

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.905.257>

Influence of Weather Parameters on the Incidence of Serpentine leaf miner, *Liriomyza trifolii* (Burgess) on Tomato

Naga Sri Navya Ravipati^{1*}, Abhishek Shukla² and Bhojeswari Sahu²

¹Department of Agricultural Entomology, CPPS, TNAU, Coimbatore – 641003, India

²Jawaharlal Nehru Krishi Vishwa Vidyalyaya, Jabalpur, Madhya Pradesh – 482004, India

*Corresponding author

ABSTRACT

Keywords

Correlation,
Population
dynamics,
Regression,
Tomato,
Weather factors

Article Info

Accepted:
18 April 2020
Available Online:
10 May 2020

The present investigation was carried out to study the seasonal abundance of Serpentine leaf miner, *Liriomyza trifolii* on tomato during 2017-18. Leaf miner reached peak during December to January and declined thereafter. Correlation studies revealed that, no. of mines, leaf infestation and no. of larvae were negatively correlated with minimum temperature (-0.61**), evening relative humidity (-0.34*), morning vapor pressure -0.55*, evening vapor pressure -0.52*, maximum temperature-0.57*, sunshine hours -0.52* and evaporation -0.58**, temperature and evening relative humidity. Whereas, leaf infestation per cent is positively correlated with evaporation (0.71**) and influenced the leaf miner population by 51 per cent.

Introduction

Vegetables occupy a prominent position in human diet owing to their richness in vitamins and minerals. More than seventy types of vegetables are grown in India, among which Tomato (*Lycopersicon esculentum* Mill) is the most popular and widely grown vegetable. It is rich source of vitamin 'C' and many minerals like calcium, potassium, magnesium and phosphorus (Anonymous, 2006). It is the world's largest vegetable crop after potato and sweet potato. Tomato is also called as poor

man's apple (Roopa, 2012). In India, an approximate vegetable production of 168.6 million tonnes was recorded from an area of 10.29 million ha, out of which tomato production was 19.7 million tonnes in an area of 0.8 million ha with average productivity 24.6 tonnes/ha (Anonymous, 2017). Madhya Pradesh is endowed with favourable climatic and soil conditions for cultivation of tomato, with 3.1 million tonnes production and 31.2 metric tonnes productivity in an area of 0.1 million ha (Anonymous, 2017). Various factors are responsible for crop yield, among

which American serpentine leaf miner, *Liriomyza trifolii* (Burgess) (Agromyzidae; Diptera) is the serious pest of tomato crop. It is suspected to have been introduced in India during 1990-91 through imported chrysanthemum cutting (Viraktamath *et al.*, 1993). It is a polyphagous pest. In India it was recorded on 70 host plants covering fibre crops, pulses, vegetables, ornamentals, green manures, fodder crops etc. (Srinivasan *et al.*, 1995). Galande *et al.*, (2004) recorded this pest on 16 new crops and 16 weed species. The estimated yield losses due to infestation by *L. trifolii* were about 70 per cent (Zoebisch *et al.*, 1984). Therefore, it is essential to understand their population dynamics under field condition so that, timely management practices can be done. A thorough knowledge on seasonal activity of pests determines the predisposing climatic factors affecting their population dynamics. Keeping in view the importance of the crop and losses caused by different insect pests, the present study was made to assess the population dynamics of pests on tomato.

Materials and Methods

The study on effect of weather parameters on incidence of leaf miner, *L.trifolii* was conducted at Breeder seed production unit Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur during Rabi season of the year 2017-18. Tomato seedlings were transplanted during third week of October in a plot size of 3X4 m with a spacing of 50X60 cm. The crop was raised by following all the recommended agronomical practices. Observations like leaf infestation (%), no. of mines/leaf and mean larval population/plant were recorded by tagging fifty plants at random. Total number of leaves, damaged or infested leaves of each plant and the number of larvae present in the mines were counted. Observations were recorded at weekly intervals starting from transplanting to the crop harvest. The whole

experiment field was kept free without any insecticide application. To find out the specific impact of different weather parameters on *L. trifolii*, data was analyzed using OPSTAT statistical software.

