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Control of fruit borer of garden egg *Leucinodes orbonalis* (Lepidoptera: Pyralidae) using organic and inorganic pesticides

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ABSTRACT

Field experiments were conducted at Michael Okpara University of Agriculture, Umudike, Nigeria during 2007 and 2008 cropping seasons to determine the efficacy of Garlic Ethanolic Extract (GEE), Kerosene Soap Emulsion (KSE) and Lambda-Cyhalothrin in the control of the population of garden egg fruit borer *Leucinodes orbonalis* Guenée and on some of the yield components of the crop. The treatments were laid out in a Completely Randomized Block Design (CRBD) with three replicates and applied at low concentrations of 0, 1, 2, 3 and 4%, respectively. The results obtained showed that all treatments exhibited varying degrees of pesticidal efficacy, as their application significantly reduced the population of the fruit borer ($P \leq 0.05$). However, plots treated with Lambda-cyhalothrin recorded the least number of *L. orbonalis* (2.00 larvas per plant and 1.30 larvas per plant in 2007 and 2008 respectively). This result was closely followed by GEE at 3 and 4% concentrations (3.67 larvas and 3.3 larvas per plant in 2007, and 2.13 larvas and 1.70 larvas per plant in 2008 cropping seasons respectively). Application of Lambda-cyhalothrin produced the highest mean number of fruits (56.20 fruits per plant) in 2007, compared to other treatments with the resultant higher fruit weight of 1.44 kg/plant. The highest fruit yields of 900 and 793.75 kg/ha were obtained from plots sprayed with Lambda-cyhalothrin in 2007 and 2008 respectively and followed by 687.50 kg/ha obtained in plots treated with 4% GEE. The results of this trial indicated that plant-derived pesticides are promising as alternatives to synthetic pesticides which are hazardous to human health and environment in the control of the garden egg fruit borer.

Keywords: Garden egg, fruit borer, garlic ethanolic extract, kerosene-soap emulsion, *Leucinodes orbonalis*, plant extract.

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INTRODUCTION

Garden egg (*Solanum gilo*) is widely grown as a vegetable throughout the tropics (Sani et al., 2004). It is also grown for home consumption in homestead gardens. In Nigeria, they are widely grown in the eastern part of the country. The fruits are eaten raw as vegetables, boiled, fried and at times stiffed before consumption (Martins, 1979; Rice et al., 1987; Anna, 1991). The crop is grown mainly due to its prolific fruit production and quick maturation. It supplements starchy foods in addition to being a cheap source of protein, phosphorus, calcium, magnesium, potassium etc vitamins like A, B and C, which are essential in the prevention/treatment of bronchitis, and asthma (Purseglove, 1988; Kochhar, 1986; Dupriez and Deleener, 1989). The leaves stem and roots provide grazing and fodder for livestock (Rehm and Espig, 1991).

According to Norman (1992), the local garden egg cultivar give an average yield of about 35 to 40

fruits/plant weighing between 0.9 and 1 kg. The yield of garden egg varies depending on the variety and the growing techniques (PROTA, 2004) and chief among them is insect infestation.

A number of pests and diseases attack this vegetable crop in the field. Mites stem borers, fruits borers and flower borers are some of the pests that attack garden egg. In Southeastern agro-ecological zone of Nigeria, fruit and shoot borer, *Leucinodes orbonalis* Guenée, has been identified as the major insect pest attacking the crop. The damage caused reduces yields and affects the quality and quantity of the produce and also affect the price significantly. This pest has been reported to cause over 60% fruit damage (Thomas, 1992). Due to the health problems associated with pesticide residues resulting from the accumulation of these chemicals by plants during application, attention is now shifted to the use of organic pesticides for the control of insect pest since they are safe, biodegradable, eco-friendly and cheap. Mangala and Mauria (2006) asserted that the use of various parts of indigenous plants as botanical extracts has become important in pest management in recent years following the environmental hazards caused by chemical control measures. The mechanisms of plant extracts action may include denaturing and degrading of proteins, inhibition of enzymes and interfering with the electron flow in respiratory chain or with ADP phosphorlation (Konstantopoulous et al., 1994). Experiments were conducted at Eastern Farm of Department of Plant Health Management, Michael Okpara University of Agriculture, Umudike, Nigeria to study the efficacy of organic pesticides like Garlic Aqueous Extract and Kerosene Soap Emulsion as compared to synthetic insecticide, Lambda-cyhalothrin on garden egg for the control of *L. orbonalis* during 2007 and 2008 cropping seasons.

