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Some Edible Insect Species Consumed by the People of Benue State, Nigeria

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Abstract: The study surveyed the edible insect species consumed by the people of Benue State, Nigeria and also identified the most abundant, most preferred and most consumed edible insect species in the study area. Seven hundred and eighty (780) copies of questionnaire were administered in 10 out of the 23 Local Government Areas and 3 major towns of Benue State. The frequencies generated from the questionnaire were transformed and subjected to one-way ANOVA. The termite, *Macrotermes natalensis* Haviland (253±92.3), was the most prevalent followed by the large African cricket, *Brachytrupes membranaceus* Drury (252±95.9) while the pallid emperor moth, *Cirina forda* Westwood (185±66.7) came third. There were however, no significant differences in the mean frequencies of these three edible insects above ($p < 0.05$). Other edible insect species encountered included *Rhynchophorus phoenicis*, *Zonocerus variegatus* L., *Oryctes monocerus* Olivier *Gryllotalpa africana* P.de.B. *Bunaea alcinoe* Cram, *Nezara viridula* L. and *Heteroligus meles* Billberger. The most abundant, most preferred and most consumed edible insect species was *Macrotermes natalensis* followed by *Brachytrupes membranaceus* and then *Cirina forda*. In all cases, the result of one-way ANOVA showed no significant differences among these three insect species ($p < 0.05$).

Key words: Edible insects, *Macrotermes natalensis*, people of Benue State, ethnic group

INTRODUCTION

Available information suggests that 30 species or more of edible insects are used by indigenous populations in many Third World countries. DeFoliart (2002, 1990, 1989) reported that scores of species of edible insects are prominent items of commerce in the town and village markets of Africa and tropical and semi-tropical regions of the world. Chavunduka (1975) also reported about insect consumption in Africa. Caterpillars are considered a luxury food and at par with the fruit of *Dacryodes edulis*, the African pear, in Bas, Congo. This appears to be the case throughout Africa, wherever caterpillars are eaten (Latham, 2001). Vane-Wright (1991) and Van Huis (1996) had reported the traditional consumption of insects in Africa. Cherry (1991) also reported that insects have been consumed as food in many parts of the world especially among the Australian Aborigines where moth feasts are held for the mass harvesting of edible insects in the Bogong mountains of new South Wales. Latham (2001) was of the view that eating insects may appear novel or even repugnant yet insects represent an important high protein food for many rural families in Africa. Although few insects other than the desert locust were used as food in northern Africa, hundreds of species have been used in central and southern Africa, Asia, Australia and Latin America. The reported total approximates 500 species in more than 260 genera and 70 families of insects (DeFoliart, 1990, 1989). According to Ruddle (1973) it has not been possible to get the precise number and identity of edible

insects and it is only in a few countries that attention has been given to carefully study edible insect species. Five insect species have been reported to be consumed in Japan (Pemberton and Yamasaki, 1995). In Nigeria, Fasoranti and Ajiboye (1993) reported the consumption of 7 edible insect species by the people of Kwara State. Adeduntan and Bada (2004) and Ashiru (1988) also reported the consumption of the African silkworm, *Anaphe venata* by the rural dwellers in Ondo State, Nigeria where the insect is collected from forests. Where careful studies have been conducted, the volume of insects consumed as a percentage of the total animal protein has been shown to be appreciable. Dufour (1987) reported that in Colombia, insects provided 12% of the crude protein from animal sources in men's diets and 26% in Women's diets and in most cases, insects were used to dampen fluctuations in the availability of fish and game. Insects are very widely consumed and in those cultures in which the use of insects as food is traditional, the insects are highly prized and much sought after, not used merely to ward of starvation. They are usually incorporated as a regular part of the diet when in season or throughout the year if available (DeFoliart, 1989). In some areas, insects are preferred to meat. For example, the Pedi of South Africa prefer certain insects to beef (DeFoliart, 1989) as do the Yukpa of Colombia and Venezuela (Ruddle, 1973). The Pedi prefer the caterpillars of the Saturniid, *Gonimbrasia belina* known as masonja or 'mopane worms' to beef and it has been reported that when masonja are

available for sale, they seriously affect the sale of beef (Ruddle, 1973). There is dearth of information on the edible insects species consumed by the people of Benue State, Nigeria. This study therefore seeks to survey the edible insect species and also identify the most abundant; most preferred and most consumed edible insects in the State.

