



Susceptibility of South African native conifers to the pitch canker pathogen, *Fusarium circinatum*

B. Porter, M.J. Wingfield, T.A. Coutinho *

Department of Microbiology and Plant Pathology, Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria 0002, South Africa

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Abstract

Fusarium circinatum is an economically important pathogen of *Pinus* species, which also occurs on Douglas fir (*Pseudotsuga menzeisii*). It causes pitch canker of mature trees and root and collar rot of seedlings and cuttings. In 2007, pitch canker was observed on *Pinus radiata* in the Western Cape and this was the first outbreak of this disease in South Africa. The Cape flora in this area includes native coniferous species of *Podocarpus* and *Widdringtonia*. In this study, seedlings of *P. latifolia*, *P. elongatus*, *P. henkelii*, *W. schwartzii*, *W. cederbergensis* and *W. nodiflora* were inoculated with a virulent isolate of *F. circinatum*, to assess their susceptibility. Six weeks after inoculation, there was no lesion development in any of the species inoculated. *Pinus patula* seedlings used as a positive control were severely affected. Results of this study show that species of *Podocarpus* and *Widdringtonia*, native to the Western Cape, are not threatened by the pitch canker fungus.

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Fusarium circinatum (Nirenberg and O'Donnell) is a pathogen which has a serious economic impact on pine production in South Africa (Wingfield et al., 2002). The South African forestry industry contributes significantly to the economy through the production of solid timber and pulp products (Anonymous, 2005), and is based on exotic plantations of pines and eucalypts. The *Pinus* species most extensively planted are *Pinus patula* (Schl. et Cham.) and *P. elliottii* (Chapm.). *P. radiata* (D. Don.) is only grown in the Western Cape.

Fusarium circinatum was first reported from a pine production nursery in Mpumalanga (Viljoen and Wingfield, 1994) and is now endemic in nurseries throughout the country, where it causes root and collar rot of both seedlings and cuttings. In 2007, large, resinous cankers appeared on mature *P. radiata* trees in the Western Cape and this was the first report of pitch canker in South Africa (Coutinho et al., 2007). These plantations are situated in close proximity to the unique Cape flora, which includes native conifers such as *Podocarpus* and

Widdringtonia. Because *F. circinatum* is an exotic pathogen in South Africa, is known to infect numerous *Pinus* species in America and Europe (Storer et al., 1997; Hodge and Dvorak, 2000; Enebak and Stanosz, 2003), and can cause disease on a non-pine species, *Pseudotsuga menziesii* (Mirb.) (Douglas-fir) (Gordon et al., 2006), concern has been raised that it might threaten native conifers.

Inoculation trials with 20 seedlings each of *Podocarpus latifolia* [(Thunb.) R.Br.: Mirb.], *P. elongatus* [(Ait.) L'Herit.: Pers.], *P. henkelii* (Stapf. Ex Dallim. & Jacks.), *Widdringtonia schwartzii* (Endl.), *W. cederbergensis* (Marsh) and *W. nodiflora* [(L.) Powrie], were conducted using a known virulent strain of *F. circinatum* (FCC 3579). Inoculum was produced by culturing this isolate on half strength potato dextrose agar (20 g Potato dextrose agar powder [Merck, Biolab Diagnostics (Pty) Ltd.], 5 g Agarose bacteriological powder [Merck, Biolab Diagnostics (Pty) Ltd.], 1 l distilled water) for 15 days. Spores were washed from the cultures with 15% glycerol, excess mycelium was filtered through sterile cheese cloth, and the concentration adjusted to 5×10^4 spores/ml using a haemocytometer. The seedlings were wounded by needle puncture of the main stem [Promex hypodermic syringe needles, 21 G, 0.80 × 40 mm], and

* Corresponding author.

E-mail address: teresa.coutinho@fabi.up.ac.za (T.A. Coutinho).

