Effect of Formulated Plant Extract and Cypermethrin on Growth and Yield of Cucumber (*Cucumis sativus* L)

Akanji, K.A[1], Olla, N.O[2].., Omilabu, S.K[1], Oladapo, O.S[1], Awodutire, O.O[3] and Akanji, E.N[4]

[1]*Department of Crop Production Technology, Oyo State College of Agriculture and Technology, Igboora, Nigeria.*
[2]*Department of Soil Science Technology, Oyo State College of Agriculture and Technology, Igboora, Nigeria.*
[3]*Department of Forestry Technology, Oyo State College of Agriculture and Technology, Igboora, Nigeria.*
[4]*Department of Agricultural Extension and Rural Development, Ladoke Akintola University of Technology, Ogbomoso, Nigeria.*

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*CORRESPONDING AUTHOR

kaakanji@oyscatech.edu.ng
+2348033961822

ABSTRACT

This study set out to evaluate the performance of formulated plant extracts such as insecticide and cypermethrin on the growth and yield of cucumber (Cucumis sativus L). The treatments Azadrachta indica, and Jatropha curcas leaves formulated as insecticides, Control (Unsprayed), and Cypermethrin (Synthetic insecticide) were applied in the control of insect pests of cucumber, and the characteristics studied included the Number of leaves, Number of defoliated leaves, Numbers of fruit/plot and Numbers of damaged fruit. A field experiment was conducted in the teaching and Research Farm of Oyo State College of Agriculture and Technology, Igboora during the planting season of 2023. The Experiment was laid in a Randomized Complete Block Design and replicated three times. 200ml of formulated plant extract mixed with 800ml of water while 1ml of synthetic insecticide mixed with 1000ml of water was sprayed using a hand sprayer in the early hours of the day and this was done every week throughout the study. Results showed that the number of leaves and the numbers of fruit/plot were significantly ($P < 0.05$) greater for plants sprayed with the formulated plant extracts and cypermethrin compared to the unsprayed plot. Thus it indicated the effectiveness of the plant extracts in controlling insect pests of cucumber, which significantly improve the growth and yield of the crop. It was observed that the application of J. curcas leaves formulated as insecticide exhibited insecticidal activity when compared to synthetic insecticide and unsprayed plots. However, the application of A. indica also improves the growth and yield of cucumber when compared to the synthetic and unsprayed plot but is not as effective as J. curcas. These findings suggest that the formulated plant extract can be used to enhance the growth and yield of cucumber as an alternative to synthetic insecticides in the study area.

INTRODUCTION

The cucumber (*Cucumis sativus* L.) is a well-known creeping vine plant from the Cucurbitaceae family. It produces cylindrical fruits that are widely used as culinary vegetables. Three main varieties of cucumber are grown, namely, slicing, pickling, and seedless, with several cultivars created within them. Although originating from South Asia, cucumbers now grow on most continents, with many different types traded on the global market. In North America, the term "wild cucumber" refers to plants in the genera Echinocystis

and Marah, though the two are not closely related. Cucumbers are important vegetable crops and one of the most popular members of the Cucurbitaceae family. However, like other cucurbits, they are susceptible to damage by a wide array of insect pests from the initial stages of the crop to the harvest of the products. The extent of loss caused by these insect pests depends on the cucurbit species and environmental conditions, ranging from 20 to 100 percent (Raih *et al*., 2014). In the present scenario, a significant constraint in the sustainable production and productivity of cucurbits is mainly due to the attack of various insect pests which are responsible for adversely affecting the qualitative and qualitative yield. A wide range of pest complexes has been noticed infesting the cucumber. The melon fruit fly, red pumpkin beetle (*Aulacophora foveicollis* Lucas) Epilachna beetle (*Henosepilachna septima* Dieke), leaf roller, green semi looper, and white fly, etc. are the most destructive pests of cucurbits (Khan *et al*., 2012).

Bio-pesticide refers to all types of natural and beneficial pest control materials that notably contribute to reducing the pest population and increasing food production. (Prabha *et al*., 2016). They are safe and eco-friendly. They are more compatible with environmental components than synthetic pesticides. Thus in the present concept of green pesticides, some rational attempts have been made to include substances such as plant extracts, hormones, pheromones, and toxins of organic origin used to transform crops to express resistance to pests (Saxena. 1998).

Natural products are an excellent alternative to synthetic pesticides as a means to reduce negative impacts on human health and the environment. Many individuals and groups advocate the use of natural pesticides and insinuate that since they are found in nature, and are not synthetically produced, they are therefore safer to use. Therefore, green pesticides encompass both synthetic and natural products and processes that eliminate or repel pests but are benign, friendly, or harmless to the environment and ecosystem. (Thakore 2006). Therefore it is pertinent to evaluate the performance of selected plant extracts formulated as insecticides in the control of field insect pests of cucumber (*Cucumis sativus* L) as it affects the growth and yield of the crop.

