

Original Research Article

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Screening of Shoot and Fruit Borer (*Leucinodes orbonalis* Guenee.), for Resistance in Brinjal (*Solanum melongena* L.) Germplasm Lines

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ABSTRACT

Keywords

Brinjal, Screening, Germplasm lines, Shoot and Fruit borer, Resistance

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Response of different brinjal genotypes against brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee.) was evaluated at horticulture research field of Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G) during *khariif*, 2015-2016. 106 brinjal germplasm lines were evaluated for resistance to shoot and fruit borer. Minimum mean infestation in fruits was found in genotype IGB-92 (20.83%) while maximum mean infestation in fruits was recorded in IGB-89 (79.30%). Among 106 germplasm lines of brinjal, two of them IGB-92 and IGB-93 were found moderately tolerant, 24 were found susceptible, rest 80 germplasm lines were highly susceptible and none of the brinjal were found resistance to shoot and fruit borer.

Introduction

Eggplant (*Solanum melongena*) is one of the most important vegetables in South and South-East Asia. It is grown on over 678,000 ha, which is about 37% of the world eggplant area, with a production of 10.50 million ton (FAO, 2007). It is cultivated all-year round in different parts of India and serves as the main source of income for many rural farmers and households. Production is however constrained by a wide range of pests and diseases, reducing total production as well as production quality.

A great diversity of species of insects from different Orders and Families have been

recorded on the brinjal of which very few are of economic importance.

The brinjal fruit and shoot borer (BFSB) *Leucinodes orbonalis* (Lepidoptera: Pyralidae) is one of the most important destructive insect pest of this vegetable crop.

Leucinodes orbonalis Guenee was described by Guenee in 1854. The preferred scientific name of the eggplant fruit and shoot borer is *Leucinodes orbonalis* Guenee, 1854.

The taxonomic position according to CABI (2007) is given as:

Phylum: Arthropoda
Class: Insecta
Order: Lepidoptera
Family: Crambidae (Syn: Pyralidae)
Genus: *Leucinodes*
Species: *orbonalis*
Scientific name: *Leucinodes orbonalis*
Guenee

Host range of *L. orbonalis* Guenee is practically monophagous, feeding principally on eggplant; however, other plants belonging to family Solanaceae are reported to be hosts of this pest. It is the most important and the first ranked pest of India, Pakistan, Srilanka, Nepal, Bangladesh, Thailand, Philippines, Cambodia, Laos and Vietnam (AVRDC, 1994). Its distribution is mostly higher in those areas having hot and humid climate (Srinivasan, 2009).

It could cause yield reduction as high as 70% (Islam and Karim, 1991; Dhandapani *et al.*, 2003). 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). Like other members of the order Lepidoptera, *L. orbonalis* goes through four growth stages: egg, larva, pupa and adult. The larval period is the longest, followed by pupal and incubation period. Oviposition takes place during the night and eggs are laid singly on the lower surface of the young leaves, green stems, flower buds, or calyces of the fruits and number of eggs laid by a female varies from 80 to 253 (Taley *et al.*, 1984; Alpuerto, 1994). The eggs are laid in the early hours of the morning singly or in the batches on the ventral surface of the leaves (CABI, 2007). Eggs are flattened, elliptical with 0.5 mm in diameter and colour is creamy-white but

change to red before hatching (Alam *et al.*, 2006). The egg takes incubation period of 3-5 days in summer and 7-8 days in winter and hatch into dark white larvae. The larval period lasts 12 - 15 days during summer and 14 - 22 days during winter season (Rahman, 2006). Larvae pass through at least five instars (Atwal, 1976) and there are reports of the existence of six larval instars (Baang and Corey, 1991; FAO, 2003).

At vegetative phase, the newly hatched larvae borer into petioles, 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 colour excreta can easily be seen to the hole of infested fruits. Larvae of this insect bore inside plant shoots and fruits, adversely affecting plant growth, yield and fruit quality, and thus making it unfit for human consumption.

Hence, to produce damage-free marketable fruits and to avoid production loss, the farmers in the region rely exclusively on the application of chemical insecticides to combat EFSB which has resulted in a tremendous misuse of pesticides. Indiscriminate use of insecticides to the control of the EFSB and other vegetables, result in soil, water and environmental pollution as well as bioaccumulation and bio-magnification of toxic residues and causes disturbance in ecological balance. So there is a need for an expedient to seek for safe and eco-friendly pest control measures. The most important and effective way to manage an insect pest is the use of resistant cultivars and it can be easily adopted with reduced cost of production. The use of

resistant varieties is regarded as the farmer's first line of defense against pests and one of the safest and most compatible approach with other control strategies (Lit, 2009). Therefore the application of Integrated pest management (IPM) is desirable and sustainable in managing these pests because it combines biological, cultural, physical, and chemical tools in a way that minimizes economic, health and environmental risks (Rechcigl and Rechcigl, 2000). Hence the study was conducted in field condition, with the objective to determine the response of brinjal germplasm lines against shoot and fruit borer.

Materials and Methods

An experiment was conducted at horticulture research field of Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G) during *khariif*, 2015-2016. 106 brinjal germplasm lines were screened against brinjal shoot and fruit borer. Each genotype was sown in a five row of 2.5 meters length, spacing 60 cm row to row with 50 cm from plant to plant. For raising a healthy crop, except plant protection measures all the recommended package of practices notified by the Indira Gandhi Krishi Vishwavidyalaya was followed. Five plants were tagged at random and observed for the

incidence of shoot and fruit borer in each brinjal genotype at seven days interval from transplanting to harvest.

From randomly selected five plants, in each genotype, infested and healthy fruits were counted and weighed in all pickings and thereafter fruit-infestation per cent was calculated.

