parts of the subcontinent, whereas the secular variation for D in the southern region turned negative. This tendency continued during 1990–95 as well as 1995–2000.

Another global sudden change in the secular variation of the geomagnetic field was reported around 1991.[19,20] This behaviour was also observed at Hermanus and Hartebeesthoek during the early 1990s, although it was not observed at Tsumeb. It is evident from Fig. 2 that, since 1995, the secular variations for declination has been accelerating, as observed at both Hermanus and Hartebeesthoek. In 1996, the observed secular variation at Hermanus and Hartebeesthoek were –2.6 min/yr and –3.3 min/yr, respectively, while at present it is –4.1 min/yr at Hermanus and –4.6 min/yr at Hartebeesthoek. In contrast, the secular variation observed at Tsumeb shows no such behaviour. The consequence of this pattern is that the gradient in declination over southern Africa is increasing. It is also evident that if this tendency continues, we will soon measure the largest value of D at Hermanus since its founding in 1941.

The patch of reversed polarity field at the core–mantle boundary below southern Africa observed by Hulot *et al.*,[21] as well as the rapid weakening of the dipole field as manifested by total field observations at Hermanus, Hartebeesthoek and Tsumeb (Fig. 3), may eventually lead to a field reversal with characteristics of the last known reversal some 780 000 years ago.[22,23]

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Coniothyrium stem canker of *Eucalyptus*, new to Argentina and Vietnam

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During routine disease surveys of *Eucalyptus* species in Argentina and Vietnam, symptoms of a damaging stem canker disease were observed. This study identifies the causal agent of the disease as *Coniothyrium zuluense*. This is the first report of Coniothyrium stem canker from Argentina and Vietnam.

Introduction

Eucalyptus species have been planted as exotics in several tropical and subtropical countries. It is estimated that plantations of *Eucalyptus* species cover approximately 10 million hectares of land worldwide.[1] Several root, stem and leave diseases have been identified in these plantations. These diseases result in considerable loss of yield and profit to forestry industries.

Stem canker, caused by *Coniothyrium zuluense* Wingfield, Crous and Coutinho, was first described from South Africa and is considered to be a serious threat to *Eucalyptus* forestry around the world.[2] Coniothyrium stem canker is characterized by small, discrete necrotic lesions/spots on young green bark. These lesions may coalesce to form larger patches and cracks (Fig. 1A). The disease also leads to abundant kino exudation and the formation of kino pockets in the xylem of infected trees (Fig. 1B). This makes the wood unsuitable for construction and as sawn timber. In severe cases infection leads to the stunting of trees and the die-back of branches.[2] Initially it was believed that *C. zuluense* is native to South Africa. Recent studies have, however, shown that the pathogen also occurs in Thailand[3] and Mexico.[4]

Surveys of *Eucalyptus* diseases have recently been conducted in Vietnam and Argentina. Disease symptoms similar to those of Coniothyrium stem canker were observed on *E. urophylla* S.T. Blake in Vietnam and on *E. grandis* Hill:Maiden in Argentina. This study was carried out to determine the identity of the causal agent of the stem canker in the two countries.

Methods

External disease symptoms were used to select infected trees for sampling. Segments of plant parts with discrete lesions were incubated in moist chambers at 25°C to induce sporulation. Masses of spores exuding from pycnidia were transferred to Petri dishes containing 2% malt extract agar (MEA). Spores and pycnidia were also examined microscopically to establish a

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preliminary identification. All isolates are maintained in the culture collection (CMW) of the Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria.

DNA was isolated from pure cultures of five representative isolates and the Internal Transcribed Spacer (ITS) regions and *5.8S* gene of the ribosomal DNA (rDNA) as well as the *β-tubulin* genes were sequenced. Sequences of Vietnamese and Argentinian isolates were compared with those of authentic *C. zuluense* isolates obtained from South Africa (CMW11220, CMW11221), Thailand (CMW5232, CMW5235) and Mexico (CMW11230, CMW11231). Sequences of the ITS rDNA and the *β-tubulin* gene were combined and aligned by the insertion of gaps, where needed. The phylogenetic relationships of the isolates were determined using a heuristic search with parsimony. *Mycosphaerella molleriana* (Thumb.) Lindau. and *M. nubilosa* (Cooke) Hansf. were used as outgroups to root the trees.

Results

Based on disease symptoms observed on the infected trees, the disease was tentatively identified as Coniothyrium canker. The disease was common in Argentinian plantations, but not so in Vietnam. In total 52 isolates were examined from Argentina and two from Vietnam. Identification based on symptoms was further supported by microscopic and cultural characteristics of the isolates obtained from the necrotic lesions. Isolates showed typical light brown amero-conidia, 4–6 × 2–3 μm in size. On MEA all isolates showed the typical slow growth and dark/olivaceous colony colour typical of *C. zuluense*.