MATERIALS AND METHODS

Experimental Site

The study was conducted at the Teaching and Research farm of Oyo State College of Agriculture and Technology in Igboora, Oyo State, Nigeria. Igboora is located between Latitude 7.42° North and 3.31° East (70 26’ 0’’N, 3 17’ 0’’E). The area experiences an average annual rainfall of 1278mm, with 80% of it occurring between August and September. In contrast, precipitation is low in January, with an average of 7mm. September is the wettest month, with an average rainfall of 175mm. The highest and lowest temperatures experienced in the area are 28°C and 21°C respectively. The average relative humidity of the area is 83%.

Land preparation

The land was cleared and ploughed manually by hoes and harrow and divided into 12 beds (4 treatments and replicated 3 times), the bed size used was 2 m by 2 m and treatments were randomly arranged using Randomized Complete Block Design (RCBD). Seeds were sown two seeds per hole at a distance of 0.75 m by 0.25 m. Thinning was carried out two weeks after planting while weeding was done as when due.

Procurement of seed and plant materials

The cucumber seeds used for the experiment were obtained from the National Centre for Genetic Resources and Biotechnology (NACGRAB) Moor Plantation Ibadan.

Formulations of Insecticides (Plant extracts)

The leaves of *Azadirachta indica* and *Jatropha curcas* were used to create plant pesticide formulations. To avoid chemical degradation, the selected plant parts were air-dried separately for two weeks at room temperature. Each dried plant part was then ground separately with a mortar and pestle into a powder with a volume of 700 g. This powder was mixed with 20g of black soap and 80g of salt. The resulting mixture was added to a 10-liter tank with 3000 ml of water and stirred vigorously with a rod. The mixture was then allowed to stay overnight. The mixture was filtered using a muslin cloth and the obtained filtrates were stored separately in a 5-liter plastic drum as a stock solution for later use. This botanical formulation method follows established procedures outlined by Alao *et al*. (2020).

Treatment application

A total of 1000 ml was measured from the stock solutions, and it was determined that the concentration of each botanical insecticide was 20% v/v. Further dilution was done by adding 800 ml of water to each botanical insecticide solution. In addition, 1 ml of the synthetic insecticide Cypermethrin was mixed with 1000 ml of water. For the plant extracts, they were applied at the concentration of 20% v/v, while for the synthetic insecticides, they were applied at the manufacturer's recommended rate of 1 ml/L. The application of treatments began three weeks after planting, and it was done in the early morning to avoid photodecomposition of the extracts. A hand-held sprayer was used to prevent drifting during application. Foliar application was carried out at 7-day intervals, and nine weekly observations were made. The applied treatments are Cypermethrin - 1 ml/L, *A. indica*, - 20 v/v, and *J. curcas.* - 20 v/v and Control.

Data collection

Each plot of cucumber had four plants that were tagged for data collection. The data collection on growth and yield parameters began three to four weeks after planting and focused only on the four tagged plants in the middle of each plot. The data collected included the number of leaves, the number of defoliated leaves, and the number of fruits and damaged pods per plot.

Data Analysis

All data collected on the growth and yield parameters were subjected to analysis of variance (ANOVA). The significance means were compared using the Duncan Multiple Range Test at a 5% probability level.

RESULT AND DISCUSSION.

Effect of Plants Extract Formulation and Synthetic Insecticides on Number of Leaves of Cucumber.

There were significant differences in the numbers of leaves both on the treated and the untreated plots of cucumber throughout observation Table 1. At week one after application of treatments (3WAT), the plot was treated with *A. Indica* leaves formulated as insecticides had the highest number of leaves while the untreated plot had the least number of leaves. The highest numbers of leaves were noticed on the plot treated with cypermethrin which was significantly higher when compared with the plots treated with plant extracts and the untreated plots which had similar counts of leaves (2WAT). At 3WAT, the untreated plot of cucumber had the highest count as regards to number of leaves while the lowest count was on the plot treated with *J. curcas*, similar observations were noticed at 4 and 5WAT.

The highest numbers of leaves were observed on the plot treated with cypermethrin at 6, 7, 8, and 9WAT which was significantly higher when compared with the untreated plot.

Table 1: Effect of Plants Extract Formulation and Synthetic Insecticides on Number of Leaves of Cucumber.

	Weeks after treatment								
Treatments	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
J. curcas	10.00c	14.00b	16.00d	18.00d	24.00d	30.00c	36.00b	36.00b	35.00b
A. Indica	12.00a	14.00b	18.00c	21.00c	27.00b	32.00b	35.00c	35.00c	35.00b
Cypermethrin	11.00b	15.00a	20.00b	23.00b	25.00c	33.00a	38.00a	38.00a	40.00a
Control	8.00d	14.00b	21.00a	25.00a	30.00a	32.00b	34.00d	34.00d	30.00d

Means with the same alphabet at $P \geq 0.05$ are not significantly different.

