Repellance Effect Of Aqueous Extract Of Alligator Pepper (*Aframomum Melegueta K. Schum*) On Insects Of Okra

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ABSTRACT: Food security could be achieved through the use of bio-insecticide to prevent insect attacks on crops which invariably would have cause damage to the crops, thereby resulting in poor crop production. The repellence effect of aqueous extract of Alligator pepper (*Aframomum melegueta K. Schum*) on the growth and yield of okra was investigated. The aqueous seed extract was prepared by air drying the spices material (*A. melegueta*) after drying, the seeds were pulverized to powder. Ten percent (10%) aqueous extract was prepared by soaking 100g of the spice powder in one liter of distilled water and allowed for 24 hours. Different concentrations of the extract were prepared consisting of control (0%), 2.5%, 5.0%, and 10%. The treatment was applied twice a week. Data were collected based on the following parameters. Days to 50% seedling emergence, plant height, number of leaves, leaf area, days to 50% flowering, pod length, number of pods, and number of seeds. The result showed that there were no significant difference ($P>0.05$) in the days to seedling emergence, days to flowering, pod length, number of pods and number of seeds but significant difference ($P<0.05$) was observed on the plant height, leaf area and number of leaves per plant. This result however, indicates that the aqueous seed extract of *A. melegueta* possesses some insecticidal properties in repelling or preventing insects from attacking the okra plant.
[Okpako E.C., Osuagwu A.N., Agbor R.B., Ekpo I.A., Kalu S.E. **Repellance Effect Of Aqueous Extract Of Alligator Pepper (*Aframomum Melegueta K. Schum*) On Insects Of Okra.** *World Rural Observ* 2013;5(3):42-46]. ISSN: 1944-6543 (Print); ISSN: 1944-6551 (Online). http://www.sciencepub.net/rural. 8

Key words: Okra, *Aframomum melegueta*, insect, repellant.

INTRODUCTION

Synthetic insecticides are widely used in most developing countries to control insect pests of food crops. This has contributed to the environmental pollution through air or as residue in food, which variably have affected human health due to the accumulation of some of the toxic compounds found in the insecticides in the food chain. Environmental safety is the surest way of maintaining good health or remaining healthy. The diverse biological activities of *Aframomum melegueta* extract include feeding and oviposition deterrence, repellency, growth disruption, reduced fitness and sterility (Saxena 1989, Isman *et al.,* 1990, Koul *et al.,* 1990, Schmutterer, 1990). Despite the sensitivity of insects of most orders to *A. melegueta* extracts, the extract are selective as they do not harm important natural enemies of pests. *Aframomum* extracts have, therefore, a considerable potential for integrated pest control measures especially in developing countries (Schmutterer, 1990).

Aframomum extracts cause various effects on insects. They act as antifecdants, growth regulators and sterilants. Vegetables in tropical countries are the crops, which are often attacked most seriously by arthropod pests. Okra are grown mostly as intensive crops with considerable input, such as fertilizers, irrigation water, insecticides etc, and often cultivated continuously in a limited area with narrow crop rotation. Thus insects find optimum conditions to develop in high populations. Because of high susceptibility of vegetables to insects, farmers tend to apply chemicals for protective purposes. Also, their high profitability combined with a lack of knowledge by the farmers has often led to improper use in handling synthetic insecticides. This has resulted in great hazards to the environment and the health of users and consumers, as well as serious resistance problems.

In order to support sustainable Okra (vegetable) production, it is important to develop alternative methods of pest control. *Aframomum* extracts, being practically non-toxic to man and warm, blooded animals and relatively harmless to beneficial insects, are very suitable for biological and integrated pest control programs. In addition, in many third world countries, subsistence farmers who cannot afford to purchase synthetic pesticides and other chemical inputs produce vegetables. The results obtained against a considerable number of key pests have been very numerous homopterans because they generally feed on the underside of foliage. Their small size, short life cycle, short generation time, and high fecundity result in high reproductive rates, in population sizes and rapid differentiation of populations into insecticide resistant strains, necessitating increased control actions. The effect of ground powders of two tropical plants, *Lantana*

camara L. and *Tephrosia vogelii* Hook, on the level of insect damage and the grain quality parameters of stored maize were evaluated for five months. The evaluations were aimed at generating natural product treatments suitable for post-harvest grain protection and as sustainable alternatives to synthetic insecticides in the control of the maize weevil, *Sitophilus zeamais* Motschulsky (1961). Three rates (1.0, 2.5 and 5.0% w/w) of each plant powder, a synthetic insecticide, Actellic Super 2% dust at 0.05% w/w and an untreated control were used as treatments. Results showed that the plant powders significantly minimised the magnitude of depression in percent grain moisture content albeit at a lesser rate with high concentration and had no effect on the percent germination of maize grains when compared to the control. The botanical treatments and synthetic insecticide were equally effective in reducing insect damage by 25%, but the level of damage was independent of the concentration applied. Grain colour and odour were unaffected by the botanicals (Ogendo *et al*., 2004).

