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EVALUATION OF BRINJAL GERMPLASM AGAINST MAJOR INSECT PESTS AND PREDATORS

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ABSTRACT

A field experiment was conducted to evaluate brinjal germplasms against major insect pests and predators. The entries IC 545884 and IC 410129 against fruit and shoot borer *L. orbonalis* were found to be highly resistant (11.0 and 20.0%) and the entries IC354562, IC354578, IC397299, IC420406, IC427017, IC433625, IC545884 and IC545928 were moderately resistant (11.0 and 20.0%) in fruit and shoot damage, respectively. Low damage by *H. vigintioctopunctata* was observed in all 25 entries. Pusa hybrid 6 and IC354694 were found to be susceptible which showed low damage by *Aphis devastans* and Pusa hybrid 6 was damaged more by *Aphis gossypi and Myllocerus.* The accessions IC 545884, IC 410129 IC354562, IC354578, IC397299, IC420406, IC427017, IC433625, IC545884, IC545928 designated as resistant and fairly resistant to *L. orbonalis* had recorded the low population of whitefly, spotted leaf beetle, *Myllocerus* and aphids. Entries IC545970, IC354635, and IC354676, were found to be more attractive to coccinellids. More number of spiders found in entries such as Pusa hybrid 6, IC354578 and IC354694 whereas Pusa hybrid 6, IC383106, IC397299 and IC420650 attracted more syrphids

Key words: Brinjal, *Leucinodes Orbonalis*, aphids, jassids, predators, host plant resistance.

Among the major constraints in cultivation of brinjal, insect pest infestation is important. Repeated use of broad spectrum pesticides against these result in environmental contamination. Hence, insect resistance in crop plants is an important component of Integrated Pest Management (IPM). Screening of brinjal cultivars against insect pests has been attempted by several workers. The present study reports on such a study done at New Delhi.

MATERIALS AND METHODS

A field experiment was conducted in a randomized block design (RBD) with three replications (10 cents). The accessions of 26 varieties were screened against major pests and their predators (Table 1). Thirty-five days old seedlings were transplanted with a spacing of 55 x 55 cm (2013 and 2014) in the naturally infested field at the ICAR-Indian Agricutural Research Institute, New Delhi. The package of practices except plant protection measures were followed. There were seven plants per replication and a total of 21 plants per accessions. Five plants were tagged at random and observed for the incidence of pests and their predators at weekly interval starting from transplanting to harvest. The percentage data of spotted leaf beetles, leafhoppers, aphids, whitefly, obtained from the field experiment were subjected for statistical analysis (SAS).

Healthy and damaged shoots by *Lenucinodes orbonalis* were recorded on five randomly selected plants and % damage was worked out. After each observation, the damaged shoots were removed. In case of fruit infestation, number and weight of healthy and damaged fruits were recorded and % was calculated. Grades 1-Immune - 0%; 2- Highly resistant - 1-10%; 3-Moderately resistant - 11-20%; 4-Tolerant - 21-30%; 5-Susceptible - 31-40%; 6-Highly susceptible – above 40% were also assigned based on fruit infestation (Mishra *et al*., 1988). The number of grubs and adults of *Henosepilachna vigintioctopunctata* were recorded from three leaves, one each from top, middle and bottom part of five randomly selected plants. Mean was worked out and expressed as number per three leaves.

Three leaves (one from top, middle and bottom) in 5 randomly selected plants were carefully assessed for the presence of nymphs and adults of aphids, *Aphis gossypii, Amrasca devastans* and whitefly, *Bemisia tabaci* and expressed as number per three leaves. Similarly natural enemies like coccinellids, syrphids and spiders were recorded, and expressed as number per plant. The number of adults of *Myllocerus* spp., were recorded from three leaves, one each from top, middle and bottom part of five randomly selected plants. Mean was worked out and expressed as number per three leaves.

