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Screening of brinjal varieties for resistance to major insect pests

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Abstract

An investigation was carried out to study the morphological characters of brinjal varieties / genotypes against sucking pests and shoot and fruit borer of brinjal during *Kharif* 2018. Amongst the ten cultivars, BH-2 showed moderately resistant to infestation of whitefly (*Bemisia tabaci* Gennadius), jassids (*Amrasca bigutulla bigutulla* Ishida) and shoot and fruit borer (*Leucinodes orbonalis* Guenee) and also obtained higher fruit yield followed by Utkal Keshari, JKJEH-6012, JB-262 and Pusa Upkar. Whereas, SBJH-691, Aussay, Utkal Jyoti and VR-2 shows moderately susceptible to the pests. The cultivar JBH-3 observed susceptible to the major insect pests of brinjal.

Keywords: Brinjal, screening, morphological characters, pests

Introduction

Brinjal or Baingan (*Solanum melongena* Linnaeus) known as egg plant and aubergine in North America and Europe, respectively, is an important vegetable in India. It is native of India and locally called 'Wangi' in Maharashtra often described as poor man's vegetable. After potato, it ranks second highest consumed vegetable in India, along with tomato and onion.

Brinjal or eggplant (*Solanum melongena* L.) crop is prone to be attacked by many sucking pests particularly, aphids, jassids, whitefly. Both nymphs and adults of sucking pests *viz.*, *Aphis gossypii*, *Amrasca bigutulla bigutulla* and *Bemisia tabaci* occur regularly on the crop from the early stage and remains till harvest of the crop causing enormous damage by sucking cell sap from the leaves and tender plant parts. Due to aphid infestation lower surface of the leaves get crinkled and slightly curled backwards. The nymphs and adults of jassids inject their toxic saliva while feeding. As a result the plant becomes stunted, the leaves crinkle, turn yellowish and become cup shaped. Brownish or reddish colour may develop along the edges of the leaves. Due to whitefly infestation leaves wrinkled, curled downwards and ultimately shed. Besides the feeding damage, aphids and whitefly also exude honeydew which favours the development of sooty mould.

Whereas, the lepidopteran pests occurred in brinjal are leaf roller, stem borer and shoot and fruit borer. Among which the brinjal shoot and fruit borer, *Leucinodes orbonalis* considered as the main constraint as it damage the crop throughout the year. These pests not only reduce the yield but also deteriorate the quality of fruits. The pest is very active during rainy and summer season and often cause more than 90% damage in Bangladesh and up to 95% in India (Naresh *et al.*, 1986) [9]. It is also reported that the infestation of fruit borer causes reduction in Vitamin 'C' content to the extent of 68% in the infested fruits (Hemi, 1955) [7].

In spite of its popularity among small resource poor farmers, brinjal cultivation is often input-intensive, especially for insecticidal applications Brinjal is a good source of carbohydrates, proteins, vitamin A, B, C and minerals like iron, phosphorus and calcium. It has medicinal properties also. Though perennial vegetable, it is grown as a seasonal crop throughout the country. It is being grown throughout the year under irrigated condition. Hence, it is subjected to attack by number of insect-pests right from nursery stage till harvesting (Regupathy *et al.*, 1997) [14]. Insect-pests damage is one of the main constraints in accelerating yield potential of brinjal. The important pests causing damage to the crop are given below.

It has been estimated that annual crop losses in India due to these pests are much more. These losses are qualitative as well as quantitative in nature, more particular so in vegetable crop like brinjal where carryover of pests is relatively more as they are grown round the year. Among the various approaches employed for pest control, use of resistant varieties is most important.

Vegetable growers depend on insecticides for their managements and take number of sprays at regular intervals that pose many problems including resistance to insecticides and resurgence of secondary pests. The present study was designed to study of screening of morphological characters of brinjal varieties / genotypes against infestation of jassids, whiteflies and brinjal shoot and fruit borer.

Material and Methods

The present investigation on “Screening of brinjal varieties for resistance to major insect pests” was conducted on the Research Farm of Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani Dist. Parbhani during *Kharif* 2018. The experiment was laid out in Randomized block design (RBD) in three replications with the spacing of 60cm x 60 cm in plot size of 4.8 m x 4.2 m. The crop was transplanted in the month of June, 2018 and last picking was done in the month of November, 2018. Total ten elite varieties / genotypes viz., SBJH-691, BH- 2, JKGEH-6012, JB-262, Pusa Upkar, Aussay, Utkal Keshri, Utkal Jyoti, JBH-3 and VR-2 were studied in present investigation.

