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Edible Insects Diversity and Their Importance in Cameroon

Meutchieye Félix

Abstract

Insects are known to be part of Sub-Saharan African region. Entomophagy is a common practice in Cameroon food systems. The current chapter is based on both original research and major literature review in the domain. A variety of insects species and consumable stages, as well as preference and their spatial distribution are presented in this chapter. Insects are described according to the recent taxonomy features and their bioecology is provided. Some consumption patterns, preferences and determinants are described. The role of insects consumption is also highlighted as well as some prospective investigation targeting edible insects preservation and sustainability in Cameroon. The paper points out some policy gaps that need to be addressed to harness the potentials of edible insects in Cameroon food systems.

Keywords: entomophagy, ecology, food systems, nutrition, conservation

1. Introduction

Most of sustainable development goals are food related and should be addressed properly. Particularly in Africa, food and nutrition insecurity is coupled to a growing demand of animal source proteins that could be solved by a different conception of food systems [1]. The ideas about considering insect production as part of livestock have been a long run scholar discussion in the West [1, 2] and emerged as a consistent topic in Africa of recent [3, 4]. Insect consumption also called entomophagy is then widely accepted as a palliative to food scarcity not only for today but also for the future [1, 5, 6]. Insect consumption is part of cultural heritage in tropics and beyond [6–8]. Insects at different stages are nutritive food sources made cheaper by their availability and sustainable by their nature [5, 7, 9]. Cameroon has been regularly cited for its richness of edible insects and related practices [3, 4]. The objective of this review is to summarize the major features concerning edible insects, few constraints and opportunities for the country in a globalized and changing environment.

2. Distribution of entomophagy in Cameroon

Cameroon is an elongated country stretching from Congo Basin (humid tropics) to Lake Chad (Sahel). The country is also described as Africa in miniature by its diversity and position. The entomophagy is present everywhere from Sahelian to humid forest regions [3–5]. There is a variety of beliefs attached to insect consumption all over the country [5, 10]. Some communities have a larger panel of edible insects throughout the year than other [11]. The differences observed concerning

practices and recipes among communities are based on preferences, ability to harvest and process as well as the social importance attached to insect consumption [11, 12]. There is a large number of insects consumed in Cameroon.

3. Diversity of edible insects

Compared to other food sources, there are little taboos in insects' consumption in most of Sub-Saharan countries [3]. About 1700 insects' species are consumed around the world with majority from tropical world [1]. Some are widely identified and few less known in the context of recent interest by research in Cameroon.

3.1 Major groups

Caterpillars (order Lepidoptera) are the most populated group of edible insects in Cameroon concerning the number of species [10, 11, 13]. About 200 species have been reported and many are still unveiled. Some are used by limited communities, making their identification a real challenge [5, 11]. Forests provide shelter and perfect milieu for numerous of them [5, 7, 9]. Populations have developed a great knowledge about the bioecology of the most marketed species. In savannah and less woody forests, there are less diversity like in Adamawa and northern regions [10]. **Figure 1** below displays the naturel gathering nest (in a tree) and fresh and dried caterpillars found in Cameroon.

The second group of most consumed insects is made up of termites (order Blattodea) with two species, *Macrotermes* sp., being the most exploited [10–12, 14]. Termites are widely exploited all over the country [10]. The common recipe is to grill them after removing wings with onions, raw or not, as shown in **Figure 2** [14].

Besides “soft” species, crunchy and crispy are very regarded as a delicacy, mainly of Coleoptera order [15]. Adult Palm weevils are known as pest but “domesticated” by raffia palm harvesters (adults and grubs) [10, 11]. Various adults' species are the most collected in *Cetonia* sp. (**Figure 3**) [13], larvae are the most demanded is palm weevil, particularly the yellowish skin which is grown in raffia palm (see **Figure 4**) in Cameroon household [11]. Some tree, shrubs or humus grubs are also exploited in particular communities and need to be properly identified [10, 13].

The acridians or grasshoppers (Orthoptera), *Locusta migratoria* (also *Schistocerca gregaria*) known as migratory locusts are commonly exploited in drier regions of Cameroon (**Figure 5**), whereas *Ruspolia differens*, *Tettigonia viridissima* and *Zonocerus variegatus* are exploited in humid environments in southern Cameroon [10, 14]. *Zonocerus* sp. is treated with care because of toxins if not well prepared before ingestion.



