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RESEARCH NOTE

FIRST RECORD OF *CRYPHONECTRIA* CANKER OF EUCALYPTUS IN SOUTH AFRICA

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ABSTRACT

Key words: Canker diseases, *Cryphonectria cubensis, Diaporthe, Endothia, Eucalyptus*

A basal canker disease of young *Eucalyptus grandis* trees in various parts of northern Natal was found during routine tree disease surveys in 1986. Based on morphological characteristics of the anamorph and teleomorph, the fungus associated with this desease was identified as *Cryphonectria cubensis*. Pathogenicity tests on 2-year-old *Eucalyptus grandis* trees resulted in severe basal cankers after 6 mo. Due to the notoriety of *C. cubensis* as a canker pathogen, the discovery of this fungus in South Africa for the first time is of considerable concern to the local forestry industry.

Uittreksel

EERSTE AANMELDING VAN CRYPHONECTRIA-*KANKER VAN EUCALYPTUS IN SUID-AFRIKA*

'n Basale kankersiekte van Eucalyptus grandis-*bome is in verskeie dele van Noord-Natal gedurende roetine veldopnames van boomsiektes in 1986 gevind. Gebaseer op die morfologiese kenmerke van die anamorf en teleomorf, was die swam met die siekte geassosieer, as* Cryphonectria cubensis *geïdentifiseer. Patogenisiteitstoetse op 2 jaar oue* Eucalptus grandis-*bome het ses maande na inokulasie ernstige basale kankers veroorsaak. As gevolg van die ekonomiese belang van* C. cubensis *op* Eucalyptus, *is die eerste ontdekking van hierdie swam in Suid-Afrika van groot belang vir die plaaslike bosbou-bedryf.*

The forestry industry in South Africa depends, almost exclusively on monocultures of *Pinus, Eucalyptus* and *Acacia*. In recent years, the planting of *Eucalyptus* spp. has become increasingly important in South African forestry (Department of Environment Affairs, 1987). This interest in *Eucalyptus* spp. and the recent trend towards propagation of clones from cuttings has prompted concern for the effect that diseases could have on the success of this industry. Recent surveys of *Eucalyptus* leaf diseases in South Africa have shown that many previously unrecorded pathogens, some with the potential to retard growth significantly, are present (Crous, Knox-Davies & Wingfield, 1989a, b). The occurrence and status of root and stem diseases of *Eucalyptus* spp. in this country have, however, received little attention.

During the course of routine tree disease surveys in 1986 and 1987, a basal canker disease of young (2–4-yr-old) *Eucalyptus grandis* Hill: Maid. was observed in various parts of the northern Natal forest region. Dying trees were scattered in plantations and were first obvious when their foliage became chlorotic. In the early stages of the disease, the only external symptoms on the boles were areas of sunken outer bark at the root collar just above ground level. In more advanced stages, longitudinal cracks appeared in the outer bark and lesions had progressed to the cambium. Cambial lesions commonly girdled trees and resulted in their death.

Pycnidia with long necks (Fig. 1) were abundant on the surface of dead bark covering the cankers and occurred singly or in groups. Pycnidia were initially orange and had globose bases which eventually became dark brown or black. During moist conditions, conidia were extruded from the pycnidia in bright orange tendrils. Conidia (Fig. 2) were hyaline, avoid, unicellular and 2,4–4,8 × 1,2–2,0 µm and were produced on branched conidiophores with phialidic conidiogenous cells. Long-necked, black perithecia containing two-celled, hyaline ascospores, 4,8–7,2, × 1,6–2,4 µm, were occasionally found on old cankers although material was insufficient to obtain illustrations.

The fungus associated with the cankers was isolated in culture by removing conidia from the necks of pycnidia and transferring these 2 % malt extract agar (MEA) (20 g Difco malt extract, 20 g Difco Bacto agar and 1 ℓ H_2O). On MEA, the fungus was white at first, becoming bright orange with age. Pycnidia having less well defined necks but producing conidia typical of those found on field-collected material, developed in culture after incubation at 20 °C under 12 h alternating cycles of dark and near-UV light. The optimum temperature for growth on MEA was 30 °C. Dried cultures as well as naturally infected *E. grandis* bearing pycnida have been lodged in the Herbarium of the National Collection of Fungi (PREM 49377, PREM 49378, PREM 49379).

