

## **Marketing**

Wasps are also sold live at the markets during the harvest season in autumn. They are quite expensive at around US\$100 per kilogram for an entire nest. Demand is increasing, so wasp foodstuffs are imported from other countries such as Republic of Korea, China and New Zealand and then cooked at the shops where they are sold. *Vespa mandarinia* is similarly retailed at the same price, but is not being imported yet.

## **Raising *Vespula***

In central Japan, when a colony of *Vespula* is found at an early stage it will be brought home and set in a wooden hive box. Care is then taken to position the nest where it will be sheltered from the elements. The colony is protected from predators and given food. Hives come in various shapes and sizes, depending on the environment they were found in.

A roof is put over the hive to protect it from direct sunlight and the wasps are fed with meat, fish and sugared water (Plate 4). Raising *Vespula* requires tender care, originality and ingenuity.



**Plate 4. An example of a protected *Vespula* spp. hive (Courtesy Kenichi Nonaka)**

Group raising of *Vespula* is becoming popular throughout central Japan and a network of *Vespula* societies has been established. The people involved recognize the importance of both resource conservation and indigenous knowledge of local customs.

### Social entertainment

A Wasp Festival is held each year, with people competing for the biggest nest, whether raised at home, or collected in the fields or mountains. People congregate for all manner of festivities celebrating the harvest (Plate 5). Food products made from wasp larvae are popular delicacies and make interesting souvenirs for visitors. The main event of the festival is the nest-weighting contest. This is where contestants can witness the results of the year's efforts. The nests are sold directly on site. This is a good opportunity for people to share information on raising wasps.



Plate 5. The winning wasp nest (Courtesy Kenichi Nonaka)

### Nature, wasps and society

The practice of eating wasps in Japan involves a relationship between nature and society. People's desire to eat wasps encourages awareness of the wasp's living environment as well

as indigenous knowledge about wasps. The commercial use of insects can generate extra income for less affluent groups. Wasps are regarded as an important food resource and contribute to the sustainable development of rural mountain villages. It is hoped that people's desire to eat wasps will lead to awareness of the natural environment that forms their habitat and encourage them to sustain wasp numbers.

## Commercialization

Commercialization of wasp consumption is involving more international trade. One cause for concern is that the people of Japan may destroy wasp habitats in the same way that other ecosystems are being degraded worldwide. However, wasps are unappreciated species in some countries, such as New Zealand, Australia and South Africa; people in these countries are glad to have such dangerous threats eliminated. On the other hand, their proper use may lead to the creation of new jobs in mountainous regions of Asia, or even in European countries where *Vespula* exists. In domestic situations, encouraging communal activities will not only promote the appropriate use of wasps, but will also raise environmental awareness. While this is indeed a local activity, it will also attract people from other areas who do not cohabit with wasp-eating cultures. Spreading networks of communal activities will again encourage environmental conservation through the appropriate use of resources.

## Conclusion

Edible insects not only serve as a source of food in mountainous areas of Japan, but also reflect rich cultural traditions and diverse biological resources. As edible insects are good resources for generating income, there is likely to be an increase in the numbers of edible insects collected. However, increases in demand could lead to competition and overexploitation. If such insects are to be used in a sustainable manner, appropriate commercial use depends on people's awareness of the insects' habitats and related environmental issues.

## Literature cited

- Miyake, T.** 1919. *Shokuyo oyobi yakuyo konchu ni kansuru chosa* (A report on the edible and medicinal insects). *Noujisi tokuho*, 31. Ministry of Agriculture. (In Japanese.)
- Nonaka, K.** 2007. *Mushihamu hitobito no kurashi* (Living on insects). Tokyo, Japan, NHK-Books. (In Japanese.)
- Nonaka, K.** 2005. *Minzoku konchugaku: Konchu-syoku no shizenshi* (Ethno-entomology: natural history of insect-eating habit). Tokyo, Japan, University of Tokyo Press. (In Japanese.)
- Nonaka, K.** 1987. *Konchu-syoku ni mirareru sizen to ningen no kakawari* (The relationship between human and nature through insect-eating habits) (1). *Kodo to bunka*, 12: 12-22. (In Japanese.)

