



Research Article

SEASONAL INCIDENCE OF AMERICAN SERPENTINE LEAF MINER *LIRIOMYZA TRIFOLII* (BURGESS), ON TOMATO AT PANTNAGAR, UTTARAKHAND

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Abstract- The incidence of *Liriomyza trifolii* Burgess on tomato (*Solanum lycopersicum* L.) at Pantnagar during the cropping season 2011-12 and 2012-13 revealed that the pest exhibited its incidence almost throughout the crop season marked its first appearance in 8th and 9th standard meteorological week (SMW) i.e. (February and March), attain peak population in 14th and 17th SMW (April), respectively. The pest population exhibit non significant correlation with various abiotic factors, except significant positive correlation with sunshine hours and significant negative correlation with morning and evening relative humidity during 2012-13.

Keywords- Pulation dynamics, *L. trifolii*, Tomato, Correlation

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Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most important vegetable grown all over the world and is a good source of vitamins. It is affected by several biotic, physiochemical and mesobiotic factors. Among the biotic factors insect pests are predominant and occur regularly at different stages of crop growth. A number of insect pests i.e., about 100 and 25 non insect pest species are reported to ravage the tomato fields [1]. Among these insect pests, the loss incurred *Liriomyza trifolii* (Burgess) has become most important in recent years [2]. The serpentine leaf miner, a native of America was accidentally introduced to India along with chrysanthemum cuttings. In India, it is one of the recently introduced pests of tomatoes, whose infestation is increasing every year at an alarming rate [3]. Leaf miner is occur throughout the season. This pest significantly reduced the yield and fruit quality by direct feeding [4-5]. Leaf miner female adult insert an egg in plant tissues with its ovi positing. The neonate larvae feeding leaves results in serpentine mines, heavily mined leaflets have large whitish blotches by fourth instar larvae [6]. Leaves injured by leaf miners drop prematurely; heavily infested plants may lose most of their leaf surface area are responsible for photosynthetic activity [7]. Twisted and curled leaves are generally the first symptoms [8] and these mines are usually partially filled with grass and are irregular in shape. Tissue death (necrosis) can occur around the mines and, during serious infestations, the leaves can become skeletonised. Small holes surrounded by grass and webbing may be visible in stems where the tomato leaf miner larvae have entered the plant to feed [9-10]. *L. trifolii*, the tomato leaf miner, is a highly polyphagous leaf miner capable of inflicting severe damage to crops [11]. Therefore, developing an effective pest management strategy, it is necessary to know the population dynamics of the pest. There are many environmental factors which influence the insect pest populations [12]. Among them abiotic factors play a vital role in multiplication and distribution of insect pests. Therefore, an attempt

has been made to work out the effect of different abiotic factors on the population dynamics of tomato leaf miner, *L. trifolii* infesting tomato in Tarai region of Uttarakhand.

Materials and Methods

A field experiments were conducted at Vegetable Research Centre (VRC), G.B. Pant University of Agriculture and Technology, Pantnagar during, 2011-12 and 2012-13. The variety 'Pant Tomato 3' was planted in Randomized complete block design with in experimental plot of 3 x 3 m² with 45 cm plant to plant distance and 60 cm row to row distance during both the years. Transplantation was done with 28-days old seedlings. Tomato crop was raised by following all the recommended agronomical practices except plant protection measures, which enabled the build up of serpentine leaf miner, *L. Trifolii* in a pesticide free environment.

Record on pest Incidence

Visual count

In situ number of leaf miner was counted after gently turning a leaf. Average of 20 leaves (10 x 2) was considered. Counts of leaf miner per leaf were obtained by randomly selecting 10 plants. From each plant two leaves were selected. Counts began 3 weeks after transplanting and continued for subsequent 25 weeks during each year of the study [13]. The data on pest population were correlated with various weather parameters for working out the correlation coefficient. The SPSS 16.0 programme was used to work out the correlation between larval population and weather parameters.

