

1. Introduction

The practice of eating insects (Box 1.1) is known as **entomophagy**. Many animals, such as spiders, lizards and birds, are entomophagous, as are many insects. People throughout the world have been eating insects as a regular part of their diets for millennia. Although this practice should be specified as *human* entomophagy, throughout this book entomophagy refers to human entomophagy. The earliest citing of entomophagy can be found in biblical literature; nevertheless, eating insects was, and still is, taboo in many westernized societies. The unconventional nature of entomophagy has meant that farming insects for food and feed has largely been absent from the great agricultural innovations in livestock farming that emerged in past centuries – with a few exceptions, such as bees, silkworms and scale insects (from which a red colorant is derived). Insects have also failed to feature on the agendas of agricultural research and development agencies worldwide, including at FAO. Until recently, references to insects for food and feed have been largely anecdotal. It is therefore unsurprising that insects are still lacking from the diets of many rich nations and that their sale for human consumption remains part of a niche food sector of novelty snacks.

Nevertheless, insect consumption is not a new concept in many parts of the world. From ants to beetle larvae – eaten by tribes in Africa and Australia as part of their subsistence diets – to the popular, crispy-fried locusts and beetles enjoyed in Thailand, it is estimated that insect-eating is practised regularly by at least 2 billion people worldwide. More than 1 900 insect species have been documented in literature as edible, most of them in tropical countries. The most commonly eaten insect groups are beetles, caterpillars, bees, wasps, ants, grasshoppers, locusts, crickets, cicadas, leaf and planthoppers, scale insects and true bugs, termites, dragonflies and flies.

BOX 1.1

What are insects?

The word insect derives from the Latin word *insectum*, meaning “with a notched or divided body”, literally “cut into sections”, from the fact that insects’ bodies have three parts. Pliny the Elder created the word, translating the Greek word ἔντομος (*entomos*) or insect (as in entomology, which was Aristotle’s term for this class of life), also in reference to their “notched” bodies. The term was first documented in English in 1601 in Holland’s translation of Pliny (Harpe and McCormack, 2001).

Insects are a class of animals within the arthropod group that have a chitinous exoskeleton, a three-part body (head, thorax and abdomen), three pairs of jointed legs, compound eyes and two antennae. They are among the most diverse groups of animals on the planet: there are more than 1 million described species, which is more than half of all known living organisms. The total number of species is estimated at 6–10 million, and the class potentially represents over 90 percent of the differing animal life forms on Earth. Insects may be found in nearly all environments, although only a small number of species occur in the oceans, a habitat dominated by another arthropod group, the crustaceans.

Insect facts:

- Insects have an exoskeleton to protect them from the environment.
- Insects are the only winged invertebrates.

Continues

Box 1.1 continued

- Insects are cold-blooded.
- Insects undergo metamorphosis to be able to adapt to seasonal variations.
- Insects reproduce quickly and have large populations.
- Insects' respiratory systems – networks of tracheal tubes – are tolerant of air and vacuum pressure, high-altitude flight and radiation.
- Insects often do not need parental care.

Source: Delong, 1960.

This publication also covers other arthropod species eaten by humans, such as spiders and scorpions, which, taxonomically speaking, are not insects.

1.1 WHY EAT INSECTS?

Overall, entomophagy can be promoted for three reasons:

- Health:
 - Insects are healthy, nutritious alternatives to mainstream staples such as chicken, pork, beef and even fish (from ocean catch).
 - Many insects are rich in protein and good fats and high in calcium, iron and zinc.
 - Insects already form a traditional part of many regional and national diets.
- Environmental:
 - Insects promoted as food emit considerably fewer greenhouse gases (GHGs) than most livestock (methane, for instance, is produced by only a few insect groups, such as termites and cockroaches).
 - Insect rearing is not necessarily a land-based activity and does not require landclearing to expand production. Feed is the major requirement for land.
 - The ammonia emissions associated with insect rearing are also far lower than those linked to conventional livestock, such as pigs.
 - Because they are cold-blooded, insects are very efficient at converting feed into protein (crickets, for example, need 12 times less feed than cattle, four times less feed than sheep, and half as much feed as pigs and broiler chickens to produce the same amount of protein).
 - Insects can be fed on organic waste streams.
- Livelihoods (economic and social factors):
 - Insect harvesting/rearing is a low-tech, low-capital investment option that offers entry even to the poorest sections of society, such as women and the landless.
 - Minilivestock offer livelihood opportunities for both urban and rural people.
 - Insect rearing can be low-tech or very sophisticated, depending on the level of investment.

