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THE USE OF PIPER GUINEENSE FRUIT OIL (PFO) AS PROTECTANT OF DRIED FISH AGAINST *DERMESTES MACULATUS* (DEGEER) INFESTATION

A. A. S. AMUSAN and T. G. OKORIE

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ABSTRACT

The efficacy of Piper guineense fruit oil in protecting dried fish against Dermestes maculatus (Degeer) infestation was investigated in the laboratory. *Piper* fruit oil extract were applied at dosages of 0.075ml/25g, 0.10ml/25g, 0.125ml/25g and 0.150ml/25g as protectant of dried fish (*Clarias spp)* against *D. maculatus. Piper* fruit oil at dosages of 0.125ml/25g fish and 0.150ml/25g fish were found to be efficient in the control of the development of *D. maculatus* adults and larvae stages on tested dried fish and was therefore recommended as appropriate dosage for prevention of insect infestation on dried fish.

Keywords: Dried fish, *Piper guineense,* protectant, *Dermestes maculatus*

INTRODUCTION

Fish is a very rich source of protein. In many countries, dried fish is being used increasingly to correct protein deficiency in the normal diet; in Nigeria for example, dried fish is a highly favoured item in many traditional dishes. Dried fish often is an alternative to fresh fish in many other places. Dried fish, particularly *Clarias* fish, a freshwater fish is highly nutritious and economically important it could be eaten fresh or dried. It serves as source of income to many farmers living around the shores of Lake Chad in Nigeria.

However, dried fish is readily attacked by several species of insects, including. *D. maculatus, D. frischii, D. ater* and *Necrobia rufipes*. These insects are generally associated with dried fish especially during storage, transportation and marketing (Don-Pedro, 1989). Hide beetles also destroys many other stored products including dried meat, dried blood, leather, cheese, bones, beans, cocoa, cowpeas, groundnut, copra and tobacco leaves (Osuji, 1973), etc.

An investigation carried out by Osuji (1973) indicated that hide beetles preferred *Clarias* fish to all other available dried fish species. Also larval stages of *Dermestes spp* usually account for infestation of about 93% in dried fish (Osuji, 1973). Unfortunately dermestid larvae are less susceptible to widely used insecticides than many other beetles that attack stored products and the use of insecticide renders the fish unattractive to consumers. Therefore research on the use of natural pesticides for crop production and storage is on the increase because of their reduced or non-toxicity to man (Mejule and Olanihun, 1986; Berenbaum, 1989, Jacobson, 1989, Ivbijaro, 1990 and Wee and Nick, 1998).

Ivbijaro (1990) investigated the efficacy of the oils from the seeds of *Azadrachta indica* and *Piper guineense* for the control of *Callosobruchus maculatus;* and found that the oils had ovicidal effects. The oil from *Piper guineense* also prevented the emergence of F_1 bruchids.

Piper guineense (the common brown pepper) is used as spice for cooking and is said to be also used in medical preparation for the treatment of coughs, intestinal diseases, bronchitis, venereal diseases, colds, rheumatism and as non-toxic insecticide. The present study was carried out to investigate the efficacy of the ethanolic extract of *P. guineense* for the control of *D. maculatus* (Hide beetles) on fish under laboratory condition.

A. A. S. AMUSAN, Dept. of Biological Sciences, College of Natural Sciences, University of Agriculture, Abeokuta, Nigeria
T. G. OKORIE, Department of Zoology, Faculty of Science, University of Ibadan, Ibadan, Nigeria

MATERIALS AND METHODS

Preparation of plant extract.

Dry fruits of *P. guineense* were bought from a local market (Ile-Ogbo) in Osun State, Nigeria. The fruits were washed and dried in the sun and then ground to a fine powder using an electric blender. The concentrate from the dried and ground samples were then extracted with ethanol using Soxhlet Extractor. The extract was then concentrated with Rotary Evaporator which removed the ethanolic component leaving behind a red viscous oil with pungent odour.

Culture of *Dermestes maculatus* and its development.

A pure culture free of *D. maculatus* was maintained at ambient temperature of 27.5 ± 2.5°C and relative humidity of 70 to 85% in the laboratory. Fifty grams of clean, undamaged dried *Clarias* fish were heat sterilized at 60°C for 30 minutes to kill off any fish pest present.

