Resistance of Melons (*Cucumis melo* L.) to leafminers (*Liriomyza spp.*; Diptera: *Agromyzidae*)

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The vegetable leafminers, Liriomyza spp. (Diptera: *Agromyzidae*) are considered as one of the most important pests affecting vegetable crop production in many parts of the world. The reason why *Liriomyza spp*. are serious problems is the enormous build up of populations which are able to feed on a wide range of plant species. In the Sudan, two species of *Liriomyza* were reported: L. *trifolii* Burgess and L. sativae Blanchard' causing severe damage to a wide range of hosts. Recent surveys in central Sudan confirmed the existence of both species and that *Liriomyza sativae* was more common than *L. trifolii* on different host plants (Salah, 2001). The host range of *L. sativae* is confined to three families: *Cucurbitaceae, Leguminaceae* and Solanaceae, while L. trifolii is a polyphagous species, which attacks tomato, cucumber, lettuce, pepper and is also a serious problem on melons (Dogimont *et al*., 1999).

Pesticides are currently used to control this pest contributing to the elimination of natural enemies and to the development of leafminer strains resistant to insecticides. Because of environmental concern over the use of pesticides in agriculture, alternative means of pest control are being sought. Development of cultivars with insect resista- nce is an effcient and inexpensive method in controlling Liriomyza spp. (Dogimont *et al*.. 1999).

Parameters used for assessment of host plant preference are the number of larvae, larval period (days), percentage of adult emergence and total life cycle (days). Four types of resistance to *Liriomyza trifolii* are known: delay in larval development, many dead larvae in the mines, mines in chlorotic spots and small numbers of larvae and mines (Dogimont *et al*., 1999). Kennedy et al. (1978) exposed 50 genotypes to *L. sativae* oviposition and found that PI 282448 (from South Africa)

and PI 313970 (from India) had the lowest mines and highest larval mortality. Those resistance effects were efficient in field trials. Resistance of PI 282448 to *L. sativae* appeared to be controlled by recessive genes, while that of PI 313970 appeared to be controlled by partially dominant genes. It was found that differences in resistance were stable over a wide range of environmental conditions and against different populations of *L. sativae* (Kennedy et al., 1978). On the other hand, the line Nantais Oblong was found promising for resistance to *L. trifolii* (Dogimont *et al.*, 1999). The objectives of this study were to identify natural sources of resistance to the vegetable leafminers under Sudan conditions and to identify their host plants.

One hundred and eleven genotypes of *C. melo* L. were grown at the University of Gezira Research Farm on the 15th of August 2002. These accessions included commercial cultivars, land races, wild melon accessions and introduced lines. The introduced lines were supplied by the Melon Laboratory of The National Institute for Scientific Rersearche (INRA) of France. Seeds were grown in beds 7 x 2.5 m^2 with inter-row spacing of 30 cm. Plants were thinned to two plants per hole, 21 days after sowing and sprayed with Sevin and Byleton to protect them against insects and fungal diseases. At two months after sowing, ten plants of each accession were randomly selected and five leaves from each plant were evaluated for infestation by the vegetable leafminers. The percentage of infested leaves of each accession was calculated. Accessions were then classified based on the mean of infestation into: resistant, slightly susceptible, moderately susceptible and highly susceptible.

A second experiment was conducted in January to March 2003, to evaluate the promising genotypes for resistance to the vegetable leafminers. These genotypes included: PI 282448, PI 313970, Nantais Oblong and the indigenous accessions HSD 2445 and 93-5-B (*C. melo* var. *agrestis*). The variety Vedrantais was used as a susceptible check. Experimental design used was the randomized complete block design with three replications. Ten plants of each genotype were randomly selected and the number of infested leaves per plant and number of mines per leaf were counted. Data was subjected to analysis of variance and means were separated using Duncan's Multiple Range Test.

Moreover, surveys were made during January to March in different cucurbit crops such as local cultivar of pumpkin, squash variety Scandrani and the lines P1282448, P1313970, Nantais oblong and NRI of melons, and variety Shambat 57of faba bean. Living larvae and pupae were collected from infested leaves and reared into cylindrical tubes until adult emergence. Adults were treated with ethyl- acetate and prepared for identification using the microscope. Adults were then differentiated into *L. sativae* or L. *trifolii* based on their eyes and dorsal morphological features, following Salah (2001). The percentage of each vegetable leafminer species was calculated for the different hosts.

