Forest Research
Open Access

Maiti and Rodriguez, Forest Res 2015, 4:4
DOI: 10.4172/2168-9776.1000e121

Editorial Open Access

Wood Anatomy Could Predict the Adaptation of Woody Plants to Environmental Stresses and Quality of Timbers

Maiti RK[1]* and Rodriguez HG[2]

[1]*Universidad Autónoma de Nuevo Leon, Facultad de Ciencias Forestales, Carr. Nac. No. 85 Km. 45, Linares, Nuevo Leon 67700, México*
[2]*Universidad Autónoma de Nuevo Leon, Facultad de Ciencias Forestales, Carr. Nac. No. 85 Km. 45, Linares, Nuevo Leon 67700, México*

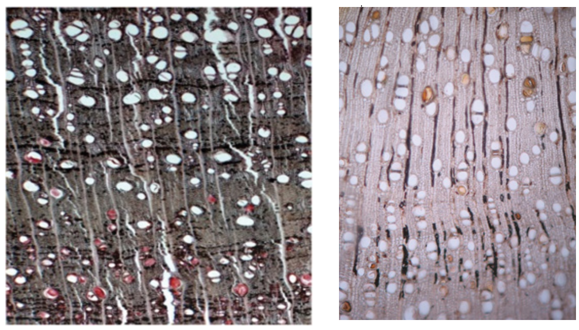
Wood is an important product of woody plants for wood industry. Wood is a hard, fibrous structural tissue present in the stems and roots of woody plants and is used for furniture, building construction, and also used as firewood for thousands of years. Besides, various industrial products like resins, gums, oleoresins etc., are obtained from it. Wood anatomical traits of timbers predict the adaptive capacity of the woody species to environmental stresses and determine the quality of a timber. Wood is formed by the secondary growth of cambium which produce secondary xylem vessels, wood fibres and wood parenchyma, but the productivity of wood tissue is influenced by the environments. Among these tissues, the wood fibre cells contribute greatly to the strength and quality of wood depending on the degree of lignification on the cell walls. The timber having highly lignified fibre cells are expected to contribute to its strength and produce hard wood useful for the manufacture of furniture, while softwood having thin walled fibre cells and high amount of wood parenchyma are suitable for soft furniture, fencing or paper pulp. The amount of lignification and length of fibre cells vary in different environments. Fibre cells are composed of cellulose fibrils embedded in matrix of lignin which resists compression.

Therefore, there is a necessity to select the species with hard wood and others for the fabrication of papers and other purposes. In the context of the information available in the literature, more research inputs need to be directed to determine the role of the wood anatomical traits for adaptation of woody species to seasonal stresses and wood quality.

Adaption to environmental stresses: Characteristics of wood anatomy in two species in north-eastern Mexico (Figure 1).

It is well documented by wood technologists that the dimensions of wood fibre cells of a species vary in different climatic conditions which have direct impact on wood quality. The results of the studies on the wood anatomical traits of both Mediterranean and semi-arid regions of Northeast Mexico where plant species are exposed to seasonally separated hot summer and freezing cold temperature in winter. These species possess specific adaptive traits under these stress conditions. It is well reported that woody species in the major Mediterranean-type ecosystems in the world possess different levels of adaptation to the seasonal dimorphism in Mediterranean climate conditions, hard dry summer and freezing winter. Veronica De Micco V and Aronne G Veronica De Micco et al. [1] studied the wood anatomy and hydraulic architecture of stems and twigs of some Mediterranean trees and shrubs along a mesic-xeric gradient. Many species in these ecosystems possess wood anatomical features that allow high efficiency of transport when water is available, but maintain hydraulic safety during drought periods. In Mediterranean-type ecosystems [1], seasonal dimorphism is an adaptive strategy to save water by developing brachyblasts with xeromorphic summer leaves as opposed to dolichoblasts with more mesomorphic winter leaves. Besides, the measurement of other specific anatomical traits, such as vessel wall thickness, suggested that brachyblast wood has a higher resistance to implosion due to drought-induced embolism . The “hydraulic distance” between the wood of main stems and twigs was estimated on the basis of suites of anatomical features related to water efficiency/safety [2]. Few studies have reported that the hydraulic architecture of the Mediterranean species (in transverse section of wood) possess mostly narrow vessels, either solitary, in groups or multiples which help to protect the vessels against cavitation and embolism [2-4]. This has been reported by various authors. In northeast of Mexico, with a more or less similar environmental conditions as the Mediterranean regions, during summer the trees are exposed to hard summer raising to sometime to 45°C and very cold temperature down to -5°C. Similar to those of Mediterranean species, the woody trees possess mostly solitary, small vessels or in groups to protect the vessels against cavitation and embolism. The species have showed large variations in wood anatomical traits; most of them are diffuse porous, few semi to ring porous, vessels are narrow resistant to cavitation during drought and freezing.

