The Pharma Innovation

Kaneria PB
Department of Entomology,
Junagadh Agricultural
University, Junagadh, Gujarat,
India

Acharya MF
Department of Entomology,
Junagadh Agricultural
University, Junagadh, Gujarat,
India

Ghelani MK
Department of Entomology,
Junagadh Agricultural
University, Junagadh, Gujarat,
India

Baraiya KP
Senior Scientist and Head,
KVK, Junagadh Agricultural
University, Jamnagar,
Junagadh, Gujarat, India

Effectiveness of sticky trap colors in trapping whitefly, *Bemisia tabaci* on *BT* cotton in Saurashtra conditions, Gujarat, India

Kaneria PB, Acharya MF, Ghelani MK and Baraiya KP

Abstract
The experiment was carried out during *Kharif,* 2020 and 2021 at Cotton Research Station, Junagadh Agricultural University, Gujarat, India. In case of August, the result indicated that the yellow sticky trap was found highly significant among other treatments. The next best treatments were a dark green sticky trap, light green sticky trap and orange sticky trap, which were at par with each other. For September, the yellow sticky trap was found significant among all the other treatments and it was found at par with the dark green sticky trap, light green sticky trap, orange sticky trap and light blue sticky trap. A close perusal of the pooled data on whitefly trapping revealed that the yellow sticky trap was found significant and it was at par with light green sticky trap, orange sticky trap and dark green sticky trap in October. While the pooled data on whitefly trapping on yellow sticky trap recorded the most significant trapping among all the other treatments for November and it was on par with the dark green sticky trap. The next best treatments were a light green sticky trap, orange sticky trap and dark blue sticky trap, which were also at par with each other. The next best treatments were an orange sticky trap, light green sticky trap and dark green sticky trap, which were also at par with each other in December.

Keywords: Cotton, *BT*, Whitefly, *Bemisia tabaci*, Colour trap

Introduction

Cotton, which has been reputed as the king of fibre, is one of the momentous and important cash crops exercising a profound influence on the economics and social affairs of the world. In India, the cotton crop is grown over an area of 120.69 lakh ha with a production of 362.18 lakh bales and a productivity of 510kg/ha. A crop has a pride of place in the farming of Gujarat's Agriculture. The economy of the entire state is very much dependent on the success or failure of this cash crop. In Gujarat, the cotton crop is grown over an area of 22.55 lakh ha with a production of 80.96 lakh bales and a productivity of 610kg/ha (Anon, 2022) [1]. In India, approximately 160 species of insect pests have been reported to attack the cotton crop right from germination until the final harvesting of the cotton crop. Among these pests, few of them are considered major/key pests causing great per cent damage to cotton crops all over the country, which results in an annual loss of up to 20 to 80 per cent of the total production (Thakare *et al.*, 1983) [8]. Among the various insect pests listed above, aphid, Jassid, thrips and whitefly are the major sucking pests of cotton and limiting the profitable cultivation. The insect is attracted to some particular colour, and their different shades, the information can be utilized for management for their monitoring & mass trapping. So, it is necessary to see the impact of colour trap on whitefly population and information regarding this utility.

Material and methods

The experiment was carried out during *Kharif,* 2020 and 2021 at Cotton Research Station, Junagadh Agricultural University, Gujarat, India. The experimental detail and treatment were given below.

The experimental details

1.	Location	:	Cotton Research Station, JAU, Junagadh
2.	Season and Year	:	*Kharif,* 2020 and 2021
3.	Design	:	RBD (Randomize Block Design)
4.	Variety	:	G. Cot. Hy-8 BG-II
5.	Replication	:	3
6.	Fertilizer	:	240:50:150 NPK kg/ha
7.	Plot size	:	Gross: 6.3 x 6.0 m² Net: 5.40 x 3.60 m²
8.	Spacing	:	120 x 45 cm²
9.	Seed rate	:	2-2.5 kg /ha
10.	Treatment	:	7 (Details given below)

Corresponding Author:
Kaneria PB
Department of Entomology,
Junagadh Agricultural
University, Junagadh, Gujarat,
India

