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Screening of brinjal varieties against, *Leucinodes orbonalis* (Guenee) infestation

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Abstract

Eight varieties of brinjal were screened under field conditions against the shoot and fruit borer in Udaipur, Rajasthan. The comparative fruit infestation by shoot and fruit borer in brinjal varieties show that the infestation of shoot and fruit borer initiated first on fruits in the fourth week of September and reached to its peak in the fourth week of October and third week of October respectively, during 2014-15 and 2015-16. At peak infestation, maximum infestation was recorded in variety BR-112 (43.91& 45.33%) on number and weight (38.39& 39.25%) basis during both the years; whereas, minimum fruit infestation was recorded in variety Pant Samrat (20.95 & 22.54%) on number and weight (19.84& 21.28%) basis during both the years.

Keywords: screening, brinjal, varieties, *Leucinodes orbonalis*, infestation

1. Introduction

Brinjal (*Solanum melongena* L.) or eggplant belongs to family Solanaceae and is a species of night shade which in British English is commonly known as aubergine. It is also known as brinjal, melongene, garden egg, or guinea squash^[13]. Brinjal is one of the widely used vegetable crops and is popular in many countries viz. Central, South and South East Asia, some parts of Africa and Central America^[1]. The brinjal is attacked by 53 species of insect pests^[6].

Among these the shoot and fruit borer, *Leucinodes orbonalis* Guenee is a key pest of brinjal and it inflicts substantial damage to the crop at all growth stages. The intensity of infestation was found to be over 90 percent^[3] and the resulting yield loss has been estimated up to 95 percent^[5] in brinjal. The pest infestation also reduces the content of vitamin C in fruit up to 80 percent^[8]. *L. orbonalis* distributed all through the vegetable growing regions of India and fruit damage due to the pest was reported to be up to 16 percent in Rajasthan^[4]. The cryptic habitat of the *L. orbonalis* and their ability to infest the crop from seedling stage to maturity make the pest management very difficult, resulting in preventive or excessive use of pesticides which in turn increases the cost of cultivation tremendously. Never the less, pesticides are still widely used to control the pest, though the indiscriminate application has posed problems of high residues in fruits; destruction of natural enemies and development of resistance to multiple classes of insecticide^[7]. In view of this requirement, the present study was undertaken to find out the resistant/tolerant brinjal varieties/lines against brinjal shoot and fruit borer. Cultivars having inherent resistance to *L. orbonalis* has the potential to improve the marketable yield and enhance economic returns of the farmers.

2. Material and methods

The present investigation entitled "Screening of brinjal varieties against, *Leucinodes orbonalis* (Guenee) infestation" was conducted at the Horticulture Farm, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan during *Kharif* 2014-15 and 2015-16.

2.1 Raising of Seedlings

The seeds of different brinjal varieties were sown in well prepared nursery bed during third week of June, 2014-15 and 2015-16 in the shed net house. The seedlings were raised by following recommended horticultural operations. The seedlings were finally ready for transplanting in the experimental field after they attained a height of about 15 cm with 3-4 leaves.

2.2 Screening of brinjal varieties

The seedlings of different brinjal varieties were transplanted in the second week of July, 2014-15 and 2015-16. The commonly grown eight varieties of brinjal viz: Kavach, Pant rituraj, MHB-80, Pant samrat, Manjarigota, BR-112, Pant brinjal-5 and Pusa purple long were screened against brinjal shoot and fruit borer under natural conditions in randomized block design with three replication. The uniform sized plots each measuring 3.0×4.5 m with row to row and plant to plant spacing of 60×50 cm, respectively. All recommended horticultural practices were followed as per the package of practices except insecticidal sprays.

2.3 Observations

The observation was recorded at weekly interval on five randomly selected and tagged plants in each plot. The total number of fruits and number of fruits infested per plant by shoot and fruit borer, *L. orbonalis* was count separately before harvest in terms of mean infestation. After harvesting, the weight of brinjal fruits was recorded by using electronic balance to determine yielding ability of varieties.

