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Organoleptic Assessment Of Clarias Gariepinus (Burchell, 1822) Treated With Xylopia Aethiopica (Dunal, 2008) After Exposure To Dermestes Maculates (De Geer, 1774)

[1]C.N Anyanwu, [2]Egbuche C.T, [1]D.I. Osuigwe, [2]Nwaihu E.C., and [1]N.J Anyachi.
[1]Department of Fisheries and Aquaculture Technology, Federal University of Technology, Owerri, Nigeria
[2]Department of Forestry and Wildlife, Federal University of Technology, Owerri, Nigeria

***Abstract*—This study was conducted to examine the efficacy of xylopiaaethiopica under tropical storage conditions for the control and repelling of Dermestes maculates. At different concentrations of 5g, 10g, 15g and 20g, the plant seed extract evolved significant mortalities in all the treatments, except the control that had no mortality throughout the period of the experiment. The study revealed that locally available plants like xylopiaaethiopica (Ethiopian pepper) could offer effective protection against the hide beetle (Dermestes maculates), which is a post harvest pest of fish. The result obtained from the mortality rate showed that the 20g xylopiaaethiopica concentration gave the highest protection against Dermestesmaculatuss. However, in the test for organoleptic assessment, the 15g xylopiaaethiopica gave the smoked fish better taste, texture color and flavor, hence it was the generally accepted level of concentration for the xylopiaaethioopica. The result of the organoleptic assessment has equally shown that the treated fish do not exhibit adverse evidence of taint, smell or change in taste texture or flavor within the period of the experiment and thereafter. Therefore, it is recommended for use as ineffective repellant for the control of Dermestes maculates as a post harvest fish pest.**

Keywords—Clariasgariepinus, xylopiaacthiopic, Dermestes maculates, mortality, and organoleptic.

I. INTRODUCTION:

Over the years, the fishery sector has been a source of income and livelihood for millions of people around the world. Aquaculture has continued to be the fastest growing annual food producing sector ready to overtake capture fisheries as a source of food fish [1]. However, developing countries still lack adequate infrastructure, including hygienic landing centers, electric power supply, portable water, long supply chains as well as storage facilities like ice, ice plants cold rooms and refrigerated transport systems. These factors coupled with tropical temperatures cause a high percentage of post-harvest losses in fish due to its high perishable nature with consequent risk to the health of consumers. Fish in developing countries is traded primarily in live or fresh form or after curing through drying or smoking, with significant capacity for processing to lengthen its shelf life and availability. But the demand for smoked fish abroad, particularly in the United Kingdom has remained constant throughout the last decade [2]. These fishes are however susceptible to post harvest deterioration by high temperatures and subsequent attack by micro-organisms, if not quickly consumed. Nigeria accounts for 30-40% postharvest losses of landed fish catches thus, prompting the subjecting of landed fish catches to a variety of processing methods, such as smoking and drying.

Smoked fish offers an alternative high quality annual protein requirement for man, in most traditional dishes in Nigeria. [3] reported that several smoked fish isone of the most widely distributed and cheapest sources of protein and micronutrients in Nigeria. According to [3], 45% of the total fish catch in Nigeria are utilized as smoked fish. However, studies have shown that a high population of dried fish is usually infested by insect pest, such as *Demestes maculates* and *Necrobiarufipes* [4]. [5] further reported that about 71.5% of dried fish infestation in most producing areas was caused by *Dermestes maculates*, with a substantial loss in dry weights of about 43-62.7% from both adults and larvae alike [6]. The limitations caused by the use of highly persistent chemicals, as fish protectants have elicited interest on seeking alternative methods of controlling fish damage. Some synthesized insecticides like pyrethroid, deltamethrin and perthrin have proved effective against stored pest products, only when used at the right time and quantity with correct application [7]. However, the general use of such chemicals has been reported to be of health hazard, with high cost of purchase and development of highly resistant strains. [4] further reported that fish treated with chemicals adversely affected consumers causing dizziness, vomiting and blurred vision. Therefore, attention is currently being focused on the use of natural preservation materials that are cheap, easily accessible and have long term protecting ability [8]. Based on these properties, research on the varieties of plant materials and spices are presently considered as a promising alternative to synthetic

