Phytophthora spp. Associated with Container-Grown Plants in Nurseries in Western Australia

G. E. HARDY, Graduate Student, and K. SIVASITHAMPARAM, Senior Lecturer, Soil Science and Plant Nutrition, School of Agriculture, University of Western Australia, Nedlands, Western Australia 6009

ABSTRACT

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Investigations on root rots of container-grown plants in 14 nurseries in Western Australia showed that one or more *Phytophthora* spp. were associated with rotted roots of 65 plant taxa. *P. drechsleri*, the most common species isolated, was associated with 73% of all plant taxa yielding *Phytophthora* spp., followed by *P. nicotianae* var. *nicotianae* (46%), and *P. cactorum* (23%). The number of *Phytophthora* spp. associated with any one host ranged from one to six, with individual plant specimens occasionally yielding up to four species of *Phytophthora*. The presence of various species of *Phytophthora* varied with nurseries, with one nursery harboring all eight species of *Phytophthora* encountered in this study. Nurseries appear to be a source of some of the outbreaks of root rot in home gardens and wild flower farms, with potential for wider spread of the fungi into natural forests.

Production of container-grown plants by nurseries is a significant component of Australia's primary industry involving a turnover of between $200 million and $500 million per year for plants sold within the country alone (1). This industry is currently expanding into overseas markets.

There has been a general concern about the presence of soilborne plant pathogens, especially *Phytophthora cinnamomi* Rands, in Australian nurseries (2). Horticulturally important plants have been implicated in the introduction of this pathogen into the native forests of Western Australia causing large scale devastation of the jarrah forests (*Eucalyptus marginata* J. Donn: Sm.) (5). Plants infected at production nurseries may, therefore, spread *Phytophthora* spp. not only to home gardens but also to plantations and wild flower farms. The purpose of this study was to identify the *Phytophthora* spp. associated with container-grown plants so that a composted hardwood-bark potting mix suppressive to these pathogens may be developed for use in nurseries.

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MATERIALS AND METHODS

Plants with root rots were obtained from 14 nurseries from some of the major production centers in the state of Western Australia. The plants were collected over a period of 2 years beginning in August, 1985. The roots of symptomatic plants were washed free of soil, blotted dry, and 5-mm root sections were plated onto the selective $P_{10}VP$ medium (3) containing pimaricin vancomycin and pentachloronitrobenzene. Fungal colonies from $P_{10}VP$ plates were transferred to cornmeal agar and identified using the key of Newhook et al (3).

RESULTS AND DISCUSSION

Roots from 65 taxa yielded a total of eight *Phytophthora* spp. (Table 1). The identity of *P. citricola* Sawada (IMI 309480). *P. cinnamomi* A1 (IMI 318111), *P. drechsleri* Tucker A1 (IMI 299429) and A2 (IMI 309485), *P. nicotianae* var. *nicotianae* Waterh. A2 (IMI 309482), and *P. cryptogea* Pethyb. & Laff. (IMI 309479) were confirmed by the International Mycological Institute, Kew, England. *P. cinnamomi*, which has been either recorded on, or found to be pathogenic to, over 900 plant species (4), was recorded only once in this screening. *P. drechsleri* was recovered from 73% of the host plants with *P. n.* var. *nicotianae* and *P. cactorum* (Lebert & Cohn) Schroet. responsible for root rot in 46 and 23% of the host plants, respectively (Table 1). Many of the associations are first records of hosts for these pathogens. The number of *Phytophthora* spp.

associated with any one host ranged from one to six (Table 1). On several occasions individual plant samples yielded more than one species of *Phytophthora*, as in the case of *Crowea saligna*, where each of four separate samples yielded two species of the genus (Table 2).

It is noteworthy that some of the nurseries were sources of several different *Phytophthora* spp. All eight *Phytophthora* spp. were recovered from one nursery. Interpretation of the significance of variability of *Phytophthora* spp. among various nurseries is not possible, however, because of variability of

Table 1. Species of *Phytophthora* associated with rotting roots of container-grown plants from 14 nurseries in Western Australia

