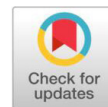


Research Article

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Effect of different color sticky traps on control for onion thrips

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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 T₄ (4 No. Yellow sticky traps). The overall average lowest thrips population (3.43thrips/plant) was recorded in treatment T₁₀ (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 T₁₀ 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 onion thrips [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 *Foccidentalis* 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 10m² 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 T₁ (1 No Yellow sticky trap) T₂ (2 No Yellow sticky trap) T₃ (3 No Yellow sticky traps) T₄ (4 No yellow sticky traps) T₅ (1 No Blue sticky trap) T₆ (2 No Blue sticky trap) T₇ (3 No Blue sticky traps) T₈ (4 No Blue sticky traps) T₉ (Control Without trap and no spray) and T₁₀ (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-1 revealed 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 T₉ (without trap and no spray) while (1.30 thrips /plant) was recorded in standard check treatment T₁₀ (Spray of Fipronil @1.0 ml/L). At 50 DAT highest number of thrips (2.50 no.) was stuck in treatment T₄ (4 no. Yellow sticky traps) and lowest (0.33 nos.) thrips were stuck in treatment T₅ (1 no. Blue sticky trap), however lowest thrips population (4.97 thrips/plant) in standard check treatment T₁₀ 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 T₄ and the lowest number of thrips (2.42 number) were stuck on sticky trap in treatment T₅. The

data further revealed that the overall average lowest thrips population (3.43 thrips/plant) in treatment T₁₀ (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 T₄ (4 no. yellow sticky trap) while the lowest Ladybird beetle (2.50 number) and Syrphid fly (0.0) were recorded in treatment T₅ (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 T₄ (4 no. Yellow sticky trap), however lowest Ladybird beetle (1.67 number) and Syrphid fly (4.83 numbers) were recorded in treatment T₅. The highest natural enemies were stuck in treatment T₄ and the lowest in treatment T₅ 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 T₄ and lowest number of natural enemies Ladybird beetle (0.97 numbers) and (11.11 numbers) Syrphid fly was stuck on sticky trap in treatment T₅.

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 T₁₀ 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 T₉ (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 bird beetle)		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.

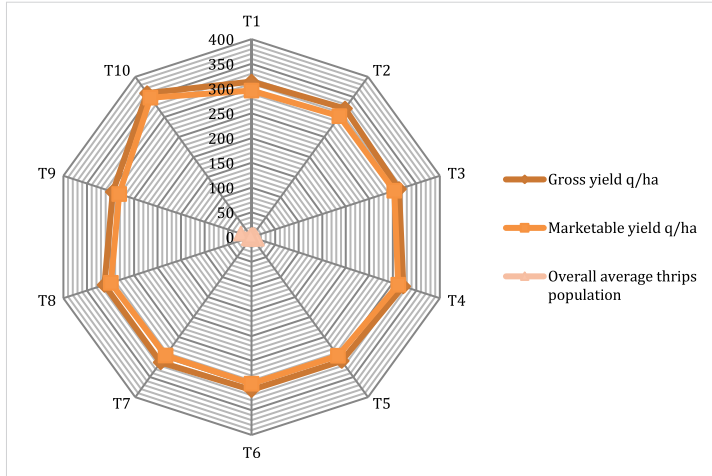


Figure-1 Gross, marketable yield q/ha & Average thrips populations

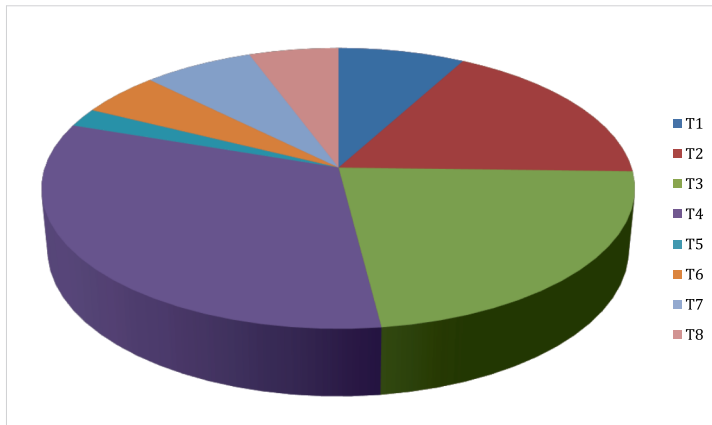


Figure-2 Overall average of natural enemies (Lady bird beetle)

