



ANATOMICAL VARIATION OF TIMBER WOOD FOREST PRODUCT IN SOME COMMON SPECIES OF ANGIOSPERM AND THEIR SYSTEMATIC ENUMERATION USEFUL FOR TAXONOMIC SIGNIFICANCE

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Abstract

Present study deals with documentation of timber wood forest product in Nandurbar district. The forests of Nandurbar district, dry deciduous type. The vegetation varies with changes in altitude and rainfall. In general the dominating timber wood plants from Nandurbar district are *Acacia nilotica* (Linn.) Wild. *Adina cordifolia* (Roxb). *Prosopis juliflora* DC. *Mangifera indica* Linn *Eucalyptus tereticornis* Sm. *Azadirachta indica* A. Juss *Terminalia arjuna* Bedd *Dalbergia sissoo* Roxb *Tectona grandis* Linn. *Ficus bengalensis* L. The paper summarizes anatomical variation, Colour, Durability, Strength and systematic enumeration.

Key words: Timber wood forest product, Anatomical variation, Taxonomy, Nandurbar district.

Introduction

Wood differs from other construction materials because it is produced in a living tree. As a result, wood possesses material properties that may be significantly different from other materials normally encountered in structural design. Although it is not necessary to have an in-depth knowledge of wood anatomy and properties, it is necessary for the engineer to have a general understanding of the properties and characteristics that affect the strength and performance of wood in bridge applications. (Bhat, K.M. and Indira, E.P., 1997). This includes not only the anatomical, physical and mechanical properties of wood as a material, but also the standards and practices related to the manufacture of structural wood products. In the broadest terms, trees and their respective lumber are classified into two general classes, hardwoods and softwoods. (Nazma; Ganapathy, P.M.; Sasidharan, N.; Bhat, K.M. and Gnanaharan, R., 1981).

The most unique feature of wood, unlike other natural materials, is its high degree of structural variability. Even, two pieces of wood belonging to the same timber species may not be exactly alike. Even though the basic wood structure of the species is more or less similar ;every fragment of it may show some difference. (Krishnankutty, C.N., 1998). Hardwoods normally have broad leaves that

are shed at the end of each growing season. Softwoods have needle like leaves that normally remain green year round. The classification as hardwood or softwood has little to do with the comparative hardness of the wood. Several species of softwoods are harder than many low-to medium-density hardwoods. With few exceptions the structural wood products used in bridge applications throughout North America are manufactured primarily from softwoods. (Pearson, R.S. and Brown, H.P., 1981). Although hardwoods are not widely used at this time, structural grading procedures for hardwoods have been developed recently and their use is increasing in some regions of the country. The cross section of a tree can be divided into three basic parts: bark, cambium and wood. Bark is the exterior layer and is composed of an outer layer of corky material with a thin inner layer of living cells. It functions to protect the tree and to conduct nutrients. (Sekhar, A.C., 1962). Wood is divided into two general classes, sapwood and heartwood. The sapwood consists of both active and inactive cells and is located on the outside of the tree, next to the cambium. It functions primarily in food storage and the transport of sap. The radial thickness of sapwood is commonly 1-1/2 to 2 inches for most species, but it may be 3 to 6 inches thick for some species. Heartwood, which was once sapwood, is composed mostly of inactive cells that differ both chemically and physically from sapwood cells. The

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heartwood cells do not function in either food storage or sap transportation. In most species, the heartwood contains extractive substances that are deposited in the cell during the conversion from sapwood to heartwood. These deposits frequently give the heartwood a much darker color than sapwood; however, in several species the heartwood is not dark and looks virtually the same as sapwood. The extractives also serve to make the heartwood of several species more resistant to attack by decay fungi and insects. Because all heartwood was once sapwood, there is generally little difference in their dry weight or strength. (Thulasidas, P.K.; Bhat, K.M. and Okuyama, T., 2006). Environmental conditions can also affect growth rings. Rings formed during short or dry seasons are narrower than those formed under more favourable growing conditions. (Choudhury, K.A. and Ghosh, S.S., 1958). This includes not only the anatomical, physical and mechanical properties of wood as a material, but also the standards and practices related to the manufacture of structural wood products. The most unique feature of wood, unlike other natural materials, is its high degree of structural variability. Even, two pieces of wood belonging to the same timber species may not be exactly alike. Even though the basic wood structure of the species is more or less similar; every fragment of it may show some difference. (Krishnankutty, C.N., 1998). Growth in wood cells varies between cells that are formed early in the growing season, early wood cells and those formed late in the growing season, latewood cells. Early wood cells are usually formed during the first or second month of the growing season and have relatively large cell cavities and thin walls. Latewood cells are formed later in the growing season and have smaller cell cavities and thicker walls. species these growth rings

vary in width, depending on species and site conditions. (Anonymous, 1963).

