COMPARATIVE BIOINSECTICIDAL EFFECT OF ETHANOLIC EXTRACT OF *ZANTHOXYLUM ZANTHOXYLOIDES (*LAM) ZEPERNICK & TIMLER ON SOME SELECTED INSECTS OF ECONOMIC IMPORTANCE TO MAN

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ABSTRACT

Ethanolic extract of *Zanthoxylum zanthoxyloides* was assayed for its insecticidal properties on *Musca domestica, Callosobruchus maculates, Anopheles* mosquito and *Sitophilus zeamais*. 1%, 2% and 4% w/v of aqueous solution of the extract was topically administered on the insects and mortality was monitored at 15, 30, 45, 60, 90 and 105 minutes intervals. The efficacy of the extract as insecticide increases with increasing concentration with 4% solution giving the best result in all cases. 4% w/v of the extract killed all the *M. domestica, C. maculates, Anopheles* mosquito and *S. zeamais* by 75th, 45th, 60th and 45th minutes respectively. This suggest that *Z. zanthoxyloides* has a great potential as a bioinsecticide.
Keywords: Ethanolic extract*, Zanthoxylum zanthoxyloides,* bioinsecticide.

INTRODUCTION

Synthetic insecticides have become very popular since their discovery in the 1940s because of their efficacy, availability and ease of application even on large scale and they constitute man's first line of defence in pest outbreaks[1,2]. Synthetic insecticides have high mammalian toxicity, low biodegradability and consequent environmental concerns. Increasing cost of synthetic insecticide and dwindling farmers' income in face of ever decreasing value of national currencies have made these insecticides too expensive for the common man. All these have called for an alternative to these synthetic products[4].

Peasant farmers all over the world use plant materials for storage of their excess harvest as protectants against pest infestation[1, 2, 3, 6, 11, 14, 15]. The past three decades have witnessed reawakening in research efforts to ascertain the effectiveness of these plant products. Literature available shows over 66 plants from 30 families have been subjected to laboratory test for their effects on different store and field pests[10].

The efficacy of *Zanthoxylum zanthoxyloides* in protecting cowpea in storage has been investigated. Root bark of *Z. zanthoxyloides* caused 100% adult mortality, inhibited mating, decreased oviposition[7, 8, 9]. Its acetone extract reduce pairing of males by 100%[8] in *Callosobruchus maculatus.* The efficacy of *Z. zanthoxyloides* in arresting *C. maculates* infestation cowpea at a level comparable to synthetic insecticide Pirimphos methyl had been reported[5].

It is against the above background that we decided to test the acute toxicity of Z*. zanthoxyloides* on three insects of great medical and agricultural importance; *Musca domestica, Callosobruchus maculates, Anopheles* mosquito and *S. zeamais*.

MATERIAL AND METHODS

The root bark of *Z. zanthoxyloides* was obtained from Bida (9^0 6′ N and $6^0$1′ E), Nigeria, dried in the open laboratory (at ambient temperature of 26 – 33°C and relative humidity of 55 – 78%) and finally ground into powder. 500g of the powder was extracted using absolute ethanol (BDH England). The extract was concentrated over water bath at 65^0C and 35g crude extract was obtained. 1%, 2% and 4% solution of crude extract was prepared using distilled water.

Toxicity test were carried out using standard methods[12, 16,]. Fresh adult insects were immobilized by refrigeration for ten minutes. These insects were then individually picked up and various concentrations of the extract (0.00%, 1.00%, 2.00% and 4.00% W/V) were applied to their dorsal surfaces using a mini dropper. They were then returned to food sources and mortality was monitored over 15, 30, 45, 60, 75, 90, and 105 minutes interval. The experimental set up for each insect and for each concentration was replicated four times.

