



## Seasonal incidence of major insect pests of okra in the north eastern hill region of India

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**ABSTRACT:** The present study on the seasonal incidence of major insect pests of okra was carried out at the experimental farm, ICAR Research Complex for NEH Region, Mizoram Centre, Kolasib, Mizoram, India during 2009-2010. Okra cultivars tested in the present study were: Crystel Seed (Okra-151), Green Challenger, Julie (Nirmal-303), Nisha (Nirmal-101), Parbhani Kranti and OH-597. The results revealed that infestation varied significantly in different cultivars of okra. The okra cultivars Nisha (Nirmal-101) was found the lowest population against *Nodostoma* spp. (0.850) and *Aphis gossypii* (Glover) (1.282). Parbhani Kranti was recorded the lowest population against *Mylabris pustulata* (Thunb) (0.026); Julie (Nirmal-303) was found the lowest population against *Dysdercus koenigii* Fabr. (0.179) and *Amrasca biguttula biguttula* (Ishida) (0.010); okra cultivar Green Challenger was recorded the minimum per cent infestation (3.08 %) and the Crystel Seed (Okra-151) cultivar was noticed maximum per cent infestation (6.15 %) against *Alcidodes affaber* Auriv. Pooled analysis indicated that Nisha (Nirmal-101) was recorded relatively lowest insects' population (1.091), while Crystel Seed (Okra-151) was observed the maximum insects population (2.163). *A. biguttula biguttula* was noticed relatively lowest population (0.037) among all okra cultivars screened. Whereas, *A. gossypii* was recorded the maximum population (3.225) among all okra cultivars screened.

**Keywords:** Okra cultivars, key insect pests, infestation, seasonal incidence

### INTRODUCTION

Okra, *Abelmoschus esculentus* (L.) is an important vegetable crop grown throughout the year. It is a native crop of Africa, South East Asia and North Australia to the pacific (Boswell and Reed, 1962). It is annual plant of the old tropics and widely cultivated in the tropical and subtropical countries. Okra is very common and widely consumed vegetable of North Eastern hill region of India. It is heavily infested by flea beetle, *Nodostoma* spp.; aphids, *Aphis gossypii* (Glover); blister beetle, *Mylabris pustulata* (Thunb); red cotton bug, *Dysdercus koenigii* Fabr.; cotton jassid, *Amrasca biguttula biguttula* (Ishida) and shoot weevil, *Alcidodes affaber* Auriv. Use of chemical insecticides for the protection of vegetable crops from the insect pests cause health hazards to human beings. Therefore, alternate non-chemical methods are sought for the management of vegetable insect pests. Host plant resistance is one of the self perpetuating and cost effective methods of pest management. Varietal resistance has often been used for the management of major insect pests on okra. Therefore, present investigation was under taken to study seasonal incidence helps to take up effective management and varietal screening of okra cultivars available in North Easter hill region of India against *Nodostoma* spp.,

*A. gossypii*, *M. pustulata*, *D. koenigii*, *A. biguttula biguttula* and *A. affaber* for the benefit of farmer and consumer communities.

### MATERIALS AND METHODS

The field experiments were conducted during 2009-2010 at the experimental farm, ICAR Research Complex for NEH Region, Mizoram Centre, Kolasib, Mizoram, India. Six okra cultivars namely, Crystel Seed (Okra-151), Green Challenger, Julie (Nirmal-303), Nisha (Nirmal-101), Parbhani Kranti and OH-597 were sown on 15<sup>th</sup> April, 2009. The net plot size was 4x5m with spacing of 30x60cm plant to plant and row to row, respectively in Randomized Block Design with four replications. All the recommended agricultural practices were followed in raising the crop. No plant protection measure was taken throughout the crop season. Observations on the incidence of insect pests were recorded at weekly interval in the morning hours starting from initial appearance to final disappearance or up to final harvest. The five plants per treatment per replication were selected randomly and tagged for recording observations of insect count, per cent damage and yield. In the case of *Nodostoma* spp., *A. gossypii*, *M. pustulata*, *D. koenigii*, and *A. biguttula biguttula* recorded the number of insect

per plant, while *A. affaber* recorded the per cent infestation on each of these selected or tagged plants were recorded to know the reaction of these cultivars of okra against major insect pests. Observations continued up to the harvest.

