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Original Article

Comparative tolerance of different Cotton cultivars against *Pectinophora gossypiella* (Saunders) (Gelechiidae: Lepidoptera) under ecological conditions of District Layyah

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Abstract

Pink Bollworm, *Pectinophora gossypiella* (Saunders) (Gelechiidae: Lepidoptera) is a serious threat to cotton crop in Pakistan. The current research trail was designed to assess the response of six cotton genotypes viz: IUB-13, BS-15, FH-142, MNH-886, NIAB-999 and MNH 1026 and role of abiotic factors on the infestation of pink bollworm on squares, flowers and green bolls of cotton cultivars under agro-climatic conditions of District Layyah from July to October 2018 on weekly basis. The results of the study revealed that maximum infestation of Pink bollworm (4.02%) on squares was noted at temperature of 31.23°C and relative humidity of (41.83%). Maximum infestation on green bolls (5.50%) was recorded at temperature 31.23°C and relative humidity 41.83% respectively. Among all tested varieties IUB-13 was found to be relatively susceptible under unsprayed condition and MNH-1026 was found to be comparatively resistant against Pink bollworm infestation on flowers. No rainfall in the experiment area was recorded during study period. Present study can be helpful in selection of resistant cultivars against Pink bollworm for good quality production of cotton.

Keywords: *Gossypium hirsutum*, Genotypes, Pink bollworm, Abiotic factors

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Introduction

Agriculture is the backbone of Pakistan's economy. It accounts for 19.5% of the gross domestic product (GDP) and employs 42.3% of the total labor force. Cotton is one of the major sectors driving economic growth of the country. It is a major source of natural fiber and vegetable oil (Abdurakhmonov, 2013). It is the leading cash crop and primary input to the country's largest industrial sector. It share 5.2% to the agricultural value addition and has a contribution of 1.0% in the GDP of Pakistan (Government of Pakistan, 2017). This crop is attacked by many sucking and chewing pests from sprouting to picking stage (Abro et al., 2004). Among chewing pests, pink boll worm *Pectinophora gossypiella* (Saunders)

(Gelechiidae: Lepidoptera), is a destructive pest and considered as limiting factor in the production of this crop. It is a key pest that causes the failure of bud opening, fruit shedding, lint damage, seed loss, damage to cotton squares, bolls and flowers (Chaudhry et al., 1999).

Host plant resistance (HPR) is a most useful technique of integrated pest management (IPM). This can quash insect pest populations without harming the environment (Khan, 2010). The development of resistant cotton varieties is most economical and environmental friendly strategy against pest and boosting up the crop yield (Khan**,** 2011). By using resistant varieties the pest population can easily be controlled without insecticide application (Hua and Hua, 2000). However, the resistance in plant is not governed by any single factor rather it is a combination of physical and environmental factors. Transgenic cotton provides resistance against chewing insect pests and increases the yield per unit area. Cultivation of transgenic cotton help to reduced the toxic impact of pesticide in the environment (Sunilkumar et al., 2006)

Cotton is a sensitive crop and climate change has profound impacts on its productivity. A number of factors are responsible for low yield of cotton such as changing climate, resistance development in target insect pests and weeds, increased heat and drought stress, excessive rains and water logging, evolution of new strains of diseases, and the huge costs of inputs which are essential for cotton crop such as insecticide, seed and fertilizer (Zohaib, 2017). Cotton crop is particularly sensitive to high temperature, low water availability, high atmospheric evaporation rate and heat stress (Singh et al., 2007). In order to cope with the problem, new varieties have been introduced by the researchers for possible resistance against pests. As the assessment of new varieties for resistance against bollworms is an important component of integrated management. Therefore, the present study was under taken to establish relationship between abiotic factors and pink bollworm infestation on different cotton varieties to screen cotton cultivars under local agro-climatic conditions of district Layyah.