RESULTS AND DISCUSSION

Toxicity test of ethanolic extract of *Z. zanthoxyloides* on *Musca domestica* shows that all insects were killed by 75^{th}, 90^{th} and 105^{th} minutes after application by 4.00%, 2.00% and 1.00% extract concentration respectively as shown in figure 1. The 2.00% and 4.00% extract killed the entire *Anopheles* mosquito by the 60^{th} minute while 1.00% extract killed the insect after 105^{th} minute (see figure 2). In the case of *Callosobruchus maculatus* all the insects were killed by the 45^{th}, 60^{th} and 105^{th} minutes by 4.00%, 2.00% and 1.00% of the extract concentration respectively (figure 3). 1 % ethanol extract of *Z. zanthoxyloides* killed all the *Sitophilus* after one hour while 2% and 4% ethanol extract killed all the insects by 75^{th} and 45^{th} minute respectively (figure 4). The trend shows efficacy of the extract is generally in the order of 4.00% > 2.00% > 1.00%.

The result is in conformity with earlier works; on acute toxicity of crude root bark powder of *Z. zanthoxyloides* as contact poison on termites[4] and on the efficacy root bark powder of *Z. zanthoxyloides* in arresting *C. maculatus* infestation cowpea at a level comparable to synthetic insecticide Pirimphos methyl [5] and similar direct toxicity effect of pithraj on red flower beetle[16] and shyialmutra on rice weevil[13] following order of toxicity 3>2>1%.

CONCLUSION AND RECOMMENDATION

This research has demonstrated that ethanolic extract of root bark of *Z. zanthoxyloides* has acute toxicity effect on *Musca domestica, Callosobruchus maculates, Anopheles* mosquito and *S. zeamais,* and can be exploited as a renewable source of biopesticide. There is need for identification and isolation of the active insecticidal components of the plant and its formulation. This will go along way in the control of these insects of agricultural and medical importance.