Figure 1.
Edible caterpillar nest and heap of fresh and dried ones (*Imbrasia* sp.).



Figure 2.
*Processing of termites (*Macrotermes* sp.) and selling packages in Cameroon.*



Figure 3.
*Adult dried cetonia (*Cetonia aurata*) in Cameroon Western highlands.*



Figure 4.
*Palm weevil grubs (*Rynchophorus* sp.) and a dish made with in Cameroon.*



Figure 5.
Migratory locusts (greyish and greenish) and dried in North Cameroon.

Field crickets and cricket-like species (order Orthoptera) are also exploited in Cameroon humid regions [10, 11]. Giant cricket also called tobacco cricket (*Brachytrupes membranaceus*) is widely harvested. Some species are believed to have particular uses in pharmacopoeia beside being considered as food.

3.2 Specialties

Insects have played important roles in some national communities. For instance, some forest groups like Baka people praise the taste, flavors, contents and properties of some insects at particular stages [5, 11]. Honey bees larvae are considered as a powerful detoxification agent and then prescribed to some recovering patients in those communities [11]. In the same line, red ants (*Oecophylla longinoda*) are used by some forest communities in Centre region to cure manhood impotency. These biting red ants are collected, grilled and mixed with some other local herbs and fruits before consumption [11].

4. Edible insects' trade

Insects contribute also to income generation in rural and peri urban households [5, 11]. Local and transboundary trade involving Cameroon has been mentioned in some studies [5, 14]. Insects' harvesting requires some abilities acquired by empirical experiences which made some people experts and providing livelihoods means. This is for instance the case of *Guizigua* and *Mofu* men reputed to master termites' ethology [16]. The rapid urbanization in African towns is also promoting agro-industries, with impact on insects' consumption [17]. There is a growing economy of edible insects though the primary objective of insects' collection is own consumption [10, 11, 14]. As shown by **Figure 6**, there are many reasons attracting consumers to insects' utilization as food sources, with varying weight.

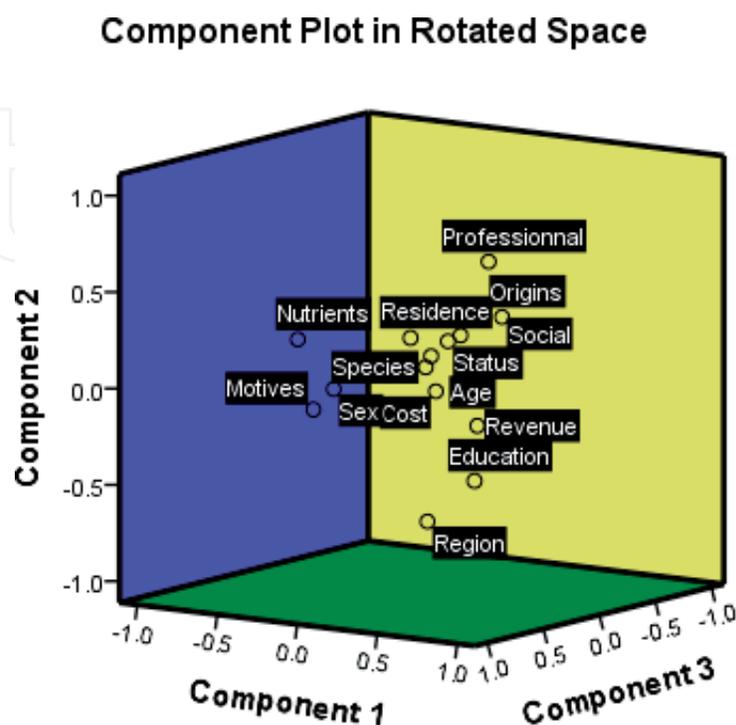


Figure 6.
Component rotational analysis of insects' consumption determinants.

4.1 Marketing channels, actors and benefits

Edible insects have become a more or less “normal” item or commodity in local trading spaces, even in big cities [17, 18]. The main categories of actors involved in collection are youths (irrespective of sex) for seasonal insects, women and youths for crickets and locusts, men for grubs and termites [5, 10, 11, 18]. Intermediate categories are made mainly by women or youths (street vendors) and exclusively women for urban markets. In *Mofu* and *Baka* communities some insects are exclusively harvested by men under specific conditions [12, 16]. Benefits are determined by the quality of products (freshness, color, origin and presentation), particularly in town markets [5, 11, 18].

