RESISTANCE IN DIFFERENT OKRA CULTIVARS (*ABELMOSCHUS ESCULENTUS* L.) AGAINST AMERICAN BOLLWORM (*HELICOVERPA ARMIGERA* HUB.)*

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ABSTRACT

Response of four okra varieties viz. Pusa Sawani, Rama Krishna, Akra Anamica and Local variety was studied against *Helicoverpa armigera* (Hub.) at PMAS Arid Agriculture University, Rawalpindi, Pakistan during 2005. The varieties exhibited varied responses to attack of *Helicoverpa armigera*. There were significant differences (P≤ 0.05) among percent damaged buds, flowers and fruits of test varieties. Rama Krishna proved comparatively to be more resistant showing less percent damage in buds (2.84), flowers (3.56) and fruits (19.33) coupled with lower trichome density on leaf lamina. Local variety was comparatively found as susceptible showing more percent damaged buds (3.89), flowers (5.00) and fruits (22.97) as well as higher trichome density on leaves. These studies showed that none of varieties under test was resistant to infestation of *H. armigera* (Hub.). Fruits were attacked more as compared to other parts of the plants, probably due to insect preference for food. The varieties having more trichome density on leaf lamina had greater attack of the pest.

KEYWORDS: ***Hibiscus esculentus;*** **cultivars;** ***Helicoverpa armigera;*** **pest resistance; Pakistan.**

INTRODUCTION

Vegetables are emerging as an important source of income for many small scale farmers in Pakistan. Okra (*Abelmoschus esculentus* L.) is one of the most important vegetables grown throughout tropics and sub-tropics. It occupies a vital place in daily food as a cheap source of nutrients like proteins, carbohydrates, vitamins, minerals and roughages. The roots and stems of okra plant are used for clearing cane juice from which gur or brown sugar is prepared (2). Its ripened seeds are roasted, grounded and used as a substitute for coffee in Turkey (8). Okra fruits are used as vegetables, soups

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and recipes. Matured fruits and stems containing crude fibre are used in paper industry (4).

A major constraint in vegetable production is poor and inadequate control of pests and diseases, which cause high yield losses (15). These can be as high as 25 percent, which result in severe income loss to small-scale farmers. Avoidable losses in okra due to pests have been placed at about 54 percent (1). Okra is one of those plants for which *H. armigera* female has a strong oviposition preference than other hosts (6). Morphological characteristics of plants (including trichome density) and chemicals being emitted from various plant tissues affect the preference for selection of oviposition site of pest (10, 16). *Helicoverpa armigera* (Hubner) is a pest of economic importance (3) attacking on many plant families (5). It bores clean circular holes in fruits and flower buds of okra fruits; rendering these distorted and unfit for human consumption.

Synthetic insecticides, no doubt, have provided a quick control of the insect pests but their continuous use has created many problems like environmental pollution, insecticide resistance, and emergence of secondary pests. Environment friendly methods for pest management are being sought throughout the world and varietal resistance has been identified as one of the most economical and environmentally safe method for pest control. Plant resistance to insects provides the indispensable foundation on which the IPM structure for different pests can be built. Insect resistant cultivars can be used as sole control method and also interact synergistically with biological, chemical and cultural control methods to reduce spread of pest insects (17). Moreover, host plant resistance is seen to be a sustainable approach to pests in order to determine resistance and susceptibility of the crop.

The present study was conducted to evaluate resistance of okra varieties against *Helicoverpa armigera* (Hub.) on the basis of pest infestation in the field.

MATERIALS AND METHODS

This study was conducted in the experimental field of PMAS Arid Agriculture University, Rawalpindi, Pakistan during 2005. Four Okra varieties viz. Pusa Sawani, Rama Krishna, Akra Anamica and Local variety were sown in RCBD with four replications. Plot size was kept as 4 x 4 meter. Seeds were sown on parallel ridges on the sides facing the sun. Plant to plant and row to row distance was kept as 30 cm and 60 cm, respectively. Uniform agronomic

practices were adopted in all plots. For recording the data ten plants were randomly selected and tagged to avoid repetition from each test plot and percent infestation of *Helicoverpa armigera* (Hub.) was determined from shoots, squares, buds, flowers and fruits of selected plants. Data were recorded on the basis of healthy and damaged plant parts. From each replicate of each variety three leaves from lower, middle and upper parts were taken randomly from sampled plants and brought in the laboratory. The hair density/cm^2 on leaf lamina was observed under stereoscopic microscope.

Data were analyzed by using analysis of variance technique and treatment mean values were compared by using Duncan's multiple range test (DMRT) at 5 percent probability (13).

RESULTS AND DISCUSSION

The analysis of variance of data on percentage shoot and square infestation (Table 1) revealed no significant difference among different cultivars of okra. However, Rama Krishna had the lowest shoot damage (5.14%) whereas Local cultivar had the highest shoot damage (6.00%). Similarly minimum square damage was observed in Pusa Sawani (5.00%) followed by Rama Krishna (5.39%). Analysis of variance of data regarding percent bud infestation showed significant differences among okra cultivars.

Table1. Means of pest infestation (%) on different parts of okra varieties caused by American bollworm (*Helicoverpa armigera* Hub.).

