

Seasonal Population Fluctuations of *-Podagrica Species* On Okra Plant (*Abelmoschus Esculentus*)

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Abstract: Among the insect pests that cause economic damage on Okra plants, two congeners; *Podagrica uniformis* and *Podagrica sjostedti* (Coleoptera, Chrysomelidae), have been observed on the cultivated plot of the okra plants during the early and late planting season. An average occurrence of 28.9 ± 5 and 30.1 ± 0.5 of *Podagrica uniformis* and *Podagrica sjostedti* were observed respectively during the early planting season, (May to August), while an average occurrence of 26.14 ± 0.5 and 28.3 ± 0.5 of *P. uniformis* and *P. sjostedti* were observed respectively during the late season, (September-December). Effects of agro-climatic factors on the growth of insect pests were also observed during the duration of the study. Relative humidity and rainfall show direct effect on the population trend of *Podagrica species*, having a correlation of 0.48 and 0.76 respectively. However, temperatures show an indirect effect with correlation coefficient of -0.25 and -0.36 on *P. uniformis* and *P. sjostedti* population respectively.

Key words: *Podagrica species*, Population, Season, Occurrence, Okra

INTRODUCTION

Pests have been a major setback for the success or growth of many crops all over the world. It has been shown that pests cause major damage to the foliage and fruits of plants as well as bore into their stems. These forms of damage had caused an increase in the poor yield of various crop plants, okra not being an exception.

According to^[1], they categorized insect pests of okra into two, that is, those that attack at early stage for example, Apids; and those that appear later at the stage of pods production, such as green stink bugs, cabbage looppers, corn earworms, European corn borers and the leaf-footed plant bug.

Major pests of okra in Nigeria have been listed; which include *Dysderus superstitiosus* (Fallen), *Empoasca fascialis* (Jacobi), *Spodotera littoralis* F. *Spilosoma maculosa* Cr, *Sylepta derogate* F, *Podagrica species*, *Leptocorisa elegans* Blote, *Acanthomyia horrida* Germ, *Lygaeus festivus* Thumb, and *Oxycarenus specie*^[2,3,4]. The population of these pests has been built up due to monocropping in recent years as a result of an increased in demand for *Abelmoschus esculentus* in commercial quantity^[5].

Van Epenhuijsen^[6], reported the following insects as the major pests of okra; *Syagrus calcaratus*, *Lagria vil/ass I Podagrica uniformis*, *Podagrica sjostedti*, *Anoplocnomis euruipes*, *Mirperus jaculus*" *Halyomorpha annulicornis*, *Earlias biplaga* and

insulana. As reported by^[7] reported that several beetles and Lepidoptera could attack the leaves of okra.

However, the most prevalent of all these pests especially within the southwestern states of Nigeria are the *Podagrica* species. These pests have constantly been observed as Major pests of okra, infesting the leaves of the plants and have had a great economic significance on the yield of the crop^[8], recognised two species of *Podagrica* in Nigeria, *Podagrica sjostedti* and *Podagrica uniformis*, the former has bluish – black elytra while the latter has shiny brown elytra. These insects are generally referred to as flea beetles.

These two species of *Podagrica* have been observed to commence their infestation on okra plants from the stage of germination throughout all stages of its growth. They are mainly leaf eaters, and have biting and chewing mouthparts^[9].

In view of the commercial and nutritional value of okra fruits and leaves, various methods of controlling or reducing the rate of pest infestation have been adopted. These include; the use of insecticides like DDT, lindane and carbanyl, the use of DDT has however been drastically reduced because of its high toxicity and persistence.^[5], while citing^[4], stated that spraying Okra plant with insecticide could be a profitable proposition especially for the dry season cropping. Thus, the use of different concentration of carbanyl insecticides on these plants resulted in great improvement of crop yield. Okra which has also been listed as an ornamental crop is believed to be an

attractant crop for insects infestation, hence most farmers are still involved in traditional ways of pest control, because is a crop that is mostly cultivated by local farmers, such as the use of goats and cow dung, combination of detergent and kerosene mixed with water and also the sprinkling of wood ash on this crop, without them knowing the pesticide composition, time of application and frequency of usage,^[10].

Therefore, the study of these flea beetles, (*Podagrica uniformis* and *Podagrica sjostedti*) will enable the identification of factors responsible for population fluctuations and the possibilities of making a rationale forecast of outbreaks on okra at various times in a year as well as determine the most appropriate control measures to enhance high yield of okra plant.

