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NEMATODES OCCURRING IN THE RHIZOSPHERE OF WALNUT IN ITALY

by
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Summary. A survey of plant parasitic nematodes associated with walnut was carried out in Italy. Data showed the occurrence of *Mesocriconema xenoplax*, *Pratylenchus vulnus*, *Cacopaurus pestis* and *Gracilacus peratica* at frequencies lower than 30% of the plants examined. Other records from the rhizosphere of walnut included *Xiphinema pachtaicum*, *X. italiae* and *Longidorus proximus*. In host status tests *P. vulnus* reproduced on walnut cvs Sorrento, Bleggiana, Conco and Fongara and *M. xenoplax* reproduced on cvs Sorrento and Bleggiana. No reproduction on cvs Bleggiana and Sorrento was observed for the longidorid species.

Nematode species reported in Italy in association with walnut (*Juglans regia* L.) include *Cacopaurus pestis* Thorne, *Longidorus iuglandis* Roca, Lamberti *et* Agostinelli, originally described from the rhizosphere of walnut in Apulia, *Xiphinema diversicaudatum* (Micoletzky) Thorne, *X. italiae* Meyl, 1953, *Paratrichodorus tunisiensis* Siddiqi and *Pratylenchus vulnus* Allen *et* Jensen (Inserra, 1973; Inserra and Vovlas, 1981; Roca *et al.*, 1984; 1991).

The identification of the main pests of walnut is of primary importance in view of the development of the cultivation of the tree in marginal farms for wood or nut production. The aim of this study was the identification of the most common nematode species associated with walnut in different Italian biotopes and regions. An extensive survey was carried out in Italy during 1993-1995 and the results are reported here.

Materials and methods

Soil samples were collected from the rizhosphere of walnut trees at 15-30 cm depth in cultivated fields in coastal and inland areas. Approximately 2.5 l soil were collected per sample in spring or autumn. Nematodes were extracted from each sample by the sieving and decanting technique with 420 µm and 45 µm sieves. Specimens were fixed in 2.5% formalin, hand picked and subsequently dehydrated to pure glycerol by the slow method for permanent mounting for direct examination in temporary mounts in water. Measurements of glycerol mounted specimens were taken using a Leitz Orthoplan light microscope at 600X.

The host status of walnut cultivars for some of the most frequently occurring nematode species was tested on seedlings obtained from local nurseries. Seedlings were planted in 18-25 cm diameter plastic pots filled with a steamed mixture of sandy soil and 5% organic matter and inoculated with the nematode species as indicated in Table II. Nematodes were inoculated in water suspension after hand picking or directly suspended in the water of the soil extract. One seedling of cv Sorrento was also inoculated with field soil containing *Xiphinema pachtaicum* (Tulaganov) Kirjanova, collected from

Cassano (Bari). Final nematode population densities and reproduction rates (Pf/Pi) were determined at six-twelve months from inoculation. Seedlings of cvs Sorrento, Fongara, Malizia, Sorrentone, Conco and Bleggiana were also examined for the presence of *P. vulnus* or other nematode species that might have originated in the nurseries.

Results and discussion

A total of 61 walnut trees was sampled. The species composition of the nematodes recovered and their relative frequencies are listed in Table I. Longidorid nematodes accounted for 54.5% of the total number of species observed, whereas criconematid species accounted for 36.3%.

TABLE I - *Nematode species found in the rhizosphere of walnut in Italy.*

Specie	Number of positive samples	Frequency (%)	Localities
Mesocriconema xenoplax	17	27.8	Ascoli (2), Barile, Borgo d'Ale, Capurso, Cassano, Cittaducale, Faiano, Fiuggi, Monopoli, Montefiascone, Mottola, Pontecorvo, Porano, Putignano, Rieti, Sarno
Cacopaurus pestis	8	13.1	Borgo d'Ale (2), Fiuggi (3), Micigliano, Nocera, Sarno
Gracilacus peratica	7	11.5	Cassano, Grisciano, Mottola, Noci, Pontecorvo, Putignano, Santeramo
Pratylenchus vulnus	6	9.8	Atessa, Borgo d'Ale, Faiano, Fiuggi, Sammichele, Zagarolo
Ogma civellae	5	8.2	Borgo d'Ale, Castel Rubello, Mozzano Micigliano, Noci
Xiphinema pachtaicum	31	50.8	Alberobello, Ascoli (2), Barile, Bolsena (2), Canosa, Cassano, Castelmezzano, Faiano (2), Fasano, Fiuggi (2), Gioia del Colle, Grisciano, Linguaglossa (2), Massafra, Monopoli (2), Montefiascone, Mozzano, Mottola, Pontecorvo, Porano, Putignano (2), Sannicandro, Santeramo, Zagarolo
X. italiae	7	11.5	Faiano (2), Linguaglossa (2), Randazzo, Sarno, Zagarolo
Longidorus proximus	3	4.9	Faiano, Nocera, Zafferana
Longidorus aetnaeus	2	3.3	Fornazze, Zafferana
X. diversicaudatum	1	1.6	Borgo d'Ale

