



ISSN (E): 2277-7695

ISSN (P): 2349-8242

NAAS Rating: 5.23

TPI 2022; 11(8): 711-714

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www.thepharmajournal.com

Received: 21-05-2022

Accepted: 24-06-2022

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Screening of different tomato hybrids for resistance against serpentine leaf miner, *Liriomyza trifolii*

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Abstract

Study on screening of different tomato hybrids against serpentine leaf miner was carried out during 2018-19, Rabi at KVK farm, Shivamogga. Ten hybrids were screened for their susceptibility to serpentine leaf miner, *L. trifolii* based on number of live mines/five compound leaves, per cent damaged leaves and yield parameters. Two from IIHR, Bangalore (Arka Samrat and Arka Rakshak) and other eight were local hybrids (Moulya, Alankar, Rishika, LHT Pooja, Aishwarya, Namadhari, PHS-448 and Soubhagya). The hybrids Namadhari (3.61 mines) and Moulya (4.81 mines) recorded lowest no. of mines and the hybrids Soubhagya (14.53 mines), Arka Rakshak (15.12 mines) and PHS-448 (17.68 mines) recorded highest number of mines. Highest per cent damaged leaves was recorded in the hybrids PHS-448, Aishwarya and Soubhagya that were on par with each other with 66.65 per cent, 64.17 per cent and 62.92 per cent damaged leaves, respectively. The hybrids Arka Samrat and Arka Rakshak recorded significantly higher yield of 55.26 and 54.46 t/ha, respectively. The hybrid PHS-448 recorded significantly lowest yield (39.23 t/ha) among the hybrids. Based on the susceptibility index, the hybrids Namadhari and Moulya were designated less susceptible. The hybrids Alankar, Rishika and LHT Pooja were moderately susceptible and the highly susceptible hybrids were Aishwarya, Arka Samrat, Soubhagya, Arka Rakshak and PHS-448.

Keywords: Leaf miner, tomato hybrids, mines, susceptibility index, per cent damage

1. Introduction

Tomato (*Solanum lycopersicum* L.) belongs to the family Solanaceae with its origin from Central and South America and it ranks second in importance next to potato and first in processing in the world. It is a rich source of important vitamins like vitamin-A, C, thiamine and riboflavin. Its pulp and juice have properties like blood purifier, intestinal antiseptic and gastric secretion promoter. It also has the ability to reduce the risk of cancer due to presence of lycopene which is an antioxidant (Miller *et al.*, 2002) [7].

The leaf miner, *Liriomyza trifolii* (Agromyzidae: Diptera) is one of the important pests of tomato in India, where its menace is increasing every year at an alarming rate (Rai *et al.*, 2013) [10]. The native of this pest is believed to be Florida. The genus *Liriomyza* is reported to have more than 300 species, out of these 300 species, 33 species are having economic importance (Parella, 1987) [9]. In India it was first reported at Hyderabad in 1991 in the proceeding of the annual castor research workers group meeting (Anon., 1991) [1].

Larval mining by this insect has an impact on photosynthesis, transpiration, stomatal as well as mesophyll conductance (Foster and Sanchez, 1988) [3]. Seedling stage was more vulnerable to leaf miner attack followed by flowering stage of the crop. There was no report of fruit bearing in heavily infested plants (Nath and Singh, 2006) [8]. In addition farmers may face quarantine restrictions in international trade due to this pest (Gitonga *et al.*, 2010).

The serpentine leaf miner has attained economic pest status in the recent past. There are reports of resistance development by this insect to broad range of insecticides (Mason *et al.*, 1987) [6], so there is a need for development of alternative management strategies. Resistant varieties remain most economical means of insect control. Based on above consideration the present investigation was carried to screen different tomato hybrids for resistance against serpentine leaf miner.

2. Material and Methods

Ten hybrids of tomato namely Arka Samrat, Arka Rakshak, LHT Pooja, PHS-448, Soubhagya, Rishika, Moulya, Namadhari, Alankar and Aishwarya were used for screening. Each of the tomato hybrids were sown in a plot size of 14 m² area, with a spacing of 90 x 60 cm.

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The experiment was laid out in Randomized Complete Block Design with ten treatments and three replications. Tomato seedlings of respective hybrids were raised by adopting recommended agronomic practices. The whole experimental plot was kept free from all insecticidal applications.

Observations on susceptibility of tomato hybrids for leaf miner were taken based on four parameters *viz.*, mean number of live mines/five compound leaves, per cent damaged leaves, yield and susceptibility index. For taking these observations, five plants were randomly selected from each plot for recording mean no. of live mines/ five compound leaves from middle portion of plant. Per cent damaged leaves were

recorded from same five randomly selected plants with the same formula used in previous objective. Picking wise fruit yield of each hybrid was recorded from each plot. Whereas, based on mean number of live mines/five compound leaves from middle portion of plant, these hybrids were designated as per susceptibility index (Rai *et al.*, 2013) [10] given in Table 1. The observations were recorded at weekly interval starting from one week after transplanting till harvest of the crop. The mine with an exit hole was considered as a dead mine and it was not counted. Whereas, the mine with maggot that is visible as light greenish to yellowish in colour was considered as a live mine.