MATERIALS AND METHOD

Investigation of *Podagrica species* infestation rate on okra plant was carried out on a plot of land, size 24 x 12m, cultivated and cleared of weeds using cutlass, rake, shovel and hoes. Okra seeds were tested for viability by soaking them in water for 24 hrs, where by the non-viable seeds floated and were discarded. Seeds of Okra, *Abelmoschus esculentus* NH47- 4 breed was obtained from National institute of horticulture research (NIHORT) and sowed twice in the year to determine the effect of climatic parameters on the two species of *Podagrica* infesting the crops plant. This breed of seed was used because of it early maturation.

There were seven rows of ridges with 15 stands of okra plants per row on the plot. The stands were spaced at 1 metre apart and 0.5 within rows. The missing stands (that is those that did not germinate) were replanted two weeks after germination had taken place. Weeding was done by manual hoeing and was done fortnightly.

Plants were not screened nor treated with chemical insecticides and plantings were done in early and late season respectively (May and August).

The population of *Podagrica species* was assessed during the two seasons of planting. The sampling was done on a weekly basis until crop maturity. The two species of *Podagrica* were collected for identification and study in the laboratory. Sampling was by direct counting of insect on the okra plant^[11].

Assessment of Infestation: The number of insects (*Podagrica species*) infesting each okra plant was counted to assess damage. Level of infestation was correlated with climatic factors during the course of this study. Data on temperature and relative humidity for the period of the study were obtained from the

meteorological station at the location of the study areas, Ijebu - Ode.

Regular visual observations were also made on the plot to detect any incidence of predation that may affect the population of insects.

The population count of the adult *Podagrica species* was done from May to August (early planting season) and September to December (late planting season), weekly on the cultivated plot of the okra plants. It was usually done between 2.00 pm to 4.00 pm because these insects are usually found at the under surface of the leaves to avoid rays of sunlight. The numbers of adults pests caught on each occasion as well as their species identity were recorded.

Insects were caught by hand picking since they were only' capable of .exhibiting - limited flight within the circle of their environment.

Analysis of pest population was carried out in relation to the effect of climatic parameters such as temperature, relative humidity and rainfall by means of correlation.

The numbers of *Podagrica species* at every week was plotted to determine the change in population structure of each species over time.

RESULTS AND DISCUSSION

Figure 1 and 2 shows the population trend of both species of *Podagrica* on 100 stands of okra plants used for the study between May – December, while Table 1 shows the mean abundance for these flea beetles during the course of the study on *Abelmoschus esculentus*.

Discussion: This group of flea beetles were been found on the leaves' surfaces and underneath of the okra plants leaves. Thus, their damages could be reflected on the leaves through their feeding habits From table 1, it was observed that the early planting season (May-August) had a significant difference in the population of the two species of *Podagrica*, but no significant difference was observed in the population of *Podagrica uniforma* and *Podagrica sjostedti* was observed for the late planting season (September-December). Therefore, it could be ascertained that the difference in population could have occurred by chance.

The study showed that these species of Flea beetles are homodynamic in their pattern of population growth. It was also revealed in the course of the study that there was an inverse relationship in the population trend of *Podagrica species* to temperature, which explains why *Podagrica species* avoid intense temperature and hide under the leaves between 2p.m-3p.m. showing a diurnal behaviour. However, there was a direct relationship to relative humidity and rainfall, as

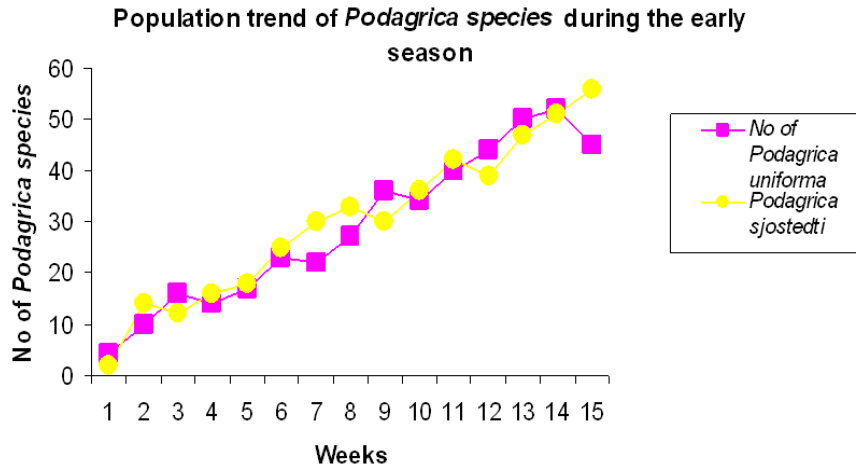


Fig. 1: The population trend of *Podagrica* species during the early season of cropping.

