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Relative performance of okra (*Abelmoschus esculentus* L. Monech) verities with the correlation of abiotic factors against Jassid

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Abstract

The present study was carried out to screen the okra genotypes against Jessid and to determine the role of abiotic factors on the population dynamics of this pest on okra under the agro climatic conditions of D.I. Khan, Pakistan. The results of the study revealed that the peak population of Jassidi. e.,3.31/leaf was observed on July 2, and minimum population was recorded on August 6, with 1.57 Jassid/leaf. The HPSI (Host plant susceptibility indices) showed that genotype Anmol and Climson was found to be susceptible with 14% HPSI, while minimum HPSI i.e., 11% was recorded on okra cultivar Sabzpari, Butter-5 and BP-1. Simple correlation analysis revealed that rainfall had maximum contribution of 24.99% in the population fluctuation of Jassid followed by maximum and minimum temperature which had a non-significant and positive correlation with Jasssid population .The role of maximum temperature was 13.01% while minimum temperature has 6.83% role in the population fluctuation of Jassid.

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Introduction

Okra (*Abelmoschus esculentus* L. Monech) is an important summer vegetable crop of Malvaceae family. It is generally known as Bhindi or ladys's finger and is used all over the world. In Pakistan, okra is mostly cultivated in the plain areas of Punjab and Sindh provinces (Anwar, Rashid, Mahmood, Iqbal, & Sherazi, 2011). The total area of okra cultivation in Pakistan is about 2.21×105 hectares and it provide yield about 2.86×106 tons of green pods (Kashif, Yaseen, Arshad, & Ayub, 2008). Okra is cultivated for pods or fruit containing round and white seeds. It is rich in vitamins, calcium, potassium and other minerals. It has wide usage in culinary purpose, paper industry and medicine. Okra is attacked by a number of insect pests that leads to significant economic loss. Okra is attacked by different insect pests from sowing up to harvesting (Ewete, 1978). Chewing insect pest damage the fruit of the plant while sucking pests damage foliage. Among sucking insect pests, Jassid is considered as destructive pest. Both nymph and adults of Jassid suck cell sap from the lower surface of the leaves. During feeding they inject toxic saliva into plant tissues, as a result leaves of plant turn yellowish and curly and the photosynthetic activity of plant is disturbed (Singh *et al.*, 2008). In case of sever attack it results in the loss of crop vigor and reduce the yield up to 54.04% (Ghosal, Chatterjee, & Bhattacharyya, 2013).

Chemical control is generally considered as the most effective and cheapest method to control pests. However, maximum use of synthetic insecticides creates numerous problems to living organisms (Malik, Javed, & Ayyaz, 2015). The insecticides application doesn't provides an immediate solution to control the pests (Tariq Mahmood, Hussain, Khokhar, Jeelani, & Ahmad, 2002). It has been reported that about two million peoples affected with exposure to insecticide and about 40000 died due to insecticide poisoning (Rajput, 2004). Host plant resistance (HPR) is a most effective approach of integrated pest management. This can quash insect pest populations (M. A. Khan, Akram, Khan, Asghar, & Khan, 2010). Growing of resistant varieties is the most operative, economic and environmental friendly strategies which proves to be the most favorable method to boost okra production (S. M. Khan, 2011). Climatic factors play a very important role in the growth, development, survival and reproduction of insect pests. Most of the activities of an insect are dependent on the environmental temperature for maintenance. Low or high temperatures have contrary effect on the insect development. Different levels of humidity and rainfall upsurge or lessen the population of certain insect pest species (Shyam Prasad & Logiswaran, 1997). These factors affect the life cycle, propagation, and outbreaks of insects to such an extent that they are either compelled to adapt themselves to the changing climatic conditions or perish (Pedigo, 2004).

The present study was designed to evaluate the susceptible/resistance response of various okra genotypes under agro climatic conditions of D.I. Khan, Pakistan and to calculate the influence of various abiotic factors in the population dynamics of *A. biguttula biguttula*.