The periodic mean incidence of major insect pests was worked out taking into consideration their population in all six cultivars. Statistical analysis of the obtained data was done using Analysis of Variance (ANOVA) procedures in AGRES. The arcsine transformation was adopted for percentage of *A. affaber* damage and square root transformation was used in other insect pests following IRRISTAT software.

## RESULTS AND DISCUSSION

### Seasonal incidence of *Nodostoma* spp. on different okra cultivars

During the study, *Nodostoma* spp. was the first to invade the crop at seedling stage (fourth week after sowing) i.e., second week of May (Table 1). The population of *Nodostoma* spp. per plant varied from 0.300 to 3.678. *Nodostoma* spp. was active from the second week of May to first week of August with a peak level of population during third week of July i.e., fourteenth week after sowing (3.678). Jalgaonkar *et al.* (2002) and Thul *et al.* (2008) reported that relatively lowest percentage of flea beetle, *Monolepta signata* recorded on different germplasms of okra. The highest population (5.27) of *Nodostoma* spp. per plant was noticed on the cultivar OH-597 at third week of July during the reproductive stage i.e., fourteenth week after sowing. There was no *Nodostoma* spp. population during first week of August on the cultivar Nisha (Nirmal-101). The incidence of *Nodostoma* spp. was varied between 0.850 - 2.097 among all cultivars over the season. The lowest population (0.850) per plant was recorded on Nisha (Nirmal-101) followed by Parbhani Kranti (1.282), while the highest population (2.097) was recorded on Julie (Nirmal-303) over the season.

### Seasonal abundance of *A. gossypii* on different okra cultivars

The incidence of *A. gossypii* commenced from first week of June i.e., seventh week after sowing on all the cultivars (Table 2). The *A. gossypii* population reached the peak infestation level at third week of June i.e., ninth week after sowing (8.900) followed by last week of June i.e., eleventh week after sowing (6.689). These findings are in line with the findings of Anitha and Nandihalli (2008). The highest population (18.80) was recorded on the cultivar Green Challenger during third

week of June i.e., ninth week after sowing. Over the season, the aphid population varied from 1.282 to 5.385 among all cultivars. The relatively lowest population was noticed from Nisha (Nirmal-101) (1.282) followed by Julie (Nirmal-303) (1.918), whereas the highest population was recorded on Green Challenger (5.385) over the season.

### Seasonal incidence of *M. pustulata* on different okra cultivars

The abundance of *M. pustulata* was started appearing from second week of July i.e., thirteenth week after sowing on all the cultivars (Table 3). The peak population was recorded during July month (1.011). Similar results were obtained by Pathak (2004). The highest population (0.87) was recorded on the cultivar Julie (Nirmal-303) at third week of July i.e., fourteenth week after sowing. Over the season, the *M. pustulata* population was varied from 0.026 to 0.164 among cultivars. The relatively lowest population over the season was recorded on Parbhani Kranti (0.026) followed by Crystel Seed (Okra-151) (0.041), while the highest population (0.164) was recorded on Julie (Nirmal-303).

### Seasonal abundance of *D. koenigii* on different okra cultivars

The infestation of *D. koenigii* was recorded from second week of July i.e., thirteenth week after sowing and it was active up to first week of August on all the cultivars (Table 4). The peak level of population was noticed at first week of August i.e., sixteenth week after sowing (2.611) followed by last week of July i.e., fifteenth week after sowing (0.489). These findings are similar with the findings of Kalaisekar *et al.* (2008). Maximum population (3.13) was noticed on the cultivar Crystel Seed (Okra-151) and Green Challenger at sixteenth weeks after sowing i.e., first week of August. The mean population within cultivars of okra varied between 0.179 - 0.359 over the season. The relatively lowest population (0.179) was recorded on Julie (Nirmal-303) followed by Nisha (Nirmal-101) (0.185) when compared to Green Challenger which was recorded maximum population (0.359).

