



Comparative Efficacy of Cypermethrin and Plant Extract in the Control of Cucumber Pests in Ado Ekiti, Southwestern Nigeria

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

Cucumber (*Cucumis Sativus*) is widely cultivated and consumed in the tropics as a source of fruit vegetable for man due to its numerous health benefits. Attainable yield in the farmers farm is considerably low due to the problem of insect pest attack. Based on the above, experiment was conducted to investigate the efficacy of cypermethrin and three plant extracts (*Datura stramonium*, *Ricinus communis* and *Sida acuta*) in the control of insect pest associated with cucumber. Cucumber variety Cu 999 was planted on a 2 x 2 m at a spacing of 40cm x 40cm. three concentrations of the extracts was used in the control of the pest and cypermethrin insecticide was used as a standard check. The control plot in each case was sprayed with distilled water. Data collected were subjected to analysis of variance and means separated using least significant different at ($p \leq 0.05$). Result from the study shows statistically significant variations. Eight insect pests belonging to different families were frequently observed on the cucumber. Incidence of normal fruits were generally higher than abnormal fruits at all the tested concentrations. At 65 % concentration with extracts of *D. stramonium*, incidence of normal fruit (80.3 %) was not

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significantly different from that of cypermethrin insecticide (82.6 %). Yield of cucumber sprayer with 65% concentration of *D. stramonium* (250 kg/ha) was not significantly different from that of cypermethrin insecticide (254 kg/ha). The study concluded that extracts of the three plants can replace the synthetic insecticide in the management of the insect plant of cucumber with corresponding yield.

Keywords: *Cucumber; plant extracts; cypermethrin; insect pests.*

1. INTRODUCTION

“Cucumber (*Cucumis sativus*) belong to the family Cucurbitaceae. It is a plant that is widely cultivated in both the tropical and temperate countries as a source of vegetable for man” (Falade [1] “Cucumber is a good source of vitamin C and an antioxidant nutrient rich in beta carotene and manganese. Cucumber is also useful as body dehydration. Apart from that, it has been reported that its use on the skin helps to ease sun burn pain, swellings and damage of skin” (Mary, 2020). “Cucumber originated from India about 3000 years ago and from there it extended to Greece and Rome from there it was introduced to China” [2]. It was introduced to Africa through Namibia, Botswana, South Africa and Swaziland. Today it is grown virtually in all countries of Africa [3]. “Estimated world production in 2020 was 91, 258, 272 million tonnes (MMT) and China is the leading producer accounting for about 80% production (72,779,73 MMT). This is closely followed by Turkey (1,926,883) and Russia (1,686,976). West Africa especially Nigeria, Egypt, Ghana and Niger are the key cucumber producing countries” [4]. “Egypt is the largest producer accounting for about 488,723 tonnes [5]. Nigeria produces about 27,000 tonnes, this output is considerably low due to some limiting factor which hinder production like problem of soil, climate, seed, pest and diseases. Scarcity of planting materials, lack of capital, high fruit perishable and lack of production experience” [6].

“In Nigeria production of cucumber has not been ranked. It is grown mostly in Jos, Kano, Kaduna, Jigawa and more recently in the southern part of the country particularly in Ekiti, Ondo and Osun” [6]. “Cucumber does well on well drained fertile soils with pH of about 6-7 and ample richness of organic matter” [7]. It is often planted on raised soils and the crop require a good amount of sunshine, warmth and high amount of rain fall.

Insect pests had been reported to affect the yield or productivity of cucumber with serious economic implications. Odewale et al, [8] reported the preliminary study of insect pest

association with production of cucumber in Ogbomoso agricultural zone, the study concluded that four insect pests belonging to two families were observed to affect the yield of cucumber. In another development, Arogundade et al. [9] reported four beetles and three aphids are known to attack cucumber production.

Similarly, Falade, 2022 reported that about 23 insect pests belonging to fifteen families affect the yield or productivity of cucumber in Ado-Ekiti South Western Nigeria. Control of these insect pest has been achieved in time past with the use of insecticides. These insecticides are usually very effective in reducing insect population beyond economic injury level. However, they have adverse effect on soil and environment, apart from that some of the insecticides are generally costly and beyond the reach of the farmers. In addition, there is always the problem of insect resistant to insecticide and resurgence of sprayed pest. Based on the above, there is therefore the need to search for botanicals that are cheap, readily available which does not have adverse effect on the soil and environment in the management of cucumber pests [10].

Leaf extracts of drumstick tree (*Moringa oliefera*) (Marala, et al., 2017), Jimson weed (*Datura stramonium*) Falade [6] and Tobacco (*Nicotiana tabacum*) (Anne, 2004) has been successfully used in the control of diseases, but its use in the management of cucumber pest has not been exploited. Based on the above, the present study was carried out to compare the effect of the extracts of the three plants at three concentrations with that of cypermethrin insecticide in the management of cucumber pest.

2. MATERIALS AND METHODS

2.1 Location of the Experimental Site

This experiment was conducted at Ekiti State University Teaching and Research Farm Ado-Ekiti, The University Teaching and Research Farm is located in latitude 7.7129°N and longitude 5.2523°E with mean annual rainfall of 1478mm, the average minimum and maximum

temperature are 27.2°C and 22.9°C respectively. The relative humidity ranges from 47.38% to 88.19%.

