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REACTION OF OLIVE CULTIVARS TO *MELOIDOGYNE* SPECIES

by

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Summary. Seven olive cultivars and one rootstock were tested in a glasshouse experiment for their reaction to *Meloidogyne incognita* and *M. javanica*. Potted soil was artificially infested with 12 eggs and juveniles/cm³ of either nematode species. Cultivar Coratina was resistant to *M. incognita* and *M. javanica* and cv. Leccino was resistant to *M. javanica* and moderately susceptible to *M. incognita*. Cultivar Cima di Bitonto was moderately susceptible to *M. incognita* and highly susceptible to *M. javanica* and cv. Cellina di Nardò was susceptible to both nematodes, as cultivars Frantoio and FS 17 and the rootstock DA 12 I were moderately susceptible. Cultivar Yusti, which had the least developed root system of all those tested, was moderately susceptible to *M. incognita* and moderately resistant to *M. javanica*.

Several plant parasitic nematodes have been reported to parasitize olive trees (Lamberti and Vovlas, 1993). In particular it was shown that two Californian populations of *Meloidogyne incognita* and *M. javanica* were pathogenic to the cultivars Ascolano, Sevillano and Manzanillo (Lamberti and Baines, 1969) and that the cultivars Ascolano, Frantoio, Leccino, Manzanillo and Taggiasco were all susceptible to an Italian population of *M. incognita* (Inserra *et al.*, 1981), whereas "Manzanillo" was considered to be highly tolerant to *M. javanica* in California (Lamberti and Baines, 1969) and "Moraiolo" moderately resistant to *M. incognita* in Italy (Inserra *et al.*, 1986).

The reaction of some olive cultivars, including "Frantoio" and "Leccino" and the rootstock DA 12 I, which are widely grown in Italy, to two species of root-knot nematodes was tested under controlled conditions. The results are reported here.

Materials and methods

Four leaved 15-20 cm long and 8-10 mm thick woody cuttings of the selected cultivars (Tables I - II), all *Olea europaea* L., were dipped for a few seconds in talc containing 2,000 ppm (by weight) indolebutyric acid and planted in perlite in mist chamber with bottom heating at 22±2 °C. After 50 days, rooted cuttings were transplanted in 200 cm³ plastic pots containing steam sterilized soil and kept in a glasshouse at 25±2 °C until required (Fontanazza, 1993).

The Italian populations used were *Meloidogyne incognita* (Kofoid *et* White) Chitw., race 1 (Taylor and Sasser, 1978) which originated from a sugar beet field at Castellaneta (Province of Taranto) and *M. javanica* (Treub) Chitw. collected from a tomato field at Torchiarolo (Lecce). They were cultured for two months on tomato (*Lycopersicon esculentum* Mill.), cv. Roma

TABLE I - Effect of *Meloidogyne incognita* and *M. javanica* on the growth of eight olive cultivars.

Cultivar	Meloidogyne species	Top fresh weight (g)	Top dry weight (g)	Root fresh weight (g)	% increase with respect to initial values			
					Main shoot length	Stem diam	Shoot diam	Node numbers
Cellina di Nardò	<i>M. incognita</i>	4.0**	1.9**	6.8**	47**	10.1	45.9	56*
	Control (non inoculated)	5.4	2.5	5.3	181	14.1	68.5	118
	<i>M. javanica</i>	5.7	2.7	6.5*	131	10.5	64.5	119
Cima di Bitonto	<i>M. incognita</i>	3.8**	2.2**	4.9	77	9.6	59.5	194
	Control	6.1	2.9	6.0	150	10.8	60.2	140
	<i>M. javanica</i>	6.5	3.0	6.6	170	8.7	77.6	132
Coratina	<i>M. incognita</i>	3.0**	1.5**	4.0	156	8.5	78.3	129
	Control	4.5	2.3	4.4	214	24.3	88.7	157
	<i>M. javanica</i>	5.7	2.7	6.2**	303	18.2	129.3	272
DA 12 I (Rootstock)	<i>M. incognita</i>	3.6**	1.7**	5.2**	462	9.5**	170.9	218
	Control	5.7	2.6	7.1	470	37.8	141.5	236
	<i>M. javanica</i>	3.9**	1.7**	5.0**	587	9.5**	143.8	215
Frantoio	<i>M. incognita</i>	4.3	2.2*	5.8	54*	6.3	54.9	54*
	Control	6.2	3.0	5.7	142	13.1	82.3	112
	<i>M. javanica</i>	5.8	2.7	5.7	97	15.2	58.7	71
FS 17	<i>M. incognita</i>	3.2	1.5	4.2	40	2.3	35.5	63
	Control	3.6	1.7	4.3	63	9.0	19.3	112
	<i>M. javanica</i>	5.7	2.5	6.5**	88	14.7	46.4	99
Leccino	<i>M. incognita</i>	3.8**	1.9**	5.8**	140	14.3	85.8	133
	Control	5.5	2.5	7.0	164	23.4	72.6	196
	<i>M. javanica</i>	4.7	2.0	5.5**	240	18.4	83.6	216
Yusti	<i>M. incognita</i>	1.7**	0.8**	2.4**	99	4.7**	45.6*	97*
	Control	4.2	2.0	3.0	203	16.1	87.8	206
	<i>M. javanica</i>	2.6**	1.2**	2.3**	194	11.9	38.5*	170