Results and Discussion

Population dynamics of American serpentine leaf miner, *L. trifolii*

In 2011-12, the incidence of the *L. trifolii* was marked from 9th SMW to 20th SMW

(56 day after transplant (DAT) to 133 DAT) [Table-1]. The pest first appearance with an average of 0.50 leaf miner/plant on 56 DAT in the 9th standard week during that time the maximum-minimum temperature, morning-evening relative humidity (RH), rainfall, sunshine hrs, wind velocity were 26.0^o C, 7.4^o C, 90% (0712 am), 36% (1412 pm), 0.00 mm, 8.0 hrs, 6.1 km/hr, respectively. The population gradually increased, reached to its peak (7.20 leaf miners/plant) at 91 DAT in 14th standard week (maximum-minimum temperature, morning-evening relative humidity (RH), rainfall, sunshine hrs, wind velocity 35.7^o C, 18.7^o C, 77% (0712 am), 31% (1412 pm), 0.00 mm, 8.5 hrs, 3.1 km/hr, respectively) followed by gradual decrease in population and attained reaches to its minimum level i.e. zero from 21st to 24th standard week (May 21 to June 17).

In 2012-13, the incidence of serpentine leaf miner was started from 8th standard week to 24th standard week (18 DAT to 130 DAT) [Table-2]. The pest first appeared with an average population of 0.25 leaf miner/plant at 18 DAT (8th standard week) when average maximum-minimum temperature, morning-evening

relative humidity (RH), rainfall, sunshine hrs, wind velocity were 22.9^o C, 10.1^o C, 91% (0712 am), 57% (1412 pm), 24.2 mm, 6.6 hrs, 4.6 km/hr respectively. The pest population increased gradually till 24th standard week (130 DAT) and reached to its peak (6.48 leaf miner/plant) in 17th standard week when average maximum-minimum temperature, morning-evening relative humidity (RH), rainfall, sunshine hrs, wind velocity were 35.0^o C, 19.5^o C, 64% (0712 am), 30% (1412 pm), 0.00 mm, 9.1 hrs, 7.7 km/hr, respectively. The population of the pest decreased gradually and reached to its minimum level i.e. zero in 25th standard week (June 18 to June 24) experienced by flashing of rain. A perusal of [Tables-1 and 2] revealed that range of maximum and minimum temperature, morning and evening relative humidity, rainfall, sunshine hours and wind velocity of 35-35.7^o C, 18.7-19.5^o C, 64-77%, 30-31%, 0.00 mm, 8.5-9.1 hrs and 3.1-7.2 km/hr, respectively during the course of two years study were found most favourable for the increased population of American serpentine leaf miner.

Table-1 Population fluctuation of leaf miner, *L. trifolii* in relation to weather parameters at VRC, Pantnagar, during 2011-12

Month	Date	SMW	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Sun-Shine Hrs.	Wind Velocity (km/hr.)	Leaf miner population /plants
			Max.	Min.	0712 am	1412 pm				
Feb	05-11	6	22.0	6.8	91	46	000.6	06.7	5.5	0.00
Feb	12-18	7	23.3	9.1	89	44	000.0	05.5	5.7	0.00
Feb	19-25	8	27.1	9.5	90	33	000.0	08.2	6.1	0.00
Feb-Mar	26-04	9	26.0	7.4	90	36	000.0	08.0	6.1	0.50
Mar	05-11	10	27.4	11.8	88	45	000.6	05.5	2.3	2.15
Mar	12-18	11	27.5	11.0	90	40	003.2	08.9	3.4	3.35
Mar	19-25	12	30.4	13.5	88	39	000.0	07.0	5.0	4.55
Mar-Apr	26-01	13	32.9	15.5	88	38	000.0	07.1	5.3	6.40
Apr	02-08	14	35.7	18.7	77	31	000.0	08.5	3.1	7.20
Apr	09-15	15	32.1	17.7	83	49	007.4	04.9	5.9	5.62
Apr	16-22	16	35.0	18.2	72	30	000.0	10.0	10.0	4.87
Apr	23-29	17	36.4	19.4	60	22	000.0	11.2	8.0	3.02
Apr-May	30-06	18	36.6	18.6	47	23	000.0	10.9	7.7	2.14
May	07-13	19	37.9	22.4	59	27	000.0	09.4	5.8	2.00
May	14-20	20	38.9	21.5	66	27	000.0	07.9	6.4	0.20
May	21-27	21	40.9	20.9	62	18	000.0	09.8	8.4	0.00
May-Jun	28-03	22	41.5	24.3	57	25	000.0	09.1	7.4	0.00
Jun	04-10	23	40.3	24.1	61	25	000.0	07.6	10.1	0.00
Jun	11-17	24	42.4	25.1	54	23	000.0	10.6	11.9	0.00
Correlation										
Leafminer population			-0.37	-0.006	0.241	0.282	0.344	-0.105	-0.371	