2.2 Collection and Preparation of Plant Materials (leaves)

Leaves of the three plants namely; *D. stramonim* (Linn), *R. communis* (Linn) and *S. acuta* (Burm.f.) were collected at Ekiti State University, Ado Ekiti and air-dried at 28° ±2°C for 5-6 weeks to constant weight. Dried leaves were milled using a blender (Okapi, Mixed-Grinder), packaged into sealable nylon and refrigerated at 4°C for 2 weeks (until they were required for bioassay).

2.3 Pre-Planting, Planting and Post Planting Operations

The site was cleared of existing vegetation and packing of debris was carried out before it was made into ridges. The experimental plot was tilled using a hoe and poultry manure was incorporated into the soil before planting. Cucumber variety Cu 999 was planted at a spacing of 40cm x 40cm. Two seeds were planted per hole and thinning was done to one seed per stand after germination, wetting of the plant was done twice in the morning (6-7 am) and evening (6-7 pm). Weeding was done twice with the use of a hoe. Three weeks after germination, taking was done and the rope was used to twine the cucumber to support the stem of the plant and also prevent trailing of the branch on the ground. Harvesting was done six weeks after planting.

2.4 Preparation of Plant Extracts

Extracts were prepared by mixing equivalent grams of prepared plant powder (65, 50 and 30/g) with 100ml of distilled hot water maintained at 70°C in 500ml bottles and kept in hot water bath-shaker for 30 minutes. Thereafter, the liquid extract was separated by using two folds cheese cloth and poured inside standard bottles which were refrigerated at 4°C. These extracts were used as the stock solution from which 65%, 50% and 30% of each extracts were prepared.

2.5 Field Experiment

The field experiment was conducted at the Teaching and Research Farm, Ekiti state University between April and May, 2022. Cucumber variety (Cu 999) was planted on 2 x 2m plot at a spacing of 40cm x 40cm. two seeds were planted per hole which was later thinned to

one per stand. Total area of the farm (120m²) was laid in a randomized complete block design and three leaf extracts: *D. stramonium*, *R. communis* and *S. acuta* was applied at three concentrations (65.50 and 30%). This was used as a foliar spray to control the insect pest frequently observed on the plot while cypermethrin insecticide was used as a standard check. The control plot in each case was sprayed with distilled water. The spraying of the extracts was done every week starting from two weeks after germination till period of maturity. Throughout the experiment, spraying was done with the aid of a hand operated sprayer in the morning between 7am – 8am

2.6 Identification of the Insects

“Before the identification of insects, petri dish were sprayed with ethanol and cleaned with tissue paper. Filter paper was spread inside the petri dishes before the identification of insect, the insects were washed with ethanol and then placed in a petri dish and later preserved in the refrigerator. The identification was carried out using a stereomicroscope and family identification was carried out in respect to its morphology” (Falade, 2022).

2.7 Data Collection

Data was collected on the number of insect pest that frequently visit the cucumber plot in the morning and the evening, and the was used for the identification of their various families. After maturity, data was collected on normal and abnormal cucumber. The normal cucumbers were those that were straight without oblong shape while the abnormal one had a deformed shape

2.8 Data Analysis

Data collected were analyzed using analysis of variance (ANOVA) and means separated using Least significant difference with the aid of SPSS statistical software.

3. RESULTS

Table 1 shows the list of insect pest associated with the production of cucumber in Ado-Ekiti, result from the study shows that eight insect pests belonging to different families were frequently observed on the cucumber plot. They have different feeding habit, some of them feed on leaves and stem while other ones feed on the fruits.

Table 2 shows the incidence of normal and abnormal fruits of cucumber sprayed with different concentrations of plant extracts and cypermethrin insecticides. Result from the study shows that incidence of normal fruits were generally higher than abnormal fruits in all the treated plots than the control. Incidence of abnormal fruits recorded in all the treated plots were generally low. At higher concentrations of plant extracts (65%), there was no significant

difference ($p \leq 0.05$) in the incidence of the disease treated with plant extracts and cypermethrin insecticide. However, at lower concentrations (50 and 30%), significant differences were observed.

Table 3 shows the effect of the three plant extracts and cypermethrin insecticide on the yield of cucumber. Yield of cucumber was generally higher in all the treated plots than the

Table 1. List of insect pest associated with cucumber production in Ado-Ekiti

Common name	Order	Family	Genus	Spp
Orange cucumber beetle	Coleoptera	Chrysomelidae	<i>Aulacophora</i>	<i>Aulacophora spp</i>
Blue cucumber beetle	Coleoptera	Chrysomelidae	<i>Podagrica</i>	<i>podagrica malvae</i>
Cotton Stainer	Hemiptera	Pyrrhocoridae	<i>Dysdercus</i>	<i>Dysdercus flavidus</i>
Long Horned grasshopper	Orthoptera	Tettigonidae	<i>Phlugis Phlugis</i>	<i>manstipa</i>
Grasshopper	Orthoptera	Acrididae	<i>Schistorcera</i>	<i>Schistorcera Americ</i>
Cinnabar moth caterpillar	Lepidoptera	Erebidae	<i>Tyria</i>	<i>Tyria jacobaeae</i>
Black cotton stainer	Hemiptera	Pyrrhocoridae	<i>Dysdercus</i>	<i>Dysdercus mimulus</i>

