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RESEARCH ARTICLE

Effect of weather parameters on incidence of leaf miner (*Lirimomyza trifolii* Burgess) on tomato

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ABSTRACT

An experiment was conducted on effect of weather parameters on incidence of leaf miner, *Liriomyza trifolii* Burgess at Main Vegetable Research Station, Anand Agricultural University, Anand during *Rabi* 2010-11. The number of mines/leaf ranged between 2.52 and 10.26 with an average of 5.95. The infestation based on mines/leaf attained the highest peak (10.26 mines/ leaf) during 3rd week of January. The number of larvae/leaf ranged between 0.24 and 2.24 with an average of 0.84. The larval population reached to the highest peak (2.24 per leaf) during 3rd week of January. Per cent damaged leaves were in the range of 9.44 to 29.40 with an average of 15.99. Per cent damaged leaves slightly increased as the crop became older and reached to the first peak (16.41%) during 4th week of November. Then after declined during next week and further increased up to the crop maturity. The infestation attained the highest peak (29.40%) during 1st week of January. Overall, the activity of leaf miner was higher during December-January. The correlation studies indicated that number of mines, larvae as well as per cent damaged leaves had significant negative correlation with maximum temperature (-0.68162**, -0.71533** and -0.71308**), minimum temperature (-0.78761**, -0.82541** and -0.82630**), mean temperature (-0.77091**, -0.80886** and -0.80795**), morning vapour pressure (-0.73098**, -0.77537** and -0.77992**), evening vapour pressure (-0.71101**, -0.77414** and -0.74275**), mean vapour pressure (-0.73715**, -0.79196** and -0.77982**) and mean vapour pressure deficit (-0.62057**, -0.60331** and -0.57694**), respectively. Moreover, mines and larvae significantly and negatively correlated with morning vapour pressure deficit (-0.48046*) and evening relative humidity (-0.43393*).

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INTRODUCTION

Tomato (*Lycopersicon esculentum*) is an important vegetable crop which ranks which second in importance to potato in many countries and believed to be a native of Central and South America. It ranks first in processing, as its amenability for various preparations like salad, soup, pickles, purse, ketch-up, sauce, paste, powder and many other products. The estimated area under tomato in India is about 6.33 lakh hectares with a production of 124.25 lakh tonnes of fruits. In Gujarat, it was grown in an area of 0.34 lakh hectares with the production of 8.41 lakh tonnes and a productivity of 24.89 tonnes per hectare (Anonymous, 2010). Various factors are responsible for reducing the crop yield, of which insect pests is one of the important factors causing considerable losses in tomato production. According to Nagaraju *et al.* (2002), the major insect pests attacking tomato are fruit borer [*Helicoverpa armigera* (Hubner) Hardwick] army worm (*Spodoptera exigua* Hubner) whitefly (*Bemisia tabaci* Gennadius); leaf miner (*Liriomyza trifolii* Burgess) and spider mites (*Tetranychus cinnabarinus*

Boisdual). Of these, leaf miner, *L. trifolii* (Agromyzidae: Diptera) has been found causing serious damage since last many years. It is believed to be a native of Florida, USA (Spancer, 1973) introduced probably along with the cut chrysanthemum flowers during early 1970s to California, USA (Parella *et al.*, 1981) and now widely spread in most of the countries including India. The estimated losses due to infestation of *L. trifolii* was 46-70 per cent loss to tomato seedlings (Pohronezny *et al.*, 1986), 90 per cent loss to tomato foliage (Johnson *et al.*, 1983) and 70 per cent loss of tomato yield (Zoebisch *et al.*, 1984). Srinivasan *et al.* (1995) reported that incidence of *L. trifolii* was relatively more on tomato, okra, field bean, ridge gourd, cucumber, potato, castor and cotton at Bangalore in India. The adult female of *L. trifolii* makes numerous punctures on the leaf mesophyll with her ovipositor for feeding and oviposition; which results in a stippled appearance on foliage especially at the leaf tip and along the leaf margins (Parella *et al.*, 1985). However, the major form of the damage is mining of leaves by larvae, which results in destruction of the leaf mesophyll. Extensive mining also causes premature leaf drop, which can result in lack of shading and sun scalding of fruits. Punctures on the foliage also allow entry of bacterial and fungal pathogens. The plants are very vulnerable to leaf miners attack during the seedling stage followed by flowering stage. Limited work has been done on population dynamics of *L. trifolii* in relation to weather parameters in tomato particularly under Middle Gujarat condition. Hence, the present investigation was carried out.

