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Evaluation of solar light trap against pink bollworm, *Pectinophora gossypiella* (Saunders) in *Bt* cotton

NK Bhute, YK Pathan and SA Gaikwad

Abstract
The present study entitled, "Evaluation of solar light trap against pink bollworm, *Pectinophora gossypiella* (Saunders) in *Bt* cotton" carried out during *Kharif* 2020. Light trap play important role in field sampling, monitoring, capturing, killing and biodiversity studies of nocturnal insect population. Solar light trap was used in cotton field during *Kharif* 2020 against pink bollworm. Effect of light trap assessed by daily night collection. Results indicated that the adult trap catch of pink bollworm started from 38th meteorological week and its ranged from 4.85 to 140.57 moths per night. The adult trap catch of pink bollworm increased gradually to its first peak with highest trap catch in the last week of November (47th SMW) (140.57 moths per week) and thereafter gradually decreases till the last week of December.

Keywords: pink bollworm, *Pectinophora gossypiella* (Saunders), light trap, *Bt*, cotton

Introduction
Cotton is a key fiber crop grown in more than seventy nations throughout the world. Cotton is a significant crop in the world's economic, political, and social concerns. Cotton is a member of the Malvaceae family and the genus *Gossypium*. It is popularly known as "White Gold" and "Friendly Fiber." Global 2019-2020 cotton area, production and productivity were 34.50 million hectares (85.50 million acres), 121 million bales and 791 Kg/ha (Anonymous, 2020a) [4]. India occupies 37.56% of world cotton area and produces 24.26% of world cotton production and stands tall. In India during 2019-2020 the area, production and productivity of cotton were 125.84 lakh hectares, 360 lakh bales of 170 Kg and 486 Kg lint/ha respectively (Anonymous, 2020b) [5]. Exports of cotton yarn, thread, textiles, and apparels bring in between $12 and $14 billion in foreign exchange each year for India. India's domestic and international trade is projected to be worth (Rs. 15,000 crores) 30 US $ billion dollars every year (Anonymous, 2015) [3]. Cotton exports generate around Rs 76,000 crores in foreign exchange earnings, accounting for one-third of our country's overall foreign exchange earnings (Anonymous, 2007) [2].

Pink bollworm *Pectinophora gossypiella* (Saunders) (Lepidoptera: Gelechidae) is a major cotton pest that burrows into cotton bolls to feed on the seed. W.W.Saunders described the pink bollworm *Pectinophora gossypiella* (Saunders) in 1843 as *Depressaria gossypiella* from specimens found harming cotton in India in 1842 (Ingram 1994) [6]. Eggs are laid in sheltered areas of the plant, such as the axis of petioles or peduncles, the underside of new leaves and on buds or flowers, early in the season. When the bolls are 15 days old, these become the preferred oviposition locations for adults. The first two larval instar are white, but the third and fourth instar are pink. In recent years severe damage to bolls by pink bollworm and yield losses were observed in *Bt* cotton in many regions of Gujarat and some parts of Andhra Pradesh, Telangana and Maharashtra (Kranthi, 2015) [8]. Maharashtra is also having more than 90% area under *Bt* cotton genotype.

Light traps are simple interception devices that attract and capture insects travelling through an area and are used for broad insect diversity surveys. Light trap became widely used in Integrated Pest Management techniques in various parts of the world when the concepts of Integrated Pest Management and Economic Threshold were introduced in 1975, as well as the resurgence of non-chemical pest control approaches. There was a sense of urgency to employ a non-chemical strategy to pest control that was both commercially viable and environmentally safe. The use of light traps is one method of pest management that does not require the use of insecticides (Vaishampayan and Vaishampayan, 2016) [9]. Therefore, present study was designed to check the effectiveness of solar light trap against pink bollworm in *BT* cotton.

Materials and Method

Experimental details

This experiment was carried out in black cotton soil at Cotton Improvement Project, Mahatma Phule Krishi Vidyapeeth, Rahuri during *Kharif* 2020. The seeds of *Bt* cotton hybrid Ajeet-155 were sown 90 cm x 90 cm between rows and plant respectively, crop was raised as per recommended agronomical practices and following observation were recorded.

Trap Installation/ Operation Details

The solar light trap was installed in the centre of cotton field. The trap was automatic on with light detector sensor during night hours and automatic off during day hours. It was provided with high quality solar panel for efficient power harvesting from solar along with high quality UV LED lamp to attract the pests.

Method of Recording Observation

The observations on the number of pink bollworm moths trapped and the beneficial insects trapped in the solar light trap were sorted out, identified and counted. The count of pink bollworm moths and beneficial insects were taken daily from installation of the trap till the harvest of the crop.