Table 1. Accessions of brinjal evaluated

	Frdn		Frdwt		Shdper	
Treatment Name	Treatment	Rank of Treatment	Treatment of Frdwt	Rank of Treatment	Treatment of Shdper	Rank of Treatment
IC354562	14.40^{JKL}	21	15.13^{KL}	21	16.40^{HIJK}	17
IC354578	14.90^{IJK}	20	17.43^{IJK}	18	18.57^{GHIJ}	16
IC354597	27.62^{CDEFG}	11	30.07^{CDEF}	10	25.17^{DEF}	8
IC354612	22.60^{FGHIJ}	15	24.70^{FGH}	14	24.87^{EF}	9
IC354635	33.17^{BCDE}	8	32.33^{CD}	8	23.10^{FG}	12
IC354655	48.17^{A}	2	52.63^{A}	2	43.87^{B}	2
IC354676	37.83^{B}	3	36.57^{BC}	4	41.17^{B}	3
IC354694	32.00^{BCDEF}	10	25.33^{EFGH}	12	23.43^{FG}	11
IC354701	34.90^{BCD}	5	31.90^{CDE}	9	30.00^{CDE}	6
IC374942	33.33^{BCDE}	7	35.03^{BCD}	6	24.63^{EF}	10
IC383106	37.23^{BC}	4	41.20^{B}	3	35.07^{C}	4
IC397299	14.03^{JKL}	22	14.43^{KL}	23	11.53^{K}	22
IC398820	24.27^{EFGHI}	14	28.40^{DEFG}	11	13.93^{IJK}	19
IC410129	6.80^{KL}	24	7.50^{M}	25	4.50^{L}	24
IC420406	18.25^{HIJ}	17	22.60^{GHIJ}	16	18.82^{GHI}	15
IC420650	33.57^{BCDE}	6	35.33^{BC}	5	30.87^{CD}	5
IC427007	27.43^{CDEFG}	12	24.13^{FGHI}	15	20.50^{FGH}	14
IC427017	15.20^{IJK}	19	14.87^{KL}	22	10.83^{K}	23
IC433547	32.53^{BCDE}	9	33.07^{CD}	7	23.00^{FG}	13
IC433625	17.87^{GHIJ}	18	16.77^{JK}	19	14.57^{IJK}	18
IC545844	4.63^{L}	25	8.67^{LM}	24	4.50^{L}	25
IC545884	13.43^{JKL}	23	15.63^{K}	20	13.55^{JK}	20
IC545928	19.50^{GHIJ}	16	19.57^{HIJK}	17	12.67^{K}	21
IC545970	25.37^{DEFGH}	13	25.33^{EFGH}	13	25.83^{DEF}	7
Pusa purple round	53.47^{A}	1	54.70^{A}	1	50.67^{A}	1
General Mean	25.41	.	26.38	.	22.34	.
p-Value	<.0001	.	<.0001	.	<.0001	.
CV(%)	12.26	.	8.16	.	8.10	.
SE(d)	2.519	.	1.740	.	1.463	.
Tukey HSD at 5%	9.7364	.	6.7262	.	5.6563	.

Means with atleast one letter common not statistically significant; Grouping letters on treatments made using pdglm800.sas (downloaded from http://animalscience.ag.utk.edu/FacultyStaff/ArnoldSaxton.html#software)

ANOVA (Dependent variable-fruit damage number)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Significant
Rep	2	39.2727	19.6363	2.0217	0.1429	NS
Trt	24	10716.6558	446.5273	45.9731	<.0001	**
Error	51	495.3527	9.7128	.	.	-
Corrected Total	77	11251.2812	.	.	.	-

** - Significant at 1%, * - Significant at 5%, NS - Non Significant

ANOVA (Dependent variable-fruit damage weight)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Significant
Rep	2	48.2556	24.1278	5.2051	0.0088	**
Trt	24	10628.9749	442.8740	95.5421	<.0001	**
Error	51	236.4044	4.6354	.	.	-
Corrected Total	77	10913.6349	.	.	.	-

