

RESEARCH ARTICLE

EFFICACY OF CONCENTRATION LEVELS OF SOME PLANT EXTRACTS ON INSECT PEST INFESTATION, GROWTH AND YIELD OF FLUTED PUMPKIN (*Telfairia occidentalis* HOOK. F) IN OKIGWE SOUTHEASTERN NIGERIA.

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ABSTRACT

Field experiments were carried out at the National Horticultural Research Institute, Mbato Okigwe Out-station, Imo State during the early cropping seasons of 2015 and 2016 to evaluate the efficacy of some ethanol plant leaf extracts of Garlic (*Allium sativum*) and Neem (*Azadirachta indica*) on the insect pests of *Telfairia occidentalis*. Three levels of concentration of each of the two extracts viz: 50%, 75% and 100% were used. There were eight treatments for each season which were replicated three times in a split-plot experimental design. Cypermethrine (12.5% E.C) served as insecticidal check. Result of the studies in 2015 and 2016 cropping seasons showed the identified insect pests of the crop to include Leaf beetle (*Podagrica* spp), *Zonocerus variegatus*, *Aulucephora* spp and Fruit flies (*Dacus* spp.). The result also showed that the three levels of concentration of the active ingredients oleoresin oil and azadirachtin of the tested plant extracts at bi-weekly spraying interval were efficacious in controlling the insect pests. The identified insect pests though constituted a nuisance to the *Telfairia* leaves by feeding on them but the damage caused was very low or minimal on the plants treated with the active ingredients of the extracts compared with the untreated in both cropping seasons. Also plants treated with 100% and 75% concentrations of the active ingredients of *A. sativum* and *A. indica* significantly gave more yield in terms of leaf, vine number, pod number and pod weight than other levels of concentration of both plant extracts used in the trial. The efficacy of the cypermethrine was highest for all the parameters considered. The study also revealed that the extracts at higher concentrations of 75% of the active ingredients and above are efficacious and could serve as an alternative in the control of insect pest of *Telfairia occidentalis*.

KEYWORDS: efficacy, extracts, insect pest, *Telfairia occidentalis*.

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INTRODUCTION

Telfairia occidentalis Hook. F., commonly called Fluted pumpkin is an important vegetable crop grown in Nigeria. It is a tropical vine which originated from Tropical West Africa. It is cultivated mainly in West African countries especially Nigeria, Ghana and Sierra-Leone for its leaves and seeds (Akoroda, 1990 and Wikipedia, 2007). Fluted pumpkin is a member of the family Curcubitaceae which are mostly prostrate or climbing herbaceous annuals or perennials (Uguru and Onovo, 2011). It is widely grown in the South-eastern part of Nigeria as a leaf and seed vegetable. Its versatility for use in the preparation of various dishes makes it increasingly popular in Nigeria hence it is referred to as “Ugu” in Igbo, “Ubon” in Efik and “Iroko” in Yoruba (Denton *et al.*, 2000).

However, all parts of the plant (leaves, shoots, stems, vines and roots) are crucial in nutrition, medicine and industry. The leaves and young shoots (up to 60 cm long) are edible as they can be harvested for food after a month of germination and subsequently every two weeks. The seeds preferably are eaten whole in the immature stage or grind into powder for soup or made into a fermented porridge and it has oil and protein content of 29% and 30% respectively (Agoro, 1995, Agatenor, 2006). The oil extracted from the seeds is not drying and is very useful in soap making; in cookies formulation and margarine production. *Telfairia* enhances breast milk production and hence its high demand by women and young babies (Akintayo, 1997). The extract from the leaves is a rich source of protein, vitamins and iron and has been recommended for anaemic patients and weak persons such as those convalescing from malaria. They also nourish, protect and heal the body (Aregheore, 2007).

The various uses to which *Telfairia occidentalis* (Ugu) can be put has undoubtedly led to a tremendous increase in demand for the crop and hence the need for increase in its cultivation. Low production or set back of the crop has been attributed to serious insect pest infestation. The insects feed on the leaves of the crop thereby creating tattered holes on them and defoliation of the leaves when infestation is severe. They also contribute to perforation of the leaves, leaf scarification all of which can result in reduction of the photosynthetic ability of the plant, reduction in yield as well as vector of other plant diseases (Emosairue, 2007). All over the world, current agricultural practices are moving away from the use of synthetic chemicals due to their adverse effects on man, livestock and the environment. Nigeria is endowed with abundant plant materials, which at various concentrations may be employed to fight insect pests and Phyto-pathogens (Dales, 1996). Ecologically friendly plant protection is critical in the development and application of economically sustainable pest and disease management techniques aimed at obviating the need for synthetic pesticides. It was against this background that the idea to carry out these investigations came to mind with a view of evaluating their efficacy for control of insect pests of *Telfairia occidentalis* in Okigwe, South-eastern Nigeria.

