Indian Journal of Entomology 84(1): 181-183 (2022) DoI.: 10.55446/IJE.2021.256

MANAGEMENT OF LEAF MINERS INFESTING TOMATO UNDER PROTECTED CULTIVATION

Monica Jat*, Narayan Lal Dangi[1] and K V Nagarjuna Reddy[2]

Division of Entomology, ICAR- Indian Agricultural Research Institute, New Delhi 110012
[1]Department of Entomology, Maharana Pratap University of Agriculture and Technology, Udaipur 313004, Rajasthan, India
[2]Department of Entomology, Indira Gandhi Krishi Vishwavidyalaya, Raipur 492006, Chhattisgarh, India
*Email: jmonicaiari@yahoo.com (corresponding author)

ABSTRACT

This study evaluates the effectiveness of YST (yellow sticky trap) and BST (blue sticky trap) in monitoring the leaf miners *Liriomyza trifolii* and *Tuta absoluta* on tomato under protected cultivation. The efficacy of insecticides viz., acephate 75SP, acetamiprid 20SP, diafenthiuron 50WP, spiromesifen 22.9SC, *Beauveria bassiana* @ 4g/ l and neem oil @ 10ml/ l including untreated control were also evaluated along with. The maximum trap catches (11.25/ trap) of *T. absoluta* was observed during 39th standard meteorological week (SMW), and with *L. trifolii*, it was (8.25/ trap) during 37th SMW in YST. Among the insecticides, acephate 75SP was highly effective with 59.50% reduction in incidence.

Key words: *Liriomyza trifolii*, *Tuta absoluta*, acephate, acetamiprid, diafenthiuron, spiromesifen, *Beauveria bassiana*, neem oil, yellow and blue sticky trap, yellow par trap, blue par trap, trap catches, standard meteorological week

Tomato is one of the most popular vegetables, and in India, its production is 18.7 mt area of 0.9 million ha (Saxena and Gandhi, 2015). It is grown in both open field and protected condition. During export and import, the movement of materials is responsible for accidental introduction or invasion of pests. American serpentine leaf miner *Liriomyza trifolii* (Burgess) and South American tomato moth or tomato leaf miner or tomato pin worm *Tuta absoluta* (Meyrick) have invaded India in 1990 and 2014, respectively. In India, *T. absoluta* M. was first reported from the Indian Institute of Horticultural Research (IIHR), Hessaraghatta, Bengaluru, Karnataka (Sridhar et al., 2014); then from Pune (Shashank et al., 2015); and Malnad and in Hyderabad- Karnataka region (Kalleshwaraswamy et al., 2015). *Tuta absoluta* is a neotropical oligophagous pest and solanaceous crops are its major hosts. These pests devastate tomato both in protected and open fields (Desneux et al., 2010). The leaf miner causes losses up to 100% and it is a key pest of greenhouse and open field tomato (Arturo et al., 2012). *Tuta absoluta* deposits eggs on the underside of leaves, stems and also on fruits, while the neonate larvae penetrate fruits, leaves and create mines and galleries. The use of insecticides is the most effective method to reduce *T. absoluta*, but chlorantraniliprole, the most effective insecticide had also been observed to suffer due to resistance. There is a need to devise more control measures and it is essential to find the efficacy of insecticides (Bawin et al., 2014). Keeping these in view, this study evaluates the blue and yellow sticky traps along with certain insecticides under protected conditions.

MATERIALS AND METHODS

The study was done under protected cultivation at the High-tech Unit of Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur. The seedlings of tomato variety "Dev" were transplanted during first week of July, 2018. The observations on pests were made during morning hours between 7 and 9 am. Completely randomized design (CRD) was followed with four replications in plots of size 7.0x 1.0 m with row to row and plant to plant spacing of 50x 45 cm. Four traps viz. YST (yellow sticky trap), BST (blue sticky trap), YPT (yellow pan trap), BPT (blue pan trap) were installed at the height of 130 cm above ground level in these 16 plots to record the pest complex. These traps were observed regularly and the insects caught, were segregated and counted separately under 10x hand magnifying lens. The number of leaf miners caught on traps were approximated at an interval of 7 days. Traps were also replaced to avoid the glue material getting dried up. For comparison between traps (YST and BST), the catches/ trap was subjected to the test of significance using two sample t test. Efficacy of insecticides was followed with seven treatments inclusive of control, with each treatment applied twice; the first when sufficient pest buildup was observed and second 30 days after first spray. Leaf miner incidence was estimated by visual count, during the early morning hours from five randomly tagged plants/ plot, before spray as pretreatment counts and at 1, 3, 5 and 7 days after spray (DAS). These data were converted to % reduction in incidence (Henderson and Tilton, 1955), transformed into arc sine values and then subjected to ANOVA to find out the significance of the efficacy of treatments.