Blast searches of the ITS sequence data, for the Vietnamese and Argentinian isolates, in the GenBank database [National Center for Biotechnology Information (NCBI), National Institutes of Health, Bethesda, MA (http:/www.ncbi.nlm.nih.gov.BLAST)] showed that the sequences had a high homology with sequences of *C. zuluense*. Analysis of the combined data sets generated six trees, with only minor differences in the internal arrangement of the clades. The consensus phylogenetic tree (Fig. 2) had a consistency index (CI) of 0.924 and retention index (RI) value of 0.847. The tree contained two sub-clades. The Vietnam isolates resided in a clade including authentic *C. zuluense* isolates from South Africa, Thailand and Mexico (80% bootstrap support), whereas the isolates from Argentina resided in a separate clade with bootstrap value of 99%. The two sub-clades, however, grouped together as *C. zuluense* (100% bootstrap), separate from other species (Fig. 2).

Conclusions

Our study confirmed the presence of Coniothyrium stem canker in Argentina and Vietnam. This is the first report of *C. zuluense* and the disease it causes on *Eucalyptus* species in these two countries. Coniothyrium stem canker is a serious disease in countries with subtropical climates and that have high annual rainfall.[2-4] Infection by this pathogen reduces growth, wood quality and causes death of tree tops. Thus, the occurrence of *C. zuluense* in Argentina and Vietnam should be of great concern to the development of *Eucalyptus* plantations in these countries. This study provides added evidence that this important fungus has a wider geographical distribution than was initially believed.

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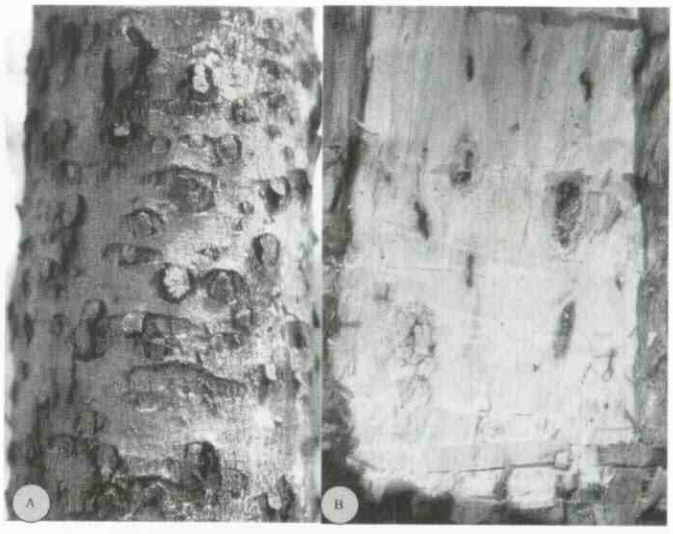

Fig. 1. Symptoms of Coniothyrium stem canker on *Eucalyptus grandis*. **A**, Discrete lesions on stem of infected tree; **B**, multiple kino pockets in wood.

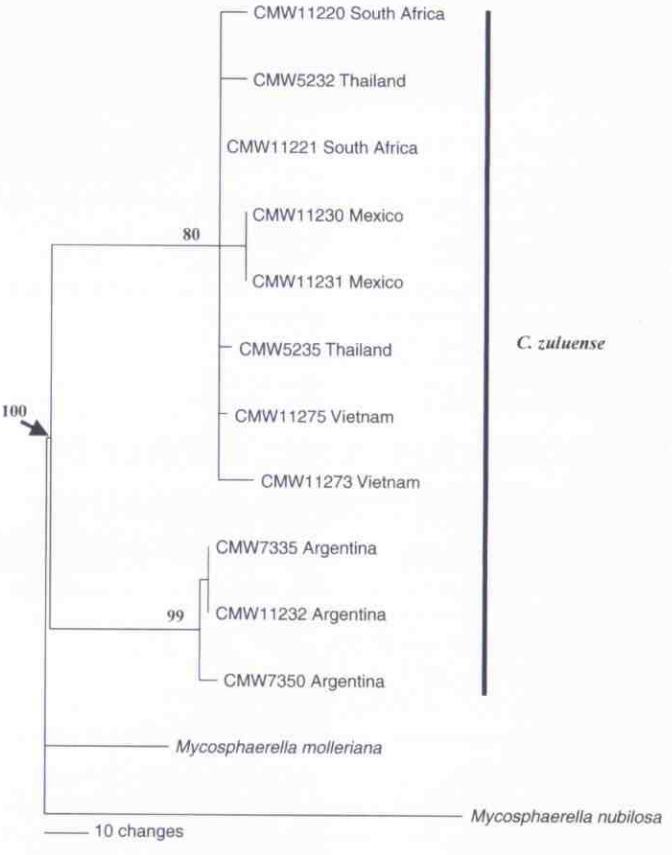

Fig. 2. Phylogenetic tree of *Coniothyrium* species generated from the combined ITS and β-tubulin sequences. Bootstrap values are shown at each branch.

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