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A Survey Study on the Practice of Entomophagy in Sekoma, Botswana

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ABSTRACT

Throughout the world, a large proportion of the human population consumes insects as a regular part of their diet. This study was undertaken to document edible insects in Sekoma in Southern District of Botswana. Thirty-five respondents were randomly selected and interviewed using a structured questionnaire. A total of 12 insect species was identified from four orders: Lepidoptera, Coleoptera, Isoptera and Hemiptera. The four most consumed insect species were Lophostethus dumolini Angus (91.4%) followed by Agrius convolvuli L (74.3%), Sternocera orrisa (71.4%) and Heniocha spp. (51.4%). In this study, insects were available for human consumption immediately after the rainy season, indicating that their availability is seasonal. The present results show that entomophagy plays an important role in human nutrition and food security.

***Key words**: Edible insects, entomophagy, nutrition, food security, Sekoma*

INTRODUCTION

The practice of eating insects is referred to as entomophagy[1]. Insects have been used as food as far back as history of mankind. In the bible John the Baptist at the beginning of the first millennium lived on locusts[2] and honey**.** Insects are some of the most abundant class of organisms in the world with a biomass exceeding 30% of all other animals put together. Insects are rich in proteins and thus represent a potential food and protein source[3]. Although the insect industry as food and feed is an evolving sector in the agricultural and food industry[4], it is reported that access to protein across the globe has improved since 2015 due considerably to the edible insect sector[5].

The traditional use of insects as food continues to be widespread in developing countries and provides significant nutritional, economic and ecological benefits for the communities[6]. It is estimated that the diets of approximately 2 billion people are supplemented by insects which have always been a part of human diets[1]. Insects are consumed by both humans and animals to provide valuable nutrients, particularly as a protein source. The use of edible insects also varies by local preference, socio-cultural significance, and region[7]. Edible insects are often regarded as cultural resources reflecting a rich biodiversity.

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There is limited information on the nutritional value of insects in Botswana[8]. Such inadequacy of information and advocacy on edible insects appear to make this valuable resource under-utilized in animal husbandry[9]. Therefore, a study was undertaken to document the practice of entomophagy in Sekoma village in the Southern District of Botswana.

MATERIALS AND METHODS

Experimental site

The study was carried out at Sekoma; a rural village situated about 80 km west of Jwaneng in Southern District (Figure 1) from December 2014 to January 2015. Sekoma is located at coordinates -24° 24'0" South and 23° 53'0" East (www.wikimapia.org/18773691/Sekoma). It is estimated[10] that the human population of Sekoma is 1263 in 2016.

Data collection

A simple random sampling method was used to select 35 respondents from the Sekoma's human population of 1263. Data were collected using a structured questionnaire and through direct observation.

