The Bioscan 10(1): 247-251, 2015
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

SCREENING OF SOME BRINJAL CULTIVARS FOR RESISTANCE TO SHOOT AND FRUIT BORER (*LEUCINODES ORBONALIS* GUENEE)

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KEYWORDS
Screening
Leucinodes orbonalis
Brinjal morphology
Lepidoptera

Received on :
16.01.2015

Accepted on :
07.03.2015

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ABSTRACT
Response of different brinjal genotypes against brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee.) was evaluated Indira Gandhi Krishi Viswavidyalaya, Raipur (Chhattisgarh) in Rabi summer season 2013. 18 eggplant entries/accessions were evaluated for resistance to shoot and fruit borer. Minimum mean infestation in fruits was found in genotype Punjab Sadabahar, 2010/ BRLVAR-3, 2010/BRLVAR-1, 2010/BRLVAR- 4 while maximum mean infestation in fruits was recorded in Swarnamani. The calyx diameter and fruit diameter was significantly positive association with fruit infestation. Greenish purple colour variety was the least preferred by fruit borers with fruit damage of 5.21 per cent and highest fruit damage (28.27%) was noticed on infested fruits in the variety of dark purple with white colour.

INTRODUCTION

Brinjal or egg plant, *Solanum melongena* L. is an important vegetable crop grown in India and other parts of the world. It is cultivated round the year in almost all the states of India. The crop is extensively damaged by insect pests and diseases apart from other constraints.Several factors are responsible for the low productivity of aubergine. These include biotic factors as insect pests and pathogens. The most extensive pest of this vegetableis brinjal shoot and fruit borer (*Lucinodes orbonalis* Guenee) which reduces the yield and inflicts colossal loss in production. The losses caused by pest vary from season to season because moderate temperature and high humidity favour the population build-up of brinjal shoot and fruit borer (Shukla and Khatri, 2010), (Bhushan *et al.*, 2011).

The yield loss caused by this pest has been estimated up to 67% in Bangladesh (Islam and Kairm, 1991). At vegetative phase, the newly hatched larvae borer in to petioles and midrib of large leaves and young tender shoots they feed on the internal tissue causing the shoot drooped down and withered at the reproductive phase the larvae prefers to bore into flower buds and also enter into the infested fruits through the calyx. Observing the boring holes, the infested fruits can easily be identified. Besides, the dark coloured excreta can easily be seen to the hole of infested fruits. Secondary infestations by certain microorganisms may cause further deterioration of the fruits (Islam and Kairm, 1991) and make them ultimately unfit for human consumption. Among the major constraints in economic cultivation of brinjal, pest infestation causes heavy losses. Chemical control is widely used means of managing insect pests in brinjal. Repeated use of broad spectrum synthetic chemicals also result in environmental contamination bioaccumulation and bio magnification of toxic residues and disturbance in ecological balance. Hence, there is an urgent need to look alternates and safer method. Use of resistant varieties is recognized as an important tool in bio intensive pest management system. The morphological and physical characteristics of plants and fruits are associated with attraction, feeding and oviposition of the insect pests.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 shoot and fruit.

MATERIALS AND METHODS

A field experiment was conducted at the Horticulture experimental field of Indira Gandhi Krishi Vishwavidyalya, Raipur in *Rabi summer* season during the period from January to May 2013. The experiment was laid out in randomized block design (RBD) with three replications. Eighteen brinjal varieties/liens were screened against major pests of brinjal. Thirty day old seedling were transplanted with a spacing of 75 × 45 cm during November to March 2013. The cultural practices expect plant protection measures were fallowed as per the crop production guide for horticultural crops. Five plants per replication were tagged at random and observed for the incidence of major pests in each brinjal varieties at ten days interval starting from transplanting to harvest.

The pest population/damage was recorded at ten days interval commencing from eleventh day after transplanting (DAT). The percentage data obtained from the field experiment were

subjected to arcsine (angular) transformation (Gomez and Gomez, 1984). The data on the number of jassid, whitefly were analyzed after following square root transformation.

