A Preliminary Assessment of the Threat of Diseases and Pests to *Widdringtonia cedarbergensis*

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SYNOPSIS

A preliminary investigation of pests and diseases of mature *Widdringtonia cedarbergensis* growing in natural stands and plantations in the Cedarberg was undertaken. No severe diseases or insect problems were found and only limited mortality of trees was observed. Various insects and fungal pathogens were found but no single factor was correlated with tree health. However, the health of cedars was lower in the plantations than in natural stands. Pathogens such as *Phytophthora cinnamomi* which have been found on *W. cedarbergensis* seedlings used to establish plantations, were not more prevalent in plantations than in natural stands. However, seedlings are potential means by which foreign pathogens and pests might be introduced into cedar stands.

INTRODUCTION

Widdringtonia cedarbergensis Marsh (the Clanwilliam cedar) is endemic in the south-western Cape Province of South Africa. The species has declined seriously in numbers, largely because of excessive exploitation and mortality owing to fires (Manders, 1986). Current populations are scattered and restricted to rocky outcrops and very rocky slopes in the Cedarberg (Andrag, 1977). Reports have shown that regeneration in natural stands of *W. cedarbergensis* is often below levels required to replace losses from fires (Andrag, 1977; Manders, 1987). Mortality of cedar trees with a DBH greater than 50 mm is only in the order of 2 % per year in the absence of fire (Manders, 1987). To our knowledge the threat of insect pests and diseases to *W. cedarbergensis* has not been considered previously. For instance, it is not known whether introduced pests or diseases are present on these trees.

Widdringonia cedarbergensis and the two congeneric species, *W. schwarzii* and *W. cupressoides*, are the only indigenous members of the Cupressaceae in Southern Africa, and are the closest relatives of the exotic conifers (*Pinus* spp. and *Cupressus* spp.) planted in South Africa. In the Cedarberg, exotic pines are grown in plantations for softwood production and *Cupressus* spp. can be found in areas close to natural populations of *W. cedarbergensis*.

Two classes of pathogen could be important on native *Widdringtonia* spp. in South Africa. These include native pathogens which might be enhanced by disturbance of, or stress to the cedars and exotic pathogens accidentally introduced into the country. Many tree disease epidemics elsewhere in the world have occurred on native species that have been challenged by introduced pathogens (Bingham, Hoff and McDonald, 1971; Horsfall and Cowling, 1978; von Broembsen, 1987). A survey of diseases and pests in mature natural and planted stands of *W. cedarbergensis* in the Cedarberg was therefore carried out.

MATERIALS AND METHODS

Widdringtonia cedarbergensis in native stands north of Sneeuberg hut (19° 9" 12' E and 32° 29" 10' S) and in plantations at the Algeria State Forest (10° 3" 30' E and 32° 22" 21' S) were examined for disease in February 1984 and March 1985. Healthy, dying and dead trees were examined for signs of disease. Where trees had died, roots were excavated and examined for root disease. In addition, dying fynbos plants were sampled for *Phytophthora cinnamomi* Rands when they were found in association with *W. cedarbergensis*. Exotic cypress trees (*Cupressus* spp.) planted as ornamentals at the Algeria State Forest were also examined for diseases.

Samples of tissue from diseased trees were collected for laboratory examination and isolation of fungi. Fungi were routinely isolated from plant material and insects on malt extract agar (1 % malt extract, 20 g Difco Bacto Agar/1 ℓ water) amended with 1 g/ℓ sodium novobiocin. *Phytophthora cinnamomi* was isolated as previously described (von Broembsen, 1984a) from roots using a selective medium and from soil using a baiting technique.

RESULTS

Root diseases

In natural stands of *W. cedarbergensis*, only single dying trees were occasionally found. Disease centers typical of those caused by root pathogens were not present. In plantations of *W. cedarbergensis*, small groups of aging trees were occasionally found. In the latter areas, trees were commonly windblown and appeared to have weak root systems. The general health of trees in plantations was markedly lower than that of trees in natural stands. Roots and root collars of windblown trees typically had well developed brown cubical rot. No sporophores were found associated with the rot and the causal fungus could not be identified. Rotten root wood was colonised by termites *(Reticulotermes* spp.) which further weakened the roots. Brown cubical rot appeared to originate in fire scars on tree boles and subsequently to move into the roots.

Phytophtora cinnamomi was infrequently isolated from roots and associated soil of *W. cedarbergensis* in plantations. This pathogen was, however, frequently recovered from dying fynbos plants growing in association with cedars in natural stands *(Table 1)*.

TABLE 1. Occurrence of Phytophthora cinnamomi *on* W. cedarbergensis *and fynbos plants in natural stands and plantations of* W. cedarbergensis

	Plantations		Natural stands	
Host	Samples Positive	Total Samples	Samples Positive	Total Samples
W. cedarbergensis	2	7	0	11
Erica inflata Thunb.	–	–	2	2
Protea punctata Meisn.	–	–	3	5
P. laurifolia Thunb.	–	1	–	–
Leucospermum vestitum (Lam.) Rourke	–	–	1	1
Paranomus tomentosus (Phill. and Hutch.) N.E. Br.	–	–	–	1
Sorocephalus lanatus (Thunb.) R. Br.	–	–	1	1
Total	2	8	8	11

Leaf diseases

A *Meliola* sp. was commonly found on apparently healthy leaves. This fungus could be recognised by the small circular crustose, black fruiting bodies on leaflets. In addition, a *Phomopsis* sp. was isolated from dead leaves and twigs.

