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Edible crickets, but which species?

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EDITORIAL

Abstract

True crickets belong to the family of the Gryllidae and they can be used not only as food and feed, but also for recreational purposes (fighting or singing). When reared on cheap substrates, they can be used as feed. The house cricket is most often used as human food. The selection of the cricket species may depend on several criteria, such as legislation, resistance to disease, but also taste.

1. Introduction

The suborder Ensifera (Orthoptera) includes true crickets, camel crickets, bush crickets or katydids, and others. The true crickets belong to the family Gryllidae (Orthoptera). The bush crickets or katydids belong to the family Tettigonidae containing a number of edible insect species such as the Mormon cricket (*Anabrus simplex*) used as feed for poultry in the USA (DeFoliart *et al.*, 1982; Finke *et al.*, 1985), the armoured cricket (*Acanthoplus discoidalis*) consumed as relish and snack in Zimbabwe (Mugova *et al.*, 2018), and the bush cricket *Ruspolia differens*, considered to be delicious human food in East Africa (Malinga *et al.*, 2018). Of the closely related family of the Stenopelmatidae, the edible ground cricket *Henicus whellani* is eaten in south-eastern Zimbabwe (Musundire *et al.*, 2014). However, we will restrict ourselves here to the family Gryllidae which includes more than 550 species in the world (Rentz and Su, 2003). This article is also meant to motivate authors to be more precise about which cricket species they are referring to, because there are several occasions where it is not mentioned (Lokman *et al.*, 2019); this may be because the authors consider the house cricket the default or did not think it relevant.

2. Uses of crickets

The house cricket, *Acheta domesticus*, is a domesticated species used as food for mammals, birds and reptiles. These domesticated strains may have difficulties surviving in nature. In Asian countries, crickets are kept for fighting and for their song. The fighting crickets are probably *Teleogryllus mitratus* (Kevan and Hsiung, 1976) in China and *Velarifictorus beybienkoi* and *Velarifictorus micado* in Japan (Suga, 2006). In China, India, Indonesia, Japan and Korea, *Homeogryllus japonicus* is used for singing, and is called 'golden bell' in Japanese, because of its beautiful sound (Pemberton, 2002; Ryan, 1996). Nocturnal crickets are best known for the loud, persistent, chirping song of the males.

2.1 Crickets as feed

Most reared cricket species are used as human food (very often *A. domesticus*) or for insectivorous amphibians and reptiles. However, a few publications mention insects as feed for common production animals and pets:

- Fish: *A. domesticus* (Irungu *et al.*, 2018; Lee *et al.*, 2017), *Gryllus assimilis* (Alfaro *et al.*, 2019), and *Gryllus bimaculatus* (Norhidayah, 2016; Taufek *et al.*, 2018).
- Feed: *G. bimaculatus* (Straub *et al.*, 2019); in Indonesia: *Gryllus mitratus*[1], *G. bimaculatus* and *Gryllus testaceus*[1] (Armansyah and Handayani, 2020; Fuah *et al.*, 2015).
- Pigs: *G. testaceus*[1] (Miech *et al.*, 2017).
- Poultry (Lokman *et al.*, 2019): *A. domesticus* (Kovitvadhi *et al.*, 2019; Nakagaki *et al.*, 1987), *G. testaceus*[1] (Kovitvadhi *et al.*, 2019; Miech *et al.*, 2016) and *G. bimaculatus* (Kovitvadhi *et al.*, 2019).
- Japanese quail (*Coturnix japonica*) eggs: *G. bimaculatus* (Permatahatia *et al.*, 2019).
- Pets such as dogs: *Gryllodes sigillatus* (Jarett *et al.*, 2019).

[1] According to Jongema (2017) *Teleogryllus mitratus* is synonymous with *Teleogryllus testaceus*, *Gryllus mitratus* and *Gryllus testaceus.*

One could question the profitability of growing crickets for production animals, when they can be eaten directly by humans. The main reason is that it may be quite cheap when rearing crickets on weeds or organic side streams such as cassava leaves (Armansyah and Handayani, 2020; Caparros Megido *et al.*, 2016; Choo *et al.*, 2017; Fuah *et al.*, 2015; Miech *et al.*, 2016; Thu Hang *et al.*, 2020).

