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Population Dynamics of Species of Flea Beetle on Okra (*Abelmoschus esculentus* L. MOENCH) and its Impact on Production

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ABSTRACT

This study was conducted to evaluate the impact of the population dynamics of species of flea beetle on Okra (*Abelmoschus esculentus* (L) Moench) production in FCT Abuja. The experiment was conducted at the Teaching and Research Farm, University of Abuja, Abuja. The treatments comprised of four different plant spacing of 50*cm* x *30cm, 50cm* x *35cm, 50cm* x 40*cm and 50cm* x 45*cm*. The two species of flea beetle encountered in the study (*Monolepta goldingi* and *M. nigeriae*) were recorded from 3 Weeks after Planting (WAP). The population of *M. goldingi* recorded was higher than *M. nigeriae* in the entire plot and throughout the duration of the experiment although the population of both remained high throughout the vegetative stage than the reproductive phase of growth of okra. Also, it was observed that the closely spaced plants had more pest infestation than wider spaced plants. The difference in the plant spacing has significance on the insect count and its population has significant reduction (P < 0.05) in fruit production, branching and Days to Flowering. The best fruit yield was obtained on the plot with plant spacing's of 50*cm* x 40*cm,* which yielded 11.84 fruits.

Keywords: Okra, FCT Abuja, *Monolepta goldingi, Monolepta nigeriae*, Yield.

INTRODUCTION

Okra is an important vegetable crop that is consumed almost all over the word (George, 2003). The tender fruits, leaves and succulent shoots are consumed either in fresh or dried forms (Burkill, 1997; Schippers, 2000; Arapitsas, 2008). Okra consumption among other fruit vegetables is found to be beneficial in moderating blood pressure, fibrinogen concentration and plasma viscosity, and for hypertensive patients. It is easy to grow and use, and also looks great throughout the growing season due to its beautiful flowers. It is also rich in vitamins, calcium, potassium and other minerals (Tindall, 1986; Poggio, 2005; Duvauchelle, 2011) and low in calories (Adebawoo *et al*., 2007). Its mucilage is suitable for medical and industrial applications. The leaves are sometimes used as basis for poultices, as an emollient, sudorific or antiscortic, in antioxidants and to treat dysuria (Habtamu *et al*., 2014). Okra mucilage has been added as size to glaze paper and is used in confectionery. The back fiber has been locally used for fish lines and game traps. It is suitable for spinning into rope and for paper and cardboard manufacture. Roasted okra seeds are used in some areas as a substitute for coffee (Siemonsma, 1982).

The challenges of okra production in Nigeria are insect pest infestation, disease incidence and poor soil nutrient level. The major pests of okra in Nigeria include *Dysdercus superstitious* Fallen, *Empoasca fascialis* Jacoby, *Spodoptera littoralis* F. *Spilosoma maculosa* Cr. *Sylepta derogate* F. *Podagrica species, Leptocoris aelegans* Blote, *Acanthomyia horrida* Germ, *Lygaeus festivus* Thumb and *Oxycarenus species.* The population of these pests has been built up due to mono-cropping in recent years as a result of an increased in demand for *A. esculentus* in commercial quantity (Youdeowei, 2002; Van Hezewiik *et al.,* 2008). Flea beetles are mainly leaf eater and have biting and chewing mouth parts. They are observed to commence their infestation on okra plants from the stage of germination throughout all stages of its growth (Ahmed *et al*., 2007; Pitan and Adewole, 2011). They produce a characteristic injury known as "shot holing" (Egwuatu, 1982) and occasionally damage flowers, shrubs and even trees.

The study of the population dynamic of flea beetles on okra fields and it impacts on yield is germane to improving okra production in Nigeria. This study was aimed at evaluating the population fluctuation of flea beetle on okra and confirms the deleterious effects of damage on the physiology of the plant and yield of crop.

MATERIALS AND METHODS

The Study Area

The study was carried out at the Teaching and Research Farm of Faculty of Agriculture, University of Abuja, FCT. Abuja is located on 9º.07′N; 7º49′E of Nigeria. The elevation is 491m above sea level during cropping seasons.

