Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(5): 759-761

Received: 12-07-2020
Accepted: 10-08-2020

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Evaluate the performance of promising germplasm/varieties of okra against shoot and fruit borer

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Abstract
An experiment was conducted during *kharif* season of 2018 and 2019 to know the infestation of okra shoot and fruit borer, *Earias vittella* (Fab.). Thirty germplasm/varieties were taken to know their response against shoot and fruit borer. On the basis of shoot damage scale, none of the germplasm/varieties was found immune or resistant. Five germplasm were moderately resistant while twenty-one and four germplasm fell under moderately susceptible and susceptible categories respectively in 2018. During 2019 and pooled data follow same pattern of 2018, On the basis of fruit damage scale germplasms/varieties were evaluated on the basis of fruit damage none of them came under immune or resistant categories. One, twenty-one and eight germplasm found moderately resistant, moderately susceptible and susceptible respectively during 2018. While during 2019 none of them came under immune or resistant categories One, nineteen and ten germplasm found moderately resistant, moderately susceptible and susceptible respectively and in pooled data was followed same pattern of 2019.

Keywords: Germplasm, screening, scale, okra shoot and borer

Introduction
Vegetables constitute as one of the important components of our food calendar, supplying carbohydrates, vitamins and minerals needed for a healthy balanced diet. Among the vegetables grown in India, Okra *Abelmoschus esculentus* L. (Moench) (Family: Malvaceae). It is mostly grown for its immature green and non-fibrous edible seed pod fruits in tropical crop. This crop is suitable for cultivation as a kitchen garden crop as well as on large high-tech commercial farms. It is an economically significant crop cultivated in India and is used all over the world as vegetable [1]. It is commercially cultivated in many parts of the world and almost at all the states in our country in both *kharif* as well as summer season [10]. It is a vital sector of national economics as source of employment, local income and foreign exchange earning. Besides being a vegetable, it acts as clarifying agent in jaggery preparation [3]. Crude fibre derived from the stem of okra plant is used for rope making. Okra is said to be very useful against genitourinary disorders, and chronic dysentery. The demand of this vegetable has led to develop number of elite varieties by premier research institutions. Okra is native to north eastern Africa in the general area of Ethiopia and Sudan. Existence of a large number of related species with wide variability and dominant characters suggest possible role of India as a secondary centre of origin. Now, its cultivation is widespread in tropical, subtropical and warm temperate regions, but is particularly popular in West Africa, India, the Philippines, Thailand and Brazil [4, 6]. The major constraint for the low productivity of okra is its more vulnerable to attack of pests. Which becomes unfit for consumption and as a result the reduction in the production is about 35-76 per cent. Among all pests, shoot and fruit borer, *Earias vitella* (Fabricius) is the most destructive pest of okra as young larva bores the growing shoot of okra plant prior to fruit formation resulting in withering and drying of shoot. On availability of fruit, larva starts feeding to the okra fruit and thus causes direct loss of yield. The major notorious pest of okra fruit borer, *Earias vittella* (Fab.), having endemic nature, inflect direct losses in yield of marketable fruits. According to an estimate this pest can cause a 76% loss in fruit yield of okra [3]. On availability of fruit, larva starts feeding to the okra fruit and thus causes direct loss of yield. The larva bores into shoot or fruit and start eating on internal contents causing withering of plant and reduction in marketable value of the fruit [9].

Therefore, the present investigation was conducted to know the performance of okra germplasm/varieties screened against shoot and fruit borer.

Materials and Methods

The experiment was laid out in Randomized Block Design with three replications and 30 genotypes of okra (Table 2) obtained from Indian Institute of Vegetable Research, Varanasi and Department of Vegetable Science ANDUA&T Kumarganj. Each genotype was assigned a row of 3m length. A distance of 45 cm between plants and 60 cm between rows was maintained. Five plants of each germplasm/varieties from each replication were selected randomly for recording the observations. The observations were recorded at weekly interval by counting the total number of healthy and infested shoot and fruit of five selected plant of okra. The resistance/susceptibility of individual germplasm was judged on the basis of shoot and fruit borer per cent/plant. On the basis of number of shoot and fruit borer/plant. On the basis of per cent incidence the genotypes were categorized under different groups based on the scale given by Gupta and Yadav [7] (Table 1).

Table 1: Resistance/ Susceptibility rating scale on the basis of per cent damage of *Earias vittella*.

S. No.	Categories	Grade	Per cent of damage
1.	Immune	1	No damage
2.	Resistant	2	< 5.0 per cent damage
3.	Moderately resistant	3	> 5.0 per cent damage
4.	Moderately susceptible	4	> 15.0 per cent damage
5.	Susceptible	5	> 30.0 per cent damage

Results and Discussion

Out of 30 germplasm of okra evaluated against *E. vittella*, none was found immune free from damage of *E. vittella*. However, damage level varied from 9.00 to 33.07 per cent in case of shoot damage and 12.52 to 36.55 per cent in case of Fruit damage. Lowest shoot damage was found in HRB-55 (9.00%) followed by EMS-8-1 (13.65%) whereas Pusa sawani, showed maximum shoot damage of 33.07% followed by Parbhani Kranti (32.74%) and GS-43 (31.57%).

