Edible insects and entomophagy in Borneo

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Collecting insects and insect products for food by local people is still practised in some rural areas in Borneo, although it is becoming less common. Unlike urban areas, food in the interior is sometimes scarce; thus, some local people eat insects as an alternative source of protein. Insects are abundant in the forest and are more easy to procure than other animals. Various stages of insects are collected for food: eggs, larvae or nymphs, pupae or adults. Insect products, such as honey and pollen, are sought after as nutritional food. Local people also use certain insects and insect products as medicine because it is difficult to find treatment from a doctor in very remote areas.

In Borneo, more than 80 species of insects are known to be eaten. Out of this figure, more than 60 species were documented among various villages throughout Sabah; they are mainly collected by the Kadazandusun, Murut and Rungus people. The most common insect groups that are consumed are the honey bee brood, grasshoppers and sago grubs. Others include crickets, rice bugs, cicadas, termites, ants and beetles. Insects are often collected for food when they are abundant and easily obtainable in the field. The methods for preparing the insects as food are highlighted. More than 25 species of edible insects were also documented in the Dayak Lunduyeh community adjacent to the Krayan Mentarang National Park in Kalimantan during a two-week transboundary expedition in 2003. Some insects and insect products with medicinal value are also discussed in this paper.

Keywords: brood, collection, crickets, grasshoppers, preparation, sago grubs

Introduction

Insects are eaten in many parts of the world. Archaeological evidence suggests that entomophagy has been practised since humans first appeared; today insects still remain an important food source. In Africa, various grasshoppers, termites and the large moth caterpillars *Gonimbrasia belina* (Lepidoptera, Saturniidae) are widely eaten. Insects are also important to South and Central Americans, Australian Aborigines, as well as Middle Eastern and Asian populations. Filipino farmers flood their fields to capture mole crickets that are sold to restaurants, while the Thais eat crickets, grasshoppers, water bugs, beetle larvae and dragonflies. Fried insects are sold at roadside food stalls in Bangkok. The Royal Thai Government has even included six insect species in a manual published for the public on nutritional food. The Chinese also eat a wide range of insects, many of which are for medicinal purposes. Similar consumption patterns can be found in Japan, Republic of Korea and Indonesia.

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A general perspective on eating insects in Borneo

"Eating insects is disgusting, primitive and weird." This was the general response, especially from urban dwellers, during interviews with people on edible insects in Sabah. The eating of insects, or entomophagy, is not a common activity among urban people, mainly because of taboos related to culture, religion and upbringing. At a very young age, most urban children have been firmly prejudiced against "creepy-crawly" by adults. Ironically, bird's nest soup is widely appreciated and is thought to be one of the most delicious and nutritious soups among the Chinese. The price is exorbitant - a kilogram of unprocessed bird nests may fetch up to a few thousand ringgit. Yet, what is the nest made from? It is constructed with the bird's saliva. Sometimes, one may find swiftlet's blood on the nest. Unappetizing to say the least.

Although entomophagy in urban areas, as well as some rural areas, is quite unpopular, some elderly rural people in Sabah, Sarawak and Kalimantan have eaten insects in some form, for their superior nutritional value and even as a delicacy. In the interior, some people consume insects as a source of protein because at times it is difficult and expensive to obtain fresh meat or fish. Scientifically, insects are higher in protein, lower in fat and have a better food-to-meat ratio than beef or chicken. They are also easy to find. Many insects are far cleaner than other creatures. For example, grasshoppers and crickets eat fresh, clean, green plants whereas crabs, lobsters and catfish eat any kind of foul decomposing materials. However, not all insects are edible. Some are toxic and may cause allergy problems.

