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African Black Wood used as a Medicinal Purpose

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ABSTRACT

African Blackwood (ABW) (Dalbergia melanoxylon) mainly occurs in the coastal areas of East Africa, including in Tanzania and Mozambique and its heartwood is commonly known to be one of the most valuable materials used in the production of musical instruments. Although the heartwood is one of the most expensive timbers in the world, very low material yield has recently resulted in the significant reduction of natural individuals. This might have serious impact on local communities, because this tree is apparently the only species that can support their livelihood. Therefore, a solution to the problem is urgently needed in terms of the sustainable development.

Keywords: Headache, Asthma, Skin diseases, Ghonerrea, African Blackwood (ABW)

INTRODUCTION

In this study, we survey environmental factors (stand structure and soil properties) in the Miombo woodlands of southern Tanzania, where ABW was once widely distributed, to clarify the factors affecting growing conditions of ABW. Three community forests located in Kilwa district, Lindi, Tanzania, were selected as the survey sites and 10-13 small plots (0.16 ha/plot) were randomly established at each site. In addition, the stem qualities of standing trees were evaluated by visual inspection rating and a non-destructive measurement of stress wave velocity, for understanding the relationship between environmental factors and growth form [1]. It was found that ABW was widely distributed under various environmental conditions with intensive population and that their growth form depended on environmental factors. Since there was no significant difference of stress wave velocities among the site, our findings suggest that the dynamic properties of ABW trees does not depend on growth conditions, which is generally influenced by various external factors. These results present important information regarding the sustainable forest management of ABW [2-4].

Dalbergia melanoxylon (African Blackwood, Grenadilla or Mpingo) is a flowering plant in the family Fabaceae, native to seasonally dry regions of Africa from Senegal east to Eritrea and south to the north-eastern parts of South Africa [5]. The tree is an important timber species in its native areas; it is used in the manufacture of musical instruments and fine furniture. Populations and genomic resources for genetic biodiversity maintenance in parts of its native range are threatened by overharvesting due to poor or absent conservation planning and by the species low germination rates [6].

It is a small tree, reaching 4 m-15 m tall, with grey bark and spiny shoots. The leaves are deciduous in the dry season, alternate 6 cm-22 cm long, pinnately compound, with 6-9 alternately arranged leaflets. The flowers are white and produced in dense clusters. The fruit is a pod 3 cm-7 cm long, containing one to two seeds [7].

Scientific information

Common name(s): African blackwood, Mpingo (Swahili), Grenadilla.

Scientific name: *Dalbergia melanoxylon.*

Distribution: Dry savanna regions of central and southern Africa.

Tree size: 20 ft-30 ft (6 m-9 m) tall, 2 ft-3 ft (0.6 m-1.0 m) trunk diameter.

Average dried weight: 79 lbs/ft^3 (1,270 kg/m^3).

Specific gravity (basic, 12% MC): 1.08, 1.27.

Janka hardness: 3,670 lbf (16,320 N).

Modulus of rupture: 30,970 lbf/in2 (213.6 MPa).

Elastic modulus: 2,603,000 lbf/in2 (17.95 GPa).

Crushing strength: 10,570 lbf/in2 (72.9 MPa).

Shrinkage: Radial: 2.9%, tangential: 4.8%.

Identification: See the article on hardwood anatomy for definitions of endgrain features.

African blackwood (endgrain 10x).

African blackwood (endgrain)

African blackwood (endgrain 1x)

Porosity: Diffuse porous.

Arrangement: Solitary and radial multiples.

Vessels: Medium to large, few, dark grey to black deposits present.

Parenchyma: Diffuse in aggregates, vasicentric, winged and banded (sometimes marginal and/or reticulate).

Rays: Narrow, normal spacing.

Lookalikes/substitutes: Commonly confused with species of ebony (*Diospyros* spp.) both of which can have completely black heartwood.

Notes: Portions of the lighter sapwood have been included to help illustrate anatomical features more clearly. In very dark woods, it’s very useful to look at sapwood rather than heartwood to help see details that would otherwise be obscured in blackness [8-10].

