

Diseases of the mukau

The last 10 years have seen isolated symptoms on the species, mainly caused by fungi

By Jane W. Njuguna

M*elia volkensii* (mukau) is an indigenous tree species belonging to the family *Meliaceae*. Current research findings indicate that its growth performance is potentially faster than the popular eucalyptus species especially in arid and semi arid areas of Kenya. It has been recorded to reach a height of 2metres in one year.

Mukau is popular for its valuable timber, which is resistant to termite attack and compares favourably with that of Camphor wood (*Ocotea usambarensis*) and Meru oak (*Vitex keniensis*) (Kidundo, Blomely)¹. The tree is also used as firewood, as fodder and in the honey-making process. It also has medicinal and insecticidal properties. The species is therefore being promoted as a potential multipurpose tree for the drylands.

For a long time, there have been no reports of serious disease or pest problems on the species. Some authors, like Konuche², argue that indigenous tree species have evolved alongside their natural enemies, are therefore less vulnerable to diseases and pests, harsh climates, etc, making such species best suited for use in agroforestry systems in the drylands. However, in the last 10 years, there have been isolated reports of various disease symptoms on the species, mainly caused by fungi. The disease symptoms affect the growth and performance of the species in the farms.

Reports of wilts, leaf spots and powdery mildews on *M. volkensii* became frequent in the late 1990s, affecting young and old *Melia* trees in Embu, Mbeere and Kitui districts. By 2002, a stem canker and dieback disease was observed to affect saplings and mature trees and in some cases resulting in the deaths of trees. Regular and monitoring surveys carried by the Integrated Pest Management team of the Kenya Forestry Research Institute (KEFRI) show that the incidence of various disease symptoms increased from 18 per cent in 2000 to 35 per cent in 2005. We also

observed that young seedlings in the nursery are more susceptible to disease attacks and about 20 per cent of deaths of seedlings occur in the first year of growth. All parts of the tree - seeds, leaves, stems, roots and branches - seem to be equally affected by different species of fungi.

Diseases affecting seeds

Pre- and post-germination damping off caused by several species of *Fusarium*, *Botryosphaeriaceae*, *Aspergillus*, *Rhizopus* and *Penicillium*, has been frequently recorded in nurseries. Pre-emergence damping off severely limits germination potential of *Melia* seeds, while post-germination damping off kills germinated seedlings thereby reducing the growth performance and number of expected seedling for agroforestry purposes. We have

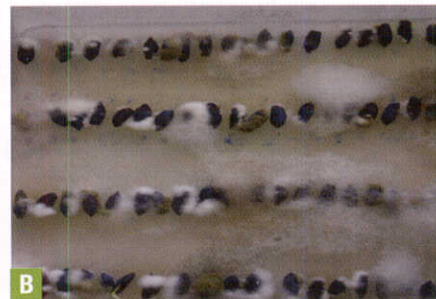
observed that some *Fusarium*, *Neofusicoccum parvum* and *Lasiodiplodia theobromae* are seed-borne; while the common moulds *Aspergillus*, *Rhizopus* and *Penicillium* were surface contaminants.

Diseases of seedlings

Young seedlings are susceptible to root collar rots, leaf blight and fall, chlorosis, wilts, yellowing and powdery mildews.

Diseases of mature trees

Stem cankers, dieback and resinosis have been observed on some older trees, attacking stems, branches, twigs and shoots. The cankers cause ugly deformations on the stems and internal



1 Blomely, T. (1994): Indigenous Agroforestry; *Melia volkensii* in Kenya. *Agroforestry today*, 6(4): 10-11; Kidundo, M. (1997): *Melia volkensii* - propagating the tree of knowledge. *Agroforestry today* 9 (2): 21-22.

2 Konuche, P.K.A. (1994): The influence of light environment on indigenous tree seedlings in Kenya. PHD thesis, University of Edinburgh 196pp.

A - Moulds on germination media. B - *Fusarium* spp. and common moulds. C - Diseased cotyledons on germinated seeds. D - Healthy seedlings sprayed with Benlate E - Post emergent damping-off yellowing and leaf spots F - Wilts and dieback of *Melia* seedlings (All photos by KEFRI)

rotting of wood. This will reduce the market value of construction woods. Crown breakage has also been observed on mainly infected trees. Leaf diseases on such trees include leaf blights, severe chlorosis, spots and powdery mildews.

