PINK BOLLWORM DAMAGE AND MANAGEMENT SCENARIO IN DIFFERENT COTTON GROWING AREAS OF SINDH-PAKISTAN

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Abstract:

Cotton, a major cash crop of Pakistan, is considered as backbone of the national economy. It contributes about 1.4% to GDP and 6.9% of total value addition in agriculture. Pakistan is the fourth largest producer, third largest consumer of cotton and the second largest exporter of cotton yarn in the world. Export of cotton and textile products have a share of 57% in the overall exports of the country. Cotton is grown by 1.3 million farmers on over 3.2 million hectares which is 15% of the cultivable area of Pakistan. During 2012-13, cotton production was 12.0 million bales and in 2013-14 it is around 12.5 million bales of 170 kg. This is consumed largely by 521 textile mills in the country though a significant quantity of up to 1 million bales is also exported. However, to meet the demand for extra long staple cotton, up to 2 million bales is imported annually. Cotton production in Pakistan has remained stagnant due to many reasons. Virus and pest attack on cotton has significantly hindered the cotton production. Although the country has adopted transgenic cotton (Bollguard-I) over the area of 86%, but small farmers, who are in larger numbers, use saved contaminated and impure cotton seed. This results in incidence of Pink bollworm and other lepidoptrous pests. This paper highlights the infestation of Pink bollworm in different areas of Sindh Province, Pakistan. It has significantly damaged cotton crop in Nara belt area of Sanghar District of Sindh Province ranging from 9 to 11%. Whereas, least damage % was observed in Khairpur district which ranges 5.8 to 9.18%. The paper also provides recommendations for, the use of eco- friendly management practices that are suitable for control of the pest and will reduce the number of toxic pesticides.

Key Words: Cotton Bollworm, Survey, Pink bollworm, Pesticides, Cotton Production

Introduction:

Cotton is one of the most important cash crops of Pakistan. It provides livelihood to millions of farmers, ginning factories and textile workers besides it earns foreign exchange. Cotton is the source of edible oil and natural fiber (Aslam *et al*. 2004). Cotton shares 7.8 percent value added in agriculture sector and in GDP 1.6% value added (Anonymous, 2013). Pakistan is the fourth largest cotton producer (Abro, 2004). Cotton is worldwide growing crop and important source of fiber and oils. In Pakistan largest area was cultivated by cotton crop. Due to growing of Bt. cotton in Pakistan, chewing pest of cotton is not a problem but sucking pest cause greater damage as reduction of yield (Jaleel et al. 2014).

Recently in Sindh, pink bollworm has become a real threat to conventional and Bt. varieties of cotton. It's attack to fruiting bodies of cotton ranges from 20-30 per cent. The pest completes its four generations on cotton crop and the larvae of fifth generation live in the leftover bolls and seed cotton in ginning factories after final picking in diapausing stage (Ahmed, 2013). For pink bollworm, 53.2% farmers gave opinion that pink bollworm attacks at a medium level thus it can be managed by applying proper control strategies. Comparing the respondents who gave opinion that pink bollworm attacks at a medium level, highest percentage was of respondents of Pak-Pattan i.e. 80.5% (Jaleel et al. 2014).

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The pink bollworm has also evolved resistance against Bt. Cotton varieties which are grown about 70-80% by the growers of Sindh due to its high yield per hectare than conventional cotton varieties. For control of pest, the use of eco- friendly methods will be suitable for control of this pest by reducing the number of toxic pesticides applications. Awareness through seminars should be given to the growers for the latest control stretegies of pink bollworm in Pakistan (Khuhro, 2014).

MATERIALS AND METHODS

Monitoring of Pink bollworm Population using Sex Pheromone Traps

The adult male moth population of main *Lepidopterous* pest, Pink bollworm of cotton crop is being monitored since 2009-10 to 2013-14 with installation of sex pheromone traps at CCRI, Sakrand farm on one hectare. To note the activity of the insects, daily observations were recorded. Funnel traps were installed in the field throughout the season and lure were changed every three weeks intervals. The specific sex pheromone traps were used and placed on one hectare area to monitor the adult population. The metrological observations were taken weekly and also took the rainfall data of 2009-10 and 2013-14 from Metrology substation at CCRI-Sakrand.

