

Comparative efficacy of plant extracts with synthetic against insect pests of okra (*Abelmoschus esculentus* L. Monech)

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ABSTRACT

A field study was carried out during the two cropping seasons of okra to investigate the efficacy of plant extracts and synthetic insecticides applied singly and synergistic effect of botanicals with the synthetic insecticide on some insect pests of okra. Plots were arranged in a Randomized Complete Block Design (RCBD), with three replications. Three insect pests of okra (*Podagrica uniformis*, *Podagrica sjostedti* and *Zenoceros variegatus*) were observed on the field. Cypermethrin applied singly and Cypermethrin combined with plant extracts effectively controlled observed insect pests, followed by lone application of plant extracts (*L. camara*, *T. vogelii* and *Z. officinales* plant extracts at 1st and 2nd season. Okra yield revealed that both plant extract and Cypermethrin combined with plant extract were not significantly different from one another at first season and at second season Cypermethrin combined with plant extracts performed better than Cypermethrin applied singly. This study indicates that the studied plant extracts can be good synergist for Cypermethrin in controlling field pest of okra.

Keywords: *Podagrica species*; *Zenoceros variegatus*; Cypermethri; okra; Plant extracts

1. INTRODUCTION

Vegetables constitute an important food item, supplying vitamins, carbohydrates and minerals needed for a balanced diet. Their value is important especially in developing countries like Nigeria, where malnutrition abounds (Randhawa, 1974; Masood Khan *et al.*, 2001). Among the species grown in Nigeria is okra (*Abelmoschus esculentus* L. Moench), also known as lady's finger or bhendi, which belongs to family Malvaceae and is an important crop grown throughout the year. Besides Nigeria, it is a popular vegetable grown in many tropical and subtropical parts of the world grown for its pod (Folorunso and Ojeniyi, 2003).

However, the yield of okra has been reported to be very low in Nigeria, hardly up to 7t/ha (Schipper, 2000).

The major problems of okra production in Nigeria are insect pest infestations. Many of the pests occurring on cotton are found to ravage okra: with up to 72 species of insects recorded on okra (Srinivas Rao and Rajendran, 2003). The most common insect pests are Aphids (*Aphis gossypii* Glover), leafhopper (*Amrasca biguttula biguttula* Ishida), grasshopper (*Zenocerus variegates*) whitefly (*Bemisia tabaci* Gennadius) and mite (*Tetranychus cinnabarinus* Boisduval) which causes significant damage to the crop. *Podagrica species* have been reported to have caused economic damage according to Fasunwon and Banjo (2010.)

To control the menace of insect pests of Okra, a number of chemical insecticides are liberally sprayed on the vegetable crop, which lead to several problems like, elimination of natural enemies, environmental hazards like air pollution, soil and water pollution and development of resistance by insect pests. Also, most of the synthetic chemicals are not available and when available are too costly for resource poor farmers to obtain due to the economic situation of the country.

To overcome the problem of synthetic insecticides, there is need to identify materials that are environmentally safe with insecticidal properties. Over the years botanicals have been discovered and used because they are biodegradable, low mammalian toxicity, safe to natural enemies, cheap and can be easily produced by skilled and unskilled farmers. Hence the aim of this study is to determine the efficacy of plant extracts and synthetic insecticide applied singly and synergist effect of the botanicals with the synthetic insecticide on some insect pests of okra.

2. MATERIALS AND METHODS

2. 1. Experimental site

Field trials were conducted during the two cropping seasons of 2011 at the Teaching and Research Farm, Ladoké Akintola University of Technology, Ogbomoso, (Latitude 07° 05'N, Longitude 04°, 50'E, 27.5 m) in the rain forest zone of Nigeria.

2. 2. Experimental materials

Seed of an early maturing cultivar (NHAE 47-4) okra (*Abelmoschus esculentus*) was procured from the Oyo State Agricultural Development Project, Ogbomoso Nigeria, while Cypermethrin a synthetic pyrethrin, and plant extracts were obtained from Jubali Agro Allied Company, Lagos and LAUTECH Botanical Garden Ogbomoso respectively.