Materials and methods

Experimental site

The field trial was conducted during summer 2015 to screen okra genotypes against Jassid based on per leaf population density count and to determine the role of various weather factors in fluctuation of Jassid population on okra cultivars at the Agricultural Research Institute, Ratta Kulachi (ARI), D.I. Khan, Pakistan. Eight genotypes of okra were cultivated in the experimental area on May 18, 2015 (Table 1).

Table 1. Mean comparison of the data regarding jassids population per leaf on different genotypes of okra during 2015.

Genotype	Means*
Bp-1	1.9904 c
Sabzpari	1.9550 c
Climson	2.5217 a
Rich Green	2.4100 a
Pusa Green	2.4379 a
Swat Green	2.3333 ab
Butter 5	2.0667 bc
Anmol	2.5217 a

Means sharing similar letters are not significantly different by LSD Test at P = 0.05.

Experimental design

The trial was laid out in Randomized Complete block design (RCBD) with three replications. The total area of plot was 100×10m² during study season. The plant to plant and row to row distance was kept 25cm and 60cm. The experiment was kept free from the insecticides application and cultivars were screen under natural insect pressure. Recommended agronomic practices were applied during the study period. The crop was surveyed on weakly basis to estimate the Jassid population. Data on Jassid population was recorded early in the morning once in a weak thirty days after sowing. Nine plants of each genotype in each replication were randomly selected and tagged. From each randomly selected plant one leave each from the top, middle and lower part of the plant were observed for the Jassid population count during observation. The data which was based on the average counts of the pest per leaf was considered an indirect reflection of pest resistance/susceptibility in plants.

Metrological data

Metrological data related to the temperature, relative humidity and rainfall were recorded from the adjoining meteorological observatory of the Physiology Section, Arid Zone Research Institute (AZRI), D.I. Khan, Pakistan. The effect of abiotic factors on the adults/ nymphs population densities of jassid on different okra genotypes was determined by working out simple correlation (Steel & Dickey, 1997).

The data of overall as well as on the individual of pest specie was presented through a multiple comparison of the mean value. The mean population of the pest was calculated separately using the following formula:-

Mean = $\sum x/n$

Where x = Sum of values

n= Number of values

Statistical Analysis

Data were subject to analysis of variance technique using statistical analysis package 8.1 Least significance difference (LSD) test was applied at 0.05 probability level to detect the statistical significant difference among the treatments.

Results and discussion

The result in (Table 1) showed that maximum Jassid population (2.52 leaf^{-1}) was recorded on okra cultivar Climson, which was statistically at par with okra cultivars Rich green (2.41 leaf^{-1}), Pusagreen (2.43 leaf $^{-1}$), Swat green (2.33 leaf^{-1}) and Anmol (2.52 leaf^{-1}). However significantly minimum Jassid population (1.95 leaf^{-1}) was recorded on okra cultivar Sabzpari with non-significant difference from okra cultivar Bp-1 and Anmol having 1.99 leaf^{-1} and 2.06 leaf^{-1}jassid population. Overall, ranking of cultivars on the basis of jassid population leaf^{-1} under descending order are: Anmol (2.5217), Climson (2.5217), Pusa green (2.4379), Rich green (2.410), Swat green (2.3333), Butter 5 (2.0667), Bp-1 (1.9904) and Sabzpari (1.9550). These results are not in line with those of Shakeel and Iqbal *et al.*, (Iqbal, Mansoor, Muhammad, Shahbaz, & Amjad, 2008; Shakeel, Zaman, Ahmad, & Hafeez, 2000) who found cultivar Pusa green as moderately resistant while present findings conform the results of Gul (1998) who reported Pusa green susceptible against the pest. In the present study cultivar Pusa green was also found to be susceptible with 2.4379 Jassid population leaf^{-1}. These findings can partially be compared with Iqbal *et al.*, (Iqbal *et al.*, 2008) who found cultivar Sabzpari as intermediate in response to Jassid while in the present finding cultivar Sabzpari with 1.9550 Jassid population leaf^{-1} was found to be resistant. The cultivar Anmol and Climson showed maximum HPSIs (Host Plant Susceptibility Indices) i.e. 14% followed by Rich green, Pusa green and Swat green with 13% HPSIs (Fig. 1). The minimum HPSIs were observed in cultivar Sabzpari, Butter 5 and Bp-1 i.e. 11%. It is evident from the findings that Anmol and Climson showed maximum HPSIs i.e. 14% and were found susceptible.

