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Monitoring of Pink Bollworm, *Pectinophora gossypiella* (Saund.) throughout the Cropping Season by Gossyplure

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ABSTRACT: Pink bollworm is the most serious and destructive cotton pest, causing locule damage to the tune of 55% and a reduction in seed cotton yield ranging from 35% to 90%. (Narayanan, 1962). This pest must be monitored on a regular basis in order to gain insight into seasonal population fluctuations and achieve effective control. Pesticides are widely used as a major weapon in the fight against this pest damage. In India, total insecticides used to control bollworms alone were 9410 MT in 2003-04, valued at 747.6 crores (Kranthi, 2012). Despite consuming such a high percentage of pesticides, pink bollworm pressure could not be controlled and instead worsened the situation by becoming resistant to both Bt toxins and major insecticides. It is now necessary to switch from conventional management methods to cutting-edge, economical, and environmentally friendly pheromone-based techniques to combat PBW in Bt cotton. Considering all those things in view an experiment was undertaken at the cotton research unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, (Maharashtra) for two years (2019-20 and 2020-21). During the year 2019-20 a sudden increase in the number of moth trap catches was witnessed during December's second fortnight (corresponding to 52nd SMW / first cotton picking) *i.e.* 341 moth/ trap/ fortnight and continued at a high level till the end of February's first fortnight (corresponding to 7th SMW/second and third cotton picking). Thereafter the moth trap catches showed a gradual decrease in number in subsequent months. Similarly, the pink bollworm moth trap catches recorded during the second (2020-21) year were found marginally greater than in the first year and began earlier. The number of PBW moth trap catches increased gradually reaching its peak during the December's first fortnight (corresponding to 50th SMW/peak boll bursting) *i.e.* 376.4 moth/ trap/ fortnight and thereafter gradually declined.

Keywords: Pink bollworm, *Pectinophora gossypiella,* gossyplure, monitoring, pheromone trap.

INTRODUCTION

The pink bollworm *Pectinophora gossypiella* (Saunders) (Lepidoptera: Gelechiidae) is one of the most important cotton pests, causing maximum seed cotton loss in quantity and quality throughout the world's cotton-growing areas (Pearson, 1958). PBW is emerging as a serious pest, and its activity is observed for a brief period beginning in January and ending in April. In recent years, the pest has been frequently observed during early flowering. The PBW larvae enter the fruiting body shortly after emergence. As a result, farmers are completely unaware of the damage caused by PBW until the boll opens, and thus cannot employ any pest-specific control measures.

Since the damage and stages of pink bollworm are not visible – therefore it is necessary to monitor pink bollworm infestation on the crop, during the cropping season. This can be done easily through the use of gossyplure pheromone baited traps that attract the males. Sex pheromone gossyplure is an effective attractant for male moths of pink bollworm and can be used successfully for mass trapping, monitoring seasonal emergence, to work out the peak periods of bollworms and their correlation with weather parameters. This will facilitate the proper timing of insecticidal spray and other control measures for the management of bollworms. Results in a substantial reduction in the number of pesticide applications required for the control of bollworms during the cotton growing season. Pheromone traps are frequently used at low densities for monitoring purposes, and it is well known that trapping doesn't significantly reduce a pest's population or the severity of its damage. These two features set the idea of mass trapping with pheromone compounds apart. The key elements of mass trapping are placing a high density of traps in the crop that needs to be protected and achieving some level of control by removing an adequate high proportion of individuals from the population.

To reduce the number of adults available for mating, control the population, and postpone the development of the next generation, mass trapping techniques are used in the field to capture males of newly emerged moths. For mass trapping of PBW, it is advised to install at least 20 traps per hectare and to reap the full benefits, it is best to do so two weeks prior to the first flowering, as this lowers the likelihood that first-generation larvae will establish themselves in the flowers. For a better outcome, pheromone septa must be changed on a regular basis and the traps must be kept in place until the last cotton is picked.