D. maculatus adults were sexed, paired and placed in specimen jars (65cm by 6.5cm) with top fitted with 1mm mesh wire gauze to prevent the escape of the experimental pest. Large intact pieces of dried *Clarias* fish were then placed in the specimen jars to serve as food and oviposition site. Wet cotton wool was then introduced into the jar to induce oviposition. Copulation commenced immediately the materials listed above were provided. Specimen jars were inspected twice daily in the morning and evening. Temperature/humidity readings were also recorded as above stated.

Evaluation of *Piper* fruit oil in the control of *Dermestes maculatus*.

Effects of *Piper* fruit oil on oviposition.

Twenty five grammes of oven dried fish obtained from the processes as earlier explained were weighed and rubbed intensely with 0.075ml *Piper* fruit oil in a specimen jar and covered with muslin material to let in air, but prevent the escape and entry of insect pest.

A pair of newly emerged male and female *D. maculatus* were placed in the jar. To induce oviposition, moisture was maintained using a piece of wet cotton (Okorie et al., 1990). The set up was kept in the Advanced Entomology Laboratory of the University of Ibadan. Nigeria, at temperatures of 30°C – 31°C and 78.96% relative humidity. The procedure was repeated using *Piper* fruit oil concentrations of 0.10ml, 0.125ml and 0.150ml respectively per 25g fish. There were three replicates for each experimental set up. Untreated fish served as control. Eggs laid on the fish were counted every 24 hours for 14 days. The number of dead adults were noted in each case.

Effects of *Piper* fruit oil on hatchability of *D. maculatus* egg.

The eggs laid were divided into three groups according to age: (i) 0-6 hours, (ii) 19-24 hours, and (iii) 37-42 hours. Twenty five grammes dried fish was treated with 0.10ml and 0.15ml and in each of these treated fish were placed 12 eggs from each age group to study the incubation time and percentage hatchability of these eggs of various ages. Each study except the control (untreated fish) were replicated 3 times.

Effect of *Piper* fruit oil on *D. maculatus* larvae

Thirty newly hatched first instar larvae of *D. maculatus* were placed on each piece of fish treated with two different concentrations of *Piper* fruit oil of 0.10ml/25g fish and 0.150ml/25g respectively with untreated fish of equal weight as control. After 35 days the number of dead and live larvae as well as increase in size of the insects were monitored. Pest density and percentage effectiveness of *Piper* fruit oil were calculated.

Statistical analysis

Results obtained from each experiment were subjected to students t- test. Differences in results were considered significant at $P<0.001$.

RESULTS AND DISCUSSIONS

Effect of *Piper* fruit oil on *D. maculatus* oviposition.

Table 1a: Effect of *Piper* fruit oil (PFO) on oviposition of *Dermestes maculatus* adults.

Treatment	Conc. Ml/25kg fish	No. of adult pairs used	Total No. of adults used	Egg/pair (mean)	No. of adults alive	No. of dead adults	Mean mortality (%)
	0.075	10	20	22	10	10	50
	0.100	10	20	12	8	12	60.00
FF0	0.125	10	20	-	3	17	85.0
	0.150	10	20	-	2	18	90.0
	Control	10	20	140	19	1	8.5

Table 1b; Effect of *P. guineense* fruit oil on hatchability of eggs of *D. maculatus*.

Age range of eggs of eggs (hours)	Conc/ml.	Mean % of eggs hatching	Mean incubation period (hours)
0- 6	0.10	16.64	96
	0.15	0.00	_
	Control	83.31	48
19-24	0.10	25.0	94
	0.15	0.0	—
	Control	94.28	48
37-42	0.10	38.28	91
	0.15	2.77	—
	Control	97.21	48

Piper fruit oil was found to be very effective in reducing oviposition substantially. No eggs were laid on fish treated with 0.125ml and 0.150ml/25g fish concentrations. The result was significantly different ($P<0.001$) from the control set up which recorded a mean of 140 eggs. (Table 1a).

Similar observations were made by Ivbijaro (1990) on efficacy of seed oil of *Piper guineense* in the control of *Callosobruchus maculatus* where *Piper* seed oil was found to be most effective in substantially reducing oviposition.

Ovicidal activity of *Piper* fruit oil on *D. maculatus*.

Very few eggs developed in most cases. About 90% of the eggs failed to develop while only 10% became partially developed. At 0-6 hours, 16.64% of the eggs hatched at 0.10ml

Table 2: Effect of *Piper* fruit oil (PFO) on *Dermestes maculatus*.