Pink Bollworm infestation and larval survival in left over bolls during 2013-14

The objective of the survey was to note the survival of pink bollworm larvae in the left over bolls. In Sindh province most of the growers planted Bt. varieties so from left over bolls mature green bolls were collected from different locations/districts in the month of September and October during survey of cotton crop in Sindh and the left over bolls brought in the laboratory for presence of mines and larvae.

Field Survey Report on Pink bollworm

A survey was conducted on complains of small growers for the attack of pink bollworm on cotton in Nara Belt area of Sindh, Province. During the survey the fields were visited and data was compiled and is summarized in Table-3. Besides that recommendations were also provided to the growers for the proper management of pink bollworm.

Pink bollworm population recorded in approved Bt. varieties Trial

The main aim of the trial survey/observations was to determine the population of pink bollworm on approved Bt. varieties during the crop season 2013-14 at CCRI-Sakrand farm. The seven varieties were sown with three replications in Randomized Complete Block Design. Approximately 100 bolls were picked and kept in laboratory for recording the pink bollworm infestation.

Climatic conditions

The meteorological data was recorded at Central Cotton Research Institute Sakrand every year regularly to maintain the meteorological data. The five years data was complied to know the trend of temperature and their effects on cotton production and infestation of insects pest.

Training/Seminars to cotton growers

The training/ seminars were conducted seasonally on regular basis for cotton growers of different districts of Sindh by Central Cotton Research Institute Sakrand, sponsored by Pakistan Central Cotton Committee, Ministry of Textile Industry Government of Pakistan. The fundamental aim of the training/seminars is to give the growers awareness about recent cotton production technology, control of insects through IPM and production of clean cotton lint.

RESULTS AND DISCUSSION

Pink bollworm, *Pectinophora gossypiella* (Saunders)

Male moth activity of *P. gossypiella* started to catch in the traps from January to march and disappeared from April to July in every year. Again their catches started from August to December. The trap population of moths fluctuated in every year. Highest moth

catches 7.67/trap was recorded during the month of October, 2013. The maximum Moth cached in month of October in all years.

Table 1: Number of Adult pink boll worm moth cached by pheromone traps in last five years from 2009-10 to 2013-14 at CCRI-Sakrand

Months	**Average adult Pink bollworm moth cached in pheromone traps**				
	2009-10	**2010-11**	**2011-12**	**2012-13**	**2013-14**
Jan.	0.81	0.48	0.55	0.72	0.47
Feb.	0.47	0.52	0.57	0.28	0.17
Mar.	0.27	0.10	0.29	0.23	0.00
Apr.	0.07	0.00	0.14	0.00	0.00
May	0.00	0.00	0.23	0.00	0.00
June	0.00	0.00	0.07	0.00	0.00
July	0.00	0.00	0.00	0.00	0.00
Aug.	0.12	0.48	1.02	0.64	0.56
Sept.	0.48	5.28	2.95	1.98	3.93
Oct.	4.90	3.43	3.99	3.09	7.67
Nov.	2.35	2.88	4.01	5.39	6.74
Dec.	0.78	1.78	2.03	3.52	2.34

Pink bollworm, *Pectinophora gossypiella* (Saunders) is major pest of cotton (Balouch *et al.,* 1990). Present results are in agreement with (Shah *et al*. 2011) who indicated that sex pheromones proved more effective for monitoring the adult moth of pink bollworm only 26 were caught by pheromones. P. gossypiella was very attractant to sex pheromones. The population of pink bollworm was present high infestation occurs in August to September and reached to its peak in September because of low rain fall in Hala and Saeedabad during both years but the infestation was higher in 2007 than 2006 because of the less rain in 2007 in comparison to 2006.