Fungi isolated from the various disease symptoms

Several species of fungi have been isolated from diseased plant parts. These included; *Fusarium solani*, *F. oxysporum*, *Colletotrichum* sp., *Phomopsis* sp. and some *Botryosphaeriaceae* spp. (*Neofusicoccum parvum* and *Lasiodiplodia theobromae*) were isolated from the diseased plant parts. *N. parvum* and *L. theobromae* were isolated in higher frequencies from stem cankers and also branches and twigs with dieback symptoms. The combined effects of *Fusarium* spp. and *Botryosphaeria* spp. were observed to cause severe root collar rots, which were very destructive on young saplings in the field, causing wilting and death.

Fungi isolated from leaves include *Colletotrichum* sp, *Alternaria* sp, and *Oidium* sp. (powdery mildews). Two wood rotting fungi; *Wrightoporia tropicalis* and *Ganoderma* sp. were observed to decay standing *Melia volkensii* trees. The above fungi are highly pathogenic and cause severe diseases on a wide range of plants including forests, ornamental and agricultural crops.

Fusarium spp, *Phomopsis* spp cause both pre and post-emergent damping off in many plants. The presence of these fungi on evergreen tree crops such as trees on small-scale farms, pose a challenge to general farm production given their unspecific nature of infection. It is therefore important that preventive measures be undertaken to avoid the spread and subsequent infection of other trees on the farms.

Management options of the various disease symptoms

Control of tree diseases is difficult especially if the trees have passed the seedling stage. The best stage to control for diseases is at the seed and seedling stage. These include:

- Seed treatment with systemic fungicides and maintaining seedling hygiene during sowing to avoid pre and post-emergent damping off of seedlings, especially at the nursery stage. In our experiments, treating seeds with Lindane³ effectively controlled surface contaminants and reduced pre and post-emergent damping off.
- Soil drenching around infected plants to stop the fungal spores from germinating in the nurseries.



G - Typical stem canker H - Breakages from cankered stems I - Basal stem canker J - Death (healthy trees in the background). (All photos by KEFRI)

- Use of systemic and curative fungicidal sprays on young seedlings, where infections are already present in the field. There are no specific fungicides for tree diseases and not much research has been done to test available fungicides on tree seedlings. However, our experiments with some broad-spectrum fungicides show that some of them are effective against a wide range of fungi. Foliar diseases caused by *Colletotrichum* spp

and *Alternaria* diseases could be controlled using foliar sprays of copper based fungicides (Copper hydroxide and Copper oxychloride). Other broad-spectrum fungicides (including the tebuconazole group) that are effective against foliar and soil-borne pathogens, could also be used. All fungicides must be used and stored according to the manufacturer's instructions.

³ Note of the Technical Editor: Lindane is a persistent organic pollutant classified as a dangerous and pesticide and as such better substituted by an alternative.

- Restricting movement of seedlings and plant debris from areas of infestation as well as removing and burning infested seedlings. Do not put infected material near the nursery to avoid spreading the fungi through spores and/or mycelia. Grow healthy plants with appropriate fertilisation with nitrate fertilisers, irrigation and weed control.
- Where the disease is present on older plants, removal or pruning of infected branches will help to reduce disease spread. Remember that infected material should be burnt.

Research strategy

KEFRI has embarked on regular field surveys and laboratory isolations and identification of the fungi. Systematic collection, analysis and interpretation of data on the epidemiology and impacts of the disease are ongoing. These results will be an important tool in forecasting disease spread and outbreaks as well as giving information on the most appropriate and long-term methods of disease control.

Conclusions

It is not yet clear why *M. volkensis* has become susceptible to fungal attacks. Our preliminary research results on seeds indicate that some fungi could be seed-borne. The isolation of *F. oxysporum* especially from basal stem cankers indicates

that the fungus could be soil-borne, noting that species in the genus *Fusarium* cause serious pre- and post-emergent damping off in many plants. The two *Botryosphaeriaceae* species - *N. parvum* and *L. theobromae* - exist mainly as endophytes but become serious pathogens when host plants are exposed to stressful environmental conditions (Desprez-Loustau et al., Slippers et al.)⁴ Changes in climatic conditions, land use practices and movement of infected planting materials may have predisposed *M. volkensis* to fungi attacks.

Important:

All *M. volkensis* growers and extension workers should report any unusual symptoms immediately to the nearest Kenya Forest Service, Forest Department Office, any KEFRI research centre or the nearest government administrative office.

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⁴ Desprez-Loustau, M.L., Marçais, B., Nageleisen, M.L., Piou, D., & Vannini, A. (2006) Interactive effects of drought and pathogens in forest trees: *Ann. For. Sci.* 63, 597-612.
Slippers, B. & Wingfield, M. J. (2007) *Botryosphaeriaceae* as endophytes and latent pathogens of woody plants: Diversity, ecology and impact. *Fungal Biology Reviews* 21, 90-106.

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