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Screening of Okra Cultivars for Resistance against *Helicoverpa armigera*

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ABSTRACT

Fruit borer, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae), is one of the most economically important and widespread pests of okra and causes worldwide yield losses. The pest is mainly controlled by chemicals which cause deleterious effects to human, livestock and environment. To dispense with the detrimental consequences of chemicals, use of resistant cultivars can prove one of the effective and reliable alternative approaches for the management of this pest. As the information regarding resistant cultivars is lacking, therefore, the objective of the present study was to identify resistant sources from among the available commercial okra cultivars. Okra cultivars showed significant variations from comparative susceptibility to comparative resistance. On the basis of fruit and shoot infestation caused by *H. armigera*, Manchali, RK-516, OH-152 and Tarnab Nargis were found comparatively susceptible, Rama Krishna, NS-810, Baharti Kaspori, Lady Finger-1 and Lady Finger-2 showed intermediate resistant reaction while KT-458, Bhindi Punjab Selection, Arka Anamika and Bhindi Sabazpari proved to be comparatively resistant. Maximum fruit and shoot infestations were recorded on comparatively susceptible cultivars while the infestations were the minimum on comparatively resistant cultivars. As comparatively resistant cultivars viz. KT-458, Bhindi Punjab Selection, Arka Anamika and Bhindi Sabazpari suffered less damage and therefore, are recommended for cultivation to avoid damage by *Helicoverpa armigera*.

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Authors' Contribution
AKK, HJ and TM designed the study, executed experimental work and analyzed the data. HJ supervised the work. TM helped in preparation of the manuscript.

Key words
American boll worm, Resistance, Susceptibility, Fruit infestation, Shoot infestation.

INTRODUCTION

Okra (*Abelmoschus esculentus*) is one of the important summer vegetables grown in many countries of the world (Khan *et al*., 2013). Being a rich source of many nutrients, it is used in curries and taken as stewed and soups. It contains 25 calories, 2 g dietary fiber, 1.5 g protein, 5.8 g carbohydrates, 460 IU vitamin A, 13 mg vitamin C, 36.5 µg folic acid, 50 mg calcium, 0.4 mg iron, 25 mg potassium and 46 mg magnesium per half cup of okra. In Pakistan, it is widely cultivated (Hussain *et al*., 2016; Javed *et al*., 2009) and its area is increasing every year. Pakistan contributes 2% share in the total production of the world. The area under cultivation in Pakistan is about 14.5 thousand hectares with an annual production of 109.3 thousand tons (Anonymous, 2006).

The successful production of okra is affected by many biotic factors including fungi (Iqbal and Mukhtar, 2014; Iqbal *et al*., 2014), viruses (Ashfaq *et al*., 2014a, b, 2015, 2017), nematodes (Kayani *et al*., 2017; Khan *et al*., 2017; Mukhtar *et al*., 2014, 2017a,b), bacteria (Shahbaz *et al*., 2015; Aslam *et al*., 2017a,b) and particularly the insect pests. The fruit borer, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae), is one of the most economically important and widespread pests of okra and causes worldwide infestation to okra and other crops and vegetables (Jallow *et al*., 2004; Reddy *et al*., 2004; Yu *et al*., 2008; Mironidis and Savopoulou-Soultani, 2008). The females have strong preference for oviposition on okra plants (Jallow *et al*., 2001). The larval stage directly causes damage to flowers, buds and fruits and incurs heavy yield losses in crops. Heavy yield losses have been reported by many researchers on different crops and vegetables by this pest (Shivaramu and Kulkarni, 2008; Deshmukh *et al*., 2010; Dinesh *et al*., 2017; Singh *et al*., 2017). Annual losses of about US$ 2 billion have been reported in semiarid tropics, even though US$ 500 million worth pesticides are applied to control the pest (Sharma and Ortiz, 2002).