Method of Observations

For recording the observations, five plants in each varieties / genotype was selected randomly and tagged and properly labelled. The observations on morphological characters were recorded on the different aspects viz., Plant height, fruit length, fruit diameter, fruit colour, fruit shape, number of hairs per leaf, flower colour and leaf colour:

Irrespective of morphological characters, the observations on insect pests were also recorded on five randomly selected plants. Total number of jassid and whitefly was recorded on the leaf each from top, middle and bottom canopy of the observation plants. In case of on shoot and fruit borer, *L.orbonalis* infestation were recorded on five plants selected at random from each net plot, after initiation of fruits. The total number of fruits per plant were counted and the infested and healthy fruits were recorded separately. From this, the percentage infestation due to shoot and fruit borer was worked out as given following formula.

$$\text{Per cent fruit infestation (Number basis)} = \frac{\text{No. of infested fruits}}{\text{Total no. of fruits}} \times 100$$

The observations were recorded at weekly interval till the final harvesting was done. At each harvesting yield record was recorded and total yield per ha was worked out.

Statistical analysis

The data obtained in number was subjected to transformation using Poisson formula it is $\sqrt{x + 0.5}$ and per cent data was transformed using arc sine transformation before further statistical analysis and subjected to the analysis of variance by outlined by Panse and Sukhatme (1978) [11] by adopting “Fishers analysis of variance technique”.

Results and Discussion

The results of present investigations on morphological characters of different varieties and infestation of major insect pests were recorded at fortnightly interval after transplanting of brinjal seedlings upto the last picking of the fruits and data presented in Table 1 to 5.

A). Morphological characters

The following 10 brinjal varieties are categorized on the basis different morphological characters are given in Table 1.

- SBJH-691 variety was fruit colour light purple, fruit shape round, hairyness, flower colour light purple and leaf colour dark green.
- BH-2 variety was fruit colour light purple, fruit shape round, hairyness, flower colour dark purple and leaf colour dark green.
- JKGEH- 6012 variety was fruit colour purple, fruit shape long, hairyness, flower colour dark purple and leaf colour dark green.
- JB- 262 variety was fruit colour light green and fruit shape oblong, hairyness, flower colour light purple and leaf colour dark green.
- Pusa Upkar variety was fruit colour dark purple, fruit shape oval, hairyness, flower colour light purple and leaf colour green.
- Aussay variety was fruit colour dark purple, fruit shape oblong, hairyness, flower colour light purple and leaf colour green.
- Utkal Keshri variety was fruit colour purple, fruit shape oval, hairyness, flower colour light purple and leaf colour dark green.
- Utkal Jyoti variety was fruit colour dark purple, fruit shape oblong, hairyness, flower colour purple and leaf colour purple green.
- JBH-3 variety was fruit colour light green, fruit shape round, hairyness, flower colour purple and leaf colour dark green.
- VR-2 variety was fruit colour green with whitestripe, fruit shape long, hairyness, flower colour and leaf colour same as JBH-3 variety.

Table 1: Morphological characters of brinjal varieties

Sr. No.	Varieties	Fruit colour	Fruit shape	Hairyness	Flower colour	Leaf colour	Plant height (cm)	Hair / leaf (in 10 x area)	Length of fruit (cm)	Diameter of fruit (cm)
1	SBJH-691	Light purple	long	Hairyness	Light purple	Light green	84.20	40.66	13.33	3.06
2	BH-2	Light purple	Round	Hairyness	Dark purple	Dark green	76.60	31.33	8.06	7.56
3	JKGEH-6012	Purple	long	Hairyness	Dark purple	Dark green	59.40	32.52	10.18	3.66
4	JB-262	Light green	Oblong	Hairyness	Light purple	Dark green	64.11	41.00	8.40	4.53
5	Pusa Upkar	Dark purple	Oval	Hairyness	Light purple	Green	72.80	28.33	7.50	6.13
6	Aussay	Dark purple	Oblong	Hairyness	Light purple	Green	94.00	39.33	11.56	5.26
7	Utkal Keshari	Purple	Oval	Hairyness	Light purple	Dark green	83.33	31.55	7.33	5.73
8	Utkal Jyoti	Dark purple	Oblong	Hairyness	Purple	Purple green	73.18	37.33	7.90	4.83
9	JBH-3	Light green	Round	Hairyness	Purple	Dark green	69.00	32.00	9.33	6.43
10	VR-2	Green with whitestripe	long	Hairyness	Purple	Dark green	85.00	34.66	11.33	3.26
	S.E. ±						0.31	0.19	0.16	0.89
	C.D.at 5%						0.94	0.27	0.48	0.26

Plant height

The plant height of five selected plants was measured with the help of measuring scale. The average height per plant varied from 59.40 to 94.00 cm. Variety Aussay was observed significantly maximum height (94.00 cm) followed by VR-2 (85.00 cm), SBJH-691 (84.20 cm) and Utkal keshri (83.33 cm). The minimum plant height was recorded in JKJEH-6012 (59.40 cm) followed by JBH-2 (64.00 cm) and JBH-3 (69.00 cm).

Number of hairs per leaf

The observation on number of hairs per leaf were recorded (each leaf from top, middle and bottom) under binocular microscope (10X). Maximum number of hairs of 41.00 per leaf was recorded in SBJH- 691 (40.66) followed by Aussay (39.33). Variety Pusa Upkar was recorded lowest (28.33) number of hairs per leaf followed by BH- 2 (31.33) and Utkal keshri (31.55).