Varieties	Damaged shoots (%)	Damaged squares (%)	Damaged buds (%)	Damaged flowers (%)	Damaged fruits (%)
Pusa Sawani	5.61 a	5.00 b	2.87 b	4.32 b	21.24 b
Rama Krishna	5.14 a	5.39 ab	2.84 b	3.56 c	19.33 c
Akra Anamia	5.36 a	5.91 a	3.46 ab	4.00 bc	18.88 c
Local	6.00 a	6.09 a	3.89 a	5.00 a	22.97 a
Mean value	**5.53**	**5.60**	**3.27**	**4.22**	**20.73**
LSD (5%)	1.309	0.8703	0.7604	0.6730	1.317
Variety MS	0.543 ^{ns}	0.957 ^{ns}	0.991*	1.483*	15.202*
CV %	12.80	9.70	14.60	9.96	3.97

Means sharing similar letters in a column do not differ significantly (P = 0.05).
NS = Non significant, *Significant (P≤0.05)

Maximum bud infestation was noted in Local variety (3.89 %) which was statistically at par with Akra Anamica (3.46%). Rama Krishna (2.84 %) and Pusa Sawani (2.87 %) were statistically similar and had comparatively less infestation. In case of flower infestation percentage, maximum infestation

was shown by Local variety (5.00 %) followed by Pusa Sawani (4.32 %). With regards to fruit infestation, also Local variety proved comparatively more susceptible (22.97%) followed by Pusa Sawani (21.24 %). Arka Anamica and Rama Krishna were statistically similar and proved comparatively more resistant with 18.88 and 19.33 percent fruit infestation, respectively. Less infestation on plant parts other than fruits may be due to non-availability of proper food for young larvae of *H. armigera* (Hub.) (6). Local variety harbored more infestation in all the five parameters under study.

The data on trichome density/cm^2 (Table 2) showed highly significant differences among all varieties for trichome density on lower, middle and upper leaves, respectively. Comparison of means for trichome density/cm^2 on lower leaf lamina of different okra varieties revealed that Local variety had maximum trichome density/cm^2 (84.25) followed by Pusa Sawani (80.00), whereas Rama Krishna had minimum (65.00). In case of middle leaf lamina, Local variety again had maximum trichome density/cm^2 (90.00) followed by Pusa Sawani (84.00), whereas Rama Krishna had minimum (75.00). For upper leaf lamina both Local variety and Pusa Sawani statistically similar trichomes density (98.50 and 97.00) followed by Rama Krishna (85/ cm^2).

Table 2. Means of trichome density/cm^2 on leaf lamina on different varieties of okra.

Varieties	Lower leaf	Middle leaf	Upper leaf	Mean
Pusa sawani	80.00 b	84.00 b	97.00 a	87.03 b
Rama Krishna	65.00 d	75.00 d	85.00 c	75.00 d
Akra Anamica	76.02 c	78.88 c	88.00 b	81.00 c
Local	84.25 a	90.00 a	98.50 a	90.92 a
Mean value	76.31	81.97	92.12	83.47
LSD (5%)	3.265	2.594	2.013	1.922
Variety MS	272.88**	168.974**	176.25**	194.55**
CV %	2.67	1.98	1.37	1.25

Means sharing similar letters do not differ significantly (P = 0.05).
**Significant (P ≤ 0.01)

The results regarding correlation coefficient (r-values) between leaf trichome density and pest infestation on shoots, squares, buds, flowers and fruits of okra (Table 3) revealed that leaf trichome density had a positive significant

Table 3. Correlation between leaf trichome density/cm^2 and infestation (%) on different parts of okra caused by American bollworm.

Plant Parts	Correlation of infestation with leaf trichome density
Shoots	0.384 ^{ns}
Squares	0.106 ^{ns}
Buds	0.442 ^{ns}
Flowers	0.772 **
Fruits	0.769 **

**Significant at P ≤ 0.01, NS = Non-significant

correlation with infestation of *H. armigera* on flowers (0.772) and fruits (0.769). Percentage infestation of *H. armigera* on shoots, sqaures and buds of okra had a non-significant correlation with leaf trichome density.

Females of *H. armigra* show more propensities to lay eggs on plant parts with high trichome density and concentration of stimulatory chemicals (14). It is conceivable that more fruit infestation in varieties having more trichome density on leaf lamina may be attributed to preference of pest for oviposition those varieties to provide suitable sites for egg protection. These results give similar trend with the findings of Lukefahr *et al.* (7) who reported upto 60 percent reduction in oviposition and number of larvae by *Heliothus* spp. on glabrous cotton in field cages. They attributed these reductions to the fact that glabrous surfaces exhibited antixenosis through non-preference for oviposition and eggs once deposited were likely to dislodge more than deposited on normally hirsute surfaces. Present findings are also similar to those of Navasero and Ramasawamy (10) who found a significant positive correlation between *H. virescens* and pubescence. Comparable results were described by Saini and Singh (12) while studying other noctuid pest (*Earias* spp.) on okra. They reported a significant and positive correlation of oviposition of *Earias* spp. with trichome density and length on leaves of test plants. They reported maximum oviposition of *Earias* spp. on fruits followed by leaves, squares, leaf petioles and terminal buds. They attributed increased oviposition on these parts to the presence of trichome together with favorable food.

The present studies showed that none of varieties was resistant to infestation of *H. armigera.* The pest attacked the fruits of plants more as compared to other parts, probably due to the preference for food. The varieties having more trichomes had more attack of the pest. However, there is need to carry further investigations to explore other instinctive factors affecting mechanism of resistance in okra against this pest.

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