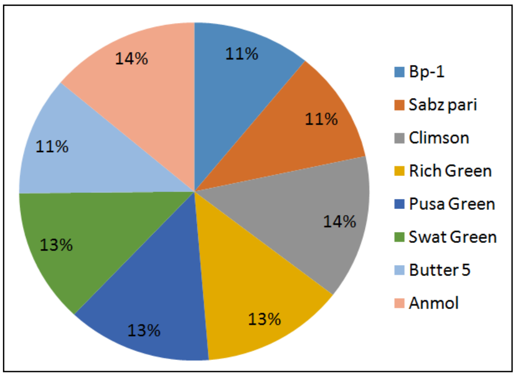

Fig. 1. Host plant susceptibility indices (HPSI) of different cultivars of okra.

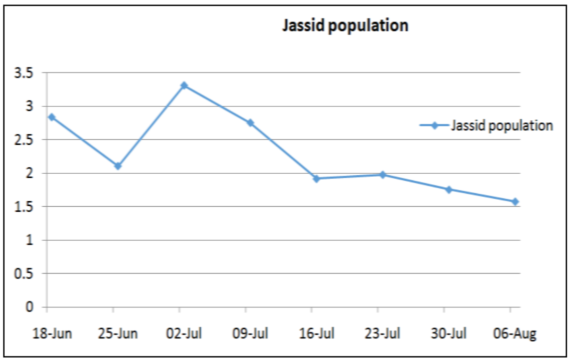

Fig. 2. Jassid population on various dates of observation.

The results (Table 2) regarding Jassid population leaf^{-1} on okra versus various weather factors showed that maximum population of Jassid was recorded to be 3.31 Jassid leaf^{-1} on July 2 with a maximum temperature of 38°C, minimum temperature of 29°C, an average temperature of 33°C and with a relative humidity of 51.85% .While minimum population of Jassid was recorded to be 1.5758 Jassid leaf^{-1}on August 6 with a maximum temperature of 38°C, minimum temperature of 28°C , an average temperature of 33°C and with a relative humidity of 54.85%. To evaluate the impact of various weather factors during 2015 on the population fluctuation of Jassid leaf^{-1}, the data regarding Jassid population leaf^{-1} on okra were correlated with the various weather factors.

Table 2. Mean comparison of the data, regarding population of Jassid on okra, at different dates of observations, during 2015.

Dates	Means
18 June	2.8383 b
25 June	2.1071 c
2 July	3.3121 a
9 July	2.7546 b
16 July	1.9167 cd
23 July	1.9779 cd
30 July	1.7542 de
6 August	1.5758 e

Means sharing similar letters are not significantly different by LSD Test at P = 0.05.