Table 2. Incidence of normal and abnormal fruit of cucumber sprayed with plant extract and cypermethrin

Plant Extract	Incidence of Normal/abnormal Fruit Cucumber (%)		
	Conc.	Normal Fruit	Abnormal Fruit
<i>D. stramonium</i>	65	80.20 ^a	19.80 ^a
	50	68.30 ^b	31.70 ^b
	30	54.10 ^c	45.9 ^c
	0	35.4 ^d	64.6 ^d
	65	77.64 ^a	22.36 ^a
<i>R. communis</i>	50	64.70 ^b	35.30 ^b
	30	51.20 ^c	48.80 ^c
	0	33.60 ^d	66.40 ^d
	65	75.60 ^a	24.40 ^a
<i>S. acuta</i>	50	62.50 ^b	37.50 ^b
	30	50.30 ^c	49.70 ^c
	0	34.70 ^d	65.30 ^d
Cypermethrin	0.1g/litre	82.6 ^a	17.40 ^a

Table 3. Effect of plant extracts and cypermethrin on yield of cucumber

Plant extract	Conc. % (w/v)	Yield (kg/ha)
<i>D. stramonium</i>	65	250 ^a
	50	234 ^b
	30	150 ^c
	0	57 ^d
	65	244 ^a
<i>R. communis</i>	50	229 ^b
	30	146 ^c
	0	58 ^d
	65	240 ^a
<i>S. acuta</i>	50	223 ^b
	30	147 ^c
	0	57 ^d
Cypermethrin	0.1g/litre	254 ^a

control. The control plot gave the lowest yield. Similarly yield of the cucumber was concentration dependent, at higher concentrations (65%), yield was relatively higher and comparable with that obtained from the use of insecticide. However, as concentration reduced from 65% to 50 and 30%, the yield obtained from plots treated with insecticides were significantly higher than those treated with plant extracts.

4. DISCUSSION AND CONCLUSION

Cucumber as a fruit vegetable consumed by man has been implicated to have many health benefits thus increasing longevity, production in the tropics has been increasing. However, attainable yield in the farmers farm has been considerably low due to the problem of insect pest known to reduce the yield and quality of output with serious economic implications (Falade, 2022). In this study, eight insect pests belonging to six families and orders were observed on the cucumber. Some of them eat the leaf, fruits and stem, the insect pest were observed at various stages of growth and their effect reduced the yield or productivity of the cucumber which have a direct effect on the farmer's income.

The result of this study agrees with the work of Odewale et al., (2015) who reported "a study on the insect pest associated with the production of cucumber in Ogbomoso agricultural zone. The study shows that four insect pests from two families were reported to attack the cucumber at various stages of production". In this study, Incidence of normal fruits were generally higher than abnormal fruits at all the tested concentration. Normal fruits were the cucumber that were straight and strong without spots or any wrinkles abnormal fruits were those that were curved with oblong shapes. At high concentrations of all the plant extracts (65%), the incidence of normal fruits observed was not significantly different from the one obtained with the spray of cypermethrin insecticide. This may be due to the presence of chemicals released by the spray of extracts that inhibit the feeding of the insect pests on the cucumber. However, at lower concentrations of the extracts, significant differences were observed. Incidence of abnormal fruits was significantly ($p \leq 0.05$) higher in the control plot than the treated plots. This study is in line with the work of Jimoh et al. [11] who reported that incidence of cercospora species and fusarium species was significantly

($p \leq 0.05$) reduced on seeds sprayed with the extract of *Chromotoena odoratum* and *Tithonias diversifolia*. The report also indicated that higher number of abnormal seeds were observed on the control. Similarly, Eno et al. [12] reported that the extract of *Anacardium occidentale*, *Gmelina arborea*, and *C. odorata* reduced the incidence of cowpea anthracnose disease.

In this study, the leaves of *D. stramonium*, *R. communis* and *S. acuta* were collected, air dried, powered and sprayed in the control of the insect pest found on the cucumber. Result from the study shows that all the extracts at the tested concentration reduced the frequency of the insect pest attack compared to the control, this has a direct effect on the quality and quantity of cucumber produced. Also, the yield of the cucumber sprayed with different concentrations of the extract were generally higher than the control and it was concentration dependent. Higher yields were observed at high concentrations and as the concentration reduces from 65% to 30%, there was a corresponding reduction in yield. The yield obtained from the spray of cypermethrin insecticides was not significantly different from those obtained from extract sprayed plots at high concentration (65%). This study agreed with the work of Falade et.al., 2018 who reported the control of cowpea anthracnose disease with extracts of *D. stramonium*, *R. cucumis* and *J. gossypifolia*. The study concluded that yield of cowpea was relatively higher at high concentrations of all the extracts.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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