TABLE II - *Reproduction of nematodes on different walnut seedlings.*

Nematode species	Pf/Pi (range)	Plants with nematodes (reproduced/inoculated)			Mean density and[a] range
Cv	Sorrento	Sorrento	Bleggiana	Conco	Sorrento
P. vulnus	0.6-90.3	9/21	–	–	3199 (125-10000)
M. xenoplax	2.0-20.3	4/19	–	–	1042 (833-1670)
L. proximus		0/17	0/5	0/3	
L. elongatus		0/2	–	–	
X. pachtaicum		0/1	–	–	
X. diversicaudatum		0/3	–	–	
X. italiae		0/2	–	–	

[a]: total numbers of nematodes per root system.

Pratylenchus vulnus and *Mesocriconema xenoplax* (Raski) Loof *et* De Grisse occurred in different areas and were recovered from samples collected in northern as well as in central and southern Italy. *Cacopaurus pestis* was found at low densities in Pedmont (Borgo d'Ale), Campania (Sarno, Nocera) and central Italy (Rieti, Ascoli). *Gracilacus peratica* Raski was found at low densities in the rhizosphere of walnut in Abruzzi and Apulia, occasionally associated with *Ogma civellae* Steiner.

Xiphinema species included *X. pachtaicum* and *X. italiae* Meyl, both appearing widespread in southern and central Italy. Occasionally, specimens of *X. diversicaudatum* were found in the rhizoshere of walnut at the edges of peach orchards at Borgo d'Ale (Vercelli). *Longidorus proximus* Sturhan *et* Argo occurred in Campania at Faiano and Nocera and in Sicily, on the Etna slope. In the latter biotope *L. aetnaeus* Roca, Lamberti, Agostinelli *et* Vinciguerra was found in the rhizosphere of walnut trees alone or in association with *L. proximus*.

The host status tests indicated that *P. vulnus* and *M. xenoplax* reproduce well on cv Sorrento (Table II) which, however, is not a host for *L. proximus*, *X. pachtaicum*, *X. diversicaudatum* and *L. elongatus* (De Man) Micoletzky. *Pratylenchus vulnus* was also found on seedlings of cvs Conco, Fongara and Bleggiana proceeding from nurseries. Population densities ranging from 667 to 5500 nematodes per root system were found on cvs Conco, Sorrento and Fongara. On cv Bleggiana, 450-2000 nematodes per root system were found. On cv Bleggiana *M. xenoplax* was present, at densities ranging from 1500 to 90500 nematodes per root system.

The results indicate that *Pratylenchus vulnus* (Ciancio *et al.*, 1995) and *Mesocriconema xenoplax* are frequently associated with walnut trees and are likely to cause damage. Therefore they must be considered as potential pests of walnut as they are in other countries (Pinochet *et al.*, 1992; Nyczepir and Halbrendt, 1993).

Xiphinema pachtaicum is the species more commonly found in the rhizosphere of walnut in Italy. It is also the most widespread species in the country (Roca and Lamberti, 1985), but nothing is known about its phytopathological importance.

Cacopaurus pestis was also frequently found in association with walnut as already reported in Italy (Inserra, 1973; Inserra and Vovlas, 1981) and France (Scotto La Massese, 1976). Its presence should not be ignored as it has been shown to be a destructive parasite of walnut in North America (Thorne, 1943). However, high population densities for this species were never observed in Italy.

Except for *X. pachtaicum*, the nematode species had distribution frequencies lower than 30%. The limited spread of *P. vulnus* and *C. pestis* is probably related to the direct planting of walnut seedlings from nuts in nematode-free soil. Apart from *C. pestis*, which has a narrow host range, the presence of other nematode species appears to be influenced by the occurrence in the field of alternative host plants. *Gracilacus peratica* frequently occurs in Italy on olive (*Olea europaea* L.) (Inserra and Vovlas, 1977). On this host *G. peratica* induces severe histopathological changes, feeding as a sedentary ectoparasite on the cortical root tissues reached through its long spear (Inserra and Vovlas, 1977). It was found, however, at low densities in the rhizophere of walnuts associated with olive trees with only a few adult females and juveniles per sample. The juveniles examined had a thin and incompletely formed stylet, which was longer and more robust in adults (Fig. 1a, b). This suggests that adults are mainly responsible for root damage. Finally, among the other species observed, walnut may be a host for *Ogma civellae* and *X. italiae*, although they were not associated with any detectable damage.

