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Effect of different color sticky traps on control for onion thrips

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ABSTRACT

The present experiment was carried out with the objective to find out the effect of different color sticky traps for control of thrips in onion. A field experiment was conducted at Regional Research Station, NHRDF Karnal, Haryana, India for two consecutive years during 2019-20 and 2020-21 in the rabi season on onion variety NHRDF Red. Result showed that over all highest number of thrips was stuck (11.53 thrips) on the sticky traps were recorded in treatment T_4 (4 No. Yellow sticky traps). The overall average lowest thrips population (3.43thrips/plant) was recorded in treatment T_{10} (Standard check spray of insecticide Fipronil 1.0 ml/L). The highest gross yield (359.45q/ha) and marketable yield (348.25q/ha) were recorded in the T_{10} treatment. The B:C ratio (9.06:1) was also recorded in the same treatment however benefit-cost ratio was negative in all sticky traps due to their higher cost. The highest thrips population and lowest yield were recorded in the control treatment. Sticky traps more effective for early detection and monitoring of the thrips population in onion.

Keywords: *Onion, color sticky trap, insecticide, thrips, natural enemies, management, gross and marketable yield*

INTRODUCTION

Onion thrips,(*Thrips tabaci* Lindeman) is a polyphagous pest that causes serious damage to vegetables and ornamentals all over the world [15]Murai, (2000). Its population is usually high on plants from the *Alliaceae* family, especially on onion (*Allium cepa L.*).The nymphs and adults feed mostly on green leaf tissue, causing direct damage by destroying epidermal cells. They feed by piercing the surface tissue and imbibing exuded cellular contents. The empty cell on attacked plants create silvery white spots, referred to as silver damage [8]Koschier *et. al*., (2002).Srinivas and Lawande (2004) reported that *thrips tabaci* could cause yield loss in the range of 46-87% in onion[24]. Mohite *et. al*., (1992) estimated the loss to be around 50% in that crop[14]. Onion thrips are an important vector for several plant viruses such as tomato spotted wilt virus[9] Kritzman *et. al*.,(2002). In most of the target crops, use of synthetic pesticides is the most common option for controlling thrips. In public concern about environmental hazards, wide spread resistance in pest populations, and their possible negative impact on the ecosystem threatened the continued use of conventional insecticides [3]Babu *et. al*., (2001).

The preference of insects towards specific color is a much known phenomenon. Most often yellow coloured sticky traps are used to trap aphids and whiteflies. Onion growers in particular face the miserable problem of thrips infestation around the year. There is virtually no effective alternative to tackle the menacing effects of thrips in onion crop. Under this situation, the use of Integrated Pest Management (IPM) rather than unilateral reliance on synthetic insecticides would be a better option for managing thrips. Liu and Chu (2004) and Maimom *et. al*.,(2017) reported that the blue traps were more attractive for *Thrips tabaci* than the white traps[10][11]. Atakan and Canhilal (2004) suggested that yellow sticky traps were significantly attractive for the western flower thrips on cotton[1]. The color sticky trap can also be used for mass trapping and monitoring of insects in horticultural crop ecosystems[23] (Shridhar *et. al.,* 2015). Pandey *et. al.*, (2020) reported that sequential spray of different insecticides significant effect in reducing the number of onion thrips[19]. Pathak *et.al.,* (2020) reported that spray of spinosad@0.3ml/L at 10 days intervals was effective for the control of onionthrips[20]. Shweta *et. al.,* (2019) reported that thiamethoxam 25WG@25g ai./ha effective for the control of onion thrips[27]. According to Gangwar *et. al.,*(2016) insecticides alongwith surfactant reduced the thrips damage severity and increased the bulb yield compared with the insecticides without surfactant[5]. Pathak *et.al.,* (2021) reported that spray of Fipronil @1.0ml/L + silica based surfactant@0.5ml/L at 15 days intervals was effective for control of onion thrips and increased the onion yield as well as quality of onion[21]. Malik *et. al.*, (2012) reported the highest attraction of yellow color trap followed by green trap in okra thrips[12]. Mir Sjad Husain (2019) reported that yellow color sticky trap attracted more number of thrips during the crop growth period[13]. According to Badran AB *et. al.,*(2018) yellow and blue sticky traps alongwith pesticides were most effective

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method for control sucking pest compared to control[2]. Hoddle *et.al.,(*2002) reported that thrips species *F.occidentalis* prefer white traps that have a better reflection of light than other trap colors such as blue or yellow[6]. According to Roditakis *et. al*., (2001) blue color trap are the most attractive to western flower thrips and an effective way to control and monitor western flower populations[22]. Maria Pobozniak *et.al.*,(2020) recorded that blue trap for effective of thrips in pea crop[16]. Sampson *et. al*., (2012) and Shalaby (2014) reported that blue sticky traps catch the highest number of western flowers with highly significant differences between yellow, color and black traps[25][26]. Demirel, N. and Yildirim, A. E.(2008) reported that yellow and orange sticky traps were the best for monitoring population densities of leaf hoppers in cotton crop[4].

