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Fruit and shoot borer resistance (*Earias vittella* Fab.) in okra *[Abelmoschus esculentus* (L.) Moench]

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Okra,[*Abelmoschus esculentus* (L.) Moench] is an important warm season vegetable crop grown for its tender pods in tropical and sub tropical regions. The present research study has done with an objective to transfer shoot and fruit borer resistance to genotypes with desirable yield attributes. For this study three high yielding varieties and three resistant genotypes of okra germplasm representing four cultivated species *Abelmoschus esculentus* and two semi-domesticated species *Abelmoschus caillei* were crossed in all possible combinations and the parents and hybrids were evaluated for resistance against borer infestation. The F_1 hybrid of Sel 2 x AC5 identified as the best hybrid for both high marketable fruit yield and resistance to fruit and shoot borer, and it also showed field tolerance to Yellow Vein Mosaic Virus.

Key words : Okra, *Abelmoschus esculentus, Abelmoschus caillei,* Fruit and shoot borer

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INTRODUCTION

India is a major producer of okra in the world with an annual production of 32 lakh tonnes (NHB, 2005). Among the pests of okra, the shoot and fruit borer (*Earias* species) is the major pest causing high yield reduction. The conventional plant protection measures using chemicals for the control of this pest is undesirable from the point of view of residual effects and health hazards, as the tender pods are used for consumption. Thus to evolve or identify a new resistant variety is of paramount importance. Karuppaiyan (2006) screened 144 okra germplasm lines of Indian and exotic origin for shoot and fruit borer resistance and reported a number of resistant and moderately resistant genotypes. In the present study these genotypes were used as donors of resistance to develop high yielding resistance varieties.

RESEARCH METHODOLOGY

Six diverse okra genotypes *viz.*, Arka Anamika, KL9, Salkeerthy, Sel 2, Susthira and AC5 were crossed in a 6 x 6 complete diallel pattern. Thirty crosses were made out of which 24 F_1s were fertile and six interspecific crosses were sterile. Fifteen F_2s were selected on the basis of their F_1 performance and the performance of their parents in earlier studies and they were raised along with check variety Salkeerthy following a spacing of 50 x 40 cm. The treatments were raised in randomized block design (RBD) replicated thrice with 15 plants in each replication. The crop was grown in ridges and furrow system. Recommended package of practices of KAU was followed to grow a successful crop of okra. The crop was left open for natural infestation by fruit and shoot borer and no pesticides were sprayed. Fruit borer susceptible variety Salkeerthy was raised in border rows. Observations were recorded from three randomly selected plants from each replication and they were evaluated for yield attributes and resistance to fruit and shoot borer.

The relative degree of resistance to shoot and fruit borer infestation was judged on the basis of percentage shoot and fruit infestation in each genotype. Kumbhar *et al.* (1991) had given a rating scale to classify the genotypes based on resistance and it was followed to group the genotypes based on their shoot and fruit infestation into five resistance classes namely, i) immune (0 per cent infestation), ii) highly resistant (1-10 per cent shoot or fruit infestation), iii) moderately resistant (11-20 per cent infestation), iv) susceptible (21-30 per cent infestation) and v) highly susceptible (>31 per cent infestation) and it was adopted in the present study.

RESULTS AND ANALYSIS

The parents used in the study were already screened for fruit and shoot borer resistance, and it was found that parents namely Sel 2, AC 5 and KL9 were moderately resistant (Karuppaiyan, 2006). Considering the cross compatibility of these parents with cultivated high yielding varieties these parents were preferably selected over resistant wild species for the purpose of resistant donors in this breeding programme (Fig.1). The performances of genotypes were assessed in the open field condition, comparing the percentage of shoot infestation, fruit infestation and marketable fruit yield (Table1).

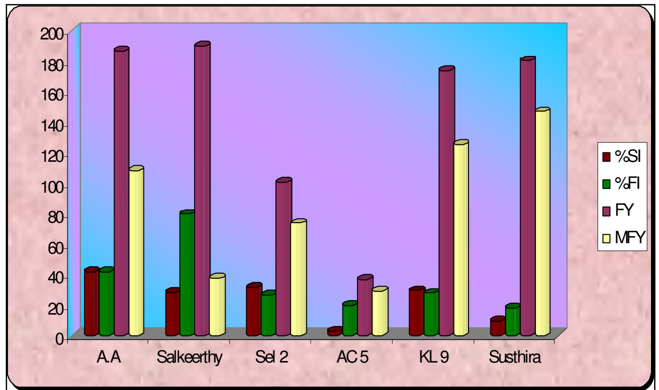

Fig. 1: Performance of parents for yield and resistance

Table 1 : Percentage shoot infestation (SI), fruit infestation (FI) fruit yield (FY) and marketable fruit yield in 15 F2 and six generations of Sel 2xAC 5 and KL 9X Salkeerthy