Based on shoot damage

The germplasm HRB-55, EMS-8-1, NDO-28, Bo-13 and SB-11 scored 9.00, 13.65, 14.55, 14.62 and 14.77 per cent shoot damage, respectively and found moderately resistant, while NDO-29, NDO-15, Go-3, SB-6, NDO-22, NDO-16, NDO-11, NDO-19, NOH-100, NDO-13, Larm-1, NOH-15, NDO-27, NDO-24, VRO-3, Arka Anamika, BO-13, Arka Abhay, VRO-4, NDO-10 and DOV-91-4 had 15.54, 16.59, 16.87, 17.80, 18.25, 18.48, 19.50, 19.84, 20.22, 20.28, 21.53, 21.69, 21.75, 21.88, 21.92, 22.76, 23.23, 24.26, 24.50, 25.14 and 28.95 recorded per cent shoot damage, respectively and fell under the moderately susceptible category and VRO-5, GS-43, Parbhani Kranti and Pusa Sawani recorded 30.55, 31.57, 32.74 and 33.07 per cent shoot damage, respectively and were under susceptible category. Mandel *et al.* [9] and Bhat *et al.*, [2] also reported Pusa Sawani as susceptible to *Earias spp.* more or less conforms the present findings. This result is in conformation with the finding of Kumar and Tyde [9] reported VRO-4 moderately susceptible. Whereas, VRO-5 and Parbhani Kranti as susceptible. Shukla, *et al.*, [11] tested seven Varieties of okra and among them AROH-2 and Komal Hy. showed lowest shoot damage (4 and 5% respectively). Varieties Ankur 35 and Parbhani Kranti registered significantly higher shoot damage (7.5 and 8%). Thus, present study more or less conforms the present finding.

Based on fruit damage

Minimum fruit damage was found in SB-11 (12.52%) whereas maximum damage was found in Pusa Sawani (36.55%) followed by VRO-5 (34.40%) and GS-43 (34.27%). In case of fruit damage the germplasm SB-11 with scored 12.52% damage and fell under moderately resistance category, while germplasm EMS-8-1, BO-13, NDO-28, Go-3, NDO-15, NDO-29, NDO-16, SB-6, NDO-22, NDO-11, NDO-19, HRB-55, NOH-100, NDO-13, NOH-15, NDO-27, Larm-1, NDO-24 and BO-13 with scored 17.80, 18.86, 19.53, 20.60, 20.74, 20.85, 22.21, 22.43, 22.51, 23.43, 23.65, 23.74, 24.06, 24.34, 24.83, 25.44, 25.50, 25.99 and 27.50 per cent damage, respectively were moderately susceptible. The remaining germplasm viz., NDO-10, VRO-4, Parbhani Kranti, VRO-3, Arka Anamika, Arka Abhay, DOV-91-4, GS-43, VRO-5 and Pusa Sawani with scored 30.03, 30.65, 30.83, 31.97, 32.25, 33.21, 33.22, 34.27, 34.40 and 36.55 per cent damage, respectively were under the susceptible category. Bhat *et al.*, [2] also reported Pusa Sawani as susceptible to *Earias spp.* more or less conforms the present findings.
Gautam *et al.*, [5] screened 100 okra germplasm/Varieties among them HRB-55, SB-11 and EMS-8-1 as moderately resistant and Arka anamika, Arka Abhay, VRO-3, BO-13, Larm-1, DOV-91-4 and NOH-100 as moderately susceptible.

Table 2: Screening of okra germplasm against okra shoot and fruit borer.

S. No	Germplasm	Shoot Damage (%)	Fruit Damage (%)
1	Arka Anamika	22.76	32.25
2	Arka Abhay	24.26	33.21
3	Pusa Sawani	33.07	36.55
4	Parbhani kranti	32.74	30.83
5	VRO-3	21.92	31.97
6	VRO-4	24.50	30.65
7	VRO-5	30.55	34.40
8	Go-3	16.87	20.60
9	SB-6	17.80	22.43
10	BO-13	14.62	18.86
11	Larm-1	21.53	25.50
12	SB-11	14.77	12.52
13	EMS-8-1	13.65	17.80
14	BO-13	23.23	27.50
15	DOV-91-4	28.95	33.22
16	NOH-15	21.69	24.83
17	NOH-100	20.22	24.06
18	GS-43	31.57	34.27
19	HRB-55	9.00	23.74
20	NDO-10	25.14	30.03
21	NDO-11	19.50	23.43
22	NDO-13	20.28	24.34
23	NDO-15	16.59	20.74
24	NDO-16	18.48	22.21
25	NDO-19	19.84	23.65
26	NDO-22	18.25	22.51
27	NDO-24	21.88	25.99
28	NDO-27	21.75	25.44
29	NDO-28	14.55	19.53
30	NDO-29	15.54	20.85

Conclusion

The okra germplasms/varieties were screened against shoot and fruit borer infestation during *kharif* season of the year 2018 and 2019. On the basis of shoot damage scale, none of the germplasm was found immune or resistant. Five germplasm were moderately resistant while twenty-one and four germplasm fell under moderately susceptible and susceptible categories respectively. On the basis of fruit damage scale germplasms/varieties were evaluated on the basis of fruit damage none of them came under immune or resistant categories One, nineteen and ten germplasm/varieties found moderately resistant, moderately susceptible and susceptible respectively, (Table-2).

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