

Eucalyptus Rust: A Disease with the Potential for Serious International Implications

T. A. Coutinho, Department of Microbiology and Plant Pathology and Tree Pathology Co-operative Programme, and M. J. Wingfield, Tree Pathology Co-operative Programme, Forestry and Agricultural Biotechnology Institute, University of Pretoria, Pretoria 0002, South Africa; A. C. Alfenas, Department of Plant Pathology, Universidade Federal de Viçosa, Viçosa MG 36570, Brazil; and P. W. Crous, Department of Plant Pathology, University of Stellenbosch, Private Bag X1, Matieland 7602, South Africa

ABSTRACT

Coutinho, T. A., Wingfield, M. J., Alfenas, A. C., and Crous, P. W. 1998. Eucalyptus rust: A disease with the potential for serious international implications. *Plant Dis.* 82:819-825.

Eucalyptus spp. are propagated extensively as non-natives in plantations in many parts of the tropics and sub-tropics. A number of diseases result in serious losses to this economically important forest resource. Eucalyptus rust, caused by *Puccinia psidii*, is one such example. The economic losses due to this disease are the result of infections of seedlings, young trees, and coppice. *P. psidii* occurs predominately in Central and South America, but reports of a similar rust are known from other areas. Eucalyptus rust is a remarkable disease in that the pathogen is not known on eucalypts in their centers of origin. It has apparently originated on native Myrtaceae in South America and is highly infective on some *Eucalyptus* spp. planted there. *P. psidii* causes one of the most serious forestry diseases in Brazil and is considered to be the most serious threat to eucalypt plantations worldwide. Advances in eucalyptus rust research are reviewed here, with a focus on topics such as distribution, host range, pathogen specialization, symptomatology, etiology, epidemiology, and control.

The Myrtaceae family includes a number of economically important tree crops, notably *Eucalyptus* spp., *Psidium guajava*, *Pimenta officinalis*, and *Syzygium aromaticum*. The greater portion of this family occurs in the Australasian and Southeast Asian regions, and in Central and South America, with four genera native to southern Africa (35,49,55). Of the economically important tree crops, *Eucalyptus* spp. are most significant and make up over eight million hectares of forest plantations in the tropics and sub-tropics (52). Diseases are thus considered to be a major threat to this forestry resource (57).

During the course of the past century, a number of genera and species of rust fungi have been reported to infect members of Myrtaceae. The majority of these species belong to the genus *Puccinia* Pers., while others are found in the genera *Aecidium* Pers., *Caecoma* Link, *Melampsora* Castagne, *Uredo* Pers., and *Uromyces* (Link) Unger (51). Further

taxonomic investigations have, however, led researchers to synonymize many of these genera (29,54).

Many of the rust fungi naturally infecting Myrtaceae occur on a wide variety of hosts. *Puccinia psidii* Winter is the only rust confirmed to be capable of infecting *Eucalyptus* spp. This fungus has also been reported to infect 10 other genera of Myrtaceae. The pathogen was first described by Winter (58) in 1884 on *Psidium pomiferum* in Brazil. In 1912, it was observed on *Eucalyptus citriodora* (26) but was not formally described from this host until 1944 (29). The first serious outbreak of *P. psidii* on a *Eucalyptus* sp. occurred in 1973 in the Brazilian province of Espírito Santo, where large-scale losses were experienced in nurseries and young plantations of *E. grandis* established from South African seed sources (20,21).

Puccinia psidii is currently a serious threat to eucalyptus plantations in many parts of the world, and particularly in Australia, where eucalypts are native. Considering the serious nature of eucalyptus rust and its international importance, this review is provided for a wider literary audience. Ferreira (21,23) published reviews on the history, biology, and control of eucalyptus rust in Portuguese. Here we discuss advances in research on topics relating to its distribution, host range, pathogen spe-

cialization, symptomatology, etiology, epidemiology, and disease control.