On the basis of mean fruit infestation percentage all genotypes were categorized in different categories grade formula given by subbaratnam and bhutani (1981). Grade- 1, tolerant (1 to 15 % fruit infestation), grade- 2, moderately tolerant (16 to 25 % fruit infestation) grade-3, susceptible (26 to 40 % fruit infestation) and grade- 4 highly susceptible (above 40%).

Result and Discussion

Infestation percent of shoot and fruit borer was recorded in brinjal germplasm, ranged from 20.83 to 79.30. Minimum mean infestation in fruits was found in genotype IGB-92 (20.83%) while maximum mean infestation in fruits was recorded in IGB-89 (79.30%). Mean percent infestation of shoot and fruit borer in fruits has been presented in Table 2.

Table.1 shows the per cent level of infestation by shoot and fruit borer in brinjal germplasm, categorization formula given by subbaratnam and bhutani (1981).

Level of infestation (%)	Categories	Grade
1-15	Tolerant	T
16-25	Moderately tolerant	MT
26-40	Susceptible	S
Above 40	Highly susceptible	HS

Table.2 shows the mean per cent infestation of fruit in different brinjal germplasm

Genotype	%infestation	genotype	%infestation	genotype	%infestation	genotype	%infestation
IGB-1	59.38	IGB-30	65.08	IGB-59	58.89	IGB-88	71.05
IGB-2	51.13	IGB-31	33.65	IGB-60	50.76	IGB-89	79.30
IGB-3	61.01	IGB-32	45.71	IGB-61	35.94	IGB-90	40.76
IGB-4	61.46	IGB-33	52.54	IGB-62	43.32	IGB-91	28.20
IGB-5	62.36	IGB-34	32.74	IGB-63	57.44	IGB-92	20.83
IGB-6	58.72	IGB-35	36.68	IGB-64	45.03	IGB-93	22.21
IGB-7	54.55	IGB-36	48.53	IGB-65	39.71	IGB-94	31.35
IGB-8	59.64	IGB-37	68.59	IGB-66	39.99	IGB-95	43.16
IGB-9	56.42	IGB-38	60.55	IGB-67	62.08	IGB-96	45.53
IGB-10	60.05	IGB-39	54.59	IGB-68	74.36	IGB-97	69.07
IGB-11	55.08	IGB-40	60.32	IGB-69	48.68	IGB-98	60.77
IGB-12	59.77	IGB-41	51.58	IGB-70	35.30	IGB-99	27.60
IGB-13	61.80	IGB-42	45.88	IGB-71	29.25	IGB-100	50.71
IGB-14	68.47	IGB-43	44.46	IGB-72	38.63	IGB-101	54.30
IGB-15	67.34	IGB-44	44.13	IGB-73	38.57	IGB-102	46.99
IGB-16	52.65	IGB-45	58.35	IGB-74	47.46	IGB-103	43.44
IGB-17	52.57	IGB-46	29.64	IGB-75	40.41	IGB-104	27.18
IGB-18	35.95	IGB-47	70.67	IGB-76	43.51	IGB-105	46.24
IGB-19	67.18	IGB-48	61.82	IGB-77	50.49	IGB-106	34.33
IGB-20	57.92	IGB-49	47.61	IGB-78	42.14		
IGB-21	59.68	IGB-50	59.27	IGB-79	66.31		
IGB-22	64.12	IGB-51	61.86	IGB-80	58.87		
IGB-23	30.03	IGB-52	48.30	IGB-81	62.02		
IGB-24	39.77	IGB-53	37.46	IGB-82	49.46		
IGB-25	34.69	IGB-54	50.01	IGB-83	73.51		
IGB-26	51.56	IGB-55	55.99	IGB-84	61.46		
IGB-27	36.63	IGB-56	67.84	IGB-85	57.08		
IGB-28	39.32	IGB-57	64.53	IGB-86	58.68		
IGB-29	73.67	IGB-58	59.85	IGB-87	56.99		



Shoot and fruit borer (*Leucinodes orbonalis*)



Adult shoot and fruit borer



Infested Shoot



Infested Fruit

Fig : : Shoot and Fruit infestation by *leucinodes orbonalis*

Among 106 brinjal germplasm none of the germplasm was tolerant to *Leucinodes orbonalis*. Sridhar *et al.* (2001) reported fifty-four brinjal (aubergine) germplasm, including 5 wild species and some F1 crosses and Mandal *et al.* (2005) reported thirty-one brinjal (aubergine) cultivar, that none of the cultivated/wild species of brinjal was found resistant to *L. orbonalis*. Another screening program involved only 20 accessions, and none of them exhibited significant levels of resistance (Hossain *et al.*, 2002).

Two germplasm IGB-92 and IGB-93 were moderately tolerant with 20.83 and 22.21 per cent fruit infestation whereas they showed 2.73 and 2.88 per cent shoot infestation. Tolerant entries of brinjal are highly useful in IPM to augment the natural enemies rather than resistant and fairly resistant entries. The tolerance nature of above entries of brinjal might be attributed by 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).

Next 24 germplasm were susceptible with the fruit infestation per cent range from 27.18 (IGB- 104) to 40.76 (IGB-90), whereas they showed 2.26 and 2.67 per cent shoot infestation. Similarly, Ashoke and Abhishek (2002) while evaluating 12 aubergine cultivars in field conditions reported 33.65- 53.02% fruit infestation of *L. orbonalis* larvae. Comparable range of fruit infestation was 20.23 to 45.61% reported by Jat *et al.*, (2003).

And rest of the 80 germplasm lines was highly susceptible to *Leucinodes orbonalis* (shoot and fruit borer) with the fruit infestation per cent range from 41.99 (IGB-66) to 79.30 (IGB-89), recording 2.18 and 2.84 per cent shoot infestation.

Khan and Singh (2014) reported, 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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