4.2 New trends

With the influence of the mainstream food systems, processing and labeling edible insects are sectors for new food ventures [15, 17]. The type and flavors of spices make the difference for some conserved or already processed items [10]. Fast communication is now harnessing the pickup of technologies and making edible insects’ as a potential popularized food item [1, 2, 6].

5. From harvesting to farming

Insect production for human consumption started very humbly under a group of researchers from Gembloux—Belgium [2]. Preliminary findings in artificial production of palm weevil larvae are promising [19]. Massive palm grub production is in pilot stages with some important success [19–23]. Substrates and microclimate conditions have been mastered and trials already done under farmers’ conditions [22]. The investment for edible insects’ production is balanced with substantial income attached and also to environmental health.

6. Some aspects of nutrition and food safety

If supposed nutritional factors with food habits have factored much entomophagy in Cameroon like in other places, some field experiences are giving evidence [1, 6, 19, 24]. Science communication and access are making consumers more attracted by appealing presentation of edible insects’ nutrition facts. Palm weevil larvae has been largely studied [25] and results are opening avenues for other larvae consumption [26]. Entomophagy is then no more a fancy or traditional habit, but a real response to nutritional insecurity [27, 28]. Food safety in edible insects encompasses both endogenous and environmental factors. Chemical analyses have shown that some insects need special care before their consumption, like *Zonocerus variegatus*, because of its gut contents [29]. Under agrochemical pollution, natural harvesting is no safer as highlighted by some consumers in Cameroon suffering of indigestion [11, 24]. Pesticides are contaminants becoming a potential problem for consumers of in Cameroon western highlands [30].

7. Perspectives about policies and research gaps

Insects’ consumption even popular or popularized is not yet legal in Cameroon context [30] because of insufficient policies. Most of gathered food in nature in Cameroon is not yet under strict safety regulation which may bring

serious public health issues in case of hazardous products. While insects' farming and trade are gaining population attention, research and other influencers should in connivance with other international bodies invest in the domain. Vocational and higher education systems should also embrace genuinely the trends by crafting appropriate curricula and learn from learning by doing experiences. *Mofu* community has a wide range of knowledge on insects in their environment [31]. Indigenous knowledge built for centuries could speak a lot to research and policy today for better future of better human nutrition security, adapted to the context of biodiversity depletion [32]. From old, new can grow, new roads from within to many other places where collaboration are opened. The International Centre of Insect Physiology and Ecology (ICIPE) is already theorizing interesting and promising channels, and some in Cameroon about insects' domestication.

8. Conclusion

Insects' consumption in Cameroon is a reality for ages. Its biodiversity is very rich and massively exploited diversely. There are large numbers of species, exploited for food and other reasons. Urbanization and communication facilities coupled to food systems unification are favoring the migration of habits across generations and regions. Besides nutritive values at home level, edible insects provide income, jobs and potential enterprises, both for economic, scientific and cultural impacts in Cameroon society. There are gaps that make excellent avenues for innovative approaches in insects research. On the food safety aspects, risks analyses regarding natural or secondary toxicity of consumed insects should be undertaken. Edible insects' value chain could be made also stronger is legal framework is well designed and implemented. There are needs to train Veterinarians and others on harvesting methods as well as processing and packaging, which could yield norms. These could mainstream numerous affordable insects within animal proteins food systems and improve nutrition security and income generation at many extents. Some indigenous habits and skills (related to products' properties and bioecology) should be well studied and not regarded as lower knowledge. Many communities practices could be excellent avenues for future, wider than food security alone. Edible insects' research and policy need to be strengthened locally with the existing findings already uncovered.

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Conflict of interest

The author declares to have not "conflict of interest."