At ten days interval, the number of nymphs and adults of jassid were assessed on three leaves (one from bottom, middle and top) in five selected plants by examining each leaf carefully during early morning hours, when the pest was less active. To begin with, jassids on upper surface of the leaves were counted and then the leaf was titled carefully to count population on the lower surface. The population was expressed as number per three leaves. Similarly whitefly population was also recorded. The population was expressed as number per plant. Damaged and undamaged fruits, from randomly selected five plants, in each genotype were counted in all pickings. Percent fruit-infestation was calculated by the method suggested by Wakil *et al.* (2009). Grades (1- Immune -0% fruit infestation; 2-highly resistant -1-10% fruit infestation; 3 Moderately resistant -11-20; 4-Tolerant -21-30; 5-susceptible- 31-40; 6-highly susceptible –above 40) were also assigned for the fruit damage bases on the rating given by Mishra *et al.* (1988).

Analyses of biophysical characteristics of brinjal varieties/ genotypes

Length of fruit

Length of fruit at the time of harvesting five fruits of average size from each variety/genotype were selected in three replications the length of fruits was measured with measuring scale.

Diameter of fruit

Diameter of fruit five fruits of average sized from each variety/ genotype were picked up in three replications. The diameter of fruits was recorded by measuring scale. The circumference of fruits from two points on each side of middle of fruit in such a way that ¼th of fruit length was left on each end mean circumference was converted in to diameter(Grewal and Singh, 1995), (Naqvi*, A. R. 2009).

Calyx diameter

Circumference (c) of calyx was measured by fixing points at periphery of calyx. The calyx diameter (d) was then calculated using the relation c = 2Àd.

Exit holes

Number of exit holes per fruit was recorded on five fruits of each variety at each picking.

Number of larvae

Five damaged fruit per plot were cut open to observe number of larvae present inside.

RESULTS AND DISCUSSION

Screening of different cultivars against sucking insect pest of brinjal crop

Overall, eighteen varieties were screened out against the sucking insect pest infestation alongwith the following results obtained for their relative. The maximum infestation (6.68/ plant) was in variety 2010/BRLVAR-2, wherein the least population of jassid 1.56 per plant of jassid was recorded in variety 2010/BRRVAR-3. Similarly, Mohmood *et al.* (2002) noticed Purple long, Nepali, Neelum varieties were quite resistant to leaf hopper while Chayat, Green, Local Gool, Violetta, Sciliana, Prospara and Violettalunga were most susceptible cultivars.

Among the eighteen varieties screened, the least number of (2.80/plant) whitefly population was noticed in variety Swarnamani. However, the highest population (5.52/plant) was recorded in variety KS-224.

Screening of different brinjal cultivar against shoot and fruit borer

Attempts were made to find out fruit damage by the shoot and fruit borer infestation was related to the fruit morphology with respect to fruit length, fruit width, calyx diameter, number of exit holes and larvae per fruit and percent fruit damage by *Leucinodes orbonalis* Guenee along with the following findings.

Fruit length

Fruit length of the eighteen tested varieties were ranged from 9.50 to 21.00 cm. The Maximum fruit length of 21.00 cm was

Table 1: Population of jassid and whitefly in different varieties of brinjal

S. No.	Varieties	Pest population / plants	
		Jassid	whitefly
1	Swarnamani	3.36	2.80
2	KS-224	3.37	5.52
3	2010/BRRVAR-1	2.87	3.07
4	2010/BRRVAR-2	1.61	3.33
5	2010/BRRVAR-3	1.56	3.18
6	2010/BRRVAR-4	2.73	4.67
7	2010/BRRVAR-5	2.01	3.17
8	2010/BRRVAR-6	3.30	3.90
9	2010/BRRVAR-7	2.42	3.40
10	KASI TAROU	4.07	4.16
11	2010/BRLVAR-6	5.61	3.37
12	2010/BRLVAR-5	5.56	4.38
13	2010/BRLVAR-2	6.68	3.46
14	2010/BRLVAR -1	3.17	4.02
15	PUNJAB SADABAHAR	6.13	3.94
16	2010/BRLVAR -4	5.59	4.24
17	2010/BRLVAR-3	5.01	3.81
18	2010/BRLVAR -7	2.33	3.85
CD (5%)		NS	NS

Table 2: Grading of varieties

Fruit damage (%)	varieties	Grade
0	-	Immune
10-Jan	PUNJAB SADABAHAR, 2010/BRLVAR-3, 2010/BRLVAR-1, 2010/BRLVAR – 4	Resistant
20-Nov	2010/BRLVAR-7, 2010/BRLVAR-5, KASI TAROU, 2010/BRLVAR-6	Fairly resistant
21-30	2010/BRRVAR -5, 2010/BR RVAR-7, 2010/BRRVAR -3, 2010/ BRRVAR- 6, 2010/BRLVAR-2,2010 /BRRVAR- 4, 2010/BRRVAR – 2, 2010/BRRVAR-1KSS-224	Tolerant
31-40	SWARNA MANI	Susceptible
>41	-	Highly Susceptible

Table 3: Measurement of fruits, number of exit holes and presents of larvae *L. orbonalis* per fruit on different brinjal varieties.

