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Infection of the cones and seeds of *Welwitschia mirabilis* by *Aspergillus niger* var. *phoenicis* in the Namib-Naukluft Park

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Abstract

Welwitschia mirabilis Hook. fil. is a unique and rare dioecious desert gymnosperm endemic to the Namib Desert. The female plants bear 90–100 megasporophylls, of which 50–60% may be fertile, but up to 80% of those fertile seeds may be infected by *Aspergillus niger* var. *phoenicis*. This contamination results in seed and seedling death, potentially negatively affecting recruitment of plants into the population.

The pattern of infection of the cones and seeds in the field was studied over a period of eight months at the Hope Mine in the Namib-Naukluft Park. Infection of the cones was found to peak coincident with the appearance of the pollination drops, and with high temperatures, winds and significant rainfall. *W. mirabilis* cones were microscopically examined and spores of *A. niger* var. *phoenicis* were found embedded in the dehydrating pollination drop at the tip of the micropyle, suggesting that this was one of the routes by which the seeds were infected. The heteropteran, *Probergrothius sexpunctatis*, was also implicated in the infection of the seeds, since it was found to be carrying spores of *A. niger* var. *phoenicis* and was observed feeding on mature seeds and immature cones. While most post-harvest treatments have proved ineffective in eradicating *A. niger* var. *phoenicis* from the seeds, promising results are presently reported using a fungicide containing tebuconazole as the active ingredient.

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Keywords: *Aspergillus niger* var. *phoenicis*; Cones; Infection; Seeds; *Welwitschia mirabilis*

1. Introduction

Welwitschia mirabilis Hook. fil. is a unique and rare plant indigenous to the Namib Desert. It is categorised among the Gymnospermae (order Gnetales), but displays many characteristics intermediate between gymnosperms and angiosperms. It is dioecious, bearing either micro- or megastrobili. The morphology of the microsporophyll and microsporangia has led to the term, anthers, for these structures as they resemble those found in angiosperm flowers, whereas the reproductive structures of the female plant are more comparable to the cones of conifers (Bornman, 1978). The plant bears only two leaves each of which is continually regenerated from a basal meristem (Bierhorst, 1971), and which become longitudinally dissected by uneven growth of the truncated stem (Bornman et al., 1972), giving the plant the appearance of having many long ribbon-like leaves.

Although studies have been undertaken on the ecophysiology of the plant, very little is known about the seed biology of *W. mirabilis*. Studies alluding to only limited aspects of the seed biology in particular were published in the 1970s (Butler et al., 1973; Bornman, 1978; Bornman et al., 1979a). More recently, it has been established that the seeds of *W. mirabilis* are highly orthodox and thus should be storable by conventional means and are also amenable to cryostorage (Whitaker et al., 2004). According to Bornman et al. (1972), 50–60% of the 90–100 megasporophylls borne by the female plant may be fertile, while the fungus *Aspergillus niger* infects up to 80% of the seeds and causes seedling death.

Seed-associated fungi could pose a serious problem in terms of propagation of the species, both in its natural habitat, and in planting programmes. Survival of *W. mirabilis* could become jeopardised by lack of seedling recruitment in the field as well as by the inability to produce vigorous young plants for regeneration programmes. It is apparent that the course of infection of the seeds by the fungus, originally suspected and subsequently confirmed to be *A. niger* var. *phoenicis* (Corda) Al-Musallam

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