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Evaluation of Yellow Sticky Trap with Different Sticky Materials and Azadirachtin against Major Sucking Pest of Cotton

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Abstract The treatments yellow sticky trap with castor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L were found to be significantly most effective treatments in minimizing the infestation of sucking pest viz., aphid (6.48, 8.56/3 leaves/plant), leaf hopper (6.44, 7.32/3 leaves/plant), whitefly (1.42, 1.70/3 leaves/plant) and thrips (0.85, 0.95/3 leaves/plant) at 7 and 14 days after spray and in trapping maximum population of aphids (53.14, 12.06, 65.28), leaf hopper (2.36, 0.82, 3.18) and whitefly (29.07, 12.90, 41.97) per trap per week on NE, SW and BS direction together.

Keywords Yellow sticky trap, Castor oil, Cotton, Sucking insect pests, Azadirachtin.

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Introduction

Cotton is most important commercial crop in India known as "King of natural fiber" and world over commonly reffered as "White gold". The sucking pests viz. leaf hopper, *Amrasca biguttula biguttula* (Ishida), thrips, *Thrip stabaci* (Linnman), aphid, *Aphis gossypii* (Glover) and whitefly, *Bemisia tabaci* (Gennadius) are known to have occupied major pest status. Yield loss due to sucking pests estimated about 20-40% losses occur annually due to different pest of cotton [1]. Atakan and Canhilal [2] assessed that yellow sticky traps at 60, 80, 100 and 120 cm above ground level in various developmental stages of cotton. The leafhopper catches significantly higher at 60 cm than 80, 100 and 120 cm when plant heights were less than 80 cm. Numbers of whiteflies were highest at 60 cm and lowest at 120 cm trap heights at all plant heights. Some researchers have shown that sticky material rather than color, shape, height and size of traps were most important for the catching of some adult flying insects [13]. Karut and Kazak [4] studied that the trap captures were counted weekly mean (± SE) numbers of *B. tabaci* captured on traps were higher in no-choice (max. : 697.8 ± 55.6) compared with choice (max. : 533.3 ± 47.4). Yellow sticky traps significantly suppressed the population of adult whiteflies. In this work, we compared the relative trapping efficiency of yellow sticky traps at two heights and three sticky materials against cotton pests. This information will improve monitoring of these pests in cotton and en-

hance integrated pest management programs.

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Materials and Methods

The investigation was conducted in 1300 m^2 area at field of Agricultural Entomology, Dr. PDKV, Akola year 2013-2014. RCH 2 Bt variety of cotton was planted in twenty eightplots with a plot length of 5.4 m × 4.5 m each. Yellow sticky traps (rectangular shape coated with castor oil, reused motor oil and white grease as a sticky material) were placed horizontally at a height along crop canopy and 15 cm height above crop canopy in alone and combination with azadirachtin spray, while traps were tied on a wooden bamboosticks. Tin sheet colored with yellow paints were cut into pieces of 30 cm × 15 cm and uniformly coated with athin layer of different sticky material on both sides. Yellow sticky traps were placed in everyplot @ 1 per plot. Fourteen treatments were replicated twice in a randomized block design along with untreated check.

Observation was made on the sticky material viz. castor oil, motor oil, white grease were used 7 days interval to each trap and observation of sucking pest viz. aphid, leaf hopper, whitefly were recorded at 7 days interval on yellow sticky trap on NE and SW direction. However, number of sucking pests was recorded per three leaves per plant at seven and fourteen days after spray. Total seven sprays were taken at fifteen days interval up to one hundred five days after emergence of crop.

Results and Discussion

Aphid population at seven and
fourteen days after spray

The data collected from the field experiment were presented in Table 1. Significantly minimum population of aphid (6.48, 8.56/3 leaves/plant) was recorded in yellow sticky trap with castor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L at 7 and 14 days after spray which statistically at par with yellow sticky trap with castor oil 15 cm above crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L, yellow sticky trap with motor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L (Table 1). These results are in agreement with Singh et al. [5] noted that, among the five neem products, azadirachtin found effective against aphids.

Leaf hopper population at seven and
fourteen days after spray

Significantly minimum population of leafhopper (6.44, 7.32/3 leaves/ plant) was recorded in yellow sticky trap with castor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L were statistically at par with yellow sticky trap with castor oil 15 cm above crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L, yellow sticky trap with motor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L, yellow sticky trap with motor oil at 15 cm height above the crop canopy followed by azadirachtin 10,000ppm @ 2 ml/L, yellow sticky trap with white grease along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L (Table 1).