1.2 WHY FAO?

Since 2003, FAO has been working on topics pertaining to edible insects in many countries worldwide. FAO's contributions cover the following thematic areas:

- generation and sharing of knowledge through publications, expert meetings and a webportal on edible insects;
- awareness-raising on the role of insects with the general public through media collaboration (e.g. newspapers, magazines and TV);
- support to member countries through field projects (e.g. the Laos Technical Cooperation Project);
- networking and multidisciplinary interactions (e.g. stakeholders working with nutrition, feed and legislation-related issues) with various sectors within and outside FAO.

Some of the most important milestones are listed below.

1.2.1 Central African study documenting the role of caterpillars

The Non-Wood Forest Products Programme of the FAO Forestry Department initiated a review in 2003 to describe the contribution of edible insects to diets in Central Africa. Four case studies and many other studies were commissioned in Central Africa with an emphasis on the Congo Basin because of the significant consumption of wild insects from important forestry resources and wildlife ecosystems. The report *Contribution of Forest Insects to Food Security: the Example of Caterpillars in Central Africa* quantified the role of edible insects as food and, as such, initiated a discussion on entomophagy as an important practice in food security. The summary and conclusions of the publication were taken up in the Overseas Development Institute's Wildlife Policy Briefing, which helped to further raise awareness among decision-makers in forestry and in bushmeat crisis discussions of the important role that edible insects play in the food security of forest-dependent people.

1.2.2 Conference in Chiang Mai, Thailand

In February 2008, the FAO Regional Office for Asia and the Pacific organized an international workshop in Chiang Mai, Thailand, titled *Forest Insects as Food: Humans Bite Back*. The workshop brought together many world experts on entomophagy, focusing specifically on the science, management, collection, harvesting, processing, marketing and consumption of edible forest insects, as well as their potential to be reared commercially by local farmers. The proceedings of the Chiang Mai workshop aimed 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.

1.2.3 Laos Technical Cooperation Programme, 2010–2013

FAO is implementing a technical cooperation project in the Lao People's Democratic Republic in the period 2010–2013, called "Sustainable insect farming and harvesting for better nutrition, improved food security, and household income generation". The project is an immediate response to several interventions identified in the Lao People's Democratic Republic National Nutrition Strategy and National Plan of Action for Nutrition, which was finalized and endorsed in December 2009, namely improving nutrient intake and addressing underlying causes (through improved access to food and increasing and diversifying domestic food production).

The project is focusing on strengthening the existing role of insects as complementary food in local diets, recognizing the role of traditional insect-collecting in the wild, by enhancing the sustainability, safety and efficiency of insect collection, preparation, post-harvest processing and consumption, as well as expanding insect farming.

1.2.4 FAO–WUR collaboration

As a follow up to the FAO workshop in Chiang Mai in 2008, the Non-Wood Forest Products Programme of the FAO Forestry Department and the Wageningen University and Research Centre (WUR) (Laboratory of Entomology) initiated a collaborative effort to promote entomophagy. The first step was the creation of a policy note, *Promoting the Contribution of Edible Forest Insects in Assuring Food Security*, for the FAO Forestry Department. This note outlined the long-term strategies for FAO in making the edible insects programme an integrated, regular FAO programme and creating awareness among (inter)national organizations/agencies and donors dealing with food security. In 2010, two researchers and authors of the present publication, Arnold van Huis and Joost Van Itterbeeck from WUR, worked at FAO for several months. A bibliography of publications concerning edible insects and a database on "who is who" in the entomophagy world was developed based on a widely disseminated questionnaire. Additionally, the writing of the present publication commenced, along

with preparations for conceptualizing and holding an international expert consultation in January 2012.

1.2.5 Expert consultation meeting

The Expert Consultation Meeting on Assessing the Potential of Insects as Food and Feed in Assuring Food Security took place on 23–25 January 2012 at FAO headquarters in Rome. Jointly organized by FAO and WUR with the financial support of the Government of the Netherlands, the meeting aimed to open a dialogue and foster an exchange of information and expertise on the potential benefits of using insects for food and feed as part of a broader strategy to achieve global food security. Fifty-seven experts from international agencies, scientific institutions and private-sector stakeholders, together with staff from relevant FAO disciplines (nutrition, aquaculture, livestock, veterinary science, food safety, forestry and conservation) attended the meeting. These experts and entrepreneurs – specialized in various aspects of insect rearing, plant protection and food engineering – mapped the current state of the art and identified knowledge gaps in the following thematic areas: insect ecology and biology; farming insects; insects as livestock and fish feed; nutrition; processing and trade; food and feed safety; communication strategies; and policies to achieve food security.

1.2.6. Webportal of edible insects

FAO has maintained a webportal on edible insects since 2010. It provides basic information on the use and potential of edible insects as well as relevant weblinks, such as to the proceedings of the 2008 Chiang Mai workshop, information on the Expert Consultation Meeting in Rome in 2012, and other relevant technical information, videos and media coverage. The address of the webportal is www.fao.org/forestry/edibleinsects.