Survey, Consumption Methods and Uses of Edible Forest Insects in Selected Local Government Areas, Cross River State, Nigeria

ABSTRACT

The survey and consumption methods of edible forest insects was investigated within a period of eight months. Information on respondents' demography, availability, harvesting methods and uses was collected using questionnaire and field survey. Data generated was analysed using frequency tables, charts and bar diagrams. Females (51%) were higher in number than males (49%) in the collection of edible forest insects, with over 70 percent of the collectors haven't completed their secondary (46%) and tertiary (32%) education. The main preservation and consumption methods were roasting and frying, with majority of the people utilizing the insects majorly as food ingredients and sweetener. Most of the insects identified were consumed at adult stage, with exception of caterpillar that was consumed at larval stage. In all the locations and with the exception of termites and crickets which were available during the rainy and dry seasons, respectively, all other insects identified were available all year round. There was a strong positive relationship interms of insect availability, collection methods and uses between Akamkpa and Obubra (rs = 0.089), Obubra and Ogoja (rs – 0.689). Thi was not the same for Ogoja and Akamkpa (rs = 0.352), as well as ogoja and Obubra (rs = 0.102), respectively.

Keywords: Survey, consumption, insects, edible, forest.

Original Research Article

1. Introduction

Insects are the largest group of animals on earth, and constitute 80 percent of the animal kingdom (Premalatha *et al*., 2011). Many of the insect species are eaten deliberately by humans, but with highly variable cultures, occasional and substantial consumption is inevitable (Raubenheimer and Rothman, 2012). Most humans in developed countries contemplate the consumption of insects with some revulsion, and where exceptions occur, insects are generally considered as food more for their novelty than their nutrients, as embedded in chocolates or ice cream (Johnson, 2010), or as a means of survival when wilderness adventures are lacking (Yoshimoto, 1999). However, in Japan, insects are eaten as part of the traditional diet (Nonaka, 2010), and in some parts of Italy (Overstreet, 2003) and Croatia (Miokovic *et al.*, 1997) the cheese maggot is regarded as a delicacy.

In many developing countries and cultures of the world, insects are preferred food and essential source of protein, fat, minerals and vitamins (Durst and Shono, 2010). Some edible insects have nutritional value that can be compared with that of meat and fish, while others have higher proportion of proteins, fat and energy value (De Foliart, 1992). Many researchers

have identified insects as either nuisance or as tree wood pests, and should be avoided, suppressed or controlled (Arnold, 2020).

Nigeria also has numerous edible insects and caterpillars, most of which are gathered from bushes and farmlands by women and children, processed and eaten or sold in school premises and open markets (Agbidye *et al.*, 2009). Most of these insects are consumed by the locals ignorantly, with no knowledge of the nutritional requirements. This study therefore, aims to survey edible insects, consumption methods and uses of the insect species in the study area.

Most insects consumed for food are harvested from natural forests. Though they account for the greatest of biodiversity in forests, they are the least studied of all fauna. Though many studies have been carried out on the survey of edible forest insect species in other parts of Nigeria, a gap in knowledge of the potentials of edible insect species in Cross River State exist.

The use of insects and its products as food is no more restricted to the local people in the villages and suburbs, but has gained wide spread acceptance in the towns and cities of Nigeria (Ebenebe *et al.*, 2017), therefore this study intends to highlight the potentials of edible forest insects, consumption methods, as well as their uses of the species in the study area.

This study will reveal information on the different edible forest insects, and in addition provide alternatives to meat from cattle, sheep and goat, especially in the face of rising insecurity arising from herders and farmers crises.