** - Significant at 1%, * - Significant at 5%, NS - Non Significant

RESULTS AND DISCUSSION

The pooled data revealed that shoot and fruits of all the entries were prone to the attack by *L. orbonalis*. Among 26 varieties, none of them was immune (Table 1). Immunity to *L. orbonalis* was reported only either in wild species of brinjal like *Solanum khasianum* (Lal *et al*., 1976) and *S. anomalum* and *S. incanum* (Behera *et al*., 1999) or in the derivatives of wild species like Arka Mahima and Arka Sanjivans (Kale *et al*.,1986). In case of fruit and shoot damage two entries, IC 545884 and IC 410129 were at par and significantly different. These were found to be highly resistant (Table 1). The resistant reaction of these might be due to the tough fruit skin, narrow pericarp, extra longish fruits with light purple colour, less seedless area and less peripheral ring. Pusa Purple Cluster and Black Beauty were reported resistant due to purple coloured leaves (Ghosh and Senapati, 2001).

The entries IC354562, IC354578, IC397299, IC420406, IC427017, IC433625, IC545884 and IC545928 were at par with each other, and moderately resistant to *L. orbonalis* (Table 1). As suggested by Panda *et al*. (1971), the presence of heavily lignified sclerenchymous hypodermis and closely packed vascular bundles in the hybrids might be responsible for this. The entries IC 354597, IC 354612 , IC398820, IC427007 and IC545970 were at par with each other and tolerant to *L. orbonalis*. Earlier report also is supportive of the present findings (Subbaratnam and Butani, 1981). The tolerance nature of above entries might be attributed to the hardness of the fruit skin and flesh (Krishnaiah and Vijay, 1975) and hard to semi-hard shoot and medium to dense pubescence (Raut and Sonone, 1980).

Remaining entries were observed to be succeptible and highly succeptible (Table 1) might be due to the softness of the shoot, sparse pubescence and spherical and oblong fruit with soft rind and loosely arranged seeds. This is in conformity with Deependra Singh Yadav and Sharma (2005). The possible reasons for high susceptibility of these accessions might be due to the round shaped fruit with less number of seeds and soft and smooth surface, as reported by Sharma *et al*. (1985) and Lal (1991).

Low damage by *H. vigintioctopunctata* was observed in all the 25 entries and the infestation ranged from 5.0 to 15.0 % (Table 2). Annamalai recorded the moderate infestation. Rajendran and Gopalan (1997) reported that the varieties, EP 19, EP 45, EP 49, EP 68, EP 78, EP 55 and Annamalai were moderately resistant to *H. vigintioctopunctata*.

Pusa hybrid 6 and IC 354694 were found to be susceptible to *Amrasca devastans* whereas only Pusa

Table 2. Accessions and incidence of sucking pests in brinjal

Treatment	*Amrasca devastans*		*Aphis gossypi*	
Accessions	Treatment	Rank	Treatment	Rank
IC354562	0.32^{DE}	18	7.87^{FG}	21
IC354578	0.00^{E}	23	10.10^{CDEFG}	16
IC354597	0.25^{DE}	19	17.33^{AB}	4
IC354612	0.21^{DE}	20	15.60^{BCD}	8
IC354635	0.33^{DE}	16	6.00^{G}	24
IC354655	0.00^{E}	24	14.17^{BCDE}	11
IC354676	0.37^{DE}	13	14.67^{BCD}	10
IC354694	4.33^{AB}	2	15.90^{BC}	7
IC354701	0.70^{CDE}	10	15.03^{BCD}	9
IC374942	0.08^{E}	22	6.17^{G}	22
IC383106	3.57^{ABC}	3	13.77^{BCDEF}	12
IC397299	0.34^{DE}	15	6.10^{G}	23
IC398820	2.03^{BCDE}	7	16.23^{ABC}	6
IC410129	0.65^{DE}	11	9.40^{DEFG}	17
IC420406	2.38^{BCDE}	6	13.58^{BCD}	13
IC420650	2.62^{BCDE}	5	17.97^{AB}	3
IC427007	0.50^{DE}	12	5.90^{G}	25
IC427017	1.37^{CDE}	8	12.00^{BCDEFG}	15
IC433547	0.00^{E}	25	13.13^{BCDEF}	14
IC433625	0.34^{DE}	14	9.40^{DEFG}	18
IC545844	0.33^{DE}	17	17.10^{AB}	5
IC545884	0.13^{E}	21	18.20^{AB}	2
IC545928	3.03^{ABCD}	4	9.38^{DEFG}	19
IC545970	0.87^{CDE}	9	8.10^{EFG}	20
pusahyb6	5.77^{A}	1	22.40^{A}	1
General Mean	1.27	.	12.66	.
p-Value	<.0001	.	<.0001	.
CV(%)	72.31	.	15.63	.
SE(d)	0.740	.	1.599	.
Tukey HSD at 5%	2.8586	.	6.1804	.