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MATERIALS AND METHODS

This experiments were conducted during the early season planting between February and August of 2015 and 2016 at the experimental field site of National Horticultural Research Institute Mbato Okigwe Out-station in Imo State. The site is located in the humid rainforest zone of Nigeria and lies on latitude 05033N and longitude 07023E with an altitude of 130 meters above sea level. The mean temperature of the area varies between 27°C and 28°C with mean annual rainfall of 2048mm. The location is also associated with high relative humidity with average values ranging from 78% in February to 85 % in July and September (Ortiz *et al.*, 1997).

Soil Analysis

A pre-planting soil sample was collected from a depth of 0-20cm using soil sampling auger. The soil sample was air dried, sieved using a 2mm mesh size sieve and then subjected to routine laboratory analysis. Organic matter (O.M) was determined by Walkley –Black dichromate digestion method (Nelson and Sommers, 1982) and total soil nitrogen was determined by the Kjeldahl method (Bremaer and Muivancy, 1982). Available P was determined by Bray-1 method. Exchangeable K⁺, Ca²⁺ and Mg²⁺ were extracted using ammonium acetate. Potassium was determined using Flame photometer and Ca and Mg by EDTA titrator. The soil pH in 0.01m CaCl₂ was determined using glass electrode.

The soil of the study area is classified as Ultisol derived from shale/sandstone. The soil was sandy loam (743g/kg sand, 155g/kg silt, 122g/kg clay) characterised by low organic matter, low C.E.C and are highly leached (Onweremadu *et al.*, 2011). The physical and chemical properties of the soil are presented in Table 1.

Table 1: Some physical and chemical composition of soil used for the trial.

Properties	Soil
pH	4.98
Total N (g/kg)	0.90
Available P (mg/kg)	6.80
Exch. K (cmol/kg)	0.19
Exch. Ca (cmol/kg)	3.20
Exch. Mg (cmol/kg)	1.60
Organic matter (g/kg)	0.17

Land preparation involving slashing, ploughing and harrowing were done with a tractor after which demarcation and marking of plots were also done, each plot measuring 1m x 1m and the plots separated by 1m path. The total area used for each of the trials for each season was 15m x 5m (0.008 ha). *Telfairia occidentalis* seeds V--1 variety obtained from National Horticultural

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Research Institute Mbato Okigwe Out- station in Imo State were planted in a concrete trough containing saw-dust and watered regularly. The seedlings were transplanted in the plots at a distance of 0.5m x 0.5m two weeks after germination. There were 24 plots and each of the experiments was made up 8 treatments which were replicated three times arranged in a Split plot design. The treatments were shown in Table 2.

Table 2. Treatments and level of concentration used for the experiment.

Treatment		Concentration	Plant material
1.	G ₁	50%	<i>Allium sativum</i>
2.	G ₂	75%	<i>Allium sativum</i>
3.	G ₃	100%	<i>Allium sativum</i>
4.	N ₁	50%	<i>Azadirachta indica</i>
5.	N ₂	75%	<i>Azadirachta indica</i>
6.	N ₃	100%	<i>Azadirachta indica</i>
7.	CY		Cypermethrin.
8.	NS		Non-sprayed
(Control).			
G	=	Garlic (<i>Allium sativum</i>),	N = Neem (<i>Azadirachta indica</i>).
CY	=	Cypermethrine,	NS = Non - sprayed (Control).

PREPARATION OF THE PLANT EXTRACTS

The plant materials for the trials in both cropping seasons namely *Allium sativum* rhizomes and *Azadirachta indica* leaves used for the experiments were obtained/sourced from NIHORT premises and fields as well as from markets in Okigwe.

The plant materials were allowed to dry under room temperature and in the sun for four days. The dried materials were ground to a fine powder manually with small wooden pestle and mortar and with motorized grinder (Honda Prostar GX 120 Model). Thereafter one kilogram (1kg) each of the two ground plant materials were poured into 5-litre capacity plastic buckets. Two litres of ethanol was measured and poured into each of the two buckets containing the ground plant materials and were allowed to stay for 24 hours. The solution in the containers (two buckets) were sieved with muslin cloth to get the various extracts for the trial. The extracts were then allowed to stay for another 24 hours. Thereafter, they (the extracts) were sieved again with muslin cloth. The various concentrations to be used for the experiment viz 50%, 75% and 100% for each of the plant extracts were worked out; for example, for 50% concentration, 50% of the extract was mixed with 50% of water, for 75% concentration, 75% of the extract was mixed (diluted) with 25% of water while 100% of the concentration remained undiluted (was not mixed or diluted with water). The treatments (the various concentrations of the extracts) 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



ten times before the end of the trials. The cypermethrine (insecticidal check) at 12.5% E.C was also applied using the same spraying equipment and for the same period till the end of the trials.

