Original Research Article

Field screening of some brinjal genotypes for resistance to major insect pests

Abstract

A field experiment was conducted to study the response of 10 brinjal genotypes against the major insect pests of brinjal. The study revealed that the genotype HE-103-1 was best in reducing the whitefly population (3.48/ leaf) and HE-101-4 proved superlative against leafhopper population (0.80/ leaf). Considering the shoot and fruit damage, the genotype HE-101-3 proved to be tolerant to *Leucinodes orbonalis* whereas BR-112 was recorded as highly susceptible. Further, the study on morphological characters revealed that in different genotypes, the length of leaf varied from 9.4 to 16.5 cm but not found associated with the sucking insect pests while the leaf width in different genotypes ranges from 4.7 to 13.6 cm and shows negative significant correlation (r = 0.737) with the whitefly population. Fruit length among different genotype studied varied from 6.4 to 19.3cm, while the maximum fruit diameter of 7.9 and 7.4 cm was recorded in genotypes H-8 and BR 112, respectively and minimum was recorded from HE-101-3 (3.3 cm). The fruit diameter was found highly significant and positively correlated with the fruit infestation by *L. orbonalis.* Among different genotypes studied, the pericarp thickness was also found positively and significantly correlated with the fruit infestation.

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Keywords: Screening, whitefly, *Leucinodes orbonalis*, shoot and fruit damage, jassid

Introduction

Solanum melongena L. (Brinjal) belongs to the family *Solanaceae* and is called by different names *viz., egg plant, garden egg, aubergine, vangi, baingan, badanekai etc.* For its immature fruits as vegetables, it is widely grown in both tropical and temperate regions of the globe and is one of the major and principal vegetable crop (Rai *et al.*, 1995). In India, it is cultivated in an area of 736 thousand hectare with production of 12.77 million metric tonnes and average productivity of 17.4 metric tonnes per hectare (Anonymous, 2021).

Brinjalisfoundtobeattackedbyanumberofinsects-pests viz., shoot and fruit borer, *Leucinodes orbonalis* Guenee (Lepidoptera: Pyralidae), leaf hopper, *Amrasca devastans* (Distant) (Hemiptera: Cicadellidae), whitefly, *Bemicia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) and aphid, *Myzus persicae* (Sulzer) (Homoptera: Aphididae). Aphid, jassid and whitefly are cosmopolitan in distribution and are found wherever brinjal is grown. Population of these insect-pests is often seen on tender parts of the plant, particularly on leaves. The nymphs and adults of these insect-pests suck the cell sap from leaves and tender parts of plants which leads to yellowing, deformation, wilting and ultimately drying of the affected parts. Sucking insect-pests also act as a vector of different diseases such as little leaf by jassids and shooty mould by aphid and whitefly.

Among them, *L. orbonalis* has been reported as the most devastating pest which has a potential to cause the losses even up to 90 percent (Jagginavar *et al.*, 2002; Indirakumar *et al*., 2016). In India, Nath *et al.* (2008) reported that fruit damage could be 70 to 90 percent while Rahman (2007) reported that it could be up to 100 percent if no control measures are taken. *L. orbonalis* is the most destructive pest in major brinjal cultivating countries of South Asia as its larvae in habits inside the plant shoots or fruits by forming tunnels, adversely affecting the marketability of its fruit yield (Alam *et al*., 2003). Javed *et al* (2011) reported that the yield of brinjal fruits was lowered down by 20.7 percent when the entire infested fruit was considered unusable and 9.7 percent loss when only the damaged portion of infested fruit was not used.

There are several measures to manage these pests including spraying of chemical insecticides, application of botanical pesticides, adopting IPM technologies, using resistant varieties and so on. Among these management practices, chemical control is most widely used and became the primary source in farmers field for managing insect pests in brinjal which leads to development of resistance in insect pests and also harmful to ecosystem. Keeping in view the economic importance of brinjal crop in daily use, where use of insecticides is not desirable, the present studies were undertaken to find out the source of resistance against the major insect pests of brinjal.

