

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Anatomical Characterization of Wood Some Natural Essences Rif (National Park Talassemrane, Chefchaouen, Morocco)

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ABSTRACT

To direct wood towards a rational use, it is necessary to identify it, in order to be able have quickly and simply an opinion on its technological quality, its aptitude to various uses and its origin. In our country, the anatomical identification of the wood of several tree species making up the base of the Moroccan forest ecosystems remains unknown. Therefore, the objective of the present study is to assess the various internal structures of the wood of some softwood and hardwood species of the Rif's area known for its broad forest extension, leading then to establish an anatomical identification key specific to these species. Consequently, wood samples were taken from 16 tree species which are the main forest species of the national Talassemrane park. This identification key is carried out through a macroscopic study of certain anatomical features, visible with naked-eye or the microscopic glass, of the wood test-tube, cut and sawn in the three plans of observation: transversal, radial and tangential. The interpretation of the observed characteristics has been achieved using a colored and thin microscope cuts prepared earlier on microtome and microphotography using digital camera connected to the microscope. This work is characterized by a quick brief over macroscopic characters of the bark and by tables including significant structures of each studied species.

Keywords: wood anatomy, wood identification key, Talassemrane, macroscopic and microscopic study, microtome, wood microphotography, Moroccan woods, Rif woods.

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INTRODUCTION

The plant anatomy is the science that deals with the study of the structure and internal composition of plants on a microscopic scale. For several decades, the science was able to go very useful to many specialties: botany, forestry, physics, chemistry ... etc. Given the current demand and needs increasing industry for wood material, identifying and determining the quality and effectiveness of the equipment before use are necessary. These characters are connected with ecology and the nature of the used fuel. For that we chose the Rif, where the forest has an important place in the lives of citizens of this region. We focused on the national Talassemtane Park spread over an area of over 60,000 hectares, this park Mediterranean climate and severe winter rainfall encourages the growth and development of many species some endemic of this park as *Pinus clusiana* (black pine).

MATERIALS AND METHODS

General characteristics of the structure of softwood

Were rather primitive plants [1] characterized by the presence of very elongated elements (1.5 to 4.5 um) [2] to the relatively narrow lumen [3] and / or the traffic moves "by chicane" from one element to the other, from bottom to top [4]. Their parenchyma is composed of cells arranged in line and scattered amid tracheids [5], the wood rays may contain resin ducts and then become larger and fusiform [6], adding that the same beam can secrete have two channels [7].

General characteristics of the hardwood structure

The structure of their wood is more complex than that of softwood, composed of elongated vessels and juxtaposed with rounded or oval light [8], the fibers located in large proportions in the final timber, lengthen following an intrusive development, the wood rays are either homocellular when formed from cells of the same morphological type, or any lying or erect all. Otherwise, they said heterocellular [9].

Plant materials

It is collected from trees originating from the same source "Rif" and belonging to different species.

Coniferous species: Were harvested seven species, two of which are endemic and characteristic of our region of harvest, it is Moroccan *Abies* and *Pinus clusiana* known under the name of *Pinus nigra* (black pine), for other species: *Cedrus atlantica*; *Juniperus oxycedrus*. *Pinus halepensis*. *Tetraclinis articulata* and *Pinus pinaster*.

Hardwood species: Nine species have been harvested namely: *Quercus suber*. *Quercus rotundifolia*; *Arbutus unedo*; *Ceratonia siliqua*; *Olea europaea*; *Nerium oleander*; *Quercus tozza*; *Pistacia lentiscus* and *Quercus faginea*.

Field materials

It is an Auger of pressler designated to harvest carrots, a saw for harvesting of the macroscopic study samples and samples sheets.

Table 1: Sampling model

Species	Fir Morocco	Cedar atlas	Holmoak
Order	Pinales	Pinales	Fagales
Family	Abietaceae	Abietaceae	Fagaceae
Genus	Abies	Cedrus	Quercus
Latin nomenclature	Abies maroccana	Cedrus atlantica	Quercus rotundifolia
Area harvested	National Park of Talassemtane (PNTLS)	PNTLS	PNTLS

Place of harvest	Chouihate	Chouihate	Tazaout
Bioclimate	Perhumide	Perhumide	Wet
Precipitation	1800 mn / an	1800 mn / an	1200 mn / an
Type substrate	Limestone	Limestone	Limestone
Diameter of the shaft to 1m30	20 cm	35 cm	18 cm
Treeheight	6 m	8 m	2.5 m
Coppice or Futaie	Futaie	Futaie	coppice
boleinclined or right	straight	straight	inclined

Laboratory materials

We need a microtome equipped with a mobile knife on the slide, a microscope with digital camera, a balance of accuracy of 0.001 g and a drying oven.

