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SHORT NOTE

SCREENING OF OKRA HYBRIDS AND VARIETIES FOR RESISTANCE TO FRUIT BORERS

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Okra or bhendi [*Abelmoschus esculentus* (L.) Moench] is an important vegetable crop grown in 3.30 lakh hectares for its tender pods in India (Thamburaj and Singh, 2002). Okra is attacked by many insect pests and the fruit borers viz., *Earias* spp and *Helicoverpa armigera* (Hub.) are the major pests. In *Earias* there are two major species *viz., Earias insulana* Boisd and *Earias vitella* Fabricius and both occur in Karnataka, South India (Patil *et al*., 1996).The fruit borers cause severe damage to the crop leading to yield losses to an extent of 3.5-90% in Andhra Pradesh (Krishnaiah *et al.*, 1976) and upto 69% in Madhya Pradesh (Rawat and Sahu, 1973). The larvae bore into the growing shoots, buds and tender fruits resulting in their shedding and consequently affecting the fruit quality and yield. Most of the present day okra hybrids/cultivars are susceptible to the fruit borers (Gupta and Yadav, 1978). For any crop improvement programme, screening germplasms is necessary to assess the existing variability, identify sources of resistance, expand genetic base of resistant varieties and to study mechanisms of resistance. To identify fruit borer resistant/tolerant okra hybrids and varieties, field screening trials were conducted.

Thirty seven new single cross hybrids from Indian Institute of Horticultural Research (IIHR), Bengaluru and 56 varieties collected from different parts of Karnataka constituted the material for the study. These hybrids and varieties were evaluated for their performance and reaction to fruit borers at the University of Agricultural Sciences, Bengaluru (13^0 5‘ N, 77^0 35‘ E, 982 amsl) during *kharif* 2007. Each hybrid and variety was grown in a row of 3.0 m length with a spacing of 60 x 30 cm following RCBD with three replications. All the recommended packages were followed to raise a healthy crop. Besides recording observations on genetic variability parameters, observations on fruit damage was also recorded. Observations on borer attack on tender shoots and fruiting bodies were recorded during July and September 2007 at weekly intervals. To determine the activity of the borers under field conditions, fruits from two randomly selected plants/replication were taken at ten days intervals till the end of the season. In all ten pickings, per cent borer affected fruits was calculated at each picking. The fruit damage by borers served as an index of their activity under field conditions. The mean of five plants per replication was considered for ANOVA following RCBD and paired ‘t’ test (Sunderaraj *et al.*, 1972).

The hybrids and varieties were classified into different grades following Nath (1966).

Grade 1 = Immune (No damage)

2 = Resistant (1-5 percent infestation)

3 = Moderately Resistant (>5-15 percent infestation)

4 = Moderately susceptible (>15-30 percent infestation)

5 = Susceptible (more than 30% infestation)

None of the hybrids and varieties was found to be immune, during rabi-summer 2007-08, and hence one hybrid and one variety each from four categories (2 to 5 grade) were selected and screened under greenhouse conditions with five plants per hybrid/variety. Moths of *E. vittella* were reared under laboratory conditions on local okra fruits and reaction of the entries to adult moths for oviposition and larval boring were recorded following Nath (1966) and Gupta and Yadav (1978). Two pairs of *E. vittella* moths were enclosed per plant per cage for studying ovipositional preference. Five second instar larvae were enclosed per plant per cage for determining preference for boring. The data sets were subjected to statistical analysis. Among hybrids, BH-102 and among varieties, Local served as check genotypes.

Field observations indicated that *E. vitella, E. insulana* and *H. armigera* constituted the borer complex on okra in the study area. However, the proportion of larvae of *E. insulana* and *H. armigera* were negligible compared to *E. vitella*. *E. vitella* constituted more than 96% of the larval populations (n=24) of the borers in the study plots. The peak borer infestation (76%) was recorded during second week of August. The borer population under field conditions throughout the cropping period was adequate (on an average 2-3 larvae/plant) for screening the okra hybrids and varieties.