It is clear that the intensive use of pesticides lead to many problems such as hazards and impacts of the pesticides on the environment, the poor control of pest as consequences of improper use and handling of pesticides and the continuous development of resistance against pesticides by the pest. The farmers without the required technical supervision conduct pest control in vegetable fields. The insecticides which are recommended for vegetables are not much and usually difficult to get, knapsack sprayer are difficult to purchase and to maintain. Alternative strategies to pesticide application are therefore needed for the control of agriculturally important pests. Such strategies will help address public concern regarding pesticide pollution, as well as the perceptions that pesticide residues on food pose a threat to human health. Moreover, due to increasingly large demand of Okra in our market and relatively low supply due to attack by pests, it becomes relevant to devise a new strategy which is economical and effective. The aim of these field trials is to study the effects of *Aframomum* extracts against the insect pest of Okra.

MATERIALS AND METHODS

The experiment was carried out at the Biochemistry Laboratory,, University of Calabar. *A. melegueta* seeds and okra pod were purchased from Watt market Calabar and identified by the plant taxonomist in Botany Department, University of Calabar.

Procedure for extract preparation

The seeds were subsequently sun-dried for one (1) week before being milled into fine powder using a microhammer mill. One hundred (100) grams of the finely milled sample was extracted by dissolving in one (1) litre of distilled water for 24 hours duration with intermittent shaking at intervals to enhance extract efficiency. The result extract solution was then filtered with a fine gauze (Muslin cloth) to remove large particles and seed debris. The filtrate obtained was made up to one (1) litre using distilled water to give a stock solution of ten percent (10%) aqueous extract. Working solutions (2.5%, 5.0% and 10.0%) of the aqueous seed extract of *A. melegueta* were there prepared by appropriate dilutions of the stock solution.

The working solutions were prepared using the formula:

$$C_1 V_1 = C_2 V_2$$

Where C_1 = concentration of the stock solution

V_1 = volume of stock to be taken

C_2 = desired concentration of working solution

V_2 = desired volume of the working solution

2.5% of the extract solution was prepared by taking 250mls from the stock solution and making it up to 1000mls by adding distilled water. 5.0% of the extract solution was prepared by taking 500mls of the stock solution and diluting it by adding 500mls of distilled water to a total of 1000mls.

Planting method

The okra seeds were dried for two weeks, then soaked in water for 24 hours before planting in four bags filled with good planting soil. The experiment consists of four groups: the control group, and three other groups that were treated with the different concentrations of *A. melegueta* ranging from 2.5%, 5.0%, and 10% respectively. Five replications were made from each group to give a total of 20 bags.

Spraying method

Spraying was done twice a week Mondays and Fridays at 9am prompt. The extracts were poured into a small spraying container filled with 2cm of the extract to ensure effective spraying. When spraying the plant with the 5.0 %, a big nylon bag was used to cover the others, to avoid 5.0% from mixing with the 2.5% concentration.

Data collection and statistical analysis

Data collected were subjected to analysis of variance (ANOVA) test while significant means were separated using least significant difference (LSD). Data collection was based on the following; plant height (cm)**,** number of seed pods**,** days to 50% seedling emergence**,** pod length, days to 50% flowering**,** number of pods per plant**,** leaf area.

RESULTS

Days to 50% seeding emergence.

The result obtained showed that there were no significant difference (P>0.05) in the days to 50% seedling emergence treated with aqueous seed extract of alligator pepper. This result thus, implies that the okra was not significantly affected by the insects at this stage of plant growth (Table 1).

Plant height

It was observed from the result that there were significant difference (P<0.05) in the plant height of the okra plant treated with different concentrations of the extract of *Alligator pepper*. The result indicated that the various concentrations of the extract increased the resistance of the okra plant from attack by the insect as compared with the control group. It was however, noted that the higher the concentration of *A. melegueta,* the higher the plant height due to the tolerance of the okra plant to insect attack. The mean values obtained are as shown in Table 1.

Number of leaves

The result for the number of leaves of the okra plant were also significantly different (P<0.05) due to the treatment of the okra with varying concentrations of the *Alligator pepper*. It was observed that no significant difference (P>0.05) existed between the various concentration of the extract of *Alligator pepper* sprayed on the plant. This implies that all the concentrations of the extract had the same impact on the number of leaves as compared with the control that gradually decreased due to the insect attack. The mean values of the number of leaves of the treated okra plant were significantly higher (p<0.05) than that of the control group (Table 1).