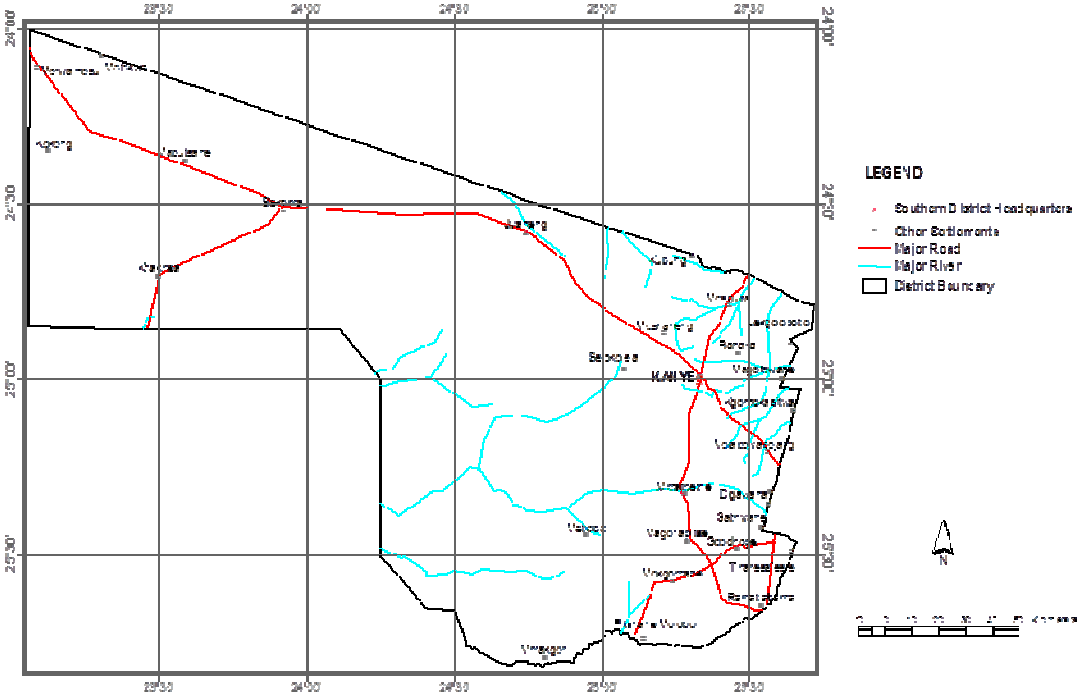

Fig. 1: Map of Southern District
Adapted from Southern District Integrated and Land Use Plan[11]

The interviews were conducted in Setswana (a local language) and responses written in English. Data were collected on sex, age and educational level of respondents; names of insects consumed, time of availability of insects and how insects were gathered and prepared (processed) for human consumption.

Data analysis

Data were encoded and entered into Microsoft Excel and analysed using SPSS software. Tables and figures were used to present summary statistics such as frequencies and percentages.

RESULTS AND DISCUSSION

The socio-economic data of the respondents is given in Table 1. The majority of the respondents (57.1%) were females while 45.7% of the respondents were aged >42 years followed by 26-33 years. The majority (74.3%) of the respondents were single. Furthermore, 74.3% of the respondents had attended school with 48.6% having attained secondary education, whereas the remainder never attended school.

Table 1: Socio-economic data of the respondents in Sekoma

Categories	Number of respondents	Percent responses
Sex		
Male	15	42.9
Female	20	57.1
Age (years)		
18-25	4	11.4
26-33	10	28.6
34-41	5	14.3
>42	16	45.7
Marital status		
Single	26	74.3
Engaged	1	2.9
Married	4	11.4
Divorced	4	11.4
Education level		
Primary	5	14.3
Secondary	8	22.9
Tertiary	9	25.7
Out of school	4	11.4
None	9	25.7

Edible insects and their uses

A total of 12 insect species were identified as human food in Sekoma (Figure 2). According to Figure 2, the four most consumed insect species were *sengana/shega* (*Lophostethus dumolini*) followed by *monakamongwe* (*Agrius convolvuli* L), *lebezana* (*Sternocera orissa*) and *sekala* (*Heniocha spp.*). Moreki[12] reported that the four most common consumed insect species in Mogonono village in Kweneng District of Botswana were *A. convolvuli* L. (90.00%), *S. orissa* Buq. (60.00%), *Cirina forda* West wood (56.67%) and *Imbrasia belina* West wood (53.33%)[12]. This indicates that the availability of insects in a certain locality influences their level of consumption by communities. About 91% of the respondents said that they consumed insects while the remainder said they derived economic benefits through sale of insects. Banjo *et al.*[13] stated that ordinarily insects are not used as emergency food during shortages, but are included as a planned part of the diet throughout the year or when seasonally available. For van Huis *et al.*[4], developing insects as feed and food is regarded as a viable strategy which can potentially contribute to global food security. The use of insects as food is associated with the culture and ethnicity of the community[14].

