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Comparative Studies of Effect of Extracts of *Zanthoxylum zanthoxyloides* (Lam) Zepernick & Timler on *Callosobruchus maculatus* F Infestation in Stored *Vigna unguiculata* (L) Walp

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ABSTRACT

Comparative studies were conducted to determine the biopesticide efficacy of ethanol and methanol extracts of root bark of *Zanthoxylum zanthoxyloides* in arresting *Callosobruchus maculatus* infestation in stored *Vigna unguiculata.* 1%, 2% and 4% w/v of aqueous solution of the extracts were used in treatment of infected cowpea. Weight lost, number of insect emerged and viability of the seeds was measured over three generations. In both ethanol and methanol extracts of the plant, 4% extract have the highest effect on the stored product; reducing mean weight loss to 1.8g and 3.9g after the third generation respectively and mean number of insect emergence to 18 and 23 after the third generation respectively. They also gave seed viability test of 77.5% and 80% respectively. The result shows no significant difference statistically at 5% probability when compared to that of synthetic insecticide (DDVP) applied at recommended dosage. The efficacy of the extract appears to increase with increasing concentration 1 % < 2 % < 4 %.

Keywords: Biopesticide, *Zanthoxylum zanthoxyloides, Callosobruchus maculatus,* infestation, *Vigna unguiculata.*

INTRODUCTION

Vigna unguiculata (L) Walp (Cowpea) accounts for between 60-80% protein intakes of West African inhabitants; it is the most important proteinous legume, grown widely in semiarid tropics of Africa and Asia [13, 20]. It is highly nutritive with 22% protein, 1.5% fat and 60% carbohydrate [5], with protein digestibility higher than that of other legumes [19]. The major constraint to all year round availability of this crop is insect pest. Up to 100% damage to cowpea in storage has been reported due to *Callosobruchus maculatus* [2].

Once infestation of pest (including *C. maculatus*) is established in stored products, farmers generally resort to application of synthetic insecticide otherwise loss of the entire stored product is inevitable. But 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 ordinary farmers. All these have called for an alternative to these synthetic products [10].

It is an established fact that peasant farmers all over the world use plant materials for storage of their excess harvest as protactants against pest infestation [1, 3, 4, 6, 7, 14, 21, 24]. The past three decades have witnessed reawakening in research efforts to ascertain the effectiveness of these plant products. Available literature shows over 66 plants from 30 families have been subjected to laboratory test for their effects on different store and field pests [18].

The efficacy of *Zanthoxylum zanthoxyloides* as a biopesticide has being under investigation [8, 9, 11, 12, 15, 16, 17].

MATERIALS AND METHODS

Z. zanthoxyloides root bark was obtained from Bida (9^0 6′ N and $6^0$1′ E), Nigeria, dried in the open laboratory for one week (at ambient temperature of 26 – 33^0C and relative humidity of 55 – 78%) and finally ground into powder. 500g each of the powder was extracted using absolute ethanol and methanol (BDH England). The extracts were concentrated over water bath at 65^0C, 35g and 38g of crude ethanolic and methanolic extracts were obtained respectively. 1%, 2% and 4% solution of crude ethanolic and methanolic extracts respectively were prepared using distilled water.

50g each of sterilized cowpea was weighed into 20 plates and 5 pairs of newly emerged *C. maculatus* were inoculated into each plate. The insects were allowed to oviposit for 8 days and then removed setting in the infestation [12]. The 20 plates were then divided into five groups of four plates each and labeled A-E. 1%, 2% and 4% ethanol extract was applied to plates labeled A-C respectively, synthetic insecticide (DDVP) was applied to plates labeled D to serve as positive control and plates in group E as negative control. This was repeated for methanol too. The set up was monitored daily and after 21 days the first generation emerged and records were taken (i.e. weight loss and number of insects emerged) for ethanolic and methanolic extracts respectively. The same procedure was repeated for second and third generations after 42 and 63 days respectively. Viability test was carried out after the third generation emergence by germinating the seeds. The results were subjected to analysis of variance.

RESULTS AND DISCUSSION

The result shows that 4% w/v of crude extract of *Z. zanthoxyloides* performed well, reducing total mean weight loss to 1.8g and 3.9g after third generation of ethanol and methanol extracts respectively (figure I) and mean number of insects emerged to 18 and 23 after third generation respectively (figure II). It also gave seed viability test of 77.5 % and 80% respectively (figure III). The result shows no significant difference statistically at 5% probability when compared to that of synthetic insecticide (DDVP). Other concentrations (1% and 2%) did not do comparably well, in fact there appears to be increasing efficacy of the crude extracts with increasing concentration (1 % < 2 % < 4 %).