insecticides, as means to pest control of plant origins, stored grains, legumes and stored fish [9]; [10].
Repellants from plant origin are considered safe in pest control operations as they minimize pesticide residues, ensures safety of people, food, environment and wildlife [11]. Plant extracts, powders and essential oils from bioactive plants were reported as repellants against different economically and important stored product insects [12]. There is therefore the need to protect smoked fish from storage pest because smoked fish from storage pest plays a role in bridging the gap between the protein demand and supply. Studies by [13] and [14] reported of the unattractive nature of stored products treated with some plant materials because dried fish is often eaten without further processing by most people in the tropics, hence this experiment sought to evaluate the effect of the powder of extract of a plant material, *Xylopiaaethiopica* (Ethiopian pepper) on the palatability and acceptability on smoked fish (*Clariasgariepinus*) by fish consumers.

II. MATERIALS AND METHOD

A: STUDY AREA DESCRIPTION

The experiment was carried out at the Departmental processing unit of the Department of Fisheries and Aquaculture Technology Farm, Federal University of Technology, Owerri, Imo State. The site is located between latitude $5^0$23 and $5^0$28'N and longitudes $6^0$58' and $7^0$30' E. It has annual rainfall of between 192 – 194 and annual mean temperature of 32^0c (Federal Ministry of Aviation, Abuja)

B: SOURCE OF MATERIALS

Live fish of average table size 13.4kg were purchased from a fish farm in Owerri West, Imo State. They were washed properly to eliminate traces of sand and dirt before they were later placed carefully in the smoking kiln. Uncontrolled burning of charcoal was avoided by regulating and ensuring the even distribution of heat. *Dermestes maculates* beetle was obtained from heavily infested smoked fish which was purchased from the Eke Ukwu market in Owerri town, Imo State. *Xylopiaaethiopica* dried seeds were purchased from Ohuru market in Abia state, Nigeria. The seed were washed with tap water sun dried for 7 days and ground into powder according to [15]. It was sieved using a mesh of small screen and kept in a plastic custard clean container with a tightly fitted bid.

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D: EXPERIMENTAL DESIGN AND LAYOUT

RANGE FINDING TEST

A preliminary test was carried out using the 10g, 20g, 30g and 40g of Ethiopian pepper *(xylopiaaethiopica*) respectively. Four beetles each were introduced to each of the four treatments containing the fish and the *xylopiaaethiopica*. At the end of the two weeks, it was discovered that there was high rate of mortality in the 30g and 40g applications, leading to an adjustment in the definitive test to 5g, 10g, 15g and 20g.

DEFINITIVE TEST

At this stage, five treatments were evaluated made of 5.0g, 10.0g, 15.0g, and 20.0g of the *xylopiaaethiopica* seed powder and *xylopiaaethiopica* free treatment, which served as the control. Each of the plant powders of 5g, 10g, 15g and 20g respectively were rubbed (applied) thoroughly on the body of the disinfested smoked fish. The treated fish was placed in an open tray to air-dry in 12 plastic containers, made of four treatments and three replicates. Each container was made to contain 5 adults and 6 larvae of the *D. maculates* and left on a shelf for one month (30 days). Then, the disinfested fish without the plant extract (control) were put in the remaining 3 containers, with the same adult Beetles and larvae as the others which served as the control. Each of 5g, 10g, 15g and the 20g *xylopiaaethiopica* were applied on each of the 250g smoked fish body with the 5 adults and 6 larvae beetle, and introduced respectively into the plastic containers covered with muslin cloths for aeration, with the perforated plastic lid in each of the containers. Mortality of the beetles were monitored and recorded every 24 hours for the entire duration of the experiment.

ORGANOLEPTIC ASSESSMENT

The rooms chosen for assessment were designed in such a way as to ensure maximum privacy and to reduce distraction from passers-by. A panel of 16 persons was selected on their knowledge of the product to be tested. A form that contained instructions (guide) was issued to each pane list so that every evaluation was carried out of bias free. During the taste evaluation, every individual panelist rinsed his or her mouth properly with clean water after each sample of the smoked fish was evaluated for taste response by eating the fish samples and noting the result. Evaluation was also carried out for texture and color, using hand to ascertain its muscular relationship to the skin and sense of sight.

III. STATISTICAL ANALYSIS

The results of mortality were subjected to one-way analysis of variance (ANOVA) using mini-tab 14.Significant mean of treatments were separated from one another using the least significant difference (LSD) at 5% probability.