2.4 Statistical analysis

The weight of both healthy and infested fruits was taken separately and level of infestation in percentage was worked out and the data thus collected were transformed to angular values.

$$\text{Fruit infestation on number basis (\%)} = \frac{\text{Number of infested fruits}}{\text{Total number of fruits}} \times 100$$

$$\text{Fruit infestation on weight basis (\%)} = \frac{\text{Weight of infested fruits}}{\text{Total weight of fruits}} \times 100$$

3 Result and Discussion

Screening of brinjal varieties against the shoot and fruit borer, *L. orbonalis* on the basis of mean fruit damage was studied. The data presented in Tables - 1 & 2 indicates that none of the varieties was completely free from the fruit borer damage. The infestation of shoot and fruit borer initiated first on fruits in the fourth week of September reached to maximum in the fourth week of October. During initiation of damage on fruits of different varieties it ranged from 6.39 to 10.87 percent on number basis and 5.84 to 9.45 percent on weight basis. The minimum fruit damage on both number and weight basis was recorded in variety Pant Samrat (6.39% & 5.84%) followed by Pant Rituraj (6.53% & 5.86%) Manjarigota (7.14% & 6.31%); whereas, maximum (10.87% & 9.45%) fruit damage was recorded in variety BR-112 followed by MHB-80 (9.32% & 8.04%) and Kavach (8.85% & 7.51%) respectively. During peak period (fourth week of October) of fruit damage, the infestation on fruit in different varieties ranged from 20.95 to 43.91 percent on number basis and 19.84 to 38.22 percent on weight basis. The minimum fruit damage was recorded in variety Pant Samrat (20.95% & 19.84%) which was statistically at par with Pant Rituraj (22.26 % & 20.98%) followed by Manjarigota (24.60% & 22.79%). The maximum fruit damage was recorded in BR-112 (43.91% & 38.39%) which is at par with MHB-80 (42.96% & 38.00 %) on number and weight basis, respectively during 2014-15.

The data presented in Tables-3 & 4 showed that the infestation of shoot and fruit borer, *L. orbonalis* occurred first

on fruits in the fourth week of September that reached to maximum in the third week of October. During occurrence of infestation on fruits on different brinjal varieties it ranged from 7.72 to 11.79 percent on number basis and 7.02 to 10.05 percent on weight basis. The minimum fruit damage on both number and weight basis was recorded in variety Pant Samrat (7.72 % & 7.02%) followed by Pant Rituraj (8.27% & 7.42%) Manjarigota (8.84% & 7.87%); whereas, maximum (11.79% & 10.05%) fruit damage in variety BR-112 which is at par with MHB-80 (11.40% & 9.84%) followed by Kavach (10.87% & 9.34%) respectively. During peak period (third week of October) of fruit infestation, the damage on fruits in different varieties ranged from 22.54 to 45.33 percent on number basis and 21.28 to 39.25 percent on weight basis. The minimum fruit damage was recorded in variety Pant Samrat (22.54% & 21.28%) which was statistically at par with Pant Rituraj (24.55% & 22.98%) followed by Manjarigota (26.18% & 24.38%); whereas maximum fruit damage was recorded in BR-112 (45.33% & 39.25%) followed by MHB-80 (44.00% & 38.94 %) on number and weight basis, respectively during 2015-16. The order of preference of brinjal varieties for shoot and fruit borer in a descending order were BR-112 > MHB-80 > Kavach > Pant Brinjal-5 > Pusa Purple Long > Manjarigota > Pant Rituraj > Pant Samrat during 2014-15.