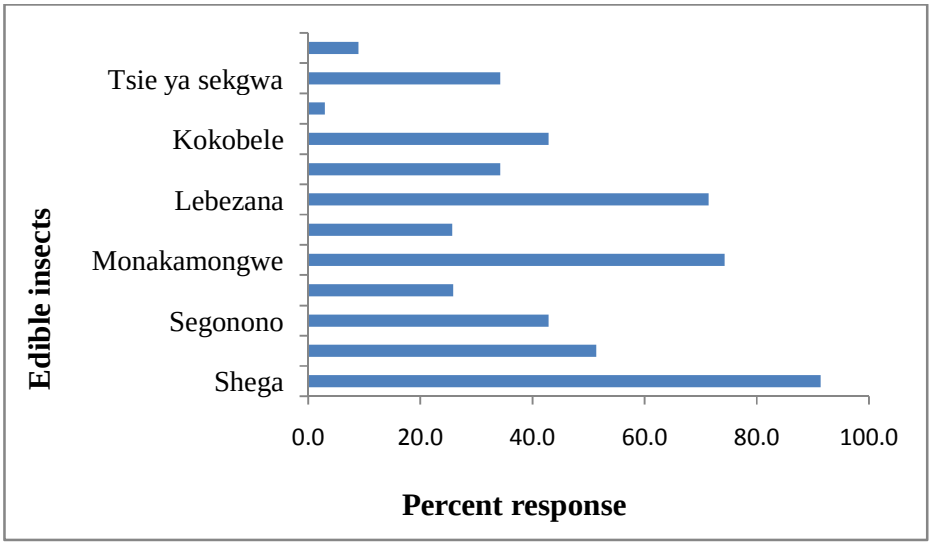

Fig. 2: Edible insects in Sekoma

Seasonal Availability and Harvesting of Insects

As shown in Table 3, most insect species are available during and immediately after the rainy season *i.e.*, October to January. However, *S. orissa*, *seretlwa* and *konkotha* are available from December to January, indicating that the availability of insects is seasonal. Similar observations were made by Moreki[12] and Moreki and Obatre[15]. However, Moreki *et al.*[16] reported that some edible insects are available throughout the year, thus making the prospects of utilising them as a source of protein in livestock diets feasible. Girard[17] observed that insects have a huge potential as a significant source of nutrients in livestock diets, mostly as replacement of traditional sources of animal protein such as fishmeal and carcass meal. In the present study, no insects were available for harvesting between April and September, indicating that during this time the respondents use the insects stored during the time of abundance or resort to alternative sources of protein.

Table 3: Edible insects and their time of availability in Sekoma

Scientific name	Local name	Month of the year											
		J	F	M	A	M	J	J	A	S	O	N	D
Heniocha spp.	Sekala	■	■	■								■	■
Lophostethus dumolini	Sengana	■	■	■								■	■
Agrius convolvuli L	Monakamongwe	■										■	■
Hodotermes mossambicus	Kokobele	■											■
Imbrasia tyrrhea Cramer	Segonono	■	■	■							■	■	■
Schistocerca gregaria. Forskal	Tsie ya naga	■	■										■
*	Ngudu	■	■	■									■
*	Seretlwa	■	■	■									■
Monomatapa insingnis Distant	Senyetse	■											■
Sternocera orissa	Lebitse/Lebezana	■											■
*	Konkotha	■											■
Acanthoplus discoidalis	Setotojane	■	■										■

Time of availability is highlighted; *scientific name not found

About 47% of the respondents mentioned that edible insects were collected by women followed by children (36.1%). Furthermore, women were responsible for sale of edible insects and money from sale of insects was used to buy groceries and to pay school fees. The current finding confirms a report by Moreki (2014)[12] who reported that 93.33% of the respondents in Mogonono village mentioned that women and children were responsible for harvesting insects. Moreki and Obatre[15] reported that 78% of the respondents said that edible insects were collected jointly by men, women and children (family); women only (11.7%); children only (8.35%) and men only (1.7%). It is apparent that the contribution of men in the collection of edible insects is low probably because of their involvement in other activities such as livestock production.

In this study, insects identified as human food derived their names from plants they feed on (Table 4). DeFoliart[6] stated that insects convert plant materials such as leaves, flowers and wood into useful forms (nutrients) needed by humans and animals. Hand-picking was the only method used to collect insects in the present study. Previous study by Obopile and Seeletso[18] in Botswana found that hand-picking, digging and trapping were the common methods used to collect insects with hand-picking being the most predominant. Similar observations were made by Moreki and Obatre[15].

Edible insects can be collected through entomological nests, hand-picking, digging and the use of suction pumps[13]. Forty percent of the respondents in this study said that they used salt during boiling as a preservation technique. However, the respondents aged >42 years of age believed that addition of salt during boiling leads to edible insects becoming extinct and this led to the respondents drying insects without using salt.