Table: 2. Effects of different concentrations of *Xylopia aethiopica* powder on the color of the experimental smoked fish.

RATES	EXCELLENT	V.GOOD	GOOD	POOR	V.POOR
0	0(1.6)0%	4(6)5%	3(5.6)3.75%	8(2.6)10%	1(0.2)%
5g	1(1.6)1.25%	6(6)7.5%	8(5.6)10%	1(2.6)1.25%	0(0.2)%
10g	3(1.6)3.75%	7(6)8.75%	6(5.6)7.5%	0(2.6)0%	0(0.2)%
15g	1(1.6)1.25%	7(6)8.75%	7(5.6)8.75%	1(2.6)1.25%	0(0.2)%
20g	3(1.6)3.75%	6(6)7.5%	4(5.6)5%	3(2.6)3.75%	0(0.2)%

( ) = value in parenthesis is expected, %= percent of the observed.

$\chi^2 = (0\text{-}E)^2 / E = 28.4$

Df= 5 treatment -1=4

3 replicates-1=2

4*2=8

Df = 8

χ^2 Calculated= 28.45 and χ^2 Tabulated=15.507

χ^2 calculated > χ^2 Tabulated, hence the null hypothesis (fish color is not significantly affected by *Xylopia aethiopica* powder) is rejected and the alternative hypothesis (Fish color is significantly affected by *X. aethiopica* powder) accepted. Since χ^2 Calculated > χ^2 Tabulated, it means that *X. aethiopica* powder has a positive effect on the color of the smoked fish.

Control (0g/ 250g of fish): 8 out of 16 observers i.e. 10% (the highest rated it poor, "2"), this will be judged as a result of the smoked fish been left untreated.

Treatment 1 (5g)/ 250g of fish): 8 out of 16 observers i.e. 10% rated it good "3" while 6 observers rated it very good "4" that is 7.5%.

Treatment 2 (10g)/ 250g of fish): 7 out of 16 observers i.e. 8.75% rated it very good "4" while 6 observers rated it good "3" that is 7.5% and 3 observers rated it excellent i.e. 3.75%, "5" which is the highest score for rating.

Treatment 3 (15g/250g of fish): 7 out of 16 observers i.e. 8.75% rated it very good "4" while 7 observers rated it good "3"that is 7.5%.

Treatment 4 (20g/250g of fish): 6 out of 16 observers i.e. 7.5% rated it very good "4" while 4 observers rated it good "3" that is 5%, 3 observers rated it excellent i.e 3.75%, "5" which is the highest score for rating. Treatment 3 (15g) and treatment 2 (10g) had the best results in color evaluation.

Texture Evaluation

Table: 3. Effects of different concentration of *Xylopia aethiopica* on the texture of the experimental smoked fish.

RATES	FIRM	FAIRLY FIRM	BRITTLE	POWDERY	VERY POWDERY
0g	6(6)7.5%	7(6.4)8.75%	3(3.4)3.75%	0(0.2)0%	0(0)0%
5g	4(6)5%	6(6.4)7.5%	6(3.4)7.5%	0(0.2)0%	0(0)0%
10g	5(6)6.25%	7(6.4)8.75%	4(3.4)5%	0(0.2)0%	0(0)0%
15g	5(6)6.25%	7(6.4)8.75%	3(3.4)3.75%	1(0.2)1.25%	0(0)0%
20g	10(6)12.5%	5(6.4)6.25%	1(3.4)1.25%	0(0.2)0%	0(0)0%

( ) = value in parenthesis is expected, %= percent of the observed.

$\chi^2 = (0\text{-}E)^2 / E$

Df= 5 treatment -1=4

3 replicates-1=2

4*2=8

Df =8

χ^2 Calculated= 12.09 and χ^2 Tabulated=15.507

χ^2 calculated < χ^2 Tabulated, hence the null hypothesis (fish texture is not significantly affected by *Xylopia aethiopica* powder) is accepted and the alternative hypothesis (Fish texture is significantly affected by *Xylopia aethiopica* powder) rejected. Since χ^2 Calculated < χ^2 Tabulated, it means that *Xylopia aethiopica* powder has no effect on the texture of the smoked fish. **Control** (0g/ 250g of fish): 7 out of 16 observers i.e. 8.75% (the highest rated it "4", fairly firm), while 6 observers rated it firm "5" that is 7.5%.

