Annals of Plant and Soil Research 27(4): 523-528 (2025)
https://doi.org/10.47815/apsr.2025.10498

Seasonal occurrence of leaf miner (*Liriomyza trifolli* Burg.) infesting tomato (*Lycopersicon esculentum* Mill.) and their management

TANMOY MANDAL[1]

Department of Plant Protection, Suri Vidyasagar College, Suri, Birbhum, West Bengal- 731101, India

Received: September, 2025; Revised accepted: October, 2025

ABSTRACT

Field experiment was conducted under Suri Vidyasagar College at Gobra village, Suri, Birbhum, West Bengal, India for the two consecutive years as rabi season tomato crop 2022 and 2023 to study seasonal occurrence of leaf miner (Liriomyza trifolli Burg.) infesting tomato (Lycopersicon esculentum Mill.) and their management. Leaf miner, major pest of tomato, was found active throughout the crop growing season. Higher level of population was maintained from 9th standard meteorological week to 15th standard meteorological week i.e. 4th week of February to 2nd week of April. Peak population (6.06 number of mine / leaf) was recorded on 12th standard meteorological week i.e. 3rd week of March. Correlation co-efficient (r) between leaf miner population and weather parameters were calculated. Leaf miner occurrence was positively (+) correlated with maximum temperature (r = 0.715), minimum temperature (r = 0.608), average temperature (r = 0.671) and average rainfall (r = 0.145). On the other hand a negative (-) correlation was found between leaf miner incidence and maximum relative humidity (r = - 0.724), minimum relative humidity (r = - 0.704), average relative humidity (r = - 0.730). Efficacy of different insecticides against leaf miner showed that Dimethoate 30 % EC (ROGAR) 2.0 ml/l was found effective against leaf miner (65.86 % reduction of leaf miner population over control) followed by Imidacloprid 17.8 SL (CONFIDOR) 0.5 ml/l (62.58 %). Among the botanicals, Azadirachtin 3000 ppm (NEEMRAJ) 4.0 ml/l was found effective against leaf miner (43.98 % reduction of leaf miner population over control) followed by neem leaf extract 50.00 ml/l (5%) (31.50 %), garlic bulb extract 50.00 ml/l (5%) (28.22 %), onion bulb extract 50.00 ml/l (5%) (25.16 %) and turmeric rhizome extract 50.00 ml/l (5%) (22.10 %).

Key words: Leaf miner, tomato, Seasonal occurrence, *Liriomyza trifolli*

INTRODUCTION

Tomato, (*Lycopersicon esculentum*) belongs to family solanaceae, is an important vegetable crop cultivated throughout the world. India produces 7.1 million tonnes of tomato annually from an area of 5.4 lakh hectares (Arora *et al.* 2012). It is a rich source of vitamin A, vitamin C and lycopene (Kumar *et al.* 2014). It adds variety of colours and flavours to the foods (Yadav *et al.* 2019). The plant is attacked by number of insect pests due to its fleshy nature (Pandey *et al.* 2006). The insect pest complex of tomato are leaf miner, aphid, jassid, white fly, thrips and fruit borer (Choudhuri *et al.* 2001). Leaf miner, *Liriomyza trifolli* (Agromyzidae: Diptera) is a major pest of tomato (Srinivasan *et al.* 1995) and causing considerable damage to the grower. It is a holometabolic leaf mining insect, also known as serpentine leaf miner, where the egg and larval stages found inside the leaf, pupation takes place in soil and the adults are free living (Parrella, 1987). The adult female punctures on the leaf mesophyll with their ovipositor for egg laying (Parrella *et al.* 1985). The larvae feed on the leaf mesophyll and produces irregular mines on tomato leaves. The estimated losses due to infestation of *Liriomyza trifolli* is 90% loss to tomato foliage (Johnson *et al.* 1983) and 70% loss to tomato yield (Zoebisch *et al.* 1984). Climatological conditions like temperature, humidity and day length directly affect the population of *Liriomyza*. Climates also restrict the dispersals of the pest to a particular locality (Srivastava, 1993). Considering this, seasonal occurrence of leaf miner (*Liriomyza trifolli* Burg.) infesting tomato *(Lycopersicon esculentum* Mill.) and their management was undertaken.

MATERIALS AND METHODS

Experiment was conducted under Suri Vidyasagar College at Gobra village, Suri, Birbhum, West Bengal, India for the two consecutive years as rabi season tomato crop 2022 and 2023. Experimental area situated at undulating red laterite zone of West Bengal,

Corresponding author Email: tanmoy_mandal22@rediffmail.com

India between 23^0 53' N latitude and 87^0 32' longitude. The soil of the cultivated land was sandy to sandy loam, mild acidic in nature with pH value 6.8. The climatic condition of this region was hot humid summer and cool dry winter.