MATERIAL AND METHODS

The study on the effect of weather parameters on incidence of leaf miner, *L. trifolii* on tomato was conducted at Main Vegetable Research Station, Anand Agricultural University, Anand during *Rabi* season of the year 2010-11. Tomato (cv. Gujarat tomato 2) was transplanted during 4th week of September in a plot size of 20 × 10 m with spacing of 90 × 60 cm and raised successfully by adopting recommended agronomical practices. For recording observations on leaf miner, 25 plants were selected randomly from the whole experimental plot. The observations on number of mines and larvae were recorded from the three compound leaves from the middle portion of the same selected plants. For observations on total and damaged leaves from three compound leaves of the same 25 plants were counted. The observations were recorded at weekly interval starting from one week after transplanting till to the crop harvest. The whole experimental plot was kept free from any insecticide application. To find out the specific impact of different weather parameters on *L. trifolli* in tomato, the data on leaf miner infestation *viz*., mines and larvae per leaf as well as per cent damaged leaves recorded in the experimental plot of population dynamics were correlated with the different meteorological parameters by standard statistical procedure (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The periodical data on number of mines/leaf, number of larvae/leaf and per cent damaged leaves are presented in Table 1. The data indicated that the infestation of leaf miner, *L. trifolii* based on mines, larvae and per cent damaged leaves noticed soon after 1st week of transplanting *i.e.* first week of October (40th standard week) and remained in the field up to 3rd week of January (3rd standard week) then after, the infestation

Table 1: Activity of leaf miner, *L. trifolii* in tomato

Months and weeks		Weeks after transplanting	Standard week	Infestation levels of leaf miner		
				No. of mines/leaf	No. of larvae/leaf	Per cent damaged leaves
October	I	1	40	2.52	0.48	10.97
	II	2	41	5.76	0.24	11.15
	III	3	42	4.92	0.24	09.44
	IV	4	43	4.8	0.48	09.79
November	I	5	44	4.13	0.37	09.93
	II	6	45	4.53	0.56	11.95
	III	7	46	4.86	0.64	12.75
	IV	8	47	5.16	0.73	16.41
	V	9	48	5.18	0.80	12.72
December	I	10	49	5.22	0.87	15.34
	II	11	50	5.34	0.93	15.19
	III	12	51	6.96	0.97	16.26
	IV	13	52	7.68	1.13	17.67
January	I	14	1	9.00	1.40	29.40
	II	15	2	8.94	1.36	27.95
	III	16	3	10.26	2.24	28.91
Mean				5.95	0.84	15.99

disappeared.

The periodical data on number of mines (Table 1) revealed that the number of mines /leaf ranged between 2.52 and 10.26with an average of 5.95. The mine population initiated after 1st week of transplanting (1st week of October) and suddenly increased in the next week (2nd week of October) then decreased up to the 1st week of November (44th standard week). Then after, mine population increased slowly up to crop maturity and reached to the highest peak (10.26 mines/ leaf) during 3rd week of January. Overall, the mine population above 5 mines/leaf was observed during 4th week of November to 3rd week of January. The periodical data on number of larvae (Table 1) revealed that the number of larvae / leaf ranged between 0.24 and 2.24 with an average of 0.84. The larval population was noticed soon after 1st week of transplanting and not fluctuated during October. The population increased during 1st week of November (44th standard week) to the 1st week of January (1st standard week). Population slightly decreased during next week and further increased and reached to the highest peak (2.24 larvae/leaf) during 3rd week of January. Overall, larval population was higher during December-January. The periodical data on per cent damaged leaves (Table 1) were in the range of 9.44 to 29.40 per cent with an average of 15.99 per cent. The larvae started to damage the leaves soon after 1st week of transplanting *i.e.* 1st week of October. The per cent damaged leaves increased during 2nd week of October, then decreased in next week and further increased up to the 4th week of November (47th standard week) and reached to the first peak (16.41%). The damage in leaves suddenly declined during next week *i.e.* 5th week of November. The per cent damaged leaves were higher during January with a highest peak (29.40%) in the 1st week of January. Overall, the activity of leaf miner based on per cent damaged leaves was higher during December-January. Numbers of researchers have carried out the studies on period of occurrence of *L. trifolii* on tomato. Choudary and Rosaiah (2000) found the higher activity of *L. trifolii* during last week of January and second week of February. Hemalatha and Maheswari (2004) recorded the peak activity of leaf miner during first week of October and January (40th and 1st standard week) and pest was completely absent during April and May. According to Galande and Ghorpade (2010), the incidence of *L. trifolii* on tomato was observed in a range of 3.53 to 7.73 live mines on eighteen terminal leaflets per plant. The peak activity of the pest was recorded during January to April with highest incidence in February. In present investigation, the activity of leaf miner was noticed from October to January. The higher activity of the pest was noticed during month of January. Thus, above report is strongly accordance with present investigation.