Results and Discussion

Light traps are the important component of Integrated Pest Management against various crop pest. These traps only attract the adult stage of different insects. So these traps are indirectly important to reduce adult population in the field thus suppresses the larval population of various pests. During current studies main focus was to attract pink bollworm and evaluate the solar light trap against pink bollworm. 3 species of beneficial insects were attracted through light trap. The species of beneficial insects were attracted through light trap was lady bird beetle, spider and chrysopa.

Pink Bollworm Moths Trapped/Night

The solar light trap will be installed in the centre of cotton field. The observation on moth catches start from the date of installation of trap till the last week of December. The moth catches were recorded and presented meteorological week wise in Table 1. and Fig. 1.

The adult trap catch of pink bollworm started from 38th meteorological week and its ranged from 4.85 to 140.57 moths per night. The adult trap catch of pink bollworm increased gradually to its first peak with highest trap catch in the last week of November (47th SMW) (140.57 moths per night) and thereafter gradually decreases till the last week of December.

Abbas *et al.* (2019) [1] reported that insects attracted towards light trap mainly belong to order Lepidoptera, Hemiptera and Coleoptera. Kalola *et al.* (2017) [7] reported that the incidence of *P. gossypiella* started from 37th SMW, gradually increased and reached at peak during 5th SMW.

Beneficial Insects

Lady bird beetle

Table 1 and Fig. 2 show that the adult trap catch of lady bird beetle started from 38th SMW and its ranged from 0.57 to 3.71 lady bird beetle per night. The highest trap catch of lady bird beetle in the 39th SMW (3.71 lady bird beetle per night). The second highest catch of lady bird beetle was in the 45th SMW (3.28 lady bird beetle per night).

Abbas *et al.* (2019) [1] reported that four natural enemies of different pest were attracted towards light trap of which Lady bird beetle had 174 captures during study year.

Spider

Table 1 Fig. 2 show that the adult trap catch of spider started from 38th SMW and its ranged from 0.28 to 3.14 spider per night. The highest trap catch of spider in the 38th SMW (3.14 spider per night). The second highest catch of spider was in the 44th SMW (2.28 spider per night).

Chrysopa

Table 1 Fig. 2 show that the adult trap catch of chrysopa started from 38th meteorological week and its ranged from 0.28 to 1.42 chrysopa per night. The highest trap catch of chrysopa in the 38th SMW (1.42 chrysopa per night).

Abbas *et al.* (2019) [1] reported that four natural enemies of different pest were attracted towards light trap of which *Chrysoperla carnea* had maximum 529 captures during study year.

Table 1: Evaluation of solar light trap against pink bollworm

SMW	Duration	PBW moth/ Night	PBW moth/ Week	Lady bird beetle/ Night	Spider/ Night	Chrysopa/ Night
31	30-05 Aug	0.00	0.00	0.00	0.00	0.00
32	06-12 Aug.	0.00	0.00	0.00	0.00	0.00
33	13-19 Aug.	0.00	0.00	0.00	0.00	0.00
34	20-26 Aug.	0.00	0.00	0.00	0.00	0.00
35	27-02 Sept.	0.00	0.00	0.00	0.00	0.00
36	03-09 Sept	0.00	0.00	0.00	0.00	0.00
37	10-16 Sept.	0.00	0.00	0.00	0.00	0.00
38	17-23 Sept.	4.85	34	2.14	3.14	1.42
39	24-30 Sept.	5.71	40	3.71	2.28	1.14
40	01-07 Oct.	12.42	87	2.85	1.85	0.85
41	08-14 Oct.	21.14	148	2.71	1.71	0.85
42	15-21 Oct.	96.57	676	2.42	1.57	0.71
43	22-28 Oct.	100.71	705	2.28	1.42	0.57
44	29-04 Nov.	72.28	506	2.14	2.28	0.42
45	05-11 Nov.	100.14	701	3.28	2.14	0.57
46	12-18 Nov	120.85	846	2.71	1.28	0.71
47	19-25 Nov.	140.57	984	2.57	0.85	0.57
48	26-02 Dec.	54.14	379	1.57	0.71	0.42

49	03-09 Dec.	40.00	280	1.14	0.57	0.28
50	10-16 Dec.	51.85	363	0.85	0.42	0.00
51	17-23 Dec.	16.14	113	0.71	0.42	0.28
52	24-31 Dec.	9.00	63	0.57	0.28	0.00