To study the seasonal occurrence of tomato leaf miner and their relation with weather parameters 'suri local' variety was grown during two consecutive year 2022 and 2023 as rabi season crop. Crop was grown under recommended fertilizer dose (120 kg N + 60 kg P + 60 kg K ha^{-1}). Healthy one month old tomato seedlings were transplanted at last week of December for both two years 2022 and 2023. Each plot was 4 m X 4 m size and spacing 75 cm x 50 cm. in randomized block design with 3 times replication. Tomato was grown with all agronomic practices without any plant protection methods. Leaf miner population was recorded by number of mine/leaf on an average by randomly selected tomato plant from each plot at seven days intervals (Standard Meteorological Week) throughout tomato growing seasons. Weather parameters were recorded from Indian Meteorological department official website on a daily basis and their weekly average calculated. Correlation co-efficient (r) between weather parameters and leaf miner infestation was calculated during the tomato growing period to find out influence of weather parameters on seasonal occurrence of tomato leaf miner.

To study efficacy of insecticides against tomato leaf miner, four plants extract along with three chemical insecticide, total seven insecticides were selected. Tomato was grown under recommended fertilizer dose (120 kg N + 60 kg P + 60 kg K ha^{-1}). Each plot was 4 m X 4 m size and spacing 75 cm x 50 cm. in randomized block design with 3 times replication. Tomato was grown with all agronomic practices. Plant extracts and chemical insecticides were applied for 2 times at 15 days intervals with a knapsack sprayer to control tomato leaf miner. In my study spraying was done in the month of March. Treatments were replicated three times with randomized block design.

Treatment details are given here under:

Treatments	Dose ml/litre (%)
Azadirachtin 3000 ppm (NEEMRAJ) (T1)	4.00 ml/l
Garlic (*Allium sativum*) bulb extract (T2)	50.00 ml/l (5%)
Turmeric (*Curcuma longa*) rhizome extract (T3)	50.00 ml/l (5%)
Dimethoate 30% EC (ROGAR) (T4)	2.00 ml/l
Neem (*Azadirachta indica*) leaf extract (T5)	50.00 ml/l (5%)
Imidacloprid 17.8 SL (CONFIDOR) (T6)	0.5 ml/l
Onion (*Allium cepa*) bulb extract (T7)	50.00 ml/l (5%)
Untreated Control (T8)	

Garlic, turmeric, neem and onion were extracted in methanol, methodology developed by Ghosh (2019). The plant parts, after washing in tap water were dried in sunlight for 2-3 days and make them powder form by grinding machine. Then 50 g of powder was mixed with 250 ml of methanol in a conical flask. Put the mixture for 72 hours at room temperature with occasional shaking. Then extracts were filtered by a muslin cloth. 50 ml of plant extract was required for one litre of water.

To study efficacy of insecticides against tomato leaf miner, number of mine / leaf were recorded by randomly selected tomato plant on an average at 7 days and 14 days after each spraying for each treatment with replicated thrice. The percentage reduction of tomato leaf miner population over control was calculated by the following formula.

Percentage reduction of tomato leaf miner over control =

$$\frac{C - T}{C} \times 100$$

Where;

C = Number of mine / leaf in control plot

T = Number of mine / leaf in treatment plot

OPSTAT- online statistical analysis tool was used for analysis of data. OPSTAT was developed and maintain by Prof. O. P. Sheoran, from Department of Mathematics and Statistics, CCS HAU, Hisar.

RESULTS AND DISCUSSION

Seasonal Occurrence of tomato leaf miner

Tomato leaf miner, *Liriomyza trifolli* (Agromyzidae: Diptera), infestation was different in both the year 2022 and 2023. In 2022, its occurrence was started in 4th standard meteorological week i.e. 4th week of January (0.42 number of mine / leaf) and population increasing gradually. Maximum population of tomato leaf miner was recorded (7.28 number of mine / leaf) on 13th standard meteorological week i. e. 4th week of March when average temperature was 29. 01°C, average relative humidity was 57.28 % and average rainfall was 0.00 mm. Higher level of infestation was recorded from 8th standard meteorological week to 16th standard meteorological week i.e. 3rd week of February to 3rd week of April when average temperature, relative humidity and rainfall were 22.09 °C – 34.94 °C, 52.34 %– 65.61 % and 0.00 mm – 15.80 mm respectively.