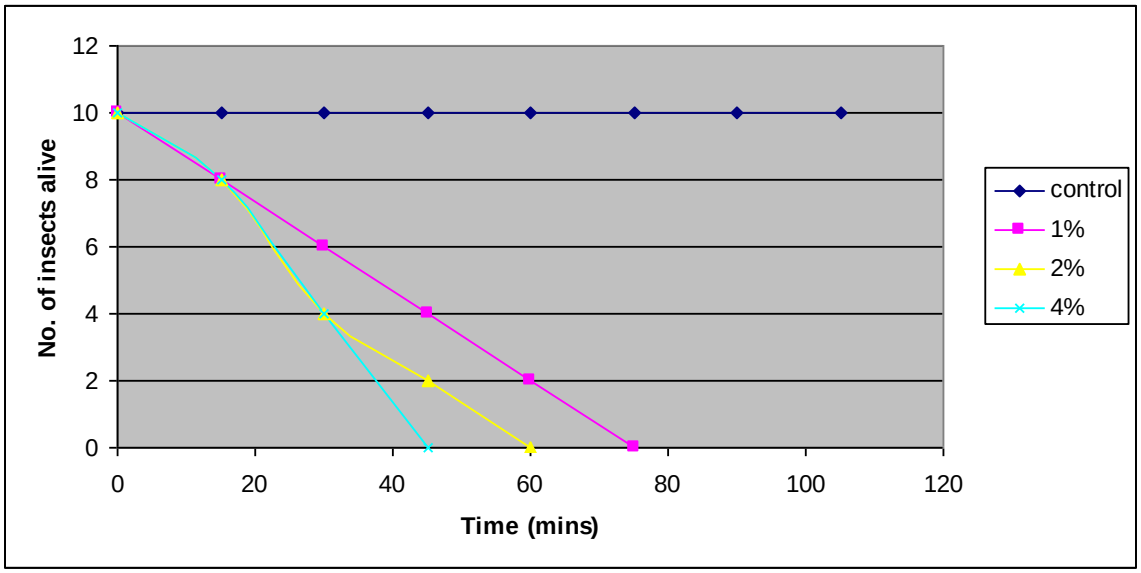

Figure 1: mean mortality rate of extract on *Musca domestica*

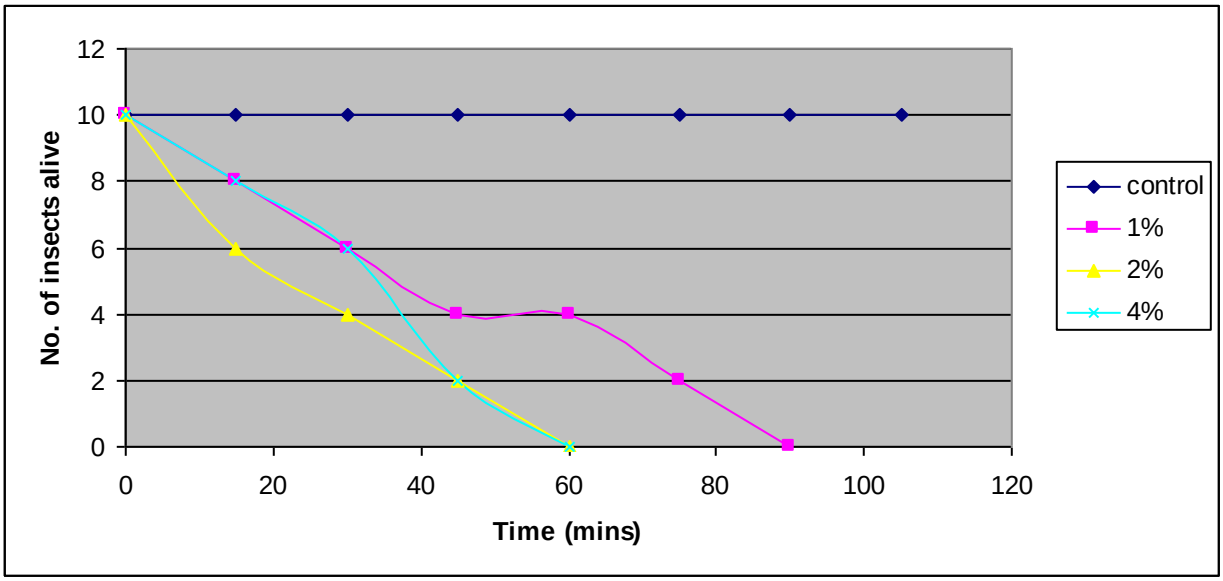

Figure 2: mean mortality rate of extract on *Anopheles* mosquito

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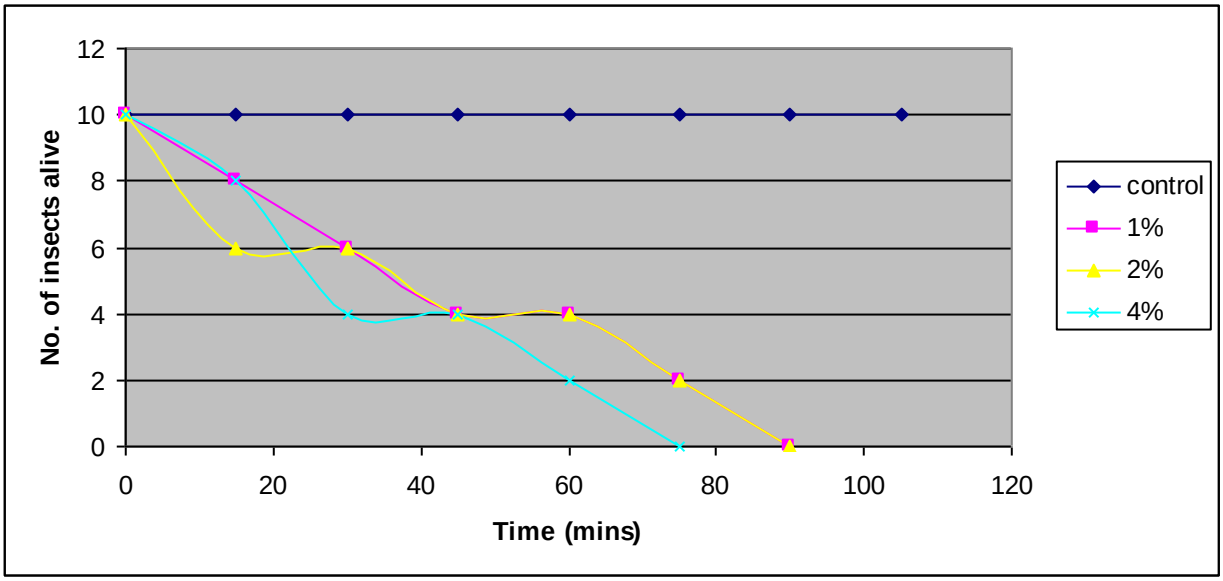