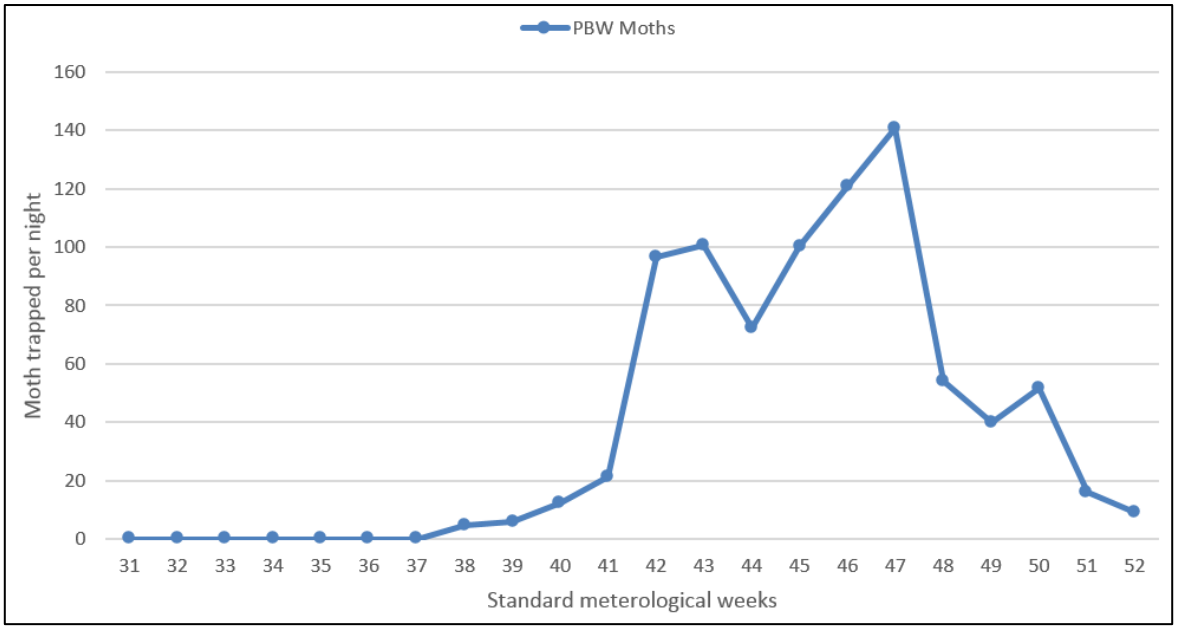

Fig 1: Evaluation of solar light trap against pink bollworm, *P. gossypiella* in *Bt* cotton

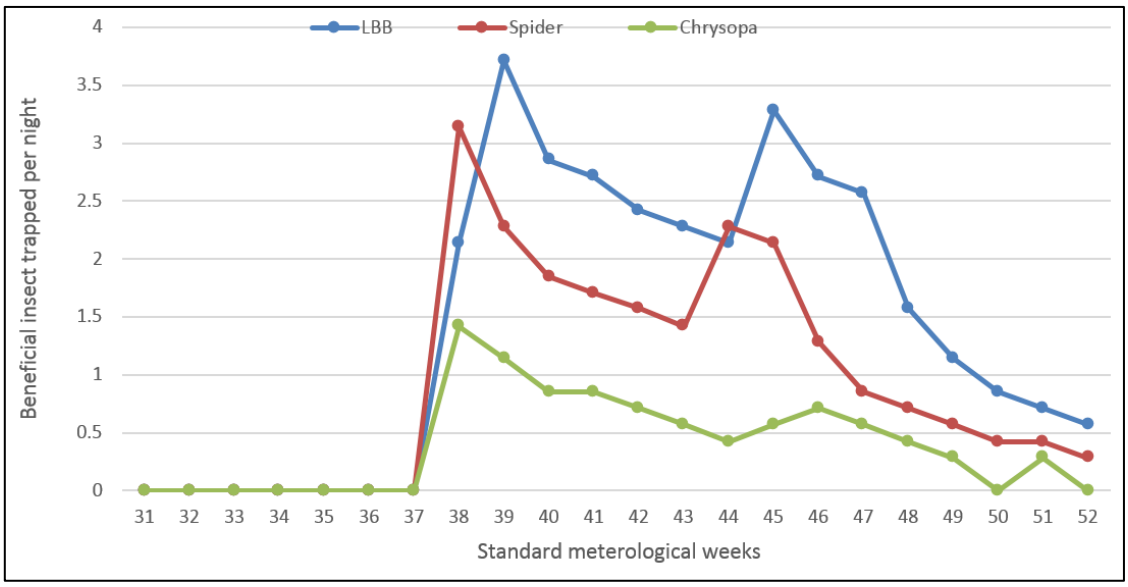

Fig 2: Evaluation of solar light trap against beneficial insects in *Bt* cotton

Conclusion

The seasonal activity of pink bollworm and beneficial insects on *Bt* cotton were observed in solar light trap catches operated in field regularly in considerable numbers from date of solar light trap installation to the last week of December. Two to three peaks were observed in general, showing period of highest and lowest activity both.

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