* Significant at 0.01 level; ** Significant at 0.05 level; Max- Maximum temperature; Min. Minimum temperature

Table-2 Population fluctuation of leaf miner, *L. trifolii* in relation to weather parameters at VRC, Pantnagar, during 2012-13

Month	Date	SMW	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Sun-Shine Hrs.	Wind Velocity (km/hr.)	Leaf miner population /plants
			Max.	Min.	0712 am	1412 pm				
Feb	19-25	8	22.9	10.1	91	57	024.2	06.6	4.6	0.25
Feb	26-04	9	25.5	10.9	94	47	000.0	09.1	6.2	0.82
Feb	05-11	10	29.0	13.2	90	46	000.0	08.9	3.4	2.00
Feb-Mar	12-18	11	29.2	12.8	88	44	013.4	08.8	3.8	1.89
Mar	19-25	12	29.9	15.2	88	43	000.0	08.3	2.5	2.67
Mar	26-01	13	30.5	14.5	88	38	000.0	08.5	2.4	3.45
Mar	02-08	14	33.3	14.8	79	24	000.0	10.3	7.1	3.62
Mar-Apr	09-15	15	36.9	17.9	68	23	000.0	09.4	6.7	4.59
Apr	16-22	16	34.7	18.2	61	29	008.4	09.4	7.3	5.68
Apr	23-29	17	35.0	19.5	64	30	000.0	09.1	7.2	6.48
Apr	30-06	18	38.9	19.1	60	23	000.0	10.1	7.4	4.26
Apr	07-13	19	38.7	19.7	56.7	26	001.2	07.9	5.1	3.00
Apr-May	14-20	20	38.4	23.8	60.4	31.6	000.0	08.8	3.0	2.55
May	21-27	21	39.2	29.1	70	44.4	000.0	04.3	3.6	1.00
May	28-03	22	37.9	25.8	66.9	40.7	000.0	07.8	3.0	1.50
May	04-10	23	35.2	27.0	75.4	56.4	023.6	04.2	2.6	2.64
May-Jun	11-17	24	33.6	25.2	80.4	65.6	119.8	03.9	8.8	1.10
Jun	18-24	25	31.3	25.2	87.1	69.9	173.0	03.0	7.5	0.00
Correlation										
leafminer population			0.451	0.045	0.603**	0.758**	0.442	0.582*	0.218	

* Significant at 0.01 level; ** Significant at 0.05 level; Max- Maximum temperature; Min. Minimum temperature

The pooled analysis showed that the incidence of serpentine leaf miner was started from 8th standard week to 24th standard week [Table-3]. The pest first

appeared with an average population of 0.13 leaf miner/plant at 8th SMW and population were increased gradually till 24th SMW and reached to its peak (5.28

leaf miner/plant) in 16th SMW when average maximum-minimum temperature, morning-evening relative humidity (RH), rainfall, sunshine hrs, wind velocity were 34.85°C, 18.2°C, 66.5% (0712am), 29.5% (1412am), 4.20 mm, 9.70 hrs, 8.65 km/hr, respectively. In present investigation the leaf miners population was maximum from first week of April (14th SMW) to last week of April (17th SMW) in both the years, which was in agreement with [14] reported that the higher

incidence of leaf miner during late March to early May in Maharashtra. The present findings are in close agreement with [13] who observed that the population of *L. trifolii* in West Bengal was initiated at 01 SMW and then steadily up to 6 SMW attaining the maximum at about 8 SMW (February) which was maintained up to about 13 SMW.