Material and Methods

The research trial was conducted on a farmer's field to test the comparative tolerance of cotton against Pink bollworm, *Pectinophora gossypiella* under ecological conditions of District Layyah during 2018. The trial was laid outin (RCBD) Randomized complete block design. Six varieties of cotton i.e. IUB-13, FH-142, BS-15, MNH-886 and MNH-1026 were procured from market of Layyah. The experiment was replicated thrice. The cotton genotypes were sown in the cultivated area in May, 2018. Total cultivation area was 1 kanal. The net plot size was 9.8 x 4.6 m having six rows. Plant to plant and row-to-row distance was kept 30 and 75cm, respectively. No plant protection measure was applied for the control of Pink boll worm of cotton. The crop was irrigated when needed. All the other standard agronomic practices were followed for the crop till harvesting. The crop was surveyed on weekly basis and data regarding *Pectinophora gossypiella* infestation on bolls, square and flowers on cotton crop were recorded early in the morning from last week of July to mid of October 2018. The data were recorded from five randomly selected plants. All the recorded data were averaged to aggregate means. The mean population of the pest and percent infestation on bolls was calculated separately by using the following formula:

$$\text{Mean} = \sum x/n$$

Where x = sum of values

n = Number of values

$$\% \text{ infestation} = \frac{\text{No of infested boll} \times 100}{\text{Total no of boll}}$$

Metrological data

Metrological data related to the temperature, relative humidity and rainfall were collected from the Metrological observatory office of district Layyah, Punjab, Pakistan. The effect of abiotic factors on the adult population densities of *Pectinophora gossypiella* on different cotton genotypes was determined by working out simple correlation (Steel & Dickey, 1997).

Statistical Analysis

Data were analyzed using statistical analysis package 8.1 (Analytical software, 2003). Least significance difference (LSD) test was applied at 0.05 % level of probability to detect the statistical difference among the treatments.

Results and Discussion

The result (Table.1) shows a mean comparison of different cotton genotypes for Pink bollworm

infestation (%) on squares, flowers and green bolls under unsprayed condition during 2018. A significant difference was recorded among all the tested genotypes regarding infestation on squares, flowers and green bolls. It is concluded from the results that maximum infestation 1.53% of Pink boll worm on squares was recorded on IUB-13 followed by FH-142 and BS-15 with 1.40% and 1.20% infestation, respectively. Minimum infestation 0.66 % of Pink boll worm was found on MNH-1026. While intermediate infestation of Pink boll worm was found on MNH-886 with 1.06% infestation and was statistically at par with NIAB-999 with 0.93% infestation. In case of flowers, maximum infestation 4.20 % was observed on IUB-13 which differs significantly from rest of the treatments. Intermediate infestation of 3.80% was noted on FH-142 which was statistically at par with BS-15 with 3.73 % infestation of Pink bollworm. Minimum infestation 2.33% was recorded on MNH-1026 which didn't differ statistically from NIAB-999 with 3.13% infestation. In case of green bolls, maximum infestation 3.93% of Pink bollworm was recorded on IUB-13 which differs significantly from rest of the treatments. On bolls, minimum infestation of 1.66 % of pink bollworm was recorded on MNH-1026 which didn't differ statistically from NIAB-999 with 2.39 % infestation of the pest. It is also concluded from the results that genotype IUB-13 was found to be more susceptible to pink bollworm and cultivar MNH-1026 showed resistance against pink bollworm attack under unsprayed conditions.

Table 1: Comparison of different cotton genotypes for Pink bollworm infestation (%) on squares, flowers and green bolls under unsprayed condition.

Squares		Flowers		Green Bolls	
Genotype Mean±0.47SE		Genotype Mean±0.34SE		Genotype Mean±0.49SE	
IUB-13	1.53a	**IUB-13**	4.20a	**IUB-13**	3.93a
FH-142	1.40b	**FH-142**	3.80b	**FH-142**	3.60b
BS-15	1.20c	**BS-15**	3.73bc	**BS-15**	2.86c
MNH-886	1.06d	**MNH-886**	3.20c	**MNH-886**	2.46cd
NIAB-999	0.93de	**NIAB-999**	3.13de	**NIAB-999**	2.39de
MNH-1026	0.66def	**MNH-1026**	2.33def	**MNH-1026**	1.66def

Means sharing the same letters didn't differ significantly from each other 0.05% level of probability

Table 2: Mean infestations of Pink bollworm on squares and bolls on different genotypes of cotton under unsprayed condition.