Statistically different from control according to Student's *t* test. * for P = 0.05; ** for P = 0.01.

VF, in a glasshouse at 25 ± 2 °C. Then nematode infested tomato roots, with large egg-masses, were finely chopped. To quantify second stage juveniles and egg population, ten 5 g root aliquots were shaken in 1% sodium hypochlorite water solution (Hussey and Barker, 1973).

Ten month old self rooted olive cuttings

were then individually planted in 0.5 l clay pots filled with steam sterilized sandy soil, to which chopped nematode infested roots had been thoroughly mixed in appropriate amount to give an initial population density of 12 eggs and juveniles/cm³ soil (*Pt*) (Di Vito *et al.*, 1986).

There were ten inoculated and ten uninoculated pots/plants for each olive cultivar and nematode species. The pots were arranged in a randomized block design on benches in a glasshouse at 26 ± 2 °C.

The experiment was discontinued 90 days after transplanting, when plants were uprooted and fresh top and root weights were recorded. Tops were then oven dried at 60 °C for 48 hours and weighed again. The effect of nematodes on plant growth was also assessed by calculating the percentage increase of main shoot length and its diameter at its insertion with the stem, the stem diameter at its base and the number of nodes on the main shoot with respect to their initial values at planting.

The final nematode population density (P_f) in each pot was determined by processing 500 cm³ soil by the modified Coolen's (1979) method and by cutting up each root system

into small pieces and further comminuting them in 1% aqueous solution of sodium hypochlorite (Hussey and Barker, 1973) for three periods of 20 sec (Marull and Pinochet, 1991). Nematodes were then extracted by differential wet sieving (250 and 5 µm - pore sieves) and centrifugation at 2,000 g for 5 min in magnesium sulphate, to eliminate root tissue and debris.

The root gall index was assessed on a scale of 1 to 6 (Marull and Pinochet, 1991), where 1 = no galls at all, 2 = 1-10 galls, 3 = 11-30 galls, 4 = 31-70 galls, 5 = 71-90 galls and 6 = more than 91 galls per root system. The host reaction of each cultivar was rated according to the reproduction factor, $r = P_f/P_i$, as highly resistant 0, resistant less than 1, moderately resistant 1 to 2, moderately susceptible 2.1 to 5, susceptible 5.1 to 10 and highly susceptible when more than 10 (Di Vito *et al.*, 1996).

TABLE II - Reproduction of *M. incognita* on eight olive cultivars.

Cultivar	Root gall index	Eggs and juveniles per gram of root	♀♀ per gram of root	Total population/cm ³ soil (soil and roots)	$r = P_f/P_i$	Resistance rating
Cellina di Nardò	4.1 AB*	3,531 AB	19 A	72 A	6.0 A	Susceptible
Cima di Bitonto	4.5 A	1,808 C	13 A	34 B	2.9 B	Moderately Susceptible
Coratina	3.2 CD	678 D	25 AB	8 C	0.7 C	Resistant
DA 12 I (Rootstock)	3.9 ABC	3,360 ABC	25 AB	47 B	3.9 B	Moderately Susceptible
Frantoio	3.5 BCD	2,113 BCD	21 A	33 B	2.7 B	Moderately Susceptible
FS 17	2.9 D	1,861 BCD	28 AB	25 BC	2.1 BC	Moderately Susceptible
Leccino	3.7 ABC	1,899 BCD	23 A	26 BC	2.1 BC	Moderately Susceptible
Yusti	3.9 ABC	4,345 A	43 B	31 B	2.6 B	Moderately Susceptible

* Data flanked in any column by the same letters are not statistically different according to Duncan's multiple range test (capital letters for P = 0.01).