Materials and methods

The present investigation for screening of various brinjal genotypes was carried out at Entomology Research Farm of Chaudhary Charan Singh Haryana Agricultural University, Hisar during *kharif* 2019-20. A total of 10 brinjal genotypes were grown following all package and practices except insect pest management and evaluated for resistance.

Table 1. Category of different varieties/germplasms on the basis of infestation

Sr. No.	Damage level (%)	Designation
1	0	Immune
2	1-10	Highly resistant
3	11-20	Moderately resistant
4	21-30	Tolerant
5	31-40	Susceptible
6	Above 41	Highly susceptible

The experiment was laid in a randomized block design with three replications. Thirty-five days old seedlings were transplanted with a spacing of 60 × 60 cm in a plot size of 3 × 3 m by maintaining 25 plants per replication. Five plants were randomly selected for observation.Counts of leaf hopper and whitefly were made from 10 leaves/ plant. For shoot and fruit borer, number of infested and healthy shoots were recorded at weekly interval from 30 days after transplanting till active fruiting. In case of fruit damage, number of healthy and damaged fruits were recorded at each picking. Further, for the estimation of relative resistance of various genotypes against major insect-pests, the observations on morphological factors of leaf and fruit *viz.*, size of leaf, presence of spines, pericarp thickness, shape of fruit, size of fruit and colour of fruit were recorded for each genotype.

Statistical analysis

All the observations recorded in the due course of investigations were subjected to statistical analysis by using GRAPESv1.1.0. Karl Pearson coefficient was calculated to elucidate theimpact of biophysical characters on major insect pests of brinjal.

Results and Discussion

Population of whitefly, *Bemisia tabaci* in different genotypes of brinjal

Whitefly incidence differed significantly among different genotypes tested (Table 2). The mean whitefly population remained maximum on HE-202-9 (4.21/leaf) and minimum on HE-103-1 (3.48/ leaf). The genotypes HE-202-9 and HE-209-1 were found to be the most susceptible genotypes to whitefly infestation and HE-103-1 and HE-202-8 were found to be least susceptible. The whitefly population was found maximum during 39th standard meteorological week after that the population declined continuously upto 47th standard meteorological week during which it was found minimum.Similar results observed by Parkash et al. (2021) specify that the activity of whitefly, *B. tabaci* was found maximum in 37th SMW.

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Table 2. Population of *Bemisia tabaci* in different genotypes of brinjal

Treatments (Genotypes)	Mean density of *B. tabaci* per leaf in (SMW)										Overall Mean
	38	39	40	41	42	43	44	45	46	47	
HE-101-3	4.42	8.10	7.14	5.82	4.82	2.82	2.48	1.82	0.42	0.18	3.80
HE-101-4	4.34	7.94	6.90	5.54	4.58	2.56	2.42	1.62	0.32	0.10	3.63
HE-103-1	4.18	7.48	6.82	5.28	4.46	2.46	2.26	1.50	0.26	0.14	3.48
HE-202-8	4.26	7.70	6.86	5.42	4.50	2.54	2.34	1.56	0.30	0.14	3.53
HE-202-9	4.82	8.80	7.58	6.22	5.30	3.22	2.90	2.22	0.74	0.32	4.21
HE-209-1	4.70	8.50	7.42	6.02	5.22	3.10	2.76	2.10	0.66	0.26	4.07
HE-210-1	4.30	7.82	7.02	5.46	4.54	2.48	2.38	1.58	0.32	0.16	3.61
HE-210-3	4.26	7.74	6.94	5.44	4.56	2.62	2.34	1.54	0.30	0.14	3.59
BR-112	4.62	8.42	7.32	5.94	4.94	3.00	2.74	2.02	0.58	0.20	3.98
H-8	4.22	7.74	6.90	5.38	4.90	2.90	2.34	1.52	0.50	0.14	3.65

C. D. (p=0.05)	0.16	0.30	0.36	0.29	0.17	0.13	0.10	0.09	0.02	0.01	0.17

Population of leafhopper, *A. bigutulla bigutulla* in different genotypes of brinjal

The mean population of leafhopper in different genotypes of brinjal varied from 0.90 to 1.09 leafhopper per leaf (Table 2). The data showed that highest population dynamics of leafhopper was recorded on genotype HE-202-9 (1.09/ leaf), followed by H-8 (1.04/ leaf) and HE-209-1 (1.01/ leaf). The lowest leafhopper population was recorded in HE-101-4 (0.80/ leaf). The leafhopper population was found maximum during 42nd standard meteorological week and after that the population declined gradually upto 47th standard meteorological week during which it was found to be minimum.