Pink Boll Worm Infestation (%)			Abiotic factors		
Date	**Squares**	**Bolls**	**Temperature (°C)**	**RH (%)**	**Rainfall (mm)**
14.7.18	0efghi	0efghi	37.27	42.21	0
22.7.18	0efghi	0efghi	35.31	39.99	0
29.7.18	0.33defg	0.33defgh	34.60	43.00	0
7.8.18	1.00defg	0.83defgh	33.06	43.20	0
14.8.18	1.33def	1.50def	34.31	45.71	0
22.8.18	1.83cde	2.50cde	33.22	44.67	0
29.8.18	2.16bcd	3.17bcd	33.97	45.04	0
7.9.18	2.83b	4.50b	33.27	42.57	0
14.9.18	2.84b	5.33ab	32.24	42.12	0
22.9.18	4.05a	5.50a	31.23	41.83	0
29.9.18	2.66bc	4.66b	30.06	44.40	0
7.10.18	1.83cde	3.16bc	29.67	41.50	0
14.10.18	1.50def	2.33cde	29.19	40.71	0
22.10.18	0.83defg	1.83def	28.16	42.91	0
29.10.18	0.50defgh	1.05defg	26.65	43.57	0
Mean	**1.57**	**2.44**	**32.14**	**42.89**	**0**

Means sharing the same letters didn't differ significantly from each other 0.05% level of probability

The result (Table 2) depicts overall mean infestations of pink bollworm on squares and bolls on different genotypes of cotton under unsprayed condition during 2018. The results revealed that mean infestation trend of PBW on squares and bolls started from July and continued up to the end of October. The results also revealed, that infestation of pink boll worm on squares was maximum (4.02%) during 3rd week of September at 31.23°C and (41.83%) relative humidity (RH).While, minimum infestation of Pink Boll worm on squares (0.33%) was recorded in July at 34.60°C and (43%) RH. No rainfall in the experimental area was recorded during study period.

Infestation of Pink Bollworm on green bolls started from end of July and continued up mid of October. Maximum infestation (5.50%) was recorded in 3rd week of September at 31.23°C and (41.83%) RH. While, minimum infestation (0.33%) was recorded at end of July when temperature was 34.60°C and (43%)

RH. No rainfall in the experiment area was recorded during study period. The present results can be compared with the findings of (Ali et al., 1993 and Izquierdo, 1996) who also said that infestation percentage of PBW increased in the month of September, when the crop is near to maturity stage.

Table 3: Mean infestation of Pink Boll Worm on flowers on different genotypes of cotton under unsprayed condition.

Month	PBW Infestation (%)	Abiotic factors		
Month	**Flowers**	**Temperature (°C)**	**RH (%)**	**Rainfall**
July	0.93d	35.72	41.73	0
August	3.20c	33.64	44.61	0
September	6.62a	31.70	42.73	0
October	3.57bc	28.41	42.17	0
Mean	**3.58**	**32.36**	**42.81**	**0**

Means sharing the same letters didn't differ significantly from each other 0.05% level of probability

The result (Table 3) shows overall mean infestations of Pink bollworm on flowers on different genotypes of cotton under unsprayed condition during 2018. It is concluded from the results that mean infestation trend of PBW on flowers started from July and continued up to the end of October. Maximum infestation of PBW on flowers (6.62 %) was observed during September at 34.70 °C & (42.73%) RH and differs significantly from the other. While intermediate infestation (3.57%) of PBW on flowers was recorded in the month of October. Minimum infestation of PBW (0.93%) on flowers was recorded in July at 35.06 °C and 41.73 % RH.

The result (Table 4) shows the correlation of weather factors and Pink Bollworm infestation on green bolls and squares of different cotton genotypes under unsprayed conditions during 2018. The findings revealed that both temperature and relative humidity were negatively correlated with population development and infestation of Pink bollworm on square and bolls of cotton. Our results are in agreement with the findings of Deepika et al. (2014) who also found negative correlation of both temperature and relative humidity on population development and infestation of Pink bollworm on cotton but our finding differ to those of Sadaany (1999) who explained that temperature, relative humidity and rainfall were positively correlated with bollworm infestation (Chaudhry et al., 1999).

