

**Susceptibility of some varieties and breeding lines of tomato to *Liriomyza* spp. infestation in central Sudan**

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**Abstract**

Tomato crop in the central Sudan is liable to heavy infestation by the leaf miners, *Liriomyza* spp. Field experiments indicated significant differences in varietal susceptibility of varieties and tomato breeding lines to *Liriomyza* spp. The breeding line Trop G 9–18 and the varieties, Alfa, Peto 86 and Strain B were the least infested (resistant). Laboratory tests revealed that Flora Dade was more susceptible to *L. sativae* than Trop-G, whereas the latter was resistant to *L. trifolii*. Resistance is attributed to anti-feedants and also associated with the glandular trichomes on the leaves.

Key words: Leaf miner, Sudan, susceptibility, tomato

**Résumé**

La culture de tomate dans le centre du Soudan est susceptible de forte infestation par les mineuses des feuilles, *Liriomyza* spp. Les expériences sur terrain ont indiqué des différences significatives dans la sensibilité variétale des variétés et des lignées de reproduction des tomates au *Liriomyza* spp. La lignée de reproduction Trop G 9-18 et les variétés, Alfa, Peto 86 et la souche B ont été les moins infestées (résistantes). Des tests au laboratoire ont révélé que Flora Dade était plus sensible au *L. sativae* que Trop-G, tandis que le dernier était absolument résistant au *L. trifolii*. La résistance est attribuée aux anti-nourrisseurs et également associée aux trichomes glandulaires sur les feuilles.

Mots clés: Mineuse des feuilles, Soudan, sensibilité, tomate

**Background**

Two species of *Liriomyza*, i.e., *L. sativae* Blanchard and *L. trifolii* (Burgess) have been reported to be common in Sudan, on various host plants (Martinez and Bordat, 1996). *L. sativae* is considered an important pest of tomato as leaflets are damaged by larvae feeding in serpentine mines between epidermal layers (Oatman and Kennedy, 1976). Long term management of these pests can only be achieved using resistant

tomato varieties. There is therefore need to test tomato varieties and breeding lines for resistance to leaf miners in Sudan.

## Literature Summary

Chemical control practices for insect pests fall short in most cases lead to the emergence of resistant strains (Johnson *et al.*, 1985) and to the destruction of beneficial organisms (Trumble, 1985; Neuenschwander *et al.*, 1987). Several investigations on resistance of tomato cultivars to *Liriomyza* spp. have been published (Kelsheimer, 1963; Wolfenbarger, 1966; Schuster, 1977). The cultivars, *Lycopersicon esulentum* and *L. hirsutum* f. *glaboratum* were rated as resistant to leaf miner infestation in greenhouses (Webb *et al.*, 1971) while the highest level of resistance to leaf miner infestation (particularly to *L. sativae*) was found in the *L. hirsutum* cultivars, P1 129230, and P1 40403 as possessing intermediate and moderate levels of resistance to *L. sativae*, respectively. However, Latterot *et al.* (1987) reported that the cultivars, Nainemor, *Lycopersicon pimpinellifum* Peru and Flora Dade, and *L. peruvianum* CMV Sel INRA were heavily damaged by both *L. hirsutum* and *L. pennellfi* (Clay Berg). On the other hand, high level of resistance to leaf miner infestation was recorded in the cultivar LA 1401, *L. cheesmanii* (Latterot *et al.*, 1987). The work reported here, summarises our attempts to assess diverse selections of *Lycopersicon esculentum* for potential resistance to leaf miners in the field and their differential impacts on leaf miners development.

## Study Description

**a) Differential susceptibility of tomato:** Field experiments were conducted during two winter seasons at the Experimental Farm of the University of Gezira, Wad Medani, Sudan to investigate possible occurrence of resistance in 7 breeding lines and 5 varieties of tomato to the damage caused by the leaf miners, *L. trifolii* and *L. sativae*. Six breeding lines tested were among the most promising lines developed at the University of Gezira, Sudan. These included Omdurman, Hillo, U.G. Fireset A3–36, U.G. Fireset A6 – 30 R, U.G. Fireset A4 – 20 R and U.G. 46. However, the breeding line Trop G. 9 – 18 was developed at INRA, Avignon, France. The varieties used in this test were, Strain B and Peto 86 (Holland Company); Alfa (Univ. of Warso, Poland); Red star (Tanzy, Italy) and Flora Dade (INRA, Avignon, France). Evaluation of damage by *Liriomyza* spp. on tomato leaves was carried out weekly from the seedling to the fruit setting stage. Percentage of the number of infested leaves was recorded for each sampling date. Collected data were subjected to arcsine transformation and statistically

analysed using Analysis of Variance and the Student Newman – Keuls Tests (SAS Institute 1985).

**b) Laboratory experiments:** 1. Tomato variety *Flora Dade* and breeding line Trop G 9- 18 with minimum leaf miners damage in the field were studied here to determine the number of larvae/plant of *L. trifolii* and *L. sativae* as a measure of plant susceptibility. 2. Tomato varieties and/or breeding lines with minimum leaf miners damage in the field were studied here to determine whether they were simply less preferred by the ovipositing females or they would have an impact on larval development of *L. trifolii*.

