Screening of hybrid varieties of Tomato crop against American Serpentine Leaf Miner, (*Liriomyza trifolii,* Burgess) in Lucknow district of Uttar Pradesh, India

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Abstract: The field incidence of the serpentine leaf miner, *L. trifolii*(Burgess) was severe during the fruiting stage of the crop. Infestation was higher on lower surface of leaf in comparisons of upper surface. On the basis of cumulative susceptibility index test varieties all varirties viz. Pusa Rohini, Pusa Uphar, Arka Saurabh, Naveen-2000, N-815, Arka Vardan, Pusa Sadabahar, Arka Vishal, N-2535 and ArkaVardan were found to be resistant/less susceptible. significant correlation could be established between the number of leaf mines and yield of tomato crop. There were no significant correlation found among leaf miner incidence and yield of crop. All tested hybrid varieties performed better in Lucknow district of Uttar Pradesh.

Key Words: Tomato, American Serpentine leaf miner,

Introduction: Tomato *Lycopersicon esculentum* (Mill.) is the essential part of daily diet. This crop grow in maximum state of country. In last two decades many number of hybrid varieties of tomato developed by government agencies as well as private companies.This in only due to high valuable cash crop for farmers. These hybrid varieties having high yield but injudicious use of fertilizer invite to pest incidence. These pest are fruit borer (*Helicoverpa armigra*), aphids (*Aphis gossypii, Myzus persicae*), jassids (*Amarasca biguttula*),American serpentine leaf miner, (*Liriomyza trifolii*), root knot nematodes (*Meloidogyne* sp.) etc. among them american serpentine leaf miner, (*Liriomyza trifolii,* Burgess) (Diptera: Agromyzidae) is serious threat in tomato crop. This black fly with red eyes, a native of Florida is polyphagous in nature, whose infestation is increasing every year at an alarming rate.

Sharma, 1994 reported that "genus *Liriomyza* contains more than 300 species known in the world. In which, approximately 23 species of *Liriomyza* have been reported as being economically important in which *L. trifolii* is very dominating in vegetable crops like tomato, cucumber, vegetable pea etc. This insect has the potential to infest on 250 crop species in India".

Review of Literature: "In tomato, the insect damages the crop by making feeding and oviposition punctures on the leaves and then by leaf mining by the maggot. The larvae tunnel inside the mesophyll and feed inside on the palisade mesophyll tissues. The destruction of chlorophyll containing tissues interferes with the photosynthetic activity of

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the plant as a result of which growth and yield of the infected plants in adversely affected. When one fourth of the leaf area was mined, photosynthesis decreased by <1%" **(Martens and Trumble, 1987)**. "Photosynthesis rates in mined tissues were reduced by 62 percent as compared with those in unmined leaflets" **(Johnson *et. al.*, 1983)**. "Identification of sources of resistance to this pest will go a long way in the control and management of this pest under field conditions. Besides, such resistant varieties will continue to harbour the natural population of parasite, which bring about natural control of *L. trifolii"*. **Kotze and Dennill (1996)** found that "neither growth nor yield were negatively affected by the infestation level up to 1092 and 458 mined per plant in a glasshouse and field trials on tomato respectively".

The data recorded of tomato crops regarding the mean number of leaf mines per 15 leaves on upper and lower leaves and whole plant indicate an increasing trends of *Liriomyza* infestation throughout the crop growth. The infestation was higher on the lower leaves of the plant than on the upper portion of leaves, it showed the insect prefer lower leaves of the plant to the upper leaves for feeding and oviposition. It was also observed that the shaded and older leaves are preferring more by the insect. Which is in conformity of the finding of **Hileman and Lieto,1981.Chaudhari *et. al.*, (2000)** also conducted "an experiment on evaluation of tomato varieties in terai region of west Bengal. Evaluation of tomato variety Pusa Ruby and 6 hybrids for yield and resistance to insect pests revealed that hybrids are more suspectable to leaf miner (*L. trifolii*) in which Abinash II recorded highest infestation, Rasika showed more susceptibility and Arjuna & Rupali were moderately tolerant to this pest". **Tendon and Bakthavatsalam (2002)** evaluated "tomato genotypes Anjali, 101 super, Varalakshmi, challenger-1, Arka Meghali, Arka Sourabh, Arka Vikas, Arka Ahuti, Arka Ashish and Pusa Ruby for their relative susceptibility to leaf miner in 1998-99". "The percent of damaged leaves varied from 48.13 to 85.97. The highest number of damaged leaves was observed in hybrid 101-super (85.97%) followed by Anjali (83.09%), while lowest damage was recorded in Varalakshmi (48.13). the maximum number of mines per leaf (2.88) was recorded on Arka Meghali followed by challenger-1 (2.81) and Arka Vikas (2.74). the minimum