Results and Discussion

The seasonal incidence, correlation coefficients and multiple regressions were estimated on leaf miner infestation with maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, sunshine hours, morning vapor pressure, evening vapor pressure and evaporation of appropriate weeks during 2017 and 2018. It is evident from the data that, the incidence of leaf miner was first noticed during 44th standard week (October) and reached to peak during 1st week (January). Leaf miner found a decline from 2nd week (January) onwards. Correlation analysis between no. of mines/leaf and weather factors revealed that, negative association was observed with minimum temperature, evening relative humidity, morning vapor pressure, evening vapor pressure and evaporation which favour the incidence of leaf miner (Table 1).

Multiple regression analysis showed that, minimum temperature, evening relative humidity, morning vapor pressure, evening vapor pressure and evaporation influenced the leaf miner population by 38 ($R^2 = 0.3785$), 12 ($R^2 = 0.1244$), 30 ($R^2 = 0.3012$), 28 ($R^2 = 0.2875$) and 34 ($R^2 = 0.3432$) per cent respectively and a unit decrease in them increased the leaf miner population by 0.05, 0.01, 0.07, 0.07 and 0.29 in number (Table 2). Regarding leaf infestation per cent correlation studies revealed that morning vapor pressure, evening vapor pressure and evaporation has negative correlation. From regression analysis, it is revealed that, morning vapor pressure, evening vapor pressure and

evaporation influenced the leaf miner population by 78 ($R^2 = 0.7844$), 39 ($R^2 = 0.3899$) and 51 ($R^2 = 0.5112$ per cent and a unit decrease in them increased the leaf miner population by 2.89, 2.32 and 9.03 in number

(Table 2). Correlation data showed that maximum temperature, sunshine hours, morning vapor pressure, evening vapor pressure and evaporation has negative influence on no. of larvae/plant (Fig. 1).

Table.1 Leaf miner activity on tomato

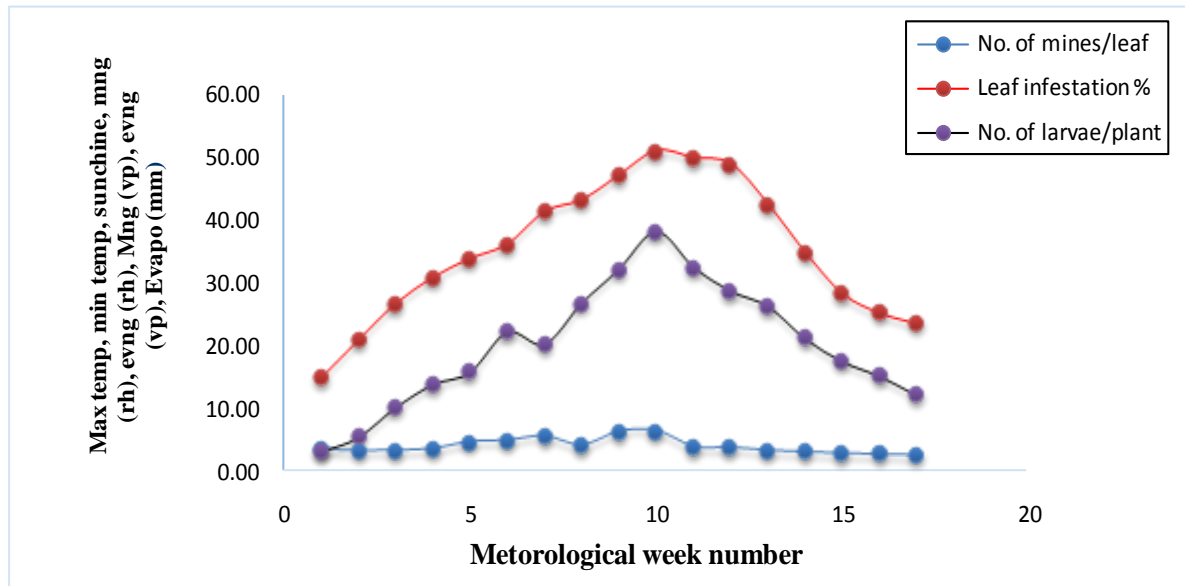
Months	Standard Week numbers	No. of mines/leaf	Leaf infestation %	No. of larvae/plant
October	44	3.41	15.00	3.24
November	45	3.26	21.00	5.55
November	46	3.32	26.80	10.32
November	47	3.59	31.00	13.98
November	48	4.63	34.00	15.93
December	49	4.87	36.30	22.34
December	50	5.51	41.50	20.41
December	51	4.14	43.40	26.96
December	52	6.23	47.33	32.36
January	1	6.35	51.25	38.33
January	2	3.89	50.12	32.68
January	3	3.75	49.16	28.84
January	4	3.32	42.70	26.44
February	5	3.06	35.00	21.26
February	6	2.85	28.40	17.62
February	7	2.72	25.30	15.28
February	8	2.58	23.60	12.24