The present investigation is in partial agreement with that of Sharma *et al.*,^[9] reported that percent fruit damage among different varieties ranged from 4.6 to 12.9 percent on number basis and 3.7 to 10.8 percent on weight basis. Variety Deshi was found less susceptible followed by Pusa kranti, Pant rituraj, NDB-4 and Pant Samrat; whereas, variety Pusa bindu was highly susceptible followed by Jawahar-64, Jumbo Hy, NSC Hy, Pusa shyamla and NBH- 249. Similarly, Srivastava and Lal^[11] screened different brinjal varieties and reported that brinjal varieties SM-17, Pusa Purple Cluster, Pant Samrat and SM-202 x PPL were moderately resistant on number and weight basis. Similarly, Kumar *et al.*^[2] evaluated forty brinjal accessions for resistance to fruit and shoot borer, *L. orbonalis* and reported that Pusa Purple Cluster and BB-13 were resistant to brinjal shoot and fruit borer. Pant Samrat, KT-4, BB-26, PB-29, PB34, BB-46, KS- 339, Composite-2, NDBH-7, NDB-25, Pusa Hybrid-5, PB-38, PB-39, PB-41, PB-42, PB-44 and ARBH-527 were found tolerant against shoot and fruit borer. Likewise, Singh *et al.*^[10] screened thirty brinjal varieties and reported that maximum infestation on fruits was recorded in Swarna Mani and BR-112. Yadav *et al.*^[14] screened ten aubergine cultivars for their resistance against the shoot and fruit borer *L. orbonalis*. They observed that all of the cultivars screened were susceptible to the pest. Further, they found that Pusa Purple Cluster, Pusa Kranti, Pusa Purple Long, Neelum Long, Black Beauty and BR-112 were least susceptible; Pusa Purple Round was susceptible; and the local variety, Krishna and Kanahya were highly susceptible. Likewise, Thapa *et al.*^[12] screened ten popular genotypes of brinjal were evaluated against brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guen.). They reported that severity of infestation was not significantly different among the tested genotypes in terms of fruit weight and number; However, highest level of infestation was recorded in Ft Long and FI Round hybrids, followed by Pusa Kranti, BR-112, Lal Guatab, Green Long, PS-1, Pusa Purple Long, Nurki, and Neelum Long.

Table 1: Comparative fruit infestation by shoot and fruit borer in brinjal varieties during *kharif* 2014-15

Varieties	Mean per cent fruit infestation at each picking (Number basis)												
	23.9.14	30.9.14	7.10.14	14.10.14	21.10.14	28.10.14	4.11.14	11.11.14	18.11.14	25.11.14	2.12.14	9.12.14	Mean
Kavach	17.27 (8.85)	21.21 (13.10)	26.14 (19.43)	26.86 (20.42)	32.43 (28.79)	37.71 (37.45)	35.25 (33.31)	30.73 (26.12)	24.22 (16.86)	20.17 (11.90)	18.90 (10.50)	15.52 (7.19)	26.20 (19.49)
Pant Rituraj	14.80 (6.53)	16.48 (8.10)	21.18 (13.06)	22.14 (14.21)	24.69 (17.49)	28.12 (22.26)	27.22 (20.95)	22.23 (14.41)	17.32 (8.89)	13.89 (5.78)	12.63 (4.95)	10.28 (3.20)	19.96 (11.65)
MHB-80	17.75 (9.32)	22.30 (14.45)	27.20 (20.91)	27.49 (21.32)	35.25 (33.32)	40.95 (42.96)	37.89 (37.73)	32.84 (29.42)	25.12 (18.06)	20.79 (12.64)	19.23 (10.86)	16.30 (8.01)	27.68 (21.58)
Pant Samrat	14.64 (6.39)	15.84 (7.52)	20.56 (12.33)	21.68 (13.68)	24.39 (17.07)	27.22 (20.95)	25.76 (18.90)	21.04 (12.89)	16.32 (7.90)	12.83 (4.95)	11.99 (4.41)	9.73 (2.86)	19.20 (10.82)
Manjarigota	15.50 (7.14)	17.71 (9.30)	22.31 (14.45)	23.02 (15.32)	25.55 (18.63)	29.73 (24.60)	28.36 (22.62)	25.07 (17.97)	19.48 (11.12)	16.45 (8.08)	14.36 (6.19)	11.63 (4.06)	21.38 (13.29)
BR-112	19.18 (10.87)	22.97 (15.26)	27.41 (21.23)	27.85 (21.85)	35.78 (34.19)	41.49 (43.91)	38.67 (39.05)	33.44 (30.41)	25.70 (18.84)	21.09 (12.99)	19.30 (10.95)	16.73 (8.33)	28.20 (22.32)
Pant Brinjal-5	16.68 (8.28)	20.32 (12.07)	24.46 (17.17)	25.51 (18.57)	30.48 (25.76)	35.02 (32.94)	32.55 (28.96)	28.75 (23.16)	23.47 (15.90)	19.03 (10.64)	17.78 (9.36)	14.36 (6.19)	24.66 (17.42)
Pusa Purple Long	16.13 (7.72)	19.90 (11.60)	24.03 (16.62)	24.44 (17.17)	28.47 (22.73)	32.83 (29.44)	30.73 (26.12)	27.17 (20.88)	21.82 (13.85)	17.89 (9.45)	16.58 (8.17)	13.15 (5.30)	23.38 (15.75)
S.Em.±	0.70	0.79	0.70	0.75	0.80	1.10	0.81	0.96	0.82	0.78	0.93	0.99	0.29
C.D (p=0.05)	2.11	2.41	2.14	2.27	2.41	3.33	2.47	2.93	2.48	2.37	2.81	3.00	0.87