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number of mines was recorded on 101 super (1.24). in this experiment all the genotypes were found highly susceptible, except for Varalakshmi. The maximum damage was recorded on Arka Ahuti, followed by Arka Saurabh; Arka Ashish and Anjali. In the present study, it was observed that as the plant grows the upper leaves ultimately occupy a position on the lower part of the plant and become classified as lower leaves. As the infestation increases, the number of leaf mines increases and this causes reduction in photosynthesis of the leaflets" (**Johnson *et. al.*, 1983)**.

Materials and Methods: Screening of hybrid tomato cultivars against serpentine leaf minor were conducted. For which Pusa Rohini, Pusa Uphar, Arka Saurabh, Naveen-2000, N-815, Arka Vardan, Pusa Sadabahar, Arka Vishal, N-2535 and Arka Vardan

Experiment was conducted in winter two subsequent years i.e. year 2016-17 and year 2017-18 at farmer field. Fifteen plants were selected at random from each of the two replications and counted number of mines, on a single compound leaf taken from each of the upper as well as the lower portion of the plant. Empty as well as mines with larvae also counted. Observation will be taken twice of which 1st observation at flowering stage and 2nd at the fruiting stage of crop growth.On that basis screening of hybrid tomato cultivars were carried out on the basis susceptibility index (given below).

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Susceptibility index for tomato cultivar's screening against *L. trifolii* (Burgess)

Category	Mean number of leaf mines/ leaves
Least susceptible/ Resistant	5
Moderately	5-10
susceptible/ModeratelyResistant	>10
Highly susceptible	

Result and Discussion:

Ten hybrid varieties of tomato were tested under open field condition for resistance against *L. trifolii*. These cultivars have been selected for yield characters; hence, their

evaluation was felt necessary against the emerging pest of tomato. The data showing relative incidence of the pest at flowering and fruiting stage of the crop is given in **Table 1, 2** and **3.**

Perusal table no.1 revealed that mean number of leaf mines per 15 leaves was not significantly different for most of the varieties. In first year tomato variety minimum incidence was seen on upper leaves of variety N-815 (1.505) and maximum of Pusa Sadabahar (2.79) and more incidence were found on lower leaves .i.e 2.175 (Arka Vishal) and maximum on Pusa Sadabahar (2.585) .In second year maximum incidence on upper leaves were found on Pusa Sadabahar (2.73) followed by others, while maximum incidence on lower leaves were found on Arka saurabh (4.46).The rating index showed that all tested varieties found resistant due less incidence. In this context yield was also a measure factor,so, on that basis evaluvation of varieties were essential. The hybrid variety of tomatoi.e. Arka Vardan gained maximum yield, 479.85 followed by Pusa Rohini, Pusa Sadabahar, Arka Vishal,N-815,Arka Saurabh,Naveen-2000, Arka Vardan,N-2535 and Pusa Uphar.

Overall result of leaf mining and yield differed signifanctaly between different varieties but some other factors were responsible for these yield differences not the *Liriomyza* infestation. It appears that tomato plants has inbuilt resistance against leaf miner activity, low to moderate level of mining activity was unlikely to cause yield loss. Since mining activity continued till fruiting, the resistance index based on cumulative number of leaf mines at fruiting could be a better index of susceptibility. Hence no definite conclusion regarding actual resistance can be drawn by number of leaf minis at flowering stage.