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References

- [1] van Huis A, Van Itterbeeck J, Klunder H, Mertens E, Halloran A, Muir G, et al. Edible Insects: Future Prospects for Food and Feed Security. *Fao Forestry Paper 171*. Rome: FAO. 2013. p. 188
- [2] Hardouin J. Production d'insectes à des fins économiques ou alimentaires: Mini-élevage et BEDIM. Notes fauniques de Gembloux. 2003;50:15-25
- [3] Niassy S, Affognon HD, Fiaboe KKM, Akutse KS, Tanga CM, Ekesi S. Some key elements on entomophagy in Africa: Culture, gender and belief. *Journal of Insects as Food and Feed*. 2016;2(3):139-144. DOI: 10.3920/JIFF2015.0084
- [4] Niassy S, Ekesi S. Contribution to the knowledge of entomophagy in Africa. *Journal of Insects as Food and Feed*. 2016;2(3):137-138. DOI: 10.3920/JIFF2016.x003
- [5] Balinga MP, Mapunzu PM, Moussa J-P, N'gasse G. Contribution des insectes de la forêt à la sécurité alimentaire, l'exemple des chenilles d'Afrique centrale. In: *Produits forestiers non ligneux Document de Travail No. 1*; FAO. 2004. p. 107. Available from: <http://www.fao.org/forestry/site/6367/en>
- [6] Bize V. Les insectes, une ressource alimentaire d'avenir? *Insectes*. 1997;3(106):11-13
- [7] Vantomme P. Les insectes forestiers comestibles, un apport protéique négligé. *Unasylva*. 2010;61(236):19-21
- [8] Schabel HG. Forests insects as food: A global review. In: *Proceedings of a Workshop on Asia-Pacific Resources and Their Potential for Development (Forest Insects as Food: Humans Bite Back)*; 19-21 February 2008; Chiang Mai, Thailand. 2010. pp. 37-64
- [9] Johnson DV. The contribution of edible forest insects to human nutrition and to forest management: Current status and future potential. In: *Proceedings of a Workshop on Asia-Pacific Resources and Their Potential for Development (Forest Insects as Food: Humans Bite Back)*; 19-21 February 2008; Chiang Mai, Thailand. 2010. pp. 5-22
- [10] Miantsa FO, Meutchieye F, Tanebang C. Diversité et Répartition des Insectes Comestibles au Cameroun. Saarbrücken: Editions Universitaires Européennes; 2016. p. 56. ISSN: 978-3-639-48385-7
- [11] Meutchieye F, Tsafo KE, Niassy S. Inventory of edible insects and their harvesting methods in the Cameroon Centre region. *Journal of Insects as Food and Feed*. 2016;2(3):145-152. DOI: 10.3920/JIFF2015.0082
- [12] Cloutier J, editor. *Insectes Comestibles en Afrique: Introduction à la Collecte, au Mode de Préparation et à la Consommation des Insectes (Agrodok 54)*. 1st ed. Wageningen: Fondation Agromisa et CTA; 2015. p. 81. ISBN Agromisa: 978-90-8573-147-4; ISBN CTA: 978-92-9081-578-5
- [13] Muafor FJ, Angwafo TS, Le Gall P. Biodiversité des insectes de la ligne volcanique du Cameroun: Distribution altitudinale d'une famille de Coléoptères. *Entomologie faunistique—Faunistic Entomology*. 2011;63(3):195-197
- [14] Tsafo KEC, Meutchieye F, Manjeli Y. Exploitation alimentaire et nutritionnelle des insectes comestibles en zone forestière du Centre Cameroun. *Sciences naturelles et agronomie*. 2016;2:245-254. ISSN 1011-6028
- [15] Muafor FJ. Des insectes au menu: Les scarabées, friandises croquantes. *Sciences au Sud—Le journal de l'IRD*. 2012;63:8