Correlation study :

The results on correlation between number of mines and different weather parameters (Table 2) revealed that out of 15 weather parameters, number of mines had significant negative correlation with maximum temperature, minimum temperature, mean temperature, morning vapour pressure, evening vapour pressure, mean vapour pressure, morning vapour pressure deficit and mean vapour pressure deficit, with correlation co-efficient (r) value of -0.68162**, -0.78761**, -0.77091**, -0.73098**, -0.71101**, -0.73715**, -0.48046* and -0.62057**,

Table 2: Relationship between infestation of *L. trifolii* and weather parameters in tomato

Weather parameters	Correlation co-efficients (r)		
	Mines per leaf	Larvae per leaf	Per cent damaged leaves
Bright sunshine hours, hrday-1 (BSS)	0.28339	0.28018	0.28787
Max. temperature, ^{0}C (MaT)	-0.68162**	-0.71533**	-0.71308**
Min. temperature, ^{0}C (MiT)	-0.78761**	-0.82541**	-0.82630**
Mean temperature, ^{0}C (MeT)	-0.77091**	-0.80886**	-0.80795**
Morning relative humidity, % (MoRH)	-0.13958	-0.21213	-0.34217
Evening relative humidity, % (EvRH)	-0.34155	-0.43393*	-0.37443
Mean relative humidity, % (MeRH)	-0.28735	-0.33256	-0.36677
Morning vapour pressure, mm of Hg (MoVP)	-0.73098**	-0.77537**	-0.77992**
Evening vapour pressure, mm of Hg (EvVP)	-0.71101**	-0.77414**	-0.74275**
Mean vapour pressure, mm of Hg (MeVP)	-0.73715**	-0.79196**	-0.77982**
Morning vapour pressure deficit, mm of Hg (MoVPD)	-0.48046*	-0.37968	-0.31717
Evening vapour pressure deficit, mm of Hg (EvVPD)	-0.40548	-0.26996	-0.32869
Mean vapour pressure deficit, mm of Hg (MeVPD)	-0.62057**	-0.60331**	-0.57694**
Wind speed, kmhr-1 (WS)	-0.25877	-0.36150	-0.17922
Rainfall, mm (RF)	-0.20031	-0.13263	-0.08692

* and ** indicate significance of values at P=0.05 and 0.01, respectively

respectively. Bright sunshine hours was positively, but non-significantly correlated with number of mines. Thus, as maximum temperature, minimum temperature, mean temperature, morning vapour pressure, evening vapour pressure, mean vapour pressure, morning vapour pressure deficit and mean vapour pressure deficit increased; the mine incidence decreased or *vice versa.*

Number of larvae (Table 2) significantly and negatively correlated with maximum temperature, minimum temperature, mean temperature, evening relative humidity, morning vapour pressure, evening vapour pressure, mean vapour pressure and mean vapour pressure deficit, with correlation co-efficient (r) value of -0.71533**, -0.82541**, -0.80886**, -0.43393*, -0.77537**, -0.77414**, -0.79196** and -0.60331**, respectively. Bright sunshine hours was positively, but non-significantly correlated. Thus, as maximum temperature, minimum temperature, mean temperature, evening relative humidity, morning vapour pressure, evening vapour pressure, mean vapour pressure and mean vapour pressure deficit increased; the larval population decreased or *vice versa*. The correlation between per cent damaged leaves and weather parameters (Table 2) indicated that per cent damaged leaves was significantly negatively correlated with maximum temperature, minimum temperature, mean temperature, morning vapour pressure, evening vapour pressure, mean vapour pressure and mean vapour pressure deficit with correlation co-efficient (r) value of -0.71308**, -0.82630**, -0.80795**, -0.77992**, -0.74275**, -0.77982** and -0.57694**, respectively. Thus, as maximum temperature, minimum temperature, mean temperature, morning vapour pressure, evening vapour pressure, mean vapour pressure and mean vapour pressure deficit increased; the per cent damaged leaves decreased or *vice versa*.

Overall, weather parameters *viz.*, maximum temperature, minimum temperature, mean temperature, morning vapour pressure, evening vapour pressure, mean vapour pressure and mean vapour pressure deficit were found to influence the infestation of leaf miner in tomato. Choudary and Rosaiah (2000) reported that minimum temperature and evening relative humidity were negatively correlated with *L. trifolii* incidence in tomato while, sunshine hours showed positive correlation. 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. According to Durairaj (2007), the leaf miner incidence exerted a positive association with sunshine hours, while the negative association with relative humidity, rainfall and rainy days. 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.

In present investigation also temperature, relative humidity and rainfall were significantly negatively correlated while, bright sunshine hours positively correlated with *L. trifolii* incidence. Thus, above reports strongly supported the present findings.

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