Table 3. Population of *A. bigutulla bigutulla* in different genotypes of brinjal

Treatments (Genotypes)	Mean density of leafhopper per leaf in (SMW)										Overall Mean
	38	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	
HE-101-3	0.50	0.74	0.80	1.02	1.82	1.36	1.06	0.66	0.42	0.26	0.86
HE-101-4	0.34	0.66	0.86	1.14	1.34	1.50	0.80	0.58	0.42	0.30	0.80
HE-103-1	0.42	0.84	0.98	1.04	1.38	1.40	0.86	0.76	0.46	0.18	0.83
HE-202-8	0.38	0.80	1.10	1.42	1.58	1.30	0.92	0.74	0.62	0.50	0.94
HE-202-9	0.62	0.88	1.14	1.58	2.26	1.46	1.02	0.70	0.66	0.54	1.09
HE-209-1	0.50	0.70	0.94	1.46	1.82	1.70	1.06	0.82	0.66	0.42	1.01
HE-210-1	0.34	0.76	1.10	1.38	1.52	1.82	1.02	0.76	0.54	0.22	0.95
HE-210-3	0.26	0.72	1.18	1.48	1.86	1.66	0.98	0.86	0.58	0.38	1.00
BR-112	0.26	0.74	1.18	1.26	1.80	1.22	0.90	0.82	0.48	0.34	0.90
H-8	0.46	1.00	1.22	1.28	1.80	1.70	1.30	0.80	0.48	0.34	1.04
C. D. (p=0.05)	0.01	0.04	0.05	0.04	0.07	0.08	0.04	0.03	0.03	0.03	0.01

Shoot damage by shoot and fruit borer in different genotypes of brinjal

The maximum shoot damage caused by *L. orbonalis* was recorded in BR-112 (18.6%), followed by HE-202-9 (18.38 %), H-8 (16.78 %), HE-202-8 (15.65 %), HE-101-4 (14.65 %) and HE-210-3 (13.18 %). The lowest population dynamics was recorded in HE-101-3 *i.e.* (9.25). These results show that the most resistant genotype against shoot borer is HE-101-3 followed by HE-209-1 while the most susceptible genotypes were BR-112 andHE-202-9.

Percent fruit damage in different genotypes of brinjal

The fruit damage caused by *L. orbonalis* was recorded highest in BR-112 (41.46 %), followed by HE- 202-9 (39.02 %), H-8 (37.46 %), HE-202-8 (35.56 %), HE-101-4 (32.68 %) and HE-210-3 (31.36 %). The lowest population was recorded in HE-101-3. (23.69 %). These results showed that the genotype HE-101-3 was least susceptible, followed by HE-209-1 while BR-112 and HE-202-9 was the most susceptible. Based on the per cent fruit infestation, the genotypes HE-101-3, HE-209-1 and HE-210-1 were categorized as tolerant to *L. orbonalis* whereas HE-101-4, HE-103-1, HE-210-3, HE-202-8, HE-202-9 and H-8 were found susceptible to *L. orbonalis* infestation. The genotype BR-112 with maximum fruit damage (41.46 %) was categorized as highly susceptible.