The borer is mainly controlled by using synthetic pesticides in Pakistan. The use of pesticides is not often without associated harmful effects and the most commonly confronted are resurgence of secondary pests, pesticide pollution, elimination of beneficial insect fauna, pest resistance to specific insecticides and various human health problems. To eliminate these side

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effects, alternative approaches must be adopted to reduce dependency on chemical pesticides. One of the effective and reliable approaches for controlling the pest is the use of resistant cultivars. The resistant cultivars can minimize yield losses and can also be used as a constituent of integrated pest management programs along with other control strategies (Shahzaman *et al*., 2015; Rahoo *et al*., 2017). As the information regarding resistant cultivars is lacking, therefore, the objective of present research was to identify resistant sources among the available commercial okra cultivars.

Table I.- Reaction of okra cultivars to *Helicoverpa armigera* on the basis of fruit and shoot infestation.

Cultivar	Infestation		Reaction
	Shoot	Fruit	
Tarnab Nargis, RK-516, OH-152, Manchali	>14%	>10%	Comparatively susceptible
Lady Finger-1, NS-810, Baharti Kaspori, Lady Finger-2, Rama Krishna	<14%	<8%	Intermediate resistant
KT-458, Bindi Sabazpari, Arka Anamika, Bhindi Punjab Selection	<10%	<5%	Comparatively resistant

MATERIALS AND METHODS

The plant material tested for resistance to *H. armigera* consisted of thirteen cultivars collected from National Agricultural Research Centre, Islamabad and authorized seed dealers of Rawalpindi. These included Baharti Kaspori, Rama Krishna, Tarnab Nargis, Bhindi Sabazpari, KT-458, Lady Finger-1, Manchali, OH-152, NS-810, Arka Anamika, Bhindi Punjab Selection, Lady Finger-2 and RK-516. The experiment was conducted at the University Research Farm Koont of Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan located at 32°56'0" North and 72°52' 0" East. Randomized Complete Block Design was used to evaluate okra cultivars. Plot measuring 40′×10′ was used for each cultivar with three replications. The overnight-presoaked seeds were sown in each plot with plant to plant and row to row distances of 60 and 75 cm, respectively. Irrigation and all other agronomic practices were applied as per requirement.

Fruit and shoot infestations were recorded on ten randomly selected plants from each experimental unit. From each of the ten specified okra plants, healthy and damaged fruits and shoots were observed and shoot and fruit infestation were recorded as described by Javed *et al*. (2017) and Fateh *et al*. (2017). The cultivars were categorized as comparatively susceptible (shoot infestation >14% and fruit infestation >10%), intermediate resistant (shoot infestation <14% and fruit infestation <8%) and comparatively resistant (shoot infestation <10% and fruit infestation <5%). All the data regarding fruit and shoot infestation percentages were subjected to statistical analysis by Costat package and their means were compared using DMR Test at 5% level of probability (Steel and Torrie, 1997).

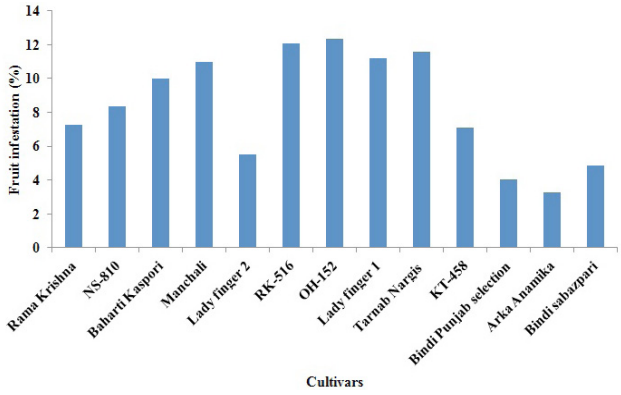

Fig. 1. Fruit infestation (%) of *Helicoverpa armigera* on okra cultivars.