Table 2: Comparative fruit infestation by shoot and fruit borer in brinjal varieties during *kharif* 2014-15

Varieties	Mean percent fruit infestation at each picking (Weight basis)												
	23.9.14	30.9.14	7.10.14	14.10.14	21.10.14	28.10.14	4.11.14	11.11.14	18.11.14	25.11.14	2.12.14	9.12.14	Mean
Kavach	15.88 (7.51)	19.73 (11.42)	24.39 (17.07)	25.20 (18.15)	30.44 (25.68)	35.20 (33.24)	33.30 (30.15)	29.13 (23.71)	22.80 (15.03)	19.03 (10.64)	17.59 (9.13)	14.37 (6.19)	24.60 (17.33)
Pant Rituraj	14.00 (5.86)	15.33 (7.14)	20.11 (11.82)	20.81 (12.62)	23.77 (16.26)	27.21 (20.98)	26.22 (19.55)	21.24 (13.19)	16.27 (7.87)	12.95 (5.03)	11.76 (4.31)	9.60 (2.79)	19.02 (10.62)
MHB-80	16.45 (8.04)	20.51 (12.31)	25.45 (18.48)	25.69 (18.79)	32.58 (29.00)	38.05 (38.00)	35.99 (34.55)	30.73 (26.12)	23.54 (15.98)	19.35 (11.02)	17.92 (9.47)	14.96 (6.78)	25.87 (19.05)
Pant Samrat	13.98 (5.84)	15.04 (6.79)	19.74 (11.40)	20.71 (12.53)	23.64 (16.09)	26.42 (19.84)	24.98 (17.86)	20.15 (11.88)	15.41 (7.06)	11.92 (4.29)	11.27 (3.91)	9.07 (2.49)	18.43 (10.00)
Manjarigota	14.54 (6.31)	16.56 (8.18)	21.16 (13.05)	21.82 (13.85)	24.52 (17.28)	28.51 (22.79)	27.23 (20.97)	23.98 (16.53)	18.45 (10.01)	15.56 (7.25)	13.32 (5.35)	10.86 (3.55)	20.35 (12.09)
BR-112	17.85 (9.45)	20.58 (12.37)	25.51 (18.59)	25.88 (19.08)	32.93 (29.56)	38.27 (38.39)	36.18 (34.86)	30.87 (26.36)	24.09 (16.71)	19.65 (11.34)	18.04 (9.61)	14.94 (6.67)	26.15 (19.42)
Pant Brinjal-5	15.55 (7.22)	19.26 (10.89)	23.02 (15.32)	24.05 (16.63)	28.98 (23.50)	33.14 (29.89)	30.99 (26.52)	27.33 (21.08)	22.23 (14.35)	17.94 (9.50)	16.83 (8.40)	13.36 (5.38)	23.36 (15.72)
Pusa Purple Long	15.08 (6.78)	18.88 (10.49)	22.79 (15.04)	22.94 (15.22)	27.28 (21.01)	31.28 (27.00)	29.09 (23.65)	25.82 (19.00)	20.75 (12.58)	16.90 (8.45)	15.61 (7.26)	12.36 (4.66)	22.19 (14.26)
S.Em.±	0.62	0.77	0.66	0.68	0.76	0.99	0.71	0.82	0.75	0.74	0.85	0.86	0.28
C.D (p=0.05)	1.89	2.34	2.01	2.06	2.30	3.02	2.16	2.48	2.26	2.26	2.57	2.61	0.85