Wood anatomy and its relation to wood quality and utility: In our study, we observed large variation in wood tissue compactness and fibre intensity which may have direct impact on wood density and wood hardness. We reported variation in wood fibre cell characteristics in 15 woody species and its possible relation to utility [5]. Furthermore,



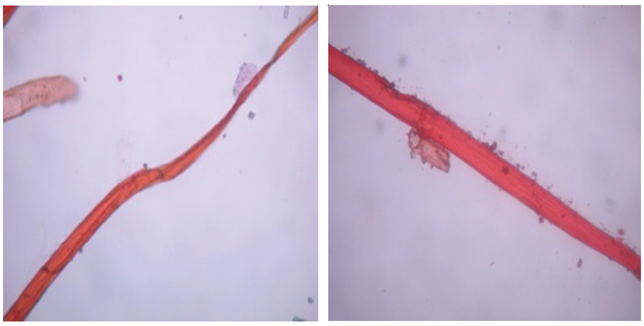
Acacia berlandieri *Karwanskia humoltdtiana*

Figure 1: Characteristics of wood anatomy in two species (*Acacia berlanderi* and *Karwanskia humoltdtiana*) in Northeast Mexico showing solitary small narrow vessels present in disperse manner.

***Corresponding author:** Maiti RK, Visiting Research Scientist, Universidad Autónoma de Nuevo Leon, Facultad de Ciencias Forestales, Carr. Nac. No. 85 Km. 45, Linares, Nuevo Leon 67700, México, Tel: +52-81-16597090; E-mail: ratikanta.maiti@gmail.com

Received november 09, 2014; **Accepted** Novmber 10, 2015; **Published** November 13, 2015

Citation: Maiti RK, Rodriguez HG (2015) Wood Anatomy Could Predict the Adaptation of Woody Plants to Environmental Stresses and Quality of Timbers. Forest Res 4: e121. doi:10.4172/2168-9776.1000e121



Acacia rigidula

(thick cell wall-highly lignified)

Caesalpinia mexicana

(cell wall thin-less lignified)

Figure 2: Variability in fiber cell wall thickness and lumen breadth in *Acacia rigidula* and *Caesalpinia Mexicana*.

we observed that wood fibres of 30 woody plants in Northeast Mexico show large variability in their dimension (length, breadth and wall thickness, length/breadth). It is to be considered that for imparting strength, several factors need to be mentioned such as not only length, but also wall thickness, length to breadth ratio are important (Figure 2).

The following species were found with very long fibre cells (>500 μm): *Quercus polymorpha* (709.39 μm), (*Celtis laevigata* (657.58 μm), *Helietta parvifolia* (647.78 μm), *Ehretia anacua* (644.66 μm), *Acacia farnesiana* (598.58 μm), *Ziziphus obtusifolia* (591.09 μm), *Acacia rigidula* (581.53 μm), *Gochnatia hypoleuca* (563.30 μm), *Fraxinus greggii* (535.67 μm), *Cordia boissieri* (518 μm), *Karwinskia humboldtiana* (507.33 μm), *Acacia shaffneri* (501.17 μm). It is expected that the species having long fibres are expected to produce strong wood or strong paper pulp. Some of the species viz. *Acacia farnesiana* and *Cordia boissieri* have desirable characteristics for good paper pulp for having l bigger fibre breath and thin cell wall.

The species having high value of length/breadth ratio of fibre cells are expected to produce strong wood fibres were: *Ehretia anacua* (55.77 μm), *Quercus polymorpha* (51.71 μm), *Helietta parvifolia* (41.85 μm), *Prosopis laevigata* (38.31 μm), *Celtis laevigata* (37.28 μm), *Acacia farnesiana* (33.95 μm), *Celtis pallida* (33.45 μm), *Gochnatia hypoleuca* (32.67 μm), *Karwinskia humboldtiana* (32.36 μm), and *Cordia boissieri* (31/47 μm). These could be recommended for paper pulp manufacture also. Species having broad breadth are expected to be desirable for paer pulp production. Species having high wall thickness are expected to produce strong fibre for high lignification. The results on fibre dimensions in the present study coincide with the findings by several authors mentioned before for its possible utility with respect to variability in fibre cell dimensionsand lignin content.

References

1. Veronica De, Micco V, Aronne G (2009) Seasonal dimorphism in wood anatomy of the Mediterranean *Cistus incanus* L. subsp. *Incanus.* Trees 23: 981-989.
2. Veronica De, Micco A, Æ Giovanna Aronnem, Bass P (2009) Wood anatomy and hydraulic architecture of stems and twigs of some Mediterranean trees and shrubs along a mesic-xeric gradient. Trees 22: 643-655.
3. 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 pp. 25-35.
4. Carlquist S (1984) Vessel grouping in dicotyledon wood: significance and relationship to imperforate tracheary elements. Aliso 10: 505-525.
5. Maiti R, Para AC Rodriguez HG, Paloma SV (2015) Characterization of Wood Fibres of Scrubs and Tree Species of the Tamaulipan Thornscrub, Northeastern Mexico and its Possible Utilization. Forest Res 4: 4.