AgriCos e-Newsletter
ISSN: 2582-7049
AgriCos e-Newsletter
Open Access Multidisciplinary Monthly Online Magazine
Volume: 02 Issue: 11 November 2021 Article No: 24

Insects as Source of Food

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SUMMARY

Entomophagy is the key to solving the growing needs of nutrients globally because edible insects can provide high amounts of proteins, fats, vitamins and mineral elements with great economic and environmental advantages. Insects can serve in various areas in addition to being eaten as cuisines and snacks. Various modern products have been developed due to the intensive studies of insects. The consumption of edible insects is increasingly popular. People are consuming insects not only for nutrition, but also for fun. However, it is still concerned that the utilization of edible insects might bring health and safety issues.

INTRODUCTION

Consumption of insect is more than 7000 years old practice. Around 2300 species belonging to 18 orders have been detected to be edible in nature. Though mostly they are originated in nature still some are farmed in large scale. Insects belonging to order Lepidoptera, Coleoptera, Isoptera and Hymenoptera are being eaten worldwide. However, tropical and subtropical climate is most suitable for harvesting insects in large number due to warm and humid climatic condition (Jongema, 2017). Tropical insects are large in size than their temperate counterparts with stable life cycle which facilitate their mass harvesting (Gaston & Chown 1999). Out of all the stages in the insect life cycle, immature forms are mostly preferred as food source as they are rich in fat and aminoacid which is responsible for giving it a better flavour. Production of animal protein is now under great demand due to sharp rise in population (Gerland *et al.*, 2014). Hence entomophagy is seen as a better alternative to it. Hence great attention is being paid towards use of edible insects as a source of food.

Modern entomophagy

There are six common commercial edible insect species at present, including cricket (*Acheta domesticus*), honeybee (*Apis mellifera*), domesticated silkworm (*Bombyx mori*), mopane caterpillar (*Imbrasia belina*), African palm weevil (*Rhynchoporus phoenicis*) and yellow meal worm (*Tenebrio molitor*). Out of all these, in some cases (*R. phoenicis, T. molitor and I. belina*) only the immature stage is edible as they give a good flavour due to high content of fat in them. In case of cricket only adults are edible. Silkworm rearing is popular since ancient times as it established a trade between china and Mediterranean region. However, silk is not the only remarkable product made from silkworms, whose pupae are traditionally consumed as food (Zhang *et al.*, 2008). They are popular in china, Thailand, Vietnam and Japan. Honeybees are raised as pollinators mostly. Bee brood extract is one luxury nourishment source (Chen *et al.*, 1998). Honey of course, has been a popular condiment all over the world. But it is not the only entomic sugar that is popular now. Actually, a newly developed product called lerp, which is the secretion produced by larvae of psyllids, is becoming particularly vogue. Besides monosaccharides and water-insoluble carbohydrates, it is abundant with minerals, especially potassium and phosphorous (Ernst & Sekhwela 1987).

Many countries are still under economic pressure and are malnourished. Practically it is better to provide them their traditional food source rather than to supply them foreign diet. A project called Win Food in China, targeting at alleviating childhood malnutrition, has thus been launched and eating insects is its key (Chamnan *et al.*, 2013). Consuming insects in a healthy and wise manner can be a solution to eradicate poverty. Edible insects are playing a big role in various food systems. In fact they are evolving as a vital source of nutrients in many countries. Proteins, Vitamins and minerals are lacking in the diets of developing countries even though it is essential for the infants and children. Farm products like vegetables and domestic livestock are often illegitimate or unaffordable for them. Insects, however, are usually cheap but with the nutrients that are deficient in traditional diets. SOR-Mite (protein-enriched sorghum porridge) project provides another insight in improving diets. In many African countries, the grains local people daily consume are lack of proteins and fats. However, these grains can balance well nutritionally with flying termites, which can be easily gathered. The porridge made of their mixtures is both nutritional and economical (Van Huis *et al.*, 2013).

Edible insects also serve as a feeding source for livestock and aquaculture. Using insects as fodders is particularly popular in areas where vegetable feeds is expensive (Krishnan *et al.*, 2011). The cost is increasingly challenging for industries to feed farmed animals on traditional meals that are made of soy. Insect meal, however, can provide enough nutrition with cost that is distinctly low. Biomass could be recycled during the production of insects, which makes the protein sustainable. Moreover, pupae of Chironomidae and Muscidae are used as fishing baits and feeds (Awoniyi *et al.*, 2004). Food additives can be extracted from insects, too. Carmine, a common natural colorant being used for hundreds of years, is obtained from *Dactylopius coccus* (Van Huis *et al.*, 2013). It provides a bright red dye for clothes, cosmetics and of course, food. Similarly, the lac insect (*Kerria lacca*) is a fabulous source of a water soluble polyhydroxy-anthraquinones called lac dye. Lac resin secreted by the lac insect is commonly used in coating candies and fruits (Siddiqui 2004). Beyond being eaten to allay the hunger or just for pleasure, insect extracts can be used as a source of medicine, healthcare and industrial products (Liu & Wei, 2002). Industrial enzymes for biodiesel production have been successfully extracted from black soldier flies (*Hermetica illucens*). The exoskeleton of adults is a rich source of chitin, which has been proven to enhance the immune system of different organisms (Mack *et al.*, 2015; Van Dyken & Locksley 2018).

Economic and Environmental benefits

Primarily, insects are taken as foods because of the low cost. For wild resource-rich species, harvesting is almost free. For farming species, they usually feed on a wide range of cheap fodders with efficient energy transmission. Notably, the efficiency of conversion of ingested food (ECI) of *T. molitor* is 53 to 73% whereas it is at most 40% in other animals (Morales-Ramos & Rojas 2015). Eating insects would reduce the consumption of pesticides, especially the chemicals. Many edible insects are important pests of economical plants, which are used to be managed by insecticides. However, they would be largely caught artificially with extra profits bringing in. Consequently, the amount of next generation would be controlled by the limited amount of mating adults. As the use of pesticides decreases, the resistance insects generate to drugs will be staved off (Cerritos, 2009; Kouřimská & Adámkova, 2016).

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