Figures in parentheses are retransformed percent values

Table 3: Comparative fruit infestation by shoot and fruit borer in brinjal varieties during *kharif* 2015-16

Varieties	Mean percent fruit infestation at each picking (Number basis)												
	23.9.15	30.9.15	7.10.15	14.10.15	21.10.15	28.10.15	4.11.15	11.11.15	18.11.15	25.11.15	2.12.15	9.12.15	Mean
Kavach	19.18 (10.87)	22.21 (14.29)	25.66 (18.76)	32.66 (29.14)	38.52 (38.79)	34.36 (31.86)	34.97 (32.87)	33.50 (30.47)	26.12 (19.39)	21.94 (13.97)	18.78 (10.37)	15.14 (6.85)	27.60 (21.47)
Pant Rituraj	16.64 (8.27)	18.05 (9.62)	20.48 (12.36)	25.28 (18.25)	29.70 (24.55)	26.36 (19.79)	26.77 (20.35)	25.25 (18.21)	20.86 (12.81)	17.82 (9.41)	12.53 (4.85)	10.21 (3.15)	21.53 (13.47)
MHB-80	19.67 (11.40)	23.45 (15.88)	26.74 (20.26)	35.29 (33.38)	41.55 (44.00)	37.00 (36.22)	37.66 (37.35)	35.87 (34.34)	27.20 (20.91)	23.21 (15.60)	19.11 (10.72)	15.99 (7.75)	29.32 (23.99)
Pant Samrat	16.13 (7.72)	17.47 (9.06)	19.99 (11.69)	24.86 (17.68)	28.33 (22.54)	25.08 (18.02)	25.47 (18.50)	23.85 (16.43)	20.41 (12.17)	17.12 (8.73)	11.92 (4.36)	9.69 (2.83)	20.68 (12.48)
Manjarigota	17.29 (8.84)	18.74 (10.41)	22.15 (14.33)	26.12 (19.39)	30.77 (26.18)	27.85 (21.86)	28.33 (22.53)	26.74 (20.27)	22.55 (14.81)	18.54 (10.19)	14.26 (6.12)	11.47 (3.95)	22.71 (14.90)
BR-112	20.08 (11.79)	24.34 (16.99)	27.22 (20.93)	36.51 (35.40)	42.32 (45.33)	37.86 (37.66)	38.57 (38.88)	37.02 (36.28)	27.70 (21.61)	24.09 (16.67)	19.47 (11.12)	16.43 (8.03)	30.04 (25.06)
Pant Brinjal-5	18.64 (10.28)	21.44 (13.37)	24.25 (16.88)	31.07 (26.63)	35.90 (34.39)	31.63 (27.51)	32.16 (28.34)	30.73 (26.12)	24.69 (17.49)	21.18 (13.06)	17.67 (9.27)	14.02 (5.89)	25.92 (19.10)
Pusa Purple Long	17.87 (9.48)	20.08 (11.79)	23.62 (16.11)	29.22 (23.85)	33.97 (31.24)	29.97 (24.97)	30.25 (25.43)	28.75 (23.16)	24.25 (16.93)	19.49 (11.13)	16.47 (8.08)	12.13 (4.41)	24.51 (17.21)
S.Em.±	0.93	0.81	0.93	0.65	0.81	0.89	0.93	0.80	0.98	0.87	0.99	0.80	0.29
C.D.(p=0.05)	2.73	2.47	2.82	1.97	2.47	2.70	2.84	2.43	2.98	2.63	2.99	2.42	0.89

