

Bug Delicacies: Insects as a Powerful Food Resource for a Troubled World

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The subject of research of cultural entomology is the influence of insects and other arthropods in a whole range of human activities [1] including the practice of entomophagy which is simply the use of insects as food [2,3]. Insects of very diverse orders have been used as food by humans and their kin since very ancient times [4]. Perhaps, the oldest record documenting entomophagy is a cave-painting in Altamira (Spain) depicting the collection of bee nests: these ancient Europeans probably ate bee larvae and pupae as well as honey [5]. Historically, entomophagy has been recorded in most of the older known religious and profane texts of different ancient civilizations [6]. For example, in the Babylonian Urra=Hubullu belonging to the Sumerian (2900-2334 B.C.) and Akkadian periods (2334-2154 B.C.) [7,8] tablet N° 14 lists the names of 410 terrestrial animals including 120 insects and many of them, e.g. grasshoppers and locusts were part of culinary recipes [9]. Sacred texts such as the Bible (both Old and New Testaments) and the Qur'an contain references to the consumption of insects which evidently was a common practice among desert nomads [10]. Eating insects is still a very common practice in many parts of the world as part of ancient traditions preserved in different cultures of Asia, Australia, Africa and the Americas [3,11-14]. Despite this, Western civilization has traditionally been prejudiced against entomophagy which is strange considering that other arthropods (e.g. crustaceans) are widely consumed [15,16] although this trend is slowly reversing as the edition of cook-books offering insect recipes increases [10,17-19]. Furthermore, recent reviews strongly support entomophagy both as a cultural activity deserving respect [20], and as a means of boosting nutrition in emergent societies where the risk of starving is unfortunately, a perpetual sword of Damocles [3,12,14,21-23].

The potential use of insects as food in the future, transcending their folk traditional use toward a more widespread utilization, requires the scientific study of their nutritional content as well as the presence of toxic compounds. Fortunately, in recent years a large number of studies in the former respect have become available [20,24-26]. Although much variability occurs between different groups and even between closely related species, as a food group insects seem to be promisingly nutritious [24,26]. They are very rich in fat and protein and their amino acid composition has been frequently shown to be better for human consumption than that of most legumes and grains thus, they could constitute an important proteinic complement to diets based on grain staples. Insects are also an important source of vitamins and minerals. However, in order that this kind of studies be performed, it is first of utmost relevance a knowledge of the folk use of insects as a food source. This is one of the subjects of ethnoentomology [27] and it should start by the careful cataloguing of the insect species consumed now and in the past by the folk people of a given region. This knowledge is reasonable for some regions of the world but fragmentary or almost inexistent for others [2,3,6,11,12]. The Americas are a good example of this disparity despite the fact that native peoples used, and still use, a wide diversity of insects as food. For example, Mexico is one of the best known countries regarding entomophagy, a practice still in use. This impressive knowledge is mainly the results of the efforts of Dr. Julieta Ramos-Elorduy and her group at the Universidad Autónoma de México [13,17,20,22]. It is important to note that north of Mexico, the importance of insects in the culture of native peoples is

poorly documented, very probably because of a stronger influence of European colonists that did not make many efforts to preserve native cultural traditions. Comprehensive studies of this kind are also starting in Brazil, an enormous country with one of the highest indices of insect biodiversity in the world and no less than 222 indigenous ethnic groups recognized by the state [28]. Costa-Neto and Ramos-Elorduy [29] have recorded 135 kinds of Brazilian edible insects included in 9 orders, 47 genera and 95 species. However in Argentina, the second largest country in South America and with a very rich entomological tradition, ethnoentomology is practically inexistent despite its diversity of native ethnic groups all of which are known for consuming insects as part of their diet, as for example the Guaraní [30]. It is thus of the utmost importance that ethnoentomological studies are financially supported by official funding agencies in this and other countries in view of the potential of insects for relieving some of the world's most pressing nutritional needs.

Insects represent a promise and a challenge in a world of dwindling resources and have also been proposed as ideal sources of food and components in waste recycling in outer space [27,31]. However, besides the lack of basic knowledge in many parts of the world, a major change in diet will also require large campaigns to raise people's awareness and produce more positive attitudes in the public and innovative marketing practices to introduce insect-based foods [3,27,32].

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Received February 24, 2015; Accepted February 25, 2015; Published February 26, 2015

Citation: Bidau CJ (2015) Bug Delicacies: Insects as a Powerful Food Resource for a Troubled World. *Entomol Ornithol Herpetol* 4: e111. doi:[10.4172/2161-0983.1000e111](https://doi.org/10.4172/2161-0983.1000e111)

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