Macroscopic study

Determination of a few characters:

- Regularity and degree of appearance of annual increases.
- Degree of appearance of wood rays, specifically reserved character to the softwood.
- Section of tracheids and the pores, characters which lead to the identification of the branch line of the species.
- Distinction between sapwood and heartwood.
- The color of the wood.
- Smell of wood.
- Disclosure of apparent and characters unique to the bark of the wood sample studies.
- Density: it's basal density calculated by the method of full saturation, according to the formula below:

$$Db \text{ (g / cm}^3\text{)} = Po / Po = Vs / (Vml + Pm - Po) = Po / ((Po / 1.53) - Po + Pm) = 1 / ((Pm / Po) - 0.347)$$

Po: weight of the sample in anhydrous State;

Pm: weight of the saturated sample;

Vs: volume of sample in a saturated state;

Vml: volume of timber.

Microscopic study

- Imbibition and softening of the wood cores.
- Implementation of cuts according to the plans of anisotropy of wood: transverse, tangential and radial.
- Treatment and cuts between slide and coverslip mounting: Simple coloring with of the safranin, mounting in canada balm and cuts under the microscope, and Jack image Observation.

RESULTS AND DISCUSSION

Sixteen species (hardwood and softwood) were identified macroscopically and microscopically, tree species of softwood and four species of hardwood that will be shown as an example in this article.

Results by species "softwood"

Tetraclinis articulata

- Macroscopic description

This is a species with heavy wood, strong and remarkable resinous odor, the annual rings are visible to the naked eye and irregular, bark reddish brown sometimes reddish gray, thin, and separating into narrow strips, the sapwood and heartwood are separate.

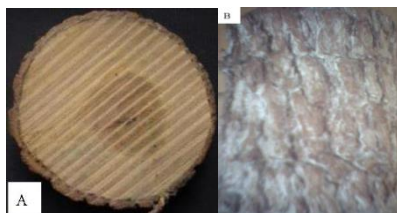


Figure 1: Wood of Thuja: A) transverse face of the washer; B) Bark.

- Microscopic description

It is a kind single anatomical structure marked by brutality of the original wooden passage to the final timber with no secretory vertical and horizontal canals, wood rays are homogeneous biseriate and uniseriate, composed of rounded cells in the order of 2-14 cells per unit length of beam, punctuation small sizes, piceoides, detectable only under high magnification. The species for identification code: 2; 4; 5; 8; 9; 11 (2 to 14); 12; 14; 21; 23; 25; 29.

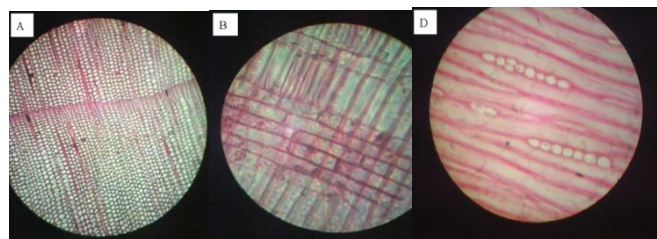


Figure 2: Map Thuja wood: (A) Cross section (GX100), (B) radial Cup (GX200), (D) tangential Cup (GX200).

Cedrus atlantica

- Macroscopic description

It is a kind wood heavyweight, with annual rings visible to the naked eye, resin ducts are concealed and sapwood and heartwood are clearly distinct. This species is individualized by a dark gray bark, smooth and shiny appearance.

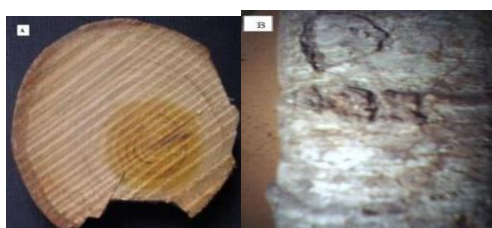


Figure 3: Wood cedar atlas: (A) cross the face of the washer, (B) Bark.