Sampling methodology

Surveys were carried out via interviews with villagers in Sabah and during an expedition with the Desa Pa' Raye villagers adjacent to the Kayan Mentarang National Park in Kalimantan. The data gathered from the interviews included opinions on and reasons for eating insects and other uses, how they were used or cooked, some ecological information on the insects and respondents' background information. Reference materials with clear illustrations were used for insect identification among the villagers because some live insect specimens were not always available during the survey. The author did not conduct any surveys in Sarawak. The information compiled in this paper comes from published material and Internet searches.

Edible insects and entomophagy in Sabah

During the surveys in Sabah, more than 60 species of edible insects were recorded. Compilation of information presented here is based on ethnoentomological surveys in Sabah conducted by Chung et al. (2001; 2003; 2002; 2004; 2005a; 2005b; 2007).

The sago grub is one of the most commonly eaten insects. The grub is actually the larval stage of a snout beetle or weevil Rhynchophorus ferrugineus (Coleoptera, Curculionidae). Among the Kadazandusuns in western Sabah, the grub is known as butod, wauod or tobodok, while in Telupid it is also called tungut. The creamy yellow larvae are collected from the sago trunk after it is felled and left to decay for about two to three months. In places where
sago palms are scarce, breeding may occur on fallen trunks of arenga and coconut palms. The villagers have various ways of cooking the grubs. After cleaning, the unappetizing guts are sometimes discarded by peeling off the dark-brown head capsule. They can be made into porridge with thin slices of ginger or stir-fried with soy sauce and shallots. Sometimes they are skewered on a small stick, like satay, and are then thrust briefly into the fire to toast lightly. Some local people may eat them raw. Besides their high protein content, some villagers claim that the grubs are good for treating diarrhoea. Conversely, one of the many respondents reported that she experienced nausea after eating the grub, and she never ate it again. The sago grubs are occasionally sold in local markets. The adult can also be eaten, though it is not as popular as the grub. It is normally roasted over an open fire. Scientific studies have revealed that the weevil of the same genus contains far more iron and vitamin B (thiamine, riboflavin and niacin) than beef or fish.

Planters and farmers who work in paddy fields often search for various species of grasshoppers (Orthoptera, Acrididae) as food. The pointed-nose grasshoppers (tombucangus), short-horned grasshoppers (butok), leaf-like grasshoppers (bazarip) and the valanga grasshoppers (gedelok) are among the most common. They are usually collected when clearing the field for paddy planting. Unlike sago grubs, grasshoppers are collected for family consumption only and are not sold in the market. Cooking is simple. They are first lightly salted, boiled in a little water and then simmered until dry. Sometimes, they are stir-fried while the bigger ones are deep-fried until crispy, like fried prawns. They can be roasted as well. Normally, they are served as one dish and are not mixed with vegetables or meat.

The mole crickets, Grylotalpa longipennis (Orthoptera, Grylotalpidae) is also sought after in the paddy field. Locally, it is called suruk or tongook, in Malay, sorok-sorok, meaning to hide. This insect is adapted to life underground. The forelegs, like those of the mole, dig rapidly into the soil and it often feeds on paddy roots. Thus, mole crickets are often collected when ploughing the field before planting. Although they may be various ways to cook them, farmers prefer to stir-fry the insects without oil. Perhaps they taste better or are even more nutritious this way.

The honey bee brood is also widely accepted as nutritious food, besides their honey product. Consumption is particularly common among the Kadazansdusun people in Telupid. More than two-thirds of the respondents had eaten wild honey bee larvae and pupae, Apis dorsata (petokam). These bees are commonly seen nesting on the majestic mengarsis tree (Koompassia excelsa). Sometimes many colonies may be seen on a single tree. The brood of cultivated honey bees Apis cerana (pomosum), hornets Vespa spp. (surun) and wasps Ropalidia spp. (ampiperaes) are also consumed. They can be eaten raw, boiled with porridge or rice, stir-fried or drunk together with honey. Sometimes, the brood together with the hive is squeezed to extract liquid, which is then boiled. Subsequently it will congeal, like fried eggs. The adult bees are seldom eaten, although this is widely practiced in other parts of the world. The bees have to be boiled in order to break down their poison, which is basically protein, and at boiling temperatures, the stinger softens. Pounding them before boiling is also effective.

