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PLANT-PARASITIC NEMATODES ASSOCIATED WITH TROPICAL AND SUBTROPICAL CROPS IN SOUTHERN SPAIN

by
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Summary. A survey on the most representatives tropical and subtropical crops in southern Spain was carried out during autumn 1989 and spring 1990 to determine the distribution and population density of plant parasitic nematodes in soil and roots. Migratory ectoparasites were the most abundant and widespread. The predominant ectoparasitic species were *Mesocriconema curvatum*, *Helicotylenchus digonicus*, *Criconema mutabile*, *Criconemoides amorphus*, *Ogma civellae*, *Helicotylenchus dihystera* and *Xiphinema pachtaicum*. Important endoparasitic and semiendoparasitic nematodes were found in soil and root samples of papaya (*Meloidogyne javanica* and *Rotylenchulus reniformis*) and banana (*M. javanica* and *Pratylenchus vulnus*).

Southern Spain is one of the few areas of Europe in which a wide variety of tropical and subtroical crops can be grown, and interest in tropical fruit production has increased in the region in recent years. For this reason it is interesting to know the present status of the nematode population and compare it with results obtained a few years ago (Gómez-Barcina *et al.*, 1981).

This paper presents results of surveys carried out to determine the distribution of plant-parasitic nematodes associated with the following tropical and subtropical crops: Avocado (*Persea gratissima* Gaertner), Cherimoya (*Annona cherimoya* Mill.), Mango (*Mangifera indica* L.), Papaya (*Carica papaya* L.), Guava (*Psidium guava* L.), Litchi (*Litchi chinensis* Sonn.), Banana (*Musa paradisiaca* L.), Medlar (*Mespilus germanica* L.), Tamarind (*Tamarindus indica* L.) and Feijoa (*Feijoa sellowiana* Berg). Avocado is the most extensively grown crop (6800 ha) in the area, followed by cherimoya (2800 ha), mango (900 ha) and litchi (600 ha). The other crops in total occupy about 400 ha.

Materials and methods

Samples were collected, during the autumn of 1989 and the spring of 1990, from the rhizosphere, in the two zones more representatives, Almuñecar and Vélez-Málaga (in the provinces of Granada and Málaga, respectively). Number of samples was proportional to the cultivated area of each crops. Soil samples were collected with a hand hoe to a depth of 30 cm from 4 sublocations which were pooled to form a single sample, following the sampling pattern of McSorley and Parrado (1982).

Nematodes were extracted from soil by centrifugation (Gooris and D'Herde, 1972) and flotation (Flegg, 1967) method's and from roots by maceration-flotation method (Coolen and D'Herde, 1972) and direct examination of roots. For identification, specimens were fixed in 4% formaldehyde and then processed to anhydrous glycerin by Seinhorst's method. The relative frequency of occurrence for each species in root samples has been calculated as percentage of samples in wich the species was present.

Results and discussion

Twenty five plant-parasitic nematode species were found associated with tropical and subtropical crops in southern Spain (Table I). The predominant ectoparasites were *Mesocriconema curvatum* (Raski) Loof *et* De Grisse, *Helicotylenchus digonicus* (Perry) Darlind *et* Thorne, *Criconema mutabile* (Taylor) Raski *et* Luc, *Criconemoides amorphus* De Grisse, *Ogma civellae* (Steiner) Raski *et* Luc, *Helicotylenchus dihystera* (Cobb) Sher and *Xiphinema pachtaicum* (Tulaganov) Kirjanova. Important endoparasites and semi-endoparasites were *Pratylenchus vulnus* Allen *et* Jensen, *Meloidogyne javanica* (Treub) Chitw. and *Rotylenchulus reniformis* Lindford *et* Oliveira.

At the time of sampling the maximum total number of plant-parasitic nematodes at any one crop was 751/300 ml in the soil of banana, followed by papaya and tamarind with 186 and 176 plant-parasitic nematodes per 300 ml of soil, respectively.

TABLE I - *Distribution of plant-parasitic nematodes in ten tropical and subtropical crops of southern Spain, (nematodes/300 ml soil).*