- [16] Seignobos C. Des insectes au menu: Les maîtres des termites. *Sciences au Sud—Le journal de l'IRD*. 2012;**63**:8
- [17] Tabuna H. Des insectes au menu: De l'économie de ramassage à l'agro-industrie. *Sciences au Sud—Le journal de l'IRD*. 2012;**63**:8
- [18] Meutchieye F, Niassy S. Preliminary observations on the commercialisation of *Rhynchophorus phoenicis* larvae at Mvog-Mbi market in Yaoundé, Cameroon. *Journal of Insects as Food and Feed*. 2016;**2**(3):199-202. DOI: 10.3920/JIFF2015.0081
- [19] Muafor FJ, Gnetegha AA, Le Gall P, Levang P. Palm weevil farming contributing to food security in sub-Saharan Africa. In: van Huis A, Tomberli JK, editors. *Insects as Food and Feed, from Production to Consumption*. Wageningen Academic Publishers: Wageningen; 2017. DOI: 10.3920/JIFF2018.x003 73
- [20] Ebenebe CI, Okpoko VO, Ufele AN, Amobi MI. Survivability, growth performance and nutrient composition of the African palm weevil (*Rhynchophorus phoenicis* Fabricius) reared on four different substrates. *Journal of Bioscience and Biotechnology Discovery*. 2017;**2**:1-9. Article Number: JBBD-28.09.16-018. Available from: www.integrityresjournals.org/jbbd/index.html
- [21] Quayea B, Atuaheneb CC, Donkohc A, Adjeid BM, Opokue O, Amankrahf MA. Alternative feed resource for growing African palm weevil (*Rhynchophorus phoenicis*) larvae in commercial production. *American Scientific Research Journal of Engineering, Technology, and Sciences (ASRJETS)*. 2018;**48**(1):36-44
- [22] Fogang Mba AR, Kansci G, Viau M, Ribourg L, Muafor FJ, Hafnaoui N, et al. Growing conditions and morphotypes of African palm weevil (*Rhynchophorus phoenicis*) larvae influence their lipophilic nutrient but not their amino acid compositions. *Journal of Food Composition and Analysis*. 2018;**69**: 87-97. DOI: 10.1016/j.jfca.2018.02.012
- [23] Monzenga Lokela JC, Le Goff GJ, Kayisu K, Hance T. Influence of substrates on the rearing success of *Rhynchophorus phoenicis* (Fabricius). *African Journal of Food Science and Technology*. 2017;**8**(1):7-13. DOI: 10.14303/ajfst.2015.065
- [24] Meutchieye F, Tsafo KE, Mekongo Fombod UC, Niassy S. La consommation d'insectes comme stratégie d'atténuation de la malnutrition: Expériences de la région du Centre Cameroun. *AGRIDAPE Revue sur l'Agriculture durable à faibles apports externes*. 2014;**30**(4):13-14
- [25] Fogang Mba AR, Kansci G, Viau M, Hafnaoui N, Meyneier A, Demmano G, et al. Lipid and amino acid profiles support the potential of *Rhynchophorus phoenicis* larvae for human nutrition. *Journal of Food Composition and Analysis*. 2017;**60**:64-73. DOI: 10.1016/j.jfca.2017.03.016
- [26] Dounias E. Des insectes au menu: Vous prendrez bien une petite larve? *Sciences au Sud—Le journal de l'IRD*. 2012;**63**:9
- [27] Le Gall P. Des insectes au menu: Entomophagie en Afrique. *Sciences au Sud—Le journal de l'IRD*. 2012;**63**:7
- [28] Muafor FJ, Gnetegha AA, Le Gall P, Levang P. Exploitation, Trade and Farming of Palm Weevil Grubs in Cameroon. Working Paper 178. Bogor, Indonesia: CIFOR; 2015. DOI: 10.17528/cifor/005626
- [29] Ehigie LO, Okonji RE, Ehigie AF. Biochemical properties of thiaminase, a toxic enzyme in the gut of grasshoppers (*Zonocerus variegatus* Linn). *Cameroon Journal of Experimental Biology*. 2013;**9**(1):9-16. DOI: 10.4314/cajeb.v9i1.2

[30] Miantzia FO, Meutchieye F, Niassy S. Relationship between new farming practices and chemical use and the consumption of giant cricket (*Brachytrupes membranaceus* Drury, 1770). *Journal of Insects as Food and Feed*. 2018;**4**(4):295-300. DOI: 10.3920/JIFF2018.0010. ISSN 2352-4588 Online

[31] Seignobos C, Deguine J-P, Aberlenc H-P. Les Mofu et leurs insectes. *Journal d'Agriculture Traditionnelle et de Botanique Appliquée*. 1996;**36**(2):125-187

[32] Niassy S, Fiaboe KKM, Affognon HD, Akutse KS, Tanga CM, Ekesi S. African indigenous knowledge on edible insects to guide research and policy. *Journal of Insects as Food and Feed*. 2016;**2**(3):161-170. DOI: 10.3920/JIFF2015.0085