- Microscopic description

Observation of cuts made microtomed shows that this species has a gradual transition from early wood (BI) to the final wood (BF), the longitudinal and horizontal resin ducts are absent and the thickened spiral. Punctuations are cupressoid type and the wood rays are homogeneous, uniseriate, each of these rays is composed of 3 to 39 cells. The study sample shows the following identification code: 1; 4; 5; 8; 11 (3 to 39); 12; 16; 18; 21; 23; 25; 29.

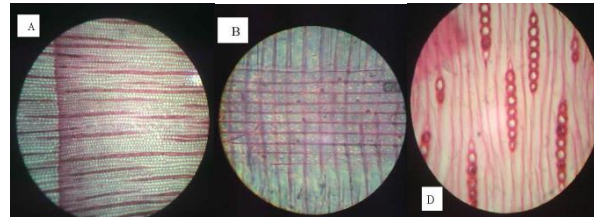


Figure 4: Plan woody cedar wood: (A) Cross section (GX100) (B) radial Cup (GX200) (D) tangential Cup (GX200).

Pinusclusiana

- Macroscopic description

This endemic species of the Rif region, is characterized by an irregular wood annual rings, light brown at the sapwood and heartwood yellowish level, the smell is strong, the bark is dark gray, rough appearance plate.

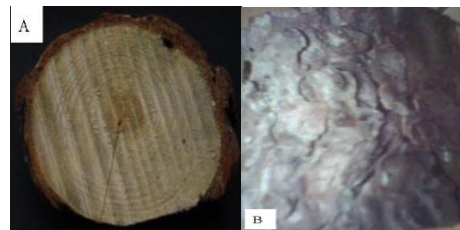


Figure 5: Wood black Pin: (A) cross the face of the washer,(B) Bark.

- Microscopic description

The passage of the BI to BF is progressive, the longitudinal and horizontal resin ducts are present, the dots are large and fenestriformes, wood rays are homogeneous, uniseriate and biseriata composed of 3 to 9 cell.The identification code of the species are present: 1; 4; 8; 9; 11 (3-9); 12; 15; 17; 21; 22; 24; 26; 29.

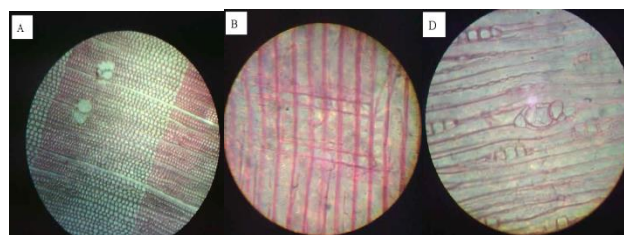


Figure 6: Black pine wood Map: (A) Cross section (GX100),(B) radial Cup (GX200) (C) Tangential section (GX200).

Results by species "Hardwood"

Oleaeuropaea

- Macroscopic description

This species has very heavy wood, is characterized by an irregular wood tree rings, heartwood and sapwood are not distinct, wood color is brown clear, this species is enveloped by a bark smooth, thin greenish gray.

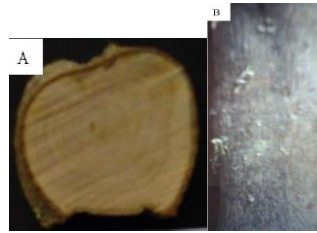


Figure 7: Wood of Oleaeuropaea: (A) cross the face of the washer, (B) Bark

- Microscopic description

It is semis diffuse pore species and many tyloses are present and the paratracheal parenchyma, wood rays are heterogeneous and biseriate, compounds 2 to 15 cells, the perforations are simple. The sample studied shows the following identification code: 3; 4; 9; 11; 15; 18; 23; 27; 29; 31; 32 (2 to 15); 34; 37; 40; 41.