2. 3. Agronomic practices

Plot size of 2.5 m x 1m was used for the establishment of the okra seeds. The gross experimental site was 27 m x 5 m replicated three times with a gap of 0.5 m in-between the rows, and with a planting distance of 0.5 m between plant to give a plant population of 18 plants per plot. The okra seeds were planted three (3) seeds per hole, weeding and thinning was carried out exactly two (2) week after germination. The experiment was laid out in a Randomized Complete Block Design (RCBD) with 8 treatments viz *Z. officinales* 25 %, *L.camara* 25 %, *T. vogelii* 25 %, Cypermethrin, *Z. officinales* + Cypermethrin, *L. camara* + Cypermethrin, *T.vogelii* + Cypermethrin and Control.

2. 4. Preparation of plant extracts

Air dried leaves (500 g) each of *Latana camara*, *Tephrosia vogelii* and rhizomes of *Zingiber officinales*, were weighed on a scale and pounded separately using mortar and pestle. The paste of each of the plants were dissolves in 2 litres of distilled water and mixed thoroughly after which it was left for 24 hours. For each of the botanicals. The aqueous solution was filtered, using muslin cloth and the extracts were kept in a refrigerator as stock solution.

2. 5. Application of plant extracts

From the stock solution 250 ml of each of the solution was diluted with 500 ml of water to get 25 % concentration spraying volume. The control (unsprayed plots) and Cypermethrin were included for comparison. Foliar application was done using manually operated hand sprayers. The treatments were applied in the morning to prevent photodecomposition of the extracts and application of treatments commenced two weeks after planting before defoliation of okra leaves and was repeated weekly for over three weeks.

2. 6. Data collection and Data Analysis

Data were collected on diversity and population of insect pest and yield of okra yield of okra. Data collected were subjected to analysis of variance (ANOVA) using Randomized Complete Block Design (R C B D) as explained by Gomez and Gomex (1987). Significant means were compared using Duncan Multiple Range test (DMRT) at 5 % probability level.

3. RESULTS

Combination of plant extracts with Cypermethrin effectively controlled *Podagrica sjostedti* when compared with control and plant extracts at 1st and 2nd season. Also *Z. officinales* 25 % was more effective than *L. camara* 25 % at 1st and 2nd season. It was observed that *T. vogelii* 25 % at 4th week and 5th week after planting were more effective than control in both season. As number of weeks of spraying increases, no of insect pest reduces for the sprayed plots. (Table 1). Unsprayed plot recorded the highest number of *P. uniforms* at 3rd and 4th WAP and the same trend was observed in 1st season and 2nd season planting. (Table 2)

Z. officinales + Cypermethrin and Cypermethrin gave the highest control of *P. uniformis* population followed by *T. vogelii* + Cypermethrin and *L. camara* + Cypermethrin at second spraying. *Z. officinales* 25 % effectively controlled the insect when compared with control. There were no significant difference at 5 WAP among the treatments. There were no significant difference between 4WAP and 5WAP on Cypermethrin and mixture of Cypermethrin with plant extract, and these treatments they effectively controlled *Zenoceros variegatus* than plant extract only 1st and 2nd season planting. *Z. officinales*, *L. camara* and *T. vogelii* at 25 % to control *Z. variegatus* concentration were not statistically different at 4WAP and 5WAP while *T. vogelii* 25 % and the ability of *Z. officinales* 25 % were significantly higher than *L. camara* 25 % which shows that they were more effective than *L. camara* 25 %. (Table 3). The same trend was observed in the second season. Control plot had the highest population of insect pests in both seasons when compared with other treatments.

Data on okra yield revealed that at first season there were no significant difference among the treated plots while at second season *Z. officinales* 25 % and combination of

different plant extracts with Cypermethrin had significantly higher yield than Cypermethrin alone. *T. vogelii* and control were not statistically different from each other.

Table 1. Effect of plant extracts and Cypermethrin on *Podagrica sjostedti* population.

Treatments	1 st season			2 nd season		
	3 WAP	4 WAP	5WAP	3 WAP	4WAP	5WAP
Control	0.30a	0.29a	0.24a	0.30a	0.29a	0.23a
<i>Z. officinales</i> 25 %	0.27ab	0.24ab	0.12bc	0.26ab	0.24ab	0.12bc
<i>L. camara</i> 25 %	0.28a	0.28ab	0.18ab	0.28a	0.28ab	0.17ab
<i>T. vogelii</i> 25 %	0.23ab	0.21b	0.06cd	0.23ab	0.21b	0.05cd
Cypermethrin	0.12c	0.00c	0.00d	0.12c	0.00c	0.00d
<i>Z. officinales</i> + Cypermethrin	0.10c	0.00c	0.00d	0.10c	0.00c	0.00d
<i>L. camara</i> + Cypermethrin	0.18bc	0.06c	0.00d	0.18bc	0.05c	0.00d
<i>T. vogelii</i> + Cypermethrin	0.09c	0.00c	0.00d	0.09c	0.00c	0.00d

Mean followed by the same alphabets in a column are not significantly different ($p < 0.05$) WAP = weeks after planting.

