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Screening of okra genotypes for fruit and shoot borer (*Earias vitella*) infestation under open field conditions

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Abstract
An experiment was carried out at Education and Research Farm, Department of Agricultural Botany, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli with twenty-six genotypes collected majorly from National Bureau of Plant Genetic Resources, Akola in a randomized block design with three replications during *summer* 2018. These genotypes were screened for the infestation of fruit and shoot borer under natural conditions. At field level, none of the crosses were neither immune nor resistant. Based on location data, eighteen genotypes *viz.,* IC006485, IC007952, IC008991, IC009856-C, IC015540, IC013664-B, IC013664, IC013999-A, IC014026, EC359954, IC16566, IC433645, EC305615, EC305769, EC306697, IC010265, EC306720, EC306703 were moderately resistant to FSB infestation on fruits under natural conditions. These genotypes can be further used as a parent in the breeding programme to develop superior varieties or hybrids.

Keywords: Screening, genotypes, okra, fruit, *Earias vitella*, conditions

Introduction
Okra [*Abelmoschus esculentus* (L.) Moench], belonging to the Malvaceae family, is an important vegetable crop of the in the tropics, sub-tropics and warmer portions of the temperate region of the world on a varying scale. This crop is attacked by many insect pests of which shoot and fruit borer, *Earias vitella* (Lepidoptera: Noctuidae) is a major pest. The larvae bore into growing shoots, buds and tender fruits resulting in their shedding and consequently affecting the fruit quality and yield to a considerable extent. Most of the present day cultivars are susceptible to this pest (Gupta and Yadav, 1978) [5]. To overcome this, host plant resistance is an economic and eco-friendly pest control tactic. Varieties suffering lesser damage in comparison with others under identical pest population pressure can be considered relatively resistant. Even a low level of plant resistance can substantially reduce the dependence on chemical protection and hence regarded as highly beneficial. Nowadays, damage based resistance evaluation is widely employed for varietal screening for pest resistance. Hence this screening programme for identifying the genotypes suffering lesser damage from shoot and fruit borer attack under natural field conditions was taken up.

Materials and Methods
The present investigation was carried out at Educational and Research farm, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during *summer 2018.* Twenty six accessions (including both indigenous and exotic) (Table1) were sown in a randomized block design of three replications. Each entry was sown in two rows of 3 m length with a row to row spacing of 45 cm and plant to plant spacing of 30 cm (45cm × 30cm) in broad beds. All the recommended agronomic package of cultivation practices were followed timely for successful raising of crop. As soon as the infestation of borer was noticed on the plants the number of infested fruits and number of healthy fruits were counted from the five randomly selected and labelled plants to work out the per cent fruit infestation at each picking. The incidence of fruit borer in a genotype was calculated by number of fruits infected in the five plants divided by total number of fruits harvested from the plot and multiplied by 100 (Narayanan *et al.,* 2016) [8] and the varieties were categorized by adopting scale developed by Gupta and Yadav (1978) [5] where germplasm with no damage are grouped as immune.

$$\text{Incidence of fruit borer} = \frac{\text{No. of fruits affected by fruit borer per plot}}{\text{Total number of fruits per plot}} \times 100$$

Table 1: Materials used in the study

IC 003304-C	IC013664-B	IC015540	EC306720
IC 006485	IC013664	IC16566	EC359954
IC 007856-A	IC013999-A	IC433645	EC359969
IC007952	IC013999-B	EC305615	EC360001
IC008991	IC14018	EC305769	Jawahar Local
IC009856-C	IC014026	EC306697	
IC010265	IC014600	EC306703	

Table 2. Scale for screening okra for resistance to fruit borer.

Grade	Fruit infestation	Category
1	0%	Immune
2	1%-5%	Resistant (R)
3	5.1%-15%	Moderately Resistant (MR)
4	15.1%-30%	Moderately Susceptible (MS)
5	30.1% and above	Susceptible (S)

Results and Discussion

The lowest infestation of fruit borer on fruits was registered by EC306697 (5.15) while the highest infestation was recorded in IC014600 (32.91). On the whole, average infestation of fruit borer on fruits was 11.68%. The infestation of the pest on the genotypes is available in table 3. The genotypes were classified into different groups based on the rating *sca*le given by Gupta and Yadav 1978 [5] (Table 4). High PCV (32.95; 44.93), GCV (32.03; 42.93), high heritability (94.50%; 95.10%) and high GAM (64.14; 85.65) was observed for the trait fruit and shoot borer infestation on fruits and yellow vein mosaic virus disease incidence (%) respectively.

