Discovery of three new fungal species from dying Baobab trees in South Africa and Madagascar

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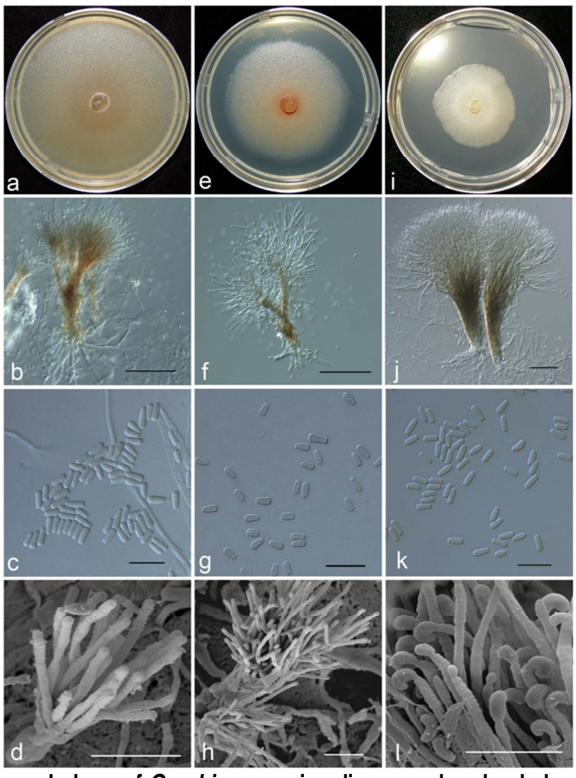
Baobab trees are iconic plants that represent some of the most recognisable trees in the world. The eight known species of baobab belong to a single genus, *Adansonia*. Madagascar is the centre of diversity, with six species endemic to the island. Only one species, *Adansonia digitata*, occurs in Africa and it is widely distributed from as far north as the Sahel to a few degrees south of the Tropic of Capricorn in southern Africa. This species has also been introduced into Madagascar and other parts of the world. The remaining species, *A. gregorii*, occurs in the Kimberley ranges in the north-western part of Australia.

Past research on these trees focussed mainly on the nutritional value of the fruit, seeds and leaves. Some studies have been conducted on the ecology of baobabs in Africa, and also on the effect of elephant populations on baobab survival and regeneration. Baobab trees can survive and recover from an incredible level of damage by humans and/or elephants. However, in recent years there has been evidence of baobab trees dying of unknown causes. This has prompted a study to identify the fungi that occur on and infect wounds on these trees, as very little is known regarding the fungal associates of baobabs.

Elephant damage on baobab trees. Left: Baobab in the Kruger National Park showing elephant damage. Right: Baobab recovered from elephant damage in a nature reserve where no elephants occur anymore.

An extensive, ongoing survey is being conducted by Elsie Cruywagen, a PhD student in the DST/NRF Centre of Excellence in Tree Health Biotechnology (CTHB) at FABI, University of Pretoria. Many species of fungi have been found on the baobabs thus far. Although Elsie is still in the process of characterizing and identifying the isolates, three new species were already discovered. Isolates of these species were collected from dead or wounded baobab trees and recognised based on DNA sequence and morphological comparisons. Elsie named and officially described these species in the

December 2010 issue of the mycological journal, *Persoonia*. The new species are *Graphium adansoniae* from South Africa, and *G. madagascariense* and *G. fabiforme* from Madagascar



Culture characteristics and morphology of *Graphium* species discovered on baobab. (a-d) *Graphium adansoniae* a. 14 day old culture on MEA; *b. synnema*; c. conidia; d. scanning electron micrograph (SEM) of conidiogenous cells and conidia. (e-h) *Graphium madagascariense* e. 14 day old culture on MEA; *f. synnema*; g. conidia; h. SEM of conidiogenous cells and conidia.(i-l) *Graphium fabiforme* i. 14 day old culture on MEA; *j. synnema*; k. conidia; l. SEM of conidiogenous cells and conidia. Scalebars b, f, j = 50 µm, c, d, g, h, k, l = 10 µm.

An intriguing outcome of this study was that two of the most closely related new *Graphium* spp. were isolated from different *Adansonia* spp. from two very distinct land masses. *Graphium adansoniae* was found on *A. digitata* in Africa and *G. madagascariense* was isolated from *A. rubrostipa* in Madagascar. These results suggest that these fungi have some degree of host or substrate specificity. Recent studies showed that baobab trees probably originated in west Africa and subsequently spread to other parts of the world where they speciated. The similarity in fungi isolated from different tree species on separate land masses, raises intriguing questions regarding the movement of fungi between these areas. *Graphium* species are commonly associated with insects and it is probable that there would be some relatedness between the insects that vector these fungi in Africa and in Madagascar. A study of these interactions would most likely lead to interesting discoveries about the biogeography and ecology of these fungi.

The discovery of three new species of *Graphium* adds knowledge to the poorly documented fungal biodiversity in Africa. It was estimated that there could be around seven species of unique fungi on each native plant in southern Africa. Clearly, only a fraction of these have been described and fewer have been studied in terms of their ecological roles. Surprisingly few fungi have been recorded from the iconic and biogeographically important baobabs. Future studies of the fungi on these trees will most likely contribute interesting insights into the ecology, biodiversity and biogeography of fungi.