In the year 2023, leaf miner incidence was noticed in 5th standard meteorological week i.e. 5th week of January (0.57 number of mine / leaf) and then population increasing. Highest population was observed (5.28 number of mine / leaf) 12th standard meteorological week i.e. 3rd week of March when average temperature, relative humidity and rainfall were 26.43 °C, 65.61 % and 15.80 mm respectively. Higher level of incidence was recorded from 9th standard meteorological week to 14th standard meteorological week i.e. 4th week of February to 1st week of April when average temperature was 23.43 – 29.08 °C, average relative humidity was 54.39 %– 65.61 % and average rainfall was 0.00 mm – 15.80 mm. The mean data of leaf miner incidence for both the year 2022 and 2023 showed that leaf miner was found active throughout the tomato growing period (Figure 1). Higher level of population was maintained from 9th standard meteorological week to 15th standard meteorological week i.e. 4th week of February to 2nd week of April. Peak population (6.06 number of mine/leaf) was recorded on 12th standard meteorological week i.e. 3rd week of March. Present finding are in accordance with those of Reddy and Kumar (2005) and Kharpuse and Bajpai (2006). They also reported that Peak population of *Liriomyza trifolli* on tomato was found in the month of March-April.

Correlation studies between tomato leaf miner population and weather parameters

Correlation co-efficient (r) between leaf miner population and weather parameters were calculated (Table 1). It was observed that significant positive correlation was found between leaf miner population and maximum temperature (r = 0.715), minimum temperature (r = 0.608), average temperature (r = 0.671). Similar findings were recorded by Chaudhary and Rosaiah (2000). On the other hand significant negative correlation was found between leaf miner population and maximum relative humidity (r = - 0.724), minimum relative humidity (r = - 0.704), average relative humidity (r = - 0.730). A positive correlation was observed between average rainfall and tomato leaf miner population (r = 0.145). It indicates that activity of tomato leaf miner increases with rise of temperature and decreases with rise of relative humidity percentage.

Table 1: Correlation co-efficient between serpentine leaf miner and environment parameters

Environment parameters	Correlation co-efficient (r)	Co-efficient of determination (R^2)	Regression equation
Maximum Temperature (°C)	0.715**	0.511	Y= 1.890x + 25.216
Minimum Temperature (°C)	0.608**	0.370	Y= 1.743x + 13.162
Temperature (°C) difference	0.143	0.020	Y= 0.151x + 12.032
Average Temperature (°C)	0.671**	0.451	Y= 1.815x + 19.196
Maximum Relative Humidity (%)	-0.724**	0.525	Y= -3.215x + 82.483
Minimum Relative Humidity (%)	-0.704**	0.497	Y= -3.257x + 63.855
Average Relative Humidity (%)	-0.730**	0.533	Y= -3.236x +73.167
Rain fall (mm)	0.145	0.021	Y= 0.640x + 3.894

*Significant at 5% level of significance; ** Significant at 1% level of significance*

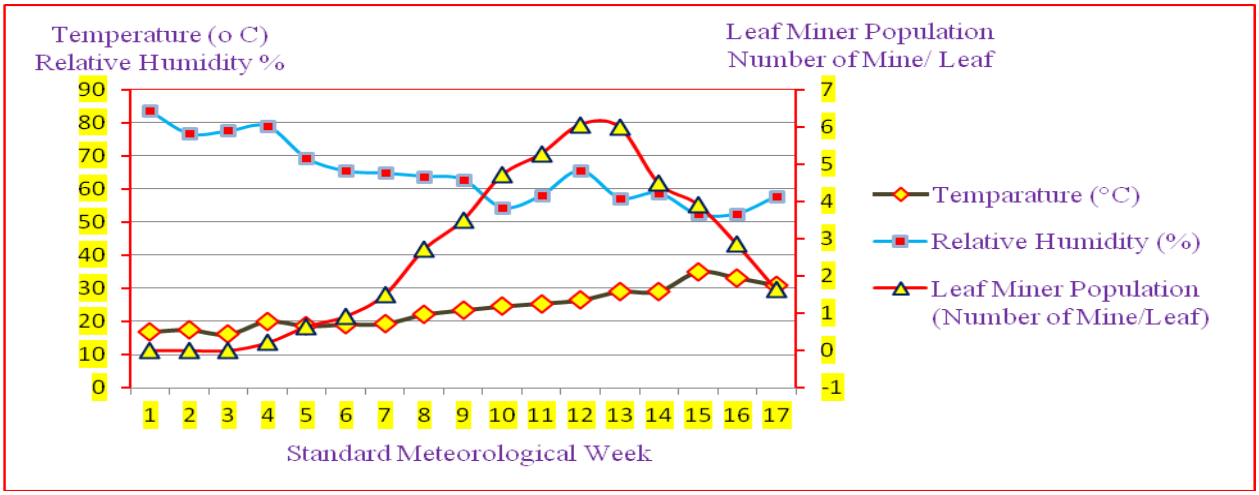

Figure 1: Seasonal occurrence of tomato leaf miner population as influenced by temperature and relative humidity %

