

# Characterization of resistance to *Liriomyza trifolii* (Burgess) in melon (*Cucumis melo* L)

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### ABSTRACT

The leafminer *Liriomyza trifolii* causes serious damage to *Cucumis melo* in tropical and Mediterranean regions. Nantais oblong, an old French variety of melon, has shown resistance to *L. trifolii*. This resistance was characterized in young plantlets and adult plants. Very few crosses will be required to introduce these resistance traits of cv Nantais oblong into modern Charentais-type melon varieties.

## Mise en évidence d'une résistance à *Liriomyza trifolii* (Burgess) chez le melon (*Cucumis melo* L).

### RÉSUMÉ

*Liriomyza trifolii*, mineuse des feuilles, provoque d'importants dégâts sur *Cucumis melo*, en particulier en régions tropicales et méditerranéennes. Nantais oblong, une ancienne variété française de melon, présente une résistance vis-à-vis de *L. trifolii*. Cette résistance a été caractérisée sur jeunes plantes et plantes adultes ; peu de croisements seront nécessaires pour introduire les caractéristiques de résistance de Nantais oblong dans des variétés modernes de type Charentais.

## Puesta en evidencia de una resistencia a *Liriomyza trifolii* (Burgess) en el melon (*Cucumis melo* L).

### RESUMEN

*Liriomyza trifolii*, minadora de las hojas, provoca daños importantes sobre *Cucumis melo*, particularmente en regiones tropicales y mediterráneas. El Nantais oblong, antigua variedad francesa de melon, presenta una resistencia frente a *L. trifolii*. Esta resistencia se caracterizó sobre plantones y plantas adultas; se necesitarán pocos cruces para introducir las características de resistencia de Nantais oblong en las variedades modernas de tipo Charentés.

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### KEYWORDS

*Cucumis melo*, *Liriomyza trifolii*, pest resistance, variety trials.

### MOTS CLÉS

*Cucumis melo*, *Liriomyza trifolii*, résistance aux organismes nuisibles, essai de variétés.

### PALABRAS CLAVES

*Cucumis melo*, *Liriomyza trifolii*, resistencia a las plagas, ensayos de variedades.

## ● introduction

The microdipteran leafminer *Liriomyza trifolii* (Burgess) is a serious pest of melon (*Cucumis melo* L.) in tropical and Mediterranean regions. Damages are caused by feeding punctures of female insects and relatively dense galleries that larvae bore through leaf tissues (photo 1). It is very difficult to control these leafminers through chemical treatment, and research on resistant varieties is therefore essential.

As a follow-up to a research project already under way on *L. trifolii*-resistance in tomato (LATERROT *et al.*, 1995), a new joint project was set up by CIRAD-FLHOR (Montpellier) and INRA (Montfavet) to study resistance to this leafminer in melon (*Cucumis melo* L.). The studies began in 1992.

The first part of this collaborative project involved attempting to identify, in a melon collection, genotypes that are less susceptible than Cantaloup Charentais-types, the most widely grown varieties in France. Secondly, highly interesting resistance was characterized in an old French melon variety, Nantais oblong.

## ● materials and methods

All biological tests, leafminer rearing, infestation tests and mine counting was carried out in the CIRAD-FLHOR laboratory. The *L. trifolii* strain used originated from Réunion Island. The leafminer mass rearing technique has been used for several years in the laboratory (DALLE and BORDAT, 1993). The infestation tests were carried out on young plantlets and adult plants under controlled conditions.



Photo 1  
*L. trifolii* pupae  
and mines.

## tests on young plantlets

Ten melon plants at the two-leaf stage were placed in a cubical transparent plastic cage (45 x 45 x 45 cm), covered with very fine netting to allow air circulation. The plants could be reached through an opening at the front of the cage. In each cage, 25 females, ie, 2.5 females/plant, were released. After 24 h contact, adults were eliminated and the plants were placed in a climate-controlled chamber (25 °C; 75% relative humidity). Leaf mines were counted 4 days later.

