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Screening of different varieties/genotypes of okra against shoot and fruit borer, *Earias vittella* (Fab.)

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Abstract
An experiment was conducted in the field, Department of Entomology, College of Agriculture, RVSKVV, Gwalior (M.P.) in *Kharif*- 2018 and 2019. The twenty eight varieties/ genotypes *viz*., Arka Anamika, Hari Kranti, VRO-22, EC-305609, EC 305718, EC 305731, EC-305769, EC-306697, EC-306700, EC-306703, EC-359637, EC-359957, EC-359969, EC-359995, EC-359898, EC-036001, IC-001543, IC-003769, IC-004328, IC-007952, IC-008991, IC-010265, IC-013917, IC-014026, IC014600, IC-015540 and IC-433641 were taken for screened on shoot and fruit borer infestation. There was none of the varieties/genotypes present in shoot and fruit borer resistant. The minimum shoot damage was recorded on variety Arka Anamika (1.90%) followed by VRO-22 (2.21), whereas the maximum shoot damage was recorded on genotypes IC-007952 (4.05%). The percent fruit damage revealed that the fruit damage ranged from 8.13 to 12.47 percent on different varieties/genotypes. The variety Arka Anamika was recorded lowest damage (8.13%) to fruits as compared to rest of the other varieties/genotypes in both the years.

Keywords: Shoot and fruit borer, *Earias vittella* (Fab.), screening, okra

Introduction
Okra, [*Abelmoschus esculentus* (L.) Moench] is a common vegetable in India. Okra locally known as ‘Bhindi’ also known as ‘Lady’s Finger’ is a popular and most common annual vegetable crop in tropical and subtropical parts of the world (Sree *et al*., 2019).

It has good nutritional value 100 g of edible fruit contains 2 g protein, 0.19 g fat, 7.45 g carbohydrate, 1.48 g of sugars, 0.7 g, 3.2 g fiber, minerals like K (299 mg), Ca (82 mg), Mg (57 mg), Fe (0.62 mg), Zn (0.58 mg) and Vitamins like A, B1, B2, C, E and K (Patel *et al*., 2018).

Okra crop is cultivated for its young tender fruits, used in curry and soups after cooking. Fruits are also dried or frozen for use during off-season. The root and stem are used for clearing cane juice in preparation of jiggery/ gur. Seeds are a source of oil, protein and are also used as a coffee substitute, while ground up okra seeds has been used as a substitute for aluminum salts in water purification.

India is second largest producer of vegetable after China in the world. Okra is widely cultivated in plains of the India area of 5.06 lakh ha with production of 60.73 lakh MT and productivity 12.00 tonnes ha^{-1}. In Madhya Pradesh okra is grown in 0.4012 lakh ha area with production 5.3673 lakh MT and 13.02 tonnes ha^{-1} productivity (Anonymous, 2018-19) [1].

The pest problem is the main limiting factor in production of okra. As high as, 72 species of insects have been recorded on okra which, the sucking pest *viz*., aphids (*Aphis gossypii* Glover); leaf hopper (*Amrasca biguttula biguttula* Ishida); whitefly (*Bemisia tabaci* Gennadius); shoot and fruit borer (*Earias vittella* Fab.) and mite (*Tetranychus cinnabarinus* Boisduval) causes significant damage to the crop. Okra fruit and shoot borer, *Earias vittella* (Fab.) is a widely distributed insect pest. When the crop is young, larvae bore into tender shoots and tunnel downwards which wither, drop down and growing points are killed. In fruits, the larvae bore inside these and feed on inner tissues which become deformed in shape with no market value. The infested fruits become unfit for human consumption, thus resulting in 35 to 76% decrease in yield and caused severe damage to the crop leading to yield losses to an extent of 35-90% (Koulagi *et al*., 2009) [6].

In order to prevent the infestation of the pests and to produce a quality crop, it is essential to manage the pest population with suitable measures. The resistant varieties of crops offer insect pest management at no additional cost. An insect resistant plant offer ideal prevention against insect damage, involved minimum cost of production and are eco-friendly.

The use of resistant varieties is one of the most economical and effective methods of control. So, looking to the economic importance of shoot and fruit borer, *Earias vittella* (Fab.) on okra crop, the present study was conducted to explore the reaction of different okra genotypes against shoot and fruit borer and it's incidence on different varieties to find out

Materials and Methods

The field experiment was conducted at Entomological Research Farm, Department of Entomology, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, College of Agriculture, Gwalior Madhya Pradesh in *Kharif*- 2018 and 2019. The experiment were conducted with twenty eight varieties/ genotypes in a Randomized Block Design and replicated thrice with plot size of 2.4 × 1.8 m^2 each were sown at 60×45 cm spacing. All the recommended package of practices was followed to raise the crop except plant protection measures.

Observations

The shoot damaged caused by shoot and fruit borer was recorded at weekly interval by counting the total number of shoots and damaged shoots each plot. At the time of fruiting, total number of fruits and damaged fruits were counted at each picking from the five plants selected randomly from each plot. The weight of healthy fruits and damaged fruits were also recorded at the time of each picking and the same was also expressed as percentage.

