

Laboratory efficacy of Nutmeg (*monodora myristica*) powder against the beetle *Dermestid maculatus* (Coleoptera: Dermestidae) on treated smoked catfish (*clarias gariepinus*) in Kano State of Nigeria.

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Abstract

Experiment was conducted to investigate the insecticidal potency of nutmeg against *Dermestid maculatus* at the Department of Biological Sciences, Bayero University Kano under the ambient conditions (32± 0.64°C and 68±3% R.H). Nutmeg (*Monodora myristica*) was purchased from Sabon Gari Market in Kano State of Nigeria. The plant materials was washed with clean tap water, dried, ground thoroughly in an electric kitchen grinder and sieved into fine powder particles. *D. maculatus* were sourced from infested smoked catfish (*Clarias gariepinus*) collected from Sabongari in Kano state, Nigeria. The beetle was identified based on the morphological characters. The powders were thoroughly admixed at the rate of (2.50g, 5.00g, 7.50g and 10.00g) with 100g of disinfested dried fish (*Clarias gariepinus*) in a separate jars. Twenty newly emerged (0-24hrs old) insect (*Dermestes maculatus*) were introduced into each jars. Control treatments were set up. These were covered with a muslin cloth. Each treatment were replicated and arranged in a completely randomized design (CRD) and left on the laboratory bench for daily observation. Mortality of the insect in each treatment was observed at every 24hrs interval. nutmeg showed a significant effect in killing the dried fish beetle within 3 days of treatment where 100% mortality was recorded at the highest concentration (10.00g) and the result was significantly (p<0.005) different with the control treatment. Nutmeg (*Monodora myristica*) was effective in controlling *Dermestid maculatus* infesting dried fish

Keywords: Nutmeg (*Monodora myristica*), Smoked Catfish (*Clarias gariepinus*) *Dermestid maculatus*

1. Introduction

Dried fish is a highly relished item of many traditional dishes in Nigerian as food and condiment that greatly enriches the flavor of various dishes. It is one of the major sources of proteins and essential minerals in the tropics (Odeyemi *et al.*, 2000). However studies have shown that a high proportion of dried which most Nigerians fish consumers rely on to supplement their proteins need is usually infested by insects pest (Ezeu, 1982; Osuji, 1974; Teye, 1970). The major pests on smoked catfish *Clarias gariepinus* include *Dermestid maculatus* (hide beetle) and *Necrobia rufipes* (copra beetle) (Osuji, 1974; Awoyemi, 1989) The extent and value of quantitative losses caused to dried fish by *D. Maculatus* have been assessed by various investigators and estimate range from negligible to up 50% weight loss, depending on length of storage, salt content, moisture content, climatic conditions and general hygiene during processing and storage (Owoade 2008)

The use of plants and minerals as traditional protectants of stored products is an old practice used all over the world (Golob & Webley, 1980). These traditions have been largely neglected by farmers, after the Second World War, with the advent of synthetic or petroleum based insecticides. However, the potential hazards for mammals from synthetic insecticides, the ecological consequences and the increase of insect resistance to pesticides has led to a search for new classes of insecticides with lower mammalian toxicity and a lower persistence. However, in recent years, there have been increasing and concerted efforts directed at developing natural pest management control agents that are relatively cheap, safe, biodegradable and environment friendly as alternatives to synthesized insecticides (Boeke *et al.*, 2001)

The present study was undertaken with a spice (nutmeg) used in nutritionally insignificant quantities as a food additive for the purpose of flavorings or as a preservative, medicine, religious rituals, cosmetics perfumery or eating as vegetable (Charles, 1999). The use of the powder was tested in

this study for toxicity against the dried fish beetle (*Dermestid maculatus*)

2. Materials and Methods

Collection of the Spice (Nutmeg *Monodora myristica*)

Nutmeg (*Monodora myristica*) was purchased from Sabon Gari Market in Kano State of Nigeria. The Spice was washed with clean tap water, dried, ground thoroughly in an electric kitchen grinder and sieved (Adedire and Lajide 2000). The powder was kept in separate plastic containers with a tightly fitted lid and placed in a cooled place for the use in the experiment (Akinwumi *et al.*, 2006).

Collection and maintenance of test insect

The initial source of beetle culture was obtained from infested smoked catfish (*clarias gariepinus*) collected from Sabon Gari in Kano State Nigeria. These beetles were identified based on the morphological characters (Akinwumi *et al.*, 2006). Identified insect was kept in the Jars covered with muslin cloth along with dried fish in the containers.