MATERIALS AND METHODS

The study area: Benue State is one of the 36 States of Nigeria and it is referred to as the Food Basket of the Nigerian nation. It was created on February 3, 1976 with Makurdi as the capital city. The State has 23 Local Government Areas (LGAs) with a population of 4,219, 244 (Daily Trust Newspaper, Wednesday, 10th January 2007). The State occupies a landmass of 30, 955 square kilometres. The major ethnic groups in the State include Tiv, Idoma and Iggede in that order (Benue State Diary, 2007). Benue State is located between latitudes 6°30'N and 8°10'N and between longitudes 7°30'E and 9°50'E. The State lies in the transition belt between the tropical rain forest of southern Nigeria and the open grassland savanna vegetation of northern Nigeria (Benue State Diary, 2007). Common tree species of Benue State include: Silk cotton tree, *Ceiba petandra*; *Daniellia oliveri*; chocolate berry, *Vitex doniana*; *Azelia africana*; Shea butter tree, *Vitellaria paradoxa*; Khaya, *Khaya senegalensis*; *Nauclea diderichi*; *Terminalia schimperiana*; Iron wood, *Prosopis africana*; detar, *Detarium microcarpum*; bush mango, *Irvingia gabonensis*; African pear (bush butter), *Dacryodes edulis*; Locust bean tree, *Parkia biglobosa* (Nwoboshi, 1982; Cole, 1986; Keay, 1989). Benue State experiences a typical tropical climate with two distinct seasons, the rainy season and the dry season. The rainy season lasts from April to October with annual rainfall in the range of 150-180mm. The dry season begins in November and ends in March while mean monthly temperatures fluctuate between 23°C and 30°C in the year.

Questionnaire survey: A questionnaire with structured and unstructured items was administered in 10 out of the 23 LGAs of Benue State (5 in the Tiv area, 3 in the Idoma area and 2 in the Iggede area). The selection of the LGAs from the three ethnic groups was done based on the cultural variations that exist within the ethnic groups. Stratified random sampling technique as suggested by Anonymous (2003) and Osuala (1986) was used to select the LGAs (Table 1). The questionnaire was pre-tested and revised before final administration. Four communities in each of the ten LGAs were chosen for the study. Questionnaire were administered on 4 persons per household (2 adults-male and female, to include head of household and 2 youths-male and female). Twelve households were selected per LGA

giving a total of 120 households and consequently, 480 respondents. The three (3) major towns in Benue State -Makurdi, Gboko and Otukpo were also used so that respondents would cut across rural and urban population. Five locations/quarters were selected in each town as follows: Makurdi-Ankpa quarters, Lobi quarters, Benue State University staff quarters, New GRA, Federal Housing North Bank; Gboko - GRA, Bristow Secondary school Staff quarters, GSS Gboko staff quarters, College of Agriculture Yandev Staff quarters, NKST Hospital Mkar staff quarters; Otukpo-General Hospital staff quarters, Government Model College staff quarters, Federal Technical College Otukpo staff quarters, the GRA, and Jesus College Otukpo staff quarters. Five households were chosen per location as well as 4 respondents in each household were administered the questionnaire. This amounted to 20 respondents per location, 100 respondents per town giving a total of 300 respondents for the 3 towns. Information validation was by personal observations, insect collection and identification. The questionnaire were collated and coded to aid statistical analysis of the data. Data obtained (frequencies) were subjected to log transformation (\log_{10}). Since zeros (0) were present, 1 was added to each observation before transformation was done. The transformed data were then analyzed using one-way ANOVA.

RESULTS

Inventory of edible insect species in Benue State Nigeria: The study revealed that over 10 different insect species were consumed by the people of Benue State (Table 2) with the termite, *Macrotermes natalensis* Haviland, having the highest mean frequency of 253 ± 92.3 followed by the large African cricket, *Brachytrupes membranaceus* Drury (252 ± 95.9) and the pallid emperor moth, *Cirina forda* Westwood (185 ± 66.7). There was however, no significant difference in the mean frequencies of the occurrence of the three insect species mentioned above ($p > 0.05$). Other edible insects encountered during the survey were the palm weevil, *Rhynchophorus phoenicis* (F), the variegated grasshopper, *Zonocerus variegatus* L., the rhinoceros beetle, *Oryctes monocerus* Olivier, the mole cricket, *Gryllotalpa africana* P.de.B., the emperor moth, *Bunaea alcinoe* Cram, the green stink bug, *Nezara viridula* L. and the yam beetle, *Heteroligus meles* Billberger which had the least mean frequency (4). The frequency of unidentified edible insects species encountered was 6 ± 6.0 . The edible insect species consumed in Benue State of Nigeria came from 5 insect orders namely, Orthoptera (3 insect species), Isoptera (1 insect species), Lepidoptera (2 insect species), Coleoptera (3 insect species) and Hemiptera (1 insect species). The insect species were from 10 families: Gryllidae, Termitidae, Curculionidae, Pyrgomorphidae,