RESULTS AND DISCUSSION

The results obtained on the comparison of sticky traps reveal that the maximum incidence of *T. absoluta* was observed in 39th SMW on YST with 11.25/ trap, while that of *L. trifolii* was during 37th SMW (8.25/ trap). Thus, YST was more effective than BST (Table 1). Previously, Nayana et al. (2017) observed that the *T. absoluta* caused devastation in both open field and in polyhouse, and its density increased with the growth of crop under both field and polyhouse. Bayisa et al. (2017) observed that YST impregnated with castor, lavender and lemon oils attracted more catches. Kaur et al. (2010) with *L. trifolii* observed that its incidence was less during the early season; and Martin et al. (2005) with red, blue, violet-, green-, white-, and yellow-coloured traps in celery observed that yellow opaque or translucent sticky cards attracted more insects.

The insecticides when evaluated revealed that there are significant reductions in leaf miner incidence at 1, 3, 5 and 7 days after first as well as second spray;

Table 1. Efficacy of traps against leaf miners under protected cultivation (2018)

SMW	Mean No./ trap			
	T. absoluta		*L. trifoli*	
	YST	BST	YST	BST
06-Aug (32)	3.50	1.25	3.00	0.75
13-Aug (33)	4.50	1.75	3.75	1.25
20-Aug (34)	5.50	1.75	3.50	1.25
27-Aug (35)	6.75	2.25	5.50	2.00
03-Sep (36)	7.00	2.50	6.00	2.25
10-Sep (37)	8.75	2.75	8.25	3.00
17-Sep (38)	9.50	2.75	7.75	2.00
24-Sep (39)	11.25	3.00	7.00	2.50
Mean	7.09	2.25	5.59	1.81
t-cal	2.21*		2.17*	
t-tab (5%)	2.14		2.14	

*significant at p=0.05

Table 2. Efficacy of insecticides on leaf miners in tomato under protected cultivation (2018)

S.No.	Treatments	Reduction (%) in incidence									
		1st Spray					2nd Spray				
		PTP/ 5 plants	1 DAS	3 DAS	5 DAS	7 DAS	PTP/ 5 plants	1 DAS	3 DAS	5 DAS	7 DAS
1.	Spiromesifen (22.9SC) @ 0.10%	19.00 (4.41)	47.08b (57.10)	51.47b (61.36)	52.65b (63.03)	53.27b (64.24)	38.33 (6.22)	45.55c (50.95)	46.40c (52.44)	47.50c (54.36)	48.14c (55.47)
2.	Acetamiprid (20SP) @ 0.02%	18.33 (4.33)	51.10a (66.56)	53.90ab (65.28)	58.76a (69.95)	57.14a (70.39)	39.67 (6.33)	49.95ab (58.59)	51.56ab (61.34)	52.87ab (63.57)	54.34ab (66.01)
3.	Neem oil @ 10ml/ l	21.00 (4.63)	45.69bc (51.20)	46.70c (54.70)	46.76c (56.38)	48.42c (57.68)	46.00 (6.79)	36.61d (35.56)	37.37d (36.84)	38.56d (38.85)	41.69d (44.23)
4.	*Beauveria bassiana* @ 4g/ l	24.00 (4.94)	43.78c (47.87)	45.97c (51.70)	46.24c (53.90)	47.03c (53.54)	44.00 (6.64)	35.47d (33.68)	35.95d (34.46)	37.11d (36.41)	40.57d (42.29)
5.	Diafenthiuron (50WP) @ 0.04%	19.67 (4.49)	46.15b (55.48)	50.45b (60.14)	52.36b (62.20)	52.89b (63.59)	50.02 (7.10)	47.06bc (53.94)	48.35bc (55.83)	49.91bc (58.57)	50.49bc (59.52)
6.	Acephate (75SP) @ 0.20%	21.33 (4.67)	51.77a (61.70)	55.21a (67.28)	59.50a (71.13)	58.96a (73.42)	45.33 (6.77)	51.06a (60.49)	52.99a (63.77)	55.25a (67.51)	56.87a (70.13)
7.	Control	22.34 (4.77)	-	-	-	-	43.33 (6.61)	-	-	-	-
	SEm	0.16	1.09	1.24	1.85	1.28	0.31	1.30	1.61	1.58	1.34
	C.D. at 5%	0.50	3.23	3.70	5.53	3.84	0.93	3.95	4.89	4.80	4.06

Figures in parentheses of PTP $\sqrt{x+0.5}$ transformed values; Figures in parentheses (after spray) arc sine transformed values; PTP: Pretreatment, 1day before treatment; Numbers followed by same alphabets in each column not significantly different at p=0.05; DAS: Days after spray pretreatment counts were uniform and varied from 18.33 to 24.00/ 5 plants; after first spray, acephate 75SP was significantly superior with 51.77 to 59.50% reduction, followed by acetamiprid 20SP being at par; spiromesifen 22.9SC and diafenthiuron 50WP were moderately effective, while the least effective one was *Beauveria bassiana* @4g/ l at par with neem oil @10ml/ l. Similarly, after the second spray acephate led to 51.06- 56.87% reduction followed by acetamiprid being at par; also, spiromesifin and diafenthiuron were moderately effective; the least effective was again *B.a bassiana* being at par with neem oil (Table 2).