### Seasonal incidence of *A. biguttula biguttula* on different okra cultivars

The incidence of *A. biguttula biguttula* was active from last week of May to till the final harvest i.e., first week of August (Table 5). The peak level of incidence was noticed during first week of July i.e., twelfth week after sowing (0.122) followed by ninth week after sowing and eleventh after sowing (0.089). The present

**Table 1. Seasonal incidence of *Nodostoma* spp. on different okra cultivars**

Date of count	Standard week	Week after sowing	Mean population of <i>Nodostoma</i> spp.*					Mean	
			Crystel Seed (Okra-151)	Green Challenger	Julie (Nirmal-303)	Nisha (Nirmal-101)	Parbhani Kranti		OH-597
15.05.2009	19	4	0.07 (0.26)	0.53 (0.73)	0.73 (0.86)	0.40 (0.63)	0.13 (0.37)	0.27 (0.52)	0.356
22.05.2009	20	5	0.27 (0.52)	0.60 (0.77)	0.40 (0.63)	0.07 (0.26)	0.20 (0.45)	0.27 (0.52)	0.300
28.05.2009	21	6	0.27 (0.52)	0.73 (0.86)	0.40 (0.63)	0.40 (0.63)	0.60 (0.77)	0.13 (0.37)	0.422
03.06.2009	22	7	0.60 (0.77)	0.33 (0.58)	0.67 (0.82)	0.27 (0.52)	0.40 (0.63)	0.67 (0.82)	0.478
10.06.2009	23	8	0.87 (0.93)	0.67 (0.82)	0.07 (0.26)	0.27 (0.52)	0.27 (0.52)	0.53 (0.73)	0.444
17.06.2009	24	9	1.53 (1.24)	1.53 (1.24)	1.13 (1.06)	1.27 (1.13)	0.47 (0.68)	0.60 (0.77)	1.078
24.06.2009	25	10	4.67 (2.16)	2.93 (1.71)	4.80 (2.19)	3.12 (1.77)	2.67 (1.63)	3.13 (1.77)	3.564
30.06.2009	26	11	1.20 (1.10)	3.07 (1.75)	3.67 (1.91)	1.67 (1.29)	1.60 (1.26)	1.27 (1.13)	2.089
07.07.2009	27	12	1.93 (1.39)	1.80 (1.34)	2.73 (1.65)	0.93 (0.97)	1.40 (1.18)	1.93 (1.39)	1.767
15.07.2009	28	13	3.40 (1.84)	2.67 (1.63)	3.13 (1.77)	0.93 (0.97)	1.20 (1.10)	1.33 (1.15)	2.067
20.07.2009	29	14	4.80 (2.19)	3.60 (1.90)	4.73 (2.18)	0.87 (0.93)	2.80 (1.67)	5.27 (2.29)	3.678
27.07.2009	30	15	4.73 (2.18)	2.73 (1.65)	3.40 (1.84)	1.27 (1.13)	2.67 (1.63)	2.73 (1.65)	2.922
03.08.2009	31	16	2.07 (1.44)	2.40 (1.55)	1.40 (1.18)	0.00 (0.00)	2.27 (1.51)	2.27 (1.51)	1.733
		Mean	2.031	1.815	2.097	0.850	1.282	1.569	1.607
		SEm±	0.922	0.838	1.074	0.553	0.784	1.267	
		CD (P = 0.05)	1.870	1.700	2.179	1.122	1.589	2.569	

\* Figures in parentheses indicate square root transformed values, means of four replications

Table 2. Seasonal abundance of *A. gossypii* on different okra cultivars

Date of count	Standard week	Week after sowing	Mean population of <i>A. gossypii</i> *					Mean	
			Crystel Seed (Okra-151)	Green Challenger (Nirmal-303)	Julie (Nirmal-101)	Nisha (Nirmal-101)	Parbhani Kranti		OH-597
15.05.2009	19	4	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
22.05.2009	20	5	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
28.05.2009	21	6	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
03.06.2009	22	7	9.00 (3.00)	9.40 (3.07)	1.73 (1.32)	0.67 (0.82)	2.67 (1.63)	2.40 (1.55)	4.311
10.06.2009	23	8	11.00 (3.32)	8.00 (2.83)	4.33 (2.08)	2.00 (1.41)	6.67 (2.58)	2.53 (1.59)	5.756
17.06.2009	24	9	16.67 (4.08)	18.80 (4.34)	2.13 (1.46)	2.80 (1.67)	6.53 (2.56)	6.47 (2.54)	8.900
24.06.2009	25	10	2.00 (1.41)	4.67 (2.16)	6.47 (2.54)	0.53 (0.73)	6.67 (2.58)	8.80 (2.97)	4.856
30.06.2009	26	11	3.20 (1.79)	8.73 (2.96)	3.27 (1.81)	4.33 (2.08)	6.13 (2.48)	14.47 (3.80)	6.689
07.07.2009	27	12	2.93 (1.71)	9.73 (3.12)	4.00 (2.00)	3.47 (1.86)	4.00 (2.00)	5.93 (2.44)	5.011
15.07.2009	28	13	8.27 (2.88)	8.00 (2.83)	3.00 (1.73)	2.87 (1.69)	3.80 (1.95)	6.00 (2.45)	5.322
20.07.2009	29	14	3.47 (1.86)	2.67 (1.63)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	1.022
27.07.2009	30	15	0.33 (0.58)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.056
03.08.2009	31	16	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
		Mean	4.374	5.385	1.918	1.282	2.805	3.585	3.225
		SEm±	3.344	5.337	1.682	1.514	2.834	4.082	
		CD (P = 0.05)	6.782	10.825	3.411	3.071	5.749	8.279	