# Edible insects in a Lao market economy

Somkhith Boulidam<sup>1</sup>

*A study of edible non-wood forest products (NWFPs) in the forest village of Dong Makkhai and the Sahakone Dan Xang fresh food market revealed the importance of edible insects as nutritious food for villagers and as a source of household cash income. A total of 21 species of edible insects are collected by the villagers; five of them are among their most important edible NWFPs. Bestselling edible insects and their products at the market include weaver ant eggs, grasshoppers, crickets, honeycombs, wasps, cicadas and honey bees.*

*Orthoptera, Coleoptera and Hymenoptera are the three most important insect orders in the study area. Sustainability of the current extractive system requires forest conservation, improvements in the collecting, handling and processing of insects, and the rearing of certain species to assure adequate supplies in the future.*

**Keywords: edible insects, crickets, cicadas, grasshoppers, honeycombs, weaver ant eggs**

## Introduction

Until just a few years ago, research targeting edible insects in Lao PDR was almost non-existent, despite the fact that insects have represented a food item in the country for a very long time. In general, the insect species of Lao PDR are poorly known. Only medical entomology has received scientific attention thus far and it has not included studies of any edible insects. Some anecdotal information on eating insects exists in the anthropological literature and in writings about Lao cuisine.

The Lao Government has identified the development of the non-wood forest product (NWFP) subsector as a national priority. This is in recognition of the potential for NWFPs as a significant component of local and national income and is offered as an alternative to communities that are engaged in unsustainable forest exploitation. The greatest diversity of NWFPs is found among edible plant products, edible insect products and ornamental plants.

Natural resources are essential for economic stability and human well-being (Ravaioli 1995). Forests provide multiple products. NWFPs are very important for local and household economies as they are used for both subsistence and trade (Soudthavong *et al.* 2003). Edible insects are an important NWFP category in Lao PDR.

Lao PDR is rich in natural resources, especially within its forests, which cover about 47 percent of the land area (Sisouphanthong and Taillard 2000). Forests are important for both the

<sup>1</sup> Department of Geography, Faculty of Social Sciences, National University of Laos, Vientiane, Lao PDR. Email: kkkhith@yahoo.com

national economy and the livelihoods of rural people (Bouapao 2005); they provide many kinds of food, herbs and fuelwood, contributing to socio-economic well-being (Smith and Maltby 2003). Most Lao people are subsistence farmers, who rely on NWFPs for their basic needs and as a source of supplementary income to purchase manufactured goods.

The research results on edible insects presented in this paper have been extracted from a broader study of edible NWFPs (see Appendix 1). Additional data are included from a new study by Nonaka *et al.* (2008) on edible insect biodiversity in the Vientiane area and from Yhoun-Aree and Viwatpanich (2005) who surveyed edible insects in Lao PDR, Myanmar, Thailand and Viet Nam and documented approximately 164 insect species eaten across the four countries.

## **The research setting**

Field research study on edible NWFPs was carried out from 1996 to 2006 at two related locations: Dong Makkhai village and Sahakone Dan Xang fresh food market. Dong Makkhai is a forest village; paddy rice is the staple food crop and some livestock are raised. In 2007, the village had a population of 1 547, representing 316 households.

Village farmers established the Sahakone market primarily to sell edible NWFPs that they collect from the rich government forests surrounding the village, where they have use rights. The small food market is located on a main road about 3 kilometres from Dong Makkhai and 13 kilometres from the centre of Vientiane.

Descriptive data on gathering edible NWFPs, including edible insects, were derived from interviews with 56 percent of the households in Dong Makkhai. On average, villagers have been gathering edible NWFPs for 21 years, with each household engaging in activities five times per week on average. Women play the lead role in gathering NWFPs, aided by husbands, children and grandparents. The average distance traveled to gather NWFPs is 3 kilometres; products are gathered by hand or by using simple tools such as knives, nets and traps. On average, 23 percent of village household income is derived from edible NWFPs.

Villagers reported that they now spend more time in gathering similar quantities of edible NWFPs compared to ten years ago. The main reason is the larger number of collectors competing for the insect stock. Collecting locations and the target species have remained the same over the ten-year period. Certain insects are more numerous seasonally. For example, crickets are collected from March to December, stink bugs from February to May and cicadas from March to May; grasshoppers can be collected year around. Stink bug populations are now in decline in forests around the village because of the felling of their chief host, the *chor* tree. One new species, never eaten before, has been added to the array of edible insects, the walking stick or praying mantis (*meang hamphée* or *meang mai*).

The efficiency and productivity of insect gathering as an economic activity cannot be quantified because most captured insects are not weighed and the time expended is not recorded; grasshoppers and weaver ant eggs are the exception. Gathering and selling of other insects are measured on the basis of insect bodies. Villagers, however, estimate that a typical household collecting activity yields 1-4 kilograms of edible insects; in the case of wasps this is much greater.

