



Effect of Foliar Application of Ginger (*Zingiber officinales*) on Shoot and Fruit Borer (*Leucinodes orbonalis* quen) of Egg Plant (*Solanum melongena* I. and *Solanum gilo* I.)

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Authors' contributions

This work was carried out in collaboration among all authors. Authors MNO and JNA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors PCO and RIAN managed the analyses of the study. Author MII managed the literature searches. All authors read and approved the final manuscript.

Article Information

Editor(s):

(1) Dr. S. Prabhu, Sri Venkateswara College of Engineering, India.

Reviewers:

(1) Shafeek Mohamed Reda, National Research Centre, Egypt.

(2) Sarir Ahmad, Abdul Wali Khan University Mardan, Pakistan.

(3) Majid Abdoli, University of Maragheh, Iran.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/57940>

Original Research Article

Received 22 April 2020

Accepted 28 June 2020

Published 06 July 2020

ABSTRACT

A field experiment was conducted to determine the effect of foliar application of Ginger (*Zingiber officinale*) on shoot and fruit borer of eggplant *Solanum melongena* and *Solanum gilo* in Ihiagwa Owerri. A randomized complete block design (RCBD) with four treatments replicated four times was used. The data collected included plant height, number of branches, number of flowers, number of leaves, pest population and number of Punctures on the leaves. Experimental treatments used

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were 0, 20, 40 and 60 grams of ginger fine powders that were produced into liquid spray known as foliar application of ginger (FAG) of 0%, 20%, 40% and 60% concentrations of ginger. Analysis of variance (ANOVA) was used to analyze the results while least significant difference was used to separate the means. Results showed that 60% concentration of liquid spray of ginger gave the best results in all the parameters used in accessing the experimental materials followed by 40%, 20% and 0% concentrations respectively. This could be due to high active ingredient found in 60% concentration of FAG of which these include *gingerols*, *shogaols*, *paradolols* and *zingerone*.

Keywords: Foliar application; ginger; fruit borer; pests; egg plant.

1. INTRODUCTION

Solanum melongena is commonly known as garden egg, or eggplant, egg fruit, and guinea squash [1]. It is a warm season vegetable belonging to the same botanical family with tomatoes, pepper, including Irish potato (*Solanum tuberosum*) called *Solanaceae*. Garden egg is originally from Southern Asia, most of the commercial varieties now grown, were developed in America and Ceylon [2]. Purselove [3] affirmed that, the egg-plant was first taken into cultivation in India, where wild plant occurs. Arab took it to Spain and Persians Africa. It has now spread throughout the tropics and sub-tropical zones [4-6]. There is a wide range of shape and color of the fruit. They are however, varieties having fruit egg thrives at a lower altitude from sea level to 1,000 feet but it can be in altitude as high as 6,000 feet. At higher altitudes however, the plant is smaller and the yield are lower. It refers medium to heavy rainfall, but can be grow in driver area of irrigation is available, with additions of coir post and fertilizer [7].

Insecticides resistance in shoot and fruit borer (S.F.B) especially to pyrethroids is now wide spread in developing countries. High levels of resistance of many organophosphates and pyrethroids have been in field population of shoot and fruit borer in various region [8] and [9]. Such assumptions are more evident from report of green variation in the requirement of pesticides application for shoot and fruit borer control in different areas.

Perhaps, the indiscriminate uses of insecticide against these pests have polluted the agricultural food system. So, more safer and efficient management methods alternative to chemical control have become inevitable in entomological research. Therefore, this research aimed on the effect of foliar application of ginger on shoot and fruit borer egg plant.

2. MATERIALS AND METHODS

The experiment was carried out at the student's research site of Federal University of Technology, Owerri. Federal University of Technology, Owerri is situated along Port Harcourt- Owerri road in Imo State, Nigeria. The region is in the tropical rainforest zone with about 2500 mm annual rainfall, and average daily temperature of 26°C-30°C.

2.1 Land Preparation

The land was mechanically cleared using a tractor and was ploughed and harrowed, debris were removed and the site was stumped. Bed was made 2 m x 2 m and the total land area measured was 10 m x 10 m (100 m²) and the beds were separated with 0.5m pathway.

2.2 Experimental Materials

The experimental materials used were *Solanum melongena* and *Solanum gilo* which were procured from Agriculture development programme (ADP) in Imo State.

2.3 Experimental Design

The experimental design used was randomized Complete Block Design (RCBD) with four treatments replicated four times. Each treatment was assigned with four beds so, the total number of beds were 16 (sixteen).

2.4 Procurement and Preparation of Foliar Spray

The ginger was procured, washed and chopped into pieces and was shade, for 2-3 weeks and was grounded into powdering form and was soaked into 1 liter of water with the various weights of 0, 20, 40 and 60 grams of ginger and left for 48 hours. The liquids were sieved with Muslim cloth to produce 0%, 20%, 40% and 60% concentrations of foliar spray of ginger respectively. The spray was done in the farm once a week for the period of 8 (eight) weeks.