Table 4: Correlation coefficients (r) between the population of pink bollworm on cotton at various weather factor during 2018

Weather factors	Correlation coefficient	
	Square	Bolls
Maximum Temperature (C^0)	-0.9364	-0.9511
Relative Humidity (%)	-0.5582	-0.5455

Conclusion

It is concluded from the present research that maximum infestation of pink bollworm (4.02%) on squares was noted at temperature of 31.23°C and relative humidity (41.83%). Maximum infestation on green bolls (5.50%) was noted at 31.23°C and relative humidity (41.83%). Among all the tested varieties, IUB-13 was found to be susceptible under unsprayed condition and MNH-1026 was found to resistant against pink bollworm infestation.

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Contribution of Authors

Iqbal J: Conceived idea, planned and designed the experiment
Irshad MC: Literature review and manuscript writing
Ahmad I: Supervised the experiment and manuscript writing
Nawaz A: Searched literature and reviewed
Aamir M: Provided assistance in Data interpretation
Ali A: Statistically Analysed the data, prepared and approved manuscript
Yaseen H: Collected the data and analysed it

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References

Abdurakhmonov IY, 2013. Role of genomic studies in boosting yield. Proceedings of International Cotton Advisory Board (ICAC). 20: 7-22.

Abro GH, Syed TS, Tunio GM and Khuhro MA, 2004. Performance of transgenic Bt cotton against insect pest infestation. Biotech. 3(1): 75-81.

Ali A, Bhatti MA and Ahmad KJ, 1993. Role of weather in fluctuating the population of Amrasca devastans (Dist.) and *Thrips tabaci* (Lind.). Proc. Pak. Congr. Zool. 13: 133-139.

Chaudhry GB, Bhsrpoda TM and Patel JJ, 1999. Effect of weather on activity of cotton bollworm in middle. Gujrat J. Agro. Meteorol. 1(2): 137-142.

Deepika K, Roshan L, Dahiya KK, Jat BL and Ankit K, 2014. Effect of abiotic factors on population dynamics of pink bollworm in relation to genetically modified cotton. J. Cotton Res. Develop. 28(2): 280-285.

El Sadaany GB, Hossain AM, El Fateh RSM and Romeilah MA, 1999. The Simultaneous effect of physical environmental factors governing the population activity of cotton bollworm moths. Egyptian J. Agric. Res. 77: 591-609.

Izquierdo JI, 1996. *Helicoverpa armigera* (Hübner) (Lep., Noctuidae): Relationship between captures in pheromone traps and egg counts in tomato and carnation crops. J. Appl. Entomol. 120(5): 281-290.

Khan MA, Akram W, Khan HAA, Asghar J and Khan TM, 2010. Impact of Bt-cotton on whitefly, *Bemisia tabaci* (Genn.) population. Pak. J. Agric. Sci. 47(4): 327-332.

Khan SM, 2011. Varietal performance and chemical control used as tactics against sucking insect pests of cotton. Sarhad J. Agric. 27(2): 255-261.

Ma L and Li C, 2000. A study on the bollworm resistance of CRI 29 and the target to control the F3 bollworms. China Cottons. 27(3): 20-22.

Raza SH, 2009. Cotton production in Pakistan. In *A grower's view.* Presentation (ppt.) at the 68th ICAC Plenary Meeting. International Cotton Advisory Committee (ICAC), USA.

Singh RP, Prasad PV, Sunita K, Giri SN and Reddy KR, 2007. Influence of high temperature and breeding for heat tolerance in cotton: a review. Adv. Agron. 93: 313-385.

Sunilkumar G, Campbell LM, Puckhaber L, Stipanovic RD and Rathore KS, 2006. Engineering cotton seed for use in human nutrition by tissue-specific reduction of toxic gossypol. Proc. National Acad. Sci. 103(48): 18054-18059.

Zohaib A, 2017. Improving cotton productivity by plant growth retardant and Boron application. PhD dissertation, Department of Entomology, University of Agriculture, Faisalabad.