Efficacy Of Plant Derived Insecticides For Control Of Insect Pests Of Garden Egg (*Solanum Spp*.) In Southeastern Nigeria

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Abstract - Early season field trials were conducted in 2011 and 2012 cropping seasons at the experimental site of National Horticultural Research Institute Okigwe, Imo State to evaluate the efficacies of four plant derived insecticides for control of major insect pests of garden egg. The bio-pesticides include Neem (*Azadirachta indica*), African black pepper (*Piper guineense*), (*Jatropha curcas*), Castor seed oil (*Ricinus communis*) and cyperforce insecticide 12.5% E.C and control which constituted the six treatments. The experimental design was randomized complete block design with four replications. Results showed observed commonest insects to include Green leaf hopper (*Empoasca spp*.), Fruit borers (*Leucinodes orbanalis*), variegated grasshopper (*Zonocerus variegatus*) and Cutworms (*Spodoptera littoralis*). All the bio-pesticidal treatments significantly ($P < 0.05$) reduced insect infestation with low damage and higher fruit yield compared with the control. The African black pepper (*Piper guineense*) displayed highest degree of efficacy in this regard of all the plant extracts in both seasons (2011 and 2012). This was followed by neem (*A. indica*), castor seed oil and *Jatropha curcas* in that order. The bio-pesticides compared favourably with the synthetic insecticide which served as a check and recorded lowest insect infestation and highest fruit yield of 13,666.7kg/ha and 16,083.3kg/ha in 2011 and 2012 cropping seasons respectively. The potential of the plant-derived insecticides in controlling the insect pests of garden egg have been identified and hence could be a good alternative for synthetic insecticide and as well could be utilized for such purpose.

Key Words: Efficacy, Extracts, Garden egg, Insect pest.

1. INTRODUCTON

GARDEN egg *(Solanum gilo*.) a native of India is a popular vegetable crop grown in West Africa and the world all over. It is a perennial woody herb of tropical and sub-tropical region and grows to about 1.5m tall, often branched with long taproot [1]. It is one of the five most important indigenous vegetable crops which belongs to the family Solanaceae and can be grown together with tomatoes, onions, peppers and okra grown all over the world [2]. It can tolerate both drought and excessive rainfall. The world production of garden egg is 55,600 ha and the total production is 8,979,000 metric tons [3].

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In Nigeria, different local species/varieties are in existence and are grown by different ethnic groups for local consumption and other uses. The fruits can be eaten raw as a vegetable. It could also be boiled, fried and stuffed before consumption [4]. The leaves of some varieties could also be eaten raw or boiled and hence they are known to provide all the nutritionally important amino-acids, vitamins and minerals in adequate quantities [5]. In addition, the alkaloid solanin extracted from the roots, and fruits are used for theurapeutic purposes [6]. Garden egg supplements starchy foods and also is a cheap source of protein, vitamins and minerals. The prominence of the crop as a vegetable is essentially due to its prolific fruit production, large size of the fruit, quick maturing etc. In the South-eastern Nigeria, the crop is highly cherished and commonly served during traditional/religious ceremonies, title taking /chieftaincy ceremonies, child dedication, wedding ceremonies, burial ceremonies, thanksgiving ceremonies, birthday ceremonies and during meeting. Garden egg production in Nigeria however in on the increase and the quest for its increased production is often constrained by edaphic and biotic factors. Pests and disease complex constitute a major biotic factors militating against increased production of this crop especially during the dry season when it commands prices. Also they tend to pose a serious setback towards its optimum productivity in which they are harmful to the plants thereby reducing yield and economic value of the crop. Prominent among them are defoliators and borers which include *Empoasca* spp, Cutworms, fruit borer (*Leucinodes orbanalis*), *Zonocerus variegatus* leaf miners to mention but a few [7], [8]. The insect pests are reported to account for reduced yield and losses of between 75-90% of the crop [9].