\* Figures in parentheses indicate square root transformed values, means of four replications

Table 3. Seasonal incidence of *M. pustulata* on different okra cultivars

Date of count	Standard week	Week after sowing	Mean population of <i>M. pustulata</i> *					Mean
			Crystel Seed (Okra-151)	Green Challenger (Nirmal-303)	Julie (Nirmal-101)	Nisha (Nirmal-101)	Parbhani Kranti	
15.05.2009	19	4	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
22.05.2009	20	5	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
28.05.2009	21	6	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
03.06.2009	22	7	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
10.06.2009	23	8	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
17.06.2009	24	9	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
24.06.2009	25	10	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
30.06.2009	26	11	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
07.07.2009	27	12	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
15.07.2009	28	13	0.27 (0.52)	0.40 (0.63)	0.27 (0.52)	0.07 (0.26)	0.07 (0.26)	0.222
20.07.2009	29	14	0.13 (0.37)	0.07 (0.26)	0.87 (0.93)	0.40 (0.63)	0.13 (0.37)	0.278
27.07.2009	30	15	0.07 (0.26)	0.33 (0.58)	0.27 (0.52)	0.27 (0.52)	0.00 (0.00)	0.233
03.08.2009	31	16	0.07 (0.26)	0.20 (0.45)	0.73 (0.86)	0.53 (0.73)	0.13 (0.37)	0.278
		Mean	0.041	0.077	0.164	0.097	0.026	0.078
		SEm±	0.061	0.123	0.235	0.187	0.054	0.111
		CD (P = 0.05)	0.123	0.249	0.477	0.379	0.110	0.225

\* Figures in parentheses indicate square root transformed values, means of four replications

Table 4. Seasonal abundance of *D. koenigi* on different okra cultivars

Date of count	Standard week	Week after sowing	Mean population of <i>D. koenigi</i> *							Mean
			Crystel Seed (Okra-151)	Green Challenger (Nirmal-303)	Julie (Nirmal-101)	Nisha (Nirmal-101)	Parbhani Kranti	OH-597		
15.05.2009	19	4	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
22.05.2009	20	5	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
28.05.2009	21	6	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
03.06.2009	22	7	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
10.06.2009	23	8	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
17.06.2009	24	9	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
24.06.2009	25	10	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
30.06.2009	26	11	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
07.07.2009	27	12	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
15.07.2009	28	13	0.20 (0.45)	0.20 (0.45)	0.13 (0.37)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.13 (0.37)	0.111
20.07.2009	29	14	0.07 (0.26)	0.53 (0.73)	0.33 (0.58)	0.27 (0.52)	0.27 (0.52)	0.53 (0.73)	0.33 (0.58)	0.344
27.07.2009	30	15	0.60 (0.77)	0.80 (0.89)	0.27 (0.52)	0.20 (0.45)	0.20 (0.45)	0.33 (0.58)	0.73 (0.86)	0.489
03.08.2009	31	16	3.13 (1.77)	3.13 (1.77)	1.60 (1.26)	1.93 (1.39)	1.93 (1.39)	2.93 (1.71)	2.93 (1.71)	2.611
		Mean	0.308	0.359	0.179	0.185	0.185	0.292	0.318	0.274
		SEm±	0.342	0.543	0.405	0.533	0.533	0.811	0.478	
		CD (P = 0.05)	0.693	1.101	0.821	1.081	1.081	1.645	0.969	

\* Figures in parentheses indicate square root transformed values, means of four replications

Table 5. Seasonal incidence of *A. biguttula biguttula* on different okra cultivars