Treatment details

Sr. No	Treatment	RGB*codes	Number of traps
T1	Dark blue sticky trap	(0, 0, 139)	3
T2	Light blue sticky trap	(140, 126, 246)	3
T3	Yellow sticky trap	(255, 255, 0)	3
T4	Dark green sticky trap	(0, 100, 0)	3
T5	Light green sticky trap	(144, 240, 144)	3
T6	Orange sticky trap	(255, 165, 0)	3
T7	White sticky trap	(255, 255, 255)	3

*Note: It was the combination of these three colors in different proportions (Red, green, and blue)

Methodology

Seven sticky colour traps viz., dark blue, light blue, yellow, dark green, light green, orange and white of uniform A4 size were tested to determine the preference of colour to whiteflies in getting attracted (Plate 3). Each card was fixed into a metal frame, which was fixed in the field using a bamboo stick at the crop canopy level against the direction of the wind. Colorless and transparent insect trapping adhesive was uniformly applied as a thin layer on both surfaces of each colour card. The sticky trap was replaced after each observation. The whiteflies stuck on the glue of different colour cards were counted using a handheld magnifying lens.

Observations

The numbers of whiteflies/sticky traps were recorded at a weekly interval from the initiation of the pest until the harvesting of the crop.

Results

The experiment was conducted on the effectiveness of sticky trap colour in trapping adult whitefly, *B. tabaci* at the Cotton Research Station, infesting cotton and activity of whitefly was recorded at weekly intervals from 32th SMW up to crop maturity during two consecutive *Kharif* seasons, 2020 and 2021. Here, different seven colors were evaluated against the whitefly for trapping at the weekly interval and then data was converted into different monthly bases.

The pooled data in Table 1 and depicted in Fig. 1 indicated that all the treatments showed significant differences while trapping the whitefly. Based on the pooled data, the highest numbers of whitefly was trapped in the yellow sticky trap which showed 5.91, 23.90, 22.15, 7.16 and 2.55 for August, September, October, November and December, respectively and the highest number of whitefly 23.90 found during September month. The lowest numbers of whitefly were found in the white sticky trap to the tune of 2.44, 13.83, 10.18, 2.32 and 1.25 for August, September, October, November and December, respectively and that was the lowest during December month.

August

Result of pooled data (Table 1) showed that the yellow sticky trap was found highly significant among other treatments. The next best treatments were dark green sticky trap, light green sticky trap and orange sticky trap which were at par with each other. The descending order of different colour sticky traps based on whitefly trapping was: yellow sticky trap > dark green sticky trap > orange sticky trap > light green sticky trap > dark blue sticky trap > light blue sticky trap > white sticky trap.

September

The pooled data (Table 1) indicated that the yellow sticky trap was found significant among all the other treatments and it was found at par with the dark green sticky trap, light green sticky trap, orange sticky trap and light blue sticky trap. The descending order of different colour sticky traps based on whitefly trapping was; yellow sticky trap > orange sticky trap > dark green sticky trap > light green sticky trap > light blue sticky trap > dark blue sticky trap > white sticky trap.

October

A close perusal of the pooled data on whitefly trapping in (Table 1) revealed that yellow sticky trap was found significant and it was at par with light green sticky trap, orange sticky trap and dark green sticky trap. The descending order of different colour sticky trap based on whitefly trapping was; yellow sticky trap > light green sticky trap > orange sticky trap > dark green sticky trap > light blue sticky trap > dark blue sticky trap > white sticky trap.

Table 1: Effectiveness of sticky traps in trapping whitefly, *B. tabaci* on *BT* cotton