MATERIALS AND METHODS

A field experiment was conducted at the Regional Research Station, National Horticultural Research and Development Foundation (NHRDF), Karnal, Haryana, India in two consecutive years during *rabi* 2019-20 and 2020-21. The seedlings of onion variety NHRDF Red were transplanted in a bed size of $10m^2$ at 15 cm x 10 cm spacing. Randomized Block Design with 3 replications and plot to plot 2-meter distances were followed. The treatments evaluated were $T_{1.}$ (1 No Yellow sticky trap) $T_{2.}$ (2 No Yellow sticky trap) $T_{3.}$ (3No Yellow sticky traps) $T_{4.}$ (4 No yellow sticky traps) $T_{5.}$ (1No Blue sticky trap) $T_{6.}$ (2 No Blue sticky trap) $T_{7.}$(3 No Blue sticky traps) $T_{8.}$ (4 No Blue sticky traps) T_9 (Control Without trap and no spray) and T_{10} (Standard check spray of insecticides Fipronil @1.0 ml/L). The Thrips population will be recorded, a number of thrips and natural enemies stuck on the surface of the sticky trap at 30,40,50,60,70 and 80 DAT with the help of a hand lens. After taking counts, the boards will be smeared with new sticky material and then fixed and thrips population per plant was counted in without trap and standard check treatment.

The application of fungicides viz. Mancozeb @ 2.5g/L and Carbendazim @1.0g/L were sprayed at 15 day intervals alternatively in all treatments to protect the crop from diseases. All other agronomical practices were performed uniformly as needed in all the treatments. The crop was harvested after attaining maturity. The data of two consecutive years were combined, analyzed statistically and are presented in Table-1.

RESULTS AND DISCUSSION

a) THRIPS

The pooled data presented in Table-1revealed that the thrips did not stuck in all sticky traps treatments and the thrips population did not appear in control and standard check treatment at 30 DAT. At 40 DAT thrips were not stuck on sticky traps treatments and (1.05 thrips /plant) were recorded in control treatment T_9 (without trap and no spray) while (1.30 thrips /plant) was recorded in standard check treatment T_{10} (Spray of Fipronil @1.0 ml/L). At 50 DAT highest number of thrips (2.50 no.) was stuck in treatment T_4 (4 no. Yellow sticky traps) and lowest (0.33 nos.) thrips were stuck in treatment T_5 (1 no. Blue sticky trap), however lowest thrips population (4.97 thrips/plant) in standard check treatment T_{10} and highest thrips population (15.98 thrips/plant) was recorded in control treatment (without trap and no spray).The highest thrips were stuck in also recorded the same treatment at 60, 70 and 80 DAT. The overall highest number of thrips (11.53 number) was stuck on the sticky trap in treatment T_4 and the lowest number of thrips (2.42 number) were stuck on sticky trap in treatment T_5.The data further revealed that the overall average lowest thrips population (3.43thrips/plant) in treatment T_{10} (Spray of Fipronil @1.0 ml/L) and the highest thrips population (22.92 thrips/plant) in control treatment (without trap and no spray) was recorded.

b) NATURAL ENEMIES

The pooled data presented in Table- 1 revealed that the natural enemies like the Ladybird beetle and Syrphid fly was recorded during the observational period. The natural enemies did not stick in all sticky trap treatments at 30 DAT. At 40 DAT highest Ladybird beetle (8.64 numbers) and (1.50 number) Syrphid fly was stuck on sticky traps treatment T_4 (4 no. yellow sticky trap) while the lowest Ladybird beetle (2.50 number) and Syrphid fly (0.0) were recorded in treatment T_5 (1 no. Blue sticky trap). At 50 DAT highest number of Ladybird beetle (14.67 numbers) and (11.50 number) Syrphid fly was stuck on sticky traps treatment T_4 (4 no. Yellow sticky trap), however lowest Ladybird beetle (1.67 number) and Syrphid fly (4.83 numbers) were recorded in treatment T_5.The highest natural enemies were stuck in treatment T_4 and the lowest in treatment T_5 were also recorded in the same treatment at 60, 70 and 80 DAT. The overall highest number of natural enemies Ladybird beetle (14.45 numbers) and Syrphid fly (78.03 numbers) recorded in treatment T_4 and lowest number of natural enemies Ladybird beetle (0.97 numbers) and (11.11 numbers) Syrphid fly was stuck on sticky trap in treatment $T_{5.}$