Data were statistically analyzed and means compared by the Student's *t* test for plant growth parameters and by Duncan's multiple range test for nematode reproduction indices.

Results and discussion

Most of the root systems of the olive plants grown in soil infested by either *M. incognita* or *M. javanica* were uniformly galled within the gall index range 2.9-4.9 (Fig. 1).

Meloidogyne incognita significantly suppressed the top fresh weight of all the cultivars tested except Frantoio and FS 17 and the dry top weight of all except FS 17 (Table I). Root fresh

weight was significantly ($P = 0.05$) suppressed by *M. incognita* only of cvs Leccino and Yusti and of the rootstock DA 12 I. When plants were infested by *M. incognita* significant suppression in the increase of shoot length, during the duration of the experiment, was evident in Cellina di Nardò and Frantoio, in the stem diameter of the rootstock DA 12 I and the cv. Yusti, in the shoot diameter for Yusti only, and in the number of nodes for Cellina di Nardò, Frantoio and Yusti (Table I).

Conversely, *M. javanica* significantly reduced the top fresh and dry weights of cv. Yusti and the rootstock DA 12 I, the top dry weight of DA 12 I, and the root fresh weight of Leccino and Yusti and rootstock DA 12 I (Table I). On plants grown in pots infested by this root-knot



Fig. 1 - Part of a root system of the olive cv. Cima di Bitonto attacked by *Meloidogyne javanica*.

species, statistically significant suppression of growth increase was observed only in the stem diameter of rootstock DA 12 I and in the shoot diameter for cv. Yusti (Table I).

The root gall index of plants grown in soil infested with *M. incognita* was moderately high (4.5) only for Cima di Bitonto (Fig. 2) and more or less moderate (2.9-4.1) for the remaining cultivars (Table II, Fig. 3). However, nematode reproduction was very low on Coratina, moderate for Cima di Bitonto, DA 12 I, Frantoio, FS 17, Leccino and Yusti and high for Cellina di Nardò.

A root gall index of 4.5 was induced by *Meoidogyne javanica* on Cima di Bitonto, 3.2-3.9

on Cellina di Nardò, DA 12 I, Frantoio and Yusti and 2.1-3.2 for Coratina, FS 17 and Leccino (Table III). Nematode reproduction was low on Coratina and Leccino, low to moderate on Yusti, moderate on DA 12 I, Frantoio and FS 17, high on Cellina di Nardò and very high on Cima di Bitonto (Table III).

Conclusions

According to the rating adopted, cv. Coratina is resistant to both *M. incognita* and *M. javanica* and cv. Leccino is resistant to *M. javanica*



Fig. 2 - Root system of the olive cv. Cima di Bitonto grown in soil infested with *M. incognita*, control at left.



Fig. 3 - Root system of the olive cv. Coratina grown in soil infested with *M. incognita*; control at left.

and moderately susceptible to *M. incognita*, as previously found (Inserra *et al.*, 1981). Moderate susceptibility to both root-knot nematode species also was evident in rootstock DA 12 I and cvs Frantoio (already shown to be susceptible to *M. incognita* by Inserra *et al.*, 1981) and FS 17. Cellina di Nardò is susceptible to *M. incognita* and *M. javanica* and Cima di Bitonto is moderately susceptible to *M. incognita* and highly susceptible to *M. javanica*.

The cultivar Yusti, which appeared to be

moderately susceptible to *M. incognita* and moderately resistant to *M. javanica*, is likely to suffer most from root-knot nematode attack because of its poorly developed root system (Fig. 4), the least vigorous of all the cultivars tested.

Finally, in some cases root fresh weight of plants grown in nematode infested pots significantly exceeded that of the controls. This is due to the large galls that sometimes developed on the root system.