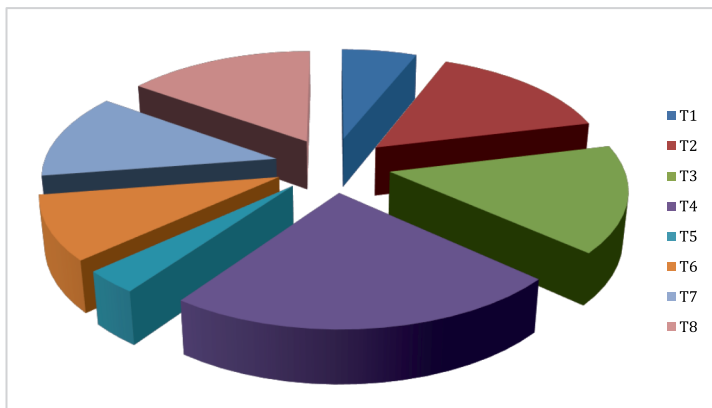


Figure-3 Overall average of natural enemies (Sirphid flies)

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REFERENCES

- Atakan, E. and R.Canhilal, (2004).Evaluation of yellow sticky trap at various height for monitoring cotton insect pest. *J. Agric. Urban Entomol.*, 21:15-24.
- Badran, A. B.; Mona I. Ammar and E. A. M. Mousa(2018) Efficiency of Colored Sticky Traps on the Population of Certain Sap-Sucking Insects on Cucumber Plants in Greenhouses *J. Plant Prot. And Path., Mansoura Univ., Vol.9 (7): 411–415.*
- Babu, R. Murgan, K. Sivaramkrish S, and Thiyagarajan,P.(2001).Laboratory studies on the efficacy of neem and the entomopathogenic fungus,Beauveria bassiana on Spodoptera litura Fab. *Entomom*,26 (Supply.Issue)58-61.
- Demirel, N. and Yildirim, A. E. (2008). Attraction of various sticky colour traps to *Thrips tabaci* Lindeman (Thysanoptera : Thripidae) and *Empoasca decipiens* Paoli (Homoptera : Cicadellidae) in cotton. *J. Entomol.* 5 : 389-94.
- Gangwar R.K., Jat G.S., Rathore S.S. and Sharma R.K.(2016).Effect of surfactant on the efficacy of insecticides against onion thrips (*Thrips tabaci*).Indian Journal of Agricultural Sciences 86(6):757-761.
- Hoddle M.S., Robinson L., Morgan D. (2002): Attraction of thrips (Thysanoptera: Thripidae and Aeolothripidae) to colored sticky cards in a California avocado orchards. *Crop protection*, 21:383–388.
- Idris, A. B., Khalid, S. A. N. and Roff, M. N. M. (2012).Effectiveness of sticky trap designs and colours in trapping alate whitefly, *Bemisia tabaci* (Gennadius) (Hemiptera : Aleyrodidae). *Pertanika J. Trop. Agric. Sci.* 35 : 127-34.
- Koschier,E.H.,Sedy,K,A, and Novak,J.(2002).Influence of plant volatiles on feeding damage caused by onion thrips *Thrips tabaci*. *Crop Protect.*21:419-425.
- Kritzman,,Gera,A.,Racaah,B.,Van Lent,J.W.M and Peters,D.(2002).The route of tomato spotted wilt virus inside the thrips body in relation to transmission efficiency.*Arch. Virol.*,147:2143-2156.