Experimental Materials

The treatment involved four different plant spacing (50cm x 30cm, 50cm x 35cm, 50cm x 40cm and 50cm x 45cm) laid out in Randomized Complete Block Design (RCBD). The site was ploughed and harrowed for fine tilth. The experimental area was divided into six units, each measuring 1m x 1m with 1m gap between the units and 1m between blocks. Okra seeds were obtained from the open market at Gwagwalada, FCT, Abuja. Planting was done on raised beds at the rate of two seeds per hole at about 3cm depth. Weeding was done by hoeing and sometimes hand weeding to pull out weeds near to the base of the plant, and this was carried out thrice in the cause of the study and also, the experimental area was partitioned into small units of 24 blocks. The plants were side dressed with Urea fertilizer at the third to fourth leaf stages of the plants.

The observations were based on plant density, number of insect count, number of leaves destroyed, number of branches and plants yield. The number of leaves destroyed was observed at 4 WAP by counting a number of small irregular rounded holes created by flea beetle on the upper surface of the leaves. The branches of the plant were observed at the 8WAP and also, the flea beetle count was commenced at 3WAP per plot/units. This was repeated fortnightly with random selection. Also, samples of insects associated with the plants were collected and an identification of the insect species was done at the Insect Museum of the Department of Crop Protection, Ahmadu Bello University Zaria.

Data Analysis

Data were analyzed with the SPSS Version 18. The parameter analyzed include: Mean and SEM. Means were separated with Duncan Multiple Range Text and also, the correlation of the yield with the growth variables and insect population was also conducted.

RESULTS

Figure 1 shows the population dynamics of the two species of flea beetles encountered in this study. The two species that affected *A. esculentus* in this study are *Monolepta goldingi* (Plate 1) and *M. nigeriae* (Plate 2). The infestation of pest on okra began at 3WAP and this continued throughout the duration of the experiment with varying population of flea beetles. *M. goldingi* had the highest population at the different stages of the crop, while *M. nigeriae* maintained the same trend at a lower population.

Plate 1*: Monolepta goldingi*

Plate 2: *Monolepta nigeriae*

The peak population of 20.17 *M. goldingi* and 3.17 *M. nigeriae* occurred at the vegetative stage creating "shot holing" on the leaves of the plant (Plate 3). The population of the two decreases drastically at the fruiting stage of the crop (i.e. after 9 WAP). Other insects encountered in the study include: *Syagrus calcaratus* Fahr, *Nisotra dilecta* Dalm (Coleoptera: Chrysomelidae), *Alcidodes sybvillosus* Fahr (Coleoptera:Curculionidae), *Silidius apicalis* Waterh (Coleoptera:Cantharidae) and *Etigmere edlingeri* Bartei (Heterocera:Arctiidae).

Plate 3: Feeding character of flee beetle (shot holing)

The impact of population dynamics of the species of flea beetle on growth performance and yield of okra in the Federal Capital Territory (FCT) as influenced by spacing. (Table 1) revealed a significant difference (P<0.05) in the population of *M. goldingi.* The least (8.67) infestation occurred in the 50cm x 40cm spacing, while the highest (20.17) population was observed on crops planted with 50cm x 30cm spacing. Also, there were significant differences (P<0.05) in the Day to Flowering (Dtf) of okra under the different spacing arrangements. Okra cropped in planting spacing 50cm x 40cm and 50cm x 45cm flowered earlier (i.e. 57 and 56 days after planting respectively) than those planted with the spacing 50cm x 30cm and 50cm x 35cm (i.e. 64 days after planting). On the contrary, there are no significant difference (P>0.05) in the population of *M. nigeriae,* number of branches and plant density. while the population variation of the flea beetle was established to cause significant (P<0.05) losses in the yield of okra. The treatment (50cm x 30cm) with the highest number of flea beetles recorded significantly low (8.8) yield.