All categories of edible NWFPs are important for personal consumption; 15 percent of the households gather products solely for their own subsistence needs. In the remaining households, the products are used for both subsistence and commercial purposes, in varying proportions.

Villagers were asked to rank the most abundant edible NWFPs they gathered. The results are given in Table 1. Wild vegetables predominate, accounting for seven items, including *dok kachea*, which is the most important; edible insects are in second position with five items. Wildlife accounts for the remaining four products.

**Table 1. Most abundant edible NWFPs in Dong Makkhai village**

Rank	NWFP	Percentage
1	<i>Dok kachea</i> – herb, tuber ( <i>Curcuma angustifolia</i> Roxburgh ?)	23
2	<i>Takkaten</i> – grasshoppers	14
3	<i>Chak chanh</i> – cicadas	12
4	<i>Het</i> – mushrooms	9
5	<i>Nou</i> – rats	8
6	<i>Meang kieng</i> – stink bugs	7
7	<i>Phak kadon</i> – leafy green vegetable	6
8	<i>Phak van</i> – young leaves	4
9	<i>Chinae</i> – crickets (possibly others as well)	3
10	<i>Phak khayeng</i> – aquatic herb ( <i>Limnophila gloffragi</i> Bonati)	3
11	<i>Phak kanchong</i> – aquatic herb ( <i>Limnocharis flava</i> [L.] Buchennau)	3
12	<i>Nok</i> – birds	3
13	<i>Khi lek</i> – vegetables	1
14	<i>Khead</i> – frogs	1
15	<i>Khai mot dieng</i> – weaver ant eggs (larvae and pupae)	1
16	<i>Ngou</i> – snakes	1

**Source:** Interviews with villagers.

Sahakone Dan Xang fresh food market was first established in 1990 and expanded to its present size in 2003. It operates year around, but the greatest activity occurs during the dry season (December to March), when edible NWFPs are in abundance. There are 93 vendors; 37 sell edible NWFPs. Interviews were conducted with 92 percent of the vendors. Individual traders had experience of one to 40 years, meaning that some had worked at a prior market location.

The 21 species of edible insects sold at Sahakone market come from 23 different villages, with Dong Makkhai being the leading source, accounting for 27 percent of the total quantity of edible insects reaching the market. The bestselling category of edible NWFPs in Sahakone

market is insects with wild vegetables ranking second. Wildlife ranks a distant third, mainly because the government has enacted restrictions on the trade of most wildlife.

Among the edible insects, the biggest sellers are weaver ant eggs (23 percent), grasshoppers (23 percent), crickets (13 percent), honeycombs (13 percent), wasps (9 percent), cicadas (5 percent) and honey bees (5 percent). These preferences are basically the same as ten years ago. The highest price is paid for young cicadas – about US\$25/kilogram.

## Results

A total of 21 edible insects was found in the field research; they were identified to the extent possible, but sometimes only by a local common name (Table 2). It must be emphasized that the data presented in the table are provisional; they are incomplete with respect to precise identification and representative of only the study area. The village survey also turned up one unidentified species of a large spider (*beuang*) that is eaten; it is not included in the table because spiders are not insects in the strict sense, but arachnids, although local people would make no such distinction.

Orthoptera, Coleoptera and Hymenoptera are the three leading insect orders, in ranked sequence, represented in Table 2, and together account for more than 50 percent of the total. This result compares favourably with global patterns of important edible insect orders (Ramos-Elorduy 2005).

**Table 2. Edible insects in the area of Dong Makkhai village, Lao PDR**

English	Lao	Order, Family, Genus, Species
Bamboo worms	<i>Daung-nor-mai</i>	Lepidoptera, Pyralidae, <i>Omphisa fuscidentalis</i> Hampson
Beetles	<i>Meang chi noun</i>	Coleoptera, Scarabaeidae ??
<i>Chik</i> tree insects	<i>Meang chik</i>	?
Cicadas	<i>Chak chanh</i>	Homoptera, Cicadoidea, <i>Orientopsaltria</i> sp.
Crickets (large)	<i>Chinai</i>	Orthoptera, Gryllidae, <i>Brachytrupes portentosus</i> Lichtenstein
Crickets (small, black)	<i>Chi lor</i>	Orthoptera, Tettigoniidae, <i>Teleogryllus testaceus</i> Walker Orthoptera, Gryllidae, <i>Acheta</i> <i>domesticus</i> L.
Crickets (small, white)	<i>Chileed</i>	Orthoptera ?
Dung beetles (larvae, pupae)	<i>Boa</i> or <i>duang chud chii</i>	Coleoptera, Scarabaeidae, <i>Helicopriss bucephalus</i> F.
Dragonflies	<i>Meang naa gam (ee niue)</i>	Odonata ?

