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: Tomato is a major cash crop of farmers of central plain of Uttar Pradesh. Injudicious use of chemicals invited too many number of insect pests. Among them sucking insect problems were very serious in comparison to biting and chewing insects because these insects developed resistance and insecticides. So, in last five years pest scenario had changed. Some new insects were seen on crops. In which, American serpentine leaf minor in one of them. Their incidence increasing very rapidly in different crops like tomato, vegetable pea and cucurbitaceous crops etc. Tomato crop was more susceptible for leaf miner. Due to which screening of popular tomato varieties were urgently needed. On that basis this study were carried out on ten popular hybrid varieties. 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 varieties 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. 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 grows 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. Due to more demand of this high valuable cash crop. These hybrid varieties having high yield but injudicious use of fertilizer invited 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 american serpentine leaf miner 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 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".

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 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. 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 ten hybrid tomato cultivars viz. Pusa Rohini, Pusa Uphar, Arka Saurabh, Naveen-2000, N-815, Arka Vardan, Pusa Sadabahar, Arka Vishal, N-2535 and Arka Vardan against serpentine leaf minor were conducted at farmers field of Lucknow district of Uttar Pradesh in kharif 2016-17 and 2017-18.

Fifteen plants were chosen at random from each replication and the number of mines were counted on a single compound leaf taken from both the upper and lower portions of the plant. Mines that were empty as well as mines that had larvae were counted. 1st observation were taken from upper and lower leaves of plants at flowering stage and 2nd observation from whole plant at fruiting stage of plant. On that basis screening of hybrid tomato cultivars were carried out on the basis susceptibility index. Yield of tomato crop were also calculated.

Chart 1: 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 tomato hybrid varieties were tested for resistance to L. trifolii in the open field. These cultivars were chosen for their yield characteristics, so their evaluation against the emerging tomato pest was deemed necessary. The data showing relative incidence of the pest at flowering and fruiting stage of the crop is given in **Table 1, 2** and **3.**

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).At fruiting stage first year incidence ranged from 1.9475(N-185) to 3.6875 (Pusa Sadabahar) in 2nd year 2.23(Naveen-2000) to3.445 (Arka Saurabh). 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 evaluation of varieties were essential. The hybrid variety of tomatoi.e. Arka Vardan gained maximum yield, 479.85q/ha followed by Pusa Rohini, Pusa Sadabahar, Arka Vishal,N-815,Arka Saurabh,Naveen-2000, Arka Vardan,N-2535 and Pusa Uphar (338.35q/ha).

The overall result of leaf mining and yield differed significantly between varieties, but these differences were caused by other factors other than the Liriomyza infestation. It appears that tomato plants have built-in resistance to leaf miner activity, with low to moderate levels of mining activity unlikely to result in yield loss. Because mining activity continued until fruiting, the resistance index based on the cumulative number of leaf mines at fruiting may be a more accurate predictor of susceptibility. As a result, the number of leaf minis at the flowering stage cannot be used to draw any firm conclusions about actual resistance.

The effect of L. trifolii leaf mining activity on yield was not significant because no significant correlation could be established between the mean number of leaf mines on lower leaves and yield. The reason for this could be that lower leaves play a smaller role in photosynthesis than upper leaves, and infestation on upper leaves was lower than on lower leaves. However, the infestation was not significant enough to affect yield in the lower leaves. The amount of leaf area mined has an impact on photosynthesis that is difficult to quantify. Leaf miners frequently prefer shaded or older leaves that are less photosynthesisally productive.

However, no significant relationship between yield and number of leaf mines could be found. The infestation was not severe enough to cause yield loss. 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

Result showed that all tested 10 hybrid varieties were found resistant against serpentine leaf miner (*L. trifolii*) and not having correlation between leaf miner incidence and yield performance. All varieties performed well at farmers field at Lucknow district of Uttar Pradesh.

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pupae of *Liromyza trifolii* (Diptera: Agromyzidae) by manipulation of relative humidity and substrate. *Environ. Entomol.*, 18,3,499-503.

Table1. Average no. of mines of leaf miner, *Liriomyza trifolii* (Burgess) on upper and lower leaves of 10 hybrid cultivars at flowering stage of tomato crop-

Sl.No.	Cultivar	Average no. of mines 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 no. of mines 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 no. of mines 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