INTERCEPTION OF NEMATODES ON IMPORTED BONSAI IN MARTINIQUE

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RESUMEN

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La expansión del comercio de plantas ornamentales, particularmente desde Asia, ha incrementado mundialmente el número de interceptaciones regulatorias para patógenos exóticos. En 1994 y 1995, las jardinerías de Martinica, intentaron importar varios tipos de plantas del tipo bonsai desde China, usando a compañías europeas como intermediarios. Estas plantas fueron confiscadas por la Unidad de Protección de Plantas de Martinica a su llegada al país, siendo enviadas al Laboratorio de Nematología de ORSTOM para análisis nematológico. Más de 12 especies de nematodos parasíticos de plantas fueron encontrados en el suelo y las raíces de las plantas. *Helicotylenchus dihystera, Meloidogyne* spp. y dos especies de *Tylenchorhynchus* fueron los nematodos más abundantemente recuperados. Además, se recuperaron especies de los géneros *Rotylenchus, Pratylenchus, Hirschmanniella, Criconemella, Hemicriconemoides,* y *Xiphinema.* Muchas de estas especies provenientes de regiones cálidas de Asia, constituyen un riesgo de introducción de nuevos géneros de nematodos (ej: *Hirschmanniella*), especies (*T. crassicaudatus, T. nudus)* o fuentes de variación genetica para las especies nativas (ej: *Pratylenchus coffeae, Rotylenchulus reniformis, Meloidogyne* spp.), en Martinica.

Palabras claves: bonsai, *Carmona microphylla, Ficus formosana, Ficus retusa, Ligustrum sinense,* Martinica, nematodos parasíticos de plantas, nematología regulatoría, *Sageritia theezans,* sanidad vegetal, *Serissa japonica.*

The expansion in trade of ornamental plants, especially from Asia, has resulted worldwide in an increase in the interception of plants infected with exotic pathogens. More than most other regions of the world, volcanic islands such as the Caribbean islands which were colonized relatively recently (500 000 to 1 million years ago) by plants and animals, are vulnerable to the introduction of new pathogens. Today, human activities continue to result in the dissemination of plants and animals which are sometimes destructive to agriculture. Well known examples of detrimental introductions of plant-parasitic nematodes are the burrowing nematode *Radopholus similis* some 300 years ago and, more recently, the yam nematode *Scutellonema bradys,* which were spread in infected vegetative propagative banana and yam material, respectively. Currently, the governmental plant protection services are aware of such risks (Cotten and Van Riel, 1993). In the French West Indies, the regulations are strict and are based on the International Plant Protection Convention (Anon., 1954) and the E.P.P.O. (European Plant Protection Organization) lists of quarantine organisms (Mathys and Smith, 1984). These lists focus mainly on economically important pathogens in Europe and are in some cases inadequate for such regions as the tropical West Indies. The main protection, however, is the total ban on the importation of potted plants in soil or of plants with adhering soil.

In 1992, the presence of nematodes on bonsai imported from Japan to Martinique was reported by Cadet and Van den Berg. Nevertheless, between 1994 and 1995, some garden centers in Martinique again

attempted to import bonsai from European companies that specialized in the importation, acclimatization, and marketing of different bonsai species from Asia. These illegally imported plants were intercepted by the Plant Protection Unit and examined for the presence of exotic pathogens.

We examined for plant parasitic nematodes, seven different species of bonsai: *Carmona microphylla* G. Don (Boraginaceae), *Ficus formosana* Maximowicz (Moraceae), *Ficus retusa* Linné (Moraceae), *Ligustrum sinense* Loureiro (Oleaceae), *Sageritia theezans* Brongniart (Rhamnaceae), *Serissa japonica* Thunberg (Rubiaceae), *Serissa japonica* cv. *variegata* Thunberg (Rubiaceae). Plants originated from a consignment from China via France in 1994, and from a second consignment from China via The Netherlands in 1995. Nematodes were extracted from soil by the elutriation-sieving technique (Seinhorst, 1962) and from shredded roots in a mist chamber (Seinhorst, 1950). Forty plants were examined in 1994 and thirty plants in 1995. The nematode population densities recovered are expressed as number of nematodes per soil volume and per gram of dry root. Identification of the nematode species was performed either on fresh specimens or on nematodes killed by gradual application of heat, fixed in TAF and permanently mounted in anhydrous glycerine (Southey, 1986).

Nematode numbers were very high, depending on the plant species and the volume of soil, ranging on average from 2 000 to 55 000 nematodes per plant species up to a maximum of 296 300 nematodes. More than twelve different plant-parasitic nematode species were extracted from soil and roots of the bonsai, including: *Helicotylenchus dihystera* (Cobb, 1893) Sher, 1961, *Pratylenchus coffeae* (Zimmerman, 1898) Filipjev and Schuurmans Stekhoven, 1941, *Rotylenchulus reniformis* Lindford and Oliveira, 1940, *Tylenchorhynchus crassicaudatus* Williams, 1960, and *Tylenchorhynchus nudus* Allen, 1955 (Table 1). Many of the nematodes recovered were juveniles which could not be identified to species level.