Growth: The trees have a scruffy appearance and are frequently multi stemmed and extensively branched. They grow very slowly and often in very gnarled and twisted shapes. Their boles are very often highly buttressed or fluted so the full diameter of the log is not available for use due to the deep intrusions of bark and sapwood that often occur. Photographs of end cuts of *Dalbergia melanoxylon* are notable because of the stark black color of the heartwood which is ringed by these irregular, sometimes petal shaped buttress protrusions, all outlined in creamy coloured sapwood. Harvestable size is not reached until an estimated 70 to 100 years. Mature trees are typically between 4.5 m and 7.5 m high and rarely exceed 0.3 m. (1 foot) in diameter [11]. In some tree databases tree size listings for African blackwood are often inaccurate, claiming 2 to 3 feet in diameter as normal. Only the rare tree in a highly protected environment has been found to be this large. As larger specimens have been harvested, the average available tree size has diminished over the decades of its use. The yellowish brown bark on the main stem flakes off in long strips and its smaller branches bear sharp spines 2 cm-3 cm in length. The tree is semi-deciduous, losing many of its leaves over the dry season in common with most trees of its habitat. The flowers are small, white, sweetly scented and grow in tight clusters. They develop into greyish, papery pods each containing one or two seeds which are wind dispersed (Figure 1).

Figure 1 showing African Blackwood (ABW).

MATERIALS AND METHODS

Plant material source and cuttings preparation source of cuttings materials were taken from two types of explants namely juvenile donor plants and mature donor plants. Juvenile donor plant cuttings were taken from 3 years old seedlings all from one open pollinated family grown in nursery while mature donor plant cuttings were taken from 15 years old mature plants. Both juvenile and mature donor plant cuttings were collected from Mkundi provenance in Morogoro, Tanzania. From each age a total of 60 donor plants were used. Proper physiological condition that promotes ready adventitious rooting and freedom from insects and disease were considered for selection of both juvenile and mature donor plants. Seedlings and cuttings of mature donor plant enclosed in a polythene bags were transported to the propagation site at the department of botany, university of Dar es Salaam [12]. Cuttings for both juvenile and mature donor plants were divided into three cutting positions from their shoots namely apical, middle and basal position of stem cuttings. Cutting positions were assigned starting at node 4 from the apex of the shoots as apical, followed by middle and basal positions sequentially down the shoots for both juvenile and mature cuttings. Seedlings height ranged from 54 cm to 71 cm; the cuttings positions from these juvenile donor plants were cut having length of 15 cm and a diameter of 0.4 cm-1.0 cm. Cuttings from shoots mature donor plant were cut having a length of 20 cm and diameter range of 0.8 cm-1.4 cm. Lengths of cuttings were kept 15 cm for juvenile compared to 20 cm for mature due to short seedlings shoot heights which could not be possible to get three cutting positions per shoot split plot experimental design was used whereby the experiment had three factors: Age donor plant, IBA treatment and cutting position. Major treatment factor was the age of donor plant which had two levels (juvenile and mature), sub major treatment factor was IBA treatment which also had two levels (300 ppm and 0 ppm) and minor treatment factor was the cutting position which had three levels (apical, middle and basal position). Based on earlier findings by Amri 2002 on trial for determination of optimal IBA concentration, 300 ppm IBA was selected for this experimentation as it has given high.

RESULTS AND DISCUSSION

Medicinal uses

Dalbergia melanoxylon is well known throughout eastern Africa as a medicinal tree, usage being made of its bark, leaves and roots and it is found in many listings of African medicinal plants. Since there is such widespread use of native plants for healing in Africa, the loss of habitat for the Mpingo tree has significant detriments for the people, because such plants are regarded as ‘irreplaceable’ species.

These are some of Mpingo’s medical usages:

- **Root decoction:** Treatment of abdominal pain, hernia and gonorrhea also used for abortion and as an anthelmintic (for intestinal parasites).
- Smoke of the burning root is used for headache, rhinitis and bronchitis.
- The bark is an antidiuretic.
- The leaves are used for throat inflammations, heat problems, syphilis, gonorrhea and dysentery.
- **Use of heartwood:** Use a sharp knife to scrape the heartwood and mix the shavings with skin lotion or oil to treat skin diseases.

Its leaves can be mixed into a goat soup that is said to be efficacious for the relief of backache and joint pain. In Kenya the tree has become over exploited for its use in curing coughs and stomach pain. For centuries the Venda people of South Africa have used the bark as an anti-bacterial. In 1993 a revue in the journal of ethnopharmacology reported on scientific tests carried out at the department of pharmacy at the university of Zimbabwe verifying this use, determining the existence of anti-microbial activity relating to use of the bark of *Dalbergia melanoxylon*. Several more recent studies have verified this use [13].

Mpingo is also important in cultural and ceremonial practices; including bathing a new-born infant in a concoction made from the tree's pounded leaves mixed with water to ensure that the baby grows strong. The Chagga people of Kilimanjaro have a traditional belief that if you have a piece of Mpingo wood in your house, it will bring peace and everybody in the family will be happy with one another.