Length of fruit

The length of five selected fruits was recorded with Vanire caliper. The significantly less mean length of fruit was recorded in variety Utkal keshri (7.33 cm) followed by Pusa Upkar (7.50 cm), Utkal Jyoti (7.90 cm). SBJH- 691 recorded significantly maximum fruit length (13.33 cm) followed by Aussay (11.50 cm) and VR-2 (11.33 cm).

Diameter of fruit

The diameter of selected five fruits was recorded with Vanire caliper. The significantly less mean diameter of fruit was recorded in variety SBJH (3.06 cm) followed by VR-2 (3.26 cm) and JKGEH-6012 (3.66 cm). While, SB-2 recorded significantly maximum fruit diameter (7.56 cm) followed by JBH-3 (6.43 cm) and Pusa Upkar (6.13 cm).

These findings are in agreement with earlier workers, Ayyasamy and Baskaran (2005) [1] noticed that leaf hairiness

and leaf thickness of brinjal accessions of host plant selection of whitefly (*Bemisia tabaci*) and results revealed that the hairy varieties viz., Hisar Jamunia followed by DBR-31 and PY-356 contained more *B. tabaci* than the glabrous varieties EP 106 and EP 89. Naqvi *et al.* (2008) [8] who revealed that leaf area had no effect on jassid population on 13 brinjal cultivars, while trichome density had a negative correlation. The leaf area had a positive effect on whitefly population, whereas trichome density had no significant effect. Gupta and Kaunty (2008) [6] reported that the length of peripheral seed ring and that of seedless area of fruit is linearly co-related with the degree of infestation by shoot and fruit borer, *L. orbonalis* Guen. and found that the varieties with round shape, less number of seeds and smooth fruit surface are most susceptible than those with long fruits and hard surface.

B). Infestation of insect pests

Whitefly, *Bemisia tabaci*

It is evident from Table 2 revealed that the population of *B. tabaci* started increasing from the seedling stage and found higher population from the 41st to 47th week. The population of whitefly was in the ranged from 0.75 to 4.29 whiteflies/3leaves/plant. Variety JB-262 (3.98) showed average lower *B. tabaci* infestation which was followed by BH-2 (4.12), JKJEH-6012(4.38), Utkal Keshari (4.69) and SBJH- 691 (4.77). However, variety JBH-3 (6.02) showed higher infestation of *B. tabaci* followed by Utkal Jyoti (5.15), Aussay (5.36), VR-2 (5.49) and Pusa Upkar (5.86).

The similar results are reported by earlier workers, Singh *et al.* (2002) [16] who reported that none of the 34 genotypes of brinjal were free from whitefly infestation, although significantly lower populations of the pest was recorded on CO-2 (4.48/3 leaves). Shaikh and Patel (2013) observed that genotype AB-09-1 (2.56/leaf) and NDB 18 (2.67/leaf) recorded significantly minimum whitefly as against genotype AB 09-14 recorded significantly higher whitefly (4.21/leaf).

Table 2: Population of whitefly, *B. tabaci* on brinjal varieties

Sr. No.	MW / Varieties	Population of whitefly/ 3 leaves / plant									
		28	29	30	31	32	33	34	35	36	37
		9 - 15 July	16 -22 July	23 - 29July	30 -05 Aug.	06 -12 Aug.	13-19 Aug.	20 -26 Aug.	27 - 02 Sept.	03 -09 Sept.	10 -16 Sept.
1	SBJH - 691	1.10 (1.44)	1.19 (1.47)	1.39 (1.54)	1.53 (1.58)	1.72 (1.64)	2.47 (1.85)	2.61 (1.89)	1.81 (1.67)	1.94 (1.71)	2.19 (1.78)
2	BH - 2	0.75 (1.32)	0.99 (1.40)	1.09 (1.44)	1.30 (1.51)	1.46 (1.56)	2.13 (1.76)	2.29 (1.80)	1.57 (1.60)	1.67 (1.63)	1.86 (1.69)
3	JKJEH -6012	1.16 (1.46)	1.32 (1.52)	1.47 (1.57)	1.64 (1.62)	1.77 (1.66)	1.57 (1.59)	1.73 (1.64)	1.88 (1.69)	2.08 (1.75)	2.05 (1.74)
4	JB- 262	0.84 (1.35)	1.04 (1.42)	1.24 (1.49)	1.40 (1.54)	1.51 (1.58)	2.07 (1.74)	2.31 (1.81)	1.60 (1.61)	1.70 (1.64)	1.79 (1.67)
5	Pusa Upkar	1.64 (1.61)	1.85 (1.68)	2.02 (1.73)	2.14 (1.76)	2.26 (1.80)	1.87 (1.69)	2.05 (1.74)	2.42 (1.84)	2.57 (1.88)	2.77 (1.93)
6	Aussay	0.79 (1.33)	1.14 (1.45)	1.40 (1.54)	1.54 (1.59)	1.66 (1.63)	2.93 (1.97)	3.09 (2.01)	1.83 (1.67)	1.97 (1.72)	2.10 (1.75)
7	Utkal Keshri	1.17 (1.46)	1.31 (1.51)	1.57 (1.60)	1.78 (1.66)	1.88 (1.69)	1.63 (1.62)	1.77 (1.66)	1.96 (1.71)	2.11(1.76)	2.26 (1.80)
8	Utkal jyoti	1.12 (1.45)	1.38 (1.54)	1.60 (1.61)	1.89 (1.68)	2.04 (1.73)	2.17 (1.77)	2.36 (1.83)	2.17 (1.77)	2.26 (1.80)	2.55 (1.80)
9	JBH - 3	1.28 (1.50)	1.44 (1.56)	1.70 (1.64)	1.95 (1.71)	2.11 (1.76)	3.43 (2.10)	3.60 (2.14)	2.28 (1.81)	2.47 (1.86)	2.57 (1.88)
10	VR - 2	1.20 (1.48)	1.49 (1.57)	1.85 (1.68)	2.06 (1.75)	2.29 (1.81)	2.07 (1.73)	2.21 (1.78)	2.39 (1.84)	2.53 (1.87)	2.65 (1.89)
	S. E±	0.04	0.05	0.04	0.04	0.04	0.09	0.09	0.05	0.05	0.05
	C.D. at 5%	0.14	0.15	0.13	0.14	0.14	0.28	0.28	0.15	0.15	0.16