Tr. No	Details	August 2020-21	August 2021-22	August Pooled	September 2020-21	September 2021-22	September Pooled	October 2020-21	October 2021-22	October Pooled	November 2020-21	November 2021-22	November Pooled	December 2020-21	December 2021-22	December Pooled
1.	Dark blue sticky trap (0,0,139)*	1.33 (1.78)	2.07 (4.27)	1.70 (2.89)	3.89 (15.16)	4.10 (16.84)	4.00 (15.99)	3.39 (11.49)	3.56 (12.65)	3.47 (12.06)	2.21 (4.87)	2.13 (4.54)	2.17 (4.70)	1.26 (1.59)	1.15 (1.31)	1.20 (1.45)
2.	Light blue sticky trap (140,126,246)*	1.29 (1.66)	1.93 (3.74)	1.61 (2.59)	4.43 (19.60)	4.64 (21.53)	4.53 (20.55)	3.75 (14.06)	3.90 (15.21)	3.83 (14.63)	1.82 (3.32)	1.73 (2.98)	1.78 (3.15)	1.21 (1.46)	1.09 (1.20)	1.15 (1.32)
3.	Yellow sticky trap (255, 255,0)*	1.70 (2.88)	3.17 (10.03)	2.43 (5.91)	4.80 (23.01)	4.98 (24.80)	4.89 (23.90)	4.65 (21.59)	4.77 (22.72)	4.71 (22.15)	2.71 (7.33)	2.65 (7.00)	2.68 (7.16)	1.64 (2.69)	1.56 (2.42)	1.60 (2.55)
4.	Dark green sticky trap (0,100,0)*	1.52 (2.32)	2.60 (6.76)	2.06 (4.25)	4.70 (22.12)	4.89 (23.91)	4.80 (23.01)	4.35 (18.92)	4.48 (20.04)	4.41 (19.48)	2.50 (6.27)	2.43 (5.92)	2.47 (6.09)	1.41 (1.99)	1.31 (1.72)	1.36 (1.85)
5.	Light green sticky trap (144,240,144)*	1.48 (2.18)	2.47 (6.08)	1.97 (3.89)	4.70 (22.06)	4.88 (23.81)	4.79 (22.93)	4.43 (19.65)	4.56 (20.79)	4.50 (20.22)	2.43 (5.89)	2.36 (5.55)	2.39 (5.72)	1.43 (2.04)	1.33 (1.77)	1.38 (1.90)
6.	Orange sticky trap (255,165,0)*	1.49 (2.23)	2.53 (6.42)	2.01 (4.05)	4.72 (22.25)	4.90 (24.01)	4.81 (23.12)	4.40 (19.39)	4.53 (20.49)	4.47 (19.94)	2.42 (5.86)	2.35 (5.51)	2.38 (5.68)	1.46 (2.12)	1.36 (1.85)	1.41 (1.98)
7.	White sticky trap (255,255,255)*	1.26 (1.59)	1.87 (3.48)	1.56 (2.44)	3.60 (12.96)	3.84 (14.72)	3.72 (13.83)	3.10 (9.59)	3.28 (10.78)	3.19 (10.18)	1.58 (2.50)	1.47 (2.15)	1.52 (2.32)	1.18 (1.39)	1.06 (1.12)	1.12 (1.25)
	S.Em.±	0.07	0.06	0.05	0.18	0.19	0.13	0.24	0.23	0.17	0.12	0.11	0.09	0.07	0.08	0.05
	C.D. at 5 %	0.21	0.20	0.14	0.55	0.59	0.38	0.74	0.71	0.48	0.36	0.38	0.25	0.22	0.24	0.15
	C.V. %	8.26	7.30	7.77	7.01	7.26	7.14	10.32	9.56	9.94	9.05	9.97	9.51	9.14	10.57	9.83
	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	S.Em.±	-	-	0.03	-	-	0.07	-	-	0.09	-	-	0.05	-	-	0.03
	C.D. at 5 %	-	-	0.07	-	-	0.20	-	-	0.26	-	-	0.13	-	-	0.08
	YXT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