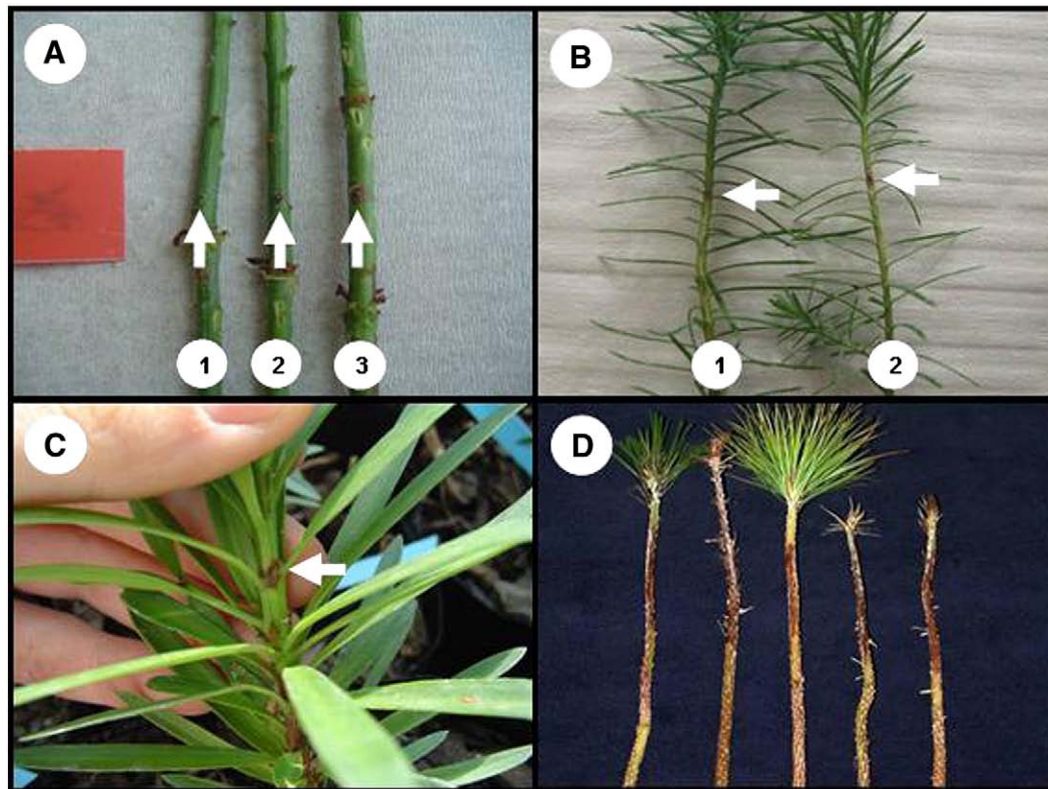


Fig. 1. A. *Podocarpus henkelii* 12 weeks after inoculation, arrows denote inoculation points. Seedling '1' negative control, '2' and '3' inoculated with *Fusarium circinatum*. B. *Widdringtonia nodiflora* seedlings 12 weeks after inoculation, arrows denote inoculation points. Seedling '1' negative control, '2' inoculated with *Fusarium circinatum*. C. Local discoloration around inoculation point on *Podocarpus latifolia* seedling (arrow denotes inoculation point). D. Positive controls, *P. patula* seedlings 3 weeks after inoculation. Bark has been removed to expose lesion development. All *P. patula* seedlings dead at 12 weeks.

inoculated with a 10 μ l drop of spore suspension. This technique was similar to that used by Kuhlman (1987), McCain et al. (1987) and Blakeslee and Rockwood (1999). *Podocarpus* seedlings were purchased from indigenous tree nurseries and *Widdringtonia* seedlings were grown from seed purchased from the Kirstenbosch Botanical Gardens (www.sanbi.org/frames/kirstfram.htm). Ten seedlings of each species were inoculated with sterile 15% glycerol as a negative control, and 20 *Pinus patula* seedlings were inoculated as a positive control. At the time of inoculation, all plants were 10 months old, planted in 2.5l black plastic bags containing composted bark medium, and maintained at a constant temperature of 25 °C in a greenhouse. Seedlings were evaluated for disease development at 3, 6 and 12 weeks after inoculation. The experiment was repeated once.

None of the conifers inoculated showed lesion development (Fig. 1-A, B), although some seedlings developed minor callusing and discoloration localized to the bark above the inoculation point (Fig. 1-C). All *P. patula* seedlings had distinct lesion development at 3 weeks after inoculation (Fig. 1-D), and by 12 weeks all had died. Thus far all plant species, other than *Pinus* spp. and *P. menziesii*, that have been tested for susceptibility to *F. circinatum* have been found to be highly resistant (McCain et al., 1987; Dick and Simpson, 2004). The resistance of *Podocarpus* and *Widdringtonia* spp. shown in this study is reassuring as *W. cederbergensis* is under threat from

over-exploitation and fire (Manders, 1986). *W. cederbergensis* exists as small scattered populations in rocky outcrops of the Cederberg, and in some localities is incapable of maintaining the wild population (Manders and Botha, 1989). An additional threat by an aggressive, exotic pathogen could be detrimental.

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