Table 1: The selected LGAs for the questionnaire/market survey of edible insects in Benue State, Nigeria

Major Ethnic Group	Sub-Ethnic Group	Local Government Area (LGA)	Selected LGA
Tiv	Jechira	Vandeikya, Konshisha	Vandeikya
	Jemgbagh	Gboko, Tarka, Buruku	Tarka
	Kwande	Kwande, Ushongo	Ushongo
	Sankera	Katsina-Ala, Logo, Ukum	Ukum
	Minda	Makurdi, Guma, Gwer, Gwer-West	Gwer
Idoma	Idoma Central	Otukpo	-
	Idoma North (Idomaanochi)	Apa, Agatu, Ohimini	Apa
	Idoma West (Idomaenone)	Okpokwu, Ogbadibo	Ogbadibo
	Idoma South (Oje-Ugbo)	Ado	Ado
Igede	Igede (Central District)	Oju	Oju
	Igede (Uwokwu District)	Obi	Obi
Total		23	10

Table 2: Frequencies of responses on occurrence of edible insects in Benue State, Nigeria

Insect Species	Order	Family	Mean Freq.
<i>Macrotermes natalensis</i> Haviland	Isoptera	Termitidae	253±92.3 ^a
<i>Brachytrupes membranaceus</i> Drury	Orthoptera	Gryllidae	252±95.9 ^a
<i>Cirina forda</i> Westwood	Lepidoptera	Saturniidae	185±66.7 ^a
<i>Rhynchophorus phoenicis</i> (F.)	Coleoptera	Curculionidae	111±38.5 ^a
<i>Zonocerus variegatus</i> L.	Orthoptera	Pyrgomorphidae	88±66.7 ^{ab}
<i>Oryctes monocerus</i> Olivier	Coleoptera	Scarabaeidae	84±59.4 ^{abc}
<i>Gryllotalpa africana</i> P.de.B.	Orthoptera	Gryllotalpidae	33±29.4 ^{abc}
<i>Bunaea alcinoe</i> Cram	Lepidoptera	Saturniidae	15±15.0 ^{bc}
<i>Nezara viridula</i> L.	Hemiptera	Pentatomidae	11±7.9 ^{bc}
<i>Heteroligus meles</i> Billberger	Coleoptera	Scarabaeidae	4±4.0 ^c
Other (unidentified)	-	-	6±6.0 ^c

Values are mean frequency + SEM of responses on occurrence of edible insects in Benue State. Means with the same superscripts in the same column are not significantly different ($p>0.05$).

Gryllotalpidae and Pentatomidae with one insect species each while Saturniidae and Scarabaeidae families had 2 insect species each.

Most abundant, most preferred, and most consumed edible insects in Benue State, Nigeria: Table 3 shows the most abundant, most preferred and the most consumed insect species in Benue State. *Macrotermes natalensis* Haviland was the most abundant edible insect in Benue State with the highest mean frequency of 242±86.1 followed by *Brachytrupes membranaceus* Drury (239±86.2) while *Cirina forda* Westwood was third with a mean frequency of 154±78.4 but with no significant difference in the mean frequencies of the three insect species mentioned above ($p>0.05$). In terms of preference, *Macrotermes natalensis* was again the most preferred having a mean frequency of 233±82.5 followed by *Brachytrupes membranaceus* (232±82.2) and then *Cirina forda* (153±78.3). *Macrotermes natalensis* was also the most consumed among the edible insects by the people of Benue State (240±85.6) followed by *Brachytrupes membranaceus* (238±84.7) and thirdly *Cirina forda* with a mean frequency of 162±87.0 There was no significant difference in the preference and consumption rates of these three insect species. The least abundant, preferred and consumed edible insect species was the green stink bug, *Nezara viridula*.