A total of 25 females and 10 males of *L. trifolii* and *L. sativae* were introduced in a plastic cage with a small drop of honey and moist cotton piece and left to breed. Data taken included the number of larvae (to evaluate the susceptibility of Flora Dade and Trop G 9-18), the number of larvae and larval period (days) to evaluate the susceptibility of the varieties Flora Dade and Strain B. Breeding lines Omdurman and Trop 9-18 were controls. The data obtained were analysed by the t-test and Kruskal – Walls ranking test, respectively.

## Research Application

**a) Differential susceptibility of tomato.** The mean percentages of infested leaves in field experiments for the different tomato varieties and/or breeding lines are summarised in Table 1. In both seasons 1 and 2, there were significant differences ( $P < 0.05$ ) between the tested tomato varieties (Table 1). As expected, the variety Flora Dade was highly infested (Latterot *et al.*, 1987) and the breeding line Trop G 9 – 18 recorded the lowest damage (Latterot *et al.*, 1993).

Generally, established varieties (i.e., Red Star, Strain, B, Peto 86 and Alfa) were also less susceptible to infestation by leaf miners compared to the breeding lines developed at the University of Gezira (i.e., Omdurman, UG Fireset A3 36 L, UG Fireset A6 30R, Hillo, UG 46 and UG Fireset A4 20R). The tested tomato varieties and/or breeding lines may be grouped on the basis of their susceptibility to *Liriomyza spp.* into three categories: highly susceptible (Flora Dade followed by Omdurman, UG Fireset A3 36L and UG Fireset A6 30R); moderately susceptible (Hillo, UG 46, UG A4 20R, Red Star) and resistant (Trop G 9 – 18, Afla, Peto 86 and Strain B).

**Table 1. Mean infestation (%) by *Liriomyza* spp. on leaves of different tomato varieties (\*) and breeding lines (\*\*) during season 1 and season 2.**

Tomato	Percent leaf infestation during the winter seasons	
	Season 1	Season 2
Flora Dade (*)	64.18 a	63.57 a
Omdurman (**)	49.66 b	53.76 a
UG Fireset A3 36L (**)	36.17 c	45.83 b
UG Fireset A6 30R (**)	35.75 c	44.94 b
Hillo (**)	27.64 d	39.35 c
UG 46 (**)	18.39 e	26.75 e
UG Fireset A4 20R (**)	17.93 e	27.96 d
Red Star (*)	11.71 f	24.60 f
Strain B (*)	10.36 fg	17.71 g
Peto 86 (*)	8.93 fg	14.03 h
Alfa (*)	7.14 gh	13.18 h
Trop G 9 – 18 (**)	4.04 i	8.65 I

Means within columns followed by the same letter (s) are not significantly different ( $P < 0.05$ )

**b) Effect of tomato varieties and breeding lines on *Liriomyza* spp. oviposition and development.** When the adult of *L. trifolii* and *L. sativae* were allowed to oviposit on the leaves of the variety Flora Dade and breeding line Trop G 9 – 18 (Test 1 and 2), test 1 showed that Flora Dade sustained 22.8 larvae /plant on *L. sativae* while Trop G 9-18 sustained only 5. On the other hand no larvae were reared on the breeding line Trop G 9 – 18 (0) for *L. trifolii* while Flora Dade sustained 32.5 larvae /plant. In Test 2, Flora Dade sustained 19.3 of *L. sativae* larvae/plant, but only 1.5 in Trop G 9-18 with respect to *L. trifolii* 30.6 larvae were sustained on the variety Flora Dade and no larvae in Trop G9-18. Highly significant differences were found between the number of *L. sativae* reared on the variety Flora Dade and the breeding line Trop G 9 – 18.

The numbers of the larvae that developed when adults of *L. trifolii* were allowed to oviposit on either Flora Dade, Strain B, Omdurman or Trop G 9 – 18 are presented in Table 2. No significant differences were found between varieties and breeding lines regarding the development of the larvae. It was apparent from the study that tomato varieties and breeding lines tested had different levels of resistance to *Liriomyza* spp. The results clearly demonstrated that Trop G 9 – 18 is a resistant breeding line to the *Liriomyza* spp. No antibiosis activity was evident since larval duration on this breeding and the other tested

**Table 2. Mean numbers and developmental periods of *Liriomyza trifolii* larvae on two varieties (v) and two breeding line (b) of tomato.**

Variety (v) or breeding line (b)	Mean number of larvae	Mean of larval period (day)
Omdurman (b)	35.5 a	6.18 ns
Flora Dade (v)	20.78 b	6.26 ns
Strain B (v)	13.60 b	6.28 ns
Trop G 9 – 18 (b)	0	0
G. mean ± S.E	17.47 ± 3.46	6.24 ± 0.1

Mean of 10 replicates; Mean followed by the same letter in the same column are not significantly different ( $P > 0.05$ ), Freidman test. ns: Not significant ( $P > 0.05$ ) Student Newman Keuls test (S.A.S Institute 1985).

tomato varieties and breeding lines showed no significant differences. According to its origin, breeding line Trop G 9 – 18 (*L. chessmanii* x *L. esculentum*) contains an anti-feedant repellent activity associated with the glandular trichomes on the leaves. This may account for the resistance exhibited by this breeding line.

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