Table 1: Susceptibility index for evaluating Serpentine leaf miner resistance in tomato hybrids

| Category of resistance | Mean number of mines/five compound leaves |
|------------------------|---|
| Less susceptible | (< 5) |
| Moderately susceptible | (5 – 10) |
| Highly susceptible | (> 10) |

3. Results and Discussion

3.1 Mean number of live mines/five compound leaves

The data on mean number of live mines/ five compound leaves (Table 2) showed that the number of live mines significantly varied between different hybrids. The mean number of live mines / five compound leaves ranged between 3.61 and 17.68. The hybrid PHS-448 recorded highest mean number of live mines / five compound leaves followed by Arka Rakshak and Soubhagya that were on par with PHS-448 with 17.68, 15.12 and 14.53 mines, respectively. These were followed by the hybrids Arka Samrat, Aishwarya, LHT Pooja, Rishika, Alankar and Moulya that showed an on par relationship with each other and recorded 12.95, 11.06, 9.23, 7.85, 6.18 and 4.81 mean number of live mines / five compound leaves, respectively. The hybrid Namadhari recorded significantly lowest number (3.61) of live mines / five compound leaves followed by Moulya (4.81).

The order of hybrids with mean number of live mines / five compound leaves in increasing order *viz.*, Namadhari, Moulya, Alankar, Rishika, LHT Pooja, Aishwarya, Arka Samrat, Soubhagya, Arka Rakshak and PHS-448 with 3.61, 4.81, 6.18, 7.85, 9.23, 11.06, 12.95, 14.53, 15.12 and 17.68 mines, respectively.

3.2 Per cent damaged leaves

The data on per cent damaged leaves is indicated in Table 2. Highest per cent damaged leaves was recorded in the hybrids PHS-448, Aishwarya and Soubhagya that were on par with each other with 66.65per cent, 64.17per cent and 62.92per cent damaged leaves, respectively. These hybrids showed an on par relationship with Arka Rakshak, Arka Samrat, Rishika and Alankar with 60.12per cent, 58.23per cent, 53.66per cent and 52.15per cent damaged leaves, respectively. These were followed by the hybrid LHT Pooja with 35.72 per cent damaged leaves. The hybrids Namadhari (15.34%) and Moulya (20.42%) recorded significantly lowest per cent damaged leaves.

The order of hybrids based on per cent damaged leaves in increasing order were Namadhari, Moulya, LHT Pooja, Alankar, Rishika, Arka Samrat, Arka Rakshak, Soubhagya, Aishwarya and PHS-448 with 15.34per cent, 20.42per cent, 35.72per cent, 52.15per cent, 53.66per cent, 58.23per cent,

60.12per cent, 62.92per cent, 64.17per cent and 66.65per cent, respectively.

The hybrids Alankar (52.15%) and Rishika (53.66%) showed highest per cent damaged leaves in spite of lower number of mines because of overall lower number of leaves per plant and higher mining occurred on most of the leaves of the plants. And the hybrids Arka Samrat and Arka Rakshak recorded lower per cent damaged leaves due to larger canopy and higher number of leaves per plant.

3.3 Fruit yield

The data on fruit yield of different tomato hybrids are presented in Table 2. The hybrids Arka Samrat and Arka Rakshak recorded significantly higher yield of 55.26 and 54.46 t/ha, respectively. And they were on par with Namadhari (52.01 t/ha) and Moulya (51.54 t/ha) followed by Alankar (45.78 t/ha). The hybrids Rishika, LHT Pooja, Aishwarya and Soubhagya showed lower yields of 44.27, 43.54, 41.99 and 41.43 t/ha, respectively. The hybrid PHS-448 recorded significantly lowest yield (39.23 t/ha) among the hybrids.

The order of hybrids based on fruit yield in increasing order were PHS-448, Soubhagya, Aishwarya, LHT Pooja, Rishika, Alankar, Moulya, Namadhari, Arka Rakshak and Arka Samrat with 39.23, 41.43, 41.99, 43.54, 44.27, 45.78, 51.54, 52.01, 54.46 and 55.26 t/ha, respectively.

The hybrids Arka Samrat and Arka Rakshak followed by Namadhari, Moulya, Alankar and Rishika recorded higher yields. The lowest yield was contributed by Soubhagya, Aishwarya and PHS-448. Though the infestation of leaf miner *i.e.*, number of mines and per cent damaged leaves was higher in hybrids Arka Samrat and Arka Rakshak, highest yield was recorded with them. This is because these two IIHR hybrid's average yield is 80 t/ha (that had higher fruit weight, higher number of fruits/plant and higher average yield) and that of local hybrids is 55 to 60 t/ha (Anon., 2018) [2]. So this difference in their average yields recorded data of higher yields in Arka Samrat and Arka Rakshak hybrids compared to other hybrids in spite of leaf miner infestation though considerable losses were recorded in all the hybrids due to leaf minor damage.