Pink Bollworm infestation and larval survival in left over bolls during 2013-14

The results in Table 2 indicates that maximum number of mines (6.0%) were recorded from bolls collected from district Umerkot followed by Mirpurkhas (4.5%), Tando Muhammad khan, Hyderabad (3.75%), Ghotki (3.5%), Khairpur (3.33%) and Shaheed Benazirabad (2.67%). Similarly highest live larvae% of pink bollworm (3.0%) was noted

from bolls collected from Umerkot district and minimum live larvae% (0.71%) from Sukkur district of Sindh Province.

Table 2: Pink Bollworm infestation and survival% of larval population in left over bolls of Bt. varieties in Sindh during 2013-14

S.No.	District	Variety/ Strains	No. of Bolls picked	No. of damaged Bolls	Pink bollworm larvae	Mines %	Pink bollworm larvae %
1.	Shaheed Benazirabad	Bt.	150	4	2	2.67	1.33
2.	Nauosharoferoze	Bt.	130	3	1	2.31	0.77
3.	Sanghar	Bt.	150	4	2	2.67	1.33
4.	Sukkur	Bt.	140	3	1	2.14	0.71
5.	Ghotki	Bt.	200	7	2	3.5	1.0
6.	Khairpur	Bt.	150	5	2	3.33	1.33
7.	Hyderabad	Bt.	160	6	2	3.75	1.25
8.	Umerkot	Bt.	200	12	6	6.0	3.0
9.	Mirpurkhas	Bt.	200	9	4	4.5	2.0
10.	Badin	Bt.	130	3	1	2.31	0.77
11.	Matiyari	Bt.	130	3	1	2.31	0.77
12.	Tando M. Khan	Bt.	150	6	2	4.0	1.33

Similarly, the same studies were conducted on the pink bollworm infestation in Punjab province. During a survey conducted to assess the attack of pink bollworm, a large number of bolls of Bt. and non Bt. varieties were found with mines but there was no indication of pink bollworm larvae (CCRIM, 2011).

Table 3: Field survey report on pink bollworm and their predators in different districts of nara belt area, sindh province during October, 2013

Sr. No.	Name of Districts	Pink Bollworm	
		Damage %	Larvae %
1.	Sanghar	11.00	3.16
2.	Khairpur	7.14	1.75
3.	Sukkur	8.06	1.76
Average		**8.73**	**2.22**

The survey was conducted on the complaint of small growers of Nara Belt area of Districts of Sindh during 2013-14. The results indicated that maximum pink bollworm damage% was 11.00% in district Sanghar, followed by Sukkur (8.06%) and Khairpur (7.1%) respectively. However, maximum pink bollworm live% was 3.16% in district Sanghar, followed by Sukkur (1.76%) and Khairpur (1.75%).

Pink bollworm population recorded in approved Bt. varieties Trial at CRI-Sakrand during 2013-14

The results show (Table 3) that pink bollworm damage% was low on all seven Bt. varieties, which were cultivated at CCRI-Sakrand farm. The maximum damage was (1.50%) recorded in NIBGE IR-3701 and minimum 0.50% in FH-113. The pink bollworm live larvae (0.50%) were recorded in NIBGE IR-3701 and no live larvae were recorded on other Bt. varieties. Overall results shows pink bollworm attack was low on Bt. varieties and small farmers should cultivate the certified Bt. varieties in Sindh. Similarly, (Hardee *et al*. 2001) reported that adoption of Bt. may result in a more efficient enterprise, while maintaining a high level of insect pest control. In this case if Bt. is adopted it will control the insects being a resistant variety. However, (Pemsl *et al*. 2005) reported that Bt. toxin also protects the pink bollworm which builds up affect the cotton crop.

Table 4: Pink bollworm population recorded in approved Bt. varieties Trial at CCRI-Sakrand during 2013-14

Variety	Pink Bollworm Damage %	Pink bollworm Live larvae %
Neelum-121	0.00	0.00
MG-6	0.00	0.00
NIBGE IR-3701	1.50	0.50
NIBGE IR-1524	0.00	0.00
FH-901	0.00	0.00
FH-113	0.50	0.00
Ali Akbar-802	0.00	0.00