2. Methodology

2.1 Study Area

This study was conducted in Akamkpa, Obubra and Ogoja Local Government Areas of Cross River State, located in the Southern, Central and Northern Senatorial districts. Akamkpa, Obubra and Ogoja lies on latitude 5.18502°N and 8.13314°E, 5.991021°N and 8.271043°E, 6.65472°N and 8.79750°E of the equator and Greenwich meridian. The areas populations are 151,125, 172,444, and 171,901 as at 2006 census (NPC, 2006), with land masses of 5,003, 1,115 and 972 square kilometres, respectively. Akamkpa Local Government Area is in the Southern Senatorial District of Cross River State, and bounded by Odukpani and Akpabuyo Local Government Areas to the west and south, Biase and Yakurr Local government Areas to the North West, Ikom and Etung Local government Areas to the north, and the Republic of Cameroon to the west. Obubra Local Government Area is in the Central Senatorial District of Cross River State, and with bordering LGAs of Yakurr, Ikom, Etung

and Abi. The people are mainly farmers of rice, cassava, yam and potato. Ogoja Local Government Area is in Northern Senatorial District of Cross River State, and the people's primary occupation is the cultivation of basically yam, rice, sweet potato, cassava and vegetables such as pepper, Amaranthus species, and garden egg fruit among others. They also plant tree crops like orange, mango, cashew and oil palm, and has a tropical humid climate characterized by distinct wet and dry seasons.