Sr. No.	MW/ Varieties	38	39	40	41	42	43	44	45	46	47	Mean
		17 -23 Sept.	24 - 30 Sept.	01-07 Oct.	08 - 14 Oct.	15 - 21 Oct.	22 - 28 Oct.	29 - 04 Nov.	05 -11 Nov.	12 - 18 Nov.	19 -25 Nov.	
1	SBJH - 691	2.32 (1.82)	2.42 (1.84)	2.54 (1.86)	2.77 (1.92)	2.97 (1.97)	3.11 (2.01)	3.25 (2.01)	3.36 2.04	3.48 (2.07)	3.58 (2.10)	4.77 (2.39)
2	BH - 2	2.03 (1.73)	2.21 (1.78)	2.33 (1.82)	2.44 (1.85)	2.58 (1.89)	2.73 (1.99)	2.83 (1.93)	2.92 (1.95)	3.04 (1.98)	3.15 (2.01)	4.12 (2.23)
3	JKJEH -6012	2.14 (1.77)	2.2 (1.80)	2.3 (1.83)	2.50 (1.86)	2.6 (1.91)	2.8 (1.93)	2.9 (1.96)	3.05 1.99	3.19 (2.03)	3.29 (2.05)	4.38 (2.31)
4	JB- 262	1.88 (1.69)	1.98 (1.72)	2.12 (1.75)	2.28 (1.79)	2.44 (1.84)	2.54 (1.86)	2.62 (1.89)	2.73 1.92	2.80 (1.94)	2.95 (1.97)	3.98 (2.22)
5	Pusa Upkar	2.89 (1.96)	3.33 (2.07)	3.41 (2.09)	3.51 (2.12)	3.60 (2.14)	3.80 (2.19)	3.91 (2.20)	4.07 2.24	4.20 (2.27)	4.29 (2.29)	5.86 (2.61)
6	Aussay	2.95 (1.98)	3.04 (2.00)	3.17 (2.03)	3.32 (2.07)	3.45 (2.10)	3.62 (2.14)	3.71 (2.16)	3.86 2.20	3.97 (2.22)	4.08 (2.25)	5.36 (2.52)
7	Utkal Keshri	2.43 (1.92)	2.57 (1.86)	2.71 (1.92)	2.85 (1.95)	2.93 (1.98)	3.02 (2.00)	3.09 (1.99)	3.19 2.02	3.30 (2.05)	3.44 (2.08)	4.69 (2.38)
8	Utkal jyoti	2.69 (1.83)	2.76 (1.93)	2.89 (1.96)	2.98 (1.99)	3.11 (2.02)	3.20 (2.04)	3.44 (2.07)	3.50 2.09	3.65 (2.13)	3.75 (2.15)	5.15 (2.48)
9	JBH - 3	2.70 (1.92)	3.34 (2.07)	3.45 (2.09)	3.58 (2.12)	3.71 (2.15)	3.90 (2.20)	4.04 (2.23)	4.13 2.25	4.24 (2.27)	4.29 (2.29)	6.02 (2.65)

10	VR - 2	2.75 (1.93)	2.83 (1.95)	2.97 (1.99)	3.10 (2.02)	3.26 (2.06)	3.40 (2.09)	3.83 (2.19)	3.93 (2.21)	4.01 (2.21)	4.10 (2.24)	5.49 (2.54)
	S.E±	0.05	0.07	0.06	0.06	0.06	0.07	0.07	0.07	0.06	0.06	0.07
	CD at 5%	0.16	0.22	0.19	0.20	0.20	0.22	0.22	0.22	0.19	0.20	0.23