Climatic conditions in Sindh

The considerable infestation of pink boll worm may depend on higher temperature and relative humidity during the month of October. Our climatic data showed (Table 5a & Table 5b) that mean highest temperature (36.5^{o}C) and mean relative humidity (55%) during 2013 increased the moth population of pink bollworm (Table 1). Present results supported the findings of Chaudhary *et al.* (1999) and Guirguis *et al*. (1999) who also reported that maximum population of Pink bollworm observed during October, when the temperature ranges 25.0-35.0 ^{o}C and relative humidity ranges from 45.0-55.0% and there was no rain fall. While in 2009-10 relative humidity was high but mean maximum and minimum temperature was low that supported the population in Pakistan due to sudden change in climatic conditions in the month of October was low and infestation of pink bollworm observed less. However, rise in temperature and humidity increased the problem of pink bollworm. Similarly, (Jha and Bisen, 1999) recorded that seasonal incidence of pink bollworm was largely influenced by the weather factors.

Table 5a: Average monthly mean of Temperature of last five years

Month	Average Maximum and Minimum Temperature (^{o}C)									
	2009		2010		2011		2012		2013	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Jan.	21.5	7.0	22.8	5.3	21.3	6.7	22.0	6.0	23.6	5.4
Feb.	26.4	9.8	26.2	6.7	24.9	11.8	24.0	7.0	25.3	9.4
Mar.	32.6	14.7	25.1	15.4	32.0	16.2	32.0	14.0	33.1	13.6
Apr.	38.4	18.7	41.6	21.0	37.3	20.0	37.0	20.0	36.8	19.5
May	43.8	24.0	45.3	28.0	43.3	26.0	42.6	24.0	43.4	23.4
June	41.1	24.6	40.6	27.4	43.2	28.0	43.0	26.0	40.8	25.7
July	38.5	24.9	38.6	28.1	39.1	26.9	40.0	26.0	39.6	25.5
Aug.	37.5	24.1	35.7	27.2	35.4	25.5	38.0	25.0	36.7	23.2
Sept.	38.7	21.1	34.3	25.1	33.3	24.3	35.0	22.0	37.3	21.7
Oct.	35.2	15.7	35.7	21.9	34.9	19.1	34.9	19.1	36.5	19.5
Nov.	28.7	10.3	29.1	14.9	31.4	17.0	31.0	12.0	29.9	11.0
Dec.	24.0	6.8	23.2	7.5	24.0	9.2	24.8	7.6	24.4	7.0

Table 5b: Average monthly mean of Relative/ Humidity% of last five years

Month	Mean Relative Humidity (%)				
	2009	2010	2011	2012	2013
Jan.	72.1	71.4	60.0	59.0	57.0
Feb.	65.4	67.3	59.6	48.0	55.5
Mar.	54.4	53.6	51.5	44.0	42.7
Apr.	36.7	41.3	40.2	40.2	38.8
May	43.1	46.1	51.5	38.0	32.2
June	53.6	57.8	45.5	43.0	50.8
July	63.7	65.7	58.2	52.0	59.5
Aug.	66.3	73.8	69.9	56.0	64.1
Sept.	65.8	75.6	75.9	67.0	61.7
Oct.	58.7	55.9	52.8	52.8	55.0
Nov.	58.6	52.7	59.1	54.0	54.5
Dec.	64.7	55.3	57.0	53.5	57.6

Table 5c: Average monthly mean of Rain fall in Sindh during last five years

Month	Rainfall (mm)				
	2009	2010	2011	2012	2013
Jan.	19.0	-	-	-	-
Feb.	0.2	-	17.0	-	38.0
Mar.	5.0	-	-	-	-
Apr.	-	-	-	-	-
May	-	-	-	-	-
June	-	45.2	-	-	22.0
July	90.0	136.2	30.0	-	-
Aug.	10.0	72.0	255.0	-	10.0
Sept.	2.0	50.0	253.0	194.0	9.0
Oct.	-	-	-		16.0
Nov.	-	-	-	-	-
Dec.	3.0	-	-	-	-

Training/ Seminars conducted by CCRI Sakrand for cotton growers of different areas of Sindh

Data presented in (Table 6) shows that during trainings growers took eager attention especially on IPM and specially control of pink boll worms through novel methods. Farmers were facilitated through proper management strategies for the control of pink boll worm. During training seminars growers told that they were used their own seed for sowing of the crop. Scientific officer from Entomology section apprised them to avoid the use of their own old cotton seed. They were advised to purchase and use government certified cotton seed.

