TESTING AND EVALUATION OF SOME LOW VALUE WOOD SPECIES GROWN IN KALAM (SWAT), KHYBER PAKHTUNKHWA

Tanvir Hussain[1], Zahid Rauf [2] and G. M. Nasir[3]

ABSTRACT

A study was carried out to find the technological properties supportive to improve quality of three lesser known wood species before utilization grown in Kalam, Swat. Standard samples and wood sections were prepared from butt logs of each species to observe the structural features and determine physico-mechanical properties. Anatomical results revealed that Kasunder wood may be medium, Geiray better and Quercus wood may be good in strength. The wood of all the species may be less resistant to biological agents however, the seasoning and preservation behaviour of the woods may be slow. Based on the results of strength properties the wood of *Fraxinus xynthoxyloides* and *Alnus nitida* can be used in making items where minimum forces and loads act on the wood. *Quercus* wood has very good machining, nailing, carving, routing properties and can be used in making agricultural implements and tool handles. Further, the wood of *Fraxinus xynthoxyloides* and *Alnus nitida* can also be used as raw material for pulp and paper manufacture, however *Quercus* wood may not be suitable.

INTRODUCTION

Pakistan has meager wood resources insufficient to fulfill the demand of wood based industries because of increasing population, uplifting literacy rate and growing per GDP in the country. In order to meet the requirements, Pakistan have to import wood and wood products from all over the glob. Unfortunatelly, there are limited number of tree species which are commercially exploited. These tree species are being over harvested and expected to reach the level of extinction if appropriate measures are not made to find out their substitute. One way of addressing the problem of acute shortage of wood in the country is to focus on finding the uses of those tree species which have been not so far exploited for industrial utilization. A number of these have comparatively high growth rate than commercial tree species grown and utilized in Pakistan or elsewhere. These lesser known tree species can also be utilized after detailed research which may provide profitable ways to use them.

Kalam is bestowed with a wide range of tree species. Nearly 28 tree species belonging to 15 families are found in this ecological zone (Hamayum, 2005; Siddiqui, 1996; Sheikh, 1993). Some are of commercial importance and others are being used as fuel wood due to lack of knowledge about their technological properties. It is, therefore, important to approach testing and

[1] Assistant Wood Technologist, Pakistan Forest Institute, Peshawar
[2] Assistant Wood Seasoning Officer, Pakistan Forest Institute, Peshawar
[3] Logging Officer/Director, FPRD, Pakistan Forest Institute, Peshawar

evaluation of these tree species through various wood properties for better utilization in view of scarce sources of Pakistan for wood industries.

In this study three low value wood species grown in Kalam (Swat) were collected and studied with the objectives to compile basic data for anatomical and physico-mechanical properties, finding measures for the improvement of wood quality and evaluating their better utilization other than the conventional.

MATERIALS AND METHODS

Anatomical Properties

To carry out research work, the wood material in logs form were collected from Ushu, Kalam Valley Swat, Khyber Pakhtunkhwa. Discs of about two inches in thickness were cut and standard blocks of 1x1x2 cm were prepared from each log. Permanent slides of cross, radial and tangential sections of wood samples of all the species were prepared by standard laboratory procedures and observe under microscope for various anatomical features. Small portion of wood from each sample was macerated in Schulze's mixture (20% Nitric acid and Potassium chlorate) to separate the fibers and observe fiber length (Anon., 1974). Data were collected for the frequency and dimensional measurements of different wood elements/ structures in each wood sample by the process of micrometry (Anon., 1971) and analyzed for statistical variables for each feature in each sample.

Physico-mechanical Properties

To study the strength properties, the butt ends logs were taken and converted into planks of 2.5 inches thickness each. The material was stacked in seasoning shed to attain equilibrium moisture content and the samples of the following sizes were prepared according to standards (ISO Standards, 1975) for testing.

S.No	Property	Size of sample
1	Density	6cmx2cmx2cm
2	Static bending (MoR and MoE).	30cmx2cmx2cm
3	Impact bending	30cmx2cmx2cm
4	Compression parallel to grain	6cmx2cmx2cm
5	Compression perpendicular to grain	4cmx4cmx4cm
6	Tensile strength Perpendicular to grain	7cmx2cmx2cm
7	Cleavage	4.5cmx2cmx2cm
8	Hardness	10cmx2cmx2cm

The samples were tested on Amsler Universal Wood Testing machine with a total loading capacity of 4000Kg and an accuracy of 1% of its total loading capacity.

RESULTS AND DISCUSSION

Table 1. Frequency and Dimensional Measurements of Different wood elements/structures in the studied wood species grown in Kalam, Swat (Average values)

Anatomical Features	Units	Kasunder (*Fraxinus Xynthxyloides)*	Geiray (*Alnus nitida)*	Bunj (*Quercus* sp.)
Fiber length	(mm)	0.79	0.91	0.68
Fiber diameter	(µ)	18.35	24.61	16.32
Fiber wall-thickness	(µ)	2.95	2.78	5.95
Fiber lumen width	(µ)	12.45	19.05	4.42
Runkel ratio	-	0.47	0.29	2.69
Frequency of vessels	No. of vessels/mm^2	93.78	76.36	28.56
Vessels diameter	(µ)	89.98	108.27	106.24
Rays frequency	No. of rays/mm^2	57.08	177.32	93.05(fine)
Rays frequency	No. of rays/mm	7.18	12.96	7.93
Height of ray	(µ)	139.98	85.90	182.88
No. of cells in ray height	-	7.14	8.71	11.61
Width of ray	(µ)	19.33	11.14	9.36
No. of cells in ray width	-	1.94	1.12	1

Anatomical data of Kasundar (*Fraxinus xynthoxyloides*) wood given in Table 1 reveals that it may be medium in strength and hardness due to narrow lumen width and average wall thickness of fibers. Further, it could be assessed that the wood may ideally suitable for manufacturing of pulp and paper products. Regarding its natural durability, Kasundar wood may be less resistant to biological agents because of high frequency of wood rays per unit area both in tangential and cross sides and may not be used without chemical treatment which could be difficult in view of smaller size of vessels. Drying process of the wood may also be slow.