Efficacy of insecticides against tomato leaf miner

The different treatments resulting different efficacy at 7 days after spraying and 14 days after spraying for percentage reduction of tomato leaf miner population over control (Table 2). Pre- treatment observations of tomato leaf miner were recorded ranging from 4.14 to 5.28 numbers of mine / leaf. Among the seven insecticides, Dimethoate 30 % EC (ROGAR) 2.0 ml/l was found most effective against leaf miner (65.86 % reduction of leaf miner population over control) followed by Imidacloprid 17.8 SL (CONFIDOR) 0.5 ml/l was found second best against leaf miner (62.58 % reduction of leaf miner population over control). Among the botanicals, Azadirachtin 3000 ppm (NEEMRAJ) 4.0 ml/l was found superior against leaf miner (43.98 % reduction of leaf miner population over control) followed by neem leaf extract , garlic bulb extract , onion bulb extract and turmeric rhizome extract (31.50 % , 28.22 %, 25.16 % and 22.10 % reduction of leaf miner population over control respectively). Barde and Srivastava (2017) also found that neem was proved significantly superior in controlling tomato leaf miner.

Table 2: Efficacy of insecticides against tomato leaf miner

Treatments	Dose ml/l (%)	Pre-treatment count	Number of mine/leaf				Percentage reduction of leaf miner over control after second spray
			First spray		Second spray		
			7 DAS	14 DAS	7 DAS	14 DAS	
Azadirechtin 3000 ppm (NEEMRAJ) (T1)	4.00 ml/l	4.28	3.52 (2.12)	4.13 (2.26)	2.33 (1.82)	2.56 (1.88)	43.98
Garlic (*Allium sativum*) bulb extract (T2)	50.00 ml/l (5%)	4.85	3.99 (2.23)	4.28 (2.29)	3.13 (2.03)	3.28 (2.06)	28.22
Turmeric (*Curcuma longa*) rhizome extract (T3)	50.00 ml/l (5%)	4.14	3.71 (2.17)	3.99 (2.23)	3.42 (2.10)	3.56 (2.13)	22.10
Dimethoate 30% EC (ROGAR) (T4)	2.00 ml/l	5.28	2.14 (1.76)	2.85 (1.96)	1.28 (1.50)	1.56 (1.60)	65.86
Neem (*Azadirachta indica*) leaf extract (T5)	50.00 ml/l (5%)	4.57	3.56 (2.13)	3.85 (2.20)	2.90 (1.97)	3.13 (2.03)	31.50
Imidacloprid 17.8 SL (CONFIDOR) (T6)	0.5 ml/l	4.42	2.56 (1.88)	3.09 (2.02)	1.42 (1.55)	1.71 (1.64)	62.58
Onion (*Allium cepa*) bulb extract (T7)	50.00 ml/l (5%)	5.14	3.80 (2.19)	4.28 (2.29)	2.94 (1.98)	3.42 (2.10)	25.16
Untreated Control (T8)		4.71	4.14	5.28	4.42	4.57	
S Em (±)			0.03	0.02	0.03	0.02	
CD at 5%			0.11	0.07	0.10	0.08	

Figure in the parenthesis are square root transformed values, DAS = days after spraying

CONCLUSION

Leaf miner was found active throughout the crop growing season. Higher level of population was maintained from 4th week of February to 2nd week of April. Peak population (6.06 number of mine/leaf) was recorded on 3rd week of March. Leaf miner incidence was positively (+) correlated with maximum temperature, minimum temperature, average temperature and average rainfall. On the other hand a negative (-) correlation was found between leaf miner population and maximum relative humidity, minimum relative humidity, average relative humidity. A positive correlation was observed between average rainfall and tomato leaf miner population. It indicates that activity of tomato leaf miner increases with rise of temperature and decreases with rise of relative humidity percentage.