Table 3: Population of jassids, *A. bigutulla bigutulla* on brinjal varieties

Sr. No.	MW / Varieties	Population of jassids/ 3 leaves /plant									
		28	29	30	31	32	33	34	35	36	37
		9-15 July	16 -22 July	23 - 29 July	30 -05 Aug.	06 -12 Aug.	13 - 19 Aug.	20 -26 Aug.	27 - 02 Sept.	03 -09 Sept.	10 -16 Sept.
1	SBJH - 691	1.26 (1.50)	1.46 (1.56)	1.55 (1.58)	1.64 (1.60)	2.17 (1.77)	2.25 (1.79)	2.34 (1.82)	1.38 (1.54)	1.67 (1.63)	1.87 (1.69)
2	BH - 2	1.17 (1.46)	1.34 (1.49)	1.40 (1.51)	1.58 (1.58)	1.41 (1.55)	1.45 (1.56)	1.47 (1.57)	1.26 (1.49)	1.40 (1.53)	1.51 (1.56)
3	JKJEH -6012	0.64 (1.28)	0.72 (1.30)	0.82 (1.34)	0.93 (1.38)	1.10 (1.45)	1.12 (1.45)	1.16 (1.46)	0.69 (1.29)	0.85 (1.35)	0.96 (1.39)
4	JB- 262	1.16 (1.45)	1.42 (1.54)	0.93 (1.38)	1.17 (1.46)	1.27 (1.50)	1.36 (1.53)	1.51 (1.56)	1.26 (1.49)	1.39 (1.53)	1.59 (1.48)
5	Pusa Upkar	0.78 (1.32)	0.83 (1.35)	0.94 (1.39)	1.00 (1.41)	1.07 (1.44)	1.23 (1.49)	1.39 (1.54)	0.85 (1.35)	0.97 (1.39)	1.18 (1.47)
6	Aussay	1.80 (1.66)	2.00 (1.72)	2.13 (1.76)	2.23 (1.81)	2.23 (1.77)	2.32 (1.80)	2.43 (1.85)	1.93 (1.70)	2.10 (1.75)	2.33 (1.81)
7	Utkal Keshri	0.42 (1.19)	0.66 (1.28)	0.69 (1.29)	0.76 (1.32)	1.13 (1.45)	1.27 (1.50)	1.35 (1.53)	0.44 (1.19)	0.56 (1.24)	0.68 (1.29)
8	Utkal jyoti	1.31 (1.51)	1.52 (1.58)	1.63 (1.61)	1.87 (1.68)	1.67 (1.62)	1.72 (1.64)	1.80 (1.66)	1.19 (1.47)	1.34 (1.52)	1.46 (1.56)
9	JBH - 3	2.50 (1.86)	2.67 (1.90)	2.93 (1.98)	3.00 (1.99)	2.41 (1.84)	2.51 (1.87)	2.72 (1.92)	2.50 (1.86)	2.73 (1.93)	2.83 (1.95)
10	VR - 2	0.89 (1.35)	1.19 (1.47)	1.35 (1.52)	1.46 (1.56)	1.25 (1.49)	1.35 (1.50)	1.45 (1.56)	0.95 (1.38)	1.06 (1.41)	1.28 (1.48)
	S. E±	0.10	0.11	0.11	0.11	0.08	0.09	0.09	0.10	0.11	0.10
	CD at 5%	0.31	0.35	0.34	0.35	0.25	0.27	0.27	0.32	0.32	0.32