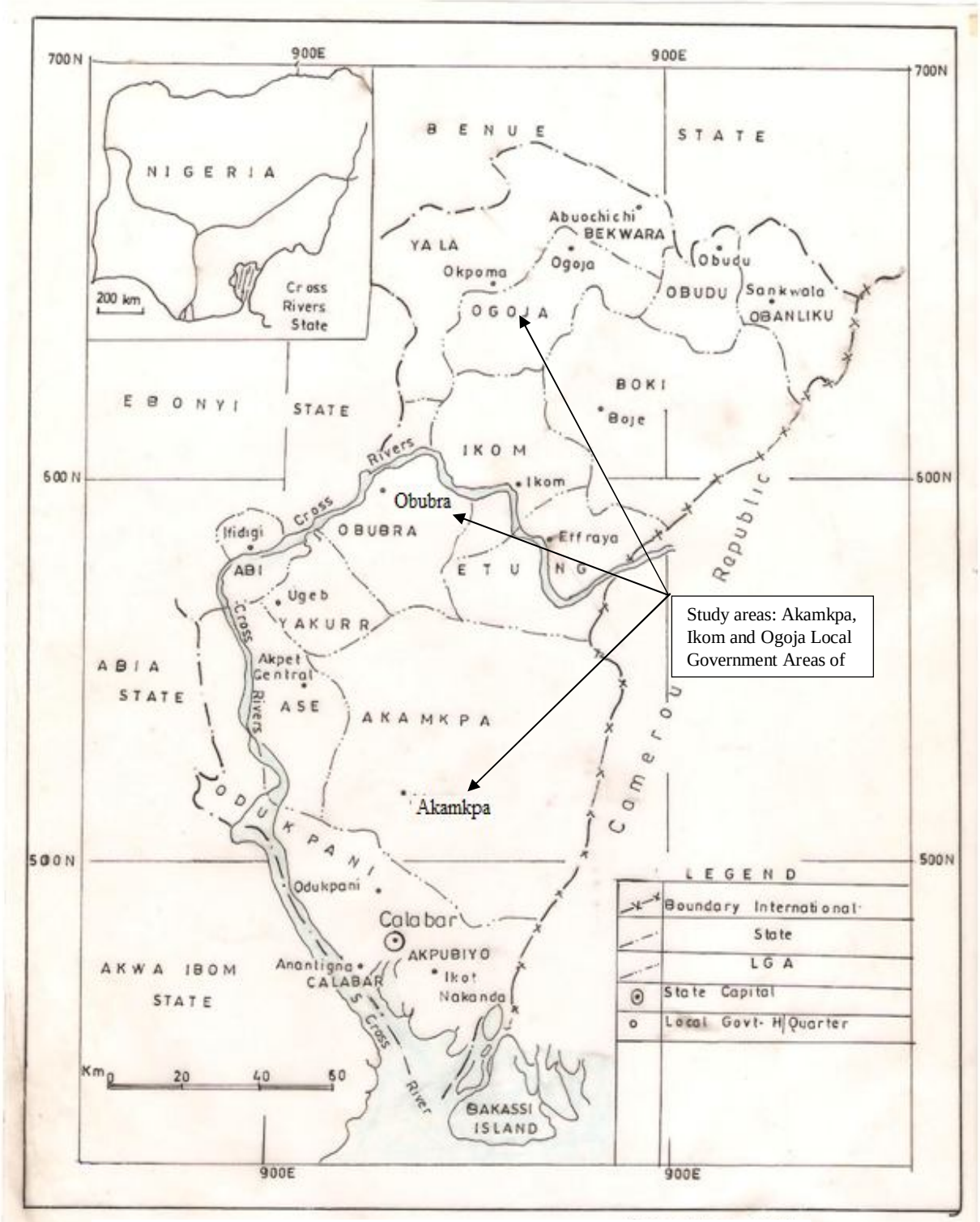

Figure 1: Map of Cross River State showing the study area

2.1.1 Sampling techniques and experimental procedure

This study adopted a multistage sampling procedure to select respondents. The first stage was the purposive selection of five (5) forest communities in the three (3) selected LGAs, giving a total of fifteen (15) communities. The next stage involved the random sampling of ten (10) respondents in each of the selected communities in the study area. One hundred and fifty (150) copies of structured questionnaire were administered to respondents in the study area. In each of the communities, forest area measuring $100m^2$ was surveyed using beating trays and pitfall traps. This method was used to collect insects from the field for identification and analysis. All insects collected not meant for the survey were released back to the wild.

2.1.2 Sources and methods of data collection

Primary data for this study was collected with the aid of questionnaire. Personal observations was done to authenticate information collected from the questionnaires. Secondary sources of information for this study included, reports, journals, bulletins, Forestry Institute's year books and past projects.

2.1.3 Data Analysis

Descriptive statistics, such as frequency tables, charts, simple means and percentages was used to describe and present data generated. The Spearman's rank correlation was employed to compare data from different locations using PAST 4.03 software.

3. Results and Discussion

3.1 Demography of Respondents

The study reveal that more females were involved in the collection of edibles insects when compared to males, even though the difference was not too significant. Those involved in this business were mostly married and within the age bracket of between 31 to 60 years (Table 1). Though majority of those involved were farmers, with a greater number unemployed, some civil servants and business people were also involved in the trade. Over 70 percent of those involved have had their secondary and tertiary education, with over 6years experience in the business. This shows that the collection of insects is not a business for the poor and uneducated alone, but also for those who are respected in the society. This may particularly be so due to the high premium placed on some edible forest insects due to its high nutritional value which are essential part of the diet of humans, as affirmed by Okweche and Atah, (2019).

Table 1: Respondents responses to demographic variables

Variables	Frequency	Percentage (%)
Gender		
Male	73	49
Female	77	51
Age (years)		
≤ 30	21	14
31-40	51	34
41-50	51	34
51-60	20	13
61 and above	7	5
Marital status		
Single	42	28
Married	105	70
Divorced	3	2
Household size		
1 to 3	45	30
4 to 6	53	35
7 to 9	42	28
10 to 12	10	7
13 & above	0	0
Educational level		
No education	12	8
Primary education	21	14
Secondary education	69	46
Tertiary education	48	32
Annual income (~~N~~)		
≤ 50,000	36	24
51,000 - 100,000	50	33
101,000 - 150,000	41	27
≥ 150,000	23	15
Occupation		
Unemployed	34	23
Farming	50	33
Civil servant	25	17
Public Servant	9	6
Business	32	21
Duration of collection (years)		
≤ 2	42	28
3 to 5	17	11
≥ 6	91	61

3.2 Consumption Methods and Uses of Insects according to Locations

The study also reveals in all the locations that the major method of consumption was roasting, followed by frying. Also, the insects collected were used as food ingredients and sweetener, while light and basket traps were the major methods of collection (Figure 1). Though other collection methods such as pitfall trapping, beating, and hand collection exist, the people tend to stick to their crude and primitive ways of collection as handed to them by their great grandparents. These methods according to them were more efficient, effective and cheaper than the others. The reliance on these crude methods may not be unconnected to the lack of equipment for preservation and the believe that insects are better consumed immediately as against preserving some for a later period, this assertion was confirmed by Okore *et al*., (2014).

