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Screening of Different Okra Genotypes Against Fruit Borer (*Earias* spp.) (Lepidoptera: Noctuidae) on Okra Crop

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Abstract.- The present study was carried out at experimental area of Vegetable Research Institute, (AARI) Faisalabad to test the resistant/susceptibility responses of 25 genotypes of okra against fruit borer under field condition during 2013. From the preliminary screening trial, nine genotypes of okra including three comparatively resistant (Sabz pari, Green wonder and Super star), three genotypes with intermediate response (Lakshami-24, Cok-1418 and Ikra anamika) and three comparatively susceptible genotypes (Pusa sawani, Ikra-2 and Okra-3) were selected for final screening trial during 2014. During preliminary and final screening trials genotype Pusa sawani proved susceptible genotype, while Sabz pari was found comparatively resistant genotype. Maximum Host Plant Susceptibility Indices (HPSI) was observed in Pusa sawani *i.e.* 16% and was found susceptible, while minimum HPSI *i.e.*, 6% was recorded in Sabz pari and found to be comparatively resistant genotype.

Keywords: Okra fruit borer, screening, okra genotype, susceptibility/resistance.

INTRODUCTION

Okra, *Abelmoschus esculentus* (L.) Moench, locally known as Bhindi, is one of the most important vegetable crops in Pakistan. Okra is being grown widely throughout the country (Javed *et al.*, 2009; Ahmad *et al.*, 2012). It is mainly grown for its tender fruits in many countries of the world. In Pakistan, it is valued as a source of good income for the growers. Total area under okra cultivation in Pakistan is estimated to be 13.9 thousand hectares yielding about 102.6 thousand tons of green pods (Khokhar, 2014).

Okra is a rich source of valuable nutrients, like protein, carbohydrate, fat, ash, vitamins (A, B, and vitamin C) and minerals especially iodine (Draper, 2009). It also have soluble and insoluble fibers, which helps to lower serum cholesterol, risk of heart diseases, keeps the intestinal tract healthy and decreases the chances of colorectal cancer (Broek *et al.*, 2007). Like other Malvaceae, okra is also susceptible to a variety of pests, which reduce its yield. The main cause of low yield of okra in Pakistan is phytophagous insect pests, diseases and mites (Ahmad *et al.*, 2012) but the spotted bollworms (*i.e.*, *Earias vittella* and *Earias insulana*) are the most serious insect pests of okra (Aziz *et al.*, 2011). It attacks rigorously on okra both at the vegetative and fruiting stage which not only affects its quality but also greatly reduce its yield (Suman *et al.*, 1984). This pest attacking on okra and cotton, two species, *Earias vittella* and *E. inisulana* are worldwide distributed especially in North Africa, Indo-Pak and other countries of the world (Arain, 1974). The spotted bollworms remain active throughout the year in different parts of the country due to conductive environment. They cause 8.4 to 73.20% fruit infestation (Kumar and Urs, 1988) and 32.06 to 40.84% yield losses (Singh and Brar, 1994).

Chemical insecticides are extensively being used in Pakistan for the management of spotted bollworms resulting in many direct and indirect side effects (Aziz *et. al*., 2012). Therefore, there is a dire need to explore alternate technologies/approaches to control this insect pest. Host plant resistance (HPR) and varietal control are the cost-effective and safe approaches which are integral part of integrated pest management (IPM), as they have compatibility with other control methods. Keeping in view of current problem of fruit borer and economic importance of

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okra crop, the present study was planned. Aim of the study was to investigate the varietal resistance of various genotypes of okra against fruit borer for the benefit of farmers, consumers and healthy environment.

MATERIALS AND METHODS

Screening of okra genotypes

Present experiments were conducted during 2013 and 2014 at the experimental area of Vegetable Research Institute, Faisalabad to screen out okra genotypes on the basis of percentage fruit infestation per plant. Experiments were laid out in randomized complete block design, with three replications. The plot size was kept at 8.5 m x 8.5 m (row-to-row distance 0.60 m and plant-to-plant 0.30 m).