DISCUSSION

This study had revealed that edible insects are consumed by the people of Benue State, Nigeria with more than ten (10) species of insects from 5 Orders and 8 Families being consumed during the period under study. This list is by no means exhaustive since not all the edible insects encountered during the survey were identified. The reported number consumed indicates that insects are cherished by the people of Benue State as it is the case in many other parts of Nigeria and Africa. Urban and rural dwellers alike in all the local government areas surveyed consumed insects suggesting that insect consumption is widespread in the State complimenting the protein needs of the people of the State. Insect consumption also cuts across all the three major ethnic groups surveyed in the State (Tiv, Idoma and Igede) The findings of this study agree with the results obtained by Ajayi and Adedire (2007) who reported the widespread consumption of termites in Ondo State, Nigeria. Fasoranti and Ajiboye (1993) also reported the consumption of 7 insect species in Kwara State of Nigeria which included *Cirina forda*, *Brachytrupes membranaceus*, *Macrotermes natalensis*, *Zonocerus variegatus*. Ashiru (1988) and Adeduntan and Bada (2004) had also reported the consumption of the African silkworm, *Anaphe venata*, in Ondo State of Nigeria. Agbidye and Tyokever (1999) had also reported the consumption of edible insects by the Tiv people of

Table 3: Frequencies of responses on the most abundant, most preferred and most consumed edible insects in Benue State, Nigeria

Insect Species	Mean Frequencies		
	Most Abundant	Most Preferred	Most Consumed
<i>Macrotermes natalensis</i> Haviland	242±86.1 ^a	233±82.5 ^a	240±85.6 ^a
<i>Brachytrupes membranaceus</i> Drury	239±86.2 ^a	232±82.2 ^a	238±84.7 ^a
<i>Cirina forda</i> Westwood	154±78.4 ^{ab}	153±78.3 ^{ab}	162±87.0 ^{ab}
<i>Rhynchophorus phoenicis</i> (F.)	31±23.9 ^{bc}	32±23.3 ^{ab}	29±23.0 ^{bc}
<i>Zonocerus variegatus</i> L.	27±15.3 ^{bc}	17±8.9 ^b	14±14.3 ^c
<i>Bunaea alcinoe</i> Cram	14±14.0 ^c	14±14.0 ^c	14±7.0 ^c
<i>Gryllotalpa africana</i> P.de.B.	8±7.8 ^c	12±11.7 ^c	8±0.6 ^c
<i>Oryctes monocerus</i> Olivier	4±4.0 ^c	8±8.0 ^c	6±5.7 ^c
<i>Nezara viridula</i> L.	1±0.6 ^c	2±1.2 ^c	1±0.6 ^c

Values are mean frequency ± SEM of responses on most abundant, most preferred and most consumed edible insects in Benue State. Means with the same superscripts in the same column are not significantly different ($p > 0.05$).

Kwande Local Government Area. DeFoliart (1989) had also reported that while a few insects were used as food in northern Africa, in recent times hundreds of species have been used in other parts of Africa. According to DeFoliart (2002, 1989), indigenous populations in many Third World countries where animal protein is scarce use 30 species of insects or more. Not many entomologists are involved in the study of edible insects, which could be one of the reasons why many species of edible insects are yet to be identified. Ruddle (1973) also reported that it has not been possible to get the precise number and identity of edible insects. It is only in a few countries that attention has been given to the careful study of edible insect species. For example, Malaisse and Parent (1980) had identified 35 insect species that are used as food by man in Zaire. Mbata and Chidumayo (2003) had also reported the consumption of caterpillars of 8 Saturniidae moth species including *Cirina forda* among the Bisa people from northern Zambia.

There was preference for certain species of edible insects compared to others while some were more heavily consumed than others. The reasons for this behaviour were however not investigated in this study. Some edible insect species were more abundant than others in the study area. The point has been made that insects form part of the diet of the people of Benue State, Nigeria. Insect consumption by the people of Benue State should not be taken as an act of barbarism or poverty but as a matter of choice as many of the insect consumers confessed. It has been widely reported that insect consumption is widespread among the rural dwellers in Africa suggesting that it is due to poverty of these areas. This may not be true because the Pedi of South Africa prefer the caterpillars of the Saturniid, *Gonimbrasia belina* known as masonja or 'mopane worms' to beef and it has been reported that when masonja are available for sale, they seriously affect the sale of beef (Ruddle, 1973). Nongo (2005) had also reported the preferred consumption of *C. forda* over other meat products by the people of Benue State. This study has identified some of the edible insects

consumed by the people of Benue State, Nigeria but since not all the edible insects were identified, more research should be done to identify more and also there is every need to research into the nutritional and anti-nutritional qualities of these edible insects so as to be able to advise consumers accordingly. There is also the need to preserve the habitats of these insects as ecological deterioration in such forms as deforestation, water pollution, and bush burning bring about a reduction in the availability of insects generally.