10. Liu, T.X. c. and C.C. Chu, (2004). Comparison of absolute estimates of thrips *tabaci* (Thysanoptera: Thripidae) with field visual counting and sticky traps in onion field in South Texas. *Southwest Entomol.*, 29:83-89.
11. Maimom Soniya Devi and Kusal Roy, (2017). Comparable study on different colored sticky traps for catching of onion thrips, *Thrips tabaci* Lindeman. *Journal of Entomology and Zoology Studies* 5 (2):669-671.
12. Malik MI, Khuhro RD, Dhiloo KH, Zaman B, Khuhro SN. (2012) Response of sucking insect complex to various colours of sticky traps in okra crop. *Pakistan journal of Entomology*. 27(2):181-186.
13. Mir Sjad Husain (2019). Evaluation of the colour and height of sticky traps in the attraction of onion thrips, *Thrips tabaci* Lindeman (Thysanoptera: Thripidae) on onion. PHM-ABP-5:347. International symposium on Edible Allium: Challenges and opportunities, February 9-12, 2019 organized by ISA, Rajgurunagar, Pune at YASHADA, Pune (Maharashtra), India.
14. Mohite, P.B., Teli, V.S. and Moholkar, P.R. (1992). Efficacy of organic synthetic insecticides against onion thrips *Thrips tabaci* Lind. *Pestology*, 16:8-10.
15. Murai, T. (2000). Effect of temperature on development reproduction on onion thrips, *Thrips tabaci* Lindeman (Thysanoptera: Thripidae), on pollen and honey solution. *Appl. Entomol. Zool.* 35:499-504.
16. Maria Pobozniak, Krzysztof Tokarz, Kazhymurat Musynov (2020). Evaluation of sticky trap colour for thrips (Thysanoptera) monitoring in pea crops (*Pisum sativum* L.). *Journal of Plant Diseases and Protection* 127:307-321.
17. Noor Nabi Bhutto, Zahid Usman Shar, Mushtaque Ali Kalroo, Allah Bux Rind, Umair Asghar Solangi (2021) Management of sucking insect pests of cotton crop through yellow sticky traps under field conditions *International Journal of Farming and Allied Sciences* Vol., 10 (2): 36-39.
18. Priyakshi Buragohain, D. K. Saikia, B. C. Dutta and R. N. Borkakati (2017) Influence of colours and height of the sticky traps against sucking pests of *Bhut Jolokia*, *Capsicum chinense* Jacq. *Res. on Crops* 18 (1): 145-152.
19. Pandey sujay, Pathak M.K., Dubey B.K. and Gupta P.K. (2020). Chemical control of onion thrips with insecticides through sequential sprays. *Journal of Entomology and Zoology Studies* 8(1):517-521.
20. Pathak M.K., Pandey Sujay, Pandey M.K., Gupta R.C., Sharma H.P. and Gupta P.K. (2020). Evaluation of different insecticides for management of onion thrips (*Thrips tabaci*). *Journal of Entomology and Zoology Studies* 8(1):1463-1468.
21. Pathak M.K., Pandey M.K., Pandey sujay, Gupta R.C., and Gupta P.K. (2021). Effect of silica based surfactant on the efficacy of different insecticides against onion thrips. *Journal of Entomological Research* 45:967-970.
22. Roditakis N.E., Lykouressis D.P., Goulinopoulou N.G. (2001): Color preference, sticky trap catches and distribution of western flower thrips in greenhouse cucumber, sweet pepper and eggplant crops. *South-Western Entomology*, 26: 227-237.
23. Sridhar V, Naik SO (2015). Efficacy of colour sticky traps for Monitoring chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) on rose. *Pest management in Horticultural Ecosystems*. 21(1):101-103.
24. Sriniwas, P.S. and Lawande, K.E. (2004). Impact of planting dates on thrips *tabaci* Lindeman infestation and yield loss in onion (*Allium cepa* L.). *Pest Manag. Hortic Ecosys.* 10:11-18.
25. Sampson, C., Hamilton J.G.C., Kirk W.D.J. (2012): The effect of trap colour and aggregation pheromone on trap catch of *Frankliniella occidentalis* and associated predators in protected pepper in Spain. *Integrated Control in Protected Crops, Temperature Climate*. IOBC/WPRS Bulletin, 80: 313-318.
26. Shalaby, H.H. (2014) Preliminary study on the control of western flower thrips, *Frankliniella occidentalis* (Pergande) in pepper crop greenhouses in Qalyubia Governorate, Egypt. *Plant Protection and Pathology, Mansoura Univ.*, vol. 6 No. (1).
27. Shweta SH, N Gangadhar, JB Gopali, MP Basavarajappa and HP Hadimani (2019). Bio-efficacy of synthetic insecticides against onion thrips, *Thrips tabaci* Lindeman (Thysanoptera: Thripidae). *Journal of Entomology and Zoology Studies* 7(2):38-42.
28. Zepa-Coradini C., Petrescu I., Petolescu C., Palagesiu I. (2010): *Frankliniella occidentalis* controlling in the cucumbers crops using physico-mechanical. *Lucrari Stiintifice*, 53: 292-297.