

## Insects in food, nutraceuticals and cosmetics

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People throughout the world have been eating insects as a regular part of their diets for millennia. But food sources such as cereals, fruits, vegetables and milk production are constantly researched, commercialized and upgraded but, insects as food remained primitive. Insects as food and nutraceuticals have high potential and need to be taken in high scale.

The practice of eating insects 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). 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 1900 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 plant hoppers, scale insects and true bugs, termites, dragonflies and flies.

### **Importance of Insects as food**

Insects as food and feed emerge as an especially relevant issue in the twenty-first century due to the rising cost of animal protein, food and feed insecurity, environmental pressures, population growth and increasing demand for protein among the middle classes.

Thus, alternative solutions to conventional livestock and feed sources would be consumption of insects or entomophagy, which contributes positively to the environment and to health and livelihoods (FAO, 2012).

Approximately 1,900 insect species are eaten worldwide, mainly in developing countries. Globally, the most commonly consumed insects are beetles (Coleoptera-31%), caterpillars (Lepidoptera-18 %) and bees, wasps and ants (Hymenoptera-14 %). Following these are grasshoppers, locusts and crickets (Orthoptera-13 %), cicadas, leaf hoppers, plant hoppers, scale insects and true bugs (Hemiptera-10 %), termites (Isoptera-3 %), dragonflies (Odonata-3 %), flies (Diptera-2 %) and other orders (5 %). They constitute quality food and feed, have high feed conversion ratios (FCRs) (Huis, 2013).

Lepidoptera are consumed almost entirely as caterpillars and Hymenoptera are consumed mostly in their larval or pupal stages. Both adults and larvae of the Coleoptera order are eaten, while the Orthoptera, Homoptera, Isoptera and Hemiptera orders are mostly eaten in the mature stage (Cerritos, 2009).

### **Insects as feed ingredients**

Insects are highly nutritious and healthy food source with high fat, protein, vitamin, fiber and mineral content. The composition of unsaturated omega-3 and six fatty acids in mealworms is comparable with that in fish (and higher than in cattle and pigs) and the protein, vitamin and mineral content of mealworms is similar to that in fish and meat. Insects have high FCRs and emit low levels of greenhouse gases.

Insects can be used as a replacement for fish meal and fish oil in animal diets. Global industrial feed production in 2011 was estimated at 870 million tons, worth approximately US\$350 billion (<http://www.ifif.org>). Meal and oil from both fish and soybean are used for compound aqua feed and animal feed. Fish meal and fish oil were derived from 20.8 million tons (19%) of the global fish production of 145 million tons in 2008. This concerned mainly small, pelagic forage fish. The worldwide production of fish meal and fish oil in 2006 was 5.46 and 0.95 million tons, respectively [processing yields of 22.5% and 5%, of which 68% and 89% were used in aquaculture, respectively

### **Insect products**

A wealth of bee products – including honey, propolis and beeswax, among others – are well known among the public and are documented extensively by Bradbear (2009). The fact that silk fabric is obtained from silkworms is common knowledge. Carmine, for example, also called cochineal, is a red dye produced by scale insects, and is typically used to colour food products and as a dye in textiles and pharmaceuticals. Silkworm pupae are considered a

delicacy in Asia. Lerp and a host of edible oils derived from pentatomid bugs are other insect products in common use.

Insects and insect derived products have been used as medicinal resources by human cultures in many parts of the world since ancient times. Science has proven the existence of immunological, analgesic, antibacterial, diuretic, anesthetic and anti rheumatic properties in the bodies of insects (Meyer-Rochow, 1979). Several authors have surveyed the therapeutic potential of insects, either by recording traditional medical practices or by employing insects and their products at the laboratory and/or clinical level. Thus, insects seem to constitute an almost inexhaustible source for pharmacological research. Furthermore chemical studies are needed to discover the list of biologically active compounds present within insect bodies (Costa-Neto, 2012).

#### **Insect nutraceuticals/ Insect as medicine**

<b>Insect</b>	<b>Medicine</b>
Grasshoppers <i>Sphenarium spp.</i> <i>Taeniopoda sp.</i> <i>Melanoplus sp.</i>	The hind legs of grasshoppers were crushed and mixed with water, then drunk as a powerful diuretic to treat kidney diseases
Locusts, <i>Schistocerca sp.</i>	Dietary supplement to alleviate nutritional deficiencies and to fortify the blood Post childbirth anaemia and in lung diseases, e.g., asthma and chronic cough
Crickets	Diuretic for dropsy (edema)
Bugs Stink bugs, <i>Euschistus spp.</i> Leaf-footed bugs <i>Acanthocephala spp.</i>	When alive, these bugs are a powerful anaesthetic against toothache, rheumatic, arthritic pain, gastrointestinal diseases It was also used to treat goitre
Leaf-footed bugs <i>Xamues sp.,</i> <i>Pachilis gigas</i>	These insects were roasted and powdered and utilized in whooping cough cases
Mealy bugs	Whole insect bodies were boiled to produce a sticky mass which was placed over lesions of leprosy, healing

	of burns Treat muscular pain, itching, scars.
Cochineal insects	When used in alcohol and drank - make for a great cure to whooping cough, urinary tract infection and asthma
Spanish fly ( <i>Lytta vesicatoria</i> )	Larvae roasted or crushed, mixed with water then drunk to treat uro-genital disorders, aphrodisiac
Scarabaeidae, Dynastinae, Elateridae	Alleviate impotence in men
White agave worm ( <i>Aegiale hesperiaris</i> )	Stomach disorders and rheumatic diseases
Silk worm	Bronchitis or pneumonia, and alleviate vomiting
Bees <b>Honey</b>	Scar tissue, rash, and burns Digestive problems, eye problems For colds, cough, throat infections, tuberculosis, lung diseases
<b>Venom</b>	Direct stings of live bees to the part of the body afflicted by arthritis, rheumatism and polineuritis
<b>Propolis</b>	All kinds of inflammations, tumours antibiotic, bactericidal properties
<b>Royal jelly</b>	Asthenia, anorexia, gastrointestinal ulcers, arteriosclerosis, anaemia, hypo or hypertension, neurasthenia
Hymenoptera Bees, Wasps, Ants	Rheumatic disease, arthritis, and poliomyelitis
<i>Polistes instabilis</i> <i>Polybia occidentalis</i>	Roasted or eaten alive are used to cure nervous breakdowns Urinary diseases
Honey ants <i>Myrmecocystus</i> spp.	Honey- anti-inflammatory and anti-fever properties Applied directly for eye diseases, cataracts
<i>Pseudomyrmex</i> spp.	Arthritis

(Lawal and Banjo, 2007)

Entomophagy will help in economic development because gathering and farming insects can offer employment and income, either at the household level or in larger, industrial-scale operations. The collaboration of government, industry and academia is often conditional to success. It is an innovative challenge demanding a multidisciplinary approach whereas, marketing and public acceptance requires interdisciplinary and transdisciplinary approaches.

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**Worms as bird feed in South Korea**



**Worms as bird feed in South Korea**



**Honey bee product- Toothpaste**



**Honey bee product- Propolis Soap**



**Cosmetics from Bee Venom**



**Honey bee product- Shampoo**