A NOTE ON ANATOMICAL, PHYSICAL AND MECHANICAL PROPERTIES OF *CONOCARPUS LANCIFOLIUS* ENGLER WOOD

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ABSTRACT

Anatomical, physical and mechanical properties of *Conocarpus lancifolius* wood grown in Sindh were determined. Density and strength properties of the wood were compared with that of Shisham (*Dalbergia sissoo*) and Babul (*Acacia nilotica*) wood. *Conocarpus lancifolius* wood was found to be better than Shisham wood and comparable to Babul wood in maximum compression parallel to grain, compression parallel to grain at elastic limit and impact bending strength.

INTRODUCTION

Conocarpus lancifolius is one of the more promising trees for growing in arid and saline soils. It is naturally found in Somalia and in Southwestern part of the Arabian Peninsula from sea level up to 1000 m (Annon.1983). It grows best in areas where the mean annual temperature ranges from 20^0 - 30^0C, and where the maximum summer temperature reaches 50^0C. It is also cultivated in Sudan, Kenya, North and South Yamman and Pakistan.

Conocarpus lancifolius is an evergreen tree and is usually multibranched in its natural habitat. Whereas those cultivated in Sudan form a single straight stem. It grows up to 10 - 20 m in height and 60 - 250 cm or more in diameter.

The wood is light coloured and of medium to heavy density (specific gravity 0.810). It is strong wood and is used for poles in house construction, in carpentry, building dhows and ship knees. It is also good firewood and is used for charcoal making.

At present there is considerable shortage of timber especially commercial timbers in Pakistan. Therefore, it is necessary to study the technical properties of fast growing but commercially less important timbers to increase their utilization. These include *Conocarpus lancifolius* which was planted at Miani Reasearch Station and Mirpur Methelo, Sindh in 1973 (Khan and Soomro,1979).

A study was carried out to evaluate the suitability of *Conocarpus lancifolius* wood for different uses and results are reported in this paper.

MATERIAL AND METHOD

The experimental material was obtained in log form from Forest Department, Hyderabad, Sindh. In order to study the anatomical properties, the samples were removed at 1.2 m distance from the butt end of logs. Permanent slides of cross, radial and tangential sections were prepared by standard laboratory method to study the microscopic features. Small portion of wood was also macerated in 20% nitric acid and potassium chlorate to measure the fibre dimensions (Johansen,1940) . About 50-100 observations were made for each microscopic feature and the data was analysed for average values, standard deviation and co-efficient of variation.

For physical and mechanical properties the material was converted into 7 cm thick planks which were air dried to about 12% moisture content in an air-seasoning shed. The test specimens were prepared from the planks in accordance with the procedure given in the standard methods. An effort was originally made to condition air-seasoned specimens to a uniform moisture content of 12% before testing. Some test specimens however, had a moisture content slightly higher or lower than this level. For this reason, the air-dry strength values were adjusted to values for moisture content of 12% as provided in the standard properties. The test specimens of the following sizes were prepared from each planks for determination of different strength properties.

i. Static bending 30 cm x 2 cm x 2cm

ii. Impact bending 30 cm x 2 cm x 2 cm

iii. Maximum compression parallel to grain 6 cm x 2 cm x 2 cm

iv. Tensile strength perpendicular to grain 7 cm x 2 cm x 2 cm

v. Cleavage 4.5 cm x 2 cm x 2 cm

vi. Hardness 10 cm x 2 cm x 2 cm

vii. Shear strength parallel to grain 2.5 inch x 2 inch x 2 inch (6.35 cm x 5 cm x 5 cm)

viii. Compression perpendicular to grain 5cm x 5 cm x 5 cm

All strength tests were made in accordance with ISO and BS 373 except the shear test which was made according to procedure given in ASTM D 143-52.

RESULT AND DISCUSSION

Conocarpus lancifolius wood grown in Sindh, was for the first time tested for its anatomical, physical and mechanical properties. The results are discussed below:

General properties

Wood is yellowish grey to grey colour, has interlocked grain and is of medium to high density (810 kg/m^3). Growth rings are inconspicuous, delimited by dense fibrous tissue and small vessels in the outer portion of the growth rings.