Helicotylenchus dihystera, a cosmopolitan species, was consistently found associated with the bonsai. This species appears to behave as a semi-endoparasite on *Ficus retusa* and *Carmona microphylla* (Table 1). The two different *Tylenchorhynchus* species found, *T. crassicaudatus* and *T. nudus*, may act as indicator species representative for the center of origin of these bonsai in China. The other nematode species were found occasionally, depending on the plant species. The *Meloidogyne* spp. were associated with both *Ficus* species.

Some of these plant-parasitic nematode species belong to economically important genera, originating from warmer areas in Asia, and thus pose a serious threat for agricultural crops cultivated in Martinique, either as new genera (e.g. *Hirschmanniella*), species (*T. crassicaudatus, T. nudus*), or gene pool sources for indigenous species (e.g., *Helicotylenchus dihystera, Pratylenchus coffeae, Rotylenchulus reniformis*, and *Meloidogyne* spp.). A similar problem occurred in Martinique some years ago concerning *Pinus pentaphylla* L. plants from Japan infected with *Rotylenchus robustus* and *Trichodorus cedarus* (Cadet and Van den Berg, 1992).

At present, there is no information on the possible eradication of nematodes from bonsai. Moreover, due to the endoparasitic nature of some of these species and the strong adherence of soil to the root ball, eradicating them (thermotherapy, chemical) is problematic and requires further investigation. Special attention should be given to plant species belonging to the Moraceae family, e.g., *Ficus* spp.,

Table 1. Average number[z] of nematode genera and species extracted from the rhizosphere and roots of bonsai in two consignments upon arrival in Martinique from China via Europe.

Consignment No. 1 No. of plants	*Carmona microphylla* 5	*Serissa japonica* 20	*S. japonica* cv. *variegata* 10	*Ligustrum sinense* 5
		Nematodes/250 cm^3 soil		
Criconematids	—	t	t	—
Helicotylenchus dihystera	1415 (± 532)	35 (± 11)	187 (± 130)	2045 (± 1020)
Hirschmanniella spp.	—	33 (± 10)	—	—
Meloidogyne spp.	t	t	117 (± 82)	t
Rotylenchulus reniformis	—	—	129 (± 51)	—
Tylenchorhynchus crassicaudatus	t	187 (± 149)	821 (± 190)	—
Xiphinema spp.	t	—	—	—
Plant-parasitic nematodes (%)	63.2	21.32	31.9	33.2
Nematodes/g roots				
Helicotylenchus dihystera	t	t	t	t
Meloidogyne spp.	—	—	34 (± 15)	—
Rotylenchulus reniformis	—	—	n.a.	—
Tylenchorhynchus crassicaudatus	—	—	6 (± 2)	—

Consignment No. 2 No. of plants	*Carmona microphylla* 6	*Serissa japonica* 6	*Ficus formosana* 6	*Ficus retusa* 6	*Sageritia theezans* 6
			Nematodes/250 cm^3 soil		
Helicotylenchus dihystera	6423 (± 1012)	96 (± 65)	648 (± 443)	5465 (± 2267)	217 (± 101)
Meloidogyne spp.	—	—	474 (± 231)	741 (± 167)	20 (± 10)
Pratylenchus coffeae	—	—	t	57 (± 23)	—
Rotylenchulus reniformis	200 (± 40)	—	—	—	235 (± 85)

[z]Mean ± SE; t = trace; n.a. = not available).

Table 1. (Continued) Average number[a] of nematode genera and species extracted from the rhizosphere and roots of bonsai in two consignments upon arrival in Martinique from China via Europe.

Consignment No. 2	*Carmona microphylla*	*Serissa japonica*	*Ficus formosana*	*Ficus retusa*	*Sageritia theezans*
No. of plants	6	6	6	6	6
Tylenchorhynchus nudus	t	969 (± 399)	680 (± 580)	101 (± 80)	14966 (± 13030)
Basiria spp.	—	353 (± 190)	t	58 (± 27)	162 (± 69)
Boleodorus spp.	t	124 (± 49)	—	—	23 (± 18)
Plant-parasitic nematodes (%)	92.7	53.7	72.1	82.2	95.1
Nematodes/g roots					
Helicotylenchus dihystera	30 (±7)	t	t	205 (± 74)	t
Meloidogyne spp.	—	t	9 (± 7)	1263 (± 846)	t
Pratylenchus coffeae	—	—	—	234 (± 117)	—
Rotylenchulus reniformis	n.a.	—	—	—	n.a.
Tylenchorhynchus nudus	—	16 (± 8)	t	t	25 (± 16)

[a]Mean ± SE; t = trace; n.a. = not available).

which are reported as hosts of many different pathogenic nematode species (Goodey *et al.*, 1965).

In other countries, such as England (Hockland, 1996) and Brazil (Mendes *et al.*, 1996), reports of the interception of similar nematode species have become more frequent. These new interceptions in Martinique indicate the need for more effective quarantine inspection for nematodes either before bonsai are imported into Europe, or prior to their shipment to other tropical regions such as the French West Indies.

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