Table 6: Training/Seminars conducted by CCRI Sakrand to cotton growers of different growing areas of Sindh Pakistan during the 2014-15

Training	Date	Village/Location
Cotton Production Technology for small farmers	March 05, 2014	Village Mohammad Siddique Sand, Tando Allahyar
Cotton Production Technology for small farmers	March 06, 2014	Village Mohammad Hussain Kalroo, Tando Allahyar
Cotton Production Technology for small farmers	March 10, 2014	Nadeem Shah Farm Matiary
Cotton Production Technology for small farmers	March 11, 2014	Village Panjmoror Matiary
Cotton Production Technology for small farmers	March 12, 2014	Village Mir Manzoor Talpur, Sanghar
Cotton Production Technology for small farmers	March 13, 2014	Village Ghulam Mohammad Laghari, Sanghar
Cotton Production Technology for small farmers	March 17, 2014	CCRI, Sakrand
Cotton Production Technology for small farmers	March 18, 2014	Village Karam Jamali, Pir Staff, Nawabshah
Cotton Production Technology for small farmers	March 19, 2014	Village Dr. Ghulam Sarwar Bughio, Moro
Cotton Production Technology for small farmers	March 20, 2014	Village Jalbani, Bhiria N. Feroze
Cotton Production Technology for small farmers	March 21, 2014	Village Dr. Wazir Phul, Sui Gas, Khairpur
Cotton Production Technology for small farmers	March 25, 2014	Village Jiskani, Khairpur
Cotton Production Technology for small farmers	March 26, 2014	Village Janogi, Saleh Pat, Sukkur
Cotton Production Technology for small farmers	March 27, 2014	Village Khosa, Rohri, Sukkar
Cotton Production Technology for small farmers	March 28, 2014	Village Unar, Mirpur Mathelo
Cotton Production Technology for small farmers	March 29, 2014	Village Ghota, CRS Ghotki
Cotton Production Technology for small farmers	February 17, 2014	Village Shair Khan Lund, Mirpur Bathoro, district Sujawal/Thatta
Cotton Production Technology for small farmers	February 18, 2014	Village Muhammad Hashim Tagar, Taluka Darro, district Sujawal/Thatta,
Cotton Production Technology for small farmers	February 19, 2014	Village Haji Mahi Khaskheli, Matli, district Badin
Cotton Production Technology for small farmers	February 19, 2014	Village Haji Mahi Khaskheli, Matli district Badin
Cotton Production Technology for small farmers	February 20, 2014	Ghulab Leghari, Taluka Matli, district Badin
Cotton Production Technology for small farmers	February 24, 2014	Mirpurkhas
Cotton Production Technology for small farmers	February 25, 2014	Village Yar Muhammad Baloach, District MirpurKhas
Cotton Production Technology for small farmers	February 26, 2014	Village Syed Noor Ali Shah, District, Umerkot

CONCLUSIONS

- Pakistan has adopted transgenic cotton (Bollguard II) over the area of about 86%.
- The pink bollworm moth population cached less numbers in pheromome traps at CCRI-Sakrand farm.
- The Pink bollworm infestation was negligible on NIBGE IR-1524 Bt. variety; other Bt. varieties were free from infestation.
- Pink boll worm infestation and larvae survival% in left over bolls were less which was collected from Bt. Varieties sown at grower fields of different districts of Sindh.
- The pink bollworm infestation was recorded during survey on cotton of Nara Belt areas. Which was due to sown of own old cotton seed and un-approved/certified from local dealers.
- In Pakistan mostly small growers of cotton are more they have less/knowledge of modern techniques, therefore training/seminars were arranged for their awareness and they took interest in training seminars and appreciated the awareness program started by Pakistan Central Cotton Committee's, Central Cotton Research Institute Sakrand sponsoring by Ministry of Textile Industry, Government of Pakistan.

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