In the recent past, efforts have been intensified to control the associated insect pests of garden egg using synthetic insecticides such as cyperforce, karate, cymbush, attack, decis to mention but a few where promising results were obtained [10]. The hazardous effect of these pesticides has increasingly become a major concern to environmentalist. Thus other options for management of pests became imperative. However, the search for more sustainable non-conventional method using plant derived insecticides that are

environmentally safe with simple application techniques for control of insect pests of garden egg gave rise to my desire to carry out this research work with the objective of contributing to increase in the production and yield of garden egg by reducing its infestation through application of locally available plant materials that are environmentally friendly, of very low cost/cheap, using simple application technique that is always available.

2. MATERIALS AND METHODS

Field experiment was conducted during the early season cropping of 2011 and was repeated at the same cropping season in 2012 at the experimental site of National Horticultural Research Institute (NIHORT) Okigwe, Imo State. The area is situated in the humid rainforest zone of Nigeria and lies on latitude 05^0 33'' N and longitude 07^0 23"" E with an altitude of 130 metres above sea level. The mean temperature of the area varies between 27^0C and 28^0C with relative humidity and mean annual rainfall of 78% and 2048mm respectively. According to reconnaissance soil survey of South-eastern Nigeria [11], Okigwe belong to soil map unit 408 which is characterized by undulation dissected plains derived from shale and sand stones classified as ultisol. Garden egg seeds (variety Ngwa Large) were raised in the nursery and transplanted into the field after six weeks. Land preparation involving slashing, ploughing and harrowing were done with a tractor and marking of plots were also done, each plot measuring 3m x 4m and each plot separated by 2m path. The total area used for the trial was 34m x18m (0.06ha.). Twenty seedlings of Ngwa large garden egg were planted on each plot at a distance of 1m x 1m. There were twenty-four plots on the whole and the experiment was made up of six treatments which were replicated four times arranged in a Randomized Complete Block Design (RCBD). The treatments were:

1. Neem (*Azadirachta indica*) seeds.
2. African black pepper (*Piper guineense*) seeds.
3. *Jatropha curcas* seeds.
4. Castor oil (*Ricinus communis*) seeds.
5. Cyperforce insecticide 12.5% E. C.
6. Control

3. PREPARATION OF THE PLANT EXTRACTS

The plant materials (botanicals) namely neem (*Azadirachta indica*) seeds, African black pepper *(Piper guineense*) seeds, *Jatropha curcas* seeds and castor oil (*Ricinus communis*)seeds used for the experiments were obtained from premises of NIHORT Mbato Sub-station Okigwe Imo State, Federal Government College Okigwe and from markets in Okigwe. The plant materials were allowed to dry under room temperature and exposed in the sun for two days. The dried materials were ground to a fine powder manually with small wooden pestle and mortar and with motorized grinder model Prostar GX 160. Thereafter, one kilogram (1kg) each of the four ground plant materials were poured into 5-litre capacity plastic bucket and allowed to stay for 24 hours. The solutions in the containers (four buckets) were sieved with muslin cloth to get the various extracts for the trial. The treatments (extracts from each of the four plant materials were applied on the plots of the crop with a 5-litre capacity manually operated sprayer. This commenced two weeks after crop establishment and was done at two weeks interval and for seven times before the end of the trial for each season. The cyperforce (insecticidal check) at 12.5% E.C. was also applied using the same equipment after rinsing it thoroughly with water and for the same period till the end of the trial. However, the control plots did not receive bio-pesticidal treatments. Compound fertilizer N.P.K 20:10:10 was applied at the rate of 250kg/ha in two equal split doses at two weeks after transplanting and at the on-set of flowering. Weeding operations were done manually with hoes as the need arises. Insect collection and identification started ten days after crop emergence. These were done using direct count method by carefully walking along the rows of each plot and counting the number of insects seen and at four days interval in the early hours of the day (6.00am – 7.30am). Assessment of infestation was based on the population of the identified major insect pests while damage was based on the number of holes/punctures on the leaves, number of defoliated leaves and damaged fruits. Fruit length and fruit breadth were also determined.. Data collected from the trial were subjected to statistical analysis using Genstat statistical package. Analysis of Variance (ANOVA) tests were conducted and means were separated using Standard Error Difference.