Anatomical properties

Vessels are small to very small, thin walled with simple perforations, joined together by concentric bands of parenchyma, larger vessels are distributed in the middle portion of the growth rings gradually decreasing in size in the latewood, occur singly or in short radial rows of 2-3, and are about 16/mm^2 in number.

Paratracheal parenchyma is present forming 1 to 3 seriate incomplete sheath around the vessels or vessel groups, with lateral and oblique extensions which extend across the rays, forming concentric bands. Metatracheal parenchyma is also sparsely present.

Fibres are libriform, non-gelatinous, extremely fine, rounded in transverse section, arranged in rows and are occasionally septate.

Rays are fine, heterogeneous, uni-seriate to bi-seriate, closely spaced about 9/mm in number in cross section and 46/mm^2 in tangential section.

Physical and Mechanical Properties:

Wood density

The average density of *Conocarpus lancifolius* wood specimens was found to be 0.846 g/cm^3 and is greater than reported value (0.810 g/cm^3) in the literature for the same species.

Table 1. Dimensions and number of different types of anatomical structures and cells

	Number of vessels	Diameter of vessel	Fibre length	Fibre diameter	Fibre wall thickness	Number of rays in cross section	Number of rays in Tangential section	Height of ray		Width of ray		Size of paratracheal parenchyma
	/mm²	u	mm	u	u	/mm	/mm²	Cell	u	Cell	u	u
A.V	16	99	0.90	12.77	4.01	9	46	7	205	1-2	28	23
S.D	3.84	24.86	0.10	1.92	0.43	1.08	7.34	3.24	69.58	-	8.96	4.55
C.V%	12	25	11	15	10	12	12	45	34	-	31	19

Mechanical Properties:

As a matter of the fact density of a wood affects directly its strength properties. *Conocarpus lancifolius* wood has high values of different mechanical properties. This wood has better values for modulus of rupture, maximum compression parallel to grain, compression parallel to grain at elastic limit, shear parallel to grain, modulus of elasticity and hardness than Shisham wood tested for strength properties in the laboratory (Table 2).

Similarly the wood is also better in maximum compression parallel to grain, compression parallel to grain at elastic limit and impact bending strength when compared with Babul wood tested for its strength properties and obtained from Hyderabad, Sindh. In addition, modulus of rupture, modulus of elasticity, maximum shear parallel to grain, cleavage and end hardness of this wood are almost identical to that of Babul wood (Table 2).

CONCLUSION

On the basis of results, it is concluded that *Conocarpus lancifolius* wood is better than Shisham wood in about all strength properties. In addition to its traditional uses such as poles in construction, building dhows and ship knees etc., it can also be used for furniture as a substitute of Shisham wood. The wood is also similar to Babul wood in strength properties and can be recommended for the same purposes for which Babul wood is used.

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Table 2. Strength properties of *Conocarpus lancifolius, Acacia nilotica* and *Dalgergia sissoo* wood in air-dry condition

Species		Density	Modulus of rupture	Modulus of elasticity	Maximum compression parallel to grain	Compression parallel to grain at E.L	Compression perpendicular to grain at E.L	Max. shear parallel to grain	Tension perpendicular to grain	Impat bending	Hardness	
											Side	End
		kg/m^3	kg/cm^2	kg/cm^2	kg/cm^2	kg/cm^2	kg/cm^2	kg/cm^2	kg/cm^2	$m\text{-}kg/4cm^2$	kg	
Conocarpus lancifolius	A.V	846	1306	100939	609	408	101	168	29	4.90	718	95
	S.D	28	103	5551	72	44	8.37	28	2.34	0.58	45	58
	C.V%	3.30	7.89	5.50	11.96	10.78	8.29	16.66	8.07	11.84	6.26	6.09
Acacia nilotica	A.V	797	1337	105041	551	398	114	184	37	4.45	868	967
	S.D	44	115	6745	46	27	4.90	16	4.18	0.49	69	76
	C.V%	5.52	8.60	6.42	8.35	6.78	4.30	8.70	11.30	11.01	7.95	7.86
Dalbergia sissoo	A.V	730	1122	87541	571	449	148	173	17	1.79	785	637
	S.D	28	94	5871	50	41	14	16	2.96	0.48	57	67
	C.V%	3.84	8.38	9.97	8.76	9.13	9.46	9.25	17.41	26.82	7.26	10.52