The results quoted above are in confirmation with Nboyine et al. [6] result showed that the 10% NSKE significantly reduced the leaf hopper population on cotton. Similar results quoted by Rashid et al. [7] were stated that neem oil 2% and neem seed water extract 3% reduced 59.85% and 52.52% population of jassids in cotton.

Whitefly population at seven and
fourteen days after spray

Significantly minimum population of whitefly (1.42, 1.70/3 leaves/plant) was recorded in yellow sticky trap with castor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L which was found statistically at par with yellow sticky trap with castor oil at 15 cm height above the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L and yellow sticky trap with motor oil along the crop

Table 1. Cumulative mean population of sucking pests per 3 leaves per plant. Figures in parentheses square root values.

Sl. No.	Treatments	Aphid		Leaf hopper		Whitefly		Thrip	
		7 DAS	14 DAS	7 DAS	14DAS	7 DAS	14 DAS	7 DAS	14 DAS
T_1	Yellow sticky trap with castor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L	6.48 (2.54)	8.56 (2.93)	6.44 (2.54)	7.32 (2.71)	1.42 (1.19)	1.70 (1.30)	0.85 (0.92)	0.95 (0.97)
T_2	Yellow sticky trap with castor oil at 15 cm height above the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L	6.92 (2.63)	9.36 (3.06)	6.78 (2.60)	7.48 (2.73)	1.52 (1.23)	1.74 (1.32)	0.94 (0.97)	0.96 (0.97)
T_3	Yellow sticky trap with motor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L	7.12 (2.67)	9.55 (3.09)	6.80 (2.61)	7.65 (2.77)	1.53 (1.24)	1.76 (1.33)	0.95 (0.97)	1.08 (1.04)
T_4	Yellow sticky trap with motor oil at 15 cm height above the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L	7.51 (2.74)	9.73 (3.12)	6.86 (2.62)	7.77 (2.79)	1.59 (1.26)	1.77 (1.34)	0.99 (0.99)	1.11 (1.05)
T_5	Yellow sticky trap with white grease along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L	7.67 (2.77)	9.80 (3.13)	6.90 (2.63)	7.89 (2.81)	1.60 (1.26)	1.88 (1.37)	1.04 (1.02)	1.17 (1.08)
T_6	Yellow sticky trap with white grease at 15 cm height above the crop canopy followed by azadirachtin 10,000 ppm@ 2 ml/L	8.88 (2.98)	10.24 (3.20)	7.05 (2.65)	7.98 (2.83)	1.61 (1.27)	1.92 (1.38)	1.10 (1.05)	1.28 (1.12)
T_7	Yellow sticky trap with castor oil along the crop canopy	9.30 (3.05)	11.16 ((3.34)	8.01 (2.83)	8.96 (2.99)	1.76 (1.32)	2.00 (1.41)	1.13 (1.06)	1.29 (1.13)
T_8	Yellow sticky trap with castor oil at 15 cm height above the crop canopy	11.12 (3.34)	11.32 (3.37)	8.06 (2.84)	9.01 (3.00)	1.77 (1.33)	2.02 (1.42)	1.19 (1.09)	1.30 (1.14)
T_9	Yellow sticky trap with motor oil along the crop canopy	11.19 (3.35)	11.46 (3.39)	8.35 (2.89)	9.12 (3.02)	1.85 (1.36)	2.03 (1.42)	1.28 (1.13)	1.32 (1.15)
T_{10}	Yellow sticky trap with motor oil at 15 cm height above the crop canopy	12.75 (3.57)	13.03 (3.61)	8.44 (2.90)	9.16 (3.03)	1.95 (1.39)	2.04 (1.43)	1.33 (1.15)	1.35 (1.16)
T_{11}	Yellow sticky trap with white grease along the crop canopy	13.18 (3.63)	13.54 (3.68)	8.50 (2.91)	9.44 (3.07)	2.15 (1.46)	2.19 (1.48)	1.41 (1.18)	1.44 (1.20)
T_{12}	Yellow sticky trap with white grease at 15 cm height above the crop canopy	13.40 (3.66)	14.36 (3.79)	8.70 (2.95)	9.46 (3.08)	2.17 (1.47)	2.28 (1.51)	1.44 (1.20)	1.47 (1.21)
T_{13}	Sprays of azadirachtin 10,000 ppm @ 2 ml/L of water	9.17 (3.03)	10.36 (3.26)	7.77 (2.79)	8.62 (2.94)	1.63 (1.28)	1.98 (1.40)	1.12 (1.06)	1.27 (1.13)
T_{14}	Untreated control	16.04 (4.01)	17.81 (4.22)	9.64 (3.10)	10.37 (3.22)	2.40 (1.55)	2.74 (1.65)	1.85 (1.36)	1.90 (1.38)
	'*F*' test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
	SE (m) ±	0.05	0.07	0.04	0.04	0.02	0.02	0.02	0.02
	CD at 5%	0.14	0.22	0.12	0.11	0.06	0.06	0.05	0.05