2.2 Crickets as food

Edible crickets in particular have been domesticated in Thailand where 20,000 farmers produce 7,500 tons per year (Hanboonsong *et al.*, 2013). In 1998, they started to rear three native species: *G. bimaculatus*, *T. mitratus*[1] and *Teleogryllus occipitalis*. However, a few years later, *A. domesticus* was introduced from Europe and the USA (also in Laos; Hanboonsong and Durst, 2014). *A. domesticus* is now commonly farmed in Thailand. The reason for the shift is probably the taste, particularly of the females owing to the large number of eggs, which are 'delightful crunchy'. Other cricket species eaten in Thailand are the bull cricket *Brachytrupes portentosus*, the largest members of the Gryllidae family, and species like *Gymnogryllus* spp., *Velarifictorus* sp. and *Modicogryllus confirmatus*. In Java Indonesia the cricket *T. mitratus*[1] is also farmed as food (Fuah *et al.*, 2015). In Madagascar the large cricket *Brachytrupes membranaceus colosseus* is sold individually (3-6 dollar cents) and specifically sought after when meat is expensive and when no other rice accompaniments are available (Van Itterbeeck *et al.*, 2019). The same publication mentions several other edible cricket species such as *Modicogryllus* sp. and *Fryerius* sp. In Kenya *B. membranaceus* is popular and traditionally consumed, but difficult to rear. In this country a new native edible cricket species, *Scapsipedus icipe*, has been described for the first time and has been suggested for mass rearing (Magara *et al.*, 2019).

In different countries of Asia and Africa, *A. domesticus* and *G. bimaculatus* are reared by farmers (Halloran *et al.*, 2018). The advantages of the first include nutritional value, soft tissue, low maintenance, low disease incidence, and the ability to consume a wide variety of foods including organic waste flows. Others prefer *G. bimaculatus* because they require less time to mature than the house cricket, 42 and 49 days, respectively (Halloran *et al.*, 2017), and they are larger and easier to sell.

2.3 Taste

Is taste a selection criterion for a certain cricket species? Ribeiro *et al.* (2019) compared *A. domesticus* with *G. sigillatus* and found that when defatted there was no difference in flavour. However, when using whole crickets, there was a difference, probably due to the lipid content, which gives crickets a characteristic flavour.

2.4 Diseases

Cricket species may differ in their susceptibility to disease. An overview of which cricket species is susceptible to which disease is given by Eilenberg *et al.* (2017). A publication from the USA (Weissman *et al.*, 2012) mentioned that the Acheta domesticus densovirus caused the collapse of commercial colonies of the house cricket. It was recommended to substitute it with *G. sigillatus*. *Gryllus assimilis* and *G. bimaculatus* also seem to be resistant to the virus (Szelei *et al.*, 2011). Also, a nudivirus of *G. bimaculatus* is lethal to other cricket species such as *G. campestris*, *Teleogryllus oceanicus* and *Teleogryllus commodus* (Huger, 1985). However, disease prevention is also a matter of maintaining the colony in optimal condition and enforcing strict hygiene measures.

2.5 Other criteria for selecting cricket species

In specific countries there may be legislation concerning the legality of breeding certain cricket species (Mariod, 2020). The websites of commercial insect rearing companies also list the pros and cons of several cricket species, using criteria such as such being active, digestible, producing minimal noise, or odour, and not being aggressive.

3. Conclusions

For centuries crickets have been used to entertain people in China and Japan. They were kept as pets either for their characteristic sound or to be used in fighting matches. Nowadays, crickets are reared commercially as feed for amphibians and reptiles, and recently also as feed for fish, poultry and pigs. Since the last twenty years, starting in Thailand, they have also been used commercially as human food, the most popular being *A. domesticus* and *G. bimaculatus*. Large companies have emerged, rearing crickets for human consumption. The criteria for selecting the species include legislation, ease of rearing, selling price, taste, disease and size.

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