Sr. No.	MW / Varieties	38	39	40	41	42	43	44	45	46	47	Mean
		17 -23 Sept.	24 - 30 Sept.	10 -07 Oct.	08 - 14 Oct.	15 - 21 Oct.	22 - 28 Oct.	29 - 04 Nov.	05 -11 Nov.	12 - 18 Nov.	19 -25 Nov.	
1	SBJH - 691	2.20 (1.78)	2.37 (1.83)	2.57 (1.88)	3.00 (2.00)	3.40 (2.09)	3.66 (2.15)	3.95 (2.22)	4.23 (2.28)	4.60 (2.36)	5.07 (2.46)	5.26 (2.44)
2	BH - 2	1.73 (1.63)	2.13 (1.76)	2.23 (1.79)	2.38 (1.83)	2.67 (1.90)	2.90 (1.96)	3.20 (2.04)	3.49 (2.11)	3.87 (2.20)	4.18 (2.27)	4.27 (2.29)
3	JKJEH -6012	1.18 (1.47)	1.43 (1.55)	1.67 (1.62)	1.87 (1.68)	2.10 (1.75)	2.29 (1.80)	2.65 (1.90)	2.94 (1.98)	3.10 (2.02)	3.36 (2.08)	3.15 (2.03)
4	JB- 262	1.72 (1.63)	1.97 (1.71)	2.10 (1.75)	2.27 (1.79)	2.59 (1.88)	2.88 (1.95)	2.96 (1.98)	3.32 (2.07)	3.58 (2.13)	3.91 (2.21)	4.03 (2.24)
5	Pusa Upkar	1.40 (1.54)	1.63 (1.62)	1.97 (1.72)	2.07 (1.74)	2.43 (1.84)	2.61 (1.89)	3.25 (2.05)	3.53 (2.12)	3.83 (2.19)	4.15 (2.26)	3.71 (2.16)
6	Aussay	2.50 (1.86)	2.70 (1.91)	3.03 (2.00)	3.27 (2.06)	3.53 (2.12)	3.87 (2.20)	4.10 (2.25)	4.35 (2.31)	4.77 (2.40)	5.17 (2.48)	5.87 (2.61)
7	Utkal Keshri	0.82 (1.34)	1.27 (1.50)	1.73 (1.65)	1.97 (1.72)	2.28 (1.80)	2.65 (1.91)	2.91 (1.97)	3.16 (2.03)	3.70 (2.16)	3.95 (2.22)	3.24 (2.05)
8	Utkal jyoti	1.63 (1.62)	1.83 (1.67)	2.27 (1.80)	2.43 (1.84)	2.63 (1.90)	2.93 (1.98)	3.30 (2.07)	3.63 (2.14)	4.13 (2.26)	4.31 (2.30)	4.18 (2.27)
9	JBH - 3	3.10 (2.02)	3.33 (2.07)	3.53 (2.12)	3.73 (2.17)	4.03 (2.42)	4.20 (2.27)	4.44 (2.32)	4.85 (2.41)	5.19 (2.48)	5.51 (2.54)	6.87 (2.80)
10	VR - 2	1.55 (1.57)	1.80 (1.66)	2.17 (1.77)	2.47 (1.85)	2.82 (1.94)	3.23 (2.05)	3.57 (2.13)	3.92 (2.22)	4.24 (2.28)	4.65 (2.37)	4.41 (2.32)
	S.E±	0.11	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.11
	C.D. at 5%	0.33	0.30	0.28	0.27	0.28	0.25	0.24	0.25	0.24	0.25	0.33

Figures in parenthesis are $\sqrt{x + 0.5}$ transformed values

Table 4: Per cent fruit damage of shoot and fruit borer, *eucinode orbonalis* on brinjal varieties

Sr. No.	MW / Varieties	Per cent fruit damage of shoot and fruit borer									
		28	29	30	31	32	33	34	35	36	37
		9-15 July	16 -22 July	23 - 29 July	30 -05 Aug.	06 -12 Aug.	13 - 19 Aug.	20 -26 Aug.	27 - 02 Sept.	03 -09 Sept.	10 -16 Sept.
1	SBJH - 691	1.20 (6.27)	1.26 (6.41)	1.45 (6.85)	1.68 (7.33)	1.73 (7.50)	1.82 (7.70)	1.30 (6.51)	1.40 (6.78)	1.58 (7.13)	2.03 (8.14)
2	BH - 2	0.85 (5.19)	0.95 (5.51)	1.24 (6.37)	1.48 (6.92)	1.47 (6.93)	1.64 (7.32)	0.88 (5.33)	1.05 (5.85)	1.24 (6.36)	1.89 (7.83)
3	JKJEH -6012	0.79 (4.99)	1.07 (5.69)	1.12 (6.06)	1.35 (6.63)	1.78 (7.66)	1.90 (7.92)	0.80 (5.06)	0.94 (5.51)	1.92 (7.95)	2.07 (8.25)
4	JB- 262	0.85 (5.26)	0.93 (5.51)	1.35 (6.63)	1.57 (7.12)	1.62 (7.05)	1.72 (7.53)	0.95 (5.56)	1.11 (6.02)	1.99 (8.11)	2.12 (8.37)
5	Pusa Upkar	0.89 (5.33)	1.04 (5.80)	1.18 (6.22)	1.26 (6.41)	1.51 (7.05)	1.62 (7.31)	0.79 (5.10)	0.97 (5.63)	1.85 (7.66)	1.85 (7.81)
6	Aussay	1.12 (6.06)	1.17 (6.19)	1.38 (6.70)	1.62 (7.21)	1.67 (7.41)	1.81 (7.71)	1.93 (7.96)	2.04 (8.19)	1.66 (7.37)	2.13 (8.36)
7	Utkal Keshri	1.00 (5.71)	1.37 (6.64)	1.56 (7.09)	1.71 (7.39)	1.89 (7.88)	2.00 (8.10)	2.15 (8.42)	2.25 (8.61)	2.47 (9.01)	2.22 (8.55)
8	Utkal jyoti	0.83 (5.22)	0.85 (5.28)	0.99 (5.71)	1.15 (6.14)	2.05 (8.16)	2.15 (8.36)	2.25 (8.58)	2.39 (8.83)	2.98 (9.84)	2.38 (8.86)
9	JBH - 3	1.23 (6.34)	1.32 (6.56)	1.45 (6.85)	1.58 (7.13)	2.12 (8.34)	2.26 (8.62)	2.39 (8.88)	2.52 (9.11)	2.76 (9.49)	2.60 (9.27)
10	VR - 2	0.91 (5.43)	1.22 (6.29)	1.52 (7.00)	1.84 (7.65)	2.33 (8.77)	2.44 (8.98)	2.56 (9.19)	2.66 (9.38)	2.59 (9.21)	2.74 (9.52)
	S. E±	0.22	0.28	0.21	0.26	0.33	0.33	0.29	0.27	0.51	0.35
	CD at 5%	0.67	0.83	0.65	0.78	1.01	1.00	0.87	0.83	1.54	1.05