Leaf area

The result obtained for leaf area also showed that there were significant difference (P<0.05) in the leaf area of the okra plant. It was observed that the mean values obtained for the okra plant treated with varying concentrations of the extract of alligator pepper was higher than the mean values obtained from the control. This thus implied that the extract of the Alligator pepper possesses some insecticidal properties in controlling the attack of the plant by the insect (Table 1).

Days to 50% flowering

The result of the days to 50% flowering of the okra plant treated with the aqueous extract of Alligator pepper showed no significant difference (p>0.05) with the control group plant. This result also signified that the days to 50% flowering was not affected by the treatment of the okra plant with the extract as compared with the control group (Table 1).

Number of seeds

It was observed that there were no significant difference (P>0.05) in the number of seeds of the okra plant. The numbers of seeds were significantly equal and thus the extract of the Alligator pepper did not have any negative impact on the number of seeds of the okra plant (Table 1).

Number of pods

The result shows that there were no significant difference (P>0.05) in the number of pods of the okra plant. This result implies that the numbers of pods were significantly equal and thus the extract did not possess any negative effect on the number of pods of the okra plant (Table 1).

Pod length

It was observed from the result obtained from the mean values of the pod length of the okra plant treated with the extract of Alligator pepper were not significantly different (P>0.05). The treated Plant and the control group produce equal pod length (Table 1).

Table 1: Growth and morphological features of okra treated with aqueous extract of *A. melegueta*

Parameters	Control	2.5%	5.0%	10.0%	LSD
Days to 50% seeding emergence	5.75^{a}±0.08	5.75^{a}±0.06	5.5^{a}±0.04	5.00^{a}±0.06	NS
Plant height (cm^3)	20.2^{d}±1.03	23.37^{c}±0.98	2683^{b}±1.11	30.5^{a}±1.14	2.20
No of leaves	6.00^{b}±0.84	8.00^{a}0.50	9.00^{a}±0.62	10.00^{a}0.32	1.26
Leaf area (cm^3)	62.00^{b}±1.42	66.48^{a}±1.27	69.33^{a}±1.15	70.13^{a}±1.23	3.29
No of seed	60.75^{a}±2.48	65.5^{a}±2.52	71.75^{a}±3.01	82.5^{a}2.46	16.13
No of pod	1.2^{a}±0.02	1.2^{a}±0.01	1.4^{a}±0.01	1.8^{a}±0.02	NS
Pod length	2.90^{a}±0.10	3.98^{a}±0.14	4.18^{a}0.09	4.2^{a}±0.10	NS
Days to 50% flowering	31.00^{a}±1.88	35.2^{a}±2.05	35.6^{a}±1.24	35.8^{a}±1.11	NS

Means with the same superscript on the horizontal array indicates no significant difference (P>0.05).