P. vulnus has a worldwide distribution on walnut and occurs frequently on other tree crops (Scotto La Massese, 1976; Inserra *et al.*, 1979; Nyczepir and Halbrendt, 1993). The man-

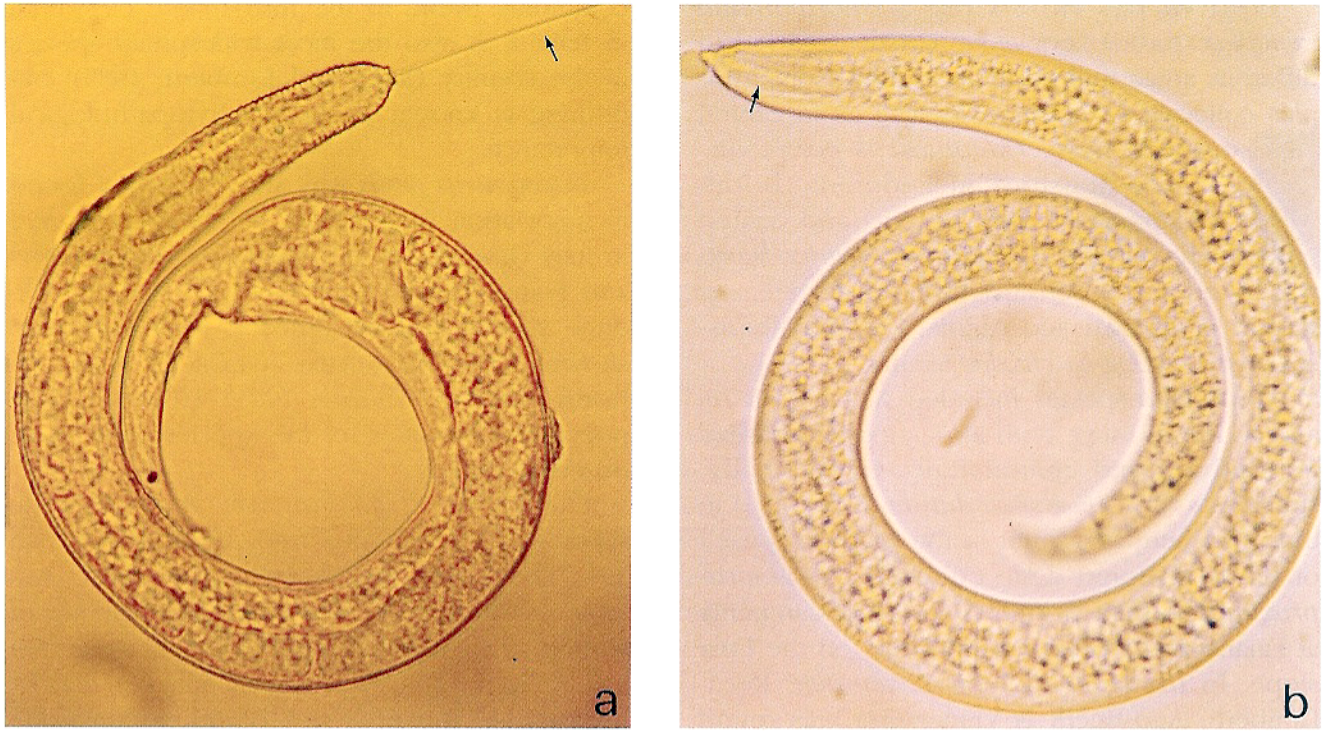

Fig. 1 - Adult female of *Gracilacus peratica* (a) with protruded stylet (arrow) and juvenile stage (b) with developing stylet (arrow).

agement of this species is based on preventive measures, chemical treatments and on the identification and use fo resistant rootstocks (Pinochet *et al.*, 1992). Commercial walnut species and cultivars are highly susceptible to *P. vulnus* (Lownsbery *et al.*, 1974). The low reproductive rates and population densities observed on some of the seedlings tested are a first indication of their variability among the plants inoculated. These results, however, are not necessarily correlated to tolerance, as several biotic and abiotic factors, together with inoculum levels, can affect the development of a nematode population and its reproductive performance.

Differences in the population densities of *M. xenoplax* between cvs Sorrento and Bleggiana suggest that they have different tolerance levels. Damage associated with high population densities have already been observed for this species on walnut (Lownsbery *et al.*, 1978). The assessment of tolerance or resistance among the seedlings studied will require further observation and long-term testing.

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