Results and Discussion

Screening of different okra varieties/genotypes against shoot and fruit borer

Results of the field experiment to screening of different varieties/ genotypes of okra against shoot and fruit borer showed in Table 1 are mentioned below

Mean per cent shoot damage in *Kharif*- 2018

On the basis of average of nine observations recorded on per cent shoot damage showed significant differences in different varieties/genotypes. Minimum and significantly less shoot damage (2.87%) was recorded on variety Arka Anamika than rest of the varieties/genotypes followed by VRO-22. Maximum and significantly higher than rest of the shoot damage (5.93%) was recorded on genotype IC-007952.

Mean per cent shoot damage in *Kharif*- 2019

On the basis of average of seven observations recorded on per cent shoot damage no significant differences in different varieties/genotypes. However, the per cent shoot damage ranged from 0.92% in Arka Anamika to 2.17% in (IC-007952).

Average (2018 and 2019)

Data recorded on percent shoot damage showed significant differences in different varieties/ genotypes. Minimum and significant less shoot damage (1.90%) was recorded on variety Arka Anamika than rest of the varieties/genotypes. Whereas, maximum and significantly higher than rest of the shoot damage (4.05%) was recorded on genotype IC-007952.Similar to the present finding Sharma and Jat (2009) [12] also reported that the minimum infestation on shoots okra was observed on Arka Anamika. Choudhary (2002) [2] pointed out that Arka Anamika was found less susceptible against shoot and fruit borer. Rahman *et al*. (2015) [11] evaluated seven okra varieties and out of which Arka Anamika was found least preferable variety with lowest shoot damage.

Mean per cent fruit damage in *Kharif*- 2018

On the basis of average of ten observations recorded on per cent fruit damage showed significant differences in different varieties/genotypes. Minimum and significant less fruit damage (9.82%) was recorded on variety Arka Anamika than rest of the varieties/genotypes. Whereas, maximum and significantly higher than rest of the shoot damage (15.37%) was recorded on genotype IC-001543.

Mean per cent fruit damage in *Kharif*- 2019

On the basis of average of nine observations recorded on per cent fruit damage showed significant differences in different varieties/genotypes. Minimum fruit damage (6.44%) was recorded on variety Arka Anamika followed by VRO-22, Hari Kranti, EC-359995, EC-305718, EC-359954, EC-305731 and EC-305609. Whereas, fruit damage (9.57%) was recorded on genotype IC-001543 than rest of the genotype followed by IC-01664, IC-010265, IC-004328, IC-433641, IC-015540, IC-008991, IC007952, IC-013917 and IC-014600.

Average (2018 and 2019)

Data revealed that the significant differences in percent fruit damage among different varieties/ genotypes Minimum and significant less fruit damage (8.13%) was recorded on variety Arka Anamika than rest of the varieties/genotypes. Whereas, maximum and significantly higher than rest of the shoot damage (12.47%) was recorded on genotype IC-001543. Similar to the present finding. Patni (2000) [10], Choudhary (2002) [2] and Naresh *et al.* (2003) [8] also pointed out that Arka Anamika was found less susceptible against shoot and fruit borer. Tripathy *et al*. (2008) [14] reported Arka Anamika as tolerant to shoot and fruit borer. Ghosh *et al.* (2010) [3] reported Arka Anamika as moderately susceptible against fruit borer. Whereas, Mandal *et al.* (2006) [7] reported Arka Anamika as moderately resistant against shoot and fruit borer. Rahman *et al*. (2015) [11] evaluated seven okra varieties out of which Arka Anamika was found least preferable variety with lowest shoot damage and fruit damage. Jalgaonkar *et al.* (2018) reported that eight varieties *viz*., Arka Anamika for their relative susceptibility to okra shoot and fruit borer, which corroborate the present finding.

Most of the researcher was found that the Arka Anamika is the more resistant against the fruit and shoot borer among different varieties/genotypes of Okra.

Table 1: Grading of different okra genotypes based on fruit infestation (Gupta and Yadav, 1978)

Sr. No.	Category	Grade	Level of fruit infestation
1	Resistant	R	1-5 percent
2	Moderately resistant	MR	6-15 percent
3	Moderately susceptible	MS	16-30 percent
4	Susceptible	S	31-50 percent

Table 1: Screening of different okra varieties/genotypes for resistance against shoot and fruit borer, *Earias vittella* (Fab.) in *Kharif*- 2018, 2019 and Pooled

