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A survey of plant parasitic fungi occurring on selected native Namibian trees species of economic importance

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ABSTRACT

Over the past few years an increase in Acacia trees showing disease symptoms has been observed in the Windhoek Municipality area and the rest of Namibia. The importance of indigenous trees to the Namibia flora is apparent considering that Namibia has two old deserts in its boarders. The trees provide vegetation cover and browsing food matter to domestic livestock and wild animals, another value is in the tourism and meat industry for Namibia. Hence it is important to ensure that this vegetation is kept healthy. This survey is the first dedicated step to find ways of protecting them from disease causing agents. The aim of this survey was to investigate the possible cause of disease symptoms on trees. It is after understanding the biology of the pathogenic agents that a possible control method can be proposed. The survey involved sampling leaves, stems and roots from dying trees showing symptoms like branch girdling, gum oozing and defoliation, suspicious general twig wilting and die-back. The survey was carried out in places where symptoms were observed. The tree surveys were done on Syzygium and Acacia species. Primary isolations from plant material and then single spore pure cultures were made for identification. In this communication, we report isolation and identification of Microsphearopsis sp. Dreschelra sp., Botryosphearia spp. Acremonium spp, Coniothyrium sp, Phellinus spp, Cytospora sp., Fusarium sp., Scytalidium sp, Phoma spp, and Gliomastix sp. Trichoderma koningii, Peacilomyces variotii, Alternaria citri and Curvularia palescens from the diseased trees.

Key words: Plant parasite, fungi, Namibian trees, economic importance.

INTRODUCTION

Fungal pathogens of trees can have devastating impacts on biodiversity, forest structure and dynamics, commercial plantations, agro forestry and urban environments[1]. This is especially the case with introduced (exotic) pathogens. A well-known example is that of *Cryphonectria parasitica*, a fungus native to Asia, which was introduced into the United States of America at the beginning of the 1900s[2]. This fungus, a mild pathogen in its areas of origin, resulted in the near extinction of North American chestnut trees (*Castanea dentata*) after its introduction to the USA. Today, a once dominant canopy tree in the Eastern USA has been reduced to a low-growing shrub and the entire ecology of the forests has been changed, impacting on animals, other trees and humans. Another example is that of sooty baobab disease, which has killed a lot of baobabs in Southern Africa[3]. The impact on plantation forestry species and agricultural crops can be equally severe and with the increased movement of humans and plant products around the world, more and more pests and diseases are being moved to areas where they previously did not occur.

In 2002, dieback on A*cacia* trees in area in and around the city of Windhoek in Namibia, especially in the Dorado Park area was observed and since then, disease symptoms and tree death have been increasing. Life-threatening basal cankers on *Syzygium guineense* trees have been observed along the Zambezi River in the Katima

Mulilo area of Namibia. *Acacia* species are particularly important for fodder, fuel wood, enhancing soil fertility through biological nitrogen fixation and gum while *Syzygium guineense* is important for its edible fruits and fuel wood. In this study, we had two objectives. Firstly, to investigate the cause of decline and death of *Acacia* species trees around Windhoek. This is in order to develop management strategies to reduce the impact of the disease. Secondly, to survey for fungal pathogens

