand, with the FAO projecting a need to expand food production by 2050 to support a population of 9 billion. Approximately 70% of agricultural land is currently used for livestock production, a figure expected to double by 2050 due to urbanization. This growth underscores the urgency to explore alternative protein sources. Insects are widely consumed as food in many regions worldwide, valued not only as delicacies but also for their high protein content and essential minerals, making them significant contributors to global food security. In North East India, entomophagy is a common practice among various communities and holds cultural importance. For instance, during the festival "Bohag Bihu" in April, red tree ants (*Oecophylla smaragdina*) are a significant food item. These ants are believed to provide health benefits, protecting against diseases like scabies, malaria, toothaches, stomach disorders, and blood pressure anomalies due to their formic acid content.

While entomophagy is most prevalent in North Eastern states of India, tribes in Tamil Nadu, Karnataka, Kerala, Odisha, Madhya Pradesh, and the Indian Andaman Islands also consume termites, locusts, ants, and bees. Globally, over 255 species of edible insects have been identified in India, with entomophagy being a longstanding tradition in many cultures worldwide, except in European and North American regions. The term "entomophagy" originates from Greek words "entomon" meaning "insect" and "phagein" meaning "to eat." According to FAO (2013), more than 1900 insect species are utilized in the diets of at least 2 billion people globally. The most commonly consumed insects belong to orders such as Coleoptera (31%), Lepidoptera (18%), Hymenoptera (14%), Orthoptera (13%), Hemiptera (10%), with smaller proportions from Isoptera, Odonata, and Diptera (each 3%). Entomophagy is predominantly practiced in Asia, Africa, Australia, and Latin America.

Nutritional Composition and Other Aspects

Proteins are crucial nutrients essential for human growth, development, and as an energy source. There is a significant global nutritional challenge stemming from the deficiency of high-quality protein, particularly affecting low-income populations. Despite the advancements brought about by the Green Revolution, protein and energy malnutrition remains pervasive in developing regions. This form of malnutrition contributes to over 50% of deaths among children under 5 years old across developing countries. Insects generally possess high levels of crude protein and fats, although the specific nutrient composition varies among species and across different stages of their development. Many edible insects are also abundant in amino acids and essential micronutrients like copper, iron, magnesium, manganese, selenium, calcium, sodium, potassium, phosphorus, and zinc. They also contain vitamins such as riboflavin, pantothenic acid, biotin, and in some cases, folic acid. These nutrients are highly valuable for human nutrition and contribute significantly to addressing dietary deficiencies.

Edible insects are typically prepared using traditional methods and consumed in various forms such as curry, roasted, fried, raw, or as chutney. Depending on the type of insect and how it is consumed, they may be prepared with or without additional ingredients like spices and oil. For instance, winged termites and weaver ants are sometimes eaten raw, while insects with harder exoskeletons such as grasshoppers, crickets, cicadas, beetles, dragonflies, and bugs are often roasted or fried. Soft-bodied insects like silkworms are

commonly cooked into curries. Among the Meitei community, the giant water bug is particularly favored and used in making chutneys with dry fermented fish or included in dishes like eromba. Typically, nymphs or grubs and adults are the stages of insects primarily consumed from groups like Dictyoptera, Orthoptera, Hemiptera, Isoptera, and Coleoptera. Odonates, or dragonflies and damselflies, are eaten only in their nymph stage, whereas Lepidoptera, or butterflies and moths, are consumed in both their larval (caterpillar) and pupal stages. In Hymenoptera insects, eggs are also consumed alongside other stages of development.

