WOOD ANATOMY OF PILU (*SALVADORA OLEIODES*)

Ghulam Mustafa Nasir[1] and Khalid Hussain Solangi[2]

ABSTRACT

Basic structure of Pilu (*Salvadora oleiodes*) wood was studied to ease its identification and provide the anatomical data helpful in different practices of wood testing and processing and assess its better utilization. Results revealed that in Pilu wood, the fibers were short, medium in diameter, wide lumened, fairly thick-walled and occupied about one third volume of the wood. The vessels were medium in frequency, smaller in diameter and engaged minimum volume of the wood. The wood rays were medium in frequency, a bit larger in size and occupied almost one third wood volume as fibers. The axial parenchyma was abundant and also occupied approximately one third volume of the wood. Over all, the parenchymatous cells occupied highest volume of the wood for the reason it may be non-durable and require preservative treatment when used as solid wood. However, preservation and seasoning behavior of the wood may be slow. Pilu wood may be medium in density and strength and can also be used for manufacturing of particleboard and pulp and paper in addition to its conventional uses.

INTRODUCTION

Pilu (*Salvadora oleiodes*) is a large evergreen shrub or small tree. It is native to Pakistan, restricted to hot dry areas of Punjab wastelands. It is intolerant tree grows in the deserts in well drained sandy soils and prefers an arid, dry subtropical, tropical climate. It grows about 6cm per year in height. It is a fodder species. The fruit is edible. It has also medicinal value. The leaves are used for cough, the root bark as vesicant and the fruit extract for spleen. The wood is straight grained, fine and even textured and used for wheels, building materials, boat building knees, tools and fuel (Sheikh, 1993).

The tree is not tall but occasionally reaches a girth of 12 feet with a broad low crown. The lower branches often droop and touch the ground. Large specimens are commonly surrounded by a ring of independently rooted plants due to seedlings springing up under the shade of the parent plants. The wood is light yellow moderately hard with small irregular purple heartwood and little used as timber (Parker, 1962).

This study was carried out to examine the basic structure of Pilu (*Salvadora oleiodes*) wood helpful in its identification and compile the anatomical data to facilitate different practices of wood testing and processing and evaluate its better utilization.

MATERIAL AND METHODS

To conduct the research work, the wood sample of Pilu (*Salvadora oleiodes)* was collected from the laboratory collection of authentic wood specimens. A block of

[1] Logging Officer, Pakistan Forest Institute, Peshawar
[2] Assistant Wood Technology Officer, Pakistan Forest Institute, Peshawar

about 13mm cube in size was cut from the specimen and prepared for sectioning. Permanent slides of cross, radial and tangential sections were prepared by standard laboratory procedures (Anon. 1974) and observed under the microscope for various structural features. A small portion of wood was macerated in 20% Nitric acid and Potassium Chlorate to separate the fibers and observe fiber length in the studied species. Data were collected for the following anatomical features by the process of micrometery (Anon. 1971).

- Fiber length
- Fiber diameter
- Fiber wall thickness
- Frequency of vessels per unit area
- Diameter of vessels
- Frequency of wood rays per mm² in tangential section
- Frequency of wood rays per mm in cross section
- Height of wood rays in number of cells and measurement
- Width of wood rays in number of cells and measurement

The data collected was analyzed for statistical variables such as mean value, standard deviation and co-efficient of variation of each microscopic feature. Runkel ratio (2 x fiber wall thickness/ lumen width) was also calculated to predict suitability of the wood for pulp and paper manufacture (James, 1980).

Photomicrographs of the cross, radial and tangential sections of the wood were prepared to show the wood structure and determine volumetric composition of the species from the cross section by wood image weighing method with the help of following formula (Brown *et al*., 1949).

$$\frac{\text{Weight of image of wood element in question}}{\text{Net weight of the wood image}} \times 100$$