MATERIALS AND METHOD

For Monitoring of pink bollworm, throughout the cropping season, "Pherosensor sleeve" traps baited with gossyplure were used. These rubber septa were impregnated with gossyplure (Cis-7, cis-11-Hexadecadien-1-yl acetate). At the experimental farm of Cotton research unit, Dr. PDKV Akola in one-acre area five such traps were installed at 1-2 feet height above the plant depending on the crop stage. The traps were rebaited at 30 days intervals to maintain them at full catching efficiency. The observation on PBW moth trap catches was recorded at fortnight intervals from June (corresponding to 23rd SMW / crop initiation) till March (corresponding to 11th SMW / crop uprooting) during both the years 2019-20 and 2020-21.

RESULTS AND DISCUSSION

During the year 2019-20, the PBW moth trap catches were recorded in the experimental form of cotton research unit revealed that the PBW moth trap catches started from the June third week (corresponding to 24th SMW / crop initiation) *i.e.* 5.4 moth/trap/fortnight. The build-up in the number of PBW moth trap catches was more or less steady till the October first fortnight (corresponding to 42nd SMW / green boll full maturity), thereafter there was a gradual increase in number of moth trap catches observed from October second fortnight to December first fortnight (corresponding to 44th to 50th SMW/ boll bursting). A sudden increase in the number of moth trap catches was witnessed during December's second fortnight (corresponding to 52nd SMW / first cotton picking) *i.e.* 341.0 moth/trap/fortnight and continued at a high level till the end of February's first fortnight (corresponding to 7th SMW / second and third cotton picking). Thereafter the moth trap catches showed a gradual decrease in number in subsequent months.

The data recorded during the year 2020-21 showed that PBW moth trap catches began from the June second week (corresponding to 23rd SMW/ crop initiation) *i.e.* 6.8 moth/trap/fortnight. The number of PBW moth trap catches increased gradually reaching its peak during the December first fortnight (corresponding to 50th SMW / peak boll bursting) *i.e.* 376.4 moth/ trap/ fortnight and thereafter PBW moth trap catches gradually declined. The pink bollworm moth trap catches recorded during the second year was found marginally greater than in the first year PBW moth trap catches.

The Pooled analysis of data (Table 1) did not deviate from the previous two year's results and revealed that the PBW moth trap catches started from the June third week (corresponding to 24th SMW / crop initiation) *i.e.* 6.1 moth/trap/fortnight. The build-up in number of PBW moth trap catches was more or less steady till the October first fortnight (corresponding to 42nd SMW / green boll full maturity), thereafter there was a gradual increase in the number of moth trap catches observed from October second fortnight to December first fortnight (corresponding to 44th to 50th SMW/ boll bursting). A sudden increase in the number of moth trap catches was witnessed during December's second fortnight (corresponding to 52nd SMW / first cotton picking) *i.e.* 352.5 moths/trap/ fortnight and continued at a high level till the end of February's first fortnight (corresponding to 7th SMW / second and third cotton picking). Thereafter the moth trap catches showed a gradual decrease in number in subsequent months.

These results are in accordance with the findings of Sandhya Rani *et al.* (2010), who reported that the incidence of PBW moth trap catches began in September and remained relatively stable until the second week of November corresponding to the 45th SMW (8.2 moths/trap), after which there was a gradual increase in PBW moth trap catches from the third week of November corresponding to 46th SMW (26.44 moths/trap) to the second week of December corresponding to 49th SMW (44.52 moths/trap).

Similarly, Qureshi *et al.* (1984) discovered that the pink bollworm moth population remained active throughout the year, with a low population during the hot summer months of May to July in Pakistan's Sindh region. From May to September, the moth population was drastically reduced, and it began to increase again in October, reaching a peak in October. In both cotton growing seasons, there were two distinct moth population peaks: one in March/April and a larger one in October.

Moreover, the present findings are also supported by work carried out by earlier workers like Dhawan and Sidhu (1984); Cividanes (1989); Gupta *et al.* (1990), Michel and Gomez (1992); Korta and Lingappa (1996); Naik *et al*. (1996); De Melo *et al.* (2012); Ramesh Babu and Meghwal (2014); Khuhro *et al.* (2015); Sharma *et al*. (2015).

Table 1: Experimental Details.