Table-3 Population fluctuation of leaf miner, *L. trifolii* in relation to weather parameters at VRC, Pantnagar, during both the years (Pooled analysis)

SMW No.	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Sun-Shine Hrs.	Wind Velocity (km/hr.)	Leaf miner population /plant
	Max.	Min.	712 am	1412 pm				
6	21.85	8.30	92.50	52.00	24.45	5.70	5.65	0.00
7	22.60	9.30	90.00	52.50	29.80	5.55	6.05	0.00
8	25.00	9.80	90.50	45.00	12.10	7.40	5.35	0.13
9	25.75	9.15	92.00	41.50	0.00	8.55	6.15	0.66
10	28.20	12.50	89.00	45.50	0.30	7.20	2.85	2.08
11	28.35	11.90	89.00	42.00	8.30	8.85	3.60	2.62
12	30.15	14.35	88.00	41.00	0.00	7.65	3.75	3.61
13	31.70	15.00	88.00	38.00	0.00	7.80	3.85	4.93
14	34.50	16.75	78.00	27.50	0.00	9.40	5.10	5.41
15	34.50	17.80	75.50	36.00	3.70	7.15	6.30	5.11
16	34.85	18.20	66.50	29.50	4.20	9.70	8.65	5.28
17	35.70	19.45	62.00	26.00	0.00	10.15	7.60	4.75
18	37.75	18.85	53.50	23.00	0.00	10.50	7.55	3.20
19	38.30	21.05	57.85	26.50	0.60	8.65	5.45	2.50
20	38.65	22.65	63.20	29.30	0.00	8.35	4.70	1.38
21	40.05	25.00	66.00	31.20	0.00	7.05	6.00	0.50
22	39.70	25.05	61.95	32.85	0.00	8.45	5.20	0.75
23	37.75	25.55	68.20	40.70	11.80	5.90	6.35	1.32
24	38.00	25.15	67.20	44.30	59.90	7.25	10.35	0.55
25	35.00	26.50	76.05	55.45	97.10	3.55	8.25	0.00
SMW – Standard Meteorological Week			Max – Maximum temperature		Min- Minimum temperature			

Simple correlation worked out between the weather parameters and incidence of *L. trifolii* population [Table-1] revealed that there was non-significant negative correlation with maximum temperature, minimum temperature, sunshine hours and wind velocity, while morning and evening relative humidity and rainfall showed a non significant positive correlation during the crop season 2011-12. However, during the crop season 2012-13 sunshine hours exhibited a significant positive correlation ($r = 0.578^*$) with leaf miner population, while morning relative humidity ($r = -0.603^{**}$) and evening relative humidity ($r = 0.758^{**}$) had a significant and negative correlation. However, influence of other weather factors appeared to be non-significant with population of leaf miner [Table-2]. He [13] also reported that maximum temperature, minimum temperature, temperature gradient, average temperature, maximum relative humidity, minimum relative humidity and sunshine hours had significant negative correlation with leaf miner population whereas, other factors such as average relative humidity, number of rainy days, rainfall showed a non significant positive effect with *L. trifolii* population. This difference may be due to different ecological condition on which the experiment was conducted.

Conclusion

From the present study, it can be concluded that the peak population of *L. Trifolii* was observed from 14th and 17th SMW during 2011-12 and 2012-13, respectively. The climatic factors such as sunshine hours and relative humidity may play active role in activity of *L. Trifolii* and its population build up on tomato. These informations generated in present study would be helpful in developing effective efficient pest management tactics against this pest of tomato.

Conflict of Interest: None declared

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