MATERIALS AND METHODS

The experiments were conducted at the Teaching and Research Farm (Eastern Farm) of Michael Okpara University of Agriculture, Umudike (05° 29' N and 07° 32' E), located within the tropical rainforest area of Southeast agro-ecological zone of Nigeria. The area has annual rainfall of 2,125 mm, minimum and maximum temperatures of 32 and 23°C; the study site has mean soil temperature of 28.9°C and mean relative humidity range of 56 to 80% (NRCRI, 2005).

Treatments consisted of five concentrations of Garlic Ethanolic Extract (GEE) and Kerosene Soap Emulsion (KSE) at 0, 1, 2, 3 and 4% each respectively; and the synthetic pesticide; Lambda-cyhalothrin. Kerosene Soap Emulsion was formulated by boiling 500 g soap in 4 L of water until evenly dissolved. The mixture was removed from heating, added 9 litres of kerosene and stirred vigorously for 5 minutes. Garlic Ethanolic Extract was formulated by crushing 50 g of garlic bulbs and soaked in 4 litre of ethanol for 24 h. Prior to application, water was used dilute the concentrated mixture to obtain the desired concentrations used for the trial. Karate 5 EC was applied at 30 ml/100 L of water. The experiments were laid out in a Completely Randomized Block Design (CRBD) with three replications. The plot sizes were measured 4 m × 4 m and plant spacing of 1 m × 1 m with total land area of 810 m^2. Treatment application commenced two weeks after transplanting and was repeated every fortnight until final harvest of fruits. Fertilizer (NPK 15:15:15) was applied at the rate of 190 kg/ha three weeks after transplanting the seedlings to the experimental plots, weeding was done when necessary in both years. All agronomic practices were carried out following the recommended standards.

Data were collected on the number of fruits, weight of fruits per plot (kg), fruit yield (kg/ha), number of damaged fruits and population of *L. orbonalis* from five randomly selected plants in each plot respectively. Sampling for *L. orbonalis* larvae was done by carefully dissecting fruits (ten fruits per plot) to check for the presence of the larvae. Data on the cumulative yield was converted to kg/ha before analysis. All data collected were subjected to Analysis of Variance (ANOVA), and treatment means were compared using Least Significant Difference (LSD) at 5% probability level.

RESULTS AND DISCUSSION

All the treatments used significantly ($P \leq 0.05$) reduced the population of *L. orbonalis* except for the controls (plots that received no treatment application) in the two cropping seasons respectively (Table 1). The most effective treatments against the pest population were Lambda-cyhalothrin and 4% GEE which recorded the lowest *L. orbonalis* population of 2.00 and 1.30, 3.30 and 1.70 per plant in 2007 and 2008 respectively (Table 1).

These results are in line with the findings of Thomas (1992) who stated that synthetic pesticides are still the most powerful tools available for pest management and hence are highly effective, curative in action, adapted to most situations, reliable for emergency action and that its application generally reduces pest infestation and increase yield markedly.

However, it is apparent from the results of this trial that GEE at different concentrations were efficacious and effective, as plants treated with the extracts recorded low pest infestation and also compared favourably with the synthetic pesticide; Lambda-cyhalothrin which performed best in terms of pest control except for 1% concentration of GEE which recorded relatively higher mean population of *L. orbonalis* of 4.3 per plant in 2007 and can be used as alternative to chemical pesticides (Table 1).

KSE also has moderate pesticidal effect as it application resulted in the control of the insect pest as plots sprayed with 3% and 4% concentrations of Kerosene Soap Emulsion recorded mean population of *L. orbonalis* of 2.3 each respectively in 2008 which significantly different from the controls ($P \leq 0.05$).

