Wood Anatomical Structure Could Determine Wood Quality and Its Utilization: A Hypothesis

Ratikanta Maiti

Visiting Research Scientist, Forest Science Faculty, Universidad de Nuevo Leon (67 700), Mexico

Corresponding Author

Ratikanta Maiti
e-mail: ratikanta.maiti@gmail.com

Article History

Article ID: IJEP91
Received in 16th August, 2015
Received in revised form 25th December, 2015
Accepted in final form 16th January, 2016

Abstract

The present paper discusses the possible role of wood anatomical structure on determination of wood or timber quality and its utility. On the basis of wood anatomy species may be classified as hard or strong wood for fabrication of strong furniture and soft wood for fire wood, fences or paper pulp. Wood fiber cell morphology determines the strength of the wood and or fabrication of paper pulp. Wood having highly thick walled lignified fiber cells could be useful for strong furniture, while the wood having broad lumen and thin cell wall are useful for fabrication of paper pulp.

Keywords: Fiber cells, paper pulp, variations, wood anatomy, wood quality, xylem vessels

1. Introduction

Wood is a product of forest of high commercial importance, for wood industry for fabrication of furniture, doors, cots, desk table, book shelves, various domestic goods, fabrication of paper pulp etc. (Reid et al., 1990). The owners of a forest land are capable to select timber of a tree species for suitable use on the basis of his own experience. In this respect wood anatomical structure of wood of a particular tree plays an important role in the determination of wood quality and its utility. Dendrology is an important branch dealing with the assessment of wood anatomical structure and its possible use.

Wood is produced by the cambial activity of secondary xylem. It is composed of various wood elements, wood fiber cells, xylem vessels, wood parenchyma, ray cells and some wood exudates like resin, tannin, crystals. Wood fiber cells (sclerenchyma) are needle shaped cells with pointed ends, a lumen and thick or thin lignified cell walls depending on species. Secondary xylem vessels are in general barrel shaped cylindrical structure with straight or inclined cell walls, the size, of which depends on species, which in turn determine the evolutionary status of the species. (Bailey and Tupper, 1918; Carlquist, 1989). Xylem vessels helps in transport of water (Sperry, 2015).

Among these, wood fiber having lignified cell wall contribute to the strength of the wood. The higher the lignification and greater intensity of thick walled wood fibres impart greater strength and produce strong wood, on the other hand, a particular wood having greater amount of soft wood parenchymatous cells, wood rays and less intensity of wood fibres with very thin cell contribute soft wood and could be use full for paper pulp.

In order to address these issues, numerous research inputs are undertaken on wood anatomy and its relation to its basic structure of each wood elements, the phylogeny of the species and its relation to adaptation to the environments, xeric or cool climate. Intensity of narrow vessels offers resistance to occlusion under xeric or cool environment (Carlquist, 1989; Sperry, 2005; Maiti and Rodriguez, 2015). Various studies have shown large variations in wood anatomical structures among woody species and variations of wood fiber cells (Maiti et al., 2015).

During last four years as a visiting research scientist in Forest Science Faculty of University of Nuevo Leon (UANL), Mexico, R. K. Maiti undertook systematic research on wood anatomy of more than 30 woody species at Linares, Northeast Mexico. The present paper makes a short synthesis of research results with special reference to importance of wood anatomy in determining wood quality and utility.

2. Materials and Methods

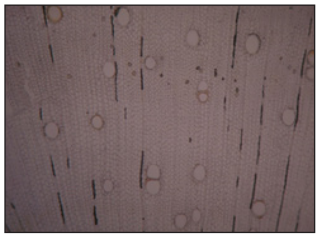
Woods of different species are collected and cut sections (transverse, tangential, radial) with wood microtome according to standard protocol (mentioned by) and wood fiber cells are macerated according to (Maiti et al., 2015).