## tests on adult plants

The melon plants were planted under a screened tunnel at the 12–15 leaf stage, with the plants efficiently isolated under an Agryl P17 insect-proof cloth tent. A complete randomized block test design (five blocks of three varieties, six plants/plot) was used. A box containing 400 *L. trifolii* pupae was placed in the middle of each plot of six plants. Mines were counted on all leaves 13 days after infestation.

## ● results

### screening for resistance

For this investigation, 120 melon cultivars from a wide range of geographical origins were tested under controlled infestation conditions at the young plantlet stage. Most cultivars tested were found to be as susceptible (74 cultivars), or more susceptible (12 cultivars), as compared to cv Védraçais (photo 2), the susceptible Charentais-type variety used as control.

Other genotypes showed some interesting traits: eg, inducing delayed larval development with all larvae transformed into pupae, causing partial mortality during the different larval stages; and prompting a marked reduction in the number of leaf mines.

The Nantais oblong variety was found to be especially interesting and was thus chosen for the *L. trifolii*-resistance characterization study.

## characterization of resistance in cv Nantais oblong

### tests on young plantlets

Three melon varieties were chosen for these tests: Nantais oblong, Védrantais (susceptible control) and B 66-5 (American Cantaloup-type variety that was found to be more susceptible than cv Védrantais).

Six separate trials were carried out in two different cages, with 20 plants/genotype, at the two-leaf stage.

Resistance was assessed according to the number of mines/plant (table I) and the percentage of larval mortality.

A mean of 15.3 mines/plant was noted in cv Védrantais, and the rate was even higher for B 66-5. In cv Nantais oblong, there were fewer mines than on cv Védrantais. Larval mortality was 5–10% on cvs Védrantais and B 66-5. In contrast, on cv Nantais oblong, larvae died at the first instar stage, and mines were therefore very short (about 1 mm) (photo 3).

### tests on adult plants

The test carried out on adult plants at the 12–15 leaf stage confirmed the results obtained on young plantlets (fig 1).

In cv Védrantais, there was a high mean number of mines (15.4 mines/plant), with low larval mortality (around 5–10%). Similar results were obtained with cv B 66-5 (26 mines/plant), whereas the number of mines was much lower for cv Nantais oblong (mean 4.3 mines/plant), and total first instar larval mortality was obtained with the latter variety. Very little infestation of young leaves was observed for the three genotypes.

## ● conclusion and prospects

The present study revealed antibiosis resistance behaviour in the Nantais oblong melon variety, causing high larval mortality and hindering gallery burrowing in the leaves. There also seemed to be an antifeeding factor involved in cv Nantais oblong resistance, as very few mines were noted, especially on adult plant leaves.

This *L. trifolii*-resistance is of considerable interest for plant breeders, as Nantais oblong, a Charentais-type melon variety, is of high agronomic

Table I

Number of *L. trifolii* mines/plant counted during controlled infestation of young plantlets at the two-leaf stage.

	B66-5	Varieties tested Védrantais	Nantais oblong
Mean number of mines	21.0 a	15.3 b	12.3 c

abc: Means with different letters were significantly different (5% level) according to the Newman-Keuls test.

