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Resistance of F1 Hybrids of Lycopersicon Genus to Populations of Meloidogyne Species

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Abstract

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The reaction of F-1 hybrids of *Lycopersicon spp.* to Bulgarian populations of *Meloidogyne incognita* (Kofoid and White,1919) *Chitw.1949* and *M. hapla Chitw.* were evaluated in a glasshouse at 26+2^{o} C .The plants were planted in plastic trays containing 12cm^{3} of steam sterilized sandy soil and artificially infested with 10 000 eggs and juveniles of each nematode population per plant..Highly resistant to *M.incognita* and *M.hapla* were the hybrids No 9-4 and 9-6.Only few galls were found on the resistant hybrids No 8-42 and 8-48. The plants of number 9-8 were highly resistant to *M. incognita* and susceptible to *M. hapla*. The remaining cultivars were susceptible to the nematode populations tested.

Key words: root-knot nematodes, resistance

Introduction

Tomato *(Lycopersicon esculentum*) is severely damaged by root-knot nematodes (*Meloidogyne spp*.) wherever it is cultivated. These nematodes can be controlled by fumigant and systemic nematic-ides but they are expensive and may pollute the environment (Lamberti,1979).The studies carries out by Stoyanov (1980,1989) ,Choleva et al. (1988) showed that *M.incognita* and *M. hapla* are widely distributed in many regions of Bulgaria. Good control can also be achieved using resistant cultivars. However while there are several tomato cultivars resistant to some species of root-knot nematodes only a few are resistant to *M. hapla.*

The resistance factor that has been used so far is the dominant Mi-gene, which confers resistance to *M. incognita, M. arenaria, M. javanica*, but not to *M. hapla* Chitw. or at temperatures above 28^{o}C.(Liharsk and Williamson,1997; Ornat et al., 2001). The objective of this study was to establish the reaction of F1 hybrids from *L. ycopersicon spp*. to Bulgarian populations of *Meloidogyne spp.*

Materials and Methods

Seventeen hybrids obtained from the Institute of Genetics Sofia were used in this experiment conducted in the glasshouse of the Plant Protection Institute,Kostinbrod.They are Bulgarian plant breeding materials derived from wild tomato species *L. chilense* and *L. peruvianum* by interspecific cross or from segregation of hybrid of Dutch origin. Twenty seed of each hybrid were kept for germination in small plastic pots filled with a sterilized mixture of peat and sandy soil (v:v 1:1).Later seedlings were transplanted in PVC plots (12 cm diameter and 15 height) with 500g sterilized soil for inoculation. Each plot contained one plant.There were six replicates of each treatment.

The inoculum from *M. incognita and M. hapla* was initially isolated from infested tomato plants and multiplied under greenhouse conditions for 2 months. After this period, heavily infested tomato roots were washed of adhering soil and used for preparing inoculum. Inoculum of second-stage juveniles were hatched, collected daily and stored at 4^{o}C before use within 5 days. The seedlings were inoculated with 10 000 juveniles per plant and deposited near the roots.

Tomato *L. esculentum Mill* cv.Ideal was used for control. Species composition of the isolates was determined by using the morphological criteria of perineal pattern of adult females. The plants were irrigated daily according to the apparent needs of the plant. The experiment was evaluated 45 days after inoculation. After this period the plants were uprooted, the roots were gently washed and the gall index (GL) was then assessed according to a 0-5 scale, where 0 = no gall on the roots, 1 = 1-2 galls; 2 = 3-10; 3 = 11-30; 4 = 32-100 and 5 = more than 100 galls per root (Taylor and Sasser, 1978). A tomato plant was considered resistant (R) when the gall index (GI) was < or = 2 and highly resistant (HR) when no gales but only localized necrosis in the host cells near the infecting pathogen.

The data were statistically analyzed and LSD, s calculated.

Results and Discussion

All cultivars grew well in the glasshouse. No galls were foud on the roots of No 9-4.9-6 and 9-8. The hybrids No 9-4, 9-6 and 9-8 were completely free of *M. incognita* and *M. hapla* (GI=0).Galls were found on the roots of No 9-8 inoculated with *M. hapla* (Table1). Few galls were found on the roots of the hybrids No 8-42 and 8-48 with GI of 1.5;1.2;1.3 and 1.6 inoculated with juveniles of *M. incognita and M. hapla* respectively. The roots of the remaining hybrids were heavily infested by the root-knot nematodes with GI ranging from 2.0 to 5.0.

The roots of the control Ideal tomato were heavily infested by nematodes, with a GI of 5.0.