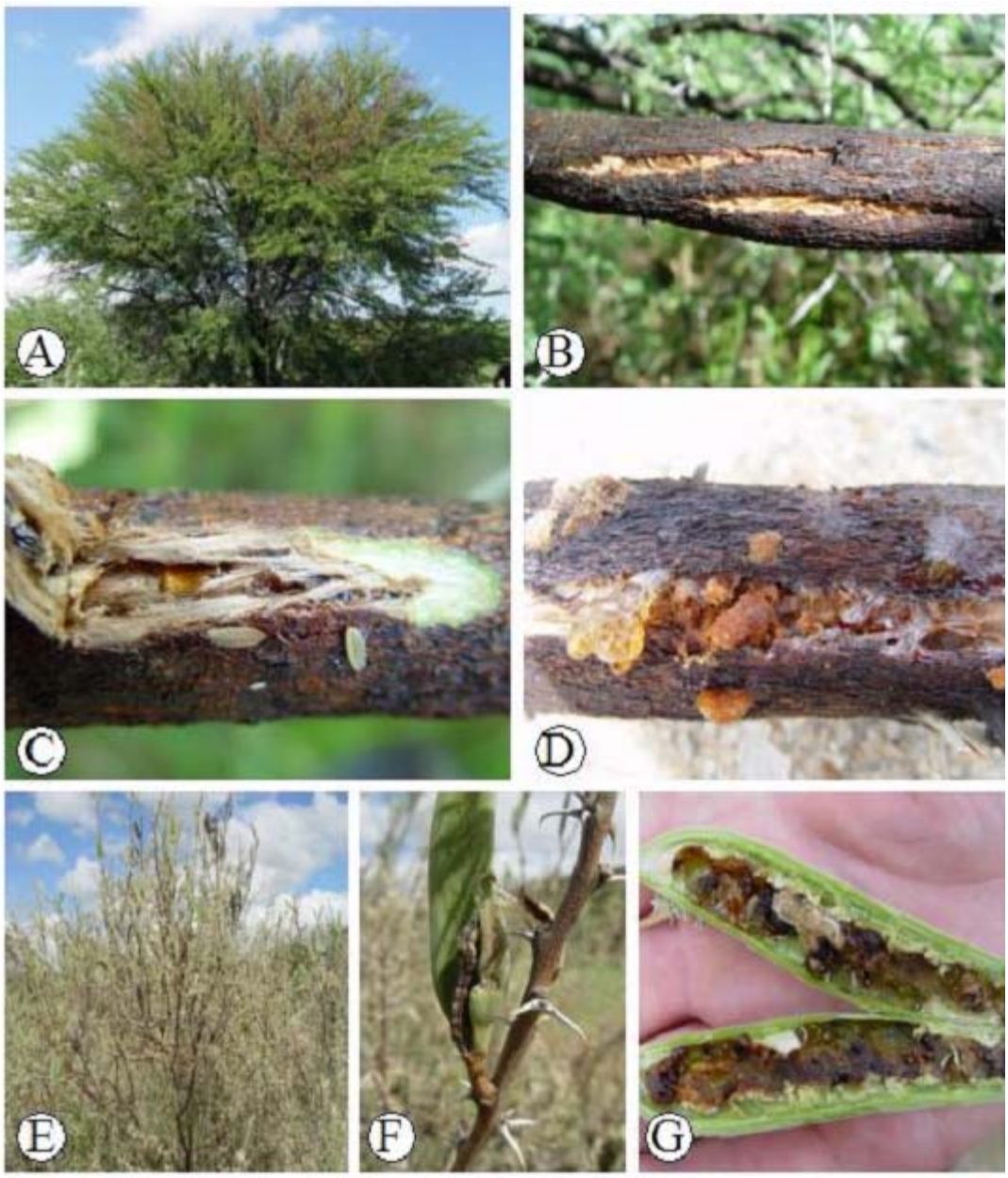

Fig. -1: (A) *A. karoo* tree in Windhoek showing branch die-back, (B) *A. karoo* branch cracking from wood borer infestation, (C) Wood borer tunnel and funal infection on *A. karoo* branch (D) Wood borer tunnel with exuding gum and frass on *A. karoo*, (E) Discoloured and "dying" *A. hebeclada* seed pod and seeds.

occurring in selected habitats of *Syzygium* and *Acacia* species in Namibia. These surveys will serve as the groundwork for future investigations on tree health in Namibia that is, in expanding our knowledge pertaining to the distribution, impact and origin of these pathogens nationally. This knowledge is also essential to understand the functional dynamics of these native ecosystems at a basic level, which is potentially important for the conservation of these ecosystems.

