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Scientific paper - Artículo científico

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Abstract

In the present paper the authors describe the *Cylindrocladium* species isolated from woody ornamental hosts in Galician nurseries, as part of their work as independent phytopathological consultants. They isolate a total number of 5 species as potencial pathogens to plants with different symtoms: *Cylindrocladium pauciramosum*, *C. buxicola*, *C. ilicicola*, *C. theae* and *C. scoparium*. The authors compare the different hosts included in their results with the hosts described by the specialized literature

Key words: Cylindrocladium pauciramosum, Cylindrocladium buxicola, Cylindrocladium ilicicola, Cylindrocladium theae and Cylindrocladium scoparium

Abstract Resumen

En el presente trabajo los autores describen las especies de Cylindrocladium aisladas de especies leñosas ornamentales en los viveros de Galicia, en su labor como consultores fitopatológicos independientes. Se aísla un total de 5 especies potencialmente patógenas de plantas con síntomas diversos: Cylindrocladium pauciramosum, C. buxicola, C. ilicicola, C. theae y C. scoparium. Los autores relacionan las diferentes especies hospedadoras sobre las que se aíslan discutiendo y comparándolas con los hospedadores que describe la bibliografía especializada

Palabras clave: Cylindrocladium pauciramosum, Cylindrocladium buxicola, Cylindrocladium ilicicola, Cylindrocladium theae y Cylindrocladium scoparium

1. Introduction

In certain container woody ornamental nurseries performing intensive chemical measures against *Phytophthora* and the formerly named *Pythium* species, *Cylindrocladium* and *Cylindrocarpon* species arise, causing collar and root injures as well as foliar spots, previously managed by broad spectrum –without antioomicete activity– fungicides.

In other cases the presence of these pathogens in Galician woody ornamental nurseries is new, considering them foreign pathogens. Nevertheless these are pathogens that have passed from being considered secondary pathogens to being included in the lists of key pathogens of the most relevant woody ornamental nurseries in the last 20 years.

The genus *Cylindrocladium* was first described by Morgan (1892) in the EEUU –based on *Cylindrocladium scoparium*– being detected as a saprophyte of pods of *Gleditsia triacanthos*. The different species of this genus have a wide distribution on tropical and subtropical regions being pathogens of a significant number of crops of economical importance for humans (Lombard *et al.*, 2010).

The symptoms of the diseases they cause are the following: cutting rots, damping-off, foliar injures, shoot wilts, stem cankers as well as root rots. Most of these diseases are related with cutting production in forest nurseries but some of these *Cylindro-cladium* species have been also referenced as pathogens of adult commercial crops. In these cases these pathogens have been referenced as responsible of tree defoliations and shoot wilts which result in vigour losses (Lombard *et al.*, 2010).

On intensive crops *Cylindrocladium* species have been mainly referenced on gardens and nurseries of the northern hemisphere, from Europe to Asia. Hosts of this type of production include ornamental trees, bushes as well as flower cuttings of species belonging to the following families: *Asteraceae*, *Ericaceae* and *Rosaceae*. Symptoms described on these species include collar, crown and root rots, foliar spots as well as cutting rots (Lombard *et al.*, 2010).

The morphological characters on which taxonomical classification is based are the following: vesicle form, stipe form and length as well as dimension and septation of macroconidia (Crous & Wingfield, 1994).

There are not few *Cylindrocladium* or *Calonectria* –teleomorf of the former–species cited as pathogens of woody ornamental plants worldwide. Belonging to *Cylindrocladium* we can mention the following: *C. avesiculatum*, *C. candelabrum*, *C. clavatum*, *C. colhouni*, *C. floridanum*, *C. ilicicola*, *C. parasiticum*, *C. pteridis*, *C. quique-septatum*, *C. reteaudii*, *C. scoparium*, *C. theae*, *C. buxicola and C. pauciramosum* (Crous & Wingfield, 1994; Polizzi & Crous, 1999; Henricot & Culham, 2002).

The references of woody ornamental species infected by its anamorphic form *Calonectria* are not less in number, we can mention the following: *Calonectria morganii, C. pauciramosa, C. lauri, C. staphiphylli, C. pseudonaviculata, C. hederae, C. polizzi, C. ilicicola, C. mexicana, C. pseudomexicana, C. tunisiana y C. rumobrae* (Vitale *et al.*, 2013).

The objective of the present study is to determine the most frequent *Cylindrocladium* species isolated from woody ornamental hosts on Galician nurseries, as a useful tool in order to design effective plant protection programs on this type of crops.

2. Material & Method

2.1. Plant production centres included in the study and sampling method

The study has been carried out in six woody ornamental production centres of Galicia –four located in the province of Pontevedra, one in A Coruña and the other one in Lugo–. Two types of samples were taken in this study in field conditions: symptomless plantation material as well as plant material with symptoms of the disease. Each sample contained six plants. The samplings were carried out on each centre, every two or four weeks, from 2013 to 2019, collecting and analyzing a total number of 55 samples.

2.2. Identification of potential telluric pathogens

2.2.1. Isolation method

The isolation of the pathogen was carried out in the phytopathological laboratory of the firm CONSUL-TORÍAS NOROESTE S.C. Fragments of the stem and root bases or of leafs with spots of diseased plants were prepared for fungi isolation. The surface of these fragments was disinfected with 0,6% sodium hypochlorite for 4 minutes and plated on PDA (potato dextrose agar) (Rapilly, 1968). The fungi were grown under laboratory conditions and microscope observations were carried out every 24 hours during one week.

2.2.2. Taxonomical criteria for the determination of *Cylindrocladium* species

Cylindrocladium species were identified following taxonomical criteria described by Crous & Wingfield (1994), as well as by the species descriptions of Polizzi & Crous (1999) and Henricot & Culham (2002).