The hybrids No 9-4;9-6 and 9-8 were highly resistant(HR) to the two nematode populations,while the No 9-8 was highly resistant to *M. incognita* but susceptible to *M. hapla*. Asimilar trend was observed by Hadisoeganda and Sasser (1982). It is know that a major gene (Mi) located on chromosome 6 controls resistance to *M. incognita, M. arenaria* and *M. javanica* but not to *M. hapla* (Hadisoeganda and Sasser, 1982; Ammati met al., 1985).This gene was introduced into cultivated tomato from the wild tomato species *L. peruvianum* L. and *L. chilense* L. by embryo rescue of an interspecific cross or from

Table 1

Response of F-1 hybrids of *Lycopersicon* spp.to root-knot nematodes

F- 1 Hybrids	Gall.index		Reaction type	
	M.inc.	*M.h.*	*M.inc.*	*M.h.*
5-1	3.4	3.8	S	S
5-4	3.3	3.4	S	S
7-1	4	3.4	S	S
7-19	3	3	S	S
7-29	3.2	3	S	S
8-1	3	3	S	S
8-2	3	4	S	S
8-6	4.4	2.8	S	S
8-42	1.5	1.3	R	R
8-48	1.2	1.6	R	R
9-4	0	0	HR	HR
9-6	0	0	HR	HR
9-8	0	2.5	HR	HR
15-12	3.8	3.5	S	S
15-14	3.5	3.4	S	S
15-19	3.7	3.3	S	S
15-33	3	3.5	S	S
control	5.3	5	S	S
LSD	0.53	0.34		

M.inc =M.incognita *M.h. =M.hapla*

S = susceptible R = resistance HR = highly resistance

the segregation derived of hybrid Dutch origin.

The hybrids No 8-42 and 8-48 were considered resistant(R) to the nematode species although few galls were found on the roots.

The results indicate that sources of resistance to *Meloidogyne spp.* are present in five F-1 hybrids of *Lycopersicon* genus.Complex resistance to *M. incognita* and *M. hapla* was found in four hybrids- [1] 9-4;9-6;8-42 and 8-48. Some of the tomato genotypes ,such the hybrid [1] 9-8 was resistant to *M. incognita* but susceptible to *M. hapla*. The other F-1 hybrids proved more or less sensitive against root-knot nematodes that is why they appear of no interest for selection.

This findings are very important because the areas were tomato is cultivated generally are infested by *M. incognita*, *M. hapla* or with both.The data presented in this study could be used in plant breeding programmes to obtain cultivars with resistance to the important species of root-knot nematodes.They are perspectivly for the selection. The resistance againt root-knot nematodes is often not universal i.e. not directed to all *Meloidogyne* species present in an area or the occurrence of virulent field populations. Moreover, several resistance-breaking *Meloidogyne* populations have already been isolated from the field in different countries (Dautova et al. 2000; Ornat et al.2001). That is why the resistance test should be carried out with several populations of *Meloidogyne spp*. with different origin.

Conclusions

The results of the study give a possibility to conclude the following:

Five F-1 hybrids of *L. esculentum* are perspective for the breeding programmes.

1. The higest resistance against root-knot nematode *M. incognita* and *M. hapla* showed F-1 hybrids [1] 9-4 and [1]9-6. Number 9-8 was highly resistant to *M. incognita* but susceptible to *M.hapla*.

2. Only few galls were found on the hybrids [1]8-42 and 8-48.

3. The hybrids [1] 9-4; 9-6; 9-8; 8-42 and 8-48 are very perspective for future selection.The other hybrids proved more or less sensitive, that is why they appear of no interest for selection.

References

Ammati, M., I. J. Thomason., P. A. Roberts.1985. Screening *Lycopersicon spp*.for new genes importing resistance to root-knot nematodes (*Meloidogyne spp*.). Plant Disease,69,112-114.

Dautova, M and F. J. Gommers, 2000. *Meloidogyne spp*. in Macedonia: Distribution and virulence for *Mi* resistance in tomato. Nematologica mediterranea, 28, 121-128.

Hadisoeganda, W. W., J. N. Sasser, 1982. Resistance of tomato,bean,southern pea,and garden pea cultivars to root-knot nematodes based on host suitability. Plant Disease, 66, 145-150.

Choleva, B., V. Sotirova., Ch. Georgiev, 1988. Study on the resistance of lines and hybrids tomato to root-knot nematodes *Meloidogyne spp*.and Golden nematode *Globodera rostochiensis* (Woll. 1923., Mulvey, Stone, 1976). Biotechnology and Biotechnique, 1, 35-39.

Lamberti, F., 1979. Economic importance of *Meloidogyne spp*. In Subtropical and sys tematics,biology and control.Academic Press, London, U. K.

Liharska, T. B., V. M. Williamson,1997. Resistance to root-knot nematodes in tomato.Pp.191-200. Cellular and Molecular Aspects of Plant-Nematode Interactions. Kluwer Academic Publishers, Dordrecht, The Netherlands.

Ornat, C., S.Verdejo Lucas., F. J. Sorribas, 2001. A population of *Meloidogyne javanica* in Spain virulent to the Mi resistance gene in tomato.Plant Disease, 85, 271-276.

Taylor, A. L., Y. N. Sasser,1978. Biology, Indentification and control of root-knot nematodes(*Meloidogyne species*). In: Nematologica Mediteranea,1998, 26, 271-274. Mediterranea climates, pp. 341-355. In: Root-knot nematodes (*Meloidogyne species*)

Stoyanov, D.1980. Plant Parasitic Nematodes and their Control. Zemizdat pp.193.

Stoyanov, D.1989. Application of Vidate insecto-nematocide for controlling *Meloidogyne* species gall nematodes. Plant sciences, 26, 112-115.