Compound fertilizer N.P.K 20:10:10 at the rate of 200kg/ha was applied in two split doses. The first dose was given two weeks after establishment while the second dose was done two weeks after flowering.

Weeding operations were done manually with hoes when necessary.

Insect collection and identification started ten days after crop emergence. These were done manually using direct count method by carefully walking along the rows of each plot and counting the number of insects seen at four days interval preferably in the early hours of the day (6.0am – 7.30am). Data was collected on the number of vines, vine length, leaf number, number and weight of marketable pods. Assessment of infestation was based on the population of the associated/identified major insect pests per plot while damage was based on the number of holes/punctures on the leaves due to attack by the associated insect pests.

Data collected from the trials were subjected to statistical analysis using Genstat statistical package. Analysis of Variance (ANOVA) tests were conducted and means were separated using Least Significant Difference (LSD) at 5% level of probability.

RESULTS AND DISCUSSION

Table 3: Effects of the concentration level of extracts of Garlic (*A. sativum*) and Neem (*A. indica*) on Insect pests of *Telfairia occidentalis* at Okigwe Southeastern Nigeria in 2015.

Treatment	Mean No of <i>Podagrica</i> spp	Mean No of <i>Zonocerus</i> <i>variegatus</i>	Mean No of <i>Aulacophora</i> <i>africana</i>	Mean No of <i>Dacus</i> spp (Fruit Flies)	Mean No of Damaged leaves
G ₁	4.0	1.2	4.6	4.5	1.2
G ₂	3.8	1.5	4.0	4.2	0.8
G ₃	2.5	1.3	3.4	3.5	0.5
N ₁	7.4	2.0	5.2	6.0	1.6
N ₂	5.3	1.4	4.3	4.8	1.0
N ₃	3.6	1.5	3.8	3.8	0.8
Cy	2.3	1.2	3.6	3.0	0.3
NS	9.3	3.8	9.6	8.7	5.8
LSD (0.05)	0.82	0.57	1.06	0.93	0.34
G = Garlic (<i>Allium sativum</i>), N = Neem (<i>Azadirachta indica</i>).					
CY = Cypermethrine, NS = Non – sprayed (Control).					

The identified insect pest of the Fluted pumpkin (*Telfairia occidentalis*) which include flea beetles (*Podagrica* spp), Variegated grasshopper (*Zonocerus variegatus*), *Aulacophora*



africana and fruit flies (*Dacus* spp) as well as the effect of the different concentrations of the aqueous plant extracts on them in 2015 and 2016 cropping seasons are shown in Tables 3 - 6. All the aqueous plant extracts significantly reduced the population of the insects and damage on the leaves compared with the control. Insect population reduction was however greatest with 100% concentration of garlic (*A. sativum*) extract, which is also not significantly different from those of 100% concentration of neem (*A. indica*) and 75% concentrations of *A. sativum* and *A. indica* extracts in both seasons (Tables 3 and 4). Synthetic insecticide (cypermethrin 12.5% E.C) had the highest efficacy in terms of reduction in insect population and damage on the leaves compared to the different concentrations of the plant extracts. However, higher insect population was recorded in 2016 cropping season than in 2015.

Table 4. Effects of the concentration level of extracts of Garlic (*A. sativum*) and Neem (*A. indica*) on Insect pests of *Telfairia occidentalis* at Okigwe Southeastern Nigeria in 2016.

Treatment	Mean No of <i>Podagrica</i> spp	Mean No of <i>Zonocerus</i> <i>variegatus</i>	Mean No of <i>Aulacophora</i> <i>africana</i>	Mean No of <i>Dacus</i> spp (Fruit Flies)	Mean No of Damaged leaves
G ₁	4.8	3.4	5.1	4.8	1.6
G ₂	4.2	3.9	4.8	4.5	1.1
G ₃	2.9	2.5	3.9	3.8	0.9
N ₁	8.3	4.1	6.4	6.4	1.8
N ₂	6.1	3.6	5.0	4.5	1.3
N ₃	4.3	2.8	4.2	4.1	1.0
Cy	2.9	2.1	3.4	3.1	0.8
NS	11.5	5.7	11.5	10.8	6.7
LSD (0.05)	0.93	0.63	1.09	0.99	0.42

G = Garlic (*Allium sativum*), N = Neem (*Azadirachta indica*),
CY = Cypermethrine NS = Non - sprayed (Control).