Conc. of PFO/25g fish	Treatment on fish	No. of larvae instar used	No. of *D. maculatus* collected				% effectiveness of treatment	Mean size of larvae used (mm)	Size range of larvae used (mm)
			Alive		Dead				
			Adt	Lar	Adt	Lar			
0.10ml/25g fish	PFO	30	2	9	4	15	63.33	2.3	1.6-3.8
0.15ml/25g Fish	PFO	30	-	1	-	29	96.7	2.1	1.8-3.2
Control	Nil	30	12	16	-	2	6.66	7.6	5.8-16.2

* Adt - adult
* Lar - larvae

Table 3: Effects of *Piper* fruit oil on larvae and adults of *D. maculatus* per unit time.

Days after treatment	Initial no. of larvae used	Mortality/concentration				Initial No. of adults used	Mortality/concentration					
		0.10ml/25g fish		0.15ml/25g fish			0.10ml/25g fish		0.15ml/25g fish		Control	
		No	%	No	%		No	%	No	%	No	%
1st 24 hours	30	4	13.33	8	26.67	30	5	16.6	10	33.33	Nil	0
2-7 days		16	53.33	20	66.67		17	56.6	16	53.33	Nil	0
8-14 days		10	33.33	2	6.67		8	26.6	4	13.33	1	3.3

treatment while none hatched at 0.150ml/25g fish while at 37-42 hours age group 38-88% of the eggs hatched at 0.10ml/25g fish and 2.77% at 0.150ml/25g fish. Student's t-test showed that these results were significantly different from the control set up where between 83.31% to 97.21% of the eggs hatched. Student's t-test between treated and untreated eggs showed that the incubation period of the few eggs that hatched from treated fish was significantly longer than that of control ($P<0.001$) (Table1b). This observed prolonged incubation period of the eggs may be due to both chemical toxicity and the physical properties of the oil, i.e. a change in the surface tension leading to protoplasm coagulation.

Don-Pedro (1989) observed similar result with vegetable oils on *D. maculatus* and Ivbijaro and Agbaje (1986) reported that *Piper guineense* adversely inhibited egg hatch in *Callosobruchus maculatus* in that no larvae emerged from Piper seed oil treated cowpea seeds.

Effects of *Piper* fruit oil on larvae of *D. maculatus*

All the thirty (30) first instar larvae treated with 0.10ml and 0.150ml *Piper* fruit oil, died after thirty-five days (Table 2). Mortality within the first twenty hours ranged between 13% in 0.10ml treated fish to 27% in 0.150ml treated fish (Table 3).

Piper fruit oil is known to be very toxic to developmental stages of insects. Ivbijaro (1990) observed that the reproductive efficiency of mated female bruchids exposed to *Piper* fruit oil was nil.

Mortality of adult *D. maculatus* exposed to *Piper* fruit oil.

Piper fruit oil at 0.10ml/25g fish caused 17% mortality in *D. maculatus* within the first twenty four hours of study and reached 100.0% in 14 days. At 0.15ml/25g fish 33% mortality was recorded within the first twenty four hours and reached 100.0% on the thirteenth day. However in the control, a mean mortality of 3% was recorded within the 14 days of study (Table 3). The relationship between the treated and control showed that they are significant using t-test ($P<0.001$).

Longevity of *D. maculatus* parents and offspring.

The three adults that emerged from the 0.10ml/25g fish did not survive beyond seven days after emergence. However, adults that emerged from the control experiment lived up to 21 days maximum (15 days minimum).

The ability of *Piper* fruit oil to protect dried fish from insect infestation could be due to the presence of Piperine [Su (1977), Scngypt and Ray (1987)]. Delay in the development of immature stages of the insect is caused by *Piper guineense* oil extract. The use of the extract may be a practicable means for the reduction of the production rates of *D. maculatus* and consequently damage to dried fishes as shown in this study.

In this study the crude extract of *Piper guineeense was* obtained from its seeds.It was found to be effective in the prevention of growth and development of *D. maculatus*.. It enhances their mortality and inhibited reproduction of the pests on dried fish as demonstrated in the study. Apart from the other numerous uses of the common brown pepper (Piper guineense) as earlier enumerated, the extract from this pepper is very useful as protectant against infestation of dried fish by D. maculatus. It is highly toxic to insects and safe for human consumption. It does not affect the quality and palatability of the treated fish.

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