3. Results and Discussion

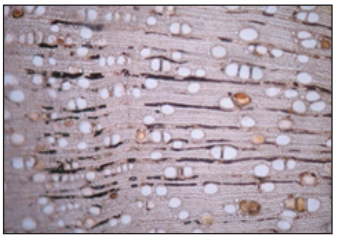
The results show that in a transverse section of wood there exists large variations in size and intensity of xylem vessels

which may be isolated, or radial rows, intensity of wood fiber cells and wood parenchyma, on the basis of which we can group species, as strong, intermediate or soft wood shown tentatively in the following manner.

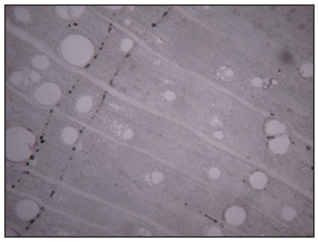
3.1. Hard and strong wood suitable for strong furniture



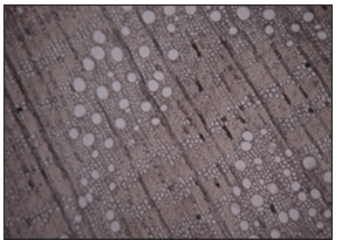
Havardia pallens



Karwinskia humboldtiana



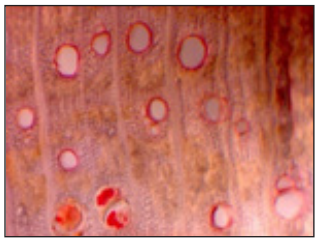
Prosopis laevigata



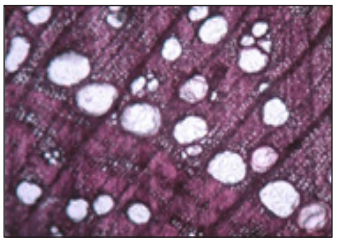
Sider oxyloncelastrinum

Hard wood: *Acacia schaffneri, A. rigidula, A. wrightii, Condalia hookeri,Havardia pallens, Helieta parvifora*

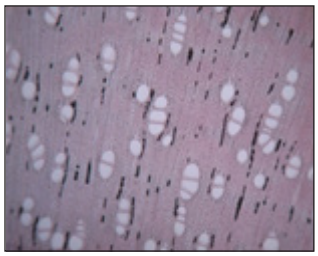
3.2. Mediumly strong suitable medium strong furniture



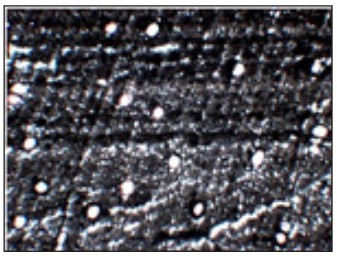
Celtis laevigata



Celtis pallida Torr



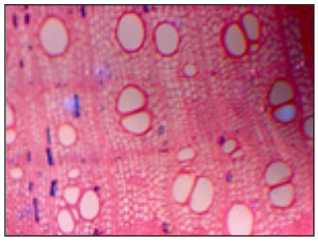
Eysenhardtia polystachya



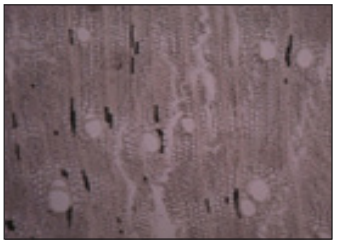
Diospyros palmeri

Medium hard wood: *Cellti pallida, Diospyros palmeri, D. texana, Eysenhardtia polystachya*

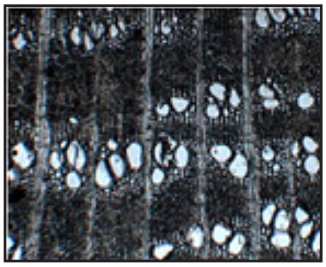
3.3. Soft wood suitable for soft furniture, fence, paper pulp



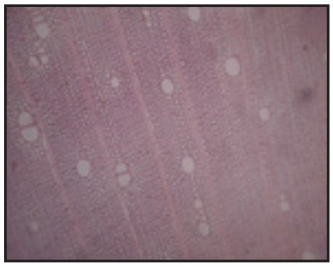
Cordia boissieri



Cercidium macrum



Havardia pallens



Karwinskia humboldtiana

Soft wood: *Cordia boisiieri, Acacai berlandieri, A. maniensis, A farnesiana,Ceasalpinia mexicana, Cercidium macrum*

On the basis of above criteria we may tentatively select

It is well documented that wood fibre cells with highly lignified cell walls contribute to trong wood usefull for fabrication of strongfurnitures, doors, table etc.