Table 2: Screening of tomato hybrids against serpentine leaf miner *L. trifolii* on different parameters

| Tomato hybrids | Mean no. of live mines/five compound leaves | Per cent damaged leaves | Fruit yield (t/ha) |
|----------------|---|-----------------------------|---------------------|
| ArkaSamrat | 12.95 (3.55) ^{bc} | 58.23 (49.98) ^{ab} | 55.26 ^a |
| Rishika | 07.85 (2.63) ^{ef} | 53.66 (47.21) ^{ab} | 44.28 ^{cd} |
| Aishwarya | 11.06 (3.24) ^{cd} | 64.17 (53.73) ^a | 41.99 ^{cd} |
| Moulya | 04.81 (2.07) ^{gh} | 20.42 (26.11) ^d | 51.55 ^{ab} |
| Soubhagya | 14.53 (3.78) ^{ab} | 62.92 (52.92) ^a | 41.43 ^{cd} |
| Alankar | 06.18 (2.41) ^{fg} | 52.15 (46.30) ^{ab} | 45.79 ^{bc} |
| Namadhari | 3.61 (1.78) ^h | 15.34 (21.81) ^d | 52.01 ^{ab} |
| LHT Pooja | 09.23 (2.92) ^{de} | 35.72 (36.44) ^c | 43.54 ^{cd} |
| PHS-448 | 17.68 (4.14) ^a | 66.65 (55.37) ^a | 39.23 ^d |
| ArkaRakshak | 15.12 (3.82) ^{ab} | 60.12 (51.17) ^{ab} | 54.46 ^a |
| S. Em. ± | 0.12 | 3.23 | 11.69 |
| C. D. at 5% | 0.36 | 9.69 | 35.07 |
| C. V. (%) | 9.98 | 12.99 | 10.57 |

Figures in parentheses are $\sqrt{x + 0.5}$ transformed values for number of mines and Arc sin transformed values for per cent damaged leaves

3.4 Susceptibility index

Susceptibility index based on number of mines, the hybrids Namadhari and Moulya were designated as less susceptible with 3.61 and 4.81 mean number of live mines/five compound leaves, respectively. The hybrids Alankar, Rishika and LHT Pooja were designated as moderately susceptible with 6.18, 7.85 and 9.23 mines, respectively. The highly susceptible hybrids were Aishwarya, Arka Samrat, Soubhagya, Arka Rakshak and PHS-448 that recorded 11.06, 12.95, 14.53, 15.12 and 17.68 mean number of live mines/five compound leaves, respectively (Table 3).

Information on screening of tomato hybrids for their resistance to serpentine leaf miner, *L. trifolii* is scanty. Tendon and Bakthavatsalam (2002) [12] reported that the IIHR, Bangalore hybrids Arka Meghali followed by Arka Vikas showed maximum number of mines per leaf. Hemalatha and

Maheswari (2004) [5] reported that Arka Vikas recorded maximum number of maggots / leaf (18.4) with maximum leaf miner infestation (50%). Out of 6 genotypes of tomato screened, none of the genotypes were found resistant to leaf miner incidence. The genotype Patherkuchi was less susceptible and NS501 was highly susceptible to leaf miner incidence (Sarka *et al.*, 2017) [11]. And out of thirty cultivars evaluated for resistance against serpentine leaf miner, the varieties HS-102, SEL-14, Pant T-4, PS-8, PT-28, NDT-44, BT-117-5-3-1, Pusa Ruby and KS-NDT-96 were less susceptible (Rai *et al.*, 2013) [10]. All others were moderately susceptible and none were highly susceptible to leaf miner incidence. The results regarding the tomato hybrids in present findings could not be supported as they are local hybrids and were not evaluated by any workers elsewhere.

Table 3: Susceptibility of tomato hybrids to serpentine leaf miner, *L. trifolii* based on susceptibility index

| Susceptibility based on mean number of mines | Hybrids | Mean no. of live mines/five compound leaves |
|--|-------------|---|
| Less susceptible (< 5) | Namadhari | 3.61 |
| | Moulya | 4.81 |
| Moderately susceptible (5 – 10) | Alankar | 6.18 |
| | Rishika | 7.85 |
| | LHT Pooja | 9.23 |
| Highly susceptible (> 10) | Aishwarya | 11.06 |
| | ArkaSamrat | 12.95 |
| | Soubhagya | 14.53 |
| | ArkaRakshak | 15.12 |
| | PHS 448 | 17.68 |

4. Conclusion

- Screening of different tomato hybrids against leaf miner revealed that lowest mean number of live mines/five compound leaves and per cent damaged leaves were recorded with hybrids Namadhari and Moulya.
- Based on susceptibility index, the hybrids Namadhari and Moulya were designated as less susceptible. The hybrids Alankar, Rishika and LHT Pooja were designated as moderately susceptible. The highly susceptible hybrids were Aishwarya, Arka Samrat, Soubhagya, Arka Rakshak and PHS-448.

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