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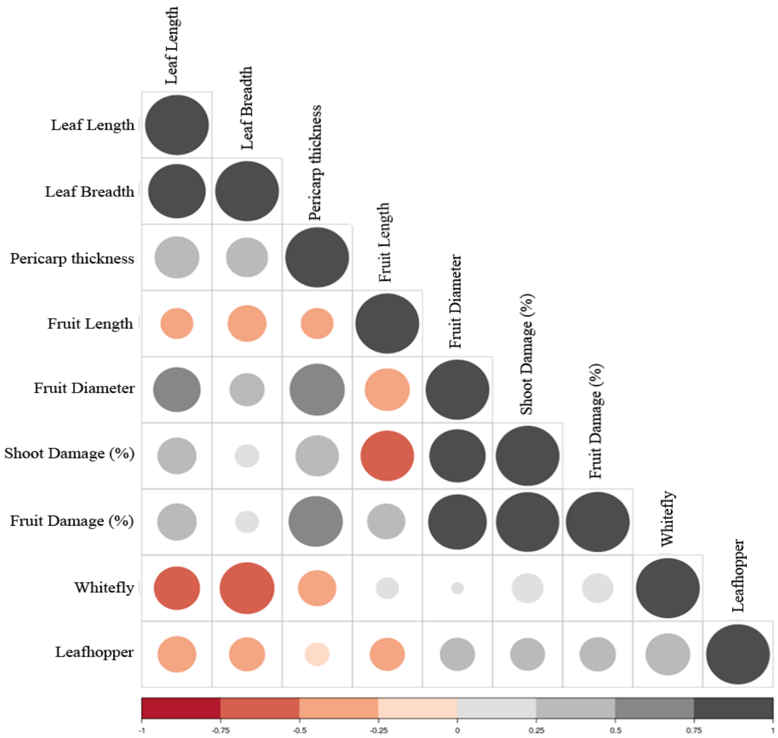

Fig. 1 Correlogram with coefficient of correlation between morphological characters and major insect pests

Morphological characters of brinjal in relation to major insect pests

Leaf length

Different genotypes showed significant variation in leaf length which varied from 9.4 to 16.5cm. Genotype BR-112 recorded significantly higher leaf length (16.5 cm) being statistically at par with HE-103-1 (16.3cm), H-8 (15.7cm) and HE- 210-3 (15.3cm). Whereas, genotype HE-209-1 recorded significantly minimum leaf length (9.4cm). The correlation study showed that leaf length was not significantly correlated with mean value of whitefly (r= -0.519) and leafhopper population (r = -0.363).

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Leaf breadth

Considerable variation was observed with respect to leaf breadth which ranged from 4.7 to 13.6cm. Genotype HE-210-3 recorded significantly higher leaf length (13.6 cm) which was at par with HE-103- 1(13.4 cm). Whereas, genotype HE-209-1 recorded significantly minimum leaf breadth (4.7cm). The correlation study showed thatmean population of whitefly was significantly negatively correlated (r= -0.737*) with leaf breadth whereas leafhopper population showed a non-significant correlation (r = -0.315) with leaf breadth. Bindu *et al.* (2017) and Naqvi *et al*., (2009) found similar results that the population of jassids showed non-significant correlation with leaf thickness (r = -0.431^{NS}), while the leaf area (r = -0.703) and trichomes density (r = -0.569) showed significantly adverse relationship.

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Table 4. Morphological characters of brinjal in relation to major insect pests

Genotypes	Presence of spines	Shape of fruit	Colour of fruit	Leaf Length (cm)	Leaf Breadth (cm)	Pericarp thickness (cm)	Fruit Length (cm)	Fruit Diameter (cm)	Shoot Damage (%)	Fruit Damage (%)
HE-101-3	No	Long	Purple	13.2	9.4	0.50	19.3	3.3	9.25	23.69
HE-101-4	Yes	Oblong	Purple	14.7	9.6	0.56	10.4	4.6	14.65	32.68
HE-103-1	Yes	Oval	Greenish white	16.3	13.4	0.63	8.7	5.3	12.48	30.57
HE-202-8	Yes	Round	Purple	12.9	10.8	0.80	7.2	5.5	15.65	35.56
HE-202-9	Yes	Round	Purple	12.6	8.1	0.40	6.4	5.4	18.38	39.02
HE-209-1	No	Long	Purple	9.4	4.7	0.52	14.3	4.5	10.04	27.26
HE-210-1	Yes	Long	Purple	14.6	9.8	0.48	12.6	4.6	10.71	28.57
HE-210-3	No	Oblong	Purple	15.3	13.6	0.65	9.2	5.9	13.18	31.36
BR-112	No	Round	Purple	16.5	10.2	0.85	11.2	7.9	18.6	41.46
H-8	No	Round	Purple	15.7	10.4	0.75	10.3	7.4	16.78	37.46
C. D. at 5%				1.86	1.36	0.08	1.31	0.74	1.20	0.70