Giant water bugs	<i>Meang da</i>	Hemiptera, Belostomatidae, <i>Lethocerus indicus</i> Lepeletier & Serville
Grasshoppers	<i>Takkaten</i>	Orthoptera, Acrididae, <i>Caelifera</i> sp.
HoneycombHoney bees	<i>Hang pheung Nam pheung</i>	Hymenoptera, Apidae, <i>Apis</i> spp.
<i>Khor</i> tree insects	<i>Meang khor</i>	?
Horned beetles	<i>Meang kham</i>	Coleoptera, Scarabaeidae, <i>Xylotrupes gideon</i> L.
Mole crickets	<i>Meang xone</i>	Orthoptera, Gryllotalpae, <i>Gryllotalpa africana</i> Palisot & De Beauvois
Silkworms	<i>Dak dir</i>	Lepidoptera, Bombycidae, <i>Bombyx mori</i> L.
Stink bugs	<i>Meang kieng</i>	Hemiptera, Pentatomidae, <i>Tessaratoma quadrata</i> Distant
Praying mantis	<i>Meang hamphee</i> or <i>Meang mai</i>	Mantodea, Mantidae <i>Hierodura</i> sp. ?
Wasps	<i>Tor</i>	Hymenoptera, Vespinae, <i>Vespa</i> spp.
Water scavengers	<i>Meang ee tao</i>	Coleoptera, Hydrophilidae, <i>Hydrophilus affinis</i> Sharp
Weaver ants (eggs)	<i>Khai mot dieng</i>	Hymenoptera, Formicidae, <i>Oecophylla smaragdina</i> F.

**Sources:** Nonaka (2008); Boulidam (2007); Yhoung-Aree and Viwatpanich (2005).

## Discussion and conclusion

Dong Makkhai village and Sahakone Dan Xang fresh food market represent a useful paradigm of how edible insects can play a dual role in advancing human nutrition and generating household income. However, any model based upon the exploitation of wild biotic resources is fraught with uncertainty about sustainability.

This study of a small area in Lao PDR can be viewed as a microcosm of the global situation, which will determine the future of NWFPs. The following comments apply equally to edible insects and other edible NWFPs. The sustainability of edible forest resources is under threat from a menacing combination of deforestation, which indirectly degrades or destroys NWFPs, and overexploitation of certain forest products through greater collecting pressures generated by increasing rural human populations. NWFPs allow rural people to supplement their diets and livelihoods through cash income to buy manufactured goods.

The immediate and longer-term solutions rest in addressing three issues.

First, overall sustainable forest management and conservation should acknowledge the true value of NWFPs as significant forest resources and make allowances for the NWFP needs of



local people; they must be brought, as stakeholders, into the process of planning and management of land units that have a direct bearing on their livelihoods.

Second, applied research should target improvements in NWFP collection, handling and primary processing, to maximize resource benefits on both subsistence and commercial levels.

Third, an assessment should identify NWFPs that have the greatest potential and value; they should be brought under better management within the forest itself and/or the steps to be taken toward plant domestication and animal rearing to increase productivity and to reduce pressures on wild populations should be mapped out.

## **Acknowledgements**

I would like express my deep gratitude to the Korea Foundation for Advanced Studies for providing financial support for this research work. I would also like to express my sincere gratitude and deep appreciation to Professor Yeo-Chang Youn, who was the host scholar for this research work, for his invaluable advice. Also, the key informants who provided me with information and excellent cooperation for fieldwork in Dong Makkhai village and Sahakone Dan Xang market, Xaithany District, Vientiane, Lao PDR.