3. Results

The different *Cylindrocladium* species identified from woody ornamental hosts in Galician nurseries were the following:

1. Cylindrocladium scoparium Morg. 1892

Teleomorf: *Calonectria cylindrospora* (Ellis & Everh.) Rossman, L. Lombard & Crous 2015.

2. Cylindrocladium pauciramosum C.L. Schoch & Crous 1999.

Teleomorf: Calonectria pauciramosa C.L. Schoch & Crous 1999.

3. *Cylindrocladium buxicola* **Henricot 2002T**.

Teleomorf: Calonectria pseudonaviculata (Crous, Groenew & Hill) L. Lombard, Wingfield & Crous 2010.

4. Cylindrocladium ilicicola (Hawley) Boedijn & Reitsma 1950.

Teleomorf: Calonectria lauri (Vanderw.) Lechat & Crous 2010.

5. Cylindrocladium theae (Petch) Subram. 1972.

Teleomorf: Calonectria indusiata (Seaver) Crous 2002.

The percentages of incidence of each species on Galician woody ornamental nurseries are specified on table 1. Those of the higher incidence were *C. pauciramosum* and *C. theae* with percentages of isolation of 52,7% and 34,5% of the total number of samples respectively. Following them we can find *C. ilicicola* -7,3% of the total number of samples–, *C. scoparium* -3,6%– and *C. buxicola* –1.8%–.

The list of hosts of these species included in this study is specified in table 2. The most polyphagous species is *C. pauciramosum* isolated from 16 different hosts, followed by *C. ilicicola* with 4 different hosts, *C. theae* and *C. scoparium* isolated from two different hosts each and *C. buxicola* with *Buxus sempervirens* as its only woody ornamental host in Galicia.

The symptoms that the diseased plants showed were also diverse being the root and collar rots the most frequently observed, specially detected on *C. pauciramosum*, *C. theae* and *C. scoparium*. Shoot and leaf spots were also observed, specially on plants infected by *C. buxicola*, *C. ilicicola* and, less frequently on hosts infected by *C. pauciramosum*.

4. Discussion

Cylindrocladium pauciramosum has already been referenced before in Spain (Pérez-Sierra et al., 2005) as well as in Galicia (Andrés, 2016) but exclusively on Polygala myrtifolia. Therefore, the isolation of such species injuring the rest of species specified in table 2 –Tryptomene calycina, Leptospermum scoparium, Ceanothus repens, Laurus nobilis, Rhododendron sp., Cupressocyparis leilandi, Cleyera japonica, Skimmia japonica, Dracaena purpurea, Aucuba japonica, Camellia japonica, azalea, Phormium tenax, Gelsenium sempervirens and Ilex aquifoliium– are first references of such pathogenic fungus on these hosts in our country (Melgarejo et al., 2010).

Cylindrocladium ilicicola has already been referenced before injuring *Ilex aquifolium* in Galicia (González *et al.*, 2008) therefore the references of such pathogen on *Syringa vulgaris*, *Photinia* ×*fraserii*, *Magnolia grandiflora y Rhododendron sp.* are also first citations of such pathogen in our country (Melgarejo *et al.*, 2010).

Cylindrocladium theae has not been referenced yet, as woody ornamental pathogen in Galicia or in Spain, therefore the citations included in this paper of such pathogen on *Camellia japonica* and *Euonymus japonicus* are first references in Spain (Melgarejo et al., 2010).

Cylindrocladium scoparium has not been referenced up to the present moment in our country, therefore the references of such pathogen on *Juniperus sabinae* and *Cercis siliquastrum* are again first citations (Melgarejo *et al.*, 2010).

Cylindrocladium buxicola has been already cited on *Buxus sempervirens* in Spain (Farr & Rossman, 2019) as well as in Galicia (Estación Fitopatoloxica do Areeiro, 2008; Andrés, 2018).

TABLE 1. PERCENTAGE OF PRESENCE OF CYLINDROCLADIUM SPECIES ISOLATED FROM WOODY ORNAMENTAL HOSTS IN GALICIAN NURSERIES

Cylindrocladium species	$N^{\underline{o}}$ of samples with positive isolation	% of samples with positive isolation
C. pauciramosum	29	52,7
C. buxicola	1	1,8
C. ilicicola	4	7,3
C. theae	19	34,5
C. scoparium	2	3,6
Total	55	

TABLA 2. HOST SPECIES OF CYLINDROCLADIUM SPECIES ISOLATED FROM WOODY ORNAMENTAL NURSERIES IN GALICIA

Cylindrocladium species	Host of isolation	Type of symptoms of the diseased plants
C. pauciramosum	Tryptomene calycina	Collar rots
	Leptospermum scoparium	Collar rots
	Ceanothus repens	Collar rots
	Polygala myrtifolia	Collar rots
	Laurus nobilis	Collar rots
	Rhododendron sp.	Collar rots
	Cuppressocyparis leilandi	Collar rots
	Cleyera japonica	Collar rots
	Skimmia japonica	Collar rots
	Aucuba japonica	Collar rots
	Dracaena purpurea	Collar rots
	Camellia japonica	Foliar spots
	azalea	Collar rots
	Phormium tenax	Collar rots
	Gelsenium sempervirens	Foliar spots
	Ilex aquifolium	Collar rots
C. buxicola	Buxus sempervirens	Foliar and shoot spots
C. ilicicola	Syringa vulgaris	Foliar spots
	Photinia × fraserii	Foliar spots
	Magnollia grandiflora	Foliar spots
	Rhododendron sp.	Foliar spots
C. theae	Camellia japonica	Collar rots
	Euonymus japonicum	Collar rots
C. scoparium	Juniperus sabinae	Collar and root rots
	Cercis siliquastrum	Collar and root rots

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