Treatment 1 (5g/ 250g of fish): 6 out of 16 observers i.e. 7.5% rated it fairly firm "4" while 6 observers rated it brittle "6" that is 7.5%.

Treatment 2 (10g/ 250g of fish): 7 out of 16 observers i.e. 8.75% rated it fairly firm "4" while 5 observers rated it firm "5" that is 6.25%.

Treatment 3 (15g/250g of fish): 7 out of 16 observers i.e. 8.75% rated it fairly firm "4" while 5 observers rated it firm "5"that is 6.25%.

Treatment 4 (20g/250g of fish): 10 out of 16 observers i.e. 12.5% rated it firm "5" while 5 observers rated it fairly firm "4" that is 6.25%.The best result for texture is

treatment 4 (20g) which had an overall highest observers of 10 person followed by the control.

Taste Evaluation

Table: 4. Effects of different concentration of *Xylopia aethiopica* on the taste of the experimental smoked fish.

RATES	EXCELLENT	V.GOOD	GOOD	POOR	V.POOR
0g	1(4.4)1.25%	1(4.6)1.25%	9(4.4)11.25%	4(2.2)5%	1(0.4)1.25%
5g	2(4.4)2.5%	9(4.6)11.25%	4(4.4)5%	1(2.2)1.25%	0(0.4)0%
10g	4(4.4)5%	9(4.6)11.25%	2(4.4)2.5%	1(2.2)1.25%	0(0.4)0%
15g	8(4.4)10%	4(4.6)5%	1(4.4)1.25%	3(2.2)3.75%	0(0.4)0%
20g	7(4.4)8.75%	0(4.6)0%	6(4.4)7.5%	2(2.2)2.5%	1(0.4)1.25%

( ) = value in parenthesis is expected, %= percent of the observed.

$\chi^2 = (0-E)^2/E$

Df= 5 treatment -1=4

3 replicates-1=2

4*2=8

Df=8

χ^2 Calculated= 39.84 and χ^2 Tabulated=15.507

χ^2 calculated > χ^2 Tabulated, hence the null hypothesis (fish taste is not significantly affected by *Xylopia aethiopica* powder) is rejected and the alternative hypothesis (Fish taste is significantly affected by *Xylopia aethiopica* powder) accepted. Since χ^2 Calculated > χ^2 Tabulated, it means that *Xylopia aethiopica* powder has a positive effect on the taste of the smoked fish. **Control** (0g/250g of fish): 9 out of 16 observers i.e. 11.25% (the highest rated it good "3") while 4 observers rated it poor "2" that is 5%.

Treatment 1 (5g/250g of fish): 9 out of 16 observers i.e. 11.25% rated it very good "4" while 4 observers rated it good "3" that is 5%.

Treatment 2 (10g/250g of fish): 9 out of 16 observers i.e. 11.25% rated it very good "4" while 4 observers rated it excellent "5" that is 5%.

Treatment 3 (15g/250g of fish): 8 out of 16 observers i.e. 10% rated it excellent "5" while 4 observers rated it very good "4"that is 5%.

Treatment 4 (20g/250g of fish): 7 out of 16 observers i.e. 8.75% rated it excellent "5" while 6 observers rated it good "3" that is 7.5%.

Treatment 4 (20g) and treatment 3 (15g) concentration were the best in the organoleptic test for taste.

4.2 Mortality Rate of *D.maculatus*

The mortality rate is described in the table below:

Table.5. The effects of different concentrations of *Xylopia aethiopica* powder on *Dermestes maculatus.*

Treatments	Total number of beetles used(33)	No that survived	No of beetles that died	Mortality rate (%)
CT_1	15A, 18L	15A, 18L	NONE	0
T_1	15A, 18L	9A, 8L	6A, 10L	48.48
T_2	15A, 18L	3A, 7L	12A, 11L	69.70
T_3	15A, 18L	1A, 2L	14A, 16L	90.91
T_4	15A,18L	NONE	15A, 18L	100

