



**INSECT INFESTATION AND BACTERIAL LOAD OF SMOKED DRIED CATFISH (*Clarias gariepinus*) IN SELECTED MARKETS OF BAUCHI LOCAL GOVERNMENT, BAUCHI- STATE**

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**ABSTRACT**

Evaluation of insect infestation and bacterial load in smoked-dried *Clarias gariepinus* was carried out to determine insect pest and bacterial contaminants in some selected markets of Bauchi Local Government (Wunti, Muda Lawal, Railway and Yelwa) which constituted a dietary intake of inhabitants of Bauchi, Bauchi State, Nigeria. Eighty smoked-dried *Clarias gariepinus* (1500g) were bought from the markets. *Dermestes maculatus* was 1003 (85%), *Necrobia rufipes*, 281 (11%) and *Calliphora spp*: 9 (4%). Insect pest populations and their developmental stages showed that larvae was the highest with: 1681 (86%), pupae was least, 9 (1%). Muda Lawal had the highest 931 (52%) insects and lowest in Yelwa 168 (11%). There was significance difference ( $P < 0.05$ ) between insect populations in smoked-dried *C. gariepinus* in the markets. Bacterial load in fish samples was determined using pour plate method and characterization of various isolates were based on biochemical tests. Mean bacterial count in smoked- dried *C. gariepinus* were found to be higher in the third week and lower in the first week of sample collection. Bacteria species isolated revealed that *Staphylococcus spp* was highest (60%) while *Bacillus* species was lowest: (5%). Retailed smoked-dried *C. gariepinus* were highly infected with the insect *Dermestes maculatus* and *Staphylococcus spp*. *Clarias gariepinus* obtained from fishers should be properly preserved.

**Keywords:** *Clarias*, *Dermestes*, *Necrobia*, Wunti, *Bacillus*

**INTRODUCTION**

Nigeria is blessed with adequate fisheries resources which have contributed immensely to the growth and development of the country. The fisheries sector is an important source of livelihood, food, security, income and employment for millions of people around the world (FAO, 2009). Fish is the most abundant source of animal foods with wide range of species and yet the least known class of vertebrates. Fish is a very perishable foodstuff, especially in tropical and hot climate areas where refrigeration techniques are not common and especially not always available (Gamane *et al.*, 2016). Due to constraints related to the preservation of fish after fishing, only a small quantity is sold fresh, a large part being subject to the artisanal transformation such as smoking and drying to allow actors to keep the finished product as long as possible (Ikenwiewe *et al.*, 2010; Babarinde *et al.*, 2016a). In rural areas and according to agro-ecological zones, virtually all fish caught are either dried or smoked. Those smoked fish are very nutritive and contain unsaturated fatty acids, liposoluble vitamins, essential minerals as well as proteins containing essential amino acids fundamental for humans (Ozogul and Balikci, 2013). However, fish is highly susceptible to damage by insects and microorganisms as soon as it is caught (Afolabi, *et al.*, 2000). Some factors responsible for their spoilage or damages includes high temperature, chemical action, enzymes and bacteria (Ojutiku *et al.*, 2009; Oparaku and Mgbenka, 2012). Processing and preservation methods slow down fish spoilage and preserve its quality and also extend fish shelf life (Okonta and Ekelemu, 2005). Several processing and preservation methods have been considered and used to prevent fish from spoilage, including salting, sun drying, solar drying, smoke drying and canning (Ugwu *et al.*, 2005).

Many fish farmers and consumers prefer to buy ready to eat smoked dried catfish whose genetic trait is unknown and may harbor some species of insects which may be dangerous to their health. The research shall suggest that, efforts made towards increased fish conservation should be matched with efficient postharvest fish handling, preservation and effective packaging and processing



to prevent spoilage and subsequent losses of fish. The main goal of the research is to provide base line information on the most common types and levels of insect population and bacterial load in ready to eat smoked dried *C. gariepinus* in some selected markets in Bauchi, similar research should be carried out in different markets in the Local Government Areas of the State that will eventually culminate into establishing monitoring reference point.

## **MATERIALS AND METHODS**

### **Description of the Study Area**

The study was conducted in Bauchi Local Government Area, Bauchi State. Bauchi State occupies an area of 23,938 sq. km and is located on latitudes 10°17'N and 11°08'N and longitudes 6°49'E and 9°20'E with a mean annual rainfall of 1099 millimeters (mm) and mean temperature of 25.4°C (FAO, 1988). The State is bordered by Yobe State to the North, Gombe State to the East, Plateau State to the South-West and Kaduna State to the West (Isah, 2009). Bauchi State forms part of the extensive plains known as the High Plains of Hausa land. The State has a population of 4,536,261 people (NIPOST, 2009). Out of this figure, about 49% are males and 51% females. Bauchi State is divided into 20 Local Government Areas and three senatorial zones: North, Central and Southern Bauchi with the people predominantly farmers, livestock rearers, traders/artisans and Civil Servants (NIPOST, 2009).