Distribution. *P. psidii* has been reported from South America (Argentina, Brazil, Colombia, Ecuador, Paraguay, Uruguay, and Venezuela), Central America, the Caribbean (Cuba, Dominican Republic, Jamaica, Puerto Rico, and Trinidad) (32), and South Florida (34). A rust, suggested to be *P. psidii*, has recently also been reported from Taiwan on *E. camaldulensis* (56). In this case, only a uredinal state was reported and it is impossible to confirm whether the fungus was the same as *P. psidii*. Despite considerable effort, the fungus has not been seen again (W. Wang, Taiwan Forestry Research Institute, per-

Table 1. List of reported hosts of *Puccinia psidii*; all belong to the family Myrtaceae

Host	Reference
<i>Callistemon speciosus</i> (Sims) DC	32
<i>Eucalyptus camaldulensis</i> Dehnhardt	19
<i>E. citriodora</i> Hook.	26
<i>E. cloeziana</i> F. Muell.	19
<i>E. grandis</i> Hill ex Maiden	20
<i>E. maculata</i> Hooker	19
<i>E. microcorys</i> F. Mueller	19
<i>E. paniculata</i> Sm.	19
<i>E. pellita</i> F. Mueller	19
<i>E. phaeotricha</i> Blakely et Mckie	19
<i>E. pirocarpa</i> L. Johnson, D. Blaxell.	19
<i>E. punctata</i> De Condolle	19
<i>E. saligna</i> Smith	21
<i>E. tereticornis</i> Sm.	19
<i>E. urophylla</i> S.T. Blake	19
<i>Eugenia brasiliensis</i> Lam.	53
<i>E. jambolana</i> Lam.	53
<i>E. malaccensis</i> L.	32
<i>Eugenia</i> sp.	54
<i>E. uniflora</i> L.	53
<i>E. uvalha</i> Camb.	32
<i>Marlierea edulis</i> Niedz	54
<i>Melaleuca leucodendron</i> (L.) L.	54
<i>Myrcia jacobitaba</i> Berg	54
<i>Myrcia</i> spp.	32
<i>Myrciaria</i> sp.	54
<i>Pimenta acris</i> Kostel	32
<i>P. dioica</i> (L.) Merr.	34
<i>P. officinalis</i> L.	3, 33
<i>Psidium araca</i> Raddi	54
<i>P. guajava</i> L.	58
<i>P. pomiferum</i> L.	58
<i>Syzygium jambos</i> (L.) Alston	32

Corresponding author: T. A. Coutinho
E-mail: Coutinho@scientia.up.ac.za

Accepted for publication 3 March 1998.

Publication no. D-1998-0423-01S
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sonal communication). Another rust infecting *Eucalyptus* spp. has been reported from India, where it was identified as a species of *Melampsora* (53). Type material of the latter fungus has, however, failed to reveal whether this identification was correct (I. Gibson, personal communication). Recently, Knipscheer and Crous (30) reported a rust on *E. nitens* in South Africa. This fungus was not successfully identified to genus, due to the absence of teliospores, and it has subsequently disappeared from forest plantations.

Host range and pathogen specialization. *P. psidii* is capable of infecting many

species in the Myrtaceae (Table 1; Fig. 1A and B). This fungus was originally described from infected *P. pomiferum* leaves (58) and, in 1904, Sydow and Sydow (51) listed only *Psidium* spp. as hosts. Arthur (4,5) and Stevenson (50) listed only *P. guajava* and *S. jambos* as hosts, but Joffily (29), Viégas (54), and Laundon and Waterston (32) listed several other genera as hosts of *P. psidii*. Joffily (29) and Viégas (54) considered several of the rusts described on various genera of Myrtaceae as not being distinct from *P. psidii*. Their conclusions were not based on detailed taxonomic studies, and until such a study is

complete, the host range of *P. psidii* will remain enigmatic.

