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Narrow-Crowned Variants of Mulanje Cedar (Widdringtonia nodiflora Powrie) in Malawi

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Summary

Narrow-crowned, thin-branched, and thin-barked variants of this indigenous fine-timber tree are reported. The probable genetic basis of these variants is discussed and their potential practical value in indigenous silviculture and arboriculture is indicated.

Key words: Widdringtonia, Mulanje Cedar, Crown form.

Zusammenfassung

Es wird über schmalkronige, fein-astige und dünnborkige Varianten der in Malawi einheimischen Wertholzbaumart *Widdringtonia nodiflora* Powrie berichtet. Die wahrscheinliche genetische Basis dieser Varianten wird diskutiert und auf ihren potentiellen praktischen Wert für den heimischen Waldbau und die Züchtung hingewiesen.

Introduction

Mulanje Cedar (*Widdringtonia nodiflora* (L.) Powrie syn. *W. whytei* Rendle), the National Tree of Malawi, is one of five species of native African Cypresses taxonomically close to the Australian *Callitris* and the monotypic N. African genus *Tetraclinis* (Chapman, 1961). This species was first reported by Alexander Whyte in 1891 from Mt. Mulanje in erstwhile Nyasaland (now Malawi) whence its common first name. It yields a durable fragrant timber much like that of the true Cedars (*Cedrus* spp.) and hence the second name. Departmental exploitation of natural forests of this Cedar on Mt. Mulanje by the colonial government for timber began around 1900 and continued for about 50 years. Simultanously plantations of it were also raised first on Zomba Mt. 70 km north of Mulanje Mt. and subsequently elsewhere in the country.

Material

During my very first tour of the Zomba Mt. *Widdringtonia* plantations on 21st August, 1985, I noticed a few narrow-crowned, heavy branched typical Cedar trees in a 1907 plantation in Compt. 34F. In their crown shape, stem form and bark colour, these offtype trees were so strikingly different from the even-aged typical neighbouring trees that not till twigs bearing seed cones could be collected by tree climbers from their crowns could I be certain that they too were Mulanje Cedar but of a different kind.

No records exist as to the seed source used for raising this 79-year old plantation but it is very likely that the seed would have come from the Thuchila plateau on Mt. Mulanje where departmental extraction in Cedar forests was in progress at that time. As far as can be ascertained from the compartment register one thinning was done in this stand in 1962. At present there are approximately 300 Cedar trees standing in this 0.12 ha plot out of which about a dozen are atypical narrow-crowned variants.

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Figure 1. — *A:* Five atypical trees in a row; *B:* Typical tree; *C:* Two atypical trees with one typical tree in the background; *D:* Atypical tree; *E:* Close-up view of crown of atypical tree; *F:* Atypical tree with two typical neighbours; *G:* Adjacent atypical and typical tree stems; note striking differences in bark and branch characters; *H:* Cores of four atypical trees (1—4) and four typical trees (5—8); note that bark in the former is only half as thick as in the latter, as is evident on the left-side white background. (Individual tree numbers correspond to those in the text).

Observations

Figure 1, A—G illustrates some of the atypical trees and their typical neighbours and in *Table 1* are summarised the morphological differences that set apart the two kinds. *Table 2* gives the individual measurements of eight atypical trees (PI—PVIII) and an equal number of typical trees (TI — TVIII) standing close to them. A perusal of the two tables will show that apart from several obvious morphological differences in stem, bark and foliage, there also are clear differences between the typical and atypical trees in total height, length of clear bole, crown-width, diameter growth and bark thickness.

Whereas sizable quantities of naturally pollinated seed could be harvested from the broad crown of most typical trees, the atypical trees as a rule yielded only small quantities of seed from their restricted crowns. Two of them viz. PI and PII failed to produce any seed during 1985 and yielded minute quantities of it in 1986. PIII yielded the largest quantity of seed for any atypical tree during both these years. Seed of all atypical trees were however viable and germinated relatively faster than those derived from typical trees.