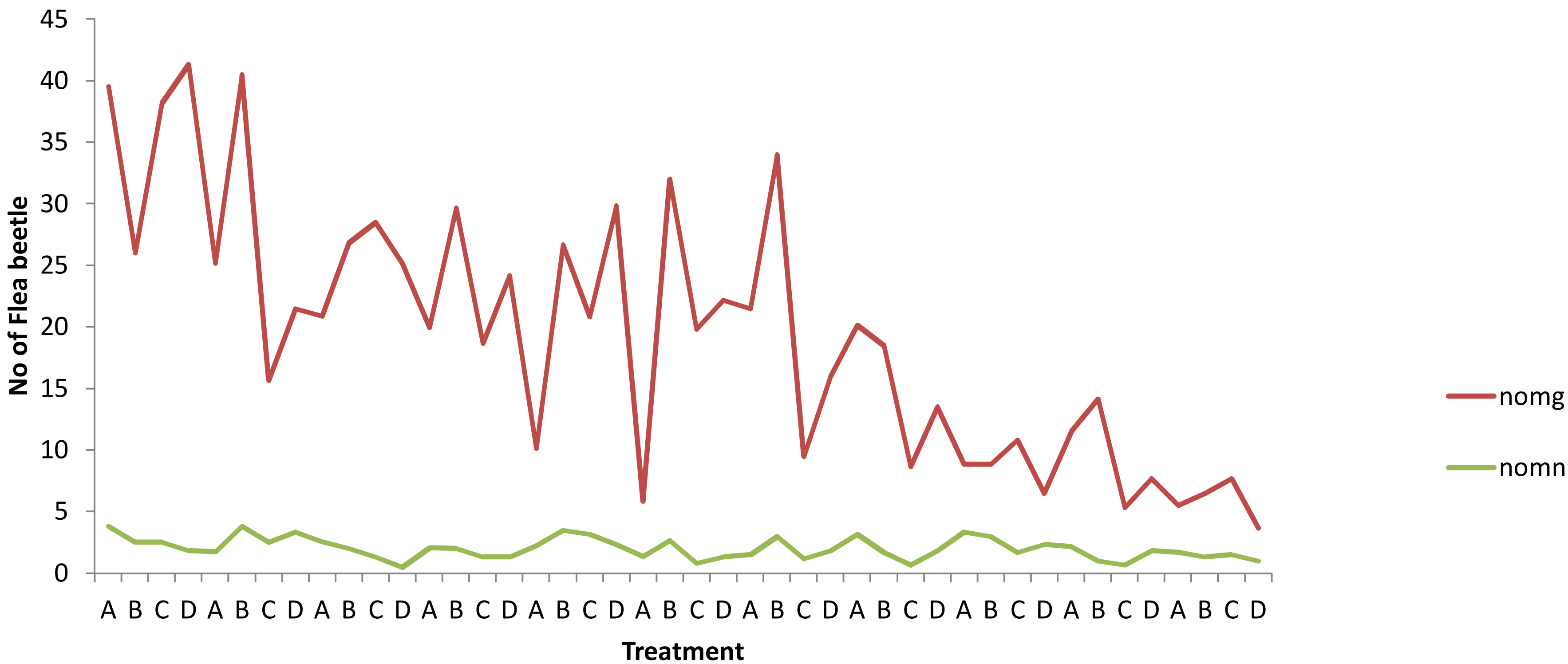

Fig 1: Population Dynamics of Species of Flea Beetles (Coleoptera: Chrysomelidae) on Okra *Abelmoschus esculentus* (L.) Moench in FCT Nigeria

Key: plant spacing: A (50 x 30cm), B (50 x 35cm), C (50 x 40cm), D (50 x 45cm), Nomg: number of *Monolepta goldingi*, nomn: number of *w*k: week

Table 1: Influence of population dynamics of species of flea beetle on growth performance and yield of okra *Abelmoschus esculentus* (L.) in FCT Nigeria