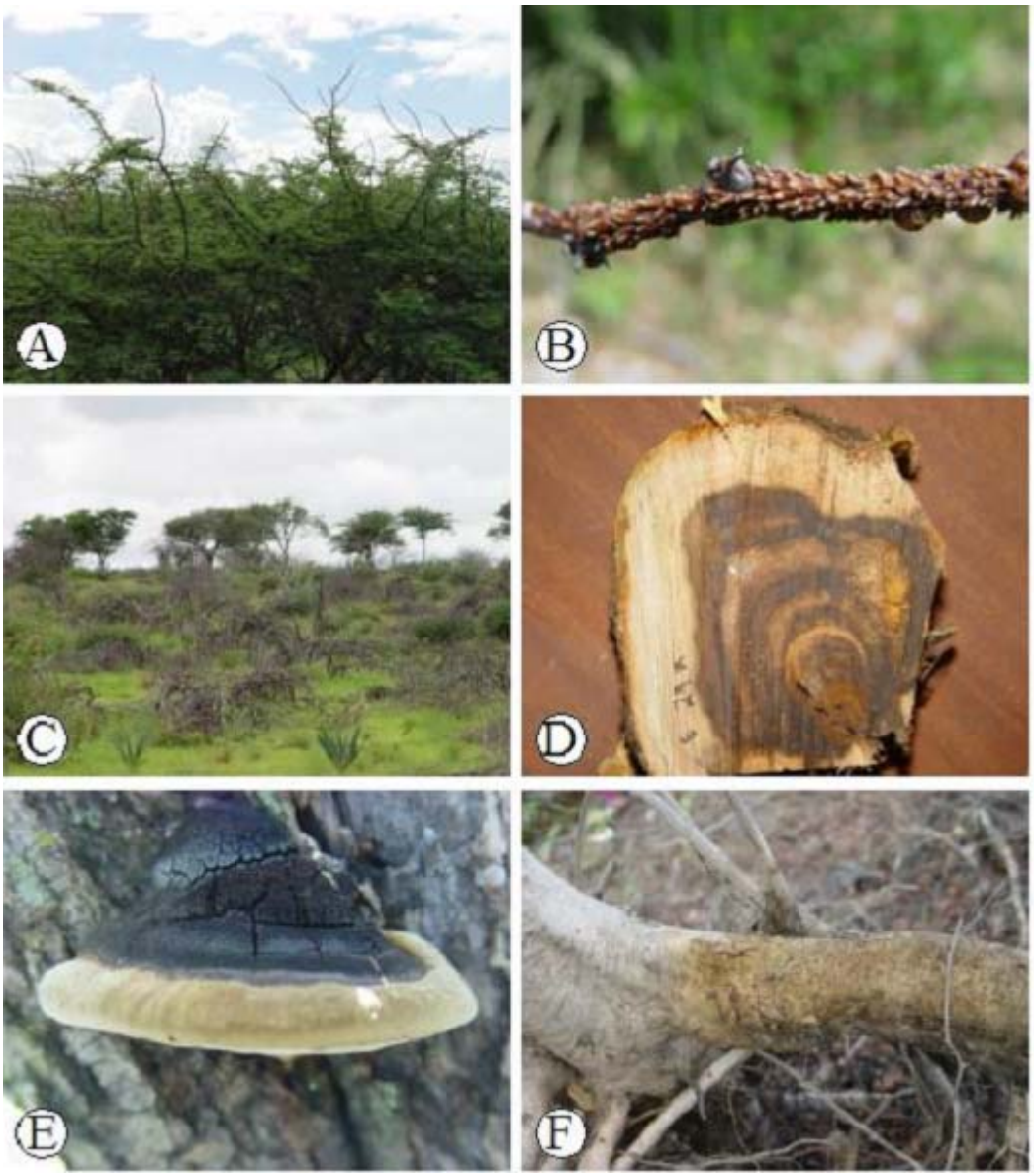

Fig. -2: (A) Tip die-back on *A. mellifera* in Windhoek, (B) insects on *A. mellifera* tips resulting in tip death, (C) dead *A. mellifera* Dordabis, (D) internal stain and decay of *A. mellifera* (E) *Phellinus* sp. on stem of *A. mellifera* tree, (F) Chrysoprthe canker on root of *S. guinnense* tree.

Table - 1: Fungi isolated from diseased *Acacia* and *Syzygium* sp. in Namibia.