Analysis of the interactions between treatments illustrated many significant effects on rooting in *D. melanoxylon*. The significant interactive effect of age of donor and IBA treatment for percent rooting revealed that IBA treated cutting from juvenile donor plant had higher rooting percentage than IBA treated cuttings from mature donor plant. Untreated cuttings from juvenile donor plant had low rooting percentage whereas none of cuttings from mature donor plant rooted without IBA application. Rout has also found that the beneficial effects of applied IBA on rooting cuttings decreased with age of donor plant due to decreased sensitivity of aging tissues to rooting promoters. A study by Swamy, et al. investigated the effect of maturity and IBA application on rooting of *Robinia pseudoacacia* found that cuttings from mature trees were not only more difficult to root, but that juvenile cuttings also responded better to IBA application. A study on the effect of IBA and juvenility on the rooting of *Rhamnus caroliniana* cuttings also found a significant interaction between the effects of IBA and age of donor plant whereby juvenile cuttings treated with IBA at 3,000 ppm, had higher rooting than mature cutting at the same IBA concentration. On the other hand, significant interactions between cutting position and age of donor plant, the cutting position and IBA treatment occurred, especially regarding the rooting percentage, root number and root dry weight. The occurrence of such interactive effects between factors could be closely related to the endogenous auxin balance and the amount of carbohydrates in the cuttings and the donor plant, as it has been reported for many forest species. Moreover, auxin-carbohydrate interactions are also observed to be vital for rooting in Arabidopsis, *Tectona grandis* and *Dalbergia sissoo*. New forests 39:183-194 191123.

Callus and root nodules formation callus formation was more prominent in mature cuttings compared to juvenile stem cuttings of *D. melanoxylon* particularly those taken from the basal and middle positions. From the results it seems that differentiation of vascular tissue within the callus at the base of the cuttings is more likely to occur with mature cuttings which were influenced by the quality of the callus produced at the base of their cuttings than from juvenile cuttings. Some of the callus at the base of cuttings of *D. melanoxylon* differentiated into roots, thus it seems important to have a high callus formation for better rooting. Callus formation is frequently described as resulting in adventitious rooting. Nevertheless, other findings by Hartmann and Kester 1975 reported that formation of callus and the formation of roots are independent of each other. In some species, however, mature cuttings, adventitious roots have been found to originate from the callus tissue formed at the basal end of the cuttings. In such cases, callus formation is a precursor of adventitious rooting as it was evident in this study of *D. melanoxylon*. Bonga has attributed the non-differentiation of callus into roots could either be due to lack of sufficient food reserve and some internal factors and/or age of the cuttings. Such limitations could also be causative factors to non-rooting in *D. melanoxylon*. Root nodules formation on roots of some rooted stem cuttings of *D. melanoxylon* was evident in this study particularly from basal cutting position of juvenile donor plant. An average of 5-8 nodules per rooted cutting was observed. All three cutting positions from mature donor plant showed no root nodule development on their roots. Root nodules formation on rooted stem cuttings from juvenile donor plants as observed in this study revealed a leguminous characteristic of *D. melanoxylon* for nitrogen fixation. With such ability for nitrogen fixation, *D. melanoxylon* can be incorporated into agroforestry systems in order to improve soil fertility and enhance agricultural production. Therefore, vegetative propagation techniques can greatly contribute to future domestication trials of *D.*

melanoxylon as a potential tree for poverty alleviation by generating income for poor subsistence farmers. Domestication of *D. melanoxylon* can also reduce already existing pressure by overexploitation in its natural populations. The non-mist propagator used in this study is appropriate for tropical areas as it does not require electricity or piped water and can be constructed from cheap, locally available material. The system is appropriate for small scale commercial and community reforestation projects (Figure 2 and Table 1).

Figure 2 Dalbergia melanoxylon plant.

Table 1 Sources of variation.

Source of variation	**df**	**Mean squares**			
		Rooted cuttings (%)	**Root number**	**Root length (cm)**	**Callused cuttings (%)**
Duplicate blocks	2	2.78	0.10	1.21	144.44
Age of donor plant	1	6136.11	125.56	14.44	1600.6
Donor (a)	2	2.78	0.13	0.83	33.33
treatment	1	18,225.0	532.84	218.05	900.0
Age of donor plant × IBA treatment	1	3,802.78	60.06	1.52	544.44
Donor (b)	4	13.89	4.15	0.34	22.22
Cutting position	2	1302.78	88.94	16.42	419.44
Cutting position × age of donor plant	2	352.78	38.01	4.19	325.00
Cutting position × IBA treatment	2	608.33	52.63	6.62	208.33

Cutting position × IBA treatment × age of donor plant	2	36.11	15.89	0.32	136.11
Rolled error (c)	16	29.17	3.02	0.46	22.22
Note: Medicinal use of black wood (shisham), black wood is bitter, sticky, astringent, reduces swelling and has warming power and causes abortion. Black wood cures white leprosy, vomiting, worms, diarrhoea, ulcer inflammation, blood disorder.					