Plant Spacing	Population variations of species (		Growth performance			Yield
	Nomg	Nomn	Dtf	Brc	Pld	
50cm x 30cm	20.17^{a}	3.17	64.00^{a}	5.33	15.00	8.8^{b}
50cm x 35cm	18.50^{a}	1.67	64.00^{a}	3.67	15.00	11.70^{a}
50cm x 40cm	8.67^{b}	0.67	57.33^{b}	5.33	12.33	11.84^{a}
50cm x 45cm	13.50^{ab}	1.83	56.00^{b}	2.83	11.83	11.44^{a}
±SEM	6.70	4.51	3.55	2.22	3.12	8.33

Means followed by the same letters within a column are not significantly different (Duncan Multiple Range Test, P< 0.05).
Key: Nomg: number of *Monolepta goldingi*, Nomn: number of *M.nigeriae*, Dtf: day to flowering, Brc: branching, Pld: plant density.

Table 2 shows the correlation of the variations in the population of flea beetles with the growth performance and yield of okra in FCT, Nigeria. Significant correlation (P<0.05) were established between the buildup of number of *M. goldingi* and Dtf (0.446) (P<0.05) as well as *M. nigeriae* (0.662) (P<0.01) while there were no significant correlations between the other variables i.e. yield, plant density and branching.

Table 2: Correlation of variations of insect population with the growth performance and yield of Okra in FCT Nigeria

	Nomg	Nomn	Dtf	Brc	Pld	Yld
Nomg	1					
Nomn	$.662^{**}$	1				
Dtf	$.446^{*}$	.301	1			
Brc	.223	.007	.124	1		
Pld	.292	.069	.232	.174	1	
Yld	-.302	-.372	-.136	.122	-.242	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Nomg: number of *Monolepta goldingi*, Nomn: number of *M. nigeriae*, Dtf: day to flowering, Brc: branching, Pld: plant density, Yld: yield.

DISCUSSION

The infestation of flea beetles being at its peak at the vegetative stage of the okra in this study differs with earlier publications, which reported the productive stage to have abundant food source (flower buds, flowers and pods) at the reproductive stage of the plant compared with the vegetative stage (Egwautu, 1982; Youdeowei, 2002). The high number of *M. goldingi* on okra compared to the level of infestation of the *M. nigeriae* is in line with earlier findings (Pitan and Ekoja, 2012), which claimed that *M. goldingi* is more prominent on okra than *M. nigeriae* in Nigeria. This can be as a result of preference or favourable environmental condition for the breeding of *M. goldingi* in okra fields compared to *M. nigeriae.*

The feeding characteristics of creating round irregular holes on okra notable with flea beetle were exhibited in this study. This supports Egwautu (1982), who reported that it has become a common sight to find numerous perforations on the leaves of okra usually caused by herbivorous insect which is almost being accepted as a common feature on crop infested by flea beetles. The high population of flea beetle recorded between 3 WAP to 5 WAP, suggests that the control of flea beetle at the early stage of growth will reduce the deleterious effect of the insect pest on growth and reduce disease incidence and in turn lead to high yield. This assertion collaborate the reports on the importance of pest control in having high yield in okra fields (Suszanne and Jeffrey, 2007; Van Hezewiik *et al*., 2008).

The yield of okra was significantly ($P < 0.05$) influenced by the population of flea beetle. The greater number of fruits per plant obtained could have resulted in the greater number of branches produced. This result supports Ijoyah *et al*. (2010) who reported that the number of pods would depend on the intensity of growth of the plant. In addition, the establishment of positive correlation between the *M. goldingi* and Dtf as well as *M. nigeriae* showed timely control of flea beetle as one of the ways of attaining early Dtf that is essential for obtaining high yield in okra production.

CONCLUSION AND RECOMMENDATION

The relationship between the population dynamics of the two species of flea beetles i.e. *M. goldingi* and *M. nigeriae* and the impacts of its damage on branching and yield of okra shows the need for prompt control of flea beetles on okra field in order to achieve high yield. *M. goldingi* have greater population than *M. nigeriae* and their population is generally higher during the vegetative stage of okra than during the reproductive phase. From this study, it could be recommended that planting of okra at the spacing of 50cm x 35cm-40cm can be adopted for the management of the population of flea beetle, to minimize damage to leaves and guarantee optimum yield.

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