Table 4: Plant species fed on by insects

Insect local name	Plant species	Scientific name
Shega (Sengana)	Mongana	*Acacia mellifera*
Sekala	Mokala	*Acacia erioloba*
Segonono	Mogonono	*Terminalia sericea*
Seretlwa	Moretlwa	*Grewia flava DC*
Ngudu	Mokgopha	*Aloe marlothii*
Konkotha	Mongana, mokala.	*Acacia spp.*
Senyetse	*	*
Monakamongwe	Motantanyane	*
Lebezana/lebitse	Mongana	*Acacia mellifera*
Kokobele	*	*
Tsie ya naga	Millet, sorghum, maize	*Pennisetum glaucum, Sorghum bicolor L. Moenc and Zea mays*
Setotojane	Millet, sorghum, maize	*Pennisetum glaucum, Sorghum bicolor L. Moenc and Zea mays*

*Data could not be established

Processing and stage of insects' consumption

Table 5 presents data on methods of preparing insects for human consumption in Sekoma. Edible insects may be eaten raw, cooked, roasted or fried[19]. Although boiling, roasting and frying were the common methods used by the respondents in this study, the most common method of preparation was boiling. Seventy one percent of the respondents mentioned that they prepared insects for consumption by boiling followed by frying (11.4%) and roasting (7.2%). This finding is consistent with Nonaka[7], Moreki[12] and Moreki and Obatre[15].

In this study, *L. dumolini* larval stage was consumed. Prior to boiling insects, especially the Lepidoptera, heads are cut, their body squeezed to degut the internal material, washed and thereafter cooked/boiled and dried in the sun. DeFoliart[20] stated that the drying of caterpillars prolongs their shelf life to almost a year, therefore maintaining a balanced supply of protein in the diet of the people in the area. Drying as a preservation method is a very important aspect of food processing[21]. Furthermore, Wong and Cheung[22] mentioned that drying could be an important factor affecting the nutritional value of insects either through chemical modifications or direct loss of mineral elements. All insects in this study except *konkotha*, *S. gregaria* and *S. orrisa* were consumed immediately after roasting as snacks due to their limited availability. Previous study showed that the drying and cooking methods improve the availability of amino acids and minerals of *S. orrisa*[23].

Table 5: Edible insects and their methods of preparation for human consumption

Order	Family	Scientific name	English name	Local name	Method of preparation
Lepidoptera	Sphingidae	*Heniocha spp.*	Marbled emperor moth	Sekala	Boiling, roasting, frying
Lepidoptera	Sphingidae	*Lophostethus dumolini*	Arrow sphinx	Sengana/ Shega	Boiling, roasting, frying
Lepidoptera	Sphingidae	*Agrius convolvuli* L.	Hawk moth	Monakamongwe	Boiling, roasting, frying
Isoptera	Hodotermitidae	*Hodotermes mossambicus*	Harvest termite	Kokobele	Roasting and frying
Lepidoptera	Sphingidae	*Imbrasia tyrrhea* Cramer	Willow emperor moth	Segonono	Boiling, roasting, frying
Hemiptera	Acrididae	*Schistocerca gregaria.* Forskal	Desert locust	Tsie ya sekaka	Roasting and frying
Lepidoptera	Sphingidae	*	*	Ngudu	Boiling, roasting, frying
Lepidoptera	Sphingidae	*	*	Seretlwa	Boiling, roasting, frying
Hemiptera	Cicadidae	*Monomatapa insingnis* Distant	Cicada	Senyetse	Roasting and frying
		Sternocera orissa	Giant Jewel beetle	Lebitse/lebezana	Roasting and frying

*Data could not be established

Only one respondent mentioned that *A. discoidalis* (Walker) was eaten by humans a long time back but that it is no longer consumed. *Acanthoplus discoidalis* (Walker) which causes significant damage to grain crops is also an important source of feed for chickens. In Uganda, Owen[24] mentioned that the larvae of many species of the larger beetles are sought and eaten in the diet. Similarly, most insect species in the current study were eaten in their larval stages.

CONCLUSION

Twelve insect species were used for human consumption in Sekoma village, indicating the important role insects play in the nutrition of the rural dwellers. The study showed that the availability of edible insects is seasonal with most insects being abundant during and immediately after the rainy season. This indicates that the availability of insects is dependent on the rainfall. There is need to carry out further research in harvesting methods that are environmentally friendly, and to evaluate chemical composition of insects. There is also a need to train gatherers on preservation techniques and nutritional value of adding insects to household menus.

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