2.5 Data Collection

Data collection were taken and recorded for the following parameters; Plant height, was measured using a meter ruler from the base of the plant to the highest point of the plant. The numbers of branches, numbers of flowers, number of leaves, number of pest population and number of punctures on the leaves were all counted physically by total counting.

2.6 Statistical Analysis

Data collected were subjected to statistical analysis using ANOVA (analysis of variance) and mean differences were determined using least significant different (LSD) at 0.05% probability level.

3. RESULTS AND DISCUSSION

3.1 Effect of Foliar Application of Ginger (Fag) on Plant Height of *Solanum Melongena* and *Solanum Gilo*

Table 1 shows the effect of foliar application of ginger on *Solanum melongena* and *Solanum gilo* in various concentrations of 60%, 40%, 20% and 0% at 3weeks, 6weeks and 9 weeks after planting. The plant height of the two varieties gave the highest on 60% concentration of foliar application of ginger followed by 40%, 20% and 0% concentrations respectively at P= 0.05 level. *Solanum gilo* gave the best performance in plant height then *Solanum melongena*.

3.2 Effect of Foliar Application of Ginger (Fag) on Number of Leaves of *Solanum melongena* and *Solanum gilo*

The mean number of leaves of *Solanum melongena* at 3 weeks 6 weeks and 9 weeks after planting on 60% concentration of foliar application of ginger gave mean numbers of leaves as 24.2, 53.1, 71.5 on *Solanum melongena* and 39.2, 59.2 and 81.1 on *Solanum gilo*. This assessment shows that at 3 WAP 60% concentration of foliar application of ginger (FAG) gave the highest mean number (24.2) followed by 40% concentration (23.2), 20% concentration (22.1) and the least was 0% concentration (21.0) on both *Solanum melongena* and *Solanum gilo*. The same trend occurred at 6 weeks and 9 weeks (Table 2).

3.3 Effect of Foliar Application of Ginger on Number of Branches *Solanum melongena* and *Solanum gilo*

Solanum melongena and *Solanum gilo* at 3 WAP, 6 WAP and 9 WAP on mean number of branches showed a significant different at P=0.05 level, At 9 WAP, the highest mean number of branches were recorded on 60% concentration of foliar application of ginger followed by 40%, 20% and 0% concentrations, at 6 weeks and 3 weeks similar observations were made on *Solanum melongena* and *Solanum gilo*.

Table 1. Mean plant height of *Solanum melongena* and *Solanum gilo*

Treatments Conc. (%)	<i>Solanum melongena</i>			<i>Solanum gilo</i>		
	3WAP	6WAP	9WAP	3WAP	6WAP	9WAP
Control (0)	15.0±1.0	17.5±1.1	18.9±1.4	17.2±1.1	29.1±2.6	34.4±3.2
FAG (20)	16.7±1.0	18.0±1.3	22.1±2.0	18.0±1.0	32.0±3.1	39.8±3.7
FAG (40)	16.9±1.1	28.3±2.4	34.5±3.2	18.6±1.3	33.3±3.2	47.1±3.8
FAG (50)	17.7±1.2	29.1±2.5	52.3±4.0	19.1±1.4	34.0±3.2	56.3±4.4
LSD (0.05)	1.7	2.0	13.4	2.2	3.5	6.1

FAG = Foliar application of ginger, WAP = Weeks after planting, LSD = Least significant difference at 0.05% level

Table 2. Mean number of leaves of *Solanum melongenc* and *Solanum gilo*

Treatments Conc. (%)	<i>Solanum melongena</i>			<i>Solanum gilo</i>		
	3WAP	6WAP	9WAP	3WAP	6WAP	9WAP
Control (0)	21.0±2.2	27.0±2.7	34.4±3.7	24.1±2.6	31.3±3.4	39.5±3.9
FAG (20)	22.1±2.3	36.3±3.3	52.2±4.0	27.0±2.7	39.0±3.7	62.2±5.1
FAG (40)	23.3±2.4	38.5±3.5	54.3±4.3	31.3±3.4	42.0±4.1	68.1±6.3
FAG (50)	24.2±2.5	54.1±4.2	71.5±5.0	39.2±3.8	59.2±4.6	81.1±8.0
LSD (0.05)	3.7	15.3	18.2	6.0	17.7	22.3

FAG = Foliar application of ginger, WAP = Weeks after planting, LSD = Least significant difference at 0.05% level