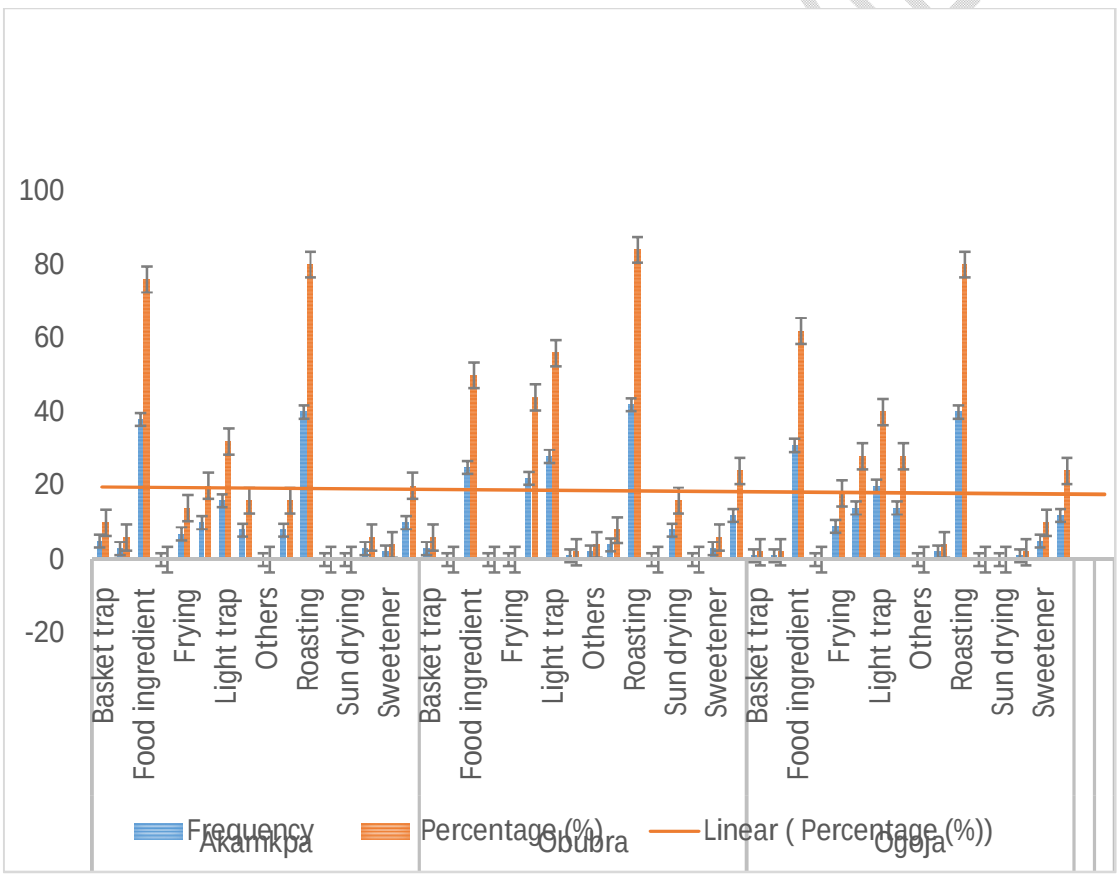

Figure 2: Uses and consumption preferences of insects in the study area.

3.3 Availability, Collection and Seasonality of Edible Forest Insects/Products

The study revealed that black beetle was not available in Akamkpa (Table 2), while in Obubra, locust, moth and black beetle were also not available (Table 3).

