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Screening of okra genotypes against shoot and fruit borer, *Earias vittella* (Fab.) in Gwalior (Madhya Pradesh)

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Abstract
An experiment was conducted at Agriculture entomology research farm, College of Agriculture, RVSKVV, Gwalior, Madhya Pradesh during kharif season 2015-16 and 2016-17 taken to know the infestation of okra shoot and fruit borer, Earias vittella (Fab.) on okra. Sixteen okra genotypes viz., 326-10-1, 633-7-1, IC – 140206, IC – 282280, 303- 10- 1, 461-10-1, IC- 43742, 419-10-1, 599-8-1, IPM-20-16-39, 1753, IC- 288892, 304-10-1, 100-10-1, 231- 10-1 and VRO-22 were screened to know their response on the basis of fruit damage scale. Only two genotypes viz., IC – 282280 and 303- 10- 1 showed tolerant, remained genotypes were falled in the category of moderately resistance, However, the IPM-20-16-39 showed minimum fruit damage with highest yield 32.29 q/ha, while, IC – 282280 genotype showed highest no. of fruit damage and fruit weight damage and it exhibited lowest health fruit yield 16.77 q/ha was noticed during 2015-16 and 2016-17. The peak borer infestation (24.50%) was recorded during fourth week of September.

Keywords: Okra, *Earias vittella*, varieties, infestation, genotypesn

Introduction
Okra (*Abelmoschus esculentus* (L.) Moench) or Bhindi or lady's finger is an important Malvaceaous vegetable crop grown in India. Vegetables constitute an important item of our food, supplying vitamins, carbohydrates and minerals needed for a balanced diet. Their value is important especially in under developed and developing countries like India. Among the states, West Bengal is the leading okra producing state which has production of around 718.9 thousand tonnes followed by Bihar (714.1 thousand tonnes) and Orissa (618.8 thousand tonnes). It is grown mostly in Hoogly, Mursidabad, Nadia, 24 Parganas, Bankur and Midnapur districts. Okra is attacked by a number of insect pests, of which shoot and fruit borer, *Earias* spp. is one of the major constraints in achieving potential yield. It is commonly known as many names in different countries as Bhindi in India, Krajiab Kheaw in Thailand, kopi in arab, Bhindi in South East Asia, Asbamia, Bamya or Bamieh and gumbo in Southern, quiabo in Portuguese and Angola, Quimbombo in Cuba, gombo commun, gombo, gumbo in France, mbamia and Mbinda in Sweden, and in Japan as okura, qiu kui in Taiwan and Igbo in Nigeria. It is a polyploidy, belong to family Malvaceae with 2n = 8x = 72,144 chromosome, it is an often cross pollinated crop, occurrence of out crossing to an extent of 4-19 per cent with the maximum of 42.2 per cent is noticed with insect assisted pollination The infested fruits become unfit for human consumption, thus resulting in 35 to 76 % decrease in yield (Hafeez and Rizvi, 1994) [3] and caused severe damage to the crop leading to yield losses to an extent of 3.5-90% in Andhra Pradesh (Krishnaiah *et al*., 1976) [7] and 30.81% at Coochbehar, West Bengal (Ghosh *et al*., 1999). Application of pesticides as the plant protection measures to overcome the pest problem causes the pesticide residues problem in harvested product and hazardous to consumers. Considering the limitations of chemical control, use of natural plant resistance to their pest at- tack can overcome the problem. Keeping this in view, the present studies were undertaken to screen out some okra varieties/cultivars against okra shoot and fruit borer.