RESULTS AND DISCUSSION

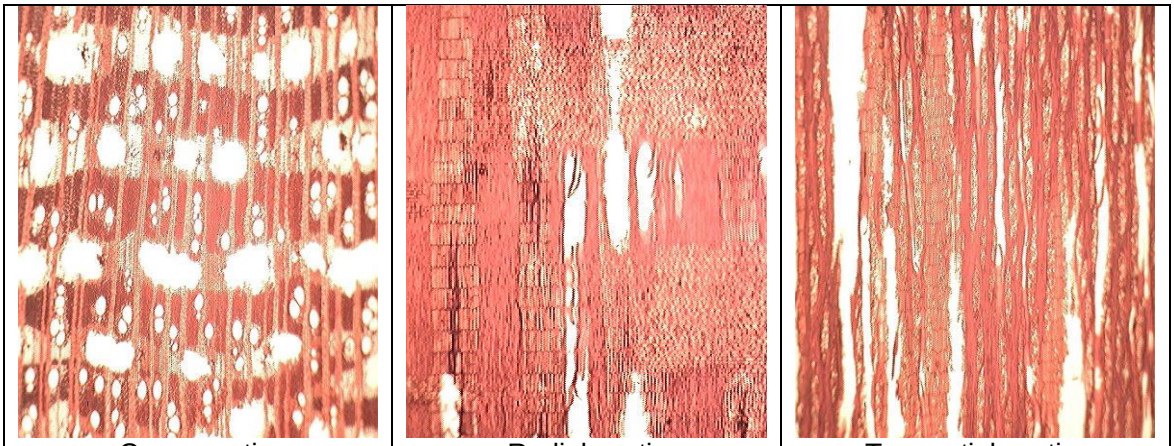
Structure of the Wood

In Pilu (*Salvadora oleiodes*) wood, the vessels are circular to oval shaped in out line, variable in size, 44 - 97u in diameter. The larger and smaller vessels are mixed within the growth ring, numerous and prominent, 8-15/mm² in number, occur singly, mostly in radial rows of 2-3 and occasionally in short groups.

Parenchyma is paratracheal zonate, abundant, forming irregular patches around the vessels, joining tangentially in irregular wavy concentric bands.

The wood rays are fine to medium, 1-4 seriate, distinct, straight or somewhat wavy, placed at unequal distance, numerous, 6-7/mm in cross section. In tangential section, the wood rays are arranged in alternate fashion (non-storied arrangement) and are 10-23 /mm² in number. The largest wood rays are 23 cells (533u) in height, 5 cells (87u) in width and are homogenous.

The fibers are non-libriform, non-septate angular in out line , not definitely arranged in radial rows, short, 0.416mm to 0.780 mm long, 12.75u to 22.95u in diameter and have 2.29 to 5.1u wall thickness.



Cross section | Radial section | Tangential section

Photomicrographs showing the structure of Pilu (*Salvadora oleiodes*) wood

Anatomical data

On the basis average values as given in Table 1, in Pilu wood, the fiber are short, medium in diameter, wide lumened and reasonably thick-walled. The vessels are medium in frequency and smaller in diameter. The wood rays are somewhat larger in size and medium in frequency both in cross and tangential sections.

Table 1. Frequency and dimensional measurements of different wood elements/ structures in Pilu (*Salvadora oleiodes)* wood (statistical analysis)

S. No.	Anatomical Feature	Average value	Standard deviation (±)	Co-efficient of variation (%)
1.	Fiber length (mm)	0.614	0.085	13.84
2.	Fiber diameter (µ)	18.22	2.58	14.16
3.	Fiber Wall thickness (µ)	3.47	0.99	28.53
4.	Fiber lumen width (µ)	11.28	-	-
5.	Number of vessels (/mm^2)	11.57	2.11	18.23
6.	Vessels diameter (µ)	68.32	14.44	21.13
7.	Height of ray (µ)	249.06	119.95	48.16
	(cells)	10.06	5.34	53.08
8.	Width of ray µ)	41.024	17.90	43.63
	(cells)	2.70	1.19	44.07
9.	No. of rays in tang. Section (/mm^2)	16.59	3.07	18.50
10.	No. of rays in Cross section (/mm)	6.29	-	-

Volumetric composition

According to studied volumetric composition of the wood as shown in Table 2, lowest percentage of wood volume has been found to be occupied by vessels, approximately one third by each i.e. fibers, wood rays and longitudinal parenchyma and the highest collectively by longitudinal parenchyma and the wood rays that has been calculated to assess durability of the wood since both consist of parenchymatous cells (food cells).

Table 2. Volumetric composition of Pilu (*Salvadora oleiodes*) wood

S. No	Wood element/ structure	Volume occupied
1.	Vessels	11%
2.	Fibers	30%
3.	Axial parenchyma	27%
4.	Wood Rays	32%
5.	Axial parenchyma + wood rays	59%

Suitability for pulp and paper

In Pilu wood, the Runkel ratio (2 x fiber wall thickness/ lumen width) has been calculated as 0.615 which shows that on the basis of fiber morphology, the wood may also be suitable for pulp and paper manufacture.

The results are based on single wood specimen therefore, does not cover minor anatomical variations with respect to growth rate and age of tree.

CONCLUSION

Based on the results, it can be concluded that Pilu (*Salvadora oleiodes*) wood may be medium in density and strength. It may be non-durable and need preservative treatment when used as solid wood though the process of preservation and drying of wood may be slow. In additional to its traditional uses, Pilu wood may also be used for particleboard and pulp and paper manufacture.

REFERENCES

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

Anon, 1974. The Preparation of Wood for Microscopic Examination, Building Researh Advisory Service Information, TIL 52, Building research Station, Garston.

Brown, H. P., A. J. Panshin and C. C. Forsaith, 1949. Text Book of Wood Technology, Vol.1, McGraw Hill Book Company, INC, New York. pp.122.

James P. Casey, 1980. Pulp and Paper Chemistry and Chemical Technology. 3rd Edition, Vol. 1. Jhon Wiley & Sons, New York. pp. 144.

Parker, R. N., 1956. A Forest Flora of the Punjab with Hazara and Delhi, Government Printing Press, Lahore p. 327.

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