Pathogenicity tests were done in September 1987 by inoculating 2-yr-old *E. grandis* trees growing in a commercial plantation at Kwambonambi in northern Natal with and isolate of the suspected pathogen. Each of 15 trees received three wounds 10 cm above ground level by the removal of a piece of bark with a 5 mm diameter cork borer to expose the cambium. Inoculation points were equidistant from each other and randomly assigned. A disc from a 3-week-old MEA culture of the fungus was placed in each of two wounds and a disk of sterile MEA was placed in the third wound as a control. Bark discs were replaced and inoculation points were sealed with masking tape.

Six months after inoculation, trees were examined for symptom development. In all but three trees, the outer bark around inoculation points was sunken and cracked. Removal of the bark covering the cankers showed that the cambium had been destroyed

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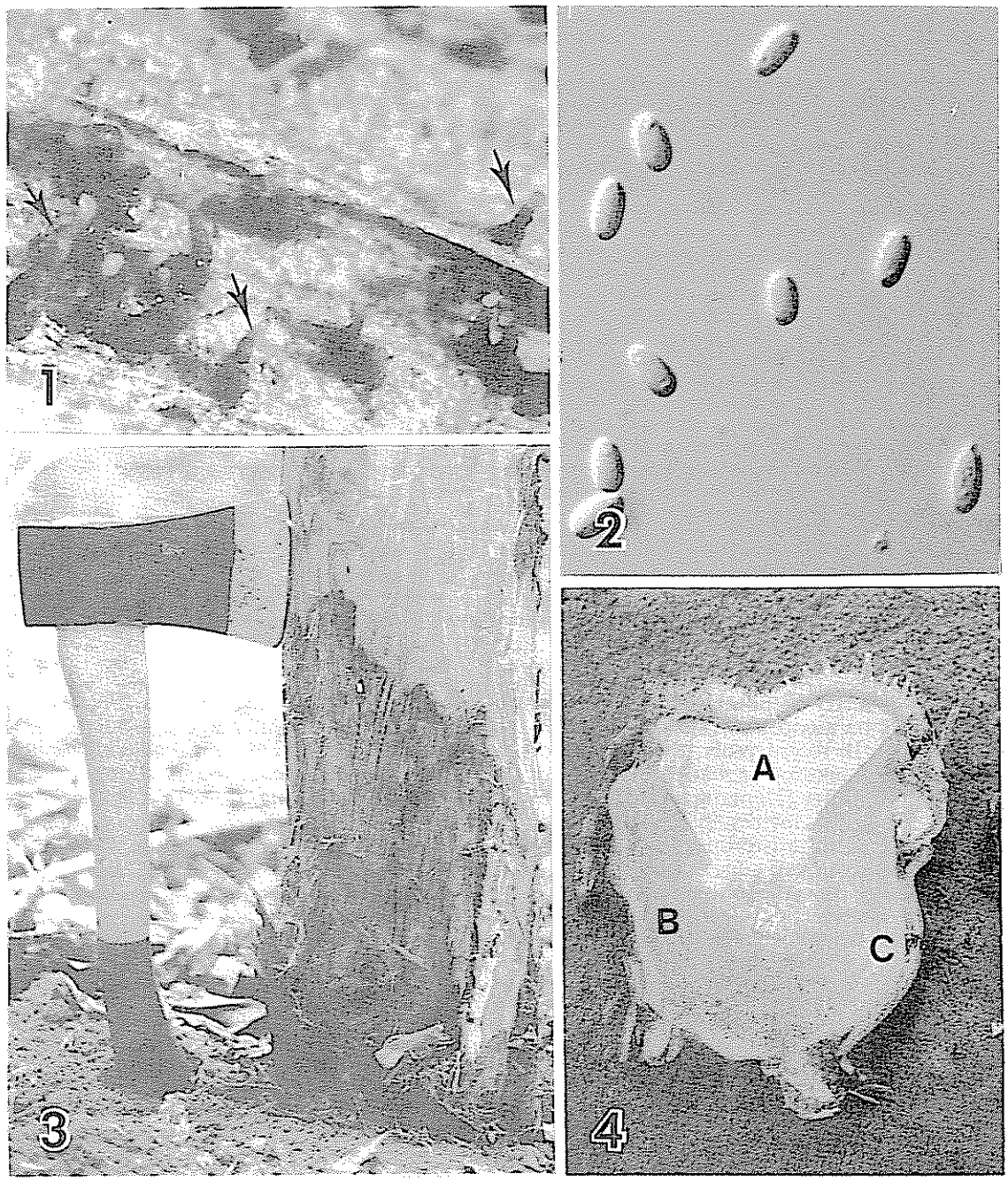

FIG. 1–4 *Cryphonectria cubensis* on *Eucalyptus grandis*. 1. Long-necked pycnidia exuding conidia on surface of malformed bark (× 4). 2. Conidia (× 2500). 3. Canker with dead cambium at the base of an inoculated tree. 4. Base of inoculated tree in cross section. Site of control inoculation (A) and inoculations with *C. cubensis* (B and C).