ABW trees were investigated to figure out the appropriate conditions for growth and quality requirements as musical instruments. ABW can survive under various environmental conditions with intensive population. However, the trees living under inferior conditions in wooded grassland tended to have smaller DBH, lower height and worse appearance. By contrast, the trees in open woodland, Kikole and Nanjirinji, showed better qualities in tree form and appearance. Especially, the trees tended to have larger DBH, higher height and better appearance in Nanjirinji site where the soils with better properties were mostly observed.

CONCLUSION

In conclusion, the present study has revealed that the best combination of factors for vegetative propagation of *D. melanoxylon* by stem cuttings is the use of basal cutting position from juvenile donor plant treated with IBA at 300 ppm. Many poor farmers are interested in fast growing; multipurpose tree species for quick earning, therefore vegetative propagation may reduce the rotation time of *D. melanoxylon* which normally takes between 70 and 100 years from seed germination to maturity for wood harvesting. Propagation through stem cuttings will be a rapid means for mass propagation of the species and will serve as alternative to the use of seeds in *D. melanoxylon* which has poor germination. It is also recommended that *D. melanoxylon* should be incorporated into agroforestry systems in Tanzania especially where soil is known to be nitrogen deficient because of its ability for nitrogen fixation.192 new forests.

REFERENCES

[1] Cunningham AB, et al. More than a music tree: 4400 years of *Dalbergia melanoxylon* trade in Africa. *South African Journal of Botany*, Vol. 98, 2015, pp. 167.

[2] Malimbwi RE and Luoga EJ. Prevalence and standing volume of *Dalbergia melanoxylon* in coastal and inland sites of southern Tanzania. *Journal of Tropical Forest Science*, Vol. 12, No. 2, 2000, pp. 336-347.

[3] Sprofman R, et al. Characterization of acoustic and mechanical properties of common tropical woods used in classical guitars. *Research Physician*, Vol. 7, 2017, pp. 1737-1742.

[4] Bremaud I, et al. Characterisations and categorisation of the diversity in viscoelastic vibrational properties between 98 wood types. *Annals of Forest Science*, Vol. 69, No. 3, 2012, pp. 373-386.

[5] Nshubemuki L, et al. Chance discoveries and germplasm conservation in Tanzania: Some observations on ‘reserved’ trees. *Environment Conservation*, Vol. 22, No. 1, 1995, pp. 51-55.

[6] Campbell B, et al. Miombo woodlands and their use: Overview and key issues. *International Journal of Forestry Research*, 1996, pp. 1-10.

[7] Khatun K, et al. Fire is REDD+: Offsetting carbon through early burning activities in South-Eastern Tanzania. *Oryx*, Vol. 51, No. 1, 2017, pp. 43-52.

[8] Ball SM. Stocks and exploitation of east African blackwood *Dalbergia melanoxylon*: A flagship species for Tanzania’s Miombo woodlands?. *Oryx*, Vol. 38, No. 3, 2004, pp. 266-272.

[9] Christian MY, et al. The influence of tourism on the woodcarving trade around Cape Town and implications for forest resources in southern Africa. *Development Southern Africa*, Vol. 25, No. 5, 2008, pp. 577-588.

[10] Boutin H, et al. Acoustic dissipation in wooden pipes of different species used in wind instrument making: An experimental study. *The Journal of the Acoustical Society of America*, Vol. 141, No. 4, 2017, pp. 2840-2848.

[11] Munishi PK, et al. Compositional gradients of plant communities in submontane rainforests of eastern Tanzania. *Journal of Tropical Forest Science,*2007, pp. 35-45.

[12] Munishi PK, et al. Plant communities and tree species associations in a Miombo ecosystem in the lake Rukwa basin, southern Tanzania: Implications for conservation. *Journal of Ecology and the Natural Environment*, Vol. 3, No 2, 2011, pp. 63-71.

[13] Banda T, et al. Woody vegetation structure and composition along a protection gradient in a Miombo ecosystem of western Tanzania. *Forest Ecology and Management*, Vol. 230, No. 1-3, 2006, pp. 179-185.