Date of count	Standard week	Week after sowing	Mean population of <i>A. biguttula biguttula</i> *							Mean
			Crystel Seed (Okra-151)	Green Challenger (Nirmal-303)	Julie (Nirmal-101)	Nisha (Nirmal-101)	Parbhani Kranti	OH-597		
15.05.2009	19	4	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
22.05.2009	20	5	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.000
28.05.2009	21	6	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.07 (0.26)	0.00 (0.00)	0.011
03.06.2009	22	7	0.00 (0.00)	0.07 (0.26)	0.00 (0.00)	0.07 (0.26)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.022
10.06.2009	23	8	0.00 (0.00)	0.13 (0.37)	0.07 (0.26)	0.13 (0.37)	0.07 (0.26)	0.07 (0.26)	0.00 (0.00)	0.067
17.06.2009	24	9	0.07 (0.26)	0.20 (0.45)	0.00 (0.00)	0.07 (0.26)	0.07 (0.26)	0.07 (0.26)	0.13 (0.37)	0.089
24.06.2009	25	10	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.07 (0.26)	0.07 (0.26)	0.00 (0.00)	0.07 (0.26)	0.022
30.06.2009	26	11	0.33 (0.58)	0.07 (0.26)	0.00 (0.00)	0.07 (0.26)	0.00 (0.00)	0.00 (0.00)	0.13 (0.37)	0.089
07.07.2009	27	12	0.20 (0.45)	0.27 (0.52)	0.07 (0.26)	0.07 (0.26)	0.07 (0.26)	0.07 (0.26)	0.07 (0.26)	0.122
15.07.2009	28	13	0.07 (0.26)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.011
20.07.2009	29	14	0.13 (0.37)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.022
27.07.2009	30	15	0.07 (0.26)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.011
03.08.2009	31	16	0.07 (0.26)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.011
		Mean	0.072	0.056	0.010	0.031	0.021	0.031	0.031	0.037
		SEm±	0.060	0.075	0.027	0.049	0.036	0.045		
		CD (P = 0.05)	0.123	0.151	0.054	0.099	0.073	0.091		

\* Figures in parentheses indicate square root transformed values, means of four replications

Table 6. Seasonal abundance of *A. affaber* on different okra cultivars

Date of count	Standard week	Week after sowing	Mean population of <i>A. affaber</i> *							Mean
			Crystel Seed (Okra-151)	Green Challenger	Julie (Nirmal-303)	Nisha (Nirmal-101)	Parbhani Kranti	OH-597		
15.05.2009	19	4	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00
22.05.2009	20	5	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00
28.05.2009	21	6	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00
03.06.2009	22	7	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00
10.06.2009	23	8	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00
17.06.2009	24	9	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00
24.06.2009	25	10	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00
30.06.2009	26	11	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00
07.07.2009	27	12	6.67 (2.58)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	1.11
15.07.2009	28	13	13.33 (3.65)	0.00 (0.00)	13.33 (3.65)	0.00 (0.00)	0.00 (0.00)	6.67 (2.58)	6.67 (2.58)	6.67
20.07.2009	29	14	20.00 (4.47)	0.00 (0.00)	13.33 (3.65)	13.33 (3.65)	13.33 (3.65)	6.67 (2.58)	20.00 (4.47)	12.22
27.07.2009	30	15	20.00 (4.47)	20.00 (4.47)	20.00 (4.47)	20.00 (4.47)	20.00 (4.47)	20.00 (4.47)	20.00 (4.47)	20.00
03.08.2009	31	16	20.00 (4.47)	20.00 (4.47)	20.00 (4.47)	20.00 (4.47)	20.00 (4.47)	20.00 (4.47)	20.00 (4.47)	20.00
		Mean	6.15	3.08	5.13	4.10	4.10	4.10	5.13	4.62
		SEm±	5.443	4.336	4.653	5.391	5.007	8.673	17.591	
		CD (P = 0.05)	11.041	8.795	9.438	10.934	10.156	17.591		

\* Figures in parentheses indicate square root transformed values, means of four replications