Plate 2. Honey and other bee products are much sought after and are often sold at local stalls together with other agricultural produce
(Courtesy A.Y.C. Chung)

Some stink bugs from the Order Hemiptera are eaten. The rice ear bug Leptocoris oratorius (peisan) and the green stink bug Nezara viridula (sangbayom) from paddy fields are also relished by villagers. Leptocoris oratorius is a paddy pest and fairly abundant when the grains are at the milk stage. Both adults and nymphs feed on the grains, thus posing problems to the yield. To many of us, the pungent and foul-smelling fluid emitted by the bugs would be a deterrent, but the elderly villagers of Tamberan mash the bugs with chilli and salt, and cook them in hollow bamboo stems. The dish is then served as a condiment. One has to be careful not to eat the brown stink bug, Poecilocapsus coarctatus, as it causes inflammation with a burning sensation on the lips, mouth and even the throat.

Some moths and butterflies (Lepidoptera) are consumed by the Kadazansdusun. Macromoths of the Sphingidae family are eaten. After removing their wings, they are boiled until dry. The banana leaf-roller pupae, Brionaca thers of the Hesperidae family, are also sought after as food. The pupa, locally known as bingay can be eaten raw or boiled until dry. The larva, known as tanaro, often covered with a white powdery substance, is not preferred as food. However, some elderly Kadazansdusun believe that the powdered substance has medicinal properties that can treat pimples. Another haspelled pupa that is also eaten is Anchistrodes nigrita.

Some villagers enjoy eating cicadas. Brown and green cicadas, Orientocatla spp. (tangir) and light green cicadas Dandahia spp. (tavir) are often roasted over an open fire. According to local people, roasted cicadas taste good and are crunchy. Sometimes they are also stir-fried with some salt and other flavourings, but without oil. The wings are often removed.
Edible insects and entomaphagy in Borneo

before cooking. The cicadas populations are seasonal. They are abundant when their host plant, Pongamia spp. starts to produce young shoots. The cicadas feed on the sap of these shoots. Collecting cicadas is normally done at night. Their presence and abundance on a tree can be detected through their collective sound produced by the males and the excess water excreted by them. The fine droplets of water are produced after feeding on the plant sap.

When there are many cicadas on a tree, it may appear as if a shower of rain is falling from the tree (hence the expression “raining tree”). Once the host tree with cicadas has been identified, a fire is set beneath the tree. The insects eventually drop onto the ground while the tree is being smoked.

Termites (sana) are widely consumed. They are the second most eaten insect worldwide, after grasshoppers. Live termites provide about 350 cal/100 gram with 23 percent protein and 28 percent fat. Villagers normally collect the reproductive males and females that are attracted, or light at night during the termite’s nuptial flight. This mating flight often occurs on a relatively cold and wet evening after a prolonged dry period. Termites are usually collected by placing a basin of water right under the light source. The light’s reflection on the water attracts the termites and eventually they are trapped on the water’s surface. The termite’s body is very soft. Thus, sometimes they are eaten raw, with their wings removed. They are also stir-fried, but without oil, or cooked in porridge or rice. The Chinese consume the raw termite queen for its purported aphrodisiacal and medicinal values. It tastes like condensed milk. Some people gulp the insect with liquor or dip it in alcohol before swallowing.

Some ants are eaten, although they are very small in size. The common weaver ant Oecophylla smaragdina (aqua) and the brood are edible and tasty. The adults are often mixed with chili and salt and served as condiments, while the brood is eaten raw or cooked with porridge or rice. In Peninsular Malaysia, the natives use the giant forest ant Camponotus gigas as flavouring because it contains high concentration of formic acid. The acid mostly disappears when it is boiled.