Stem diseases and pests

Cankers were commonly found on the boles of trees in plantations. These cankers appeared to have originated from fire scars which had subsequently served as infection courts for a brown cubical rot fungus. Brown cubical rot was always found in these wounds and often extended into the roots.

Bark beetles (Coleoptera: Scolytidae) were found in the bark of most dead and dying trees. These included *Lanurgus widdringtoniae* Schedl. and *Afrocleptus widdringtoniae* Bright. In addition, the wood borer *Acmaeodera glabella* Obenberger (Coleoptera: Buprestidae) was common under the bark and in the wood of dead trees. No fungi were found sporulating in the bark beetle galleries when these were examined for known insect-associated fungi such as *Ceratocystis* spp. and *Ophiostoma* spp. Isolations made from *Lanurgus* spp. yielded only *Penicillium* spp. that are common contaminant fungi.

Severe stem cankers were found on stems of approximately 15-year-old *Cupressus lusitanica* Miller growing on the grounds of the Algeria forest station. The fungal pathogen, *Seiridium cardinale* (Wagner) Sutton and Gibson was isolated from these cankers and was apparently the cause of this disease.

DISCUSSION

Fire damage was more extensive in plantations where tree density was greater than in natural stands. In plantations, trees appear to suffer more from the pathological consequences resulting from fire damage than trees in natural stands. These secondary problems include brown cubical rot of the boles and root collars, weakening of the root systems and insect infestation. Similar root collar rot and heart rots have been known for many years (Lückhoff, personal communication) but the cause of these diseases are not known. As far as we are aware, no fungal pathogens of leaves of branches of *W. cedarbergensis* have been reported previously in South Africa (Gorter, 1981). Doidge (1950), however, listed *Pestalotia funerea* Desm. and

Fumago vagans Pers. on *Widdringtonia* sp. in the Marandellas district of Southern Rhodesia, now known as Zimbabwe. Both of these fungi are subject to taxonomic confusion. Fungi such as the *Phomopsis* sp. (a genus known to cause conifer needle disease) found on diseased juvenile leaves deserve further study. No pathogens known to be of exotic origin were found on *W. cedarbergensis* in natural stands.

Phytophthora cinnamomi was found to be associated less frequently with dying *W. cedarbergensis* than with fynbos plants such as Proteaceae. Previously, *P. cinnamomi* was found on several occasions on *W. cedarbergensis* in the nursery supplying seedlings for plantations and from dying mature *W. cedarbergensis* in this area (von Broembsen, 1984a). High levels of the fungus have been recovered from streams in this region (von Broembsen, 1984b) and the fungus is apparently indigenous to the mountain catchments (von Broembsen and Kruger, 1985). There is no indication that *P. cinnamomi* is a significant cause of mortality of mature *W. cedarbergensis* either in plantations or natural stands.

During the first year of this survey, cyprus canker caused by *Seiridium cardinale* was found on the exotic *Cupressus lusitanica* at the Algeria forest station. The fact that this forest station is the primary access point to the Cedarberg led to concern that the pathogen might become established on *W. cedarbergensis*. Since particular attention was given to the presence of *Seiridium*-associated cyprus canker, failure to find this disease on native cedars suggests that it is not able to become established on these trees. Preliminary inoculations with the two species of *Seiridium (S. cardinale* and *S. unicorne* (Cke. and Ellis) Sutton) known to cause cypruś canker in South Africa did not kill *W. cedarbergensis* seedlings (Wingfield and Du Toit, 1985) which also shows that these pathogens are not likely to threaten native cedars.

From this preliminary survey, it does not appear that any single fungal pathogen or insect pest is playing an important role in the overall health of mature *W. cedarbergensis*. However, the basic question of whether diseases and pests might be affecting the reproductive capacity of *W. cedarbergensis* has not been dealt with adequately. Only the health of mature plants has been examined. Regeneration in populations of *W. cedarbergensis* may also be affected by indigenous or introduced pathogens increasing the mortality of emerging seedlings.

Because of the inability of *W. cedarbergensis* to maintain population levels, suitable techniques for the establishment of stands are being investigated. These include the possibility of planting nursery produced seedlings in natural areas. Knowledge of seed and seedling pathogens and their effects during establishment of stands might be useful to optimise re-establishment of cedars by either seed or seedling transplants. Planting seedlings infected with pathogens could result in the transfer of pathogens to new areas. As there is so little known about pathogens of *W. cedarbergensis* and their potential to cause disease, movement of seedlings from nurseries to natural stands should be undertaken with care.

ACKNOWLEDGEMENTS

We are grateful to Mr G.D. Tribe for information on insects infesting cedars and to Mr M. Viviers for assistance with field surveys.

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