S. No.	Varieties/ Genotypes	Mean per cent damage of shoots/plot			Grade	Mean per cent damage of fruits/plant			Grade
		2018	2019	Average		2018	2019	Average	
V1	Arka Anamika	2.87 (9.87)	0.92 (5.49)	1.90 (7.90)	R	9.82 (18.25)	6.44 (14.69)	8.13 (16.56)	MR
V2	Hari Kranti	3.43 (10.66)	1.28 (6.31)	2.36 (8.83)	R	11.23 (19.56)	6.81 (15.11)	9.02 (17.46)	MR
V3	VRO-22	3.32 (10.49)	1.10 (5.97)	2.21 (8.53)	R	10.95 (19.32)	6.65 (14.93)	8.80 (17.25)	MR
V4	EC 305609	3.71 (11.11)	1.41 (6.74)	2.56 (9.20)	R	11.61 (19.91)	7.26 (15.60)	9.44 (17.87)	MR
V5	EC 305718	3.83 (11.27)	1.50 (7.00)	2.67 (9.38)	R	11.46 (19.77)	7.21 (15.56)	9.34 (17.78)	MR
V6	EC 305731	3.91 (11.40)	1.39 (6.75)	2.65 (9.37)	R	12.09 (20.33)	7.55 (15.92)	9.82 (18.24)	MR
V7	EC 305769	3.91 (11.39)	1.40 (6.72)	2.66 (9.36)	R	11.59 (19.89)	7.34 (15.69)	9.47 (17.90)	MR
V8	EC 306697	4.03 (11.56)	1.38 (6.72)	2.71 (9.45)	R	12.40 (20.60)	7.94 (16.33)	10.17 (18.57)	MR
V9	EC 306700	3.83 (11.28)	1.56 (7.11)	2.70 (9.44)	R	11.69 (19.89)	7.31 (15.67)	9.50 (17.94)	MR
V10	EC 306703	3.95 (11.44)	1.53 (7.03)	2.74 (9.50)	R	11.98 (20.22)	7.53 (15.91)	9.76 (18.18)	MR
V11	EC 359637	5.12 (13.07)	1.83 (7.66)	3.48 (10.72)	R	12.34 (20.54)	7.82 (16.22)	10.08 (18.44)	MR
V12	EC 359954	3.94 (11.42)	1.41 (6.53)	2.68 (9.35)	R	11.87 (20.14)	7.36 (15.73)	9.62 (18.06)	MR
V13	EC 359969	3.76 (11.16)	1.57 (7.07)	2.67 (9.35)	R	12.67 (20.83)	7.90 (16.82)	10.29 (18.68)	MR
V14	EC 359995	4.03 (11.56)	1.64 (7.31)	2.84 (9.67)	R	10.90 (19.26)	6.83 (15.14)	8.87 (17.31)	MR
V15	EC 359898	3.22 (10.37)	1.25 (6.36)	2.24 (8.59)	R	12.49 (20.67)	7.81 (16.21)	10.15 (18.56)	MR
V16	EC 036001	3.87 (11.32)	1.60 (7.23)	2.74 (9.51)	R	12.14 (20.38)	7.78 (16.17)	9.96 (18.38)	MR
V17	IC 001543	4.45 (12.17)	1.76 (7.61)	3.11 (10.14)	R	15.37 (23.07)	9.57 (18.00)	12.47 (20.66)	MR
V18	IC 003769	4.60 (12.36)	1.77 (7.32)	3.19 (10.22)	R	12.62 (20.79)	8.27 (16.70)	10.45 (18.84)	MR
V19	IC 004328	4.76 (12.54)	1.77 (7.64)	3.27 (10.40)	R	13.42 (21.48)	8.73 (17.16)	11.08 (19.42)	MR
V20	IC 007952	5.93 (14.08)	2.17 (8.45)	4.05 (11.60)	R	13.32 (21.39)	8.62 (17.04)	10.97 (19.32)	MR
V21	IC 008991	4.70 (12.50)	1.97 (8.00)	3.34 (10.49)	R	13.53 (21.56)	8.64 (17.08)	11.09 (19.44)	MR
V22	IC 010265	4.82 (12.67)	1.94 (7.96)	3.38 (10.57)	R	13.84 (21.83)	8.86 (17.30)	11.35 (19.68)	MR
V23	IC 013664	4.67 (12.47)	1.92 (7.94)	3.30 (10.44)	R	14.14 (22.07)	9.04 (17.48)	11.59 (18.89)	MR
V24	IC 013917	4.72 (12.54)	1.86 (7.79)	3.29 (10.44)	R	13.72 (21.72)	8.62 (17.06)	11.17 (19.91)	MR
V25	IC 014026	4.76 (12.57)	1.83 (7.77)	3.30 (10.44)	R	13.56 (21.60)	8.51 (16.96)	11.04 (19.40)	MR
V26	IC 014600	4.99 (12.90)	1.90 (7.89)	3.45 (10.69)	R	13.94 (21.91)	9.04 (17.45)	11.49 (19.79)	MR
V27	IC 015540	4.99 (12.90)	2.14 (8.28)	3.57 (10.85)	R	13.40 (21.45)	8.68 (17.10)	11.04 (19.38)	MR
V28	IC 433641	5.17 (13.14)	2.14 (8.38)	3.66 (11.02)	R	14.11 (22.05)	9.07 (17.50)	11.59 (19.88)	MR
S.Em±		0.14	0.65	0.03		0.20	0.41	0.02	
CD at 5%		(0.42)	NS	(0.09)		(0.59)	(1.20)	(0.06)	

Figure in the parentheses are angular transformed value, NS= Non-significant

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