Preliminary screening

Preliminary screening of okra genotypes was carried out during 2013. Twenty five genotypes of okra (*i.e.*, Pusa sawani, Okra-3, Ikra-2, Zeenat, PMS-55, Pusa green, Makhamali, Arka anika, Super green, Green gold, Neelam green, Pb. Selection, Lakshami-24, Cok-1418, Ikra anamika, Salini, Sonhal, OH-152, Karam-5, Punjab selection, Sanam, Deralocal, Green wonder, Super star, Sabz pari) were sown in RCBD, with three replications. No plant protection measures were adopted and the material was screened under natural condition. All the recommended agronomic practices were applied during the study. Okra genotypes were classified into four categories based on % infestation: 0-5.5, immune; 5.6-11, resistant; 11.1-16.5, intermediately resistant; 16.6-22, Susceptible.

Final screening

During 2014, nine genotypes of okra (three with high, three with intermediate and three with low infestation rate) were selected from preliminary trials based on percent fruit infestations and sown in the same experimental area for final screening. The final screening was done to confirm the results of preliminary screening. Experiments were laid out in RCBD, with three replications. Same procedure was adopted as mentioned above.

Data collection

Percentage fruit Infestation: To calculate the percentage fruit infestation, damaged and un-damaged fruits were recorded from randomly selected five plants per plot of each treatment. Data were collected at 7 days interval for 8 weeks. Percent fruit infestation was calculated by the following formula:

$$\text{Fruit Infestation Percentage (FIP)} = \frac{A}{B} \times 100$$

Where A is total number of fruits and B is damaged fruits

Host plant susceptibility indices (HPSI)

The HPSI, based on fruit infestation caused by fruit borer, on different selected genotypes of okra were calculated using the following formula:

$$\text{HPSI \%} = 100 - \frac{B - A}{B} \times 100$$

Where A is fruit infestation in individual genotypes, and B is fruit infestation in all genotypes of 'okra' on average basis.

Statistical analysis

After calculation fruits infestation data were analyzed by using analysis of variance techniques (Steel and Torrie, 1997) and means were compared by applying Tukey's HSD test at 5% significance level.

RESULTS

Fruit infestation by fruit borer

Table I shows infestation of different genotypes of Okra by fruit borers. The genotype Pusa sawani showed maximum mean fruit infestation, *i.e.*, 20.97%, followed by Okra-3, Ikra-2 and Zeenat with 20.33, 19.42 and 18.36%, respectively. The minimum mean fruit infestation was recorded in genotype Sabz pari *i.e.*, 8.40%, which was statistically different with other genotypes. The Mean percent fruit infestation in Super star and Green wonder was 9.36 and 10.24, respectively. The genotypes: Arka anika, Super

green, Green gold and Neelam green showed 16.54, 16.33, 16.10 and 15.63% mean fruit infestation respectively, and did not differ significantly with each other.

Table I.- Fruit infestation (%) caused by fruit borer on different genotypes of okra during 2013 and 2014.

Genotypes	Fruit borer Infestation %	
	2013	2014
Pusa sawani	20.97±1.16 ^{a} *	22.73 (±1.36) a
Okra-3	20.33±1.20 ^{ab} *	21.02 (±1.53) a
Ikra-2	19.42±0.88 ^{abc} *	20.42 (±0.95) a
Zeenat	18.36±0.95 ^{abcd}	
PMS-55	18.23±0.65 ^{bcd}	
Pusa green	17.73±1.03 ^{bcde}	
Makhamali	17.46±0.94 ^{cdef}	
Arka anika	16.54±0.78 ^{defg}	
Super green	16.33 ±0.62 ^{defgh}	
Green gold	16.10±0.74 ^{defgh}	
Neelam green	15.63±0.81 ^{defghi}	
Pb. selection	15.24±0.66 ^{efghij}	
Lakshami-24	14.72±1.03 ^{fghijk} **	16.33 (±0.86) b
Cok-1418	14.64±0.90 ^{ghijk} **	15.16 (±1.03) bc
Ikra anamika	14.32±0.54 ^{ghijk} **	14.92 (±0.98) bcd
Salini	13.70±0.77 ^{hijkl}	
Sonhal	13.64±0.68 ^{hijkl}	
OH-152	13.35±0.78 ^{ijkl}	
Karam-5	12.89±0.63 ^{jklm}	
Punjab selection	12.63±0.66 ^{jklm}	
Sanam	12.26±0.61 ^{klm}	
Deralocal	11.54±0.72 ^{lmn}	
Green wonder	10.24±0.51 ^{mno} ***	11.86 (±0.80) cde
Super star	9.36±0.86 ^{no} ***	11.24 (±0.56) de
Sabz pari	8.40±0.42 ^{o} ***	9.42 (±1.01) e
LSD value @ 5%	2.7304	3.6924