canopy followed by azadirachtin 10,000 ppm @ 2 ml/L (Table 1).

The results regarding the whitefly population are in agreement with Rashid et al. [7] reported that neem oil 2% and neem seed water extract 3% reduced 57.46% and 48.29% population of whitefly in cotton.

Thrips population at seven and fourteen days after spray

Significantly minimum cumulative mean population of thrips (0.85, 0.95/3 leaves/plant) was recorded in yellow sticky trap with castor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L which followed by yellow sticky trap with castor oil at 15 cm height above the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L (Table 1).

The results regarding the whitefly population are in agreement with Rashid et al. [7] who reported that neem oil 2% and neem seed water extract 3% reduced 32.69% and 25.04% population of thrips in cotton. Khattak et al. [8] who stated that neem oil and neem seed water extract significantly reduced the population of thrips up to 33.7% and 29.1%, respectively.

It is clear from the Table 1 showed that the cumulative mean minimizing population of sucking pests like aphid, leaf hopper, whitefly and thrips combination of yellow sticky trap with castor oil and azadirachtin were found to be most effective than other treatments.

Cumulative mean population of aphid/trap/ week (Average of 13 counts)

The data collected from the field experiment were presented in Table 2. Maximum cumulative mean population of aphid (53.14, 12.06, 65.28/trap/week) was trapped in yellow sticky trap with castor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L were trapping north -east, south-west and both side direction together found most effective treatments than other (Table 2).

It is clear from data that yellow sticky trap with castor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L >yellow sticky trap with castor oil at 15 cm height above the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L and yellow sticky trap with castor oil along the crop canopy was found significantly most effective in trapping maximum aphid population in decreasing order on NE and SW direction. However, overall population of aphid trapping on NE direction was four times more than SW direction.

Present findings are in confirmation with Salioji and Emden [9] who reported that the yellow sticky plastic-sheet traps were found to be good management techniques for suppressing the aphid populations.

Cumulative mean population of leaf hopper /trap/week (Average of 14 counts)

The treatment were found to maximum trapping of leafhopper in yellow sticky trap with castor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L (2.36, 0.82, 3.18/trap/week) on NE, SW, BS direction together and found effective treatment (Table 2).

It is clear from above data that yellow sticky trap with castor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L>yellow sticky trap with castor oil at 15 cm height above the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L and yellow sticky trap with castor oil along the crop canopy was found significantly most effective in trapping maximum leaf hopper population in decreasing order on NE and SW direction. However, overall population of leaf hopper trapping on NE direction was four times more than SW direction.

The results quoted above are supported by Raja and Arivudainambi [10] who reported that highest number of *A. biguttula*, per sticky trap (89.82) was recorded in the yellow with red border traps while the lowest (18.07) was recorded in red-trap.

Atakan and Canhilal [2] assessed that highest leaf hopper captured at 60 cm above ground level where plant height less than 80 cm. It means that the population of leaf hopper along crop canopy was highest which conformation with above research.

Cumulative mean population of whitefly/ trap/week (Average of 13 counts)

Maximum population was trapping in treatment yel-

Table 2. Cumulative mean population of sucking pests per trap per week. Figures in parenthesis indicates square root + 0.5 values.