Wankhede et al. (2007) against *L. trifolii* in tomato, observed that neem oil @ 10ml/ l was the least effective, followed by 0.01% spinosad and 5% NSKE. Moussa et al. (2013) observed that indoxcarb 15EC, chlorantraniliprole 20SC, chlorfenapyr 36SC, spinosad 24SC, chlofenapyr 36SC mixed with indoxacarb 15EC, spinosad 24SC mixed with abamectin 1.8%, emamectin benzoate 5SG and imidacloprid 20SC provided excellent control of *T. absoluta*. Derbalah et al. (2012) suggested that the mixing of imidacloprid with *Artemesia cina* extract improved the efficiency against *T. absoluta* on tomato crop under greenhouse conditions. Mondal (2016) against *Liriomyza sp.* found that imidacloprid (0.01%) followed by acephate (0.15%) were effective.

ACKNOWLEDGEMENTS

Authors thank the Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan for facilitating the work.

REFERENCES

Arturo C, Salvatore D, Gavino D. 2012. Integrated control in protected crops. Mediterranean Climate IOBC-WPRS Bulletin 80: 319-324.

Bawin T, De Backer L, Dujeu D. 2014. Infestation level influences oviposition site selection in the tomato leaf miner *Tuta absoluta* (Lepidoptera: Gelechiidae). Insects 5(4): 877-884.

Bayisa N G, Hundesa N, Tefera B N. 2017. Essential oils applied on sticky traps increase trapping of sucking pests under greenhouse condition. International Journal of Research Studies in Agricultural Sciences 25: 36-45.

Derbalah A S, Morsey S Z, Samahy M. 2012. Some recent approaches to control *Tuta absoluta* in tomato under greenhouse conditions. African Entomology 20(1): 27-34.

Desneux N, Wajnberg E, Kag W, Burgio G, Arpaia S, Narvaezvasquez CA et al. 2010. Biological invasion of European tomato crops by *Tuta absoluta*: Ecology, history of invasion and prospects for biological control. Journal of Pesticide Science 83: 197-215.

Kalleshwaraswamy C M, Murthy M S, Viraktamath C A, Kumar N K K. 2015. Occurrence of *Tuta absoluta* (Lepidoptera: Gelechiidae) in the Malnad and Hyderabad-Karnataka Regions of Karnataka, India. Florida Entomologist 98(3): 970-971.

Kaur S, Srinivasan R, Cheema D S, Lal T, Ghai T R, Chadha M L. 2010. Monitoring of major pests on cucumber, sweet pepper and tomato under net-house conditions in Punjab, India. Pest Management in Horticultural Ecosystems 16: 148-155.

Hinderson C F, Tilton E W. 1955. Tests with acaricides against the brown wheat mite. Journal of Economic Entomology 48: 157-161.

Martin A D, Vernon R S, Hallett R H. 2005. Influence of colour and trap height on captures of adult pea leaf miner, *Liriomyza huidobrensis* (Blanchard) (Diptera: Agromyzidae) in celery. Journal of Entomological Society 136: 25-35.

Moussa S, Baiomy F, Sharma A, Adl F E. 2013. The status of tomato leaf miner in Egypt and potential effective pesticides. Academic Journal of Entomology 6(3): 110-115.

Mondol D. 2016. Efficacy of some insecticides in the management of *Liriomyza brassicae* on *Pisum sativum*. International Journal of Engineering Science and Computing 6: 1640-1642.

Nayana B P, Shashank P R, Kalleshwaraswamy C M. 2017. Seasonal incidence of invasive tomato leaf miner, *Tuta absoluta* (Lepidoptera: Gelechiidae) on tomato in Karnataka, India. Journal of Entomology and Zoological Studies 6(1): 400-405.

Saxena M, Gandhi C P. 2015. Indian Horticulture Database-2014. National Horticulture Board, Ministry of Agriculture, Government of India P. 286.

Shashank P R, Chandrashekar K, Naresh M, Sreedevi K. 2015. Occurrence of *Tuta absoluta* (Lepidoptera: Gelechiidae): An invasive pest from India. Indian Journal of Entomology 77(4): 323-329.

Sridhar V, Chakravarthy A K, Asokan R, Vinesh L S, Rebijith K B, Vennila S. 2014. New record of the invasive South American tomato leaf miner, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in India. Pest Management in Horticultural Ecosystems 20(2): 148-154.

Wankhede S M, Deotale V Y, Undirwade D B, Mane P N, Deotale R O, Kahare R N. 2007. Performance of some insecticides and biopesticides against tomato leaf miner *Liriomyza trifolii* Burgess. Journal of Soils Crops 17: 136-138.

(Manuscript Received: October, 2020; Revised: January, 2021;
Accepted: January, 2021; Online Published: March, 2021)
Online published (Preview) in www.entosocindia.org Ref. No. e20278