Of a total of 3000 seedlings that were raised early in 1986 at the Institute nursery, less than a hundred were from atypical tree parents and seventy three of these were from the PIII parent tree. Seedlings of this family were different and easily distinguishable from those derived from several typical tree parents. The former had reddish stems at the cotyledon stage, light green cotyledons and juvenile leaves as against blackish stems and glaucous green cotyledons and needles of the latter. Further, the needles on PIII seedlings were relatively longer, stiffer and narrower at the tip as compared to those on seedlings from typical parent trees. These juvenile differences are apparently correlated with the differences observed of the adult trees of the two kind. Similar juvenile character comparisons were not possible in the case of other atypical trees because there were very few seedlings of them.

Table 1. — Comparative morphology of typical and atypical trees.

Character	Typical trees	Atypical trees	Fig.no.
Crown	Wide and flat-topped	Narrow, elliptical, pyramidal or conical	A-E
Bole	Short clear bole	Long clear bole	F
Stem surface	Rough	Smooth	G
Branches	Long, irregular, heavy, persistent	Short, regular thin, deciduous	B-E
Bark colour	Dark	Light	B,C,G
Foliage	Leaf sprays shorter, blunt at the tip, scale leaves broader, not closely appressed to axis; dark green in colour	Leaf sprays longer, finer and pointed at the tip, scale leaves narrower closely appressed to axis; glaucous green in colour	-

Discussion

In many North Temperate species of conifers narrow-crowned varieties have long been known and described by taxonomists under appropriate varietal names such as *pyramidalis, columnaris, fastigiata, pendula* etc. (see Dallimore and Jackson, 1954). The narrow-crowned variants of Mulanje Cedar reported here probably represent a similar true-breeding variety of this native Central African conifer.

Recently Finnish tree breeders obtained a 1:1 segregation of narrow-crowned and normal trees in open pollinated progeny of a 90-year old narrow-crowned tree of Scots pine (Karki, 1986) and two 'pendula' trees of Norway Spruce (Lepisto, 1984) suggesting that the parent trees they investigated were heterozygous for a single gene dominant mutation with pleiotropic effects. The same could also be true of the narrow-crowned atypical Mulanje Cedar trees described here. Further investigations are continuing.

Karki (1980, 1985) enumerated the several possible advantages of using genetically narrow-crowned tree ideotypes in plantation forestry. The narrow-crowned Mulanje Cedar variants reported here could potentially have similar advantages in future Silviculture and Arboriculture of this valuable native conifer.

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*) not seen in original

Table 2. — Comparative measurements of typical and atypical trees for six characters.

Character	Typical Trees									Atypical Trees								
	I	II	III	IV	V	VI	VII	VIII	Average	I	II	III	IV	V	VI	VII	VIII	Average
Total height (m)	32.3	29.6	30.1	29.9	32.6	32.8	28.8	35.1	31.4	31.8	32.6	31.6	31.8	32.1	33.1	33.6	33.6	32.5
Height of clear bole (m)	14.8	12.3	14.3	14.3	14.8	13.8	13.8	11.1	13.7	17.6	17.3	19.1	17.6	16.6	14.3	17.8	18.6	17.4
Crown height (m)	17.5	17.3	15.8	15.1	17.8	19.0	15.0	24.0	17.7	14.2	15.3	12.5	14.2	15.5	18.8	15.8	15.0	15.2
Crown width (m)	8.6	15.8	10.5	8.6	10.1	10.0	8.3	12.2	10.5	3.2	2.6	3.6	4.0	4.4	4.6	2.5	5.4	3.8
DBH OB (cm)	57	57	61	53	52	54	48	71	56.6	34	35	40	34	34	32	32	37	34.8
Bark thickness (cm)	1.4	1.2	1.3	1.4	1.6	1.5	1.6	1.3	1.412	0.4	0.6	0.6	0.7	0.6	0.6	0.6	0.5	0.575

Growth and Ectomycorrhizal Development of Loblolly Pine Progenies Inoculated with Three Isolates of Pisolithus tinctorius

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Summary

Loblolly pine (*Pinus taeda* L.) progenies from an Oklahoma, USA, tree improvement program were inoculated with different isolates of the fungal symbiont *Pisolithus tinctorius*. Seedlings showed genetic variation in ectomycorrhizal development, shoot height, component dry weights, and net assimilation rate. Rapid growing progenies exhibited superior mycorrhizal colonization and a positive correlation between infection and total dry weight. Net assimilation rates of seedlings from each family inoculated with selected strains of *P. tinctorius* were superior to con-