Sr. No.	MW/ Varieties	38	39	40	41	42	43	44	45	46	47	Mean
		17 -23 Sept.	24 - 30 Sept.	10 -07 Oct.	08 - 14 Oct.	15 - 21 Oct.	22 - 28 Oct.	29 - 04 Nov.	05 -11 Nov.	12 - 18 Nov.	19 -25 Nov.	
1	SBJH - 691	2.12 (8.33)	2.25 (8.60)	1.98 (7.90)	1.98 (7.90)	2.32 (8.74)	2.49 (8.77)	2.68 (9.36)	2.74 (9.46)	2.87 (9.67)	3.12 (10.16)	4.00 (11.27)
2	BH - 2	2.00 (8.08)	2.09 (8.37)	1.91 (7.78)	2.06 (8.24)	2.15 (8.42)	2.35 (8.79)	2.89 (9.70)	3.08 (10.10)	3.35 (10.53)	3.55 (10.82)	3.81 (11.21)
3	JKJEH-6012	2.18 (8.47)	2.28 (8.66)	1.76 (7.49)	1.85 (7.66)	1.98 (7.90)	3.45 (10.65)	3.68 (11.02)	3.81 (11.21)	4.26 (11.90)	4.38 (12.06)	4.33 (12.00)
4	JB- 262	2.25 (8.62)	2.37 (8.84)	2.18 (8.48)	2.37 (8.83)	2.48 (9.02)	2.67 (9.35)	2.76 (9.49)	2.93 (9.76)	3.17 (10.24)	3.26 (10.39)	4.06 (11.34)
5	Pusa Upkar	1.94 (8.00)	2.11 (8.34)	2.03 (8.18)	2.28 (8.67)	2.51 (9.07)	2.71 (9.41)	2.87 (9.67)	2.98 (9.84)	3.11 (10.15)	3.36 (10.54)	3.91 (11.34)
6	Aussay	2.26 (8.63)	2.39 (8.86)	1.87 (7.70)	2.78 (9.53)	2.87 (9.67)	2.97 (9.83)	3.25 (10.37)	3.47 (10.71)	3.67 (11.01)	3.74 (10.93)	4.58 (12.33)
7	Utkal Keshri	2.34 (8.77)	2.44 (8.96)	2.65 (9.31)	2.87 (9.67)	2.97 (9.83)	3.24 (10.36)	3.48 (10.73)	3.57 (10.86)	3.75 (11.12)	3.86 (11.28)	4.97 (12.83)
8	Utkal jyoti	2.50 (9.08)	2.63 (9.32)	2.57 (9.18)	2.91 (9.73)	3.22 (10.32)	3.38 (10.57)	3.55 (10.82)	3.68 (11.02)	3.95 (11.40)	4.23 (11.86)	5.06 (12.80)

9	JBH - 3	2.78 (9.58)	2.89 (9.77)	3.15 (10.21)	3.47 (10.71)	3.57 (10.86)	3.64 (10.96)	3.82 (11.04)	4.12 (11.70)	4.38 (12.06)	4.52 (12.25)	5.65 (13.73)
10	VR - 2	2.84 (9.69)	2.97 (9.91)	3.10 (10.13)	3.16 (10.23)	3.22 (10.32)	3.31 (10.47)	3.42 (10.64)	3.55 (10.67)	3.63 (10.78)	3.72 (11.08)	5.37 (13.32)
	S.E±	0.34	0.33	0.47	0.39	0.35	0.43	0.39	0.40	0.42	0.42	0.56
	CD at 5%	1.04	1.00	1.40	1.19	1.05	1.29	1.16	1.22	1.27	1.26	1.69

Table 5: Average population of major insect pests and fruit yield in different brinjal varieties

Sr. No.	Variety	Mean number of pest population/3 leaves/ plant		Per cent fruit infestation of BSFB	Fruit yield (qt/ha.)
		Whitefly	Jassids		
1.	SBJH - 691	4.77	5.26	4.00	543
2.	BH - 2	4.13	4.27	3.81	598
3.	JKJEH - 6012	4.38	3.15	4.33	535
4.	JB - 262	3.98	4.03	4.06	490
5.	Pusa Upkar	5.86	3.71	3.91	458
6.	Aussay	5.36	5.87	4.58	521
7.	Utkal Keshari	4.69	3.24	4.97	658
8.	Utkal Jyoti	5.15	4.18	5.06	452
9.	JBH - 3	6.02	6.87	5.65	412
10.	VR - 2	5.49	4.41	5.37	524
	S. E±	0.07	0.11	0.35	0.08
	C.D. at 5%	0.23	0.33	1.67	0.24

Jassids, *Amrasca biguttula biguttula*

The data presented in Table 3 indicated that varieties, JKJEH-6012, Utkal Keshri and Pusa Upkar was found lower jassids infestation during almost all meteorological weeks. The population started increasing from the day of transplanting and showed maximum population during month of November. *A. biguttula biguttula* population ranged from 0.25 to 10.12 jassids / 3 leaves / plant. Mean observation of all the weeks showed that variety JKJEH- 6012 (3.15), Utkal keshri (3.24) and Pusa Upkar (3.71) recorded significantly lower infestation over rest of cultivars. Whereas, variety JBH-3 appeared highly susceptible cultivar to jassids as compared to the other varieties in the season.