Sl. No.	Treatments	Aphid			Leaf hopper			Whitefly		
		NE	SW	BS	NE	SW	BS	NE	SW	BS
T_1	Yellow sticky trap with castor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L	53.14 (7.32)	12.06 (3.54)	65.28 (8.11)	2.36 (1.69)	0.82 (1.15)	3.18 (1.92)	29.07 (5.44)	12.90 (3.66)	41.97 (6.52)
T_2	Yellow sticky trap with castor oil at 15 cm height above the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L	45.36 (6.77)	11.12 (3.41)	56.48 (7.55)	1.79 (1.50)	0.75 (1.12)	2.54 (1.74)	28.57 (5.39)	12.66 (3.62)	41.24 (6.45)
T_3	Yellow sticky trap with motor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L	42.45 (6.55)	10.50 (3.32)	52.75 (7.30)	1.07 (1.25)	0.50 (1.00)	1.57 (1.44)	23.60 (4.91)	11.25 (3.42)	34.84 (5.94)
T_4	Yellow sticky trap with motor oil at 15 cm height above the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L	41.07 (6.45)	10.30 (3.29)	49.71 (7.09)	0.82 (1.15)	0.29 (0.88)	1.11 (1.26)	7.63 (2.85)	4.40 (2.21)	12.03 (3.54)
T_5	Yellow sticky trap with white grease along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L	27.77 (5.32)	7.23 (2.78)	35.09 (5.97)	0.14 (0.80)	0.08 (0.77)	0.23 (0.85)	2.91 (1.84)	2.13 (1.62)	5.05 (2.35)
T_6	Yellow sticky trap with white grease at 15 cm height above the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L	18.15 (4.32)	6.06 (2.56)	24.23 (4.97)	0.08 (0.76)	0.07 (0.76)	0.15 (0.81)	2.48 (1.72)	1.75 (1.50)	4.24 (2.18)
T_7	Yellow sticky trap with castor oil along the crop canopy	43.33 (6.62)	10.89 (3.38)	54.25 (7.40)	1.46 (1.40)	0.61 (1.05)	2.07 (1.60)	25.30 (5.08)	11.53 (3.47)	36.83 (6.11)
T_8	Yellow sticky trap with castor oil at 15 cm height above the crop canopy	41.33 (6.47)	10.36 (3.29)	51.83 (7.23)	0.89 (1.18)	0.32 (0.91)	1.21 (1.31)	9.30 (3.13)	5.17 (2.38)	14.47 (3.87)
T_9	Yellow sticky trap with motor oil along the crop canopy	39.33 (6.31)	9.37 (3.14)	49.67 (7.08)	0.79 (1.13)	0.21 (0.84)	1.00 (1.22)	7.21 (2.77)	4.33 (2.19)	11.54 (3.46)
T_{10}	Yellow sticky trap with motor oil at 15 cm height above the crop canopy	37.58 (6.17)	8.59 (3.02)	46.93 (6.89)	0.46 (0.98)	0.14 (0.80)	0.61 (1.05)	6.72 (2.68)	4.13 (2.15)	10.85 (3.37)
T_{11}	Yellow sticky trap with white grease along the crop canopy	20.61 (4.59)	6.63 (2.67)	27.24 (5.27)	0.14 (0.79)	0.08 (0.76)	0.22 (0.85)	2.86 (1.83)	1.90 (1.55)	4.76 (2.29)
T_{12}	Yellow sticky trap with white grease at 15 cm height above the crop canopy	13.60 (3.76)	5.58 (2.47)	19.20 (4.34)	0.07 (0.76)	0.07 (0.75)	0.14 (0.80)	2.33 (1.68)	1.63 (1.46)	3.97 (2.11)
T_{13}	No trap (Untreated control)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
	'*F*' test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
	SE (m) ±	0.24	0.12	0.22	0.08	0.04	0.06	0.13	0.10	0.14
	CD at 5%	0.75	0.36	0.68	0.23	0.11	0.18	0.40	0.30	0.42

low sticky trap with castor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L (29.07, 12.90, 41.97/trap/week) were found to be most effective (Table 2).

It is clear from above data that yellow sticky trap with casor oil along the crop canopy followed by azadirachtin 10,000 ppm @ 2 ml/L>yellow sticky trap with castor oil at 15 cm height above the crop canopy followed by azadirachtin 10,000 ppm @ 2 2 ml/L.yellow sticky trap with castor oil along the crop canopy was found signicantly most effective in trapping maximum whitefly population in decreasing order on NE and SW direction.

However, overall population of whitrfly trapping on NE direction was four times more than SW direction comparatively best in all treatments.

Present findings regarding the whitefly population are in agreement with Idris et al. [11] who reported that vertical yellow sticky trap was most effective against alate whitefly.

Gencsoylu [3] stated that the maximum number of *B. tabaci* population was trapped on 30 cm height above ground level, in contrast with his results maximum *B. tabaci* population was trapped on crop canopy level.

Atakan and Canhilal [2] assessed that highest whitefly captured at 60 cm above ground level where crop height between 60 to 80 cm. It means that the population of whitefly along crop canopy was highest which conformation with present research.

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