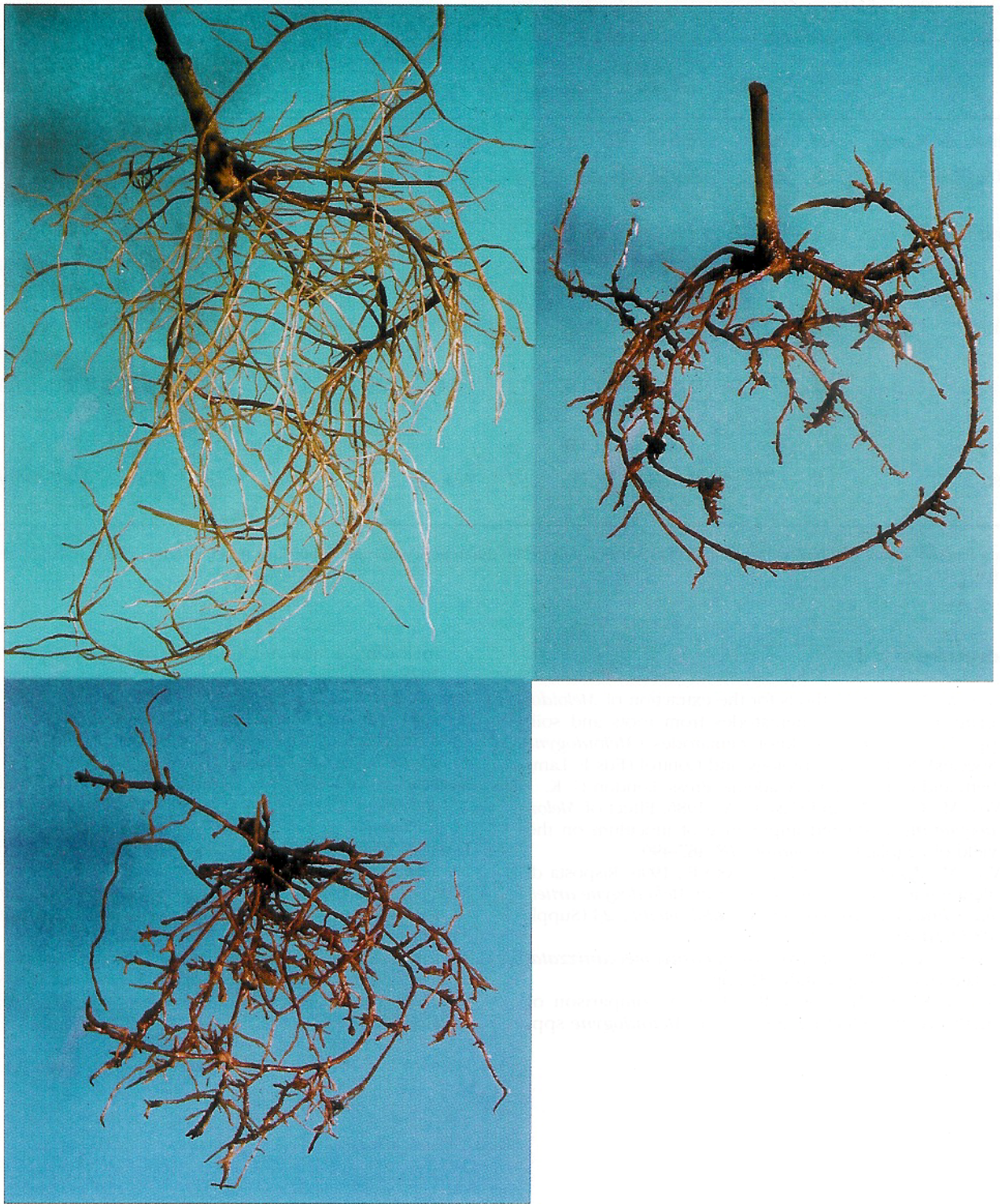


Fig. 4 - Root system of the olive cv. Yusti grown in soil infested with *M. incognita* right and *M. javanica* (bottom left); control at top left.

TABLE III - *Reproduction of M. javanica on eight olive cultivars.*

Cultivar	Root gall index		Eggs and juveniles per gram of root		♀♀ per gram of root		Total population/cm ³ soil (soil and roots)		$r = Pj/Pi$		Resistance rating
Cellina di Nardò	3.9	AB*	5,516	AB	27	AB	92	B	7.7	B	Susceptible
Cima di Bitonto	4.5	A	8,071	A	28	AB	159	A	13.2	A	Highly Susceptible
Coratina	2.5	CD	87	E	2	C	7	D	0.6	D	Resistant
DA 12 I (Rootstock)	3.4	B	3,722	BC	34	AB	60	BC	5.0	BC	Moderately Susceptible
Frantoio	3.2	BC	3,834	BC	44	A	51	BC	4.2	C	Moderately Susceptible
FS 17	2.2	D	1,827	CDE	19	BC	34	CD	2.8	CD	Moderately Susceptible
Leccino	2.1	A	368	DE	6	C	5	D	0.4	D	Resistant
Yusti	3.4	B	3,188	BCD	32	AB	24	CD	2.0	BC	Moderately Resistant

* Data flanked in any column by the same letters are not statistically different according to Duncan's multiple range test (capital letters for $P = 0.01$).

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