The plant extract (GEE) were not phytotoxic to the crop rather it caused increased fruit number, fruit yield and reduced fruits damage by suppressing the insect pest population and fruit infestation. Lambda-cyhalothrin had the highest fruit yield of 900 and 793.75 kg/ha in 2007 and 2008 respectively (Table 2). This result could be attributed to the higher fruit number of 56.2/plant/plot and 45.30/plant/plot recorded by the treatment in 2007 and

Table 1. Effect of treatment application on the population of *L. orbonalis* of garden egg and total fruit yield ($kgha^{-1}$).

Treatment	Population of *L. orbonalis* per plot		Fruit Yield (kg/ha)	
	2007	2008	2007	2008
GEE_0	7.00	4.00	125.00	206.25
GEE_1	4.30	2.30	312.50	293.75
GEE_2	3.70	2.30	418.75	375.00
GEE_3	3.67	2.13	275.00	456.25
GEE_4	3.30	1.70	687.50	625.00
KSE_0	7.30	4.30	206.25	293.75
KSE_1	7.00	4.00	356.25	393.75
KSE_2	5.30	3.00	481.25	393.75
KSE_3	4.80	2.30	293.75	493.68
KSE_4	4.30	2.30	456.25	606.25
LCT	2.00	1.30	900.00	793.75
$LSD_{(0.05)}$	2.19	1.41	181.25	160.00

GAE = Garlic Ethanolic Extract, KER = Kerosene Soap Emulsion, LCT = Lambda-cyhalothrin, 0 = 0%, 1 = 1%, 2 = 2%, 3 = 3%, 4 = 4%.

Table 2. Effect of application of Garlic Ethanolic Extract (GEE), Kerosene Soap Emulsion (KSE) and Lambda-cyhalothrin on number of fruits, weight of fruits (kg/plot) and number of damaged fruits during 2007 and 2008 cropping seasons.

Treatment	Number of fruits per plant		Weight of fruits per plant		Number of damaged fruits per plant	
	2007	2008	2007	2008	2007	2008
GEE_0	10.00	15. 00	0.20	0.33	4. 00	6.33
GEE_1	24.00	16.70	0. 50	0. 47	3. 10	5.67
GEE_2	31.00	25. 00	0.67	0.60	2.42	5.00
GEE_3	27.70	31. 70	0.44	0.73	2.33	4.00
GEE_4	42.00	38. .00	1.10	1.00	2.00	3.20
KSE_0	8.94	16.30	0.33	0.47	4.67	6.33
KSE_1	24.30	24. 00	0.57	0.63	3.67	5.67
KSE_2	28.70	24.70	0.77	0.63	3.33	5.22
KSE_3	21.70	26.40	0.47	0.79	3.60	4.67
KER_4	40.70	32.30	0.73	0.97	2.50	3.67
LCT	56.20	45.30	1.44	1.27	1.33	2.38
$LSD_{(0.05)}$	9.61	10.65	0.29	0.256	1.34	3.008

GAE **=** Garlic Ethanolic Extract, KER = Kerosene Soap Emulsion, LCT = Lambda-cyhalothrin, 0 = 0%, 1 = 1%, 2, = 2%, 3 = 3%, 4 = 4%.

2008 cropping seasons respectively (Table 2). This result was closely followed by 4% GEE with fruit yield of 687.50 and 625kg/ha in 2007 and 2008, respectively. This result agrees with the observation of Adedire and Lajide (1999) that plant materials increases yield of the crop. Overall, GEE at 4% concentration ranked second best to Lambda-cyhalothrin in terms of number fruits, weight of fruits and number of damaged fruits (Table 2).

Conclusion

The results of this study has shown that 4% concentration of GEE may provide one of the efficient and cheap methods of controlling the fruit borer of garden egg; *L. orbonalis*, as its application was effective and significantly reduced the population of the insect pest and is environmentally safe to farmers and produce users. However, further studies have to be done before recommending this product for the management of the insect pest, *L. orbonalis*.

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