S.No.	Varieties	Fruit length (cm)	Fruit width (cm)	Calyx diameter (cm)	Exit holes (No.)	Larvae per fruit (No.)
1	Swarna Mani	9.50	6.59	5.30	2.20	0.8
2	KS-224	14.20	8.89	6.54	3.16	1.00
3	2010/BRRVAR-1	15.50	6.77	4.95	2.00	0.60
4	2010/BRRVAR-2	11.46	6.75	4.74	2.60	0.60
5	2010/BRRVAR-3	13.10	8.48	6.93	3.16	1.80
6	2010/BRRVAR-4	11.10	8.67	7.10	2.10	0.40
7	2010/BRRVAR-5	13.04	7.38	4.16	2.00	1.00
8	2010/BRRVAR-6	11.10	8.24	6.60	1.80	0.40
9	2010/BRRVAR-7	11.24	8.33	6.16	1.20	0.60
10	KASI TAROU	19.50	3.98	3.20	2.50	1.10
11	2010/BRLVAR-6	12.26	4.71	3.80	1.80	0.80
12	2010/BRLVAR-5	14.80	4.30	3.40	1.60	1.00
13	2010/BRLVAR-2	12.61	4.00	3.30	3.14	0.60
14	2010/BRLVAR -1	21.00	4.37	3.35	1.50	1.00
15	PUNJAB SADABAHAR	17.73	3.44	2.20	1.40	2.00
16	2010/BRLVAR -4	14.00	5.63	4.26	2.00	1.00
17	2010/BRLVAR-3	11.90	6.32	4.78	2.20	2.20
18	2010/BRLVAR -7	17.28	6.01	4.64	3.40	0.80
	Range	9.50 to 21.00	3.44 to 8.89	2.20 to 7.10	1.40 to 3.40	0.40 to 2.20

Table 4: Incidence of shoot and fruit borer in related to colours of brinjal varieties

S.No.	Varieties	Fruit colour	Fruit shape	Fruit damage by weight (%)
1)	SWARNA MANI	Dark purple	Round	35.58
2)	2010/BRRVAR-1	Dark purple	Oval	26.47
3)	2010/BRRVAR -5	Dark purple	Round	21.84
4)	2010/BRRVAR-7	Dark purple	Oval	22.10
5)	KASI TAROU	Dark purple	Oblong	13.35
6)	PUNJAB SADABAHAR	Dark purple	Long	7.18
7)	2010/BRLVAR-3	Dark purple	Long	9.54
8)	2010/BRLVAR -7	Dark purple	Round	13.00
9)	2010/BRLVAR -1	Greenish purple	Oblong	5.20
10)	2010/BRRVAR -3	Green	Oval	21.96
11)	2010/BRLVAR-6	Green	Oblong	15.23
12)	2010/BRLVAR-5	Dark green with white strip	Oblong	12.41
13)	2010/BRLVAR - 4	Greenish white	Long	5.283
14)	2010/BRRVAR- 6	Purple with white	Oblong	28.27
15)	2010/BRLVAR-2	Purple	Long	20.12
16)	KSS-224	Purple	Round	29.33
17)	2010/BRRVAR- 4	Purple	Round	27.40
18)	2010/BRRVAR - 2	Purple	Round	27.22

recorded in variety 2010/BRLVAR -1 with 5.20 per cent fruit damage on weight basis. The variety Swarnamani had the fruit of smallest length (9.50 cm) and 35.58 per cent mean fruit damage on weight basis was recorded.

Fruit diameter

The fruit diameter ranged from 3.44 to 8.89 cm amongst the test varieties. The maximum fruit width (8.89 cm) recorded in variety KS-224. The variety Punjab Sadabahar had the minimum fruit width (3.44 cm). The present findings are in agreement with that of Naqvi *et al.* (2009). The fruit diameter had significant positive correlation with fruit borer infestation. Subbaratnam (1982) computed positive significant correlation between diameter of fruit and infestation.