Materials and Methods
The field experiment were conducted at entomology research farm, RVSKVV, Gwalior, Madhya Pradesh during *kharif* season 2015-16 and 2016-17 taken to know the infestation of

okra shoot and fruit borer, *Earias vittella* (Fab.) on okra. Sixteen okra genotypes *viz.*, 326-10-1, 633-7-1, IC – 140206, IC – 282280, 303- 10- 1, 461-10-1, IC- 43742, 419-10-1, 599-8-1, IPM-20-16-39, 1753, IC- 288892, 304-10-1, 100-10-1, 231- 10-1 and VRO-22 were sown in plots measuring 3 x 2.4 m, having 30cm x60cm spacing plant X row. The experiments were laid out in a Randomized Block Design with three replications. In the fruit borer infestation, number and weight of healthy and damage fruits were recorded at each harvest. The observations were recorded at weekly intervals to assess the relative susceptibility of different genotypes of okra under natural infestation conditions. In the fruit borer infestation, number and weight of healthy and damage fruits were recorded at each harvest. Harvesting was done at regular interval (2-3 times/week). Then per cent damage on number was calculated by counting the infested and healthy fruits separately from ten tagged plants and grades were also assigned for the fruit damaged based on the rating given by Mishra *et al*., (1988) [5] [Grade: 1. Immune= 0% (I) fruit damage; 2=Highly resistant (HR) 1-10%; 3=Moderately resistant (MR) 11-20%; 4 = Tolerant (T) 21- 30%; 5= Susceptible (S)-31-40%; 6= Highly susceptible(HS) above 40%.] and it was adopted in the present study.

Results and Discussion

The incidence of okra fruit and shoot borer (Earias spp.) on different okra cultivars during *kharif* 2015-16 and 2016-17 were presented in Table-1 and Table-1. The sixteen genotypes *viz.*, 326-10-1, 633-7-1, IC – 140206, IC – 282280, 303- 10-1, 461-10-1, IC- 43742, 419-10-1, 599-8-1, IPM-20-16-39, 1753, IC- 288892, 304-10-1, 100-10-1, 231- 10-1 and VRO-22 were screened against insect pests of okra to know their response on the basis of fruit damage scale. The shoot and fruit borer infestation per cent ranged from 11.59 – 24.50 was noticed while screening of okra genotypes. The difference in the infestation per cent of shoot and fruit borer indicated the capacity of genotypes of okra to resist the infestation of this pest. Out of sixteen genotypes, Out of theses genotypes, none of the okra genotypes were found to be immune to the borer attack. All genotypes were found moderately resistance except two genotypes *viz.*, 303-10-1 and IC-282280. However, only, IPM-20-16-39 genotype minimum infestation was noticed and can be augmented with any suitable insecticide to obtain maximum yield potential, hence, IC-282280 showed highest no. of fruit damage and fruit weight damage and it exhibited lowest healthy fruit yield. This clearly indicated that okra germplasm under test had variable response to resist the disease as reported. The genotype, IPM-20-16-39 showed lowest no. of fruit damage and fruit weight damage during 2015-16 and 2016-17. The peak borer infestation (24.50%) was recorded during fourth week of September. The borer population under field conditions throughout the cropping period from reproductive stage was adequate (on an average 2-3 larvae/plant) for screening the okra genotypes. There were statistical significant differences among the okra genotypes to the borers attack. The genotype, IPM-20-16-39 was found statistically significant (P=0.05%) superior at par with 326-10-1, IC-140206, 419-10-1,599-8-1 and 1753 genotypes. The maximum (32.29q/ha) yield was registered in IPM-20-16-39 genotype, while, minimum (16.77 q/ha) was noticed in IC – 282280 genotype. With view of discussion related work, in accordance to Mouli and Tayde (2017) [6] resulted that the eight okra varieties were screened to know their response on the basis of shoot and fruit damage scale. Based on the infestation of the shoot and fruits (number and weight basis) the grading is done as resistant, moderately resistant, moderately susceptible, susceptible sources. Among the eight genotypes, IC-117076 (5.98%, 8.54%, and 7.03%) and HRB-9-2 (6.78%, 7.01% and 5.78%) were moderately resistant to shoot and fruit damage (number and weight basis) and IC-033854 (16.43%, 25.39% and 21.22%) was found moderately susceptible to shoot and fruit damage (number and weight basis). VRO-4 (18.12%, 39.16% and 32.25%), VRO-3 (16.18% 37.76% and 31.09%) and VR0-22 (17.02%, 38.44% and 31.65%) were found moderately susceptible and susceptible to shoot and fruit damage (number and weight basis), respectively. PUSA SAWANI (31.20%, 39.30% and 32.42%) and IC-45831 (30.01%, 36.98% and 30.45%) found susceptible to shoot and fruit damage (number and weight basis).