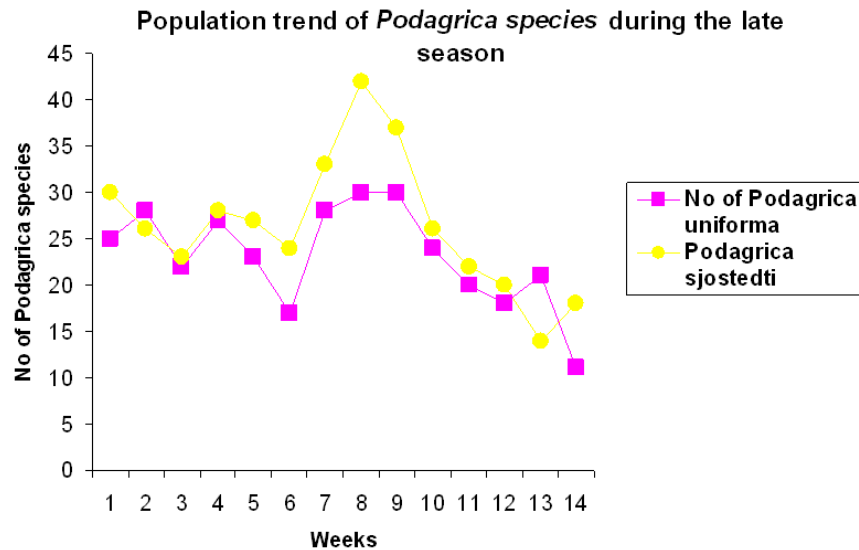


Fig. 2: The population trend of *Podagrica* species during the late Season of cropping

seen in Table 2, therefore, indicating a higher population of these Flea beetles during the early season than the late season as seen in Figure 1. *Podagrica* species (especially *uniformis* and *sjostedti*) do have mandibulate mouthparts, which are adapted for chewing and biting. They feed on the lamina of the foliage and matured leaves of the okra plant, thus reducing the photosynthetic surfaces of the crop's leaves.

During the period of May - August, the temperature declined from 28.3°C to 25.6°C while the relative humidity increased from 84% to 89%. The period with high population of *Podagrica* species occurred between week 8 -week14 (July - August) of the early season with a relative humidity of 89% and average rainfall of 160.2mm and a temperature of between 27.0 - 27.8°C. The population built up within the period of these two months represented the total

population built up during the period of the two planting season of May - September and September - December.

The lowest population built up of these insects was observed in their first week of emergence probably due to the fresh germination of the okra plant had not been cultivated on that piece of land for a period of two years. Although there were other related crops, which could have been likely infested by these Pests in not too far away plot from the area of study. These plots have plants like *Telfairia occidentalis*; *Amaranthus species* and *Cochorus olitorius*, which had probably, hasten the early infestation of the okra plants. (All these plants were vegetables). These vegetable crops/plants have been confirmed to serve as alternate hosts to these two species of *Podagrica*,^[3,6].

Table 1: Mean Abundance of *Podagrica Species* in the Early and Late Season

MONTH	SPECIES	MEAN
MAY	<i>Podagrica uiforma</i>	10.0000 ± 3.4641
	<i>Podagrica sjostedti</i>	9.3333 ± 3.7118
	Total	9.6667 ± 2.2755
JUNE	<i>Podagrica uiforma</i>	19.0000 ± 2.1213
	<i>Podagrica sjostedti</i>	22.2500 ± 3.2243
	Total	20.6250 ± 1.8892
JULY	<i>Podagrica uiforma</i>	36.2000 ± 2.8705
	<i>Podagrica sjostedti</i>	36.0000 ± 2.1213
	Total	36.1000 ± 1.6829
AUGUST	<i>Podagrica uiforma</i>	49.0000 ± 2.0817
	<i>Podagrica sjostedti</i>	51.3333 ± 2.6034
	Total	50.1667 ± 1.5794
SEPTEMBER	<i>Podagrica uiforma</i>	26.5000 ± 1.5000
	<i>Podagrica sjostedti</i>	28.0000 ± 2.0000
	Total	27.2500 ± 1.1087
OCTOBER	<i>Podagrica uiforma</i>	22.2500 ± 2.0565
	<i>Podagrica sjostedti</i>	25.5000 ± 1.1902
	Total	23.8750 ± 1.2598
NOVEMBER	<i>Podagrica uiforma</i>	28.0000 ± 1.4142
	<i>Podagrica sjostedti</i>	34.5000 ± 3.3789
	Total	21.2500 ± 2.0938
DECEMBER	<i>Podagrica uiforma</i>	17.5000 ± 2.2546
	<i>Podagrica sjostedti</i>	18.5000 ± 1.7078
	Total	18.0000 ± 1.3229
TOTAL	<i>Podagrica uiforma</i>	26.1379 ± 2.1886
	<i>Podagrica sjostedti</i>	28.3103 ± 2.2792
	Total	27.2241 ± 1.5726

A decline in the population growth of these insect pests were also observed in the late season of planting except between weeks 7 - 9 where there seems to be an increase in population with a relative decrease in rainfall from 228.3 mm in week one to almost traces in week fourteen and, a relative humidity of 88% in week one to 71 % in week fourteen of the late season.