4. RESULTS AND DISCUSSION

Results in table 1 – 4 show the effect of the extracts of the tested plant materials on the insect pest population and yield of the garden egg in 2011 and 2012 cropping seasons. The identified major insect pests of the crop include Green leaf hopper (*Empoasca spp*), cutworms Spodoptera *litteralis*), variegated grasshopper (*Zonocerus variegates*) and fruit borer (*Leucinodes orbanalis*). Generally, all the tested plant extracts reduced significantly ($P < 0.01$) insect population on the garden egg in both seasons. There were no significant difference in the insect pest population in the *Piper guineense* and *Azadirachta indica* treated plots (tables 1 and 2) Of all the plant extracts used in the trial *Piper gineense* seed extract recorded lowest in insect number, number of insect punctures on the leaves and number of defoliated leaves, in 2011 and 2012 cropping season. This was followed by *A infica, J. curcas* and castor seed oil treated plants in that order. The highest insect population was observed in the control for the two seasons and this differed significantly ($P<0.01$) from the treated plants (tables 1 and 2). More so, all aspects of leaf damage in plots sprayed with the plant extracts (botanicals) were not significantly different from that of the synthetic insecticide (Cyperforce) but were significantly different from the control. *Piper guineense recorded* significant lowest number of insects, leaf punctures and defoliated leaves compared with other treatments. The cyperforce insecticide was highest in reducing the number of insects and had the highest yield as well having recorded fruit yield of 15.6kg/plot and 19.8kg/plot in 2011 and 2012 cropping seasons respectively (Table 2). The result is of the indication that the plant extracts/materials differed in their potential for control of insect pests with *P. guineense* and *A. indica* giving more promising results than the other plant extracts used for the trials in both seasons. This however is responsible for low insect infestation and high yield obtained from them. This observation is in agreement with earlier studies by [12] and [13] that *A. indica* whether crude or purified has insecticidal effects on different lepidopteran insect pests. The efficacy of these plant extract especially *A. indica* products could be attributed to the presence of triterpenoids, azadirachtin and salanin that are anti-feedant to growth and modifying

properties of the insects [14], [15]. Neem is reported to contain more than 25 active compounds that combat insect in various ways such as acting as anti-feedant where it suppresses the insects desire to feed, a repellant where the insects simply stayed away from areas sprayed with neem oil and as insect growth regulator, where it disrupts the delicate hormonal balance so that it dies before it moults to the next life stage [16], [17]. Moreso, *Piper guineense* has been found to contain isobutylamides, a plant secondary compounds that act as neurotoxins in insects. These materials are considered safe to mammals because Piper spp. had been used for centuries as a spice for medicinal purposes. Its formulations also had a repellent activity, thus protecting plant leaves [18]. The low yields recorded in the control (untreated) plants in the two cropping seasons could be attributed to the feeding effects of the insects on the leaves of the plant thereby creating extensive tattered holes which invariably reduced photosynthetic activities of the affected plants.. This observation agrees with reports by [19], [20] on the devastating infestation and damage by leaf beetles in their study on the insect pest complex associated with cowpea in Umudike, South-eastern Nigeria which not only resulted in reduction of the photosynthetic activities of the plant but also accounted for low yield of the crop.

5. CONCLUSION.

The results obtained from the studies highlights the feasibility of exploiting various plant-derived insecticides as variable alternatives to conventional insecticides for control of insect pests of garden egg since observation showed that all the plant extracts have insecticidal effect on the insect pests of garden egg with *P.* guineense and *A.* indica giving more promising results than others involved in the trials.

Table 1: Effect of the botanicals on the population of the insect pests of garden egg in Okigwe Southeastern Nigeria in 2011.