REFERENCES

- Adeduntan, S. A. and F.A. Bada, 2004. Socio-Economic Importance of Local Silkworm (*Anaphe venata*) to the Rural Dwellers in Ondo State, Nigeria. Abstracts of Papers presented at the 35th Annual Conference of the Entomological Society of Nigeria held at the Federal University of Akure, 3-7, October, 2004, pp: 7.
- Agbidye, F.S. and J. Tyokever, 1999. Insects in the Diet of the Tiv people of Benue State: A Preliminary Survey of Kwande LGA of Benue State. Being a paper presented at the 30th Annual Scientific Conference of the Nutrition Society of Nigeria held at Hotel Presidential Enugu, 17-20, November 1999.
- Ajayi, O.E. and C.O. Adedire, 2007. Nutrient Characteristics of the Subterranean Termite, *Macrotermes subhyalinus* (Rambur) (Isoptera: Termitidae). Nig. J. Entomol., 24: 42-47.
- Anonymous, 2003. Guidelines for Planning Effective Surveys. Statistical Services Centre, University of Reading. (<http://www.rdg.ac.uk/ssc/develop/dfid/booklets/toppes.html>).
- Ashiru, M.O., 1988. The food value of the larvae of *Anaphe venata* Butler (Lepidoptera: Notodontidae). Ecol. Food Nutr., 22: 313-320.
- Benue State Diary, 2007. Benue State of Nigeria Diary, produced by the Ministry of Information and Culture, Makurdi.
- Chavunduka, D.M., 1975. Insects as a source of food to the African. Rhod Sci., News, 9: 217-220.

- Cherry, R.H., 1991. Use of insects by Australian Aborigines. *Am. Entomologist*, 32: 8-13. (http://www.insects.org/ced1/aust_abor.html).
- Cole, M.M., 1986. *The Savanna's Biogeography and Geobotany*. Academy Press, London.
- Daily Trust Newspaper, Wednesday, 10th January, 2007. Printed and Published by Media Trust Limited, Abuja, Nigeria.
- DeFoliart, G.R., 1989. The human use of insects as food and as animal feed. *Bull. Ent. Soc. Am.*, 35: 22-35.
- DeFoliart, G.R., 1990. Insects as food in indigenous populations. *Ethno-biology: Implications and applications*. Proceedings of 1st International Conference on Ethno-biology. Belem, 1: 145-150.
- DeFoliart, G.R., 2002. *The Human Use of Insects as a Food Resource: A Bibliographic Account in Progress* (<http://www.food-insects.com/book>).
- Dufour, D.L., 1987. Insects as food. A case study from the Northwest Amazon'. *Am. Anthropol.*, 89: 383-397.
- Fasoranti, J.O. and D.O. Ajiboye, 1993. Some edible insects of Kwara State, Nigeria. *Am. Entomologist*, 39: 113-116.
- Keay, R.W.J., 1989. *Trees of Nigeria*. Oxford University Press, New York, 476 pp.
- Latham, P., 2001. Edible Caterpillars and their Food Plants in Bas Congo, *D.R. Congo*. *Forneth (U.K.)*, 41 pp.
- Malaisse, F. and G. Parent, 1980. Les chenilles comestibles du Shaba meridional (Zaire). *Les Naturalistes Belges*, 61: 2-24.
- Mbata, K.J. and E.N. Chidumayo, 2003. Traditional Value of Caterpillars (Insecta: Lepidoptera) among the Bisa people of Zambia. *Insect Sci. Applic. ol.*, 23: 341-354.
- Nongo, N.N., 2005. Conversion of Pestiferous Caterpillars to Food in Benue State. Readings on Indigenous Processing, Storage and Marketing for Poverty Reduction in Nigeria edited by Obinne, C.P.O. CEKARD Associates Publishers. Pages 264-271.
- Nwoboshi, L.C., 1982. *Tropical Silviculture: Principles and Techniques*. Ibadan University Press, Ibadan, 333 pp.
- Osuala, E.C., 1986. *Introduction to Research Methodology* 2nd Edn. Africana-FEP Publishers, Onitsha, Nigeria, 228 pp.
- Pemberton, R.W. and T. Yamasaki, 1995. Insects: Old food in new Japan. *Am. Entomologist*, 41: 227- 229.
- Ruddle, K., 1973. The human use of insects; examples from the Yukpa, Myanmar. *Biotropica*, 5: 94-101.
- Vane-Wright, R.I., 1991. Why not eat insects. Guest Editorial, *Bull. Ent. Res.*, 81: 1-4.
- Van Huis, A., 1996. The traditional use of Arthropods in sub-Saharan Africa. Proceedings of the Section Experimental and Applied Entomology of the Netherlands Entomological Society, 7: 3-20.