Greiray wood may be better in strength properties but low values of fiber wall-thickness and lumen width reflect its medium hardness. Moreover, the wood may reveal suitability for making pulp and paper products. High value of vessels frequency indicates its good preservation behavior but the wood may dry with moderate ease in view of vessels diameter. Further, the characteristics of wood parenchyma (wood rays) like its frequency both in tangential and cross-sides

and their relevant, height and size represent its less resistance to wood deteriorating agents. Therefore, its prior chemical treatment with preservatives may enhance durability of the wood.

Structural features of *Quercus* wood given in table1 revealed that the wood may be good in strength and very hard because of thick walled and narrow lumend fibers. The runkel ratio of fibers indicates non-suitability of the wood for the making pulp and paper products. High value of wood rays also reveals the low resistance of wood against biological agents and its impregnation with chemical preservatives may be slow. Further, seasoning of this wood may be somewhat difficult as the vessels are of medium size.

Table 2. Strength properties of the studied wood species grown in Kalam, Swat (Average values)

Strength Properties	Units	Kasunder (*Fraxinus xynthxyloides*)	Geiray (*Alnus nitida*)	Bunj (*Quercus* sp.)
Modulus of rupture	(kg/cm²)	809	945	809
Modulus of elasticity	(kg/cm²)	67115	90401	58623
Maximum compression parallel to grain	(kg/cm²)	196	310	267
Maximum compression perpendicular to grain	(kg/cm²)	44	60	150
Cleavage	(kg/cm)	24	26	29.5
Tensile strength perpendicular to grain	(kg/cm²)	17	18	30.5
Impact bending	(m-kg /4 cm²)	1.82	0.35	1.22
Hardness Side End	(kg)	 273 370	 413 530	 853 916
Density	(Kg/m³)	388	461	1101

Strength properties of Kasundar wood given in Table 2 showed that it is low density class wood. The wood is of low strength in terms of both MoR and MoE and may be used in light wooden activities and wood based products other than the mega structures. Cleavage, hardness, compression and tension values indicate that the wood may be used in wooden items making where minimum forces and loads act on the wood.

Results given in the Table 2 indicated that Geiray wood is a low density class wood. The Wood is of medium strength in terms of MOR& MOR and low strength with respect to compression parallel to grain. It means that the wood can't be used in building mega structures. Cleavage is moderate tensile strength is low and the hardness is low to moderate. Above qualities suggest that the wood may be used in the wooden articles where low to medium strength is a pre-requisite and for the manufacturing of wood based products.

Table 2 showed the properties of Bunj wood. It has very high density i.e. greater than the density of water. But the wood is quite brittle as it has low MoE value. MoE value of the wood is medium which enables the wood to be used in structures where medium strength is necessitated. Compression parallel to grain is very low and indicates that the wood may be used in Micro-structures i.e. furniture making etc. Cleavage and tension strength perpendicular to grain values are good and the hardness is high. This points out that the wood has very good machining, nailing, carving, routing, and properties and can be used in making agricultural implements and tool handles.

CONCLUSION

- Kasunder (*Fraxinus xynthoxyloides*) wood can be used in wooden items where minimum forces and loads act on the wood, and also suitable for manufacturing of pulp and paper products.

- Geiray (*Alnus nitida*) wood can be used in the wooden articles where low to medium strength is a pre-requisite and for the manufacturing of wood based products like particleboard, plywood, and pulp and paper products etc.

- Bunj (*Quercus* sp.) wood is very good in machining, nailing, carving, routing and can be preferred in making agricultural implements and tool handles. However, the wood is not suitable for the manufacturing of pulp and paper materials .

REFERENCES

Anon., 1971. Examination of Timber, Teaching Aid No.7.Timber Research and Development Association, Hughenden Valley, High Wycombe, Bucks.

Anon., 1974. The Preparation of Wood for Microscopic Examination.TIL52, Building Research Advisory Service; Building Research Station Garston, Watford WD27JR.

Hamayun, M., 2005. Ethnobotany of some useful trees of Hindu-Kush mountain region: A case study of Swat Kohistan, District Swat, Pakistan. Ethnobotanical Leaflets pp:1-10. (www.ethnoleaflets.com).

International Standards Organization (ISO), 1975. Wood-Determination of Density for Physical and Mechanical Tests.ISO3131-1975(E).

Sheikh, M. I., 1993. Trees of Pakistan, Pakistan Forest Institute, Peshawar.

Siddiqui, K. M., M. Ayaz and I. Mahmood, 1996. Properties and Uses of Pakistani Timbers. Forest Products Research Division, Pakistan Forest Institute, Peshawar. Printing Corporation of Pakistan Press, Islamabad.