Treatment	Mean No. of Green leaf hopper *(Empoasca spp)* per plot.	Mean No. of cutworms (*Spodpotera littoralis)* per plot.	Mean No. of Variegated grasshopper *(Zonocerus variegatus*) per plot	Mean No. of fruit borer *leucinodes orbanalis* (per plot)	Mean No. of Insect punctures/holes on the leaves per plot	Mean No. of defoliated leaves per plot
Neem seeds	2.0[a]	2.4[a]	1.5[a]	2.3	3.9[a]	4.3[a]
African black pepper seeds	1.8[a]	1.8[a]	1.3[a]	1.2[a]	2.7[a]	3.6[a]
Jatropha curcas seeds	5.6ab	6.3[ab]	6.1[ab]	5.7[ab]	8.8[ab]	10.8[ab]
Castor oil seeds	7.3ab	9.1[ab]	5.3[ab]	8.1[ab]	9.3[ab]	11.4[ab]
Cyperforce	1.4[a]	1.6[a]	1.2[a]	1.0[a]	2.0[a]	3.3[a]
Control	12.8[b]	16.8[b]	9.7[b]	14.3[b]	23.4[b]	19.7[b]
S.E. ±	1.04	1.32	021	1.06	1.22	1.58

Table 2: Effect of the botanicals on the population of the insect pests of garden egg in Okigwe Southeastern Nigeria in 2012.

Treatment	Mean No. of Green leaf hopper (*Epoasca* spp.) per plot	Mean No. of Cutworms (*Spodoptera littoralis*) per plot	Mean No. of Variegated grasshopper *(Zonocerus variegatus*) per plot	Mean No. of Fruit borer (*Leucinodes orbanalis)* per plot	Mean No. of Insect holes on the leaves per plot	Mean No. of defoliated leaves per plot
Neem seeds	1.8[a]	2.0[a]	1.8[a]	2.2[a]	3.2[a]	3.3[a]
African black pepper seeds	1.6[a]	1.8[a]	1.4[a]	11.7[a]	2.7[a]	2.1[a]
Jatropha curcas seeds	6..3[ab]	5.4[ab]	5.8[ab]	6.2[ab]	5.8[ab]	6.4[ab]
Castor oil seeds	8.2[ab]	7.6[ab]	7.9[ab]	8.1[ab]	7.7[ab]	8.4[ab]
Cyperforce	1.2[a]	1.4[a]	0.9[a]	1.3[a]	1.6[a]	1.8[b]a
Control	11.4[b]	17.6[b]	15.2[b]	12.3[b]	21.6[b]	20.1[b]
S.E. ±	1.18	1.54	0.27	1.33	1.28	1.63

Table 3: Effect of the botanicals on the yield of garden egg in Okigwe Southeastern Nigeria in 2011.

Treatment	Mean No. of fruits per plot	Mean Wt. of fruit (kg) per plot.	Mean No. of damaged fruits per plot	Mean Wt. of damaged fruit (kg) per plot.
Neem seeds	287.1[a]	14.6a	1.1[a]	0.08[a]
African black pepper seeds	321.3[a]	16.4[a]	0.9[a]	0.08[a]
Jatropha curcas seeds	235.4[ab]	8.2[ab]	1.8[ab]	0.26[ab]
Castor oil seeds	223.5[ab]	8.0[ab]	1.9[ab]	0.28[ab]
Cyperforce	362.1[a]	15.6[a]	0.7[a]	0.06[a]
Control	175.3[b]	5.4[b]	4.2[b]	0.51[b]
S.E. ±	0.33	0.83	0.31	0.26

Table 4: Effect of the botanicals on the yield of garden egg in Okigwe Southeastern Nigeria in 2012.

Treatment	Mean No. of fruits per plot	Mean Wt. of fruit (kg) per plot	Mean No. of damaged fruits per plot	Mean Wt. of damaged fruit (kg) per plot.
Neem seeds	307.4[a]	15.3[a]	2.1[a]	0.52[a]
African black pepper seeds	378.2[a]	19.3[a]	1.8a	0.36[a]
Jatropha curcas seeds	232.7[ab]	12.1[ab]	2.8[ab]	0.73[ab]
Castor oil seeds	219.6[ab]	11.4[ab]	3.1[ab]	1.12[ab]
Cyperforce	396.8[a]	19.8[a]	1.3[a]	0.33[a]
Control	187.9[b]	9.6[b]	7.4[b]	2.14[b]
S.E. ±	0.41	0.94	0.36	0.29

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