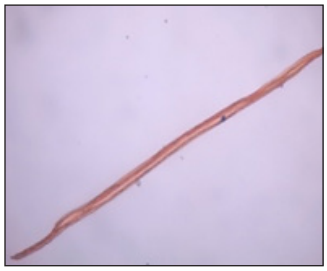
On the other hand, wood fibre cells with broad lumen and thin cellwall is suitable for production of paper pulp and paper.

In the following is given few examples

3.4. Woody species with thick walled wood fibres suitable for strong furniture

Acacia rigidula

Acacia shaffneri

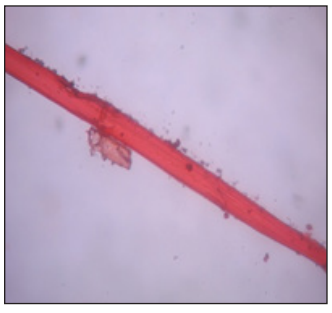


Condalia hookeri

Bernardia myricifolia

3.5. Woody species with broad lumen and thin cell walls suitable for paper pulp

Acacia farnesiana



Caesalpinia mexicana

Cordia boissieri

Diospyros palmeri

The following woody species may be recommended for paper pulp, *Acacia berlandieri, farnesciana, Celtis laevigata, Cordia boissieri, Diospyros palmeri, Forestieria angustifolia, Lantana macropoda, Prosopis laevigata Salix lasiolepis*

4. Conclusion

The present report shows large variability in wood anatomical structures and wood fibres among woody species studied at Linares Northeastern Mexico. It is hypothesized that wood anatomy may be used in the classification of woods for wood quality and its utility. This needs to be confirmed in future study. It is suggested that concentrated research activities need to be directed to classify woody species for its possible wood quality and utility.

5. References

Bailey, I.W., Tupper, W.W., 1918. Size variation in tracheary cells. I. A comparison between the secondary xylem of vascular cryptogams, gymnosperms and angiosperms. Proceedings of American Academy of Arts and Sciences 54,149–204.

Carlquist, S., 1989. Adaptive wood anatomy of chaparral shrubs. In: Keely JE (ed) The California chaparral: paradigms re-examined. Los Angeles Country Museum of Natural History Contributions, Los Angeles, 25–35.

Maiti, R., Para, A., Rodriguez, H.G., Paloma, S.V., 2015. Characterization of Wood Fibres of Scrubs and Tree Species of the Tamaulipan Thornscrub, Northeastern Mexico and its Possible Utilization. Forest Research 4,4 http://dx.doi.org/10.4172/2168-9776.1000154

Maiti, R., Rodriguez H.G., Diaz, J.C.G., Tijerina, H.A.D., Flores, A.A.C., Kumari, A., Sarkar, N.C. 2016.Comparative Wood Anatomy of Woody Plant Species in Northeastern Mexico and its Significance. International Journal of Bio-resource and Stress Management, 7(2), 229-246.

Maiti, R.K., Rndriguez, H.G., 2015. Wood Anatomy Could Predict the Adaptation ion of Woody Plants to Environmental Stresses and Quality of Timbers. Forest Research 4,4 http://dx.doi.org/10.4172/2168-9776.1000e121

Reid, N., Marroquín, J., Beyer, M.P., 1990. Utilization of shrubs and trees for browse, fuel-wood and timber in the Tamaulipanthornscrub, northeastern Mexico. Forest Ecology and Management 36,61-79.

Sperry, J.S., 2005. Patterns in hydraulic architecture and their implications for transport efficiency. Tree Physiology 25,257–267.