Effect of Plants Extract Formulation and Synthetic Insecticides on Number of Defoliated Leaves of Cucumber.

There were no significant differences in the numbers of defoliated leaves of cucumber at 1 and 2WAT both on the treated and the untreated plots Table 2. The number of defoliated leaves increased on the untreated plot as the weeks increased, significant differences were noticed in the numbers of defoliated leaves with the

untreated plot exhibiting the highest numbers of defoliated leaves from 3 to 9WAT while the plot treated with *J. curcas* had the least numbers of defoliated leaves through the period of study.

Table 2: Effect of Plants Extract Formulation and Synthetic Insecticides on Number of Defoliated Leaves of Cucumber.

	Weeks after treatment								
Treatments	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
J. curcas	0.00a	0.00a	2.00a	2.00c	2.00c	2.00c	3.00c	3.00c	3.00c
A. Indica	0.00a	0.00a	1.00b	3.00b	3.00b	3.00b	4.00b	4.00b	4.00b
Cypermethrin	0.00a	0.00a	0.00c	1.00d	3.00b	3.00b	3.00c	4.00b	4.00b
Control	0.00a	0.00a	2.00a	4.00a	8.00a	10.00a	12.00a	12.00a	13.00a

Means with the same alphabet at $P \geq 0.05$ are not significantly different.

Effect of Plants Extract Formulation and Synthetic Insecticides on Number of Fruits of Cucumber.

The number of fruits of cucumber increases as the weeks under observation increases Table 5, also there were significant differences in the numbers of fruits of cucumber both on the treated and the untreated plot, however, there were no significant differences in the numbers of fruits produced on the treated and untreated plots at 1 and 2WAT. The plot is treated with *A. Indica* produced the highest numbers of fruits at 3WAT, while similar numbers of fruit counts were observed on plots treated with *J. curcas*, cypermethrin, and the untreated plot. The plot treated with cypermethrin had the highest numbers of fruits from 4 to 9WAT, while the lowest numbers of fruits were observed on the untreated plot throughout the study.

Table 3: Effect of Plants Extract Formulation and Synthetic Insecticides on Number of Fruits of Cucumber.

	Weeks after treatment								
Treatments	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
J. curcas	0.00a	0.00a	0.00b	1.00d	4.00d	7.00c	10.00c	10.00c	11.00c
A. Indica	0.00a	0.00a	1.00a	3.00b	6.00b	8.00b	12.00b	12.00b	12.00b
Cypermethrin	0.00a	0.00a	0.00b	4.00a	7.00a	10.00a	14.00a	15.00a	15.00a
Control	0.00a	0.00a	0.00b	2.00c	5.00c	5.00d	5.00d	6.00d	6.00d

Means with the same alphabet at $P \geq 0.05$ are not significantly different.

Effect of Plants Extract Formulation and Synthetic Insecticides on Number of Damaged Fruits of Cucumber.

There were significant differences in the numbers of damaged fruits of cucumber through the period under observation although there were no significant differences in the numbers of damaged fruits on the treated and untreated plots at 1, 2, 3, and 4WAT.

The highest numbers of damaged fruits were noticed on the untreated plot from 5 to 9WAT which is significantly higher than the plots treated with plant extracts and the plot treated with cypermethin however the plot treated with *J. curcas* had the least number of damaged fruits when compared to the plots treated with *A. Indica* and cypermethrin Table 4.

Table 4: Effect of Plants Extract Formulation and Synthetic Insecticides on Number of Damaged Fruits of Cucumber.

	Weeks after treatment								
Treatments	1	2	3	4	5	6	7	8	9
J. curcas	0.00a	0.00a	0.00a	0.00a	0.00b	1.00b	1.00b	1.00c	1.00c
A. Indica	0.00a	0.00a	0.00a	0.00a	0.00b	1.00b	1.00b	2.00b	2.00b
Cypermethrin	0.00a	0.00a	0.00a	0.00a	0.00b	0.00c	1.00b	1.00c	1.00c
Control	0.00a	0.00a	0.00a	0.00a	1.00a	2.00a	3.00a	3.00a	4.00a

Means with the same alphabet at P ≥ 0.05 are not significantly different

CONCLUSION AND RECOMMENDATION

Botanical pesticides are an important group of naturally occurring, often slow-acting crop protectants that are usually safer to humans and the environment than conventional pesticides, and with minimal residual effects. It also contains mixtures of biologically active substances, no resistance is developed in pests and pathogens. The study also portaryed the effectiveness of plant extracts and the synthetic insecticides in controlling insect pests of cucumber which enhance its growth and yield however, the application of these formulated plant extracts performed effectively when compared with synthetic insecticides and is environmentally friendly.

It's therefore recommended to farmers that *Jatropha curcas* leaves formulated as insecticides be adopted as a means of controlling the insect pests of cucumber in the study area.

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