Table 2. Effect of plant extracts and Cypermethrin on *Podagrica uniformis* population.

Treatments	1 st season			2 nd season		
	3 WAP	4 WAP	5WAP	3 WAP	4 WAP	5 WAP
Control	0.24c	0.19c	0.10a	0.24a	0.19a	0.10a
<i>Z. officinales</i> 25 %	0.16ab	0.11abc	0.06a	0.16ab	0.11abc	0.05a
<i>L. camara</i> 25 %	0.19ab	0.14ab	0.06a	0.19ab	0.13ab	0.57a
<i>T. vogelii</i> 25 %	0.12bc	0.09bc	0.00a	0.11bc	0.09bc	0.00a
Cypermethrin	0.00d	0.00d	0.00a	0.00d	0.00d	0.00a
<i>Z. officinales</i> + Cypermethrin	0.05cd	0.00d	0.00a	0.04cd	0.00d	0.00a
<i>L. camara</i> + Cypermethrin	0.09bcd	0.05cd	0.00a	0.09bcd	0.04cd	0.00a
<i>T. vogelii</i> + Cypermethrin	0.04cd	0.00d	0.00a	0.04cd	0.00d	0.00a

Mean followed by the same alphabets in a column are not significantly different ($p < 0.05$), WAP = weeks after planting

Table 3. Effect of plant extracts and Cypermethrin on *Zenoceros variegatus* population.

Treatments	1 st season			2 nd season		
	3 WAP	4WAP	5WAP	3 WAP	4 WAP	5 WAP
Control	0.19a	0.19a	0.17a	0.19a	0.18a	0.17a
<i>Z. officinales</i> 25 %	0.12ab	0.10ab	0.06bc	0.11ab	0.10ab	0.05bc
<i>L. camara</i> 25 %	0.15ab	0.10ab	0.08b	0.15ab	0.10ab	0.08b
<i>T. vogelii</i> 25 %	0.10ab	0.08ab	0.00c	0.10ab	0.08ab	0.00c
Cypermethrin	0.03b	0.00b	0.00c	0.00d	0.00d	0.00c
<i>Z. officinales</i> + Cypermethrin	0.06ab	0.00b	0.00c	0.05ab	0.00b	0.00c
<i>L. camara</i> + Cypermethrin	0.09ab	0.03b	0.00c	0.09ab	0.03b	0.00c
<i>T. vogelii</i> + Cypermethrin	0.05b	0.00b	0.00c	0.04b	0.00b	0.00c

Mean followed by the same alphabet in a column are not significantly different ($p < 0.05$), WAP = weeks after planting.

Table 4. Effect of plant extracts and Cypermethrin on Okra yield.

Treatments	1 st season	2 st season
Control	1.79b	2.06b
<i>Z. officinales</i> 25 %	3.37a	3.43a
<i>L. camara</i> 25 %	2.23a	2.40ab
<i>T. vogelii</i> 25 %	2.02a	2.23b
Cypermethrin	2.23a	2.50ab
<i>Z. officinales</i> + Cypermethrin	3.20a	3.30a
<i>L. camara</i> + Cypermethrin	3.12a	3.12a
<i>T. vogelii</i> + Cypermethrin	3.43a	3.43a

Mean followed by the same alphabet in a column are not significantly different ($p < 0.05$).

4. DISCUSSION AND CONCLUSIONS

Generally, it was observed that the unsprayed plot (control) had the highest number of insect pests and Cypermethrin with botanicals effectively controlled the observed insect pests

of okra. The selected botanicals have been evaluated for their pesticidal properties against insects by several authors (Adebayo 2003; Babarinde and Ogunkeyede 2008 and Amuji *et al* 2012).