Table 5: Effects of the concentration level of extracts of Garlic (*A. sativum*) and Neem (*A. indica*) on yield and yield component of *Telfairia occidentalis* at Okigwe Southeastern Nigeria in 2015

Treatment	Mean Vine length (m)	Mean Number of leaves per plant	Mean Fresh Shoot/Leaves of per per plot	Mean No of pods per plot	Mean Weight of pods per plot (kg).
G ₁	3.40	233.0	6.4	3.0	3.3
G ₂	3.56	250.7	7.3	3.4	3.6
G ₃	4.03	294.1	8.1	4.6	4.7
N ₁	3.24	228.5	6.0	2.7	3.0
N ₂	3.41	243.6	6.4	3.0	3.2
N ₃	3.64	284.4	6.8	4.0	4.2
Cy	4.22	298.2	7.6	5.3	5.6
NS	3.13	206.2	5.2	2.4	2.8
LSD (0.05)	NS	NS	1.09	0.56	0.74

G = Garlic (*Allium sativum*), N = Neem (*Azadirachta indica*),
CY = Cypermethrine NS = Non - sprayed (Control).



Tables 5 and 6 show the effect of the different concentrations of the aqueous plant extracts of *A. sativum* and *A. indica* on the yield components of *Telfairia occidentalis* for the two cropping seasons. Significant ($P < 0.05$) differences existed in the fresh leaves/shoot, number of pods and weight of pods for all the concentrations of the bio-pesticides used in the trials. Higher yield in terms of fresh leaf weight, pod number and pod weight were recorded in the plants treated with 100% and 75% concentration of *A. sativum* and *A. indica* and this differed significantly from the untreated (control). However, no significant differences were recorded in the number of leaves and vine length in the treated plots and control. Highest yield of 7.6kg, 5.3 and 5.6kg were recorded for fresh leaves/shoots, number of pods and weight of pods respectively for cypermethrin treated plots in 2015. Similar result was obtained in 2016 cropping season for cypermethrin treated plots for the same parameters (Tables 5 and 6). The control (untreated) plots recorded highest insect population and lowest yield compared to the treated ones.

Table 6: Effects of the concentration level of extracts of Garlic (*A. sativum*) and Neem (*A. indica*) on yield and yield component of *Telfairia occidentalis* at Okigwe Southeastern Nigeria in 2016

Treatment	Mean Vine length (m)	Mean Number of leaves per plant	Mean Fresh Shoot/Leaves per plot	Mean No of pods per plot	Mean Weight of pods per plot (kg).
G ₁	3.68	246.3	6.8	3.8	3.9
G ₂	3.73	264.1	7.9	4.2	4.6
G ₃	4.37	311.6	8.3	4.8	5.3
N ₁	3.11	234.6	6.6	3.3	3.6
N ₂	3.65	257.2	6.9	3.9	4.4
N ₃	4.18	302.4	7.5	4.1	4.9
Cy	4.86	373.0	8.7	6.0	6.3
NS	3.40	237.8	5.4	2.9	3.3
LSD (0.05)	NS	NS	1.09	0.63	0.86

G = Garlic (*Allium sativum*), N = Neem (*Azadirachta indica*).

CY = Cypermethrine NS = Non – sprayed (Control).

The studies have shown the effectiveness of 75% and 100% of *A. sativum* and *A. indica* in reducing the insect population on *Telfairia occidentalis* with the attendant increase in yield. The efficacy of the extracts could be attributed to their active ingredients oleoresin oil and azadirachtin for *A. sativum* and *A. indica* respectively which can combat insect in various ways such as acting as anti-feedant, repellent and as insect growth inhibitor (Sridhar and Vijayalakshmi, 2002). This observation is in agreement with earlier studies by Ibekwe *et. al.*, (2015) where promising results were obtained in terms of reduced insect infestation and increased yield on water melon using some plant leaf extracts. It also supports the observation of other investigators (Singh *et. al.*, 1997) who found that garlic (*A. sativum*) extracts were



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effective in controlling insect pests on vegetables. The insects apart from direct damage suck sap from plants and cause them great debilitation and their affect their vigour and yield. (Emosairue, 2007).

CONCLUSION

The trials have shown that above 75% concentration of extracts of *A. sativum* and *A. indica* significantly reduced the insect population and increased yield of *Telfairia occidentalis*. The results from the economic point of view indicated that the extracts apart from being highly efficacious were less cost effective compared to the cypermethrin (synthetic insecticide) which recorded the highest efficacy.

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