Figure 3: mean mortality rate of extract on *C. maculates*

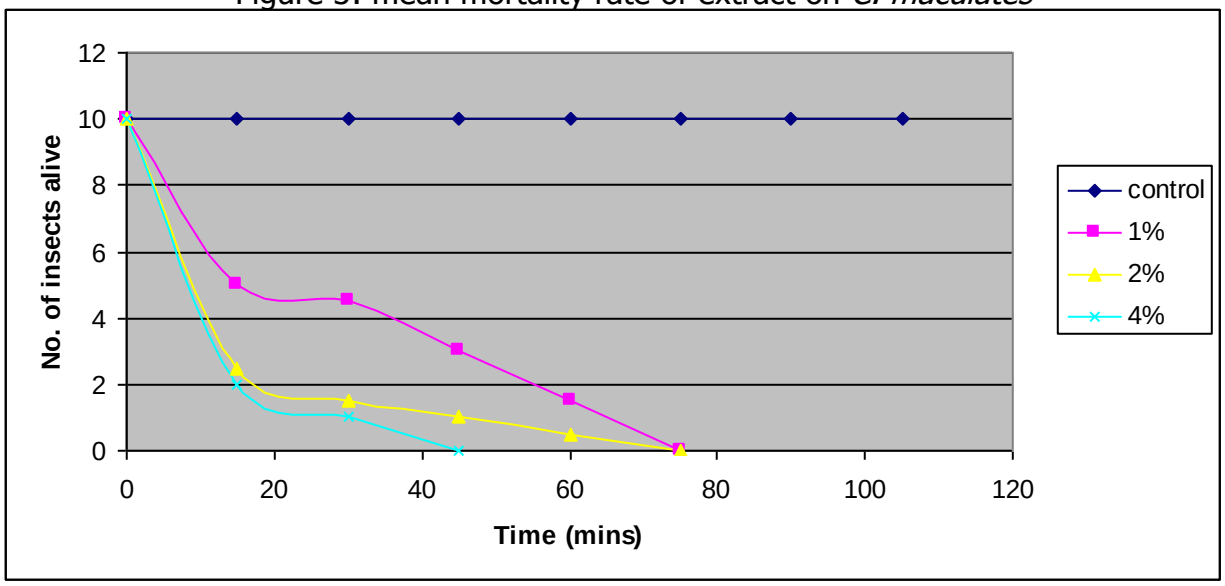

Figure 4: mean mortality rate of extract on *S. zeamais*

REFERENCES

1. Ajayi, O., Arokoyo, J.T., Nezan, J. T., Olayinka, O. O., Ndaranbula, B. M. and Kannike, O. A. (1987). Laboratory assessment of the efficacy of some local plant materials for the control of storage insect pests. *Samaru Journal of Agricultural Research* **5**:81-85.

2. Bernard, S. (1957). The control of stored grain insects in South Africa. *Samaru Research Bulletin* **No.355,** 35.

3. Don Pedro, K. N. (1985). Toxicity of some citrus peels to *Dermestes maculates* (F). *Journal of stored products Research* **21**:31-34.