Nematode species / Crops	A	B	C	D	E	F	G	H	I	J	Total
n	23	18	9	5	4	3	3	2	1	1	69
Amplimerlinius sp.	2	–	–	–	–	–	–	–	–	–	2
Bitylenchus sp.	–	–	29	–	–	–	–	–	–	–	29
Criconemoides amorphus De Grisse	68	5	421	4	–	–	1	–	–	–	499
Mesocriconema curvatum (Raski) Loof *et* De Grisse	–	–	–	–	–	–	–	1423	–	–	1423
Mesocriconema xenoplax (Raski) Loof *et* De Grisse	13	9	–	–	–	–	–	–	120	–	142
Criconema mutabile (Taylor) Raski *et* Luc	7	–	63	17	–	–	–	–	–	–	87
Diptherophora sp.	9	19	33	2	–	46	5	–	–	–	114
Ditylenchus sp.	1	–	2	–	–	–	–	–	–	–	3
Helicotylenchus digonicus (Perry) Darlin *et* Thorne	27	82	34	740	331	–	–	29	–	–	1243
Helicotylenchus dihystera (Cobb) Sher	317	36	25	–	–	–	2	–	–	–	380
Meloidogyne javanica (Treub) Chitwood	–	–	–	16	–	–	–	6	–	–	22
Ogma civellae (Steiner) Raski *et* Luc	419	4	4	–	–	–	–	–	–	–	427
Paratrichodorus sp.	18	–	–	–	–	–	–	–	23	–	41
Paratylenchus ciccaronei Raski	24	–	11	–	–	–	30	–	–	–	65
Paratylenchus microdorus Andrássy	4	–	–	–	–	–	–	–	2	–	6
Paratylenchus vandenbrandei De Grisse	–	–	–	2	–	–	–	–	–	–	2
Pratylenchus thornei Sher *et* Allen	–	–	–	–	–	4	–	–	–	–	4
Pratylenchus vulnus Allen *et* Jensen	–	–	–	–	–	–	–	38	–	–	38
Rotylenchulus reniformis Lindord *et* Oliveira	–	–	–	144	–	–	–	–	–	–	144
Trichodorus sp.	4	–	2	–	–	–	–	–	–	–	7
Tylenchorhynchus sp.	13	3	4	5	–	–	1	1	–	–	26
Xiphinema diversicaudatum (Micoletzky) Thorne	1	–	–	–	–	–	–	–	–	–	1
Xiphinema italiae Meyl	3	9	3	–	–	–	–	–	–	–	15
Xiphinema pachtaicum (Tulaganov) Kirjanova	39	17	33	1	7	10	16	–	31	5	159
Xiphinema sp.	–	–	–	–	–	–	–	4	–	–	4
TOTAL	969	184	664	931	338	60	55	1501	176	5	4883

A = avocado; B = cherimoya; C = mango; D = papaya; E = guava; F = litchi; G = medlar; H = banana; I = tamarind; J = feijoa; n = number of samples.

The plant-parasitic nematode populations apparently had increased from 1981 to 1990 in the two zones studied (Almuñecar and Velez-Málaga), ranged 27.4, 68.5 and 89.0 and 205.5 plant-parasitic nematodes per 300 ml of soil, respectively and this can be due to many factors but can be interpreted as an establishment of nematological populations during this time. The frequencies of occurrence of plant parasitic nematodes associated to root samples are the following: avocado, with no plant-parasitic nematodes in roots; cherimoya, *H. digonicus* in 38.9% of root samples; mango, *C. amorphus*, *H. digonicus* and *Paratylenchus microdorus* with 22.2%, 11.1% and 11.1%, respectively of root samples; papaya, *M. javanica, R. reniformis* and *H. digonicus* in 20%, 20% and 40%, respectively; and banana, *M. javanica, P. vulnus* and *H. digonicus* in 50%, 50% and 50%, respectively.

It is evident from the results presented here that *X. pachtaicum, H. digonicus* and *C. mutabile* are widely distributed in tropical and subtropical fruit trees of Southeastern Spain. Although little research information is available concerning the damage induced by many of the species foud, it is known that some of them as *M. javanica, R. reniformis, H. dihystera, X. pachtaicum* and *C. amorphus* are capable of causing considerable damage to these crops (McSorley *et al.*, 1980). The record of *M. javanica* on papaya confirmed that this tropical fruit is a good host of *Melidogyne* species which cause yellowing and low production as well as premature dropping of both leaves and fruits (Inserra and Cartia, 1977; Roy and Das, 1980; Khan, 1989).

R. reniformis was found in soil and root samples of papaya and must be considered as an introduced species

in this zone (Almuñecar) with any infested plant material. We consider it as an important nematological problem for this crop and a potential pathogen for other crops in this area. This species has been associated with poor growth and reduced yield in Puerto Rico (Ayala *et al.*, 1971), and associated with damaged plants in Trinidad (Singh and Farrel, 1972), however, McSorley *et al.*, 1983 found that the highest populations levels (78/100 cc of soil) were still insufficient to cause significant yield loss in southern Florida. For this reason, it is clear that additional research is needed to determine the damage of *R. reniformis* to papaya.

It is interesting to note that plant-parasitic species found in this survey are quite similar to those recorded by several authors in Florida, except for *Hemicriconemoides mangiferae* Siddiqi, that has not been found here, and a low abundance and distribution of *R. reniformis* that has been recorded from avocado, mango and litchi by McSorley (1981).

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