Table 3: Infestation of Fruit and shoot borer on the fruits of twenty-six genotypes

Genotype	FSB infestation (%)	Genotype	FSB infestation (%)
IC003304-C	21.43 (0.48)	EC305615	16.67 (0.42)
IC006485	6.97 (0.27)	EC305769	11.67 (0.35)
IC007856-A	30.52 (0.59)	EC306697	10.00 (0.32)
IC007952	7.33 (0.27)	IC010265	6.67 (0.26)
IC008991	6.04 (0.25)	EC306720	20.00 (0.46)
IC009856-C	6.54 (0.26)	EC306703	10.00 (0.32)
IC015540	5.24 (0.23)	EC359969	45.00 (0.74)
IC03664-B	11.28 (0.34)	EC 360001	20.00 (0.46)
IC013664	5.17 (0.23)	IC014018	55.00(0.84)
IC013999-A	9.76 (0.32)	Mean	19.49 (0.44)
IC013999-B	15.49 (0.40)	Minimum	6.67 (0.26)
Jawahar local	21.62 (0.48)	Maximum	66.97 (0.96)
IC014026	9.69 (0.32)	S.E. (m)	0.02
IC014600	32.91 (0.61)	CD (5%)	0.07
EC359954	5.93 (0.25)	CV	9.77
IC16566	5.20 (0.23)		
IC433645	6.98 (0.27)		

At field level, none of the genotypes were neither immune nor highly resistant. Based on location data, eighteen genotypes *viz.*, IC006485, IC007952, IC008991, IC009856-C, IC015540, IC013664-B, IC013664, IC013999-A, IC014026, EC359954, IC16566, IC433645, EC305615, EC305769, EC306697, IC010265, EC306720, EC306703 were moderately resistant to FSB infestation on fruits under natural conditions. The results are similar to the findings of Gautam *et al.* (2014) [4], Narayanan *et al.* (2016) [8]. IC003304-C, IC013999-B, Jawahar local, EC359969, EC360001, IC014018 showed moderate susceptibility to FSB infestation on fruits. IC007856-A, IC014600 were susceptible to FSB infestation on fruits under natural conditions. Similar results were reported by Gautam *et al.* (2014) [4], Konsam *et al.* (2015) [6], Narayanan *et al.* (2016) [8], Dave and Pandya (2017) [2], Eswaran and Anbandan (2018) [3], Kumar and Tayde (2018) [7], Raghuwanshi *et al.* (2019) [9], Chandrasekaran (2020) [1].

Table 4: Classification of genotypes based on the grades (Gupta and Yadav 1978) [5] for fruit and shoot borer infestation (%) on fruits

S.No.	Category	Genotypes	Grade
1.	Immune	No genotypes showed immunity	1
2.	Resistant	No genotypes showed resistant	2
3.	Moderately resistant	IC006485, IC007952, IC008991, IC009856-C, IC015540, IC013664-B, IC013664, IC013999-A, IC014026, EC359954, IC16566, IC433645, EC305615, EC305769, EC306697, IC010265, EC306720, EC306703	3
4.	Moderately susceptible	IC003304-C, IC013999-B, Jawahar local, EC359969, EC360001, IC014018	4
5.	Susceptible	IC007856-A, IC014600	5

Conclusion

The genotypes *viz.*, IC006485, IC007952, IC008991, IC009856-C, IC015540, IC013664-B, IC013664, IC013999-A, IC014026, EC359954, IC16566, IC433645, EC305615, EC305769, EC306697, IC010265, EC306720, EC306703 showed low infestation of fruit and shoot borer pest giving scope for further improvement of okra breeding using these genotypes. Best genotypes in the present investigation should be used as parents in future research of heterosis and conventional breeding methods especially for the transfer of resistance.

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