The effect of leaf mining activity of *L. trifolii* on the yield was not significant because no significant correlation between the mean number of leaf mines on lower leaves and yield could be established. The reason behind this might be that lower leaves do not play major role in photosynthesis as compared to upper leaves and infestation on upper leaves were less than on lower leaves. But for the lower leaves the infestation was non-significantly high to affect the yield. The amount of leaf area mined has an effect on

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photosynthesis that is complicated to analyze. Leaf miners often prefer shaded or older leaves that are less productive photo synthetically.

But no significant correlation between yield and number of leaf mines could be established. The infestation was not up to the extent to cause reduction in yield. The present study is in conformity with the findings of **Keularts and Lindquist(1989)**, who studied the effect of *Liriomyza trifolii* infestations on yield of greenhouse tomato and found that yield of marketable fruits either size or number in the fruit cluster were not significantly reduced. **Kotze and Dennill (1996)** examined "the effect of various level of infestation on growth and yield of tomatoes and found that neither growth nor yield were negatively affected by infestation level up to 1092 and 458 mines per plant in a glasshouse and field trials respectively". Therefore, application of the chemical insecticides for its control may be avoided.

Conclusion

On the basis of this susceptibility index, rating of 10 hybrid varieties were found resistant against serpentine leaf miner (*L. trifolii*) and all tested varieties performed well and not having correlation between leaf miner incidence and yield..

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Table1, Relative field incidence of leaf miner, *Liriomyza trifolii* (Burgess) on upper and lower leaves of 10 hybrid cultivars at flowering stage of tomato crop-

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Sl.No.	Cultivar	Relative incidence of Leaf miner per 15 leaves ex-portion of leaves on flowering stage of crop			
		1st Year		2nd Year	
		Upper leaves	Lower leaves	Upper leaves	Lower leaves
1	Pusa Rohini	1.89	3.4	1.96	3.67
2	Pusa Uphar	2.6	4.44	2.29	3.46
3	Arka Saurabh	2.44	3.25	2.43	4.46
4	Naveen-2000	1.54	2.675	1.765	2.695
5	N-815	1.505	2.39	1.495	4.25
6	Arka Vardan	1.355	3.75	2.67	3.515
7	Pusa Sadabahar	2.79	4.585	2.73	3.04
8	Arka Vishal	1.175	2.175	1.505	2.455
9	N-2535	2.53	4.24	1.655	2.59
10	ArkaVardan	2.49	3.57	2.845	3.75

Table2. Average incidence of leaf miner, *Liriomyza trifolii* (Burgess) on whole plant at fruiting stage of tomato crop of 10 hybrid cultivars and their rating index :

Sl.No.	Cultivar	Average incidence of leaf miner on Whole plant at fruiting stage			Rating Index
		1st Year	2nd Year	Mean	
1	Pusa Rohini	2.645	2.815	2.73	Resistant
2	Pusa Uphar	3.52	2.875	3.1975	Resistant
3	Arka Saurabh	2.845	3.445	3.145	Resistant
4	Naveen-2000	2.1075	2.23	2.16875	Resistant
5	N-815	1.9475	2.8725	2.41	Resistant
6	Arka Vardan	2.5525	3.0925	2.8225	Resistant
7	Pusa Sadabahar	3.6875	2.885	3.28625	Resistant

8	Arka Vishal	1.675	1.98	1.8275	Resistant
9	N-2535	3.385	2.1225	2.75375	Resistant
10	ArkaVardan	3.03	3.2975	3.16375	Resistant

Table3. Average yield of 10 hybrid tomato cultivars during the incidence of leaf miner, *Liriomyza trifolii*(Burgess):

Sl.No.	Cultivar	Average yield (Q/ha)		Mean (Q/ha.)
		1st year	2nd year	
1	Pusa Rohini	476.5	454.4	465.45
2	Pusa Uphar	387.2	289.5	338.35
3	Arka Saurabh	375.65	378.8	377.225
4	Naveen-2000	353.8	356.6	355.2
5	N-815	452.5	463.0	457.75
6	Arka Vardan	483.7	476.0	479.85
7	Pusa Sadabahar	459.5	463.6	461.55
8	Arka Vishal	457.3	458.5	457.9
9	N-2535	360.6	346.0	353.3
10	ArkaVardan	353.5	358.0	355.75