B. tabaci		*H. vigintiopunctata*		*Myllocerus* beetle	
Treatment	Rank	Treatment	Rank	Treatment	Rank
2.00^{CDEFG}	9	5.50^{D}	24	0.13^{EF}	18
3.80^{ABC}	3	10.00^{BCD}	14	0.16^{EF}	15
2.27^{CDE}	7	16.13^{AB}	3	0.04^{F}	19
0.15^{GH}	21	12.63^{ABCD}	12	0.70^{EF}	8
0.45^{EFGH}	14	5.87^{D}	22	0.13^{EF}	16
0.54^{EFGH}	12	12.03^{ABCD}	13	0.30^{EF}	12
2.60^{CD}	6	12.70^{ABCD}	11	0.13^{EF}	17
4.77^{AB}	2	13.30^{ABCD}	8	3.60^{CD}	4
3.17^{BCD}	5	9.00^{BCD}	17	0.20^{EF}	14
0.38^{EFGH}	16	6.60^{CD}	21	4.73^{BC}	3
1.83^{DEFGH}	10	12.93^{ABCD}	9	5.67^{B}	2
0.08^{GH}	22	5.37^{D}	25	0.50^{EF}	10
0.31^{FGH}	19	14.53^{ABCD}	5	0.30^{EF}	13
0.40^{EFGH}	15	8.93^{BCD}	18	2.00^{DE}	6
0.19^{H}	20	12.73^{BCD}	10	0.00^{F}	20
2.13^{CDEF}	8	16.53^{AB}	2	0.00^{F}	21
0.32^{FGH}	18	5.70^{D}	23	0.00^{F}	22
0.00^{H}	25	9.20^{BCD}	16	0.00^{F}	23
3.34^{BCD}	4	13.33^{ABCD}	7	0.00^{F}	24
0.04^{H}	24	7.63^{BCD}	20	0.67^{EF}	9
0.37^{EFGH}	17	14.17^{ABCD}	6	0.93^{EF}	7
0.04^{H}	23	15.27^{ABC}	4	0.33^{EF}	11
0.58^{EFGH}	11	8.00^{BCD}	19	0.00^{F}	25
0.53^{EFGH}	13	9.50^{BCD}	15	3.00^{CD}	5
5.40^{A}	1	21.20^{A}	1	8.33^{A}	1
1.38	.	11.21	.	1.23	.
<.0001	.	<.0001	.	<.0001	.
44.71	.	26.31	.	48.89	.
0.499	.	2.385	.	0.484	.
1.9277	.	9.2177	.	1.8723	.