GROSS AND MARKETABLE YIELD

The data of two consecutive years were presented in Table -1 the highest gross yield (359.45 q/ha) and marketable yield (348.45q/ha) were recorded in treatment T_{10} standard check (Spray of Fipronil @1.0 ml/L) while the lowest gross yield (295.03q/ha) and marketable yield (281.40q/ha) was recorded in control plot treatment T_9 (without trap and no spray). The highest cost-benefit ratio (9.06:1) was recorded in standard check (Spray of Fipronil @1.0 ml/L), however benefit-cost ratio was negative in all sticky trap treatments due to their higher cost.

The present study is in conformity with the result obtained by Atakan and Canhilal (2004), who suggested that yellow sticky traps were significantly attractive for the western flower thrips on cotton[1]. Similarly Shridhar *et. al.,* (2015) and Malik *et. al*., (2012) reported highest attraction of yellow color trap followed by green trap in okra thrips[23][12]. Mir Sjad Husain (2019) reported that yellow colour sticky trap attracted more number of thrips during the crop growth period[13]. Zepa-Coradini *et. al*., (2010) they confirmed that the use of yellow sticky traps in cucumber crop in greenhouses attracted a large number of WFT adults and could be used to directly control or monitor WFT populations[28]. Noor Navi *et. al*., (2021) recorded that the yellow sticky trap is most effective for trapping of sucking pests in cotton crops[17]. Priyakshi *et. al.,*(2017) confirmed above finding that the highest numbers of sucking pests were observed recorded at yellow sticky traps placed at the plant canopy in capsicum crops[18]. Idris *et. al.,* (2012) also found that the highest whitefly catches in the yellow trap and was followed by red, green, blue, white, and black traps[7]. These findings support and confirm our present results that the yellow sticky trap was most effective for monitoring of thrips population as well as early detection of thrips in onion crops.

CONCLUSION

The present study concluded that sticky traps uses not for the management of thrips in onion crop while traps use only for monitoring of thrips populations and sticky traps not economical due to higher cost, however, sticky traps are harmful to natural enemies like lady bird beetle and syrphid flies as per study.

Farmers are suggested to use of yellow sticky traps for monitoring of thrips population in onion crops as well as use of pesticides for control of the thrips population after ETL.

Table-1 Effect of different colour sticky traps on control of onion thrips (Combined data rabi, 2019-20 & 2020-21)

Treatments	Days											
	30 DAT						40 DAT					
	Thrips population		Natural enemies (Lady bird beetle)		Natural enemies (Sirphid flies)		Thrips population		Natural enemies (Lady bird beetle)		Natural Enemies (Sirphidflies)	
T1	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	2.67	(1.77)	0.00	(0.71)
T2	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	5.67	(2.48)	0.67	(0.99)
T3	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	5.17	(2.35)	0.50	(0.94)
T4	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	8.67	(3.00)	1.50	(1.28)
T5	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	2.50	(1.71)	0.00	(0.71)
T6	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	4.33	(2.19)	0.50	(0.94)
T7	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	5.50	(2.44)	0.83	(1.09)
T8	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	0.00	(0.71)	6.17	(2.57)	0.67	(1.00)
T9	0.00	(0.71)					1.05	(1.21)				
T10	0.00	(0.71)					1.30	(1.33)				
S.Em±	-	-	-	-	-	-	-	**0.08**	-	**0.53**	-	**0.15**
CD at 5%	-	-	-	-	-	-	-	**0.17**	-	**1.08**	-	**0.31**