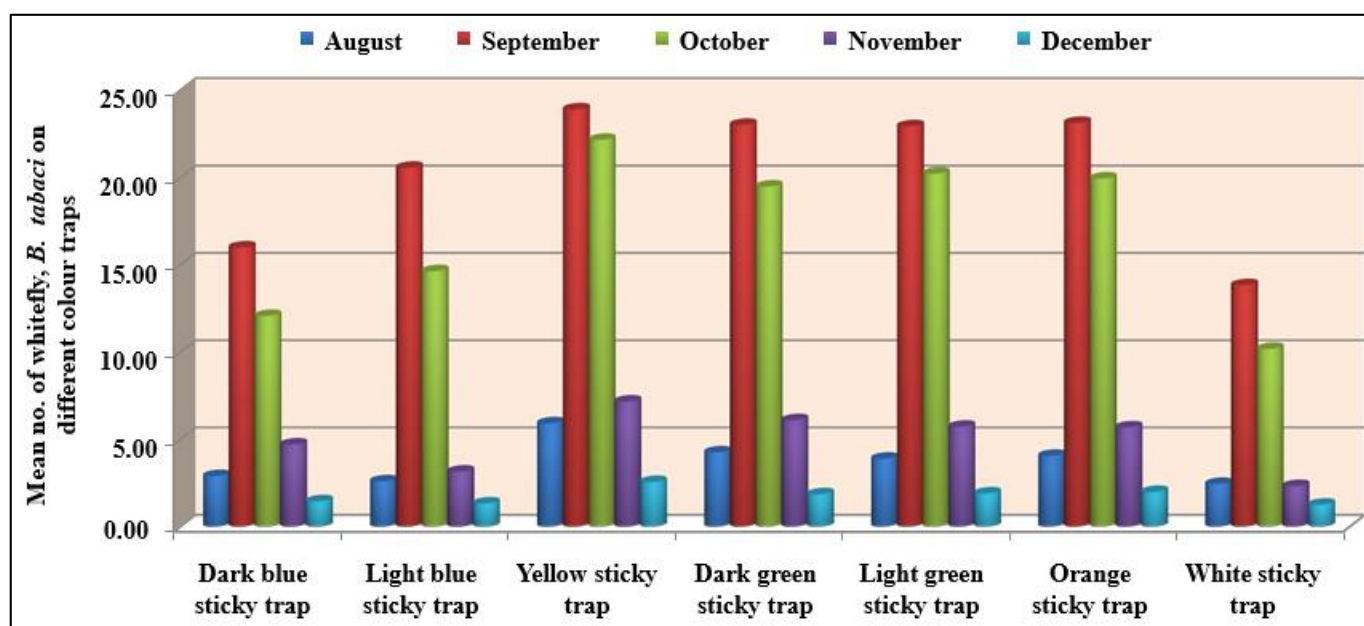|																
S.Em.±	-	-	0.07	-	-	0.19	-	-	0.23	-	-	0.12	-	-	0.07
C.D. at 5 %	-	-	NS	-	-	NS	-	-	NS	-	-	NS	-	-	NS

Fig 1: Effectiveness of sticky traps in trapping whitefly, *B. tabaci* on *BT* cotton (Pooled: 2020-21 & 2021-22)

November
Looking to the pooled data on whitefly trapping (Table 1) yellow sticky trap was recorded the significant trapping among all the other treatments and it was on par with dark green sticky trap. The next best treatments were light green sticky trap, orange sticky trap and dark blue sticky trap, which was also at par with each other. The descending orders of different colour sticky trap were; yellow sticky trap > dark green sticky trap > light green sticky trap > orange sticky trap > dark blue sticky trap > light blue sticky trap > white sticky trap.

December
The pooled data on whitefly trapping showed that (Table 1) the yellow sticky trap was found highly significant among all the other treatments. The next best treatments were an orange sticky trap, light green sticky trap and dark green sticky trap, which was also at par with each other. The descending orders of the different colour sticky traps were; yellow sticky trap > orange sticky trap > light green sticky trap > dark green sticky trap > dark blue sticky trap > light blue sticky trap > white sticky trap.
The present findings are in agreement with the Chu *et al.* (2000) [3], Hassan and Mohammed (2004) [4] who indicated that significantly more insect pests were trapped on fluorescent yellow as compared to other traps, whereas pink, green and orange colored traps caught a significantly lower number of insects and were found statistically similar. Idris *et al.* (2012) [5], Buragohain *et al.* (2017) [2], Murtaza *et al.* (2019) [7] and Lashari *et al.* (2021) [6] concluded that maximum number of whitefly (19.50±1.42days) was recorded on the yellow trap followed by green (6.90±0.62days) and blue sticky traps (5.40±0.42days), whereas the minimum was recorded on the red trap (0.50±0.16days) in all mustard varieties. So, the above results are more or less in line with our findings.

Discussion
In the case of both seasons, the incidence of the whitefly started at vegetative growth of crop which provides the congenial condition for the whitefly. Hence, the incidence started in August and peaked in September. The pest population declined slightly in October as the crop stage went into the reproductive phase. With the advancement of the crop towards maturity at the end of December, the vascular and parenchymatous tissue become harder making unfavorable conditions for whitefly, resulting in the drastic decline of this pest.

Conclusion
Considering the overall above result, yellow sticky trap was found most effective in trapping and attracting while fly which on par with dark green sticky trap, light green sticky trap and orange sticky trap. These can be used in IPM practices for monitoring and mass trapping the whitefly of *BT* cotton.

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