(Fig. 3). Cross sections through the cankers showed that the wood associated with the inoculations had been discoloured (Fig. 4). Pycnidia similar to those found on naturally infected trees were abundant on the surface of dead bark. Discolouration of the cambium below inoculation points extended into the roots and could not be measured effectively. Discolouration above inoculation points ranged from 170–440 mm with an average length of 270 mm.

Results of pathogenicity tests strongly suggest that the fungus causing cakers in inoculated trees was the cause of the disease observed in plantations. Morphological characteristics of the fungus associated with *E. grandis* cankers in this study are identical to those of *Cryphonectria cubensis* (Bruner) Hodges (= *Diaporthe cubensis* Bruner) and the *Endothiella* anamorph (Hodges, 1980; Hodges, Alfenas & Ferreira, 1986). The virulence of the fungus in pathogenicity tests on *E. grandis* is also consistent with the expected behaviour of *C. cubensis*.

Cryphonectria cubensis is one of a notorious group of canker pathogens of trees. This includes *Cryphonectria parasitica* (Murr.) Barr responsible for chestnut blight which devastated the American chestnut [*Castanea dentata* (Marsh.) Borkh.] (Griffin & Elkins, 1986). *C. cubensis* was first recorded in Cuba as *Endothia havanensis* (Bruner, 1916), subsequently found to be conspecific with *Diaporthe cubensis* Bruner which was more appropriately placed in the genus *Cryphonectria* (Hodges, 1980). Besides occurring in Cuba, Cryphonectria canker is known to occur in the United States, India, Indonesia, South America, Surinam, Cameroons and the Carribean region (Boerboom & Maas, 1970; Hodges

& Reis, 1974; Hodges, Geary & Cordell, 1979; Gibson, 1981; Sharma, Florence & Mohanan, 1986; Hodges *et al.*, 1986). *Cryphonectria* canker caused by *C. cubensis* is one of the most serious diseases known to affect *Cryphonectria* spp. under cultivation. Discovery of this pathogen in South Africa for the first time is thus of considerable concern.

Most research on *Cryphonectria* canker has been conducted in Brazil where this disease has had a significant impact on the propagation of *Eucalyptus* spp. (Alfenas, Jeng & Hubbes, 1983). In areas of Brazil where rainfall is high and average temperatures exceed 23 °C infection rates can be as high as 80 % (Hodges *et al.*, 1979). It is, therefore, not suprising that *C. cubensis* was first encountered in the warm northern Natal forest region. The preference of the pathogen for warm temperatures could be cause for optimism as the disease might not spread to cooler parts of South Africa. The relatively short rainy season in northern Natal could also reduce spread of the pathogen (Hodges *et al.*, 1979).

Eucalyptus spp. vary in their susceptibility to *C. cubensis*. Amongst the species commonly planted in South Africa, *E. maculata* Hook. and *E. saligna* Sm. are considered highly susceptible whereas *E. grandis* and *E. tereticornis* Sm. are moderately susceptible (Hodges *et al.*, 1979; Alfenas *et al.*, 1983). Of particular concern is the susceptibility reported for *E. grandis* which is by far the most extensively planted species in this country. The occurrence of *C. cubensis* in South Africa currently appears to be limited to scattered trees in the warmer parts of the country only. The notoriety of this pathogen as a *Eucalyptus* pathogen elsewere in the world suggests that its presence here should be taken seriously. There is evidence that considerable variation in susceptibility exists within *Eucalyptus* spp. and that variation in virulence exists among isolates of the pathogen (Alfenas *et al.*, 1983). The recent trend in South Africa of propagating selected clones of *E. grandis* from cuttings could lead to catastrophic losses through extensive planting of highly susceptible plants. The propagation of trees from cuttings, however, provides an ideal opportunity to screen clones for resistance to *C. cubensis*. Thus, through breeding and selection, future plantations which are not in jeopardy could be established.

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