Treatments	Days											
	50 DAT						60 DAT					
	Thrips population		Natural enemies (Lady birdbeetle)		Natural enemies (Sirphid flies)		Thrips population		*Natural Enemies (Lady bird beetle)		**Natural enemies (Sirphid flies)	
T1	0.17	(0.80)	2.83	(1.78)	2.83	(9.31)	1.33	(5.33)	8.33	(16.73)	100.00	1.28
T2	1.00	(1.15)	6.00	(2.46)	7.00	(13.94)	2.67	(9.31)	20.67	(27.00)	262.17	1.48
T3	1.50	(1.27)	8.33	(2.83)	9.33	(14.69)	4.33	(11.59)	19.33	(26.08)	244.50	1.59
T4	2.50	(1.53)	14.67	(3.85)	11.50	(18.87)	6.50	(14.49)	33.33	(35.22)	367.00	1.76
T5	0.33	(0.86)	1.67	(1.36)	4.83	(11.57)	2.50	(7.79)	0.00	-	47.67	1.20
T6	0.83	(1.09)	4.33	(1.98)	9.33	(15.46)	3.83	(9.74)	0.00	-	149.50	1.53
T7	1.17	(1.19)	4.83	(2.23)	9.33	(14.71)	3.83	(10.41)	2.00	(8.13)	200.50	1.52
T8	1.50	(1.29)	3.67	(1.95)	16.83	(19.72)	4.17	(11.14)	0.00	-	233.83	1.57
T9	15.98	(3.99)					23.67	(28.88)				
T10	4.97	(2.28)					4.62	(12.35)				
S.Em±	-	**0.12**	-	**0.32**	-	**1.80**	-	**1.47**	-	**0.77**	-	**0.09**
CD at 5%	-	**0.23**	-	**0.66**	-	**3.68**	-	**2.98**	-	**1.58**	-	**0.18**

Treatments	Days											
	70 DAT						80 DAT					
	*Thrips population		Natural enemies (Lady bird beetle)		*Natural enemies (Sirphid flies)		*Thrips population		Natural enemies (Lady bird beetle)		Natural enemies (Sirphid flies)	
T1	3.50	(10.58)	5.00	(2.29)	16.33	(1.00)	2.17	(8.35)	2.67	(1.77)	2.33	(1.54)
T2	6.50	(14.44)	7.67	(2.85)	30.00	(1.11)	3.50	(10.60)	7.00	(2.72)	4.50	(2.11)
T3	9.50	(17.61)	14.33	(3.83)	48.83	(1.33)	5.17	(12.79)	13.67	(3.74)	8.00	(2.61)
T4	12.17	(20.38)	15.67	(3.96)	77.00	(1.51)	7.00	(15.29)	14.33	(3.83)	11.17	(3.05)
T5	4.00	(11.38)	1.67	(1.39)	11.83	(0.86)	2.50	(8.91)	0.00	(0.71)	2.33	(1.52)
T6	6.33	(14.47)	5.00	(2.11)	23.67	(1.04)	3.50	(10.55)	0.00	(0.71)	4.50	(1.82)
T7	6.67	(14.68)	6.33	(2.33)	31.83	(1.10)	5.00	(12.41)	0.00	(0.71)	6.17	(2.16)
T8	6.67	(14.84)	5.33	(2.15)	43.50	(1.26)	5.67	(13.31)	0.00	(0.71)	8.83	(2.64)
T9	32.93	(34.68)					30.68	(32.53)				
T10	6.13	(14.33)					4.95	(12.80)				
S.Em±	-	**0.86**	-	**0.31**	-	**0.06**	-	**0.87**	-	**0.31**	-	**0.24**
CD at 5%	-	**1.75**	-	**0.63**	-	**0.13**	-	**1.76**	-	**0.63**	-	**0.50**

Treatments	Gross yield (kg/plot)	Market able yield (kg/plot)	Gross yield (q/ha)	Market able yield (q/ha)	*Overall average of thrips population		*Overall average of natural enemies (Lady bird beetle)		*Overall average of natural enemies (Sirphid flies)		B:C ratio
T1	32.49	29.60	314.21	296.02	4.06	(10.92)	3.58	(2.02)	20.25	(0.94)	0.49:1
T2	33.21	30.20	321.08	301.98	5.92	(13.64)	7.83	(2.88)	50.72	(1.18)	0.35:1
T3	32.37	30.33	313.22	303.25	8.00	(16.10)	10.14	(3.26)	51.86	(1.21)	0.24:1