ANOVA Analysis (Dependent variable-*Amrasca devastans)*

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Significant
replication	2	1.6162	0.8081	0.9652	0.3878	NS
treatment	24	177.8056	7.4086	8.8485	<.0001	**
Error	51	42.7006	0.8373	.	.	-
Corrected Total	77	222.1224	.	.	.	-

** - Significant at 1%, * - Significant at 5%, NS - Non Significant

ANOVA Analysis (Dependent variable-*Aphis gossypi)*

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Significant
replication	2	15.8927	7.9464	2.0304	0.1418	NS
treatment	24	1500.9371	62.5390	15.9796	<.0001	**
Error	51	199.5980	3.9137	.	.	-
Corrected Total	77	1716.4279	.	.	.	-

** - Significant at 1%, * - Significant at 5%, NS - Non Significant

ANOVA Analysis (Dependent variable-*Bemisia tabaci)*

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Significant
replication	2	1.1085	0.5543	1.4558	0.2427	NS
treatment	24	191.2727	7.9697	20.9328	<.0001	**
Error	51	19.4171	0.3807	.	.	-
Corrected Total	77	211.7983	.	.	.	-

** - Significant at 1%, * - Significant at 5%, NS - Non Significant

ANOVA Analysis (Dependent variable-*Henosepilachna vigintioctopunctata)*

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Significant
replication	2	44.1233	22.0617	2.5342	0.0893	NS
treatment	24	1195.6072	49.8170	5.7225	<.0001	**
Error	51	443.9767	8.7054	.	.	-
Corrected Total	77	1683.7072	.	.	.	-

** - Significant at 1%, * - Significant at 5%, NS - Non Significant

ANOVA Analysis (Dependent variable-*Myllocerus*)

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Significant
replication	2	0.6793	0.3397	0.9456	0.3951	NS
treatment	24	339.9690	14.1654	39.4377	<.0001	**
Error	51	18.3184	0.3592	.	.	-
Corrected Total	77	358.9667	.	.	.	-

** - Significant at 1%, * - Significant at 5%, NS - Non Significant

Means with atleast one letter common not statistically significant; Grouping letters on treatments made using pdglm800.sas (downloaded from http://animalscience.ag.utk.edu/FacultyStaff/ArnoldSaxton.html#software)

hybrid 6 was damaged more, significantly different than 25 entries which shown low damage by *Aphis gossypii, Bemisia tobaci and Myllocerus* (Table 2).

The accessions of viz., IC 545884 and IC 410129 IC354562, IC354578, IC397299, IC420406, IC427017, IC433625, IC545884 and IC545928 designated as resistant and fairly resistant to *L. orbonalis* in the present study had also recorded the low population of whitefly, spotted leaf beetle, *Myllocerus* and aphids. (Table 2). Gaikwad *et al*. (1991) reported KB 9, Pusa Purple Long, KP 10, L 13 and BB 1 as tolerant to *A. devastans*. PKM-1, KKM-1, Pootheri Local and Soorakundu Local were less susceptible to *B. tabaci*. Shunmugaraj (1995) reported

few resistant entries (EP 55, EP 78, EP 52) to *B. tabaci*. The less susceptibility of these sucking pests are due to the poor quality of host plants with purple coloured leaves, as pointed by Kalra (2004). The accessions IC545970, IC354635, and IC354676, were found to be more attractive to coccinellid. More number of spiders were found in entries such as Pusa hybrid 6, IC354578 and IC354694 whereas Pusa hybrid 6, IC383106, IC397299 and IC420650 attracted more syrphids (Table 3).