Fruit length

The data presented in Table 4 signifies that there were significant variations in length of brinjal fruits of various genotypes. The fruit length varied from 6.4 to 19.3 cm. Genotype HE-101-3 recorded significantly higher fruit length (19.3 cm) followed by HE-209- 1(14.3 cm), HE-210-1(12.6 cm) and BR-112(11.2 cm). Whereas, genotype HE-202-9 recorded significantly less fruit length (6.4 cm) which was statistically at par with the genotype HE-202-8. However, there was no significant correlation (r= -0.351) between the per cent fruit damage caused by *L. orbonalis* and fruit length. Ghosh and Senapati (2001) also reported that lengthy fruits observed minor infestation of fruit borer. The similar results were observed by Jat and Pareek (2003) and Wagh *et al*. (2012) and they stated that the fruit length had no effect on damage by fruit borer. Shukla *et al.* (2001) and Chandrashekhar *et al.* (2009) also reported that the length of fruit was non-significant to create any association with weight of infected fruit affected by shoot and fruit borer.

Fruit diameter

Among the genotypes, considerable variations were observed with respect to fruit diameter which ranges from 3.3 to 7.9 cm. The minimum fruit diameter (3.3 cm) was recorded in genotype HE-101-3 followed by HE-209-1(4.5 cm) and HE-101-4(4.6 cm). The genotypes H-8 and BR-112 recorded maximum fruit diameter of 7.9 and 7.4 cm, respectively in comparison to all other genotypes. The correlation study revealed that there was a highly significant positive correlation (r= 0.843**) between per cent fruit damage and diameter of fruit. Similar results were recorded by Naqvi *et al*. (2009) and Behera *et al.* (1998) by observing affirmative association between damaged fruits and fruit diameter. Thangamani *et al.* (2011) observed less fruit thickness in sturdy genotypes of brinjal as compared to vulnerable genotypes to *L. orbonalis*. The contradictory result was observed by Shukla *et al.* (2001) that the fruit diameter had insignificant connection with per cent fruit infestation caused by shoot and fruit borer.

Pericarp thickness

The pericarp thickness of fruit of different genotypes varied from 0.40 to 0.85 cm. The brinjal genotype with narrow pericarp thickness (HE-202-9 with 0.40 cm) showed least per cent fruit infestation (28.33 %) whereas, significantly wider pericarp thickness (0.85 cm) was noticed in genotype BR-112 followed by H-8(0.75 cm) and HE-210-3(0.65 cm). Likewise, the thickness of pericarp showed highly positive correlation (r= 0.705*) with per cent fruit infestation. Similar results were observed by Naqvi *et al.* (2009), Chandrashekhar *et al.*

(2009) and Jat and Pareek (2003) that the least infestation of *L. orbonalis* was observed in thevarieties of fine pericarp thickness.

Fruit shape and colour

The data presented in Table 4 revealed that round fruits were susceptible while long fruits were relatively resistant to *L. orbonalis*. The fruit colour in brinjal genotypes did not show any significant correlation with per cent fruit infestation. Similar results were observed by Panda (1999), Ghosh and Senapati (2001) and Naqvi *et al.* (2009) that the genotypes having long fruits had lesser incidence of fruit and shoot borer (*L. orbonalis*).

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Conclusion

The genotype HE-103-1 proved best against the whitefly population and HE-101-4 against leafhopper. Considering the shoot and fruit damage, the genotype HE-101-3 proved to be tolerant to *Leucinodes orbonalis* whereas BR-112 was recorded as highly susceptible. The leaf width of different genotypes shows negative significant effect on the population build-up of whitefly whereas leaf length does not affect the sucking pest population. The fruit diameter was found highly significant and positively correlated with the fruit damage caused by *L. orbonalis.*The pericarp thickness also found positively and significantly correlated with the fruit infestation.

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