Dimethoate 30 % EC (ROGAR) 2.0 ml/l and Imidacloprid 17.8 SL (CONFIDOR) 0.5 ml/l both were found effective against tomato leaf miner (more than 60 % reduction of leaf miner population over control). Azadirachtin 3000 ppm (NEEMRAJ) 4.0 ml/l was also found effective and showing more than 40 % reduction of leaf miner population over control. Botanicals are the safe and may incorporate in Integrated Pest Management against tomato leaf miner.

ACKNOWLEDGEMENT

Experiment was carried out with the help of Department of Plant Protection, Suri Vidyasagar College, Suri, Birbhum and providing laboratory for the study. I thank the Department as well as I thank Dr. Tapan Kumar Parichha, Principal, Suri Vidyasagar College. I thank Sri Samim Mondal, student of B.Sc. (General) and all others who have contributed to it.

REFERENCES

Arora, S., Kanojia, A.K., Kumar, A., Mogha, N. and Sahu, V. (2012) Biopesticide formulation to control tomato lepidopteran pest menace. *Current Science*, **102**: 1051-1057.

Barde, S.K. and Shrivastava, S. S. (2017) Efficacy of Plant products against Serpentine Leaf Miner and White Fly on Tomato. *Biosciences Biotechnology Research Asia*, **14**(3): 1187-1190.

Chaudhary, D.P.R. and Rosaiah, B. (2000) Seasonal occurrence of *Liriomyza trifolli* (Burgess) (Agromyzidae: Diptera) on tomato crop and its relation with weather parameters. *Pest Management and Economic Zoology*, **8**(1): 91-95.

Choudhury, N. and Senapati, S.K. (2001) Evaluation of pesticides from different origin-synthetic and biological, against pest complex of tomato under terai region of West Bengal. *Haryana Journal of Horticultural Sciences*, **30**(3/4): 274-277.

Ghosh, S.K. (2019) Climate impact on red spider mite (*Tetranychus sp*, Koch) infesting eggplant (*Solanum melongena* L.) and their management using plant extracts. *Journal of Entomological Research*, **43**: 345-350.

Johnson, M.W., Welter, S.C., Toscano, N.C., Ting, I.P. and Trumble, J. T. (1983) Reduction of tomato leaflet photosynthesis rates by mining activity of *Liriomyza sativa* (Diptera: Agromyzidae). *Journal of Economic Entomology*, **76**: 1061-1063.

Kharpuse, Y.K. and Bajpai, R. (2006) Seasonal incidence of major insect pests of tomato (*Lycopersicon esculentum* M.) at JNKVV Research Farm Jabalpur. *Indian Journal of Tropical Biodiversity*, **14**(2): 178-181.

Kumar, M.S., Madhavi, M. and Reddy, K. C. (2014) Economics of tomato as influenced by Integrated Weed Management. *Annals of Plant and Soil Research*, **16**(1): 75-76.

Pandey, A.K., Namgyal, D., Mehdi, M., Mir, M.S. and Shikh, B.A. (2006) A case study: Major insect pest associated with different vegetable crops in cold arid region, Ladakh of Jammu and Kashmir. *Journal of Entomological Research*, **30**: 169-174.

Parrella, M.P., Jones, V. P., Youngman, R. R. and Lebeck, L. M. (1985) Effect of leaf mining and leaf stippling of *Liriomyza spp.* on photosynthetic rates of chrysanthemum. *Annals of Entomological*

Society of America, **78**: 90-93.

Parrella, M.P. (1987) Biology of *Liriomyza*. *Annual Review of Entomology*, **32**: 201-2024.

Reddy, N. A. and Kumar, C.T.A. (2005) Influence of weather factors on abundance and management of serpentine leaf miner, *Liriomyza trifolli* (Burgess) on tomato. *Annals of Plant Protection Sciences*, **13**(2): 315-318.

Srinivasan, K., Virakamath, C.A., Gupta, M. and Tiwari, G. C. (1995) Geographical distribution, host range and parasitoids of serpentine leaf miner in South India. *Pest Management in Horticultural Ecosystem*, **1**: 93-100.

Srivastava, K.P. (1993) A text book of applied entomology. Vol. 1. Kalyani publishers. India pp. 3-126.

Yadav, V., Yadav, M.S. and Prasad, F.M. (2019) Effect of gibberelhic acid and boron on growth and biochemical composition of tomato (*Lycopersicon esculentum*) plants. *Annals of Plant and Soil Research*, **21**(2): 141-144.

Zoebisch, T.C., Schuster, D.J. and Gilreath, J.P. (1984) *Liriomyza trifolli*: ovipositional development in foliage of tomato and common weed hosts. *Florida Entomology*, **67**(2): 250-254.