Collection of dried fish

The fish was purchased from Sabongari Market in Kano State of Nigeria. The fish was disinfested for 24 hours in a freezer to eliminate any infestation on the fish.

Preparation of test concentration

Different Concentration of plants powders was prepared after a trial experiments. The concentration of 2.50g, 5.00g, 7.50 and 10.00g were separately weight into separate jars.

Bioassay

Different concentration of the Nutmeg (*Monodora myristica*) (2.50g, 5.00g, 7.50g and 10.00g) were separately mixed with 100g of disinfested dried fish (*Clarias gariepinus*) each in a separate jars. Twenty newly emerged (0-24hrs old) insect (*Dermestid maculatus*) were introduced into each jars (containing different concentration of nutmeg) these jars were kept under ambient laboratory conditions (30± 3°C and 70 ±5% R.H). and were also covered with muslin cloth in order to provide aeration, and prevent entry of other insect (Akinwumi *et al.*, 2006). Similar set up was prepared as a control treatment which was not treated with nutmeg powder. Each treatment were replicated and arranged in a completely randomized design (CRD) and left on the laboratory bench for daily observation (Adedire and Lajide, 2000). Mortality of the insect in each treatment was observed at every 24hrs interval.

3. Results and Discussion

A spices is a dried seed, fruit root bark, leaf or vegetative substance used in nutritionally insignificant quantities as a food additive for the purpose of flavor, color or as preservative that kills harmful bacteria or prevent their growth (Dalby 2002).

The present study indicates that spices (*M. myristica*) strongly effected the development of *Dermestids maculatus*. The effects of the nutmeg (*M. myristica*) on the mortality of the insect was higher in dried fish treated with higher dosage of nutmeg (Table 1). 10.0g of the spice powder (nutmeg) was found to record 100% mortality of the beetle within 3 days of treatment in comparison with untreated control which recorded 25% mortality of the beetle after 5 days of treatment. The result further indicated that all the concentration of the nutmeg (*M. myristica*) used in the study was effective in controlling infestation of the beetle in comparison to the untreated control (Table 1). The mortality caused by the spice (nutmeg) could be attributed to several mechanisms (Odeneyi *et al.*, 2000). The use of the spice (*M. myristica*) could have resulted to death in the tendency of the powder to block the spiracles of insects thus impairing respiration leading to the death of insects (Owoade 2008). The results of this study is in agreement with many other works on the use of plant products against stored products insects. Olaifa and Erhun (1988); Fasakin and Aberejo (2002) observed that p. *guineense* spice powder prevented oviposition on *Callosobruchus maculatus* and *Dermestes maculatus* respectively and therefore reducing the longevity of the insect. Similarly Okonkwo and Okoye (1996) noted that both the powder and extract of p. *guineense* and *D. tripetela* inhibited adult emergence of *C. Maculatus* and *sitophilus Zeamaiz* completely. The finding in this study was also similar to that of Ofuya *et al.*, (1992) who reported ovicidal, laticidal and anti ovipositional effect of *M. myristica* on *C. Maculatus*. The bioactive constituents found in *M. myristica* include eugenol, limonene, tannic acid, asarone and citral (Golob *et al.*, 1999).

The insecticidal activity of *M. myristica* (nutmeg) on treated fish with (Table 1) may be due to the presence of the bioactive constituents such as eugenol, limonene, tannic acid, asarone and citral which were reported to be present in *M. myristica* (Golob *et al.*, 1999).

This bioactive agent could cause a depolarizing neuromuscular blocking action which could lead to the death of insect (Udoh *et al.*, 1999).

The treated fish in this experiment with nutmeg powders has no any adverse evidence of taint smell or change in taste, texture or flavor of fish. The result obtained therefore has demonstrated the insecticidal activity of the nutmeg in preserving the quality of smoked *Clarias gariepinus* fish.

Table 1: Effects of different concentrations of nutmeg (*M. myristica*) powder on the mortality of *D. maculatus*

Concentration of nutmeg used(g)	Number of insect used	Mortality of <i>D. maculatus</i> (in %)				
		Day 1	Day 2	Day 3	Day 4	Day 5
2.50	20	11.5	20	63	80	100
5.00	20	23.0	61.5	100	100	100
7.50	20	16.5	35	85	96.5	100
10.00	20	50	80	100	100	100
Control	20	0	5	5	15	25

4. Conclusion

The use of Spice (*M. myristica*) is quite effective in protecting dried fish against infestation by the beetle *D. maculatus*. It is therefore important to consider the use of spices in controlling insect pest of our stored products in order to minimize problems caused by the use of chemical insecticides as these spices are major cash crops in Nigeria and are readily available in the local market and their powders are readily used as additives or flavor in our daily food, and are also unlikely to cause any health problems to the users.