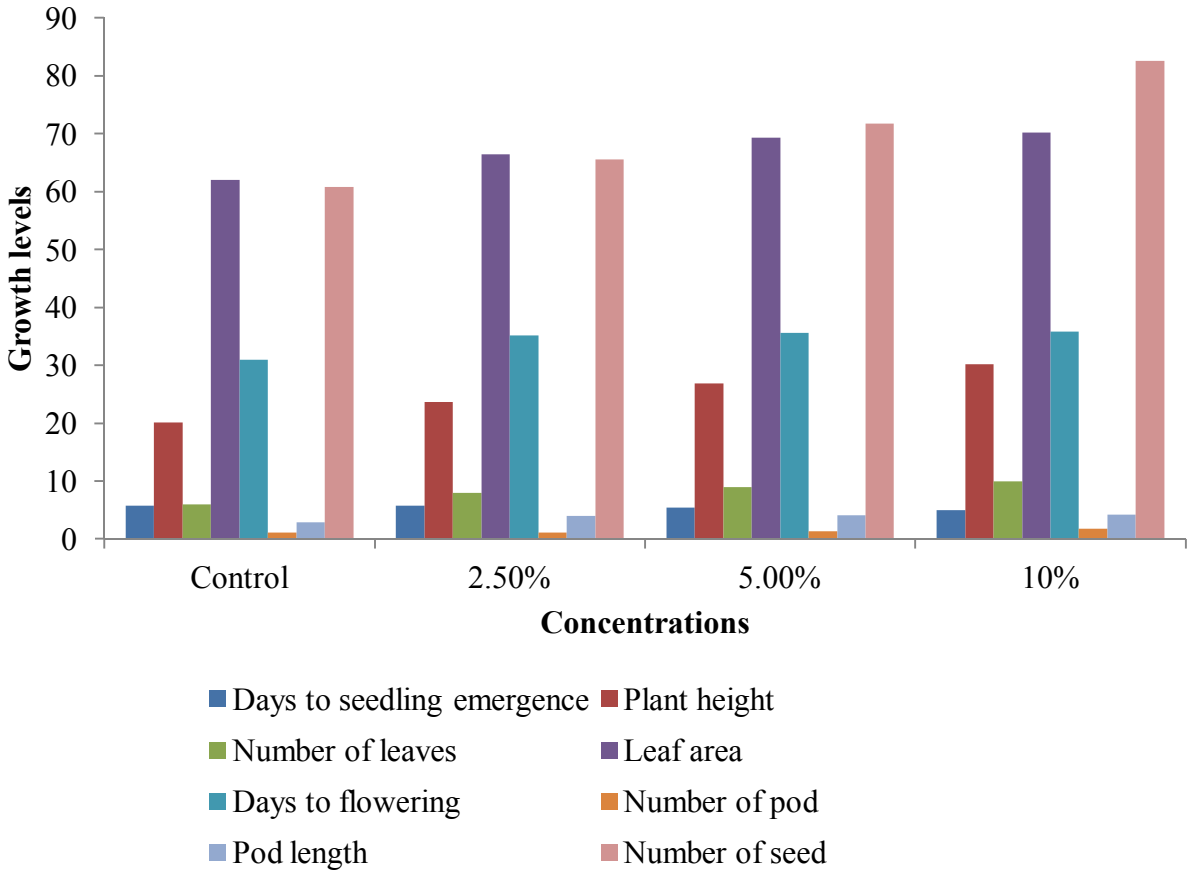

Fig.1: Growth and morphological attributes on okra treated with *A. melegueta*

Discussion

The repellency of plant material has been exploited for thousands of years by man by hanging bruised plants in houses, a practice that is still in wide use throughout the developing countries. Moreover, plants have also been used for centuries in the form of crude fumigants where plants were burnt to drive away nuisance mosquitoes and later as oil formulations applied to the skin or clothes which was first recorded in writings by ancient Greek, Roman and Indian scholars (Maia and Moore, 2011). Conventional insecticides possess inherent toxicities that endanger the health of the farm operators, consumers and the environment. Negative effects on human health led to a resurgence interest in botanical insecticides because of their minimal costs and fewer ecological side effects. Plant- based insecticides are not only toxic to pests, but can also deter and/or repel pests which may contribute to their overall efficacy against some pests that cause great economic loss at the pre- as well as the post-harvest stages of the crop production and reduce transmission of diseases to plants. Moreover, the use of synthetic chemicals has been restricted because of their carcinogenicity, teratogenicity, high and acute residual toxicity, ability to create hormonal imbalance, spermatotoxicity, long degradation period, and result intoxic residues in food (Dubey *et al.,* 2011). As a form of allelopathy, some pesitcidal plants serve as control agents for pests and diseases after intercropping or mix-cropping with the main crop, for example, *N. tabaccum* and some other plant species, especially grasses (Ogunnika, 2007) have been found to possess this attribute. The height of a plant can also be significantly affected by the soil environment, climatic condition and amount of photosynthetic activities that occurred within that environment. The plant height achieved in this study may be as a result of the tolerance conferred on the okra plant by the seed extract of *A. melegueta* which was able to repel the insects from attacking the okra plant. This study showed that the application of the extract using the various concentrations also influences the growth of the okra plant as compared to the control group. This implies that the extract possess the insecticidal elements in reducing insect attack. Pandey *et al.* (1986) reported that petroleum ether extracts of *L. camara* and four other plant

species had no adverse effects on the germination of green gram, Vigna radiate. Reduced leaf area could result in lower photosynthetic capacity for a plant and ultimately limit growth. However, the aqueous extract of the root of *Helianthus tuborosus* L; *Lactuca sativa* and *Circium japonica* all in the family of Asteraceae inhabit the growth of *Amaranthus retroflexus*, *Cucumis sativa* and *Hordeum vulgare*. This study indicated that the aqueous leaf extract of *A. melegueta* did not produce any inhibitory effect on the growth of okra plant rather it increases the performance of the plant due to lesser attack by insects. The result of the yield of the okra plant showed that the days to flowering, number of pod, pod length and number of seeds produced from the plant were not significantly different (P>0.05). This however, implies that though, the extract confer resistance to the okra plant against attack by insects and thus led to the increase in the plant height, the number of leaves and leaf area but the productivity of the plant was the same.

Conclusion

Botanical insecticides for example *A. melegueta* from the result of this study are desirable alternatives to synthetic chemical insecticides for controlling pests. They are best suited for use in organic food production in industrialized countries but can play a much greater role in developing countries as a new class of eco-friendly products for controlling pests.

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7/24/2013