Calyx diameter

The maximum calyx diameter of 7.10 cm was observed in the 2010/BRRVAR-4 variety and minimum of 2.20 cm in Punjab Sadabahar variety. The minimum calyx diameter was associated with 8.18 per cent mean fruit damage and variety with highest calyx length had 27.40 per cent mean fruit damage on weight basis.

Fruit shape

Fruit shape may also play an important role in the incidence of shoot and fruit borer. Varieties with long fruit were observed to be least preferred by shoot and fruit borer with a mean fruit damage of 10.78 per cent by weight. The highest overall mean fruit damage (26.09%) was observed in round fruits, although there was a wide range of 13.00 to 35.58 percent fruit damage in this category. Varieties, with oblong and oval shape fruits were most preferred with 11.55 and 23.51 per cent fruit damage, respectively.The present finding corroborates with those of Naqvi *et al.* (2009) reported the varieties Pusa Purple Cluster, Arka Nidhi, IC 112358, IC 90984 and Pusa Purple Long had long fruit and were rated as less susceptible to borer and oblong and round shaped fruits more susceptible to fruit

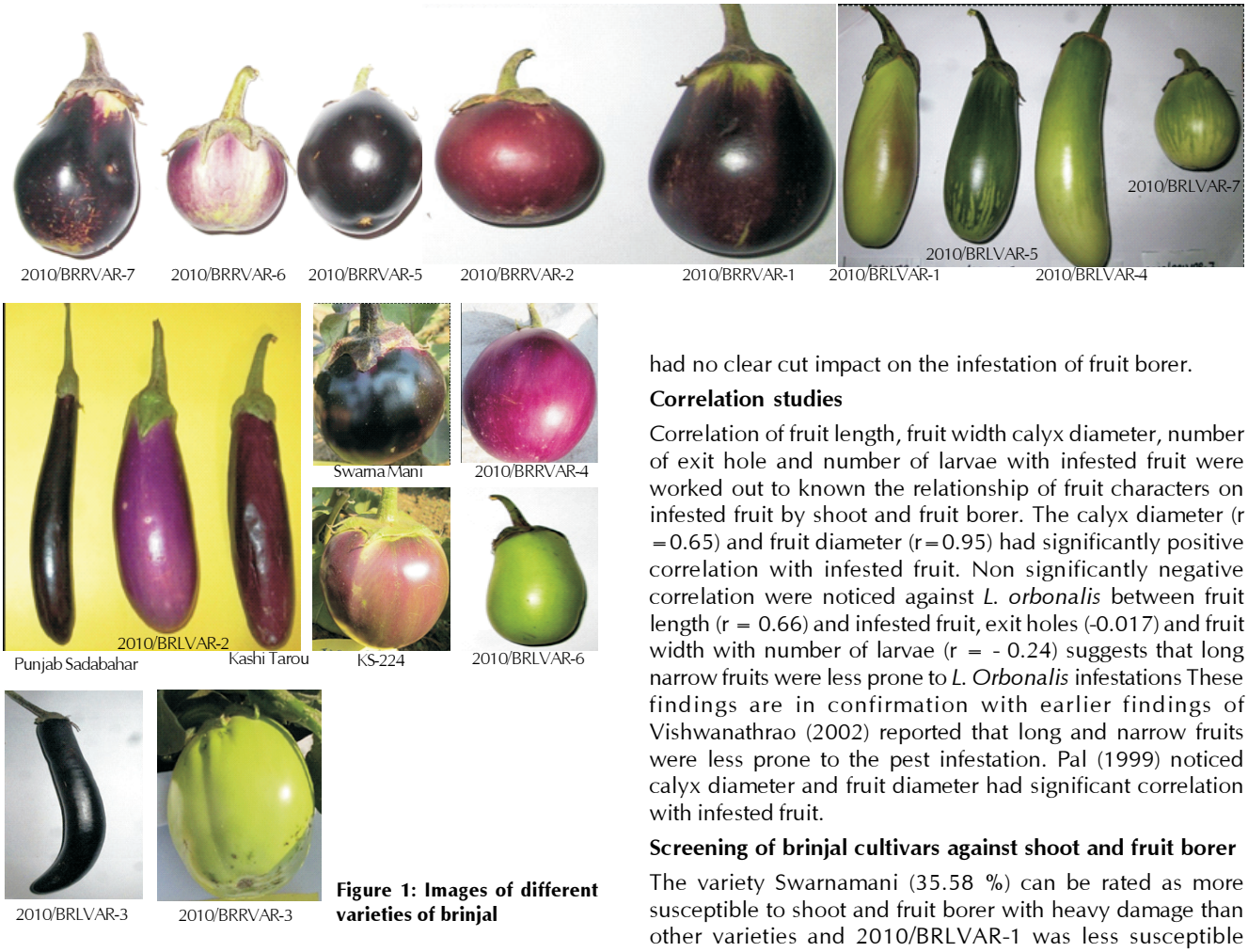

Figure 1: Images of different varieties of brinjal

borer attack. Isahaque and Chaudhari (1984) reported round and oblong fruits more susceptible to fruit borer attack.Grewal and Singh (1995) reported that long fruited varieties were more susceptible to fruit borer attack dose not collaborate the present finding.

Fruit colour

Out of 18 test varieties had seven different types of fruit colours which showed purple (four), dark purple (eight), greenish purple (one), green (two) dark green with white strip (one), greenish white (one) and dark purple with white colour (one), respectively. Out of which greenish purple colours variety was the least preferred by fruit borers with an overall mean fruit damage of 5.21 per cent. Overall highest fruit damage (26.02%) was noticed on infested fruits in the variety of purple colour.The present finding provide support from the work of Jat and Pareek (2003) reported that green fruited varieties had low fruit damage. Grewal and singh (1995) observed dark purple coloured fruits more susceptible and light purple coloured and green fruited varieties had less susceptible Gupta and Kauntey (2008) observed that varieties with dark purple or white colored fruit were more susceptible damage (54.65-64.00%) and those with light purple, purple or green coloures were less susceptible (24.38-36.05). Naqvi *et al.* (2009) observed that the colour of fruits of brinjal varieties screened had no clear cut impact on the infestation of fruit borer.