1	Type of experiment	Field Experiment
2	Test insect	*Pectinophora gossypiella* (Saunders) (Lepidoptera: Gelechidae)
3	Period of observation recorded	From June (corresponding to 23rd SMW/ crop initiation) to March (corresponding to 11th SMW/ crop uprooting) during 2019-20 and 2020-21.
4	The cotton field selected for observation recording	Experimental farm of Cotton Research Unit (CRU)

Table 2: Pink bollworm moth catches per trap at fortnight intervals during 2019-20, 2020-21, and Pooled.

Fortnight	Average pink bollworm moth catches per trap at fortnight interval		
	2019-20	2020-21	Pooled
June 1st	5.4 (2.28)	6.8 (2.6)	6.1 (2.46)
June 2nd	7.0 (2.63)	8.2 (2.84)	7.6 (2.75)
July 1st	8.8 (2.94)	9.6 (3.07)	9.2 (3.01)
July 2nd	10.6 (3.22)	11.4 (3.33)	11.0 (3.28)
Aug 1st	12.0 (3.41)	13.6 (3.69)	12.8 (3.56)
Aug 2nd	14.6 (3.81)	15.8 (3.97)	15.2 (3.89)
Sept 1st	16.8 (4.08)	19.8 (4.44)	18.3 (4.26)
Sept 2nd	22.4 (4.69)	24.6 (4.95)	23.5 (4.84)
Oct 1st (42nd SMW)	30.4 (5.50)	33.2 (5.75)	31.8 (5.63)
Oct 2nd (44th SMW)	87.0 (9.32)	122.8 (11.08)	104.9 (10.24)
Nov 1st	123.8 (11.12)	146.6 (12.1)	135.2 (11.62)
Nov 2nd	235.2 (15.23)	324.8 (17.96)	280.0 (16.72)
Dec 1st (50th SMW)	281.8 (16.78)	376.4 (19.35)	329.1 (18.12)
Dec 2nd (52nd SMW)	341.0 (18.42)	364.0 (19.02)	352.5 (18.75)
Jan 1st (3rd SMW)	313.2 (17.65)	359.0 (18.93)	336.1 (18.33)
Jan 2nd	295.2 (17.15)	326 (18.03)	310.6 (17.62)
Feb 1st (7th SMW)	212.8 (14.55)	267.0 (16.33)	239.9 (15.47)
Feb 2nd	186.0 (13.61)	186.0 (13.64)	186.0 (13.63)
Mar 1st	62.2 (7.85)	106.0 (10.21)	84.1 (9.15)
Seasonal mean	119.27 (9.17)	143.24 (10.06)	131.25 (9.64)

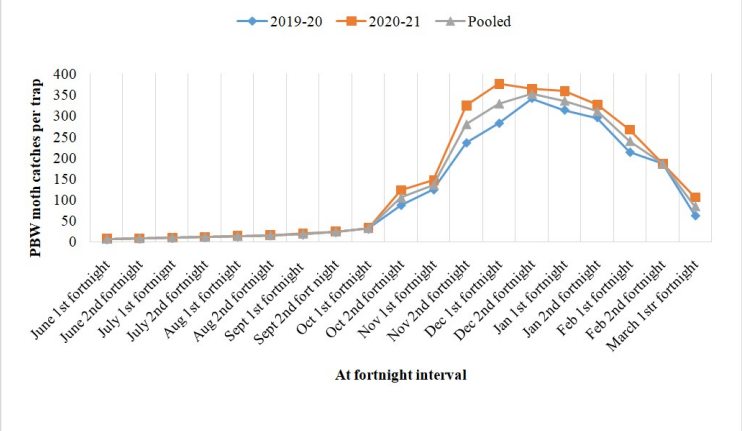

Fig. 1. Pink bollworm moth trap catches during 2019-20, 2020-21 and pooled.

CONCLUSION

While monitoring pink bollworm moth catches during both the year, the PBW moth trap catches registered from June 1st fortnight (corresponding to crop sowing), thereafter its population increased gradually and reached its peak during December – January (corresponding to peak boll bursting and cotton picking) and then after declined.

FUTURE SCOPE

The current study has gathered year-round information on PBW moth trap catches and aids in better-informing cotton growers about the level of pink bollworm infestation, its peak period of emergence, the extent of damage, and the crucial stage for implementing management practices against this pest.

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Conflict of interest. None.

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