Figures in parentheses are retransformed percent values

Table 4: Comparative fruit infestation by shoot and fruit borer in brinjal varieties during *kharif* 2015-16

Varieties	Mean percent fruit infestation at each picking (Weight basis)												
	23.9.15	30.9.15	7.10.15	14.10.15	21.10.15	28.10.15	4.11.15	11.11.15	18.11.15	25.11.15	2.12.15	9.12.15	Mean
Kavach	17.74 (9.34)	20.88 (12.70)	24.02 (16.58)	30.79 (26.23)	36.29 (35.04)	32.38 (28.69)	32.78 (29.34)	31.67 (27.57)	24.32 (16.97)	20.62 (12.41)	17.46 (9.01)	13.96 (5.85)	25.94 (19.14)
Pant Rituraj	15.75 (7.42)	17.06 (8.63)	19.53 (11.28)	24.41 (17.09)	28.63 (22.98)	25.38 (18.43)	25.78 (18.96)	24.24 (16.86)	19.99 (11.77)	16.85 (8.44)	11.68 (4.23)	9.54 (2.75)	20.61 (12.40)
MHB-80	18.24 (9.84)	21.74 (13.77)	24.87 (17.70)	32.66 (29.12)	38.60 (38.94)	35.07 (33.02)	35.56 (33.83)	34.12 (31.48)	25.35 (18.35)	21.59 (13.61)	17.79 (9.34)	14.69 (6.56)	27.48 (21.30)
Pant Samrat	15.37 (7.02)	16.62 (8.21)	19.15 (10.76)	24.08 (16.66)	27.45 (21.28)	24.26 (16.93)	24.66 (17.41)	23.11 (15.47)	19.54 (11.19)	16.29 (7.91)	11.30 (3.93)	9.03 (2.46)	19.91 (11.60)
Manjarigota	16.29 (7.87)	17.56 (9.18)	21.14 (13.11)	25.13 (18.05)	29.59 (24.38)	26.66 (20.15)	27.31 (21.06)	25.64 (18.74)	21.43 (13.43)	17.44 (9.05)	13.23 (5.29)	10.70 (3.45)	21.68 (13.65)
BR-112	18.47 (10.05)	22.59 (14.76)	25.20 (18.14)	33.60 (30.63)	38.79 (39.25)	35.40 (33.55)	35.91 (34.41)	34.70 (32.42)	25.65 (18.75)	22.39 (14.51)	18.00 (9.56)	14.87 (6.60)	27.89 (21.88)
Pant Brinjal-5	17.48 (9.08)	20.22 (11.96)	22.82 (15.06)	29.57 (24.36)	33.87 (31.08)	30.02 (25.04)	30.58 (25.89)	29.04 (23.57)	23.18 (15.54)	19.98 (11.68)	16.74 (8.31)	13.02 (5.10)	24.52 (17.22)
Pusa Purple Long	16.79 (8.37)	18.91 (10.51)	22.52 (14.71)	27.79 (21.76)	32.15 (28.34)	28.40 (22.64)	28.59 (22.94)	27.30 (21.04)	22.82 (15.07)	18.29 (9.86)	15.53 (7.19)	11.02 (3.66)	23.19 (15.51)
S.Em.±	0.78	0.72	0.88	0.61	0.72	0.78	0.80	0.69	0.87	0.80	0.89	0.64	0.29
C.D.(p=0.05)	2.29	2.17	2.68	1.85	2.19	2.37	2.44	2.10	2.63	2.44	2.71	1.95	0.87

Figures in parentheses are retransformed percent values

4 Conclusion

Eight varieties of brinjal were screened against *L. orbonalis* and none of the varieties were found completely free from the infestation of shoot and fruit borer. On the basis of mean fruit infestation, the order of susceptibility of brinjal varieties was recorded as Pant Samrat < Pant Rituraj < Manjarigota < Pusa Purple Long < Pant Brinjal-5 < Kavach < MHB-80 < BR-112 during 2014-15 and 2015-16, respectively.

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