Large adult beetles of the families Scarabaeidae, Lucanidae, Cerambycidae, Buprestidae, Dytiscidae and Chrysomelidae are also consumed. They are normally roasted and the hard parts of the body and legs are removed before eating. For the fairly large beetles, the gut is often removed because of its bitter taste. Some beetle larvae are also eaten using the same culinary skills employed for cooking the sago grub. Other insects consumed by local people in Sabah include cockroaches, stick insects, moth bugs, dragonflies and praying mantis.

Edible insects and entomaphagy in Sarawak

Although not much information is available from published papers, there should be many similarities between the edible insects and entomaphagy practices in Sabah and Sarawak. The commonest example is the sago grub, which is a delicacy among the Melanau communities and is often featured in various documentaries (Anon 2008). It has been reported that the Dayaks of Borneo sometimes mix worker weaver ants, Oecophylla smaragdina in their rice for flavouring (due to the formic acid). Bragg (1990) has mentioned how, in Sarawak, the eggs of the stick insect Hasmeniella grayi grayi (Westwood) are eaten as a delicacy by the local people.

Edible insects and entomaphagy in Kalimantan

According to a survey in Kayan Mentarang, Kalimantan (Chung et al. 2003), all the respondents consumed insects in various forms. Seventy-five percent indicated that they liked eating insects, while the remainder tried them out of curiosity. The villagers do not deliberately hunt for insects (unlike hunting for wild boar), but they collect them when they are abundant in the field. It is interesting to note that most of the villagers, including children, knew the local names of many of the insect species. For example, there are different local names for different grasshopper species. This shows the proximity of the relationship between the Dayak Lundayat community and insects.

More than 25 species of insects are consumed by the villagers of Desa Pr’ Raye of Kayan Mentarang. The most commonly consumed insect group is the grasshoppers and bush crickets (Orthoptera), followed by the wild sago grubs (Coleoptera, Curculionidae), bee, wasp and hornet brood (Hymenoptera), stink bugs (Hemiptera) and dragonfly nymphs (Odonata). Some insects, especially beetle adults, are often grilled, while the softer ones, for example bee brood, can be eaten raw or boiled in rice.

Besides being eaten, a few insects and insect products are used in traditional medicine. Other ethnomedical uses include insects as toys for children, fishing bait and as adhesive materials. Some insects are also mentioned in myths and are part of the traditional beliefs of this community.

A number of beetle species are collected for food, but the most common is the giant weevil, Protocerus sp. (Curculionidae) of the wild sago palm Enteisoma utilis, on the hills along the Pr’ Raye River. Identification of this large species is still tentative (Hiroaki Kojima, personal communication). It is different from the common sago weevil Rhynchophorus ferrugineus, found on Metaxyllus sago in Sabah. The larval stage of the weevil is more commonly sought after as food. The creamy yellow sago grubs are collected from the felled sago trunk, which has been left to decay for about two to three months. They may also breed on bamboo shoots and other palms. The grubs are stir-fried, boiled or cooked with rice, while the adult weevils are often roasted.

Besides Protocerus sp., one specimen of Rhynchophorus ferrugineus was found in a wild sago trunk during the survey. This is a smaller species, measuring about 4.5 centimeters, with a broad bright orange median line on its pronotum.

Other beetles that are eaten include the large long-horned beetles, Ratocera spp. (Curculionidae), large scarab beetles Lepidota stigma and Chalcisoma moellenkampi (Scarabaeidae) and the stag beetles Odontolabis spp. (Lucanidae). Only the adults are consumed. Although the larvae are flashy and are eaten by some locals in Sabah, they are not consumed by the villagers in Kalimantan. A few L. stigma specimens were collected via light-trapping at the village, indicating that they are fairly common within the area.

Mayflies are small, delicate, soft-bodied insects found in the vicinity of freshwater – both streams and ponds. They have two or three long delicate tail filaments. As adults, they do not
feed and usually live for only one day. For most of their life cycles they remain as aquatic nymphs and are easily recognized by their tail filaments and abdominal gills for respiration. The adults are usually collected from the sandy area of streams twice a year, using a lamp to attract them. They are often stir-fried.