## **Literature cited**

- Bouapao, L.** 2005. *Rural development in Lao PDR. Managing projects for integrated sustainable livelihoods*. Chiang Mai, Thailand, Regional Center for Social Science and Sustainable Development, Faculty of Social Sciences, Chiang Mai University.
- Boulidam, S.** 2007. *Gathering non-timber forest products in (a) market economy: a case study of Sahakone Dan Xang fresh food market in Xaithany District, Vientiane Capital, Lao PDR*. Final research results, Supported by the Korea Foundation for Advanced Studies, International Scholar Exchange Fellowship Program, 2006-2007.
- Nonaka, K., Sivilay, S. & Boulidam, S.** 2008. *The biodiversity of edible insects in Vientiane*. Kyoto, Japan, Research Institute for Human and Nature.
- Ramos-Elorduy, J.** 2005. Insects: a hopeful food source. In M.G. Paoletti, ed. *Ecological implications of minilivestock*, pp. 263-291. Enfield, NH, USA, Science Pub.
- Ravaioli, C.** 1995. *Economists and the environment*. London, Zed Book Ltd.
- Sisouphanthong, B. & Taillard, C.** 2000. *Atlas of Laos, spatial structures of the economic and social development of the Lao People's Democratic Republic*. Thailand, NIAS, Silkworm Books.
- Smith, R.D. & Maltby, E.** 2003. *Using the ecosystem approach to implement the Convention on Biological Diversity. Key issues and case studies*. Gland, Switzerland, IUCN-The World Conservation Union.
- Soudthavong, B. et al.** 2003. *National Biodiversity Steering Committee. Biodiversity country report Lao PDR*. Vientiane.
- Yhoun-Aree, J. & Viwatpanich, K.** 2005. Edible insects in the Laos PDR, Myanmar, Thailand, and Vietnam. In M.G. Paoletti, ed. *Ecological implications of minilivestock*, pp. 415-440. Enfield, NH, USA, Science Pub.

## **Appendix 1. Summary of the complete study**

The full study (Boulidam 2007) describes the gathering of edible NWFPs in Dong Makkhai village and their trading at the Sahakone Dan Xang fresh food market. A key objective was to understand NWFP activities and changes over the past decade, by identifying the major edible plant and animal species collected and traded in the village and the demand for the products in the market. An attempt was made, over the ten-year period, to determine any changes in the abundance of edible NWFPs in this forest-dependent village, to investigate the local knowledge of natural resource management and to assess the sustainability of the edible NWFP resources. Individual surveys were conducted in the village and in the local market; the Yamane method was used to select sampling size. Using only simple tools, all of the villagers surveyed gathered edible NWFPs, comprising 31 species of wild vegetables, 21 species of insects, 1 species of spider and 10 species of other wildlife. Wildlife species numbers are rapidly decreasing, while the numbers of species of wild vegetables and insects are stable. However, the abundance of wild vegetables and insects has declined.

Most species of NWFPs found in the market come from many locations: 31 species of wild vegetables from 17 locations, 21 species of insects from 23 locations and 4 wildlife species from 10 locations. Most NWFPs delivered to Sahakone Dan Xang market come from Xaithany District, particularly Dong Makkhai village. Of the 16 most common NWFPs in Dong Makkhai village, 7 were vegetables, 5 were insects and 4 were animals. Market demand for wildlife NWFPs typically is greater than the supply.

Local people have a keen interest in sustaining NWFP sources. They believe they should practise forest conservation, avoiding harvesting NWFPs during the full moon and on moonless days and reducing overall NWFP gathering. However, in reality, local people expand and intensify their NWFP gathering to meet the growing market demand. Local villages need to be guided to protect the forests as common land by participatory community programmes for sustainable resource utilization. Government and international development agencies should provide villages with interim alternative income sources while technical assistance programmes are being implemented to cultivate and to rear edible NWFPs with high market demand.

**Appendix 2. Insects for trade in Sahakone Dan Xang market in the dry season (all plates Courtesy S. Bouldam)**



**Bamboo worms**



**Cicadas**



**Crickets**



**Small black crickets (*Chilor*)**



**Dragonflies/shrimps**



**Honeycomb**



**Grasshoppers**



**Honey**



**Mole crickets**



**Silk worms**

*Edible insects and entomophagy in Borneo*



**Stink bugs**



**Wasp nest**



**Water scavengers**



**Weaver ant eggs**

# Edible insects and entomophagy in Borneo

Arthur Y.C. Chung<sup>1</sup>

*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 Lundayeh community adjacent to the Kayan 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.

---

<sup>1</sup> PO Box 1407, Forest Research Centre, Forestry Department, 90715 Sandakan, Sabah, Malaysia.  
Email: arthur.chung@sabah.gov.my

## **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-crawlies” 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 feed-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*, *wutod* or *tobindok*, while in Telupid it is also called *sungut*. 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



**Plate 1. Sago grubs are a delicacy among the local communities and are often sold in Sunday markets (Courtesy A.Y.C. Chung)**