	***Phytophthora* spp.**							
Plants	***cactorum***	***cinnamoni***	***citricola***	***cryptogea***	***drechsleri***	***megasperma***	***nicotianae* var. *nicotianae***	***n.* var. *parasitica***
Adenanthos sericeus Labill.					1(4)[a]			
Agonis flexuosa Schau.	1(12)						1(13)	
Azalea indica L. 'White Wings'			1(12)		1(11)			
Banksia dryandroides Baxt. & Sweet.	2(4)				1(4)		3(4,1)	
B. hookerana Meissn.	3(1,5)				4(1,4,5)	1(4)	2(1)	
B. laricina Gardn.	2(4)			3(4,5)	2(1,5)		2(1,4)	
B. occidentalis R. Br.	1(4)			1(4)	3(4,5)		2(1,5)	
B. praemorsa Andrews	1(4)			3(4,5)			2(1,4)	
B. prionotes Lind.					3(4)		3(4)	
Bauera sessiflora F. Muell.	1(10)			2(1,4)			2(4)	
Beaufortia eriocaphala W. V. Fitzg.							5(10,1)	
B. sparsa R. Br.			1(1)		3(1,8)			
Boronia megastigma Nees					3(9,7)			
Callistemon citrinus Stapf.					1(12)			
C. viminalis G. Don: Loud.					1(12)			
C. viminalis 'Kings Park'					1(12)			
Callitris pressei Miq.					1(14)			
Calluna vulgaris Hull.					1(13)			
Calothamnus gracilis R. Br.							1(11)	
C. villosus R. Br.							2(11)	
Calytrix angulsta Lindl.	1(1)				1(1)			
Chamaelaucium uncinatum Schau.					3(4,10)		13(1,2,4,9)	
C. unicatum 'Alba'			1(7)				2(4,5)	
C. uncinatum 'Burgundy Blush'					2(4,11)			5(2,4,5)
Coleonema pulchrum Hook. 'Rubrum'					2(4)			
Coprosma repens Rich.					2(3,8)			
Cordyline australis Hook.					3(12,6)			
Crowea saligna Andr.	8(6,11)			2(6)	18(6,11)		12(6,11)	
Cytisus albus Hacq.				1(11)				
Dodonea viscosa Jacq.					1(2)			
Dryandra polycephala Benth.						2(1)		
D. proteiodes Lindl.					2(4)			
D. speciosa Meissn.					3(1,4)		1(4)	
Erica sp. 'Dawn'			1(4)	1(4)				
Eucalyptus ficifolia F. Muell.				2(1)				
Eutaxia obovata Gardn.				1(6)	2(6,13)			1(6)
Gastrolobium calycinum Benth.							1(1)	
Grevillea biternata Meissn.					2(4)		1(2)	
G. dielsiana Gardn.				1(1)	3(1,2)			
G. drummondii Meissn.	1(1)						2(1,4)	
G. thelemanniana Endl.							2(4)	
G. 'Honey Gem'					1(1)			
G. 'Robyn Gordon'					3(10,2)			
G. 'Sandra Gordon'					1(1)			
Hakea francisiana F. Muell.	1(1)		1(1)	1(1)	1(1)		3(1,4)	1(4)
H. laurina R. Br.			1(4)		3(1,4)		2(4,5)	
H. platysperma Hook.	1(1)				3(1,4)		1(4)	
Hebe speciosa Lock. & Al. 'Buxifolia'	2(2,3)				1(3)			1(3)
H. speciosa 'La Sequisante'							3(3)	
Hypocalyma angustifolium Endl.	1(13)						1(13)	
H. tetrapterum Turcz.					2(4,13)		3(13)	
Indigofera australis Willd.					1(11)			
Isopogon cuneatus R. Br.					3(1)			
Kunzea baxteri Schau.					1(4)			
K. pulchella George					1(4)			
Lagerstroemia indica L.					1(3)			
Melaleuca armillaris Sm.					1(5)			
M. diosmaefolia Andr.					1(4)			
M. hypercifolia Sm.					1(4)		3(4)	
M. lateriflora Benth.					2(13)		1(13)	
M. nesophila F. Muell.					1(11)			
Pimilea ferruginea Labill.	6(1,4,9)	1(4)		3(4)	11(1,4,9)		9(1,2,4,9)	
Sollya heterophylla Lindl.							2(11)	
Viburnum tinus L.					1(2)			
Westringia rosemariniformis Smith					2(10)		2(9)	

[a] Number of plants yielding the pathogen, code number for nursery from which plant was collected in parentheses.

Table 2. Plant species from which more than one *Phytophthora* species was isolated from an individual plant specimen

Plant species	*Phytophthora* spp.	No. of samples
Banksia occidentalis	*drechsleri, nicotianae* var. *nicotianae*	3
B. prionotes	*drechsleri, n.* var. *nicotianae*	2
Crowea saligna	*citricola, n.* var. *nicotianae*	4
Hakea platysperma	*cactorum, drechsleri*	1
Pimelea ferruginea	*cinnamomi, citricola, drechsleri*	2

susceptible plant species grown at different nurseries and nonuniformity in sampling procedures. Some of the plant material was purchased anonymously to facilitate freedom of sampling.

P. drechslera was present in all 14 nurseries sampled, while *P. cactorum* was found in 11, and *P. n.* var. *nicotianae* was found in nine. *P. n.* var. *nicotianae* has recently been recovered from plants dying in home gardens and wild flower farms, but most other species, except *P. cinnamomi*, have not been recovered from plants dying in natural forests of Western Australia. When plants from these nurseries are planted in areas within or close to natural forests or wild flower farms there is a likelihood of *Phytophthora* spp. other than *P. cinnamomi* being introduced.

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