Cross-inoculations among hosts indicate that there is considerable physiological variability within *P. psidii* (7,8,12,14,20,23,33). Ferreira (23) suggested that the host range has expanded within the Myrtaceae family. He speculated that the wild ancestor of *P. psidii* was able to infect a number of species, such as *S. jambos*, *Eucalyptus* spp., *Myrcia jaboticaba*, *Calistemon speciosus*, and wild and commercial varieties of *P. guajava*. Reciprocal cross-inoculations among these hosts were performed (23), and it was found that only

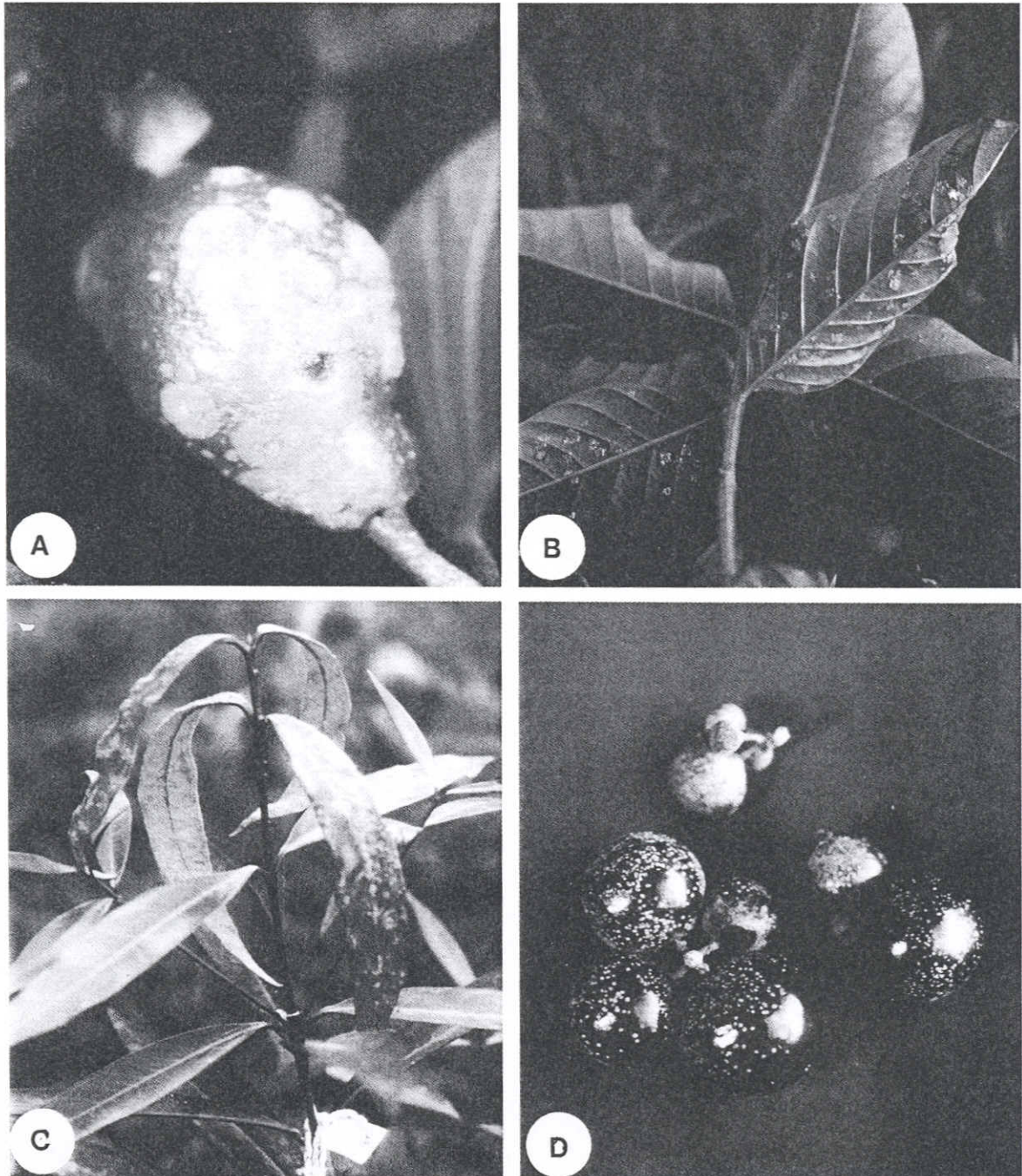


Fig. 1. Pustules of *Puccinia psidii* on different hosts. (A) *Psidium guajava* fruit. (B) *P. guajava* leaves. (C) *Syzygium jambos* leaves. (D) *Myrcia jaboticaba* fruit.