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 unsavoury 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 rashes 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 a 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 (*tombuzungus*), short-horned grasshoppers (*butoh*), leaf-like grasshoppers (*kazap*) and the valanga grasshoppers (*gedoh*) 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 cricket, *Gryllotalpa longipennis* (Orthoptera, Gryllotalpidae) 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 there 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 Kadazandusun people in Telupid. More than two-thirds of the respondents had eaten wild honey bee larvae and pupae, *Apis dorsata* (*petiokan*). These bees are commonly seen nesting on the majestic mengaris tree (*Koompassia excelsa*). Sometimes many colonies may be seen on a single tree. The brood of cultivated honey bees *Apis cerana* (*pomosuon*), hornets *Vespa* spp. (*surun*) and wasps *Ropalidia* spp. (*tampiperes*) 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 practised 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 *Leptocorisa oratorius* (*pesisang*) and the green stink bug *Nezara viridula* (*tangkayomot*) from paddy fields are also relished by villagers. *Leptocorisa 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 Tambunan mash the bugs with chili 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, *Scotinophara coarctata*, 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 Kadazandusuns. Macromoths of the Sphingidae family are eaten. After removing their wings, they are boiled until dry. The banana leaf-roller pupae, *Erionata thrax* of the Hesperidae family, are also sought after as food. The pupa, locally known as *bingog* can be eaten raw or boiled until dry. The larva, known as *tataro*, often covered with a white powdery substance, is not preferred as food. However, some elderly Kadazandusuns believe that the powdery substance has medicinal properties that can treat pimples. Another hesperiid pupa that is also eaten is *Anchistroides nigrita*.

Some villagers enjoy eating cicadas. Brown and green cicadas, *Orientopsaltria* spp. (*tengir*) and light green cicadas *Dundubia* 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

before cooking. The cicada 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 (*tanai*) 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 to 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* (*laga*) 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 entomophagy in Sarawak**

Although not much information is available from published papers, there should be many similarities between the edible insects and entomophagy 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 *Haaniella grayi grayi* (Westwood) are eaten as a delicacy by the local people.

## Edible insects and entomophagy 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 Lundayeh community and insects.

More than 25 species of insects are consumed by the villagers of Desa Pa' 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. Some are fried, 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 ethnoentomological 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, *Protocerius* sp. (Curculionidae) of the wild sago palm *Eugeissona utilis*, on the hills along the Pa' 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 *Metroxylon 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 *Protocerius* 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 centimetres, with a broad bright orange median line on its pronotum.

Other beetles that are eaten include the large long-horned beetles, *Batocera* spp. (Cerambycidae), large scarab beetles *Lepidiota stigma* and *Chalcosoma moellenkampii* (Scarabaeidae) and the stag beetles *Odontolabis* spp. (Lucanidae). Only the adults are consumed. Although the larvae are fleshy 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 *tuhau* 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 *Pomponia merula*, 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 (*Tosena 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 *Provespa anomala*, *Vespa* spp. and *Ropalidia* spp. 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 *Provespa 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 weedy areas. The villagers have specific local names for various grasshopper species. *Kato tulang* is considered a delicacy and is often collected when the field is cleared for paddy planting. The mole cricket, *Gryllotalpa longipennis* and field cricket *Nisitrus vittatus*, 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.

## **Acknowledgements**

Richard J. Majapun of the Sabah Forestry Department assisted in the compilation of information for this paper.

## Literature cited

- Anon.** 2008. *Sago grubs*. [http://en.wikipedia.org/wiki/Sago\\_worm](http://en.wikipedia.org/wiki/Sago_worm) (accessed 5 January 2008).
- Bragg, P.** 1990. Phasmida and Coleoptera as food. *Amateur Entomologists' Bulletin*, 49: 157-158.
- Chung, A.Y.C.** 2007. Diversity and sustainable use of insects as a source of food in interior Sabah. In *Proceedings of the 14<sup>th</sup> Malaysian Forestry Conference, Kota Kinabalu, Sabah. Forestry in Malaysia: reinventing human-nature relationships*, pp. 752-756. Sabah Forestry Department.
- Chung, A.Y.C., Binti, M., Ansis, R.L. & Yukang, J.L.** 2005a. Ethnoentomological survey of the local community at Ulu Sumbiling of Sg. Melalap, Crocker Range Park, Sabah. In M. Maryati, N. Manshoor & A. Takahasi, eds. *Proceedings of Melalap scientific expedition*, pp. 73-76. UMS and JICA.
- Chung, A.Y.C., Dasim, P. & Yukang, J.L.** 2005b. Ethnoentomological survey of the local community near Meliau Range, Ulu Tungud Forest Reserve, Sabah. Poster presented at the 2<sup>nd</sup> Workshop on Biodiversity Conservation at Meliau Range, Ulu Tungud, F.R., Sabah in Sandakan. 25 April, 2005.
- Chung, A.Y.C., Ansis, R.L., Allai, M. & Saman, M.** 2004. Ethnoentomological survey of the local community near the Crocker Range Park, at Ulu Kimanis. In M. Maryati, H. Zulhazman, T. Takuji & N. Jamili N., eds. *Crocker Range scientific expedition 2002*, pp. 141-146. UMS, JICA and Sabah Parks.
- Chung, A.Y.C., Binti, M. & Fadan, A.** 2003. Ethnoentomological survey at the northern Kayan Mentarang National Park, East Kalimantan, Indonesia. In A. Mardiasuti & T. Soehartono, eds. *Joint biodiversity expedition in Kayan Mentarang National Park*, pp. 343-356. Jakarta, Ministry of Forestry-WWF Indonesia-ITTO.
- Chung, A.Y.C., Chey, V.K., Unchi, S. & Binti, M.** 2002. Edible insects and entomophagy in Sabah, Malaysia. *Malayan Natural Journal*, 56(2): 131-144.
- Chung, A.Y.C., Chey, V.K., Unchi, S., Tingek, S. & Won, A.** 2001. A survey on traditional uses of insects and insect products as medicine in Sabah. *Malaysian Naturalist*, 55(1): 24-29.