Table 2: Collection and Seasonality of Forest Insects/Products (Akamkpa)

Species	Availability	Collected/Used	Stage of Consumption	Seasonality
Raphia palm beetle	a	d	c	f
Grasshoppers	a	d	c	f
Locusts	a	e		
Caterpillar	a	d	c	f
Moths	a	e		
Beeswax	a	d	c	f
Black beetle	b	g		
Palm wine weevil	a	d	c	f
Hill termites	a	g		
Winged termites	a	d	c	h
Crickets	a	e	c	h
Oil palm grubs	a	e		
Termites	a	d	c	h
Beetles	a	e		
Tot. 13				

a (available), b (not available), c (adult), d (consumed), e (not consumed), f (not seasonal), g (rarely consumed), h (seasonal)

In Ogoja, Raphia palm beetle, moth, black beetle and hill termites were also not available (Tables 4). It was however, observed that only black beetle was common among the insects that were not available in the three locations. Also, not all insects available in the study area were consumable. Results indicates that in Akamkpa, raphia palm beetle, grasshopper, caterpillar, beeswax, palm wine weevil, winged termite and termites were all said to be consumed, while black beetle and Hill termites were rarely consumed (Table 2).

Table 3: Collection and Seasonality of Forest Insects/Products (Obubra)

Species	Availability	Collected/Used	Stage of Consumption	Seasonality
Raphia palm beetle	a	d	c	f
Grasshoppers	a	d	c	f
Locusts	b	e		
Caterpillar	a	d	c	f
Moths	b	e		
Beeswax	a	d	c	f
Black beetle	b	e		
Palm wine weevil	a	d	c	f
Hill termites	a	d	c	f
Winged termites	a	d	c	f
Crickets	a	d	c	g
Oil palm grubs	a	d	c	f
Termites	a	d	c	g
Beetles	b	e		
Tot. 10				

a (available), b (not available), c (adult), d (consumed), e (not consumed), f (not seasonal), g (seasonal)

In Obubra, raphia palm beetle, grasshopper, caterpillar, beeswax, palm wine weevil, winged termite, hill termite, cricket, oil palm grubs and termites are consumed (Table 3). Similarly, in Ogoja, Grasshopper, caterpillar, beeswax, palm wine weevil, winged termite, crickets, oil palm grubs, termites and beetles are consumed (Table 4). This result supported the findings of Okweche and Atah (2019) that some people in some parts of Nigeria, do not like consuming forest insects, and have associated the consumption of insects to a primitive way of life. In all the locations, the study revealed that most insects were consumed in their adult stages, though a few of the insects were consumed in their larval stages. The findings agree with that of Banjo *et al* (2006) that insects are both consumed in their adult and larval stages.

Findings also revealed that majority of the forest insects in the study area were not seasonal (Tables 2, 3 and 4). This confirms why majority of insects were consumed in both seasons. However, crickets and winged termites are among the few forest insects that are seasonal hence, are collected and consumed during their seasons. Field reports indicated that winged termite appears at the inception of rainy season, precisely in April, May and June. While crickets were gotten in most part of dry season, from November, through March. These findings did not conform to the findings of Okweche and Atah (2019), where they stated that cricket is among the edible insects that are harvested during the rainy season. However, Adeoye, *et al.*, (2014), in their findings revealed that crickets are found in limited parts of the year. This include most of dry and little during rainy season. The difference in seasonal availability may be attributed to ecological diversity and period of harvesting in the areas where these study was conducted.

Table 4: Collection and Seasonality of Forest Insects/Products (Ogoja)

Species	Availability	Collected/Used	Stage of Consumption	Seasonality
Raphia palm beetle	b	e		
Grasshoppers	a	d	c	g
Locusts	a	f		
Caterpillar	a	d	c	g
Moths	b	e		
Beeswax	*	d	c	g
Black beetle	b	e		
Palm wine weevil	a	d	c	g
Hill termites	b	e		
Winged termites	a	d	c	g
Crickets	a	d	c	h
Oil palm grubs	a	d	c	g
Termites	a	d	c	h
Beetles	a	d	c	g
Tot. 10				

a (available), b (not available), c (adult), d (consumed), e (not consumed), f (rarely consumed) g(not seasonal), h (seasonal)

The study also revealed that there was a strong positive relationship in the type of insects collected from the wild and its abundance between Akamkpa and Obubra, as well as Obubra and Ogoja as indicated in the spearman's rank correlation (table 5). These peculiarities may not be unconnected to the fact that Obubra and Akamkpa are lie within the tropical rain forest of Nigeria, with Ogoja being more or less a derived savannah zone.