Means sharing similar letters in each column are not different significantly (Tukey's HSD, P<0.05), * Susceptible genotype; ****** Intermediate genotype; ******* Resistant genotype.

On the basis of mean percentage fruit infestation of *Earias* spp. all the genotypes were categorized in descending order are: Pusa sawani, Ikra-2, Okra-3, Zeenat, PMS-55, Pusa green, Makhamali, Arka anika, Super green, Green gold, Neelam green, Pb. selection, Lakshami-24, Cok-1418, Ikra anamika, Salini, Sonhal, OH-152, Karam-5, Punjab selection, Sanam, Deralocal, Green wonder, Super star and Sabz pari.

On the basis of preliminary screening trial three highly susceptible genotypes (Pusa sawani, Okra-3 and Ikra-2), three genotypes (Lakshami-24, Cok-1418 and Ikra anamika) with intermediate resistance and three genotypes (Green wonder, Super star and Sabz pari) with the lowest fruit infestation were selected for final screening trial during the year 2014. The result of fruit infestation (Table I) revealed that maximum mean percentage fruit infestation of *Earias* spp. was observed as 22.73% per plant on genotype Pusa sawani that was statistically at par with Ikra-2 and Okra-3 with 21.02 and 20.42% fruit infestation per plant. The minimum mean percentage fruit infestation of *Earias* spp. was recorded 9.42% in Sabz pari which was statistically different with all other genotypes, followed by Super star and Green wonder with 11.24 and 11.86 % fruit infestation, these were statistically different with all other genotypes of okra. The fruit infestation was recorded to be 16.33, 15.16 and 14.92% in okra genotype Lakshami-24, Ikra anamika and Cok-1418, respectively. From the above results it was concluded that Sabz pari was least preferred and found comparatively resistant genotype, whereas Ikra-2 was found comparatively susceptible genotype with highest fruit infestation caused by *Earias* spp., respectively.

Host plant susceptibility indices (HPSI)

The HPSI based on fruit infestation caused by *Earias* spp. on various genotypes of okra during 2013 and 2014 are presented in Table II.

The genotype Pusa sawani gave maximum HPSI followed by Ikra-2 and Okra-3. These three genotypes were found comparatively susceptible to fruit infestation caused by *Earias* spp. The genotypes Lakshami-24, and Ikra anamika both showed 11% HPSIs during 2014. The minimum HPSI was recorded for genotype Sabz pari, followed by Super star and Green wonder and were found comparatively resistant.

The results regarding HPSI based on mean percentage fruit infestation caused by *Earias* spp. in various genotypes of okra recorded during 2013 and 2014 showed that Pusa sawani gave maximum HPSI (16%) followed by Ikra-2 (15%) and Okra-3 (14%), respectively. The genotype sabz pari was found comparatively least preferred and minimum HPSI was observed *i.e.* 6% followed by Super star (7%) and Green wonder (8 %). The genotypes Lakshami-24, and Ikra anamika each showed 11% HPSI followed by Cok-1418 (10%), which were found intermediate.

Table II.- Plant susceptibility indices (%) based on mean percentage fruit infestation caused by fruit borer on different genotypes of Okra, during 2013 and 2014.