# 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<sup>1</sup>

*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 katydid species. Edible arachnids are not common, but some farmers reported having eaten the larger-sized scorpions and centipedes. Korean bugs, *Palembus dermestoides* Fairmaire were also a popular food item in the early 1970s. Descriptions, bionomics and folk recipes of the edible species are presented. Currently, edible insects are underutilized 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, *Palembus*

## 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 her 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.

---

<sup>1</sup> College of Agriculture; Institute of Biological Sciences, College of Arts and Sciences University of the Philippines, Los Baños, College Laguna, 4031 Philippines. Email: aydsadalla@yahoo.com



## **Culinary preparation**

In general, entomophagy has not become a day-to-day event in the Philippines because the availability of edible insects is seasonal and other food sources are perceived as more nutritious foods.

Public awareness has been enhanced by the serving of edible insects in a specialty restaurant in Metro Manila called Cabalen. It has several branches located in large Metro Manila malls. During the rainy season (June to October) and early dry season (November and December) an insect menu, in particular a mole cricket dish, is served in various restaurants in Northern Luzon (commonly along the national highway), to attract the attention of tourists and to serve local curiosity. During seasons of locust outbreaks, live and cooked locusts are peddled at bus stops and in local public markets.

Mole crickets are the most common insects served in restaurants. At Cabalen restaurants the crickets are cooked *adobo* style (Appendix 1) – a popular Filipino recipe. The crickets are sautéed in garlic and onions and seasoned with soy sauce, vinegar and hot pepper (Plate 1). In some areas, coconut milk is added to create a thick sauce. In villages, the most common species consumed are the extra broods of wild honey bees harvested during honey collection. The broods are either fried, sautéed *adobo* style or sautéed with vegetables. Larger species like adult June beetles and grasshoppers are also grilled and deep-fried.



**Plate 1. Cabalen's mole crickets *adobo* style (Courtesy the authors)**

## Nutritive value of insects

Recent reports in Nigeria confirm that insects are indeed excellent sources of protein and other important nutrients (Banjo *et al.* 2006). Aside from high quality protein, the study also found important supplements like minerals and vitamins, even in dried form. Protein content can range as high as 29.8 percent for *Analeptes trifasciata* F., and good quality vitamins A, B2 and C are found in *Apis mellifera* L.

In the Philippines, the nutritive value of *camaru* (mole cricket, *Gryllotalpa* sp.) was analysed and results showed that a 150 g serving of the dish provided 28 and 74 percent of the daily protein and energy requirement, respectively, of average Filipinos between the ages of 19 and 49 (Barrion-Dupo *et al.* 2008).

Clearly, the studies have validated the high nutritive value of edible insects, particularly mole crickets. Yet, insects have remained a specialty meal rather than part of the regular Filipino diet for the following reasons:

- Edible insect species, like all other arthropods, are not available year round. In fact at the Cabalen chain of restaurants, they are not able to serve *adobong camaru* (a mole cricket specialty) on a daily basis due to irregular supply of crickets.
- Availability of alternative food sources perceived to be more nutritious than insects. Some people interviewed claimed that insects are their last recourse and qualify as a survival/emergency food only. At the Cabalen Restaurant, however, people who eat *adobong camaru* claim that the dish is their incentive to come back to the restaurant and they even call up to inquire if the dish is being served before they decide to eat there.
- Perception that insects are “yucky” (possibly influenced by western culture), due to the dirty habits and environments of household insects like flies and cockroaches.