Table 5: Correlative relativity of parameters across locations in the study area

	Akamkpa	Obubra	Ogoja
Akamkpa		0.84286	0.35238
Obubra	0.089465		0.10238
Ogoja	0.46454	0.68917	

4. Conclusion

Insects are important creatures and contributes to the protein requirements of humans. As important as they are, not all persons consume insects as food because some of them are considered as nuisance and even crop pests. This study has indeed revealed that many households especially in rural areas utilize different kinds of insects for different purposes, food, ingredients and several other economic uses. Importantly, all insects identified except termites and crickets were available all year. This implies further that people living in rural areas have alternatives to the consumption of meat from goat, sheep and cow, especially in the face of rising cost of beef occasioned by the farmers-herders crises in the northern part of Nigeria. This can reduce over dependence on red meat and reduce cost living on rural populace, especially that these insects are collected free of charge from the wild and other natural environment. It is therefore recommended that people in the rural areas including those living cities consume more of insects such as crickets, termites, grass hoppers, oil palm grubs as they contain more nutrients than that from meat of some species of animals.

Competing Interest

Authors hereby declare that this work is original and have not been previously published by any person, institution or organization.

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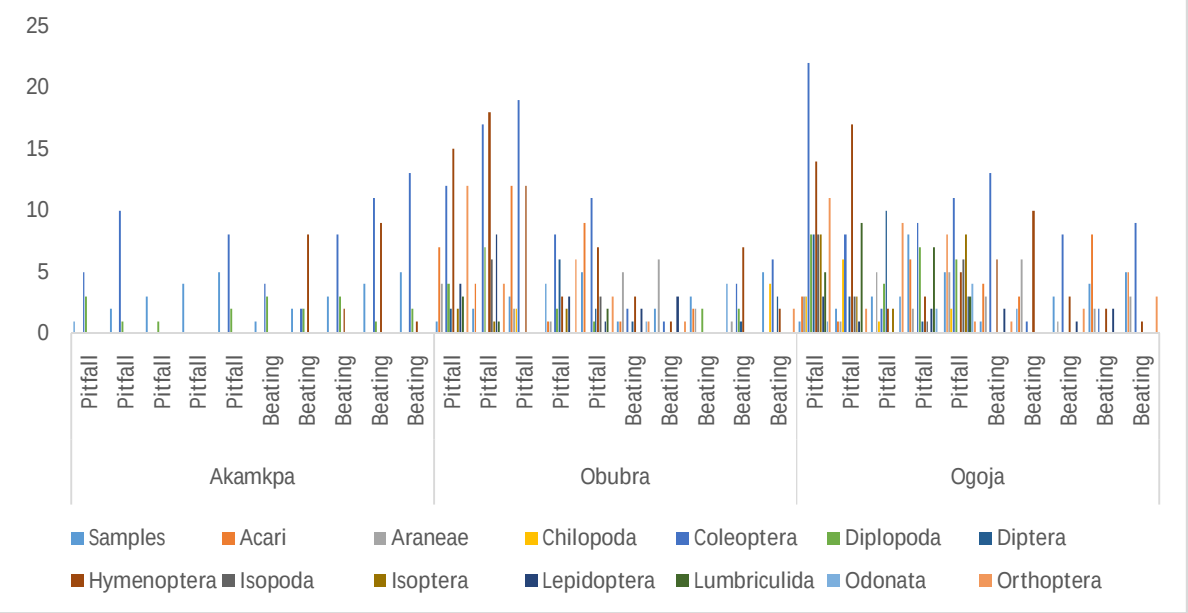
APPENDIX

Appendix 1: Collection methods of insects according to location



Appendix 2: Richness and abundance of insects identified in the study area

Labels	Samples	Acari	Araneae	Chilopoda	Coleoptera	Diplopoda	Diptera
Akamkpa	20	0	0	0	5	3	0
Obubra	20	7	4	0	12	4	2
Ogoja	20	3	3	3	22	8	8
Total	**60**	**10**	**7**	**3**	**39**	**15**	**10**

Acari (mites), Araneae (Spiders), Chilopoda (centipedes), Coleoptera (Beetles), Diplopoda (Millipedes), Diptera (Flies)