REFERENCES

- Adedire, CO and Lajide, L. (2000) Effects of pulverised plant materials on fish damage and growth performance of the fish beetle (*Demestes maculatus*) (degeer). *Entomol. Soci Nig. Occasional publication* 32;215-221.
- Akinwumi F.O, Fasakin E.A, Adedire C.O. (2006). Progeny inhibiting effects of four plant products against the leather beetle and the copra beetle of smoked African mudfish. *J. of Biological sciences* 6(6); 1023-1028.
- Amusan, A.A.S and T.G Okorie,(2002). the use of *piper guineese* fruit oil (PFO) as protected of dried fish against *Demestes maculatus* (degeer) infestation. *Global J. pure Applied sci.* 8;197 -201.
- Boeke, S.J.,J.J.A.vanlon, A.Vanluis,D.k.kossou and M. Dicke,(2001). The use of plant materials to protect stored leguminous seed against seed beetles; A review. The Netherlands , Backhuys publishers pp;108
- Dalby Andrew.(2002) Dangerous tastes; the story of spices. Berkeley; University of Californiapressher
- Fasakin, E.A. and B.A. Aberejo,(2002). Effects of some pulverized plant material on the developmental stages of fish beetle *Dermestes maculatus* degeer in smoked catfish (*Ckarias garaepinus*) during storage *Biosci. Technol.*, 85: 173-177.
- Golob, P. & Webley, D.J.(1980). The use of plants and minerals as traditional protectants of stored products *J Stored product* 19 80
- Owoade R.A (2008). Mortality, Growth and Development of *Dermestes maculatus* African scientist vol. 9. No. 1
- Golob, P., C. moss, M. dales, A Fidge, J. evans and I. Gudrups,(1999). The use of spices and medicinals as bioactive protectants for grains food *Agric. Org.Agric service Bull.*, PP; 137.
- Ivbijaro M.F, Agbaje M. (1988) Insecticidal activities of *P. guineense* and capsicum spp. On the cawpea bruchid *Callosobruchus maculatus* insects science and its application 7(4); 521-524.
- Lale, N.E.S., (1995). An overview of the use of plant products in the managements of stored products. *Coleoptera in the products post harvest news inform.*, 6;69-75N.
- Odeyemi, O.O., R.A. Owoade and R. Akinkulore, (2000). Toxicity and Population.Suppression effects of parkia clappatoniana and dried fish pests (*Dermestes maculatus* and *necrobia rufipes*) *Global J.pure applied science.*, 6:191-195.
- Ofuya,T.I., B.C.Okoye and A.S.Olola, (1992). efficacy of crude extracts from seeds of *Monodora myristica* (Gaertn) Dunal as surface protectant against *Callosobruchus masculatus* (F) attacking legume seeds in storage *J. plant Dis. Protect.*,99; 528-532.
- Okonkwo, E.O. and W.I. Okoye(1996). the efficacy of Four seed powders and the essential oils as protectants of cowpea and maize grains against infestation by *Callosobruchus maculatus* (F) (Coleoptera;Bruchidae) and *Sitophilus Zea mays* (M) (Coleoptera; curculionidae) in Nigeria *inf.J. pest manage.*, 42:143-146.
- Okonkwo, E.O and W.I.Okoye,(2001).Insecticidal activity of *Dennettia tripetala* Bakur

F. and piper guineense schum and thonn against *Dermestes maculatus* Degeer (coleopteran; Dermestida) and *Necrobia rufipes* Degeer on dried fish. *Nig.J. Entomol*, 18:109-117.

16. Olaifa, J.I. and W.O.Erhun.(1998). laboratory evaluation of piper guineense for the protection of cowpea against *Callosobruchus maculatus*. *Insects Sci.Applic.*, 9;55-59.

17. Owoade R.A (2008). Mortality, Growth and Development of *Dermestes maculatus* African scientist vol. 9. No. 1(2008).

18. Su,H.C.F., (1997). Insecticidal properties of black pepper to rice weevils and cowpea weevils. *J.Econ. Entomol.*,70;18-20.

19. Udoh,F.V.,T.Y.Lot and V.B.Braide,(1999). Effects of extracts of seed and leaf of piper guineense on skeletal muscle activity in rat and frog. *Phytother Res.*, 13;106-110.