## Brief descriptions of certain edible insect species in the Philippines

### **Honey bees (*Apis cerana* F., *A. dorsata* F. and the stingless bee *Trigona biroi* Friese)**

Honey bees (Plate 2) are generally abundant in the Philippines and are primarily sought for honey and other by-products like pollen and propolis<sup>2</sup> (Plate 3). In the process of harvesting honey, the extra larvae and pupae are eaten as a tasty dish or served as appetizers at social drinking and village gatherings. It should be emphasized, however, that only the extra brood of wild honey bees is eaten.

---

<sup>2</sup> A brownish resinous material of waxy consistency collected by bees from the buds of trees and used as a cement.

Apiculture is a thriving industry in the Philippines and the cultured broods are not eaten because the beekeepers get more income by allowing the broods to develop and produce honey, which is more valuable and easy to sell. Both *Apis cerana* and *A. dorsata* are indigenous species, as well as the stingless bee *Trigona biroi*. All three honey bees are adapted for domestic cultivation.



a. *A. cerana* colonies



b. *T. biroi* chambers



c. *A. dorsata* colonies

**Plate 2. The edible honey bees (Courtesy the authors)**

***Mole crickets (Gryllotalpa sp.)***

Mole crickets (the local name is *aro-aro*, Plate 4) are insect pests of field crops like rice, maize and sugar cane, the underground parts of which they commonly attack. Mole crickets are a very popular food among villagers in Central Luzon. Despite the demand from restaurants in Metro Manila like Cabalen, the deliberate farming or mass rearing of mole crickets has not been carried out by farmers in the Philippines.

Of the many edible insect species, this is the most popular and most traded in local markets. Folk recipes include spicy *adobo*, fried and sautéed with vegetables.



**Plate 3. Products from stingless bees (Courtesy the authors)**



**Plate 4. The mole cricket (Courtesy the authors)**

### **June beetles (*Leucopolis irrorata* Chevrolat)**

The June beetle or *salagubang* (Tagalog, Plate 5) is a pest of upland crops, primarily upland rice, maize, sugar cane and coconut. The larva or grub feeds on the roots of the host plants while the adults usually feed on the leaves. The adults also feed on the leaves of broadleaf fruit trees like mango. The insect is abundant during the early rainy season (May to July), which coincides with the active vegetative stage of many of the upland crops mentioned above.

Folk recipes include grubs grilled over charcoal, deep-fried, spicy *adobo* and sautéed with vegetables.



**Plate 5. Larvae of June beetles (Courtesy the authors)**

**Migratory locusts (*Locusta migratoria manilensis* Meyen)**

This is a highly seasonal species and outbreaks occur in swampy areas when natural vegetation is disturbed and human activities are ecologically disruptive. This insect is a general feeder, eating grassy weeds, cereal crops and some broadleaves. It is endemic in the Philippines, yet does not occur in great enough numbers year round to assure a steady supply as part of the regular Filipino diet (Plate 6).



**Plate 6. The migratory locust (Courtesy the authors)**

**Carpenter ants (*Camponotus spp.*) or *karakara***

This insect species is a delicacy in the northern Philippines (Ilocos region). The eggs are the preferred stage, cooked as spicy *adobo* or sautéed in garlic and onions with a small amount of pepper. The egg mass (Plate 7) is collected from tree trunks, but with sufficient care to create the least disturbance to the adult ant, which can be highly aggressive and whose bite can be fatal to people sensitive to insect bites and toxins. The difficulty in collecting the egg mass limits the number of people interested in this edible species.



**Plate 7. Egg mass of the carpenter ant or *karakara* (Courtesy the authors)**

Korean bugs (*Palembus dermestoides* Fairmaire), a pest of stored cereal grains, were a popular food item in the early 1970s (Dacanay and Cervancia 1989; Chua *et al.* 1977; Yoshida 1974). There are other edible species in the Philippines, but their very highly seasonal nature and low fecundity mean that they are only occasionally tapped for human nutrition.

### **Eating insects: implication for pest management and biodiversity conservation**

Entomophagy is an emerging reality in this era of dwindling traditional food resources. While this is an important development, especially in terms of quality nutrition, care must be taken to insure the safety of the consuming public. Efforts should also be made to ensure that the habitats of insects used as food are clean and free from toxic environmental