Genotypes	Host Plant susceptibility indices during		
	2013	2014	2013 and 2014
Pusa sawani	16%	16%	16%
Ikra-2	16%	15%	15%
Okra-3	15%	14%	14%
Lakshami-24	11%	11%	11%
Ikra anamika	11%	11%	11%
Cok-1418	11%	10%	10%
Green wonder	8%	8%	8%
Super star	7%	8%	7%
Sabz pari	6%	7%	6%

DISCUSSION

The results of present study revealed that Pusa sawani proved susceptible having maximum fruit infestation *i.e.,* 20.97% during preliminary screening trial and showed 22.73 percent fruit infestation during final screening. The genotype Okra-3 ranked next towards preference with 20.33 percent fruit infestation during preliminary screening. The same genotype also showed similar pattern during final screening trial with 21.02 percent fruit infestation. The present findings are in conformity with those of Akhter *et al.* (2014), who reported that Pusa sawani gave maximum fruit infestation after Parbhani kranti when compared with a set of twenty genotypes of okra. However, the results of current study are not comparable with those of Teli and Dalya (1981), Patil *et al.* (1986), Vyas and Patel (1991) and Memon *et al*. (2004) due to different genotypes of okra they studied under different ecological conditions against fruit borer. The findings of present study can be compared with Vyas and Patel (1990); who reported that maximum fruit infestation was recorded on okra genotype Pusa sawani which was most preferred by fruit borer.

The current findings are contradictory to the results of Madave and Dumbre (1985), reported that okra genotype Pusa sawani was least preferred and showed a tolerance response against fruit borer, because they used such okra genotypes which were more preferable than pusa sawani or other environmental factors, whereas in the current study, Pusa sawani was found to be most preferred and showed maximum fruit infestation of fruit borer, which also confirmed by Dhandapani (1986) and Mandal *et al*. (2006).

In the current study Punjab selection was found moderately resistant with 12.63% fruit infestation compared to most preferred Pusa sawani (20.97%) and these findings can be compared to those of Akhter *et al*. (2014) who reported that Punjab selection was found moderately resistant against fruit borer in a set of 20 different genotype of okra.

The findings of present study revealed that during final screening trial minimum fruit infestation was observed on Sabz pari (9.42%) and least preferred by fruit borer, which is confirmed by Aziz *et al*. (2012) and Mastoi *et al*. (2013); who reported that Sabz pari was found comparatively resistant and showed minimum fruit infestation caused by fruit borer.

The results of present study regarding host plant susceptibility index (HPSI) showed that Ikra-2 and Pusa sawani gave maximum HPSI whereas Sabz pari and Super star showed minimum HPSI during 2013 and 2014. The current findings are also confirmed by Aziz *et al*. (2012) who reported that Parbani kranti and Pusa sawani showed maximum HPSI and minimum in Diksha and Sabz pari regarding fruit infestation caused by fruit borer. An effective resistant variety can be considered those which maintain pest population below damage threshold (Aslam *et al*., 2004) and offer an economical preventive measure which compatible with other methods of pest control (Chauhadry and Arshad, 1989). Screening of varieties is a key tool in IPM to manage the insect pest population without causing damage to the predators and parasites and keep the environment pollution free.

CONCLUSION

It can be concluded that okra genotype Sabz pari is comparatively resistant while Pusa sawani is susceptible regarding infestation of okra fruit borer. Due to this reason Sabz pari will be selected for IPM regarding attack of fruit borer on okra plants.

REFERENCES

AHMAD, Z., SAIFULLAH, F., RAZIQ, H., KHAN AND IDREES, M., 2012. Chemical and biological control of spotted bollworm of okra. *Pak. J. Bot*., **44**: 453-457.

AKHTER, M., JABEEN, F., SULTANA, S., SULTANA, T., HUSSAIN, D. AND ALI, A., 2014. Selection of different okra genotypes against *Earias* spp. (Lepidoptera: Noctuidae). *J. Ent. Zool. Stud.*, **2**: 138-141.

ARAIN, N., 1974. *Studies on incidence and relative abundance of different species of boll worms at TandoJam.* MSc. thesis University of Sindh, Jamshoro, Pakistan, pp. 55.

ASLAM, M., RAZAQ, M., RANA, S. AND FAHEEM, M., 2004. Efficacy of different insecticides against sucking pests on cotton. *Pak. Entomol*., **25**:155-159.

AZIZ, M.A., HASAN, M. AND ALI, A., 2011. Impact of abiotic factors on incidence of fruit and shoot damage of spotted bollworms *Earias* spp. on okra (*Abelmoschus esculentus* L.). *Pakistan J. Zool.*, **43**: 863-868.