Stink bugs are commonly eaten, although they produce a pungent smell. Ironically, the elderly villagers like this smell, which is similar to the smell produced by a type of local ginger in Sabah, known as nabah, by the Dusuns. This unpleasant smell is emitted from the glands at the base of the legs when the insect is disturbed. Two common species encountered in paddy fields are the rice ear bug Leptocorisa oratorius and the green stink bug Nezara viridula. They are often eaten raw as a snack while working in the paddy field. Occasionally, they are made into condiments and are eaten with plain rice. The brown stink bug, which is found on fig trees (Ficus sp.), can also be eaten, although this is not commonly practised. Other stink bug species are not consumed as they can cause irritation and inflammation to the mouth and throat.

Cicadas are eaten by some villagers, although this is not as common as the practice in Sabah, possibly due to myths and beliefs about cicadas. The larger species, such as Pimopodia menula, are preferred. The body length is about 6.5 centimetres while its wingspan is about 18.5 centimetres. They are often stir- or deep-fried, the result being crunchy and crispy. The black cicada with green and white bands (Toxena fasciata F.) is not eaten, although it is frequently encountered in the forests of Pa’ Raye.

The broods of bees, wasps and hornets are often consumed by villagers. Ant broods from the genus Crematogaster are also eaten occasionally. The giant honey bee brood, Apis dorsata, is most commonly eaten, followed by Proverpa anomala, Vespa sp. and Ropalidia sp. Many of the broods are often eaten raw or boiled with rice. During the expedition, however, very few A. dorsata were seen. It is believed that they are seasonal and are more abundant in upstream Krayan Hulu. Apis cerana brood is occasionally consumed. The night wasps Proverpa anomala are very common and are attracted to artificial light like moths. It is fairly slender and rusty brown in colour. The sting of this wasp is severe, but is only likely to be encountered singly, as experienced by the author during light-trapping. A number of their carton nests were also spotted. Vespa tropica and V. affinis, on the contrary, are active only during the day. Pollen gathered by the carpenter bee (Xylocopa spp.) inside the nest is consumed by the villagers. The brood, however, is not eaten. Xylocopa spp. is often seen hovering around the village as they bore into beams and posts to build their nests.

Many dragonflies were observed in Desa Pa’ Raye because of suitable habitats such as streams, ponds and paddy fields. The nymphs are aquatic and some may take more than a year to develop. They are predatory, feeding on small aquatic animals, including small fish. Various dragonfly nymphs are much sought after as food. They can be collected in the paddy field using a sieve. The nymphs are often stir-fried.

Grasshoppers and bush crickets are the most commonly eaten insects and are frequently plentiful in hill paddy fields and woody areas. The villagers have specific local names for various grasshopper species. Kano tulang is considered a delicacy and is often collected when the field is cleared for paddy planting. The mole cricket, Gryllotalpa longipes and field cricket Nesitus vitulus, are not eaten, although they are common.

Praying mantises are known for the way they raise their forelegs, folded at the side of the face, in the manner of prayer. They are fierce, predatory insects, feeding on smaller insects and spiders. Only a few villagers indicated that they eat praying mantises, similar to the way they consume grasshoppers.

Conclusion

Entomophagy has declined significantly because of modern upbringing, culture and religion, except in certain very rural areas. Nevertheless, it is important to document this information as a foundation for further research and reference. There may be a new or different perspective on insects for sustainable animal food production in the future in the context of Borneo.