Table 3. Accessions and incidence of predators

Treatment	Coccinellids		Spiders		Syrphids	
Treatment Name	Treatment of coccinellids	Rank of Treatment	Treatment of spiders	Rank of Treatment	Treatment of syrphids	Rank of Treatment
IC354562	4.37^{BCDE}	8	0.24^{CD}	16	2.93^{ABCDE}	6
IC354578	5.80^{BC}	4	0.93^{AB}	2	1.97^{BCDEFG}	17
IC354597	1.90^{DEF}	20	0.09^{D}	22	2.13^{BCDEFG}	15
IC354612	4.20^{BCDE}	9	0.51^{BCD}	6	1.33^{DEFG}	20
IC354635	7.17^{AB}	2	0.07^{D}	24	1.17^{DEFG}	21
IC354655	4.87^{BCD}	5	0.30^{CD}	14	1.93^{BCDEFG}	18
IC354676	6.93^{AB}	3	0.15^{CD}	18	2.23^{BCDEFG}	14
IC354694	2.03^{DEF}	19	0.70^{ABC}	3	2.03^{BCDEFG}	16
IC354701	1.40^{EF}	22	0.43^{BCD}	9	0.53^{G}	25
IC374942	2.17^{DEF}	15	0.43^{BCD}	10	2.23^{BCDEFG}	13
IC383106	2.15^{DEF}	17	0.27^{CD}	15	3.83^{AB}	2
IC397299	2.20^{DEF}	14	0.13^{D}	19	3.73^{AB}	3
IC398820	1.30^{EF}	24	0.08^{D}	23	3.20^{ABCD}	5
IC410129	2.07^{DEF}	18	0.52^{BCD}	5	2.70^{ABCDEF}	9
IC420406	1.33^{F}	23	0.49^{BCD}	7	2.88^{ABCD}	7
IC420650	4.67^{BCD}	6	0.37^{CD}	12	3.50^{ABC}	4
IC427007	3.27^{CDEF}	12	0.35^{CD}	13	2.77^{ABCDEF}	8
IC427017	2.93^{CDEF}	13	0.21^{CD}	17	0.80^{FG}	24
IC433547	0.53^{F}	25	0.43^{BCD}	11	$2.43^{ABCDEFG}$	12
IC433625	3.63^{CDEF}	10	0.45^{BCD}	8	1.47^{CDEFG}	19
IC545844	2.17^{DEF}	16	0.07^{D}	25	2.67^{ABCDEF}	10
IC545884	1.87^{DEF}	21	0.11^{D}	21	2.67^{ABCDEF}	11
IC545928	3.30^{CDEF}	11	0.11^{D}	20	1.00^{EFG}	23
IC545970	9.47^{A}	1	0.58^{BCD}	4	1.00^{EFG}	22
pusahyb6	4.60^{BCD}	7	1.14^{A}	1	4.37^{A}	1
General Mean	3.37	-	0.37	-	2.32	-
p-Value	<.0001	-	<.0001	-	<.0001	-
CV(%)	29.76	-	47.20	-	28.86	-
SE(d)	0.811	-	0.142	-	0.542	-
Tukey HSD at 5%	3.1342	-	0.549	-	2.0946	-

Means with atleast one letter common not statistically significant; Grouping letters on treatments using pdglm800.sas (downloaded from http://animalscience.ag.utk.edu/FacultyStaff/ArnoldSaxton.html#software)

ANOVA Analysis (Dependent variable-coccinelid)

Source	DF	Type III SS	Mean Square	F Value	Pr > F Significant
replication	2	5.3771	2.6886	2.6713	0.0788 NS
treatment	24	347.2149	14.4673	14.3745	<.0001 **
Error	51	51.3293	1.0065	.	. -
Corrected Total	77	403.9213	.	.	. -

** - Significant at 1%, * - Significant at 5%, NS - Non Significant

ANOVA Analysis (Dependent variable-spiders)

Source	DF	Type III SS	Mean Square	F Value	Pr > F Significant
replicaton	2	0.0199	0.0100	0.3222	0.7260 NS
treatment	24	5.3686	0.2237	7.2441	<.0001 **
Error	51	1.5749	0.0309	.	. -
Corrected Total	77	6.9634	.	.	. -

** - Significant at 1%, * - Significant at 5%, NS - Non Significant

ANOVA Analysis (Dependent variable-syrphids)

Source	DF	Type III SS	Mean Square	F Value	Pr > F Significant
replication	2	0.8823	0.4412	0.9814	0.3818 NS
treatment	24	74.0301	3.0846	6.8618	<.0001 **
Error	51	22.9260	0.4495	.	. -
Corrected Total	77	97.8385	.	.	. -

** - Significant at 1%, * - Significant at 5%, NS - Non Significant

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