Consequently, it can be ascertained that the seasonal fluctuation in the population growth of *Podagrica uiforma* and *Sjostedti* appears to be closely associated with the seasonal pattern of okra cultivation especially in the Southwestern Nigeria, where it is mostly cultivated. [5] stated that the incidence of insect infestation on okra plant is higher during the dry season (late season) than the rainy season (early season) however, in the case of *Podagrica species*, a higher population was recorded in the early planting season than the late planting season. In southwestern Nigeria planting of okra is done in April/May and intermittently done in June/July and in August-September as late cropping season.

Therefore, the high population of these flea beetles observed or recorded from week 5 to week 14 of the early season was due to high content of moisture, which allows for high ovipositor and the succulent

Table 2: Multiple Comparisons of *Podagrica Species* Population During the Early Season

LSD (I)MONTH	(J) MONTH	MEAN DIFFERENCE (I-J)	STD ERROR
MAY	JUNE	-10.9583*	2.7719
	JULY	-26.4333*	2.6505
	AUGUST	-40.5000*	2.9633
JUNE	MAY	10.9583*	2.7719
	JULY	-15.4750*	2.4346
	AUGUST	-29.5417*	2.7719
JULY	MAY	26.4333*	2.6505
	JUNE	15.4750*	2.4346
	AUGUST	-14.0667*	2.6505
AUGUST	MAY	40.5000*	2.9633
	JUNE	29.5417*	2.7719
	JULY	14.0667*	2.6505

*The mean difference is significant at the .05 level

nature of the foliage/leaves of the okra plant at that period which made it easier for them to feed on. An average of 3 - 4 *Podagrica* species were observed on each stand of okra with a ratio of 2: 1 or 1: 1 of *sjostedti* to *uiforma* species. The great marginal difference between the early period of *Podagrica* population in the early planting season and late planting season whereby there was a high infestation

rate at the beginning of the late season than the beginning of early season may certainly be due to the presence of these pests on the already cultivated plot which was also used for the cropping of the okra seeds in the late season, hence there was already an established population of *Podagrica* species on and near the plot used.

Table 3: Multiple Comparisons of *Podagrica Species* Population During the Late Season

LSD (I) MONTH	(J) MONTH	MEAN DIFFERENCE (I-J)	STD. ERROR
SEPTEMBER	OCTOBER	3.3750	2.6432
	NOVEMBER	-4.0000	2.6432
	DECEMBER	9.2500*	2.6432
OCTOBER	SEPTEMBER	-3.3750	2.6432
	NOVEMBER	-7.3750*	2.1581
	DECEMBER	5.5750*	2.1581
NOVEMBER	SEPTEMBER	4.0000	2.6432
	OCTOBER	7.3750*	2.1581
	DECEMBER	13.2500*	2.1581
DECEMBER	SEPTEMBER	-9.2500*	2.6432
	OCTOBER	-5.8750*	2.1581
	NOVEMBER	-13.2500*	2.1581

* The mean difference is significant at the .05 level

Table 4: Correlation Coefficient of Climatic Parameters on *Podagrica Species* During the Early and Dry Season

NOS OF SPECIES	%RELATIVE HUMIDITY	RAINFALL (mm)	TEMPERATURE (°C)
30	.855**	.030	-.492**
28	.775**	.026	-.680**

** Correlation is significant at the .01 Level (2- tailed)

A dramatic reduction in the population of the two species of *Podagrica* in late season at weeks 12 - 14 after an increase in weeks 7 - 9 which, may largely be due to a decrease in relative humidity from 96% - in weeks 7 -9 to 71% in weeks 12 - 14, with a fall in the amount of rainfall from 20.9 mm to traces (0.09 mm) in relation to an increase in temperature from 25.1°C to 27.5°C.

The study on seasonal fluctuation in the pest population of *Podagrica* species appears to be clearly associated with seasonal pattern of leaves and flower production just as observed by ^[12], when they studied the pests' population of black cowpea moth.

Conclusion: The importance of *Abelmoschus esculentus* to the nutritional value of man's diet cannot be overlooked and the insect pests that could be hindrances to the proper or better yield of these crop plant need to be study in order to know the appropriate measures of control and as at when due to apply the control for maximum yield.

This study has helped to show that the peak population of *Podagrica species* occurs more during the early planting season, while there is a lower population of emergence during the late planting season.

In view of this study, it has become necessary to develop a strategic method or way of controlling these flea beetles by employing an integrated control measures in relation to their peak period of emergence. This has become necessary because of the nutritional

value of okra especially the foliage leaves which could also be consumed as vegetable soup.

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