This result is in conformity with earlier works; on acute toxicity of crude root bark powder of *Z. zanthoxyloides* as contact poison on termites [10]. and on the efficacy of root bark powder of *Z. zanthoxyloides* in arresting *C. maculatus* infestation cowpea at a level comparable to synthetic insecticide Pirimphos methyl [12] and direct toxicity effect of pithraj on red flower beetle [25], Shyialmutra on rice weevil [23] and *Macaranga postulata* on rice weevil [22] following order of toxicity 3%>2%>1%.

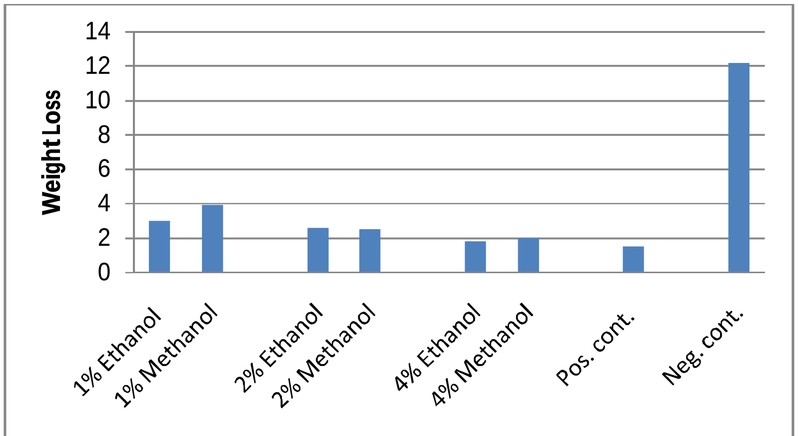

Fig I: Weight Loss/Treatment

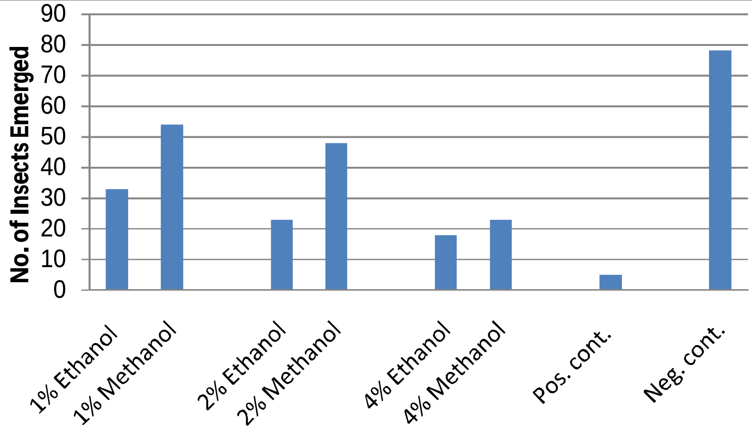

Fig II: Showing No. of Insects Emrged/ Treatment

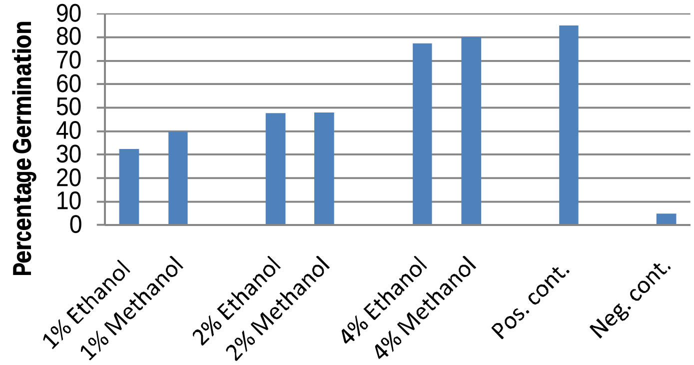

Fig III: Showing Percentage Germination/Treatment

CONCLUSION AND RECOMMENDATION

This research has demonstrated the potential of ethanol and methanol extracts of root bark of *Z. zanthoxyloides* as a biopesticide on *Callosobruchus maculatus* 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 a long way in its utilization and commercialization.

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