None of the hybrids and varieties of okra was immune to the borer attack. Nineteen hybrids reacted as susceptible; twelve as moderately susceptible; five as moderately resistant and one hybrid Saloni (4.39% fruit infestation) reacted as resistant (Table 1) with higher standard heterosis for fruit yield over commercial check (Mahaveer, 2007). The hybrid Saloni (216.74 g/plant) which registered better yield with resistance to fruit borer can be recommended for cultivation. The mean fruit borer damage among 37 okra hybrids varied from 4.93% in Saloni to 81.17% in NBH-180 (Table 1).

The percentage infestation of fruit borer and the classification of varieties is given in Table 2. The mean fruit borer damage among 56 okra varieties varied from 3.50% in the entry number 105 to 83.28% in AOL-03-1 (Table 2). Twenty two varieties showed susceptible reaction; 24 moderately susceptible; nine moderately resistant and one (entry number 105) was resistant (3.5% fruit infestation) but with low mean fruit yield (90.30 g/plant). However, the varieties Pusa Sawani, KA-026, PB-236, lines 111, 114 and 116 were moderately resistant. The variety Pusa Sawani also had a considerable mean yield (297.42 g/plant) along with moderate resistance to fruit borer. Hence, Pusa Sawani may be used as a parent in further breeding programmes. This will help in increasing the profits by reducing the spraying costs for insect pest suppression. The hybrid Saloni had comparatively higher fruit weight (18.07 g) compared to general mean fruit weight of 16.15 g/ in the germplasm tested. Among okra varieties screened, Pusa Sawani had comparatively better fruit weight (24.5 g/fruit) and fruit yield per plant (300 g/plant) (Mahaveer, 2007).

In laboratory, hybrid Saloni confirmed its field reaction as resistant as the moths laid fewer eggs and it was the least preferred preferred by larvae. Similarly, entry number 105 was resistant because it was non-preferred for oviposition. It showed susceptibility to larvae. Pusa Sawani also

Table 1. Classification of okra hybrids based on their reaction to fruit borer damage in field

S. No.	Entry	Mean* fruit damage (%)	Grade	Remarks**
1	NOH-303	08.59	3	MR
2	MBORH-311	16.11	4	MS
3	MBORH-913	24.78	4	MS
4	AROH-221	29.54	4	MS
5	Arya Dhanalaxmi	44.62	5	S
6	GS-33	34.91	5	S
7	NOH-303	50.10	5	S
8	SOH-1016	08.60	3	MR
9	Karisma -33152	43.11	5	S
10	VOH -267	52.86	5	S
11	NIMBKAR -55	25.97	4	MS
12	MAHABEEJ -333	37.62	5	S
13	NBH -180	81.17	4	MS
14	VLH -105	37.08	5	S
15	NBH-225	21.94	4	MS
16	SALONI	04.93	2	R
17	OH-1	23.49	4	MS
18	OH-2	31.11	5	S
19	OH-3	14.21	3	MR
20	OH-4	19.79	4	MS
21	OH-5	11.44	3	MR
22	US- 7109	30.36	5	S
23	BSS- 594	17.28	4	MS
24	BSS-593	31.11	5	S
25	AROH-218	41.85	5	S
26	JNDOH -02-2	53.33	5	S
27	EG- 5008	44.14	5	S
28	Evergreen (P-43)	14.71	3	MR
29	AOH-04-3	26.60	4	MS
30	KDOH-404	32.62	5	S
31	CEKAY SEEDS	18.18	4	MS
32	SEMINIS	33.29	5	S
33	BH-101	48.97	5	S
34	AROH-10	39.06	5	S
35	BH-102	44.83	5	S
36	AROH-11	54.82	5	S
37	BH-103	25.80	4	MS
	C.D. at 5%	**9.86**		