Naresh *et al*. (2003) [8] observed that Vijaya cultivar was less susceptible based on shoot damage by *Earias spp*., however, fruit damage was lowest in Hybrid No. 8 followed by Jaya, OH-1, Arka Abhoy, Harsha, Vijaya, Arka Anamika and Soumya. Neeraja *et al*. (2004) screened some okra hybrids against fruit borer at Rajendranagar (Hyderabad) and reported that the fruit borer incidence ranged from 21.7 per cent in MBORH-913 to 27.6 per cent in JNDOH-1. Konsam *et al*., (2015) fifteen okra varieties were screened to know their response on the basis of fruit damage scale. The genotype, VNR Green showed highest no. of fruit damage fruit weight damage and exhibited lowest healthy fruit yield. PAN-2128 showed lowest no. of fruit damage fruit weight damage. Only wild species of okra like Abelmoschus manihot (Raut and Sonone, 1979) [10] and *A. manihot* spp. tetraphullus, *A. tuberculatus* and *A. tetraphyllus* (Prabu *et al*., 2009) [9] were reported as immune *to Earias* spp.

Table 1: Classification of okra genotypes based on their reaction to shoot and fruit borer damage in field during Kharif 2015-16 and 2016-17.

SN	Entry	% Infestation			Yield (Healthy fruits) q/ha			Scale Rating	Reaction
		2016	2017	Polled Mean	2016	2017	Polled Mean		
1	326-10-1	11.64	12.84	12.24	33.33	28.66	31.00	3	MR
2	633-7-1	15.76	17.43	16.59	25.09	26.14	25.61	3	MR
3	IC – 140206	12.99	16.99	14.99	30.63	25.36	27.99	3	MR
4	IC – 282280	22.50	26.50	24.50	17.23	16.30	16.77	4	T
5	303- 10- 1	21.78	25.54	23.66	20.17	15.61	17.89	4	T
6	VRO-22	15.17	18.94	17.05	26.27	19.79	23.03	3	MR
7	461-10-1	15.22	19.34	17.28	26.16	15.65	20.91	3	MR
8	IC- 43742	13.86	17.75	15.81	28.87	25.50	27.19	3	MR
9	419-10-1	12.72	16.71	14.71	31.17	20.91	26.04	3	MR
10	599-8-1	12.41	16.41	14.41	31.78	21.51	26.64	3	MR
11	IPM-20-16-39	12.16	11.01	11.59	32.28	32.31	32.29	3	MR
12	1753	11.94	15.94	13.94	32.72	22.46	27.59	3	MR

13	IC- 288892	15.03	19.22	17.12	26.54	15.89	21.22	3	MR
14	304-10-1	15.89	19.89	17.89	24.81	14.55	19.68	3	MR
15	100-10-1	15.02	19.02	17.02	26.56	19.96	23.26	3	MR
16	231- 10-1	15.99	20.00	17.99	24.61	21.01	22.81	3	MR
Se(M)±		1.51	2.27	1.360	3.398	3.343	2.383		
CV		18.23	21.58	20.5	21.49	27.12	23.96		
CD @0.05		4.37	6.55	3.86	9.813	9.653	6.74		

Conclusion

The shoot and fruit borer is a potential threat to okra cultivation. It was caused 11.59 – 24.50 per cent damage in different okra genotypes. Out of sixteen screening genotypes, none of the okra genotype was found to be immune to the borer attack. All genotypes were found moderately resistance except two genotypes *viz.,* 303-10-1 and IC-282280. However, only, IPM-20-16-39 genotype minimum infestation was noticed and can be augmented with any suitable insecticide to obtain maximum yield potential (32.29q/ha), while, minimum (16.77 q/ha) was noticed in IC – 282280 genotype. The peak borer infestation (24.50%) was recorded during fourth week of September.

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