Sr. No.	Genotype	%SI	%FI	FY	MFY
1.	Salkeerthy x KL9	18.18	27.50	203.00	147.17
2.	Salkeerthy x Arka Anamika	18.18	31.50	238.00	163.03
3.	Salkeerthy x Susthira	16.66	20.80	144.00	114.04
4.	KL9 x Sel 2	20.00	11.76	170.00	150.08
5.	KL9 x AC5	8.33	36.84	228.00	144.04
6.	KL9 x Susthira	25.00	20.00	237.50	190.00
7.	Arka AnamikaxKL9	0.00	24.00	212.50	161.50
8.	Arka AnamikaxSalkeerthy	0.00	29.60	243.00	171.07
9.	Arka AnamikaxSusthira	30.00	36.00	212.50	136.00
10.	Arka AnamikaxSel 2	0.00	34.60	234.00	153.03
11.	Sel 2xSalkeerthy	11.00	42.00	161.50	93.67
12.	Sel 2xArka Anamika	0.00	33.33	216.00	144.07
13.	SusthiraxAC5	0.00	21.05	152.00	120.04
14.	SusthiraxSel 2	0.00	14.20	35.00	30.03
15.	Salkeerthy	28.57	80.00	190.00	38.00
	Sel2 x AC 5				
16.	P1	31.92	26.80	101.03	74.43
17.	P2	2.87	19.88	36.86	29.24
18.	F1	12.78	4.25	163.11	152.41
19.	F2	14.75	18.88	115.58	21.13
20.	BC1	15.88	24.13	75.98	56.95
21.	BC2	29.40	17.83	54.37	45.12
	KL9xSalkeerthy				
22.	P1	29.68	27.93	174.20	124.07
23.	P2	27.01	27.02	205.04	156.00
24.	F1	15.86	22.37	197.58	157.03
25.	F2	26.03	26.58	209.57	150.72
26.	BC1	28.42	28.71	108.81	77.33
27.	BC2	19.70	33.64	120.92	82.35

Table 2 : Classification of germplasm based on their relative degree of resistance to shoot and fruit borer

Group	Category	Percentage of infestation	Shoot borer	Fruit borer
I	Immune	0 %	Susthira x Sel 2, Susthira x AC 5, Sel2 Arka Anamika, Arka Anamika x Sel2, Arka AnamikaxSal, Arka AnamikaxKL9	Nil
II	Highly resistant	1 - 10.99%	AC5, KL9xAC5	Sel 2xAC5 (F_1)
III	Moderately resistant	11 - 20.99%	Sel 2xSal, KL9xSel 2, SalxKL9, SalxArka Anamika, SalxSusthira, Sel 2xAC5 (F_1, F_2, BC_1), Kl 9 x Sal (F_1, BC_2)	KL 9 x Sel 2, Sal x Susthira, KL 9 x Susthira, Susthira x Sel 2, AC 5, Sel 2 x AC 5 (F_2, BC_2), AC 5
IV	susceptible	21 - 30.99%	KL 9 x Susthira, KL 9, KL 9 x Sal (BC_1), Sel 2 x AC 5 (BC_2)	Sel 2, KL9, SalxKL9, Arka AnamikaxKL9, Arka AnamikaxSal, SusthiraxAC5, Sel 2xAC5(BC_1), Kl 9 x Sal (F_1, F_2, BC_1)
V	Highly susceptible	> 31 %	Salkeerthy	Salkeerthy, SalxArka Anamika, KL9xAC5, Arka AnamikaxSusthira, Arka AnamikaxSel 2, Sel 2xSal, Sel 2xArka Anamika, Kl 9 x Sal(BC_2)

There was little scope in studying the shoot and fruit borer infestation in case of F_1s as they were grown under protected green houses in pest free conditions. Therefore, 15 selected F_2s and genotypes of generation mean analysis of Sel 2 x AC 5 and KL9 x Salkeerthy were screened for pest infestation in open field conditions with susceptible variety in border rows to raise the pest population for better screening. Data on percentage shoot infestation, fruit infestation and marketable fruit yield recorded from F_2s. The mean infestation data were used for the classification. The genotypes grouped according to their resistance reactions are shown in Table 2. Out of the 15 F_2s tested, six were immune to shoot borer and only KL 9 x AC 5 was highly resistant. Five F_2s were moderately resistant. The remaining two F_2s, which includes KL 9 x Susthira (25 per cent) and Arka Anamika x Susthira (30 per cent), were either susceptible or highly susceptible to shoot borer. The F_1, F_2 and BC_1 generation of Sel2 x AC 5 were also moderately resistant to shoot borer. No genotype was immune to fruit borer. F_1 of Sel2 x AC 5 was observed to be highly resistant to fruit borer. KL 9 x Sel 2 (11.76 per cent), Susthira x Sel 2 (14.2 per cent) and KL 9 x Susthira (20 per cent) showed less than 20 per cent fruit infestation, hence, treated as moderately resistant to fruit borer. The remaining F_2 generations of crosses were susceptible or highly susceptible to fruit borer. Previous workers like Mahadevan and Dhanapani (1985), Gupta (1988), Vyas and Patel (1991), Srinivasa and Sugeetha (2001), and Neeraja *et al.* (2004) reported the susceptibility of many cultivated varieties to fruit borer.

