



Insect for Food and Feed

RESEARCHER: Duncan Mwinzi

TOPIC: Insect for Food and Feed

THEME: Insects and Food Security

DEPARTMENT: Entomology



Lesson Objectives

1. The participants shall identify insects used for food and feed.
2. The participants shall appreciate the role of insects in food security.
3. The participants shall explore and appreciate insect farming for food and feed.

Learning resources

1. Text
2. Video
3. Photo

Insect for food and feed: An introduction

The consumption of insects is known as entomophagy. Edible insects have always been a part of human diets as well as livestock feed. In some communities, there is a degree of distaste for the consumption of insects.

Consuming insects is an alternative to conventional food and feed for livestock. Additionally, the high demand coupled with high prices of conventional feeds for livestock is pushing for new research and development on the use of insect protein for livestock.

Insects have a high nutritional value as they contain high protein content and essential amino acids, a dietary requirement for humans and livestock. As such, insect-based feeds are comparable with fishmeal and soy-based feed formulae.

Edible insects are commonly gathered from forest habitats. However, technologies have been developed to enable mass rearing and safe harvesting of edible insects, particularly; crickets, grasshoppers, locusts, palm weevils, mealworms, dung beetles and black soldier flies.

Advantages of insects for food and feed

Advantages of insects for food and feed include:

1. Edible insects form a traditional part of many regional and national diets. They are healthy and nutritious alternatives to mainstream staples such as chicken, pork, beef and fish.
2. Many edible insects are rich in protein and good fats; and high in calcium, iron and zinc.
3. In the environmental sphere, insects emit lower greenhouse gases than most livestock and require less land to produce.
4. Insect rearing produces less ammonia compared to livestock farming. Insects are also very efficient at converting feed into protein. They can also be fed on organic waste streams.
5. As a source of livelihood, insect rearing and harvesting offers livelihood opportunities to the local communities. It requires low capital investment making it an affordable venture to many including the poor and the landless.

Major groups of insects used for food and feed

It is estimated that insects form part of the traditional diets of at least 2 billion people. About 1,900 species of insects are used for food and feed.

Globally, the most commonly consumed insects are:

- Beetles (Coleoptera)
- Caterpillars of moths and butterflies (Lepidoptera)
- Bees, wasps and ants (Hymenoptera)
- Grasshoppers, locusts and crickets (Orthoptera)
- Cicadas, leafhoppers, planthoppers, and true bugs (Hemiptera)
- Termites (Isoptera)
- Dragonflies (Odonata)
- Flies (Diptera).



Photo of dung beetle larvae (edible beetle)
Source: NMK Entomology

Insects as a natural resource

Edible insects inhabit a variety of habitats; from aquatic ecosystems and farmed land to forests. Edible insects have been harvested from nature seemingly inexhaustibly. However, this is currently changing as some species are now in danger. A number of anthropogenic factors, such as overharvesting, pollution, wildfire and habitat degradation, have contributed to a decline in many edible insect populations.

Conservation strategies and semi-cultivation practices to protect insect species and their host plants is therefore crucial.



*Photo of natural termite mound
Source: NMK Entomology*

Insects farming systems

Insect farming for food and feed, for most edible insects is commonly practised in the wild for example, cricket farming. Recently, industrial scale production for some species such as black soldier flies has been done enhancing its processing into animal feed.

Some knowledge on biology, rearing conditions and diet formula are important in insect rearing



Photo of a pinned black soldier fly (aerial view, right and cross sectional view, left)



Photo of black soldier flies

Nutrition value of edible insects

Insects are a highly nutritious and healthy food source with high fat, protein, vitamin, fibre and mineral content. This nutritional value is highly variable among edible insects due to the wide range of edible insect species. Even within the same species, nutritional value may differ depending on the metamorphic stage of the insect, the habitat in which it lives and its diet.

Two examples of the nutritional value of an edible insect are;

- The composition of unsaturated omega-3 and -6 fatty acids in mealworms is comparable with that in fish.
- The protein, vitamin and mineral content of mealworms is similar to that in fish and meat

Chart showing protein content for different insect orders at different metamorphic stages:

| Insect Order | Stage | Range (% protein) |
|---------------------|--------------------------------|--------------------------|
| Coleoptera | Adults and larvae | 23 – 66 |
| Lepidoptera | Pupae and larvae | 14 – 68 |
| Hemiptera | Adults and larva | 42 – 74 |
| Homoptera | Adults, larvae and eggs | 45 – 57 |
| Hymenoptera | Adults, pupae, larvae and eggs | 13 – 77 |
| Odonata | Adults and naiad | 46 – 65 |
| Orthoptera | Adults and nymph | 23 – 65 |

Source [Xiaoming et al., 2010](#)

Processing edible insects for food and feed

Edible insects need high quality processing methods to be carried out to increase their use as food and feed. Commercial processing methods render the protein suitable for food and feed formulation, while maintaining the safety, nutritional and sensory quality of the final product. Some of these methods include:

1. Killing harvested insects by freeze-drying, sun-drying or boiling.
2. Grinding or milling dried insects to granular or paste form.
3. Extracting protein, fat or chitin, minerals and vitamins for fortifying food and feed products.

When not processed, edible insects such as termite alates can also be consumed whole and alive or fried.

Safety and preservation

The processing and storage of edible insects and their products should follow the same health and sanitation regulations as any other food or feed items to ensure food safety.

Issues such as microbial safety, toxicity, palatability and the presence of inorganic compounds should be considered while also considering the biological makeup of the edible insects. Harvested insects should be free from pesticide exposure.

Contribution of edible insects in livelihood improvement

Insect gathering and rearing as a mini-livestock activity at the household level or industrial scale can offer important livelihood opportunities such as employment and income generation. Women and the youth can be involved in gathering, cultivation, processing and sale of insects. These activities will improve their diets and provide an income as they can sell off the excess. Insects being consumed as food have the potential to alleviate protein and other nutritional deficiencies in the community

Insect for food and feed and citizen science

Local communities need to raise awareness and promote acceptance of insects as a viable source of food and feed. This can be achieved through collecting data and sharing observations on the various aspects of insect farming, processing and consumption to audiences at the community level. This awareness will help in creating economic opportunities for small-scale insect farming and processing.

Environmental threats to edible insects

There are several potential threats of wild harvesting of insects for food and feed including:

1. Causing direct competition with other predators which leads to undermining population viability.
2. Over-exploitation or overharvesting: when the number of collected individuals exceed the regeneration capacity.
3. Damage to habitat through deforestation, forest degradation and pollution.

Conservation of edible insects

Implementing conservation strategies and semi-cultivation practices within the local communities to protect insect species and their host plants is important. The public can undertake a raft of conservation measures including:

1. Supporting sustainable farming practices.
2. Reducing pesticide use which is harmful to insects.
3. Creating habitats for insects by planting indigenous plants.
4. Reducing light pollution as artificial light disrupts insect behaviour.
5. Creating awareness on the importance of insects for food and feed.

Role of National Museum of Kenya in promoting edible insects for food and feed

The National Museums of Kenya plays an integral role in promoting insects for food and feed through:

1. Collection and preservation of insects that are used for food and feed.
2. Taxonomy of different insects utilised as food and feed.
3. Research on different aspects of edible insects such as insect ecology, nutritional value and sustainability of insect-based food and feed.
4. Training of institutions and the general public on insects for food and feed.
5. Creating awareness on utilisation of insects for food and feed through exhibitions.
6. Conservation of insects used for food and feed.



Photo of NMK staff training JOOUST scientists.
Source: NMK Entomology