In North East India, most edible insects are typically gathered from the wild when they appear seasonally. For instance, grasshoppers are collected from rice or grassland fields using nylon nets or cloths, while field crickets and mole crickets are hand-picked at night. Wild hornets, honeybees, and wasps are harvested after smoking their hives during nighttime. Some terrestrial hemipteran bugs and red ants are collected by shaking branches of plants or searching under large stones near seasonal rivers. Aquatic edible insects are generally caught through fishing in ponds, lakes, and rivers. These harvested insects are either consumed at home or sold in markets. However, certain edible insects are also bred for their commercially valuable products, such as silkworms (Mulberry, Muga, Tasar, and Eri) and honeybees (*Apis cerana* and *Apis mellifera*), which have been consumed for delicacy for a long time. Thus, insect farming is not unfamiliar in these regions. Mulberry and Eri silkworms are reared indoors in plastic or bamboo trays, feeding on mulberry and castor leaves respectively.

Muga and Tasar silkworms are reared outdoors, using Som (*Machilus bombycina*) and Soalu (*Litsaea polyantha*) trees as hosts for Muga silkworms, and oak trees (*Quercus* sp.) for Tasar silkworms in the region. The last larval stage and pupa of silkworms are typically consumed as food and sold in various markets. Domesticated honeybees are raised in wooden boxes, logs, or mud walls, and sometimes the developing broods are consumed as delicacies. In countries like Thailand, Laos, and Vietnam, insects like *Gryllus bimaculatus* and *Acheta domesticus* are specifically bred for human consumption. However, in Europe and North American countries, crickets, mealworms, grasshoppers, wax moths, cockroaches, and housefly maggots are primarily bred as pet food or fish bait rather than for human consumption.

North-Eastern Region of India

The North East region of India is renowned for its biodiversity and encompasses eight states: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, and Sikkim. This area is bordered by Nepal, Tibet-China, and Bhutan to the north, Myanmar to the east, and Bangladesh to the south-west. Covering an area of 262,179 square kilometers, the region is predominantly hilly terrain, making up approximately 7% of India's total landmass. It is home to over 220 ethnic tribal communities, with 78 large tribes each having a population exceeding 5,000. These tribes constitute about 12% of India's tribal population and 25.81% of the total population of North East India. Due to its distinct socio-cultural environment, the North East region exhibits different dietary habits compared to the rest of India. Entomophagy, the practice of consuming insects, has been a longstanding cultural tradition in the region.

However, with the influence of Western culture on younger generations, the consumption of insects is increasingly viewed as distasteful and primitive, leading to a decline in this practice over time. Despite this, scientists and researchers have documented over 200 species of edible insects from the North East region. In Nagaland, seven tribes including Angami, Ao, Chakhesang, Khamnuingan, Konyak, Lotha, and Sumi traditionally consume 92 different species of edible insects belonging to 9 orders and 29 families. Similarly, in Manipur, the Meitei, Taro, Tangkhul, Chothe, and Thadou tribes consume a significant number of species compared to other ethnic groups, totaling 69 species from 29 families and 9 orders.

In Assam, entomophagy is prevalent among tribes in districts like Dhemaji, Morigaon, Udalguri, Baksa, and Karbi Anglong, where approximately 67 species from 8 orders and 27 families are consumed. In Arunachal Pradesh, 65 species of edible insects from 9 orders and 24 families have been reported, with ethnic tribes like Nyishi, Galo, Adi, Wangcho (Wancho), Nocte, Shingpo, Tangsa, Deori, and Chakma actively practicing entomophagy. Notably, the cinnamon bug *Ochrophora montana* is fried in oil and consumed in Assam, Mizoram, Manipur, and Tripura. Additionally, termites are a delicacy in Meghalaya, along with *Ochrophora montana*, a pentatomid bug, enjoyed by inhabitants of the Mizo hills according to Paul and Dey.

In Conclusion

Insects provide valuable proteins and fats, and entomophagy is widely embraced not only as a dietary practice but also for medicinal purposes and as a cultural tradition among various ethnic tribes in North East India. Scientists and researchers have identified over 200 insect species in the region. However, the tradition of consuming insects is waning due to urbanization and the influence of Western culture. Therefore, it is crucial to promote entomophagy through awareness programs in different communities. Additionally, there is a need to encourage insect farming beyond silkworms and honey bees, and to enhance conservation and marketing efforts in the region. These steps can potentially boost the income of landless farmers.

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