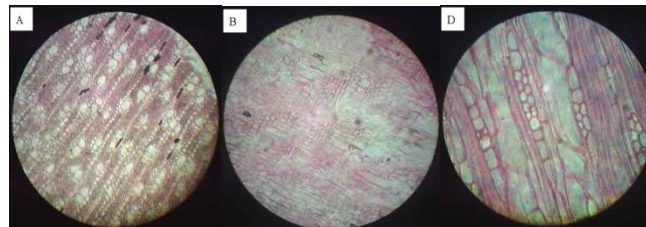


Figure 8: woody Plan Oleaeuropaea: (A) Cross section (GX100), (B) radial Cup (GX100), (C) Tangential section (GX200)

QuercusTozza (Quercuspyrenaica)

- Macroscopic description

This species has a wood with annual increases are not apparent, wood beams are visible to the naked eye, heartwood and sapwood are distinct with light brown sapwood and heartwood dark brown, finally this species is covered by a thick bark, crusty blackish.

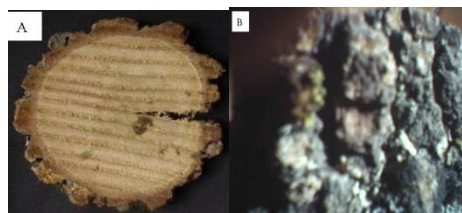


Figure 9: Wood Oak tauzin: (A) cross the face of the washer, (B) Bark.

- Microscopic description

It is a species in porous woods, tyloses are present but not abundant, the wood rays are homogeneous, uniseriate, composed of rounded cells, perforations are scalariform type and axial parenchyma is present. The species studied has identification code: 1; 4; 9; 11; 16; 20; 27; 29; thirty; 32 (15); 33; 37; 40; 41.

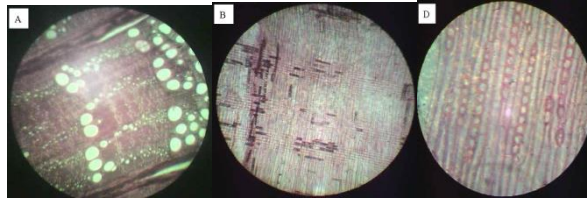


Figure 10: Map of Oak wood Pyrenean: (A) Cross section (GX100),(B) radial Cup (GX100), (C) Tangential section (GX200).

Pistacialentiscus

- Macroscopic description

This species has a woody bark reddish brown which splits naturally, wood is very heavy with a distinct sapwood and heartwood, annual increases are apparent to the naked eye and irregular.

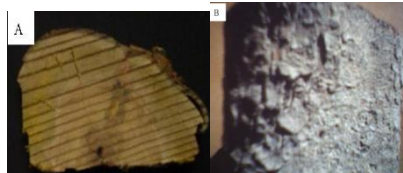


Figure 11: Wood Pistacialentiscus: (A) cross the face of the washer,(B) Bark

- Microscopic description

It is a kind wood-porous, tyloses are present but not abundant while the paratracheal and apotracheal parenchyma are absent, the wood rays are heterogeneous, and multisérie, axial parenchyma is absent, the perforations are simple cells lying are present when we do not notice any trace of upright cells.

The sample studied for identification code: 1; 5; 9; 11; 15; 18; 27; 29; 31; 32 (5 to 39); 33; 34; 35; 36 (1 to 3); 38; 40; 42.

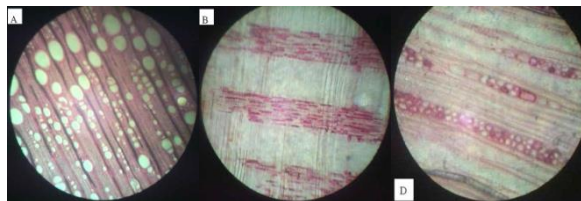


Figure 12: Map of Pistacialentiscus timber: (A) Cross section (GX100),(B) radial Cup (GX100),(D) tangential Cup (GX200).

Ceratoniasiliqua

- Macroscopic description

This is a species that has a thin bark, rough and hard, the wood is very heavy wood with low odor and sapwood and heartwood not distinct, the annual increases are apparent to the naked eye and irregular.

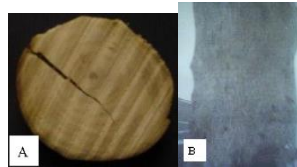


Figure 13: Wood Carob: (A) cross the face of the washer, (B) Bark.

- Microscopic description

It is a species diffuse porous, few tyloses are absent while the paratracheal parenchyma is located completely surrounding certain vessels, wood rays are homogeneous, and biseriate-multiseriate, axial parenchyma cells, and lying are present and the perforations are simple.