Table.2 Estimated correlation coefficients (r), regression coefficients (bxy) and R square values of weather factors on incidence of leaf miner

Weather factors	No. of mines/leaf			Leaf infestation %			No. of larvae/plant		
	R	R ²	bxy	r	R ²	bxy	r	R ²	bxy
Maximum temperature	-0.27NS	0.07	-	-0.45NS	0.20	-	-0.57*	0.26	-0.28
Minimum temperature	-0.61**	0.38	-0.05	-0.35NS	0.12	-	-0.32NS	0.10	-
Sunshine hours	0.42NS	0.08	-	0.40NS	0.16	-	-0.52*	0.26	-0.25
Morning relative humidity	0.13NS	0.06	-	0.21NS	0.04	-	0.12NS	0.06	-
Evening relative humidity	-0.34*	0.12	-0.01	-0.23NS	0.05	-0.21	-0.11NS	0.01	-
Morning vapor pressure	-0.55*	0.30	-0.07	-0.86**	0.78	-2.89	-0.89**	0.79	-0.51
Evening vapor pressure	-0.52*	0.28	-0.07	-0.62**	0.39	-2.32	-0.58**	0.33	-0.37
Evaporation	-0.58**	0.34	-0.29	0.71**	0.51	-9.03	-0.70**	0.49	-1.54

NS -Non significant, * - Significant at 5% level, ** - Significant at 1% level

Fig.1



Whereas, regression studies revealed that, maximum temperature, sunshine hours, morning vapor pressure, evening vapor pressure and evaporation influenced the leaf miner population by 26 ($R^2 = 0.2612$), 26 ($R^2 = 0.2641$), 79 ($R^2 = 0.7932$), 33 ($R^2 = 0.3315$) and 49 ($R^2 = 0.4941$) per cent, and a unit decrease in them increased the leaf miner population by 0.28, 0.25, 0.51, 0.37 and 1.54 in number (Table 2).

The occurrence and progress of all insect pests are much dependent on the environmental factors such as temperature, relative humidity and precipitation (Aheer *et al.*, 1994). In order to precisely assess the relative importance of weather parameters in explaining the variation in population of pest, the partial regression coefficients of leaf miner on weather parameters were computed taking population of pests as dependent variables and maximum and minimum temperatures, relative humidity, vapor pressure, rainfall and evaporation as independent variables. The present findings are in accordance with Choudary and Rosaiah (2000) reported that minimum temperature

and evening relative humidity were negatively correlated with *L. trifolii* incidence in tomato. Reddy and Kumar (2005) reported that mean and total rainfall as well as number of rainy days significantly negatively correlated with seasonal abundance of leaf miner while, negative non-significant correlation obtained between morning and evening relative humidity. Galande and Ghorpade (2010) showed negative correlation between morning relative humidity and *L. trifolii* incidence. Chakraborty (2011) also reported that temperature and maximum as well as minimum relative humidity had significant negative influence on *L. trifolii* population. Variya and Patel (2010) reported that maximum temperature and sunshine had negative influence on larval populations of leaf miner.