These present findings are in corroboration with the results of Qudsia Yousefi *et al.* (2013) [12] who reported that the seasonal mean number of jassid, *A. biguttula biguttula* (Ishida) per leaf on different varieties of brinjal was in the order; Black Beauty (14.7±0.4) > Dilnasheen (3.8±0.17) > Hybrid Shilpa = Round Black (3.3±0.2) > Bemisal (3.0±0.16) > Hybrid 888 (2.7±0.13) > Black Pearl (2.5±0.19) > Hybrid 3715 (2.4±0.19) > Nirala (2.3±0.13). It was also revealed that jassid per leaf on all the varieties started to build from 49 days after transplanting (DAP) and reached a peak on 63 DAP. Thereafter it was decreased up 84 DAP. Shaikh and Patel (2013) reported that the genotype AB-09-1 (2.29/leaf) and JBGR 1 (2.46/leaf) was at par with each other by recording minimum jassids than Genotype AB 09-14 recorded significantly higher jassids (3.95/leaf). Deole (2008) [4] indicated that the mean jassid population among the cultivars of brinjal varied significantly and ranged between 6.37 to 12.62 jassids/plant in variety IBR-174 and IBR-7, respectively. Reddy and Srinivasa (2001) [13] recorded the incidence of jassid and whitefly on brinjal at 15 days intervals between 30 and 90 days after planting. Jassid were abundant on Green long, Arka Neelkant and Arka Sheel during *kharif* and low on MHB 10, Pusa Puple round, Pusa Purple long and Arka Shirish.

Infestation of shoot and fruit borer, *Leucinodes orbonalis*

The data are presented in Table 4 revealed that the per cent fruit infestation caused by *L. orbonalis* was in between 0.42 to 5.51 per cent during the crop season. Varieties BH-2 and Pusa Upkar recorded significantly lower infestation during almost all MW followed by VR-2 and JBH-3. Variety appeared to be

highly susceptible cultivar to brinjal shoot and fruit borer at all the meteorological weeks. However, population of shoot and fruit borer started increasing from 34th week and showed higher infestation in 41st to 47th MW. The mean of per cent fruit infestation was recorded that variety BH-2 had significantly lower (3.81%) and which was statistically at par all the cultivars except JBH-3 which was recorded maximum fruit infestation (5.65%).

The similar results are reported by Dadmal *et al.* (2004) [3] who reported that BH-2 variety was more resistant which is followed by Pusa Upkar, SBJH- 691 and VR-2. Simialry Bhandurje (2012) [2] also observed lower average of shoot and fruit borer in BH-2 cultivar as compared to JKJEH-691. Thapa *et al.* (2009) [17] recorded the severity of infestation of brinjal shoot and fruit borer *Leucinodes orbonalis* Guen. was not significantly different among ten tested genotypes in terms of fruit weight and number. Pal Rishi *et al.* (2018) [10] revealed that the infestation of shoot and fruit borer, *L. orbonalis* appeared in 43rd week (18-24 October) and it was varied between 0 to 20% shoot infestation and 14.18 to 53.19% fruit infestation. Elanchezhyan *et al.* (2008) [5] revealed that the hybrid, Sweta was the best in reducing the shoot and fruit borer damage by *L. orbonalis* Guen. recording the mean shoot and fruit damage of 8.0 and 8.7 per cent (number basis). Yadav *et al.* (2003) [18] screened 10 cultivars of brinjal for their resistance against the shoot and fruit borer in Rajasthan and observed that all of the cultivars were susceptible to the pests.

C) Fruit yield

The data in respect to mean fruit yield are presented in Table 5. The significantly maximum mean yield of brinjal fruits (658 q/ha) was obtained from Utkal keshri variety Next best variety was BH-2 (598 q/ha). The significantly mean low fruit yield was harvested from JBH -3 (412 q/ha) followed by Utkal Jyoti, (452 q/ha), Pusa Upkar (458 q/ha) and JB- 262 (490 q/ha). The yields of different varieties of brinjal are depend up on the various biotic as well as abiotic factos. However, Shaikh and Patel (2013) [15] reported that genotype AB-09-01 yielded significantly higher fruits (296.64 q/ha) than PLR-1, GOB-1, AB-07-2, AB-07-8, AB-08-5 and AB-09-14. Whereas, genotype AB-09-14 registered significantly lower fruit yield (131.00 q/ha) and was at par with AB- 08-5, AB-07-8, AB-07-2, GOB-1 and PLR-1.

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