The species studied has the following identification code: 1; 5; 8; 12; 15; 18; 27; 29; 30; 32 (16 to 30); 34; 35; 36 (3 to 4); 37; 40; 41.

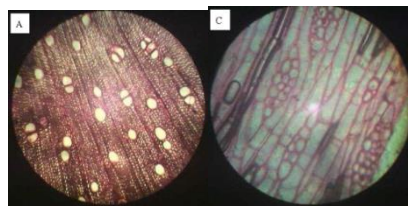


Figure 14: woody map Carob: (A) Cross section (GX100), (C) Tangential section (GX200).

CONCLUSION

The results obtained at the end of this modest work, enhance awareness wood anatomy in Morocco. These findings are the result of:

Microscopic study that proved necessary and mandatory to have certainty as to the identification of certain species, to reveal and assess the quality of their wood and detect any anomalies that could be a negative effect on the components of this last. This study also allowed us to reveal the origin of the richness and floristic variability that characterizes our sampling area, given that it provided us with more details and information on each timber component element of the studied species.

Macroscopic study, which despite the considerable influence played by extrinsic factors on the macro-structure, has enabled:

- Identify without using microscopy, the branch of a limited nature.
- Go to the genus of the species studied: the case of coniferous species of the genus *Pinus* in resin canals features, and deciduous species of the genus *Quercus* in clear-cut wood rays to the naked eye.
- Separate or subdivide wood species harvested in four categories (very heavy wood, heavy wood, light heavyweight and light wood wood) leading to the orientation of the wood of these species to optimal industrial use.

ANNEX

Identification key softwood:

longitudinal tracheids

1. Passage of initial or final Wood is progressive.
2. Passage of initial or final Wood is brutal.
3. Presence of thickening spiral.
4. Absence thickening spiral.
5. bordered pits are arranged in a single punctuation wire.

6. bordered pits are arranged in two wire isolated punctuation.
7. bordered pits are arranged an alternate manner

wood rays

8. uniseriate rays.
9. Rays biseriate.
10. Rays multiseriate.
11. Minimum and Maximum size of the radius.
12. homogeneous rays.
13. heterogeneous Rays.

Punctuation crossing field

14. Picéoides
15. fenestréformes
16. taxodioides
17. Pinéoides
18. cupressoides.
19. Presence of cross tracheids included in the middle of wood beam.
20. Presence of cross tracheids includes bordering the wood beam
21. Absence of crosstracheids.

Elements secretory

22. Presence longitudinal resin canals.
23. Absence of longitudinal resin canals.
24. Presence of horizontal resin ducts.
25. Absence of horizontal resin ducts.
26. Channels grouped resiniferous.
27. Channels resiniferous isolated.
28. axial parenchyma presence.
29. Lack axial parenchyma

Identification key hardwood:***Ships*****Distribution of vessels (cross section):**

1. Wood-porous.
2. Wood diffuse porous.
3. Wood semi-porous.

Contour vessels (cross section)

4. Circular.
5. oval
6. elliptical.
7. Polygonal

Pore density (cross section)

8. Few.
9. Many.
10. Very many.

Tyloses (cross section)

11. Presence tyloses.
12. Absence tyloses

pore size (cross section)

13. very small pores.
14. Small Pores
15. pored.
16. large pores.
17. very large pores.

Types of perforations

18. simple Perforations
19. Perforations networks
20. Perforations scalariform
21. Perforations foraminate

fiber

- 22. Presence trachéide fiber.
- 23. Lack of fiber tracheid
- 24. Presence of fiber libreformes
- 25. Lack of libreformes fibers.

Tracheids

- 26. vascular trachéide Presence
- 27. Absence of vascular trachéide
- 28. trachéide Presence scanty
- 29. Absence of scanty trachéide

wood rays

- 30. homogeneous Rays
- 31. heterogeneous Rays.
- 32. size of the timber radius: cell number per unit height of the ray
- 33. unisérié Rays
- 34. biseriéte Rays.
- 35. Rays multiseriate
- 36. thickness of the timber radius: number of ray unit width

Parenchyma

- 37. Presence parenchyma paratracheal.
- 38. Absence of paratracheal parenchyma
- 39. parenchyma presence apotracheal
- 40. No apotracheal parenchyma
- 41. Presence of axial parenchyma
- 42. Absence of axial parenchyma

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