The results presented in Table 1 showed high infestation by the vegetable leafminers during the early winter season of 2002. Resista- nce to the vegetable leafminers was not common in C. *melo* L. Results showed high variability among the evaluated genotypes, with a standard deviation of 23%. Among the evaluated genotypes, 47 were found highly susceptible, 46 were moderately susceptible, 17 were slightly susceptible and only one accession HSD 2445, which was collected in Wad Medani area in 1996, was considered resistant with an infestation rate of 16%. Commercial cultivars and the indigenous cultivated melons were found highly susceptible (30 genotypes) to moderately susceptible (34 genotypes). Among the introduced geno- types, only the line PI 414723 was found to be slightly susceptible (%43)The introduced line lv1R-1 showed the highest infestation rate (69%).

Table 1. Resistance of different genotypes of *Cucumis melo* L to the vegetable leafminers (Diptera: *Agromidae*) under field conditions،Wad Medani, October 2002.

Genotype	Total	corresponding infestation score to mean	Number of genotypes		
		R	SS	MS	HS
Sweet melons	29	-	1	14	14
(Wild melons (C. melo var. agrestis	30	1	11	12	6
(Snake melons (C. melo var. flexousus	2	0	I	I	0
Commercial cultivars	38	0	2	16	20
Introduced lines	12	0	2	4	6
Total	111	1	17	47	46

Resistant (R) = > 28%.
Slightly susceptible (SS) = 28-52%.
Moderately susceptible (MS) = 52-75%.
Highly sucerptible (HS) = <75%

Further experiments showed significant differences among the promising genotypes with regard to the percentage of infested leaves per plant and the average number of mines per infested leaf (Table 2). The introduced line PI 313970 had the lowest percentage of infested leaves per plant (12%), followed by the accession 93-5-B (19%) Vedrantais (23%), Nantais Oblong and HSD 2445 (24%), whereas, the line P 1282448 was highly infested with the vegetable leafminer (30%).

Table 2. Percentage of infested leaves by leaf miners per plant and number of mines per infested leaf observed on different genotypes of *Cucumis melo* L.

Genotype	leaves/plant (%) Infested	Number of mines/ leaf
93-5-B	b19	8.0 b
Pl 313970	c 12	3.3 c
Vedrantais	b 23	8.3 b
Pl 282448	a 30	16.3 a
Nantais Oblong	b 24	15.0 c
HSD 2445	b 24	9.3 b

The average number of mines per infested leaf of the different genotypes showed the same trend depicted by the percentage of infested leaves per plant. The line P 1313970 was found to be the best (3.3 mines/leaf) followed by 93-5-B (8 mines/leaf), Vedrantais (8.3 mines per leaf) and HSD 2445 (9.3 mines/leaf), whereas, the line PI 282448 showed the highest number of mines per infested leaf (16.3 mines/leaf). Hence, the results showed that line PI 313970 was a natural source of resistance to the vegetable leafminers. Such finding was confirmed by the work of (Kennedy *et al*., 1978).

The results of surveys carried out at the University of Gezira Research Farm in different cucurbit crops and faba beans for the occurrence of the vegetable leafminer species are presented in Table 3. Results indicated that L. *sativae* was the most common species on cucurbits (71.61%) compared to L. *trifolii* (28.39%). Adults emerged from samples collected from the different genotypes of C. *melo* L. showed the presence of the two species while those emerged from faba bean showed only the presense of *L. trifolii*. These results are in line with those of Kennedy

(1978) and disagreed with those of Peter and Gunter (1994), who found that faba bean was infested by L. *sativae*.

Table 3. The occurrence of *Liriomyza sativae* and *Liriomyza trifolii* on different plant species, under field conditions, Wad Medani, March 2003

Plant species	Total number of adults	*L. sativae*	*L. trifolii*
Pumpkin (Cucurbita moschata)	15	12	3
Squash (C. pepo)	31	18	13
Pl 313970 (C. melo)	4	4	0
Pl 282448 (C. melo)	16	13	3
Nantias Oblong (C. melo)	10	7	3
MR-1 (C. melo)	5	4	1
Faba bean (Vicia faba)	9	0	9

In conclusion, the line P1313970 was the best genotype for resistance to the vegetable leafinineers under field conditions and it could be recommended as a natural source of resistance in breeding programmes.

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