* Mean of 5 plants/replication and 10 observations
** R = Resistant
MR = Moderately resistant
MS = Moderately susceptible
S = Susceptible

Table 2. Classification of okra varieties based on their reaction to fruit borer damage in field

Sl. No.	Entry	Mean* fruit damage (%)	Grade	Remarks**
1	Local collection (Raichur)	44.44	5	S
2	Unknown	33.98	5	S
3	Larm-1	16.96	4	MS
4	Punjab Padmini	36.39	5	S
5	Arka Abhay	19.56	4	MS
6	Ujwala Seeds	33.25	5	S
7	HRB-9-2	78.00	5	S
8	Pusa Sawani	11.12	3	MR
9	HRB-55	18.70	4	MS
10	KA-006	22.74	4	MS
11	KA-035	25.28	4	MS
12	Arka Anamika	25.92	4	MS
13	KA-075	34.87	5	S
14	KA-026	07.10	3	MR
15	Parbhani Kranti	45.16	5	S
16	KA-079	24.45	4	MS
17	KA-052	20.01	4	MS
18	KA-013	28.73	4	MS
19	KA-010	37.77	5	S
20	Kamini	19.19	4	MS
21	PB-236	10.01	3	MR
22	JNDOL-03-1	21.96	4	MS
23	AOL-03-1	83.28	5	S
24	DOV-2	24.62	4	MS
25	DSV-I	23.54	4	MS
26	DOV-I	34.33	5	S
27	PB-266	43.88	5	S
28	DSN-I	17.56	4	MS
29	Barka	26.28	4	MS
30	P-7	16.65	4	MS
31	Arya-351	29.45	4	MS
32	101	70.72	5	S
33	102	17.34	4	MS
34	103	32.00	5	S
35	104	23.11	4	MS
36	105	03.50	2	R

37	106	32.94	5	S
38	107	71.85	5	S
39	108	32.95	5	S
40	109	45.23	5	S
41	110	27.72	4	MS
42	111	09.20	3	MR
43	112	34.50	5	S
44	113	57.61	5	S
45	114	09.00	3	MR
46	115	38.18	5	S
47	116	11.27	3	MR
48	117	21.29	4	MS
49	118	34.50	5	S
50	119	24.69	4	MS
51	120	15.00	3	MR
52	121	25.00	4	MS
53	122	76.25	5	S
54	123	14.09	3	MR
55	124	15.94	3	MR
56	125	24.80	4	MS
	C.D. at 5%	**11.40**		

* Mean of 5 plants/replication and 10 observations ** R = Resistant MR = Moderately resistant
MS = Moderately susceptible S = Susceptible

Table 3. Reaction of okra hybrids and varieties to *Earias* fruit borer in laboratory

Hybrid/variety	**Mean* number of eggs/plant for 3 days**	**Mean (%) stalk/fruit bored**
NOH - 303	26.00 ± 1.78	11.20 ± 2.10
Saloni	6.00 ± 0.56	5.69 ± 1.17
BH-102(check)	174.00 ± 1.24	57.8 ± 3.16
OH-4	49.00 ± 2.10	26.84 ± 4.24
Local (check)	186.00 ± 3.17	68.24 ± 3.26
105	2.00 ± 0.01	2.45 ± 2.86
Larm 1	35.00 ± 2.20	18.40 ± 2.45
Pusa Sawani	28.00 ± 1.70	16.20 ± 1.50
CD at 5%	**17.85**	**23.86**

* Mean of 5 plants (x ± S.D.)

showed considerable degree of resistance with non-preference to oviposition and larval feeding (Table 3). There were statistical significant differences among the four categories of hybrids/ varieties to the borers attack.

Observations on genetic variability and heterosis analyses indicated that shorter nodal length and lower number of branches per plant were consistently associated with borer susceptibility and vice-versa in the select okra germplasm evaluated. Multi location testing of the resistant okra lines against varying populations of fruit borers would be useful in confirming the stability of resistance and further utility in crop improvement programme.

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