AZIZ, M.A., HASAN, M., ALI, A. AND IQBAL, A., 2012. Comparative efficacy of different strategies for management of spotted bollworms, *Earias* spp. on okra, *Abelmoschus esculentus* (L). Moench. *Pakistan J. Zool*., **44**: 1203-1208.

BROEK, R.V., IACOVINO, G.D., PARADELA, A.L. AND GALLI, M.A., 2007. Alternative control of *Erysiphe cichoearun* on okra crop. *Ecossistema*, **27**: 23-26.

CHAUDHRY, M.R. AND ARSHAD, M., 1989. Varietal resistance to cotton insects. *Pakistan Cotton*, **33**:44-55.

DHANDAPANI, N., 1986. Consumption digestion and utilisation of bhendi varieties by *Earias vittella* Fabricius. *Madras agric. J.*, **73**: 676-678.

DRAPER, H.H., 2009. Advances in Nutritional Research. *Afr. J. agric. Res*., **4:** 171-177.

JAVED, H., AZIZ, M.A. AND LEGHARI, R.A.K., 2009. Resistance in different okra cultivars against American bollworm (*Helicoverpa armigera* Hub.). *J. agric. Res*., **47**: 433-438.

KHOKHAR, M.K., 2014. Production status of major vegetables in Pakistan, their problems and suggestions. *Agric. Corner*, pp. 9. (www.agricorner.com).

KUMAR, K.K. AND URS, K.C.D., 1988. Population fluctuation of *Earias vittella* (Fab.) on okra in relation to abiotic factors. *Ind. J. Pl. Protec*., **16**: 137-142.

MADAVE, R.P. AND DUMBRE, R.B., 1985. Reaction of okra varieties to shoot and fruit borer. *J. Maharashtra Agric. Univ.*, **10**: 276-277.

MANDAL, S.K., ABDUSSATTAR, S. B. AND GUPTA, S.C., 2006. Prediction of okra shoot and fruit borer (*Earias vittella* Fab.) incidence using weather variables at Pusa, Bihar. *Int. J. agric. Sci*., **2**: 467-469.

MASTOI, A.H., MEMON, S.A. AND HAQ, W., 2013. Varietal resistance of okra against whitefly (*Bemisia tabaci*) and fruit borer (*Earias* spp). *Scholar J. agric. Sci.*, **3**: 78-82.

MEMON, A. J., ABRO, G.H. AND SYED, T.S., 2004. Varietal resistance of okra against *Earias* spp. *J. Ent.*, **1**:1-5.

PATIL, C.S., MOHOLKAR, P.R. AND AJRI, D.S., 1986. Studies on moth attraction and egg laying preference of shoot and fruit borer (*Earias vittella* Stoll.) on different varieties of 'okra', (*Abelmoschus esculentus* L.). *Curr. Res. Rep. Mahatma Phule agric. Uni*. **2(2)**: 289-291.

SINGH, G. AND BRAR, K.S., 1994. Effects of dates of sowing on the incidene of *Amrasca biguttula* (Ishida) and *Earias* spp. on okra. *Ind. J. Ecol.*, **21**: 140-144.

STEEL, R.G.D. AND TORRIE, J.H., 1997. *Principles and procedures of statistics with special reference to the biological sciences*. McGraw Hill Book Co. Inc., New York.

SUMAN, C.L., WAHI, S.D. AND JAGAN MOHAN, N., 1984. Distribution pattern of 'okra' shoot and fruit borer (*Earias vittella* Fab.) under natural conditions. *Indian J. Ent.*, **45**: 362-364.

TELI, V.S. AND DALYA, V.P., 1981. Studies on varietal resistance in 'okra' (*Abelmoschus esculentus* Linn.) Moench) to shoot and fruit borer, *Earias vittella* Fabricius. *South Ind. Hort*., **29**: 54-60.

VYAS, S.H. AND PATEL, J.R., 1990. Relative susceptibility of some lady finger cultivars to *Earias vittella* Fab. *Ind. J. Pl. Prtotect*., **18**: 115-118.

VYAS, S.H. AND PATEL, J.R., 1991. Intensity and damage of *Earias vittella* Fab. on various cultivars of Bhendi. *Guj. Agric. Univ. Res. J*., **17**: 140-141.

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