KEY
A- Adult beetles
L- Larva

Table 6: Mean ± standard deviation of mortality

Treatment	No that survived	No that died	Mortality Rate
T_0	5.67 ± 1.52^a	11.00 ± 0.00^b	0.00 ± 0.00^c
T_1	5.67 ± 1.52^a	6.00 ± 1.73^c	52.00 ± 13.86^b
T_2	3.33 ± 0.58^b	7.67 ± 0.58^c	66.67 ± 5.77^b
T_3	1.00 ± 1.00^c	10.00 ± 0.00^a	90.00 ± 10.00^{ab}
T_4	0.00 ± 0.00^c	11.00 ± 0.00^b	100.00 ± 0.00^a

a, b, c shows significant different among means

Results presented in Table shows the effect of different concentration of *Xylopia aethiopica* powder on the mortality of *Dermestes maculatus*. The ANOVA showed that the application of *X. aethiopica* had a significant effect on the mortality of *Dermestes maculatus* (L.S.D= 0.05) the highest mortality was observed in T_4 (20g of*X. aethiopica*), followed by T_3 (15g of *X. aethiopica*), T_2 (10g of *X. aethiopica*) and T_1(5g of *X. aethiopica*) while T_0(control) recorded the lowest, without any mortality count.

IV. DISCUSSION

Plant products, particularly spices and extracts of various plant parts are extensively used as natural antimicrobials. In the commercial preservation of fish and fish products, natural antimicrobials from plant sources have been found to extend shelf life and preserve fish taste and flavor [16]. The spice and herb extracts of *xylopiaaethiopica* contain high levels of phenolic compounds which contributed to lower the pH values in meat and in the maintenance of meat color through their anti-oxidant effects. Phenolic and carbonyl compounds contribute towards taste in smoked fish [17]; [18].Specific volatile compounds especially phenolic compounds have been treated to different smoking techniques which later influence the sensory characteristic of smoked fish. Some of the phenolic compounds are the guaiacol and syringol which are characteristically seen in smoked fish [19].

The organoleptic properties of smoked foods are heavily influenced by the composition of the smoke and the nature of the wood. It is assumed that reactions between the carbonyl compounds and proteins are responsible for color formation on smoked fish surfaces while the absorbed phenolic compounds are for flavor and aroma of the smoked fish [20]; [21]. The partial hydrophobic nature of phenolic compounds may have degraded the cell wall interacted with the composition and disrupted the cytoplasmic membrane integrated enzymes, which may have lead to cell death [22]. This study has revealed *xylopiaaethiopica* powder as an effective preservation substance which caused mortality when 5 adults and 6 larvae of Dermestes maculates was introduced to different concentrations of *xylopiaaethiopica*. Their effectiveness was however attributed to the rate and period of application. The resultant high mortalities of the adults and larva of D. maculates observed on smoked *Clariasgariepinus* treated with *Xylopiaaethiopica* powder could be due to contact with toxic compounds resulting in the blockage of the spiracles [23] which subsequently led to their suffocation and death. The treatment with 20g X. aethiopica powder (highest percentage mortality) reduced the number of adult emergence than any other concentrations of the seed powder. The reduction in oviposition could be due to respiratory impairment that probably affects the process of metabolism and other systems of the body of beetles [24]. The reduction in the rate of oviposition of *callospbruchus maculatus* as reported by [25] that storing cowpea seeds and mixed with plant powders would fill intergranular air spaces and prevent the free movement of adults for mating and oviposition. [26] observed that piper guineensis powder prevented oviposition on *callosobrachus maculates* and Dermestes maculates respectively. The result of this study agrees with the works of the above researchers as well as that of [10] that both the powder and extract of piper *guineense* and *Dernettiaspp* inhibited adult emergence of *callosobrachrus maculates* and *sitophiluszeamais* completely. In this study, the insecticidal activities of *xylopiaaethiopica* powder could be attributed to the presence of alkaloids, flavonoids and tannins [27]. Since insecticidal property of any plant material is dependent in the active constituents of the plant material, the study also confirms that the sensory evaluation and consumers acceptance of smoked fish treated with plant powder like the X. aethiopic after the storage period showed that irrespective of the powder concentration treated fish was generally ranked good by fish consumers in taste, color and texture. There was also no evidence of taint, smell or change in taste, texture or flavor of the fish within the period of study. It is therefore recommended that *X. aethiopica* plant materials could serve as potential bio insecticides in stored product protection since it has a broad spectrum of activity against D. maculates [28]. Organoleptic assessment of the treated fish also showed no evidence of taint, smell, fragmentation and change in color, hence increased dosage of the *Xaethiopica* especially at the 15g and 20g is ideal for post harvest storage.

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