Correlation studies

Correlation of fruit length, fruit width calyx diameter, number of exit hole and number of larvae with infested fruit were worked out to known the relationship of fruit characters on infested fruit by shoot and fruit borer. The calyx diameter (r =0.65) and fruit diameter (r=0.95) had significantly positive correlation with infested fruit. Non significantly negative correlation were noticed against *L. orbonalis* between fruit length (r = 0.66) and infested fruit, exit holes (-0.017) and fruit width with number of larvae (r = - 0.24) suggests that long narrow fruits were less prone to *L. Orbonalis* infestations These findings are in confirmation with earlier findings of Vishwanathrao (2002) reported that long and narrow fruits were less prone to the pest infestation. Pal (1999) noticed calyx diameter and fruit diameter had significant correlation with infested fruit.

Screening of brinjal cultivars against shoot and fruit borer

The variety Swarnamani (35.58 %) can be rated as more susceptible to shoot and fruit borer with heavy damage than other varieties and 2010/BRLVAR-1 was less susceptible (5.20%) to shoot and fruit borer. These finding are in collaboration with earlier findings of Pal (1999), who reported pusa purple long, pusa purple cluster, green long, IAHS Long, F1 Hy Nishant and Alankar can be rated as less susceptible to *L. orbonalis* with lesser damage. Similarly, Mannan, Begum, Rahman and Hossian (2003) observed that the brinjal varieties Jumki -1 and Jumki-2 were highly resistant, Islampuri -3, BL - 34 and Muktakeshi were fairly resistant, Singnath long and Singnath -4 were tolerant to brinjal shoot and fruit borer. The susceptible varieties Islampuri -1 and Irribegoon-1 were susceptible against brinjal fruit and shoot borer. Elanchezhyam *et al.* (2008) revealed that hybrid Sweta was best in reducing the shoot and fruit damage by *L. orbonalis* Guenee recorded on the number basis mean shoot and fruit damage of 8.0 and 8.7 percent, respectively. Khan and Singh (2014) Reported that the minimum mean infestation in fruits was found in genotype EC305163 (0.0%) and IC090132 (0.0%) while maximum mean infestation in fruits was recorded in IC261792 (100%) and IC420406 (100%). Among 192 genotypes of brinjal tested, two of them EC305163 and IC090132 was found immune to shoot and fruit borer, three genotype namely IC545256, IC433625 and IC264470 found resistance, 21 fairly resistance, 38 tolerant, 52 susceptible and rest 76 genotypes were found highly susceptible to brinjal shoot and fruit borer.

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