### **Sampling Techniques**

Eighty (80) ready to eat smoked dried adult *C. gariepinus* were bought from fish retailers in four randomly selected markets of Bauchi LGA with 20 fishes from each of the markets (Wunti (A), Muda Lawal (B), Railway (C) and Yelwa (D) markets) respectively. The fish samples were packed in polythene bags and taken to the Animal Production Laboratory, Abubakar Tafawa Balewa University Bauchi. The levels of development of insect pests in the samples were observed with hand magnifying lens.

### **Insect Pest Evaluation**

The samples from all the four markets (Wunti, Muda Lawal, Railway and Yelwa) were observed for presence of insect pests for up to four (4) weeks duration of the experimental period. The insects and their stages of development (eggs, larvae, pupae and adult) were identified according to the method described by Abdulkarim *et al.*, (2017).

### **Bacterial Counts and Characterization of the Isolates**

Some of the portions of the fish flesh with the replicated samples were taken from each of the samples for four (4) weeks of the experimental period from all the different markets. The samples were grounded in a sterile porcelain mortar and pestle into homogeneous powder. One gram (1g) of each sample was measured with electronic digital meter (EHA 251). The grounded sample was aseptically introduced inside a universal bottle containing 9ml of sterile nutrient broth, homogenates 0.1, 0.2, 0.3 and 0.4 solutions were pipetted by means of a sterile automated pipette, and each dilution was introduced into a standard nutrient agar plate by means of a wire loop and then incubated at 37°C for twenty-four (24) hours. The colonies formed were counted with a counter as described by Monica (1984). A colony was selected at random and cultured in petri dish at a temperature of 34°C for 24 hours to obtain pure isolates. Identification of the isolates was carried out based on the methods described by Moshood and Tengkuhaziyamin (2012) and Cheesebrough (2002).

### **Data Analysis**

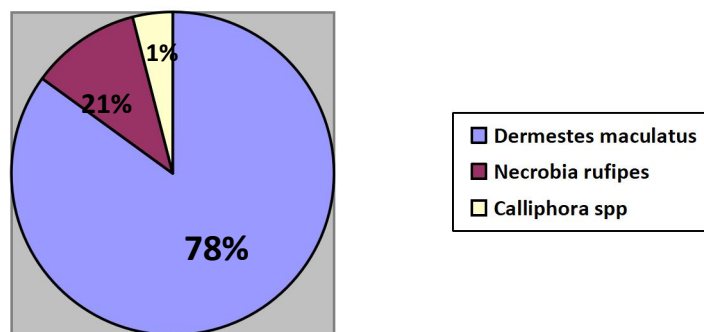
Simple percentages, frequencies of occurrence and means were used to analyze the data collected. Mini tab software was used for the analysis of variance (ANOVA) for the insect pest populations in the markets. Least Significant Difference (LSD) was used to compare different sample treatment means, following the method described by Ogbeibu (2005).

## **RESULTS AND DISCUSSION**

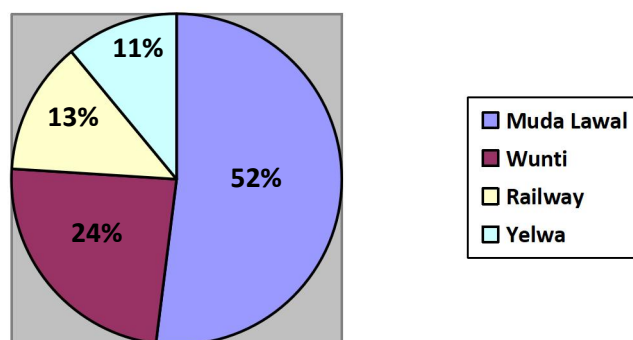
### **Insects Infestation in Smoked Dried *Clarias gariepinus***

Figure 1 shows the processed fish infested by insects based on the predominant populations: *Dermestes maculatus* had the highest: 1003 (78%) insect population in the smoked-dried *C.*

*gariepinus*, followed by *Necrobia rufipes* 281 (21%) and lowest; 9 (1%) in *Calliphora spp.* Assessment of insects according to their stages of development (Table 1) indicated that the smoked fish showed that larvae had the highest population: 1681 (87%), followed by adult: 241 (12%) and least pupae: 9 (1%). Population of insects observed on the processed fish in the markets (Figure 2) showed that Muda Lawal had the highest 931 (52%) population of insect followed by Wunti market 473(24%), Railway 299 (13%) and lowest in Yelwa 168(11%) markets.