4. Gbate, M. and Alhassan, I. (2004). Laboratory assessment of termiticidal effect of some plants. *Nigerian journal of Arts, Science and Technology* **2**:2-8.

5. Gbate, M. and Fasoranti, J. O. (2008). Comparative assessment of *Zanthoxylum zanthoxyloides* (Lam) Zepernick & Timler, *Piper guineense* Schum & Thonn, *Hyptis suavolens* Poit and Pirimphos methyl (synthetic insecticide) for arresting *Callosobruchus maculates* F. infestation in *Vigna unguiculata* (L) Walp. *Nigerian journal of Arts, Science and Technology* **4** (2) : 215 – 225.

6. Khare, B. P. and Agrawal, H. K. (1972). Effect of non toxic material on insect infestation in stored grains. *Indian Journal of Entomology* **34**:169-173.

7. Ogunwolu, E.O. and Odunlami, A. T. (1996). Suppression of seed bruchid *Callosobruchus maculates* (F) development and damage on cowpea *Vigna unguiculata* (L) Walp with *Zanthoxylum zanthoxyloides* (Lam) Western root bark powder compared to Neem seed powder and pirimphos methyl. *Crop Protection* **15(7)**:603-607.

8. Ogunwolu, E.O., Igoli, J. O. and Longe, N. N. (1998). Reduction in reproductive fitness of *Callosobruchus maculates* (F) exposed to Powdered *Zanthoxylum zanthoxyloides* (Lam) Western. *Journal of Herbs, Spices and Medicinal Plants* **6(1)**:11-27.

9. Ogunwolu, O. and Idowu, O (1994). Potential of powdered *Zanthoxylum zanthoxyloides* (Rutaceae) root bark and *Azadiracta indica* (Meliaceae) seed for control of cowpea seed bruchid, *Callosobruchus maculates* (Bruchidae) in Nigeria. *Journal of African Zoology* **108 (6):** 521-528.

10. Okonkwo, E.U. (2001). Plant materials for controlling insect pests of stored products in Nigeria - a review. *ESN Occasional Publication* **33**:1-65.

11. Pereira, J. (1983). The effectiveness of six vegetable oils as protectants of cowpea and Bambara groundnut against infestation by *Callosobruchus maculates* (F) (Coleopteran; Bruchidae). *Journal of Store Products Research* **19**:57-62.

12. Rahman, S. S., Rahman, M., Khan, M. M., Begum, S. A., Roy, B. and Shahed, S. M. F. (2007). Ethanolic extract of melgota (*Macaranga postulata*) for repellency, insecticidal activity against rice weevil (*Sitophilus oryzae*) *African Journal of Biotechnology* **6** (4): 379-383

13. Roy B, Amin R, and Uddin MN (2005), Leaf extracts of Shiyalmutra (Blumea lacera) as botanical insecticides against lesser grain borrer and rice weevil. J. Biol. Sci. **5** (2): 201-204.

14. Singh, S.R., Luse A. R., Leusschener, K. and Mangju, D. (1978).groundnut oil treatment for control of *Callosobruchus maculates* (F) during cowpea storage. *Journal of Store Products Research* **14**:77-80.

15. Su, C. F. H. (1977). Insecticidal properties of black pepper to the weevils. *Journal of Economic Entomology* **70**:18-20.

16. Talukdar FA and Howse PE (1993). Deterrent and insecticidal effect of extract of pithraj, Aphanamixis polystacha against Tribolium Castaneum. J. Chem. Ecel. **19**:2463-2471.

Books

1. Ajari, O. and Gbate, M. (2006). Introduction to pest and control measures. Yekabo Educ. Pub. Bida, Nigeria p102

2. Pedigo, L. P. (1996). Entomology and Pest Management. Prentice Hall Inc. N. J. USA p365