From the data it is clear that temperature, is an important unique meteorological that influences the pest population. This study gives us the impact of extreme climatic conditions. Similarly, relative humidity, vapor pressure and evaporation has their influence in the build-up of *L. trifolii*. Knowing the

behaviour of this pest under variable climatic factors, this study may be helpful in re-scheduling the pesticide uses and modification of some available control options in infestation of this pest in tomato. Those planters who make the best use of the basics of integrated pest management such as field monitoring, pest forecasting and choosing economically and environmentally sound control measures will be successful in dealing the effects of climatic factors.

References

- Anonymous. 1995. Observation trial on *Liriomyza trifolii* on tomato. A report of research work done on vegetable entomology during 1994-95. Dr.Panjab Rao Deshmukh Krishi Vidyapeeth.
- Anonymous. 2006 (a). Economic survey of India 2005-06. India.
- Anonymous. 2016-17. Annual report of National Horticulture Board, Haryana.
- Aheer, G. M., K. J. Ahmed and Ali, A. 1994. Role of weather influencing aphid density in wheat crop. *Journal of Agricultural Research*.32:295-301.
- Asalatha, R. 2002. Seasonal activity and bio-efficacy of some eco-friendly insecticides against the serpentine leaf miner *Liriomyza trifolii*. Master's thesis, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, India.
- Bhupender, S., and Narender, H. 2017. Seasonal incidence and management of sorghum shoot fly, *Atherigonasoccata* (Rondani) - A Review. *Forage Research*. 42(4):218-224.
- Chakraborty, K. 2011. Incidence and abundance of tomato leaf miner, *Liriomyza trifolii* (Burgess) in relation to the climatic conditions of Alipurduar, Jalpaigur, West Bengal, India. *Asian Journal of Experimental Biological Sciences*. 2(3):467-473.
- Choudary, D.P., and Rosaiah, R. B. 2000. Seasonal occurrence of *Liriomyza trifolii* (Burgess) (Agromyzidae:Diptera) on tomato crop and its relation with weather parameters. *Pest Management Eco Zoology*. 8(1):91-95.
- Durairaj. 2007. Influence of abiotic factors on the incidence of serpentine leaf miner, *Liriomyza trifolii*. *Indian journal of plant protection*. 35(2):232-234.
- Devinder, S., M. Asifa, A. Hafeez, and Vishav, V. S. J. 2012. Meteorological factors influencing insect pests of Tomato. *Annals of Plant Protection Sciences*. 21(1):68-71.
- Frick, K.E.1957. Nearctic species in the *Liriomyza, pusilla* complex, No.2, *L. munda* and two other species attacking crops in California (Diptera: Agromyzidae). *Pan-Pacific Entomologist* 33(2):59-70.
- Galande, S.M., U.N. Mote, and Ghorpade, S. A. 2004. New host plants of serpentine leaf miner, *Liriomyza trifolii* in western Maharashtra. *Annals of Plant Protection Sciences*. 12:425-475.
- Galande, S.M., and Ghorpade, S. A. 2010. Population dynamics of serpentine leaf miner (*Liriomyza trifolii* Burgess) on tomato and its relation with meteorological parameters. *Journal of Maharashtra Agricultural Universities*. 35(1): 89-92.
- Hemalatha, B., and Maheswari, T. U. 2004. Biology and seasonal incidence of serpentine leaf miner, *Liriomyza trifolii* (Burgess) on tomato in southern zone of Andhra Pradesh. *Indian Journal of Entomology*. 66(2):107-110.
- Jian, L., R.S. Dakshina, L.L. Gary and Oscar, E. L. 2012. Seasonal abundance and spatial distribution of the leafminer, *Liriomyza trifolii* (Diptera: Agromyzidae), and its Parasitoid, *Opiusdissitus* (Hymenoptera: Braconidae), on bean in Southern Florida. *Florida Entomological Society*.