T4	33.22	31.15	322.41	311.53	11.53	(19.14)	14.45	(3.86)	78.03	(1.40)	0.25:1
T5	32.19	29.68	309.42	296.75	2.42	(8.88)	0.97	(1.20)	11.11	(0.80)	.052:1
T6	31.83	29.62	309.03	296.21	3.72	(11.10)	2.28	(1.64)	31.25	(1.05)	0.25:1
T7	32.36	29.58	312.91	295.77	4.50	(12.22)	3.11	(1.88)	41.45	(1.09)	0.16:1
T8	32.25	29.91	312.88	299.08	6.45	(14.51)	2.53	(1.71)	50.61	(1.17)	0.15:1
T9	30.81	28.14	295.03	281.40	22.92	(27.64)					-
T10	36.74	34.83	359.45	348.25	3.43	(10.59)					9.06:1
S.Em±	**0.38**	**0.49**	**4.40**	**4.86**	**-**	**0.44**	**-**	**0.13**	**-**	**0.06**	**-**
CD at 5%	**0.78**	**0.99**	**8.92**	**9.86**	**-**	**0.90**	**-**	**0.26**	**-**	**0.12**	**-**

Note- Data in the parenthesis shows square root/*arcsine transformed values.
Note: - Count of natural enemies only on sticky trap.

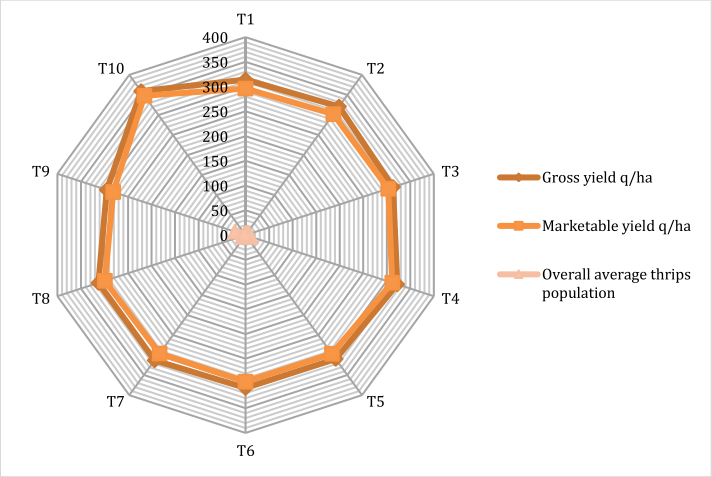

Figure-1 Gross, marketable yield q/ha & Avearge thrips populations

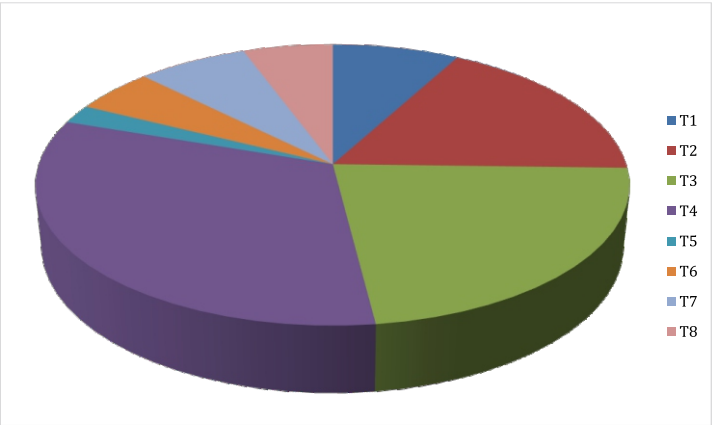

Figure-2 Overall average of natural enemies (Lady bird beetle)

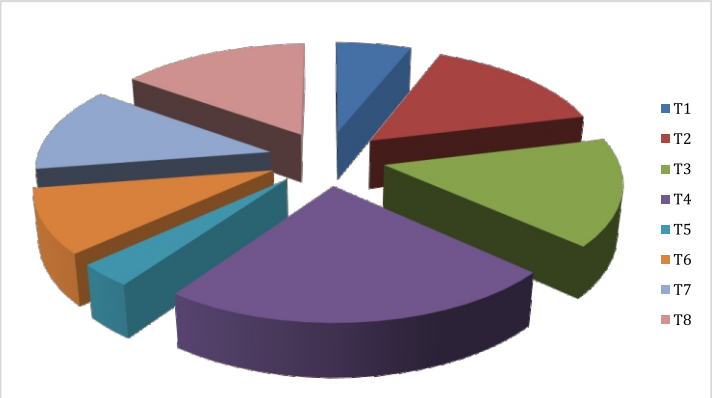

Figure-3 Overall average of natural enemies (Sirphid flies)

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