**Table 7. Reaction of different cultivars of okra against major insect pest of okra**

Okra Cultivars	Major insect pests of okra*							Mean
	<i>Nodostoma</i> spp.	<i>A. gossypii</i>	<i>M. pustulata</i>	<i>D. koenigii</i>	<i>A. biguttula biguttula</i>	<i>A. affaber</i>		
Crystal Seed (Okra-151)	2.031 (1.43)	4.374 (2.09)	0.041 (0.20)	0.308 (0.55)	0.072 (0.27)	6.154 (2.48)	2.163	
Green Challenger	1.815 (1.35)	5.385 (2.32)	0.077 (0.28)	0.359 (0.60)	0.056 (0.24)	3.077 (1.75)	1.795	
Julie (Nirmal-303)	2.097 (1.45)	1.918 (1.38)	0.164 (0.41)	0.179 (0.42)	0.010 (0.10)	5.128 (2.26)	1.583	
Nisha (Nirmal-101)	0.850 (0.94)	1.282 (1.13)	0.097 (0.31)	0.185 (0.43)	0.031 (0.18)	4.103 (2.03)	1.091	
Parbhani Kranti	1.282 (1.13)	2.805 (1.67)	0.026 (0.16)	0.292 (0.54)	0.021 (0.14)	4.103 (2.03)	1.421	
OH-597	1.569 (1.25)	3.585 (1.89)	0.062 (0.25)	0.318 (0.56)	0.031 (0.18)	5.128 (2.26)	1.782	
Mean	1.607	3.225	0.078	0.274	0.037	4.615	1.639	
CV (%)	43.6	66.5	80.7	36.6	130.5	33.5		

\* Figures in parentheses indicate square root transformed values, means of four replications

findings are similar conformity with the findings of Anitha and Nandihalli (2008) and Singh and Brar (1994). The population of *A. biguttula biguttula* per plant indicated that the population was noticed on all cultivars during entire period of study. The highest population (0.33) was recorded on the cultivar Crystel Seed (Okra-151) during last week of June i.e., eleventh weeks after sowing. Among all cultivars, the lowest population was noticed on Julie (Nirmal-303) (0.010) followed by Parbhani Kranti (0.021), while the highest population (0.072) was recorded on Crystel Seed (Okra-151) over the season. Mahal *et al.* (1993) reported that IC 7194, Pb. Padmani, New Selection and IC 13999 had resistant to the *A. biguttula*.

### Seasonal abundance of *A. affaber* on different okra cultivars

The infestation of *A. affaber* commenced from first week of July i.e., twelfth week after sowing on the cultivar Crystel Seed (Okra-151) and it was active up to first week of August i.e., till the final harvest (Table 6). The highest per cent infestation was recorded during last week of July i.e., fifteenth week after sowing and first week of August i.e., sixteenth week after sowing (20.00 %) followed by third week of July i.e., fourteenth week after sowing (12.22 %). Over the season, the per cent infestation was varied from 3.08 to 6.15 among all cultivars. The relatively lowest percentage of infestation was noticed on Green Challenger (3.08 %) followed by Nisha (Nirmal-101) (4.10 %) and Parbhani Kranti (4.10 %), whereas the maximum per cent infestation was observed in Crystel Seed (Okra-151) (6.15 %).

Pooled analysis (Table 7) indicated that Nisha (Nirmal-101) was recorded relatively lowest insects' population (1.091) followed by Parbhani Kranti (1.421), while Crystel Seed (Okra-151) was observed the maximum insects' population (2.163). *A. biguttula biguttula* was noticed relatively lowest population (0.037) among all okra cultivars screened followed by *M. pustulata* (0.078), whereas *A. gossypii* was recorded the maximum population (3.225) among all okra cultivars screened. However, *A. affaber* was observed the 4.615 per cent infestation among okra cultivars screened

Overall observations recorded on the infestation of major insect pests on promising okra cultivars indicated that none of the above cultivars was found free from the attack of insect pests (Table 7). However, the degree of pest infestation varied considerably during the entire period of crop growth. The cultivar Nisha (Nirmal-101) recorded lowest population and Julie (Nirmal-303) was noticed the highest population against *Nodostoma* spp.;

the cultivar Nisha (Nirmal-101) recorded lowest population and Green Challenger was noticed the highest population against *A. gossypii*; Parbhani Kranti cultivar showed relatively lowest population and Julie (Nirmal-303) was recorded higher population against *M. pustulata*; the cultivar, Julie (Nirmal-303) was recorded lowest level of infestation and Green Challenger was noticed higher population against *D. koenigii*; Julie (Nirmal-303) cultivar was noticed lowest level of infestation and Crystel Seed (Okra-151) was noticed higher population against *A. biguttula biguttula*; Green Challenger was noticed lowest per cent infestation and Crystel Seed (Okra-151) was recorded highest per cent infestation against *A. affaber*.

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