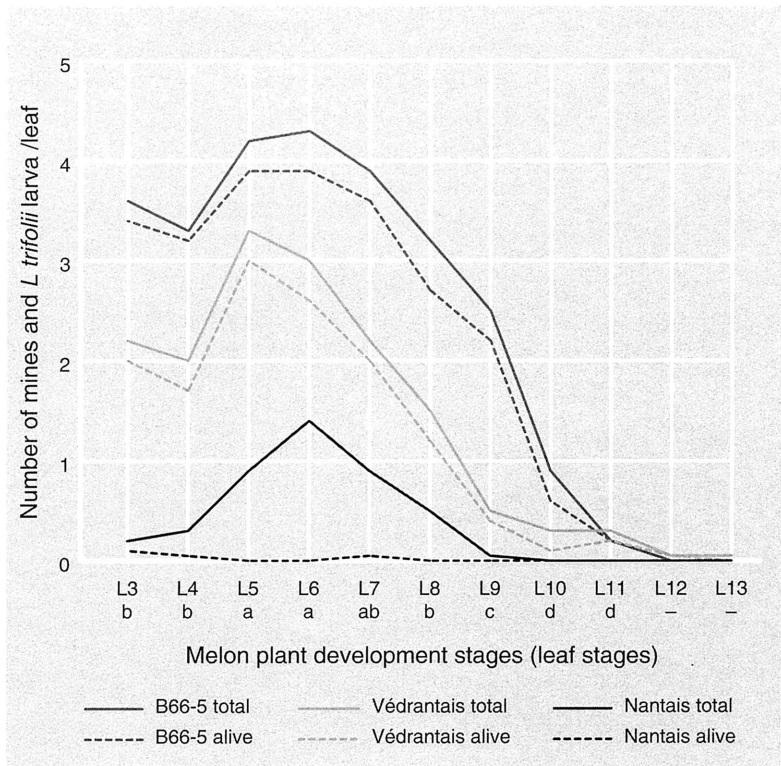


Figure 1

Number of mines/leaf and living larvae counted during controlled *L. trifolii* infestation of adult plants of three melon varieties (Védrantais, B 66-5 and Nantais oblong) conducted under a screened tunnel. Leaf stages with different letters (a, b, c and d) are significantly different at the 5% level (Newman-Keuls test).

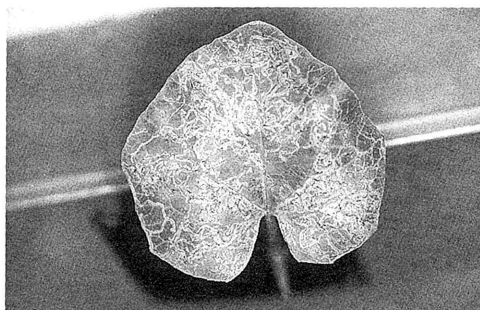
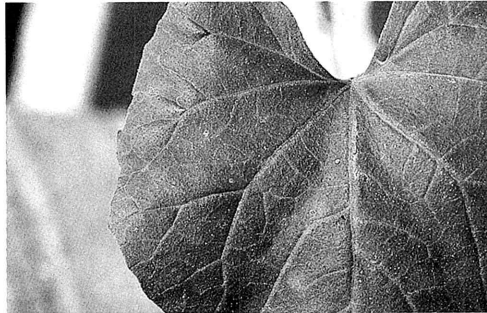


Photo 2

Infestation tests with *L. trifolii* on leaves of a melon susceptible variety, Védrantais.

*Photo 3*  
*Infestation tests with Liriomyza trifolii on leaves of a melon resistant variety, Nantais oblong. The mines are very short because there was total first instar larval mortality.*



quality. Moreover, very few crosses will be required to introduce this resistance in modern Charentais-type varieties.

Further genetic analyses on *L trifolii*-resistance in cv Nantais oblong, and studies on the resistance expression limits for this variety, will now be carried out. These limits will be studied:

– under various environmental conditions, particularly in experiments that have been set up in Réunion Island, the region of origin of the leaf-miner strain used in the present study;

– with various *Liriomyza* species; tests carried out under artificial infestation conditions revealed that the resistance noted in cv Nantais oblong is not very efficient against *L huidobrensis*, recently identified on melon crops in the Provence region of France; the melon collection is currently being screened for new resistance sources against this *Liriomyza* species. Moreover, cv Nantais oblong is being monitored in New Caledonia, where *L sativae*, which is not found in Europe, predominates.

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