The result (Table 3) shows correlation coefficient between the population of jassid on okra and various weather factors during year 2015. The result showed that both minimum and maximum temperature during 2015 showed a non-significant and positive correlation with the Jassid population, whereas average relative humidity and rainfall resulted in negative non-significant correlation. The present findings are in agreement with those of Mahmood *et al.*,(Tariq Mahmood *et al.*, 2002) and Arif *et al.*, (Arif, Gogi, Mirza, Zia, & Hafeez, 2006) who reported a positive correlation of minimum temperature with the population density count of jassid, while the present results didn't confirm the findings of Patel (Patel, Patel, Jayani, Shekh, & Patel, 1997) who reported a negative correlation between the temperature and Jassid population. The present results partially support the finding of Shivanna *et al.*,(Shivanna *et al.*, 2011) who reported that maximum temperature showed significant positive effect and minimum temperature showed non-significant negative effect on population of leafhopper on cotton crop. Similarly the present results are in partial agreement with Iqbal (Iqbal *et al.*, 2008) who reported that minimum temperature have significant and positive correlation with Jassid population while other factors were non effective. In the present findings all the environmental factors showed a non-significant correlation with the population of Jassid. However negative and non-significant effect of rainfall was observed on Jassid population. The present findings can be compared with those of (Tariq Mahmood *et al.*, 2002) who find non-significant correlation of rainfall towards increasing or decreasing of Jassid population. The present results can also be compared with Iqbal (Iqbal *et al.*, 2008) who reported that rainfall showed maximum contribution in population fluctuation of Jassid on okra. However the present findings are not in confirmative with Lal (Lal, Mahal, Singh, & Singh, 1990) who reported that rainfall had an unfavorable effect on the population buildup of Jassid.

Table 3. Correlation coefficients (r) between population of jassid on okra and various weather factors.

Weather Factors	Correlation coefficients (r)
Maximum Temperature (C°)	0.3607
Miniumum Temperature (C°)	0.4454
Average Temperature (C°)	0.40305
Relative Humidity (%)	-0.3704
Rainfall (mm)	-0.2470

The results regarding the impact of weather factors on the population of Jassid during 2015 on okra are given in (Table 4). The results revealed that rainfall showed a maximum contribution of 24.99% in the population fluctuation of Jassid on okra followed by maximum temperature, minimum temperature, and relative humidity with 13.01%, 6.83% and 4.57% role in the population fluctuation respectively.

The $100R^2$ value was found to be 49.4%, when the contribution of all the abiotic factors on the population fluctuation of Jassid on okra was analyzed together. None of the regression equation was found to fit the best. In the present findings relative humidity showed a non-significant & negative effect with the Jassid population during 2015. Furthermore, this factor contributed a minimum role in the population fluctuation of the pest. These results can be compared with those of Mahmood *et al.,* (T Mahmood, Khokhar, Banaras, & Ashraf, 1990) who found non-significant contribution of relative humidity towards increasing or decreasing Jassid number but disconfirm with those of Bishoni *et al.*, (Bishnoi, Singh, Rao, Niwas, & Sharman, 1996) who found a significant relationship between relative humidity & Jassid population.

Furthermore Sharma and Sharma (Sharma & Sharma, 1997) reported a non-significant and positive correlation between Jassid population and relative humidity. Similarly Shyam (Shyam Prasad & Logiswaran, 1997) reported a positive correlation between the relative humidity and Jassid population. The present findings can be compared with Arif *et al.,* (Arif *et al.*, 2006) who reported that relative humidity didn't show a significant effect on population fluctuation of Jassid on cotton crop. The present findings support with Shiwana *et al.*,(Shivanna *et al.*, 2011) who reported that relative humidity showed a non-significant effect on Jassid population. The present results are in line with those of Kumawat *et al.*, (Kumawat, Pareek & Meena, 2000) Mahmood *et al.,* (Tariq Mahmood *et al.*, 2002) and Arif *et al.,* (Arif *et al.*, 2006) who found a non-significant and negative correlation between Jassid population and relative humidity.

Table 4. Multiple linear regression models along with coefficients of determination (R^2) regarding the impact of weather factors on the population of Jassid during 2015 on okra.

Regression equation	R^2	$100 R^2$	Role of individual factor (%)
$Y = -5.49652 + 1.26731 X_1$	0.1301	13.01	13
$Y = -9.60662 + 2.24012 X_2$	0.1984	19.84	6.83
$Y = 6.83550 + -0.60568 X_3$	0.2441	24.41	4.57
$Y = 2.41594 + -0.4768 X_4$	0.494	49.4	24.99

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