Area sampled	Tree species	Fungi isolated
Windhoek	***A. karroo***	*Acremonium* sp.
		Alternaria citri
		Botryosphearia sp.
		Curvularia palescens
		Cytospora sp.
		Dreschlera sp.
		Fusarium spp.
		Microsphearopsis sp.
		Paecilomyces lilacinus
		Phoma spp.
		Trichoderma koningii
	A. hebeclada	A. citri
		Acremonium sp.
		Botryosphearia sp.
		Dreschlera sp.
		Fusarium spp.
		Microsphearopsis sp.
		Phoma spp.
	A. mellifera	*Fusarium* spp.
		Botryosphearia sp.
		Gliomastix sp.
		Paecilomyces variotii
		Phoma spp.
Dordabis	***A. mellifera***	*Botryosphearia* sp.
		Coniothyrium sp.
		Cytospora sp
		Fusarium sp.
		Paecilomyces variotii
		Phellinus sp.
		Phoma sp.
Grootfontein	***A. erioloba***	*Phellinus* sp.
	A. mellifera	*Botryosphearia* sp.
		Fusarium sp.
		Phellinus sp.
		Phoma spp.
		Trichoderma sp.
Rundu	***A. erioloba***	*Phellinus* sp.
	A. mellifera	*Phellinus* sp.
Popa Falls	***A. mellifera***	*Phellinus* sp.
	S. guineense	*Chrysoporthe* sp.
Katima Mulilo	***A. erioloba***	*Phellinus* sp.
	S. guineense	*Chrysoporthe* sp.

MATERIALS AND METHODS

Survey trips were conducted in various sites in Namibia including Windhoek, Dordabis, Grootfontein, Katima Mulilo, Omaruru, Swakopmund, Rundu, Popa Falls and Rehoboth between 2003-2006 to collect leaves, stems and roots of *Acacia* and *Syzygium* plants showing disease symptoms. At least 10 trees were sampled from each site. In most cases non-destructive sampling was used. Small pieces of infected/ cankered tissue were removed for isolation of the fungi. In few cases destructive sampling was used when whole sections of dying tree parts would need to be removed to determine the cause of death and in the long-term prevent other trees from dying. For this, stems and branches were chopped off and roots of infected plants were dug out.

Collected samples examined for insect damage and used for fungal isolations. Primary isolations and pure cultures of fungi were made using 2% MEA media. All isolates were identified in the laboratory using morphology and ribosomal DNA sequencing of the internal transcribed spacer (ITS) regions.

RESULTS

Several fungal species have been isolated and some of them for the first time in diseased *Acacia* species and *Syzygium guineense* in Namibia[4, 5] (Table 1). Visual inspections of disease symptoms on *A. karroo* trees in Windhoek (Figure 1a) showed that these trees had all been infested by a wood boring insect (Figure 1b,c,d). This resulted in girdling of branches and subsequent wilt and death of these branches (Figure 1a). Isolations from lesions (Figure 1c) associated with the insect infestation resulted in a number of different fungal species (Table 1). A few *A. hebeclada* trees were surveyed in Windhoek. Symptoms on these trees included stem cankers and branch die-back. No primary pathogens were, however, isolated from these trees. Those fungi isolated are opportunistic stress associated pathogens[6] (Table 1), capable of causing die-back and death of trees. Symptoms of foliage discoloration and apparent death of trees (Figure 1e) observed on *A. hebeclada* in the Rehoboth area were as the result of insect infestation. Caterpillars of an unidentified insect species, possibly of the Lepidoptera group were found feeding on the leaves and seedpods of these trees (Figure 1f,g). Three sites with *A. mellifera* die-back were investigated. In Windhoek, tip defoliation and death of branch tips on *A. mellifera* trees caused by insects were observed (Figure 2a, b). Extensive mortality of trees was observed on the farm near Dordabis where a number of trees were sampled and isolations done (Table 1). On a farm in Grootfontein, branch die-back associated with a *Phellinus* sp., was the most common symptom observed, although a number of other fungi were also isolated (Table 1). *Chrysoporthe* sp[1]. (previously *Cryphonectria*) was found on *S. guineense* trees around Popa Falls and Katima Mulilo. This fungus was found sporulating abundantly on stem and root cankers of trees.

CONCLUSIONS

We have purified, stored and identified several fungi species associated with diseases on *Acacia* and *Syzygium* trees in Namibia. There are on-going surveys and confirmation studies of disease causation on other parts of the country. Population studies of the isolated fungi are underway. Possible pathogens and other fungi of interest are currently being identified to species level using morphology and DNA sequence data.

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