Table 3. Mean number of branches of *Solanum melongena* and *Solanum gilo*

Treatments Conc. (%)	<i>Solanum melongena</i>			<i>Solanum gilo</i>		
	3WAP	6WAP	9WAP	3WAP	6WAP	9WAP
Control(0)	6.0±0.2	9.7±0.5	16.1±1.1	8.7±0.4	11.3±0.8	19.3±1.4
FAG(20)	9.2±0.4	16.6±1.3	27.2±2.2	11.8±0.9	19.2±1.3	31.0±3.3
FAG(40)	10.3±0.7	17.2±1.4	28.3±2.4	14.0±1.0	21.0±2.3	33.0±3.6
FAG(50)	19.1±1.2	28.0±2.8	42.4±3.5	22.5±2.4	33.1±3.2	51.6±4.4
LSD(0.05)	6.3	10.5	11.6	7.1	11.5	12.2

FAG = Foliar application of ginger, WAP = Weeks after planting, LSD = Least significant difference at 0.05% level

Table 4. Mean number of *Leucinodes orbonalis* in *Solanum melongena* and *Solanum gilo*

Treatments Conc. (%)	<i>Solanum melongena</i>			<i>Solanum gilo</i>		
	3WAP	6WAP	9WAP	3WAP	6WAP	9WAP
Control(0)	0±0.0	18±1.0	31±2.2	0±0.0	13±1.4	22±1.9
FAG(20)	0±0.0	4±0.3	13±1.4	0±0.0	2±0.2	9±0.8
FAG(40)	0±0.0	2±0.2	4±0.5	0±0.0	2±0.2	9±0.8
FAG(60)	0±0.0	1±0.1	2±0.2	0±0.0	1±0.1	3±0.2
LSD(0.05)	0.0	6.3	8.4	0.0	4.2	6.1

FAG = Foliar application of ginger, WAP = Weeks after planting, LSD = Least significant difference at 0.05% level

Table 5. Mean number of flowers, fruits and fruit weight of *S. melongena* and *S. gilo*

Treatment Conc. (%)	<i>Solanum melongena</i>			<i>Solanum gilo</i>		
	FL	FR	WF(Kg)	FL	FR	WF(Kg)
Control(0)	8±0.0	14±1.0	2.1±2.0	9±0.0	15±1.0	2.6±2.0
FAG(20)	14±1.0	24±2.0	6.6±0.0	16±1.0	26±2.0	9.2±2.0
FAG(40)	22±2.0	36±2.0	11.7±2.0	25±2.0	41±2.0	16.1±2.0
FAG(60)	34±2.0	49±2.0	18.1±2.0	38±2.0	52±2.0	21.3±2.0
LSD(0.05)	4.7	5.4	3.2	5.9	7.3	4.8

FAG = Foliar application of ginger, FL= Flowers, FR = Fruits, WF = Weight of fruits, LSD = Least significant difference at 0.05% level

3.4 Effect of Foliar Application of Ginger on *Leucinodes orbonalis* (Shoot and Fruit Borer) of *Solanum melongena* and *Solanum gilo*

The shoot and fruit borer pest identified is *Solanum melongena* and *Solanum gilo* was *Leucinodes orbonalis* (Larve) of the family rard belonging to the order.

The mean number of *Leucinodes orbonalis* found in *Solanum melongena* was significantly high then the mean number of *Leucinodes orbonalis* in *Solanum melongena* at P= 0.05 level. The 60% concentration of foliar application of ginger gave a significant reduction in mean number of *Leucinodes orbonalis* in both *Solanum melongena* and *Solanum gilo* followed by 40%, 20% and 0% concentrations of foliar application of ginger (Table 4).

3.5 Effect of Foliar Application of Ginger on Number of Flowers and Yield of *S. melongena* and *S. Gilo*

The mean numbers of flowers, fruits and weight of fruits increases as the concentration of ginger increases on application on *S. melongena* and *S. gilo*. On *S. melongena* 60% concentration of ginger gave a mean weight of fruits (18.1 kg), 40% concentration (11.1 kg), 20% concentration (6.6 kg) and 0% concentration (2.1 kg) while *S. gilo* gave (16.1 kg), 20% concentration (9.2 kg) and 0% concentration (2.6 kg) Table 5.

4. DISCUSSION

This study on the effect of foliar application of ginger (FAG) on shoot and fruit borer of egg plants, *S. melongena* and *S. gilo* showed that 60% concentration of FAG gave the best performance and this agrees with the work of

[10,11,12,13,8,9,14] on *neem* for pest control and rural development in Asia and Pacific. An important ginger component, *gingerols* disrupts the metamorphosis of insect larvae by inhibiting molting, it keeps the larvae from developing into pupa and they die in producing new generation [15].

5. CONCLUSION AND RECOMMENDATIONS

Based on the results obtained from the study, extracts of ginger have been proved to be effective against some insect pests of garden egg in Umuagwo Ohaji at 60% concentration.

5.1 Recommendation

Having undergone a detailed study on this research work. This research hereby given the following recommendations:

- For optimum pest control of egg plant, farmer should go for 60% concentration foliar application of ginger (FAG).
- This information should be disseminated to the farmers nationwide through the agricultural extension agents.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:

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