Differential response to fruit and shoot borer infestation was observed in all genotypes even the pest causing the damage was same. The study revealed that minimum shoot infestation was shown by F_2 s of Arka Anamika x KL9, Arka Anamika x Sel 2, Sel 2 x Arka Anamika, Susthira x AC5 and Susthira x Sel 2. AC5 which showed minimum shoot infestation among the parents. In case of fruit infestation F_1 of Sel 2 x AC 5, F_2 s of KL9 x Sel 2 and Susthira x Sel 2 shown high resistance or low infestation. Salkeerthy was found highly susceptible for both shoot borer and fruit borer infestation. In case of marketable fruit yield KL9 x Susthira secured the highest. It is evident from the result that the progenies of resistant parents had shown preferable traits for further selection. These results are consistent with the findings of workers like Bairwa *et al.* (2005) and Karuppaiyan (2006).

The F_1 of Sel 2 x AC 5 was found to be the best genotype which was showing highest degree of resistance to both fruit borer (highly resistant) and shoot borer (moderately resistant) compared to all other genotypes under study (Fig.2).This was having comparatively high fruit yield (163.11 g) and marketable fruit yield (152.41g). Therefore, this genotype can be considered as an elite genotype with both high yield and resistance to fruit and shoot borer. This F_1 had shown field resistance to yellow vein mosaic virus also

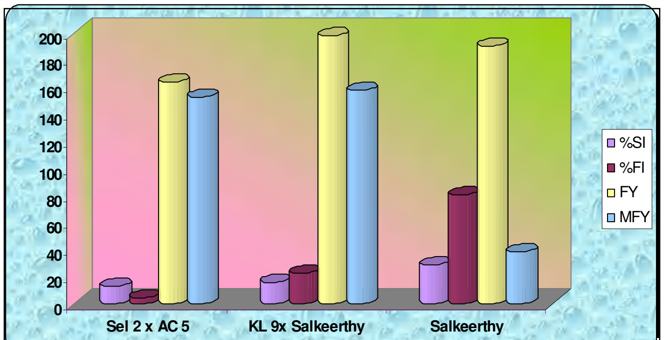

Fig. 2: Performance of superior hybrids for yield and resistance with check variety salkeerthy

Conclusion:

In the F_2, variability was higher for shoot infestation and fruit infestation. High genetic advance, genetic gain and heritability were recorded for shoot infestation and fruit infestation indicated that selection can be resorted for the improvement of these characters. Selection of genotypes with short growth habit, short flowering period and short fruit length will help to minimize the shoot and fruit borer infestation. Generation mean analysis of Sel 2 x AC5 indicated the presence of complementary epistasis for fruit infestation. In the inter varietal cross KL9 x Salkeerthy it was observed that duplicate epistasis govern the fruit borer resistance and digenic non-allelic interaction model was inadequate to explain shoot borer infestation.

Presence of biochemical factors like high phenol and tannin content in the fruits and shoots of resistant genotypes compared to susceptible genotypes indicated that the biochemical constituents play a role in fruit and shoot borer resistance. The study revealed that the F_1 hybrid of Sel 2 x AC5 identified as the best hybrid for both high marketable fruit yield and resistance to fruit and shoot borer, and it also showed field tolerance to Yellow Vein Mosaic Virus.

LITERATURE CITED

Bairwa, D.K., Kanwat, P.M. and Kumawat, K.C. (2005). Screening of okra varieties against shoot and fruit borer (*Earias vittella* Fab.). *Haryana J. Hort. Sci.,* **34**(3-4): 343-345.

Gupta, A. (1988). Effect of food plants on the life process of *Earias fabia* Stoll with reference to three varieties of okra. *Bull. Ent.,* **29**(2): 190-198.

Karuppaiyan, R. (2006). Breeding for resistance in okra to shoot and fruit borer (*Earias Vittella*). Ph.D (Agri.) thesis, Kerala Agricultural University, Trichur, 178 pp.

Kumbhar, T.T., Kokate, A.S. and Dumbre, A.D. (1991). Studies on the varietal resistance in okra [*Abelmoschus esculentus* (L.) Moench] to shoot and fruit borers (*Earias* spp). *Maharashtra J. Hort*., **5**(2): 78-82.

Mahadevan, J.R. and Dhandapani, N. (1985). Varietal resistance in bhendi to fruit borer. *TNAU Newsl.,* **14**(10): 3.

Neeraja, G., Vijaya, M., Chiranjeevi, C. and Gautham, B. (2004). Screening okra hybrids against pest and diseases. *Indian J. Plant Prot.,* **32** (1): 129-131.

NHB [National Horticultural Board]. (2005). Horticulture Information Service, August 2005, National Horticultural Board, Gurgaon, pp. 55-56.

Srinivasa, N. and Sugeetha, G. (2001). Field screening of certain okra varieties for resistance against major pests. *Insect Env.,* **7**(2): 74-76.

Vyas, S.H. and Patel, J.R. (1991). Intensity and damage of *Earias vittella* Fab. on various cultivars of bhendi. *Gujarat Agric. Univ. Res. J.,* **17**(1): 140-141.

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