Similarly, *T. vogelii* and *Z. officinales* controlled the insect pest more than *L. camara* at different spraying week. The mixture of plant materials with Cypermethrin effectively controlled insect pest of okra. The high effectiveness of Cypermethrin could be attributed to its knock down effect on target organism (Hill, 1988). Also the synergistic effect of Cypermethrin and plant materials enhanced its performance thereby reducing okra insect pest population. This corroborates the work of Adebayo (2003) who reported that *T. vogelii* + Lamdacylothrin was more effective than using Lamdacylothrin at recommended rate. This finding indicates the possibility of reducing the amount of synthetic insecticides that will go into the ecosystem when botanicals are incorporated as synergist with Cypermethrin.

Z. officinales 25 %, *T. vogelii* + Cypermethrin, *Z. officinales* + Cypermethrin *L. camara* + Cypermethrin produced the highest yield of okra followed by Cypermethrin. This is in agreement with the work of Adebayo (2003) who reported that combination of locust lotion + *T. vogelii* gave the higher okra yield than Labdacylothrin. The high population of *Podagrica species* and *Z. variegatus* recorded on control plot (unsprayed plot) as compared with those treated with Cypermethrin, *T. vogelii*, *Z. officinales* and Cypermethrin + *T. vogelii* and *Z. officinales* + Cypermethrin showed that application of the treatments on okra seedlings constituted a toxic material or an antifeedant to the insect. This study corroborates the work of Miller and strickler (1984) who reported that suitability of any refuge for habitation or feeding by insect is determined by nutritional quality, presence or absence of toxins and exposure to natural enemies.

The extracts and insecticides exhibited different levels of toxicity. *Z. officinales* and *T. vogelii* effectively controlled insects especially at 4th and 5th week after planting this agrees with work of Adebayo 2003 that *T. vogelii* effectively controlled *Podagrica species* on okra as Lamdacylothrin.

Use of botanicals in pest management of okra can help the farmers to reduce the sole reliance on synthetic insecticides. Moreover, this eco-friendly approaches of pest control with minimum disturbance to natural beneficial insects and non target organisms should be highly encouraged.

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References

- [1] Adebayo T. A. (2003). Efficacy of mixture formulations of synthesis and botanical insecticides in the control of insect pests of okra and cowpea. Ph.D. Thesis submitted to Ladoke Akintola University of Technology, Ogbomoso, Nigeria.
- [2] Adebayo T. A., J. I. Olaifa, *Science focus* 7 (2004) 45-52.
- [3] Amuji C. F., Echezona B. C., Dialoke S. A., *Journal of Agriculture and Veterinary Sciences* 4 (2012) 45-52.

- [4] Babarinde S. A., Ogunkeyede A. F., *Journal of Ultra scientist of Physical Sciences* 20(2) (2008) 411.
- [5] FAO. The state of food and agriculture (Food and Agriculture Organization of the United Nations. 2006).
- [6] Folorunso O. O., Ojeniyi O. S., *Federal University of Technology Akure Nigeria Asset series* 3(4) (2003) 65-53.
- [7] Hill D. S., Waller J. M., (1988). *Pests and Diseases of Tropical Crops*, Logman, New York, pp. 414.
- [8] Fasunwon B. T., Banjo A. D., *Research Journal of Agriculture and Biological Sciences* 6 (2010) 283-288.
- [9] Gomez K. A., Gomez A. A. (1984). *Statistical procedures for Agricultural Research*, 2nd Edn., John Willy and Sons, New York, pp. 18-192.
- [10] Miller J. R., Stricklder K. L. (1984). Finding and accepting host plants. In chemical ecology of insects Ed. Bell, W.J and Carde, R.T. Sinauer Associates Inc. pp. 127-150.
- [11] Masood Khan M. A., Jagadishwar Reddy D., Venkateshwar Rao S., *Pestology* 26(6) (2001) 18-23.
- [12] Randhawa G. S. (1974). *Horticulture; Importance of pest control*. Pesticides Annual, pp. 85-87
- [13] Srinivas P. S., V. P. S. Panwar, *Pesticide Research Journal* 15 (2003) 131-133.
- [14] Schippers R. R. (2000). African Indigenous Vegetables: *An overview of the cultivated species*. Chathan, UK: Natural Resources Institute/ACPEU Technical Centre for Agricultural And Rural Cooperation, 103-113.

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