RESULTS AND DISCUSSION

On the bases of fruit and shoot infestations caused by *H. armigera* larvae, Manchali, RK-516, OH-152 and Tarnab Nargis were found comparatively susceptible, Rama Krishna, NS-810, Baharti Kaspori, Lady Finger-1 and Lady Finger-2 showed intermediate resistant reaction while KT-458, Bhindi Punjab Selection, Arka Anamika and Bhindi Sabazpari appeared as comparatively resistant (Table I). Fruit and shoot infestations on each variety have been shown in Figures 1 and 2. It is clear from the Figures 1 and 2 that maximum fruit and shoot infestations were recorded on comparatively susceptible cultivars while the infestations were the minimum on comparatively resistant cultivars. Many researchers have evaluated different okra varieties under varying climatic conditions in different okra producing countries. In the present studies okra cultivars showed variable infestations of *H. armigera* on fruit and shoot. The minimum fruit infestation was observed on Arka Anamika (3.3%) fallowed by Bhindi Punjab Selection (4.1%) and Bhindi Sabazpari (4.8%). The findings are to some extent similar to those observed by Afzal *et al*. (2015), Aziz *et al*. (2012) and Mastoi *et al*. (2013) who have reported low fruit infestation on Sabzpari. The cultivar Rama Krishna with 5.5% fruit infestation showed intermediate resistance against *H. armigera*. The

findings are not similar to the results observed by Javed *et al*. (2009) on Rama Krishna with 9.4% fruit infestation. This variation in infestation might be due to differences in temperature, humidity and rainfall. Arka Anamika and Bhindi Punjab Selection were found comparatively resistant cultivars with 3.3 and 4.1% fruit infestations, respectively. The findings are in accordance with those of Akhter *et al*. (2014) who also found that Punjab Selection was moderately resistant against *H. armigera*.

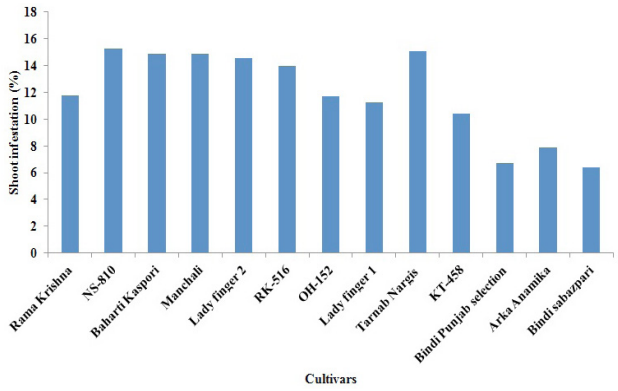

Fig. 2. Shoot infestation (%) of *Helicoverpa armigera* on okra cultivars.

Earlier many researchers have studied resistance in many okra cultivars and reported role of different physico-morphic characters in imparting resistance against the insect pests (Hussain *et al*., 2014, 2016). Similarly, density of hairs on crown leaves (Agarwal and Katiyar, 1974) and leaf hairiness (Sharma and Agarwal, 1983) had a significant effect on the selection of oviposition sites by *Earias vittella* (Fab.). Conversely, several workers have reported that okra cultivars showing greater fruit infestation had more hair density and soft skin (Teli and Dalaya, 1981). Chaudhuri *et al*. (1981) had also reported that fruit damage by *E. vittella* larvae was higher in open pollinated varieties than hybrids.

CONCLUSION

Okra cultivars showed significant variations in fruit and shoot infestations from comparative susceptibility to comparative resistance. Four cultivars *viz.* KT-458, Bhindi Punjab Selection, Arka Anamika and Bhindi Sabazpari appeared as comparatively resistant and suffered less damage and hence are recommended for cultivation to avoid damage by *Helicoverpa armigera*. The resistant cultivars can minimize yield losses and can also be used as a component in integrated pest management programs along with other control strategies.

Statement of conflict of interest

The authors declare that there is no conflict of interests regarding the publication of this article.

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