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Philippine edible insects: a new opportunity to bridge the protein gap of resource-poor families and to manage pests

Candida B. Adalla and Cleofas R. Cervancia

The Philippines has a rich host of tropical flora and fauna, with arthropods representing the greatest diversity. The most popular edible insects are honey bees, Apis dorsata F. and A. cerana F., both indigenous species. Bees are popular, not only for their prized honey and related products, but local people also enjoy the larvae as a delicacy. Apiculture is popular and has been contributing significantly to higher agricultural productivity and biodiversity. Among other forest insects eaten by rural people are the migratory locust (popular nationwide, particularly in swampy and grassy areas where outbreaks occasionally occur), field crickets, mole crickets, carpenter ants (eggs particularly), coconut beetles (particularly the grubs), June beetles and some katydids species. Edible arachnids are not common, but some farmers reported having eaten the larger-sized scorpions and centipedes. Korean bugs, Palumbus damcostilos Fairmaire were also a popular food item in the early 1970s. Descriptions, biometrics and folk recipes of the edible species are presented. Currently, edible insects are underutilised as a general food resource in the Philippines. A deliberate effort is needed to educate Filipinos about this alternative food resource, which may yet offer a significant breakthrough, not only in nutrition but also in its positive impact on pest management.

Keywords: ants, bees, beetles, crickets, katydids, Palumbus

Introduction

In the Philippines, the more popular edible insects include June beetles, grasshoppers (particularly the migratory locust), ants (eggs), mole crickets, water beetles, katydids and dragonfly larvae. More recently, the preference for honey bee brood, particularly Apis cerana F. and A. dorsata F., was documented by Tilde et al. (2000). In bee sampling from all over the Philippines for their biodiversity study, Tilde noted that rural people were eating both the sealed and unsealed brood of honey bees in all the areas sampled. It should be emphasized however, that for A. cerana, the beekeepers eat only brood that will no longer fit into the frames of prepared beehives.

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Forest insects as food: humans bite back

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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Foreword

In this fast-paced modern world, it is sometimes easy to lose sight of valuable traditional knowledge and practices. There is a tendency to think of traditional habits and customs as outdated or primitive. Yet, experience across numerous fields has highlighted the value and benefits to be gained from combining customary knowledge and approaches with modern science and understanding.

Such is the case with edible forest insects. The practice of eating insects goes back thousands of years and has been documented in nearly every part of the world. In modern times, however, consumption of insects has declined in many societies and is sometimes ridiculed as old-fashioned and unhealthy. Yet, it would be prudent to carefully consider the value of customary knowledge before discarding it too readily. Scientific analysis confirms, for example, the exceptional nutritional benefits of many forest insects, and studies point to the potential to produce insects for food with far fewer negative environmental impacts than for many mainstream foods consumed today.

Aside from their nutritional and environmental benefits, experts see considerable opportunity for edible insects to provide income and jobs for rural people who capture, rear, process, transport and market insects as food. These prospects can be enhanced through promotion and adoption of modern food technology standards to ensure that the insects are safe and attractive for human consumption.

Traditionally, most edible insects have been harvested from natural forests, but surprisingly little is known about the life cycles, population dynamics, commercial and management potential of most edible forest insects. Among forest managers, knowledge and appreciation of how to manage and harvest insects sustainably is limited. On the other hand, traditional forest dwellers and forest-dependent people often possess remarkable knowledge of the insects and their management, offering excellent opportunities for modern science and traditional knowledge to work together.

In an effort to more fully explore the various facets of edible forest insects, the FAO Regional Office for Asia and the Pacific organized an international workshop, entitled “Forest Insects as Food: Humans Re-Back” in Chiang Mai, Thailand, in February 2018. The workshop brought together many of the world’s foremost experts on entomophagy – the practice of eating insects. Specialists in the three-day workshop focused specifically on the science management, collection, harvest, processing, marketing and consumption of edible forest insects, as well as their potential to be reared commercially by local farmers.

It is hoped that this publication, containing the edited proceedings of the Chiang Mai workshop, will help to raise awareness of the potential of edible forest insects as a food source, document the contribution of edible insects to rural livelihoods and highlight linkages to sustainable forest management and conservation.

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