**Figure 1:** Percentage Insect Population in Smoked-dried *Clarias gariepinus*

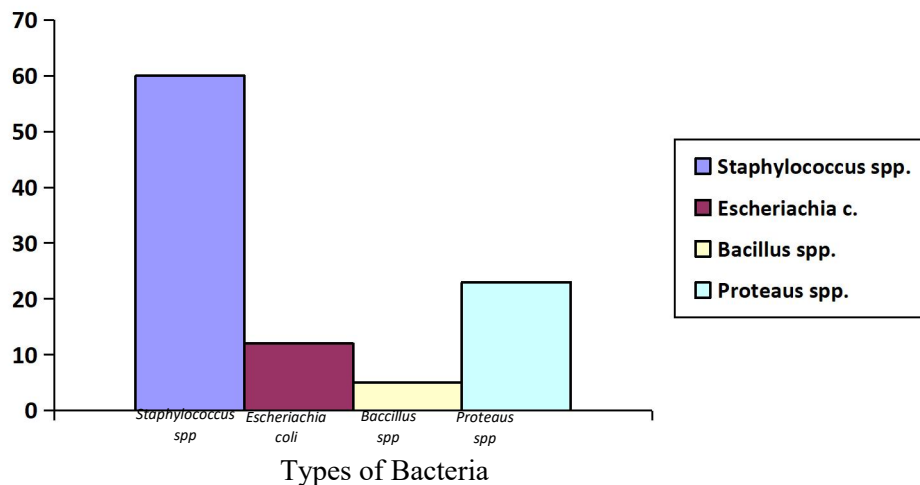


**Figure 2:** Percentage Population of Insect in the Markets

### Microbial Analysis

Four species of bacteria were isolated from the smoked-dried *Clarias gariepinus*; *Staphylococcus spp*, *Escheriachia coli*, *Bacillus spp* and *Proteaus spp*. *Staphylococcus spp* had the highest 60% bacteria isolated in the market, followed by *Proteaus spp* 23%, *Escheriachia coli* 12% and *Bacillus specie* the least: 5% (Figure 3).

The mean bacteria count of smoked-dried *Clarias gariepinus* were found to be higher with mean value  $5.01 \times 10^6$ cfu/g and lowest mean value:  $1.18 \times 10^8$ cfu/g in the first week of sample collection. Mean bacteria count of the smoked fish in Muda Lawal market had the highest mean counts  $1.48 \times 10^7$ cfu/g in the second week and lowest mean counts:  $1.41 \times 10^7$ cfu/g in the first and third weeks of sample collection respectively. Furthermore, mean bacteria counts of smoked-dried *Clarias gariepinus* obtained in Wunti market had the highest mean counts  $2.87 \times 10^6$ cfu/g in the second week and lowest:  $1.18 \times 10^8$ cfu/g in the first week of sample collection (Table 2).



**Figure 3:** Bacteria Population in Smoked Dried *Clarias gariepinus* from Selected Markets of Bauchi

**Table 1:** Population of Insect Pests Based on the Stages of Development

Stage of development	Number of occurrences	Percentage of occurrence (%)
Adult	241	12
Larvae	1681	87
Pupae	09	1
Total	1931	100

**Table 2:** Mean Bacterial Count in the Smoke-dried *Clarias gariepinus* in Some Markets of Bauchi

Markets	Sample means count value			
	Weeks			
	0	1	2	3
Wunti	$1.14 \times 10^7$	$1.19 \times 10^8$	$2.87 \times 10^7$	$5.01 \times 10^6$
Muda Lawal	$1.39 \times 10^7$	$1.41 \times 10^7$	$1.48 \times 10^7$	$1.41 \times 10^7$
Railway	$1.39 \times 10^7$	$1.41 \times 10^7$	$1.48 \times 10^7$	$1.41 \times 10^7$
Yelwa	$1.51 \times 10^6$	$1.58 \times 10^8$	$2.77 \times 10^7$	$2.64 \times 10^8$

## CONCLUSION AND RECOMMENDATIONS

The following insect pests were identified in the study areas; *D. maculatus*, *N. rufipes*, and *Calliphora spp* with *D. maculatus* having the highest population (85%) and *Calliphora spp* (4%) the least, Percentage populations of insects showed that Muda Lawal had the highest (52%) and the least was in Yelwa market (11%), Larval populations were highest in all the markets where the research was carried out, The mean bacterial counts in the smoked dried *C. gariepinus* were found to be higher in the third week and lower in the first week of sample collection.

Stringent hygiene practices during processing of fish products should be implemented as this can further reduced infestation by insects, continuous monitoring of microbial contamination and levels in fish products is essential to ensure adherence to quality standards and regulatory requirements, educating consumers about the nutritional differences of variously processed smoked *C. gariepinus* can help them make informed dietary choices, further studies should be carried out on fish inoculation.

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