- 95(1):128-135.
- Johnson, M.W., C. Welter, N.C. Toscano, I.P. Ting, Trumble, J. T. 1983. Reduction of tomato leaflet photosynthesis rates by mining activity of *Liriomyza sativae* (Diptera: Agromyzidae). *Journal of Economic Entomology*. 76:1061-1063.
- Lakshminarayana, M., H. Basappa and Singh, V. 1992. Report on the incidence of hitherto unknown leaf miner *Liriomyza trifolii* 158 (Burgess) (Diptera: Agromyzidae) on castor. *Journal of Oilseeds Research*. 9(1):175-176.
- Levins, R.A., S.L. Poe, R.C. Littell, Jones, J. P. 1975. Effectiveness of a leaf miner control program for Florida tomato production. *Journal of Economic Entomology*. 68:772-774.
- Roopa, S. P. 2012. Epidemiology and management of early blight of tomato caused by *Alternaria solani* (Ellis and Martin) Jones and Grout, M.Sc. Thesis, University of Agricultural Sciences, Dharwad, India.
- Reddy, N.A., and Kumar, C. T. A. 2005. Influence of weather factors on abundance and management of Serpentine leaf miner, *Liriomyza trifolii* (Burgess) on tomato. *Annals of Plant Protection Sciences*. 13:315-318.
- Saradhi, P., and Patnaik, N. C. 2004. Seasonal population fluctuations of serpentine leaf miner, *Liriomyza trifolii* (Burgess) in different host plants. *Journal of Applied Zoological Researches*. 15(1):60-63.
- Srinivasan, K., C. A. Viraktamath, M. Gupta and Tiwari, G. C. 1995. Geographical distribution host range and parasitoid of serpentine leaf miner, *Liriomyza trifolii* (Burgess) in south India. *Pest Management in Horticultural Ecosystem*. 1: 93-100.
- Selvaraj, S., R.S. Bishit and Ganeshamoorthi, P. 2016. Seasonal incidence of American serpentine leaf miner *Liriomyza trifolii* (Burgess) on Tomato. *International Journal of Agriculture Sciences*. 8(38):1777-1779.
- Sharma, D., and Sharma, S. 1997. Status of *Liriomyza trifolii*(Burgess) and its host plants in Jabalpur district in Madhya Pradesh. *Cropresearch (Hisar)*. 14(2): 351-355.
- Variya, M.V., and Patel, J. J. 2013. Population dynamics of Leaf miner (*Liriomyza trifolii*Bugress) on tomato in relation to weather parameters. *An international e-Journal* 2(3): 385-391.
- Viraktamath, C. A., G. C. Tewari, K. Srinivasan and Gupta, M. 1993. American Serpentine leaf miner is a new threat to crops. *Indian Farming*. pp 10-12.
- Zoebisch, T.C., D. J. Schuster and Gilreath, J.P. 1984. *Liriomyza trifolii*: Oviposition and development in foliage of tomato and common weed hosts. *Florida Entomologist*. 67(2): 250-254.

How to cite this article:

Naga Sri Navya Ravipati, Abhishek Shukla and Bhojeswari Sahu. 2020. Influence of Weather Parameters on the Incidence of Serpentine leaf miner, *Liriomyza trifolii* (Burgess) on Tomato. *Int.J.Curr.Microbiol.App.Sci*. 9(05): 2260-2265. doi: <https://doi.org/10.20546/ijcmas.2020.905.257>