Materials And Method

Area Profile

The district occupies an area of 5035 km² and has a population of 1,311,709 of which 15.45% were urban (as of 2001). Nandurbar district is bounded to the south and south-east by Dhule district, to the west and north is the state of Gujarat, to the north and north-east is the state of Madhya Pradesh. The northern boundary of the district is defined by the great Narmada river. The district comprises 6 talukas. These talukas are Akkalkuwa, Akrani Mahal (also called Dhadgaon), Taloda, Shahada, Nandurbar and Navapur. Nandurbar is primarily a tribal (Adiwasi) district. Before 1 July, 1998 Nandurbar was part of the larger Dhule district. Nandurbar, Dhule and Jalgaon districts formed what was known as the Khandesh district. Dhule was known as the west Khandesh whereas Jalgaon was known as the east Khandesh. So, much of history applicable to Khandesh and Dhule, is applicable to Nandurbar. The forests of Nandurbar district are tropical, dry deciduous type. Nandurbar district is a tribal district. These tribal communities are mainly dependent on forest products. They still use for different purposes like food, fodder, medicine, timber, firewood, etc. To ensure ecological balance and meet increasing demand for fodder, timber, fuel-wood and other forest produce, development of forestry on private wastelands with institutional credit support, is necessary. The Schemes for conservation and afforestation of forests are being implemented by Forest Department. The forests in the district contain many species of trees. The important species are Teak, Sadad,

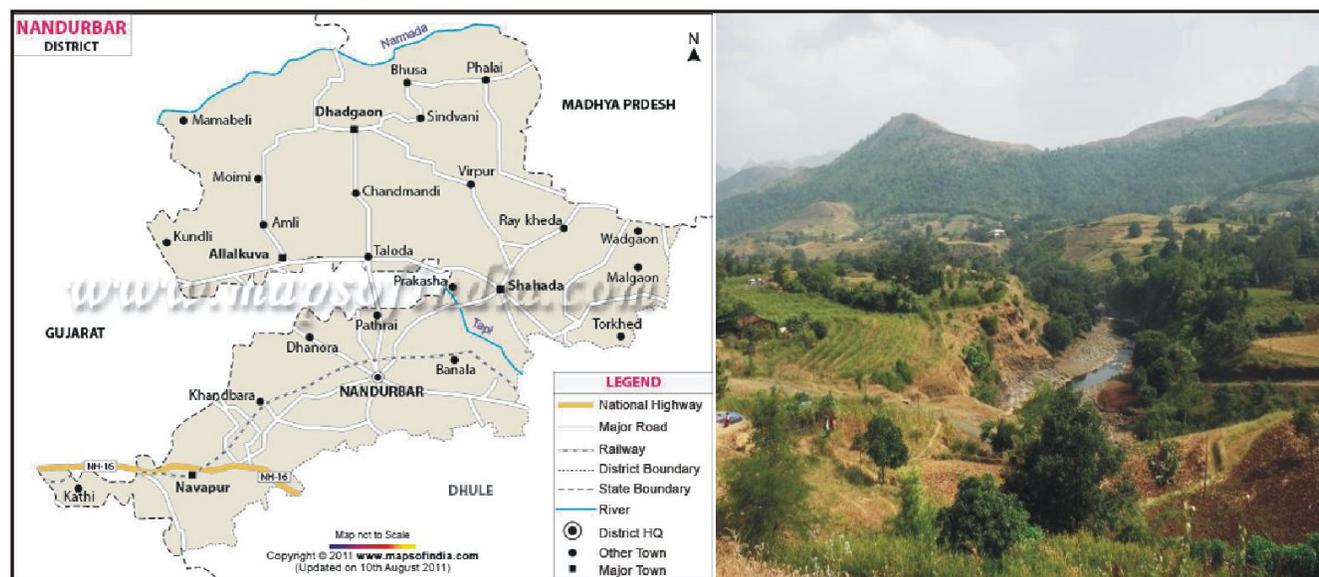


Fig. 1: Location of the area.

Khair and Shisum from the economy point of view. The major forest produce of the district are fuel wood, teak wood, bamboo, grass, tendupatta, mahua flowers, etc.

Data Collection

Heartwood samples collected from the timber depots, in Nandurbar district used for collecting the information about timber. For data collection or during survey, the local name, distribution and tree characteristics were incorporated in the description of each species from the existing records. Wood samples of different tree species for the study were obtained from mature standing trees from timber mart. Depending on availability, 2 to 4 trees were sampled per species. The tree girth, sapwood width, thickness of bark, wood colour, odour etc. were recorded during the collection. The increment core samples were subsequently used for anatomical studies for microtome.

Results and Discussion

Wood samples of different tree species. Study materials were obtained from mature standing trees from timber mart. The data gathered on tree characteristics, wood properties and structure are presented species-wise. The details include botanical name(s), synonym(s) and common name(s) and family. Wood physical characteristics like colour, texture, grain, heartwood extent, basic density and shrinkage; and wood anatomical details such as type and arrangement of cells, their dimensions, special structural features etc.

Systematic Enumeration

1. *Acacia nilotica* (Linn.) Wild. ex Del. Syn.

- Family - Leguminosae (Fabaceae)
- Trade Name:-Babul

• General feature: - Small sized evergreen tree reaches a height of 10 m and is about 30 cm in diameter with short thick cylindrical trunk and a spreading crown. Bark is dark brown or black. The heart wood of *Acacia nilotica* (Babul) is pinkish brown to reddish brown and is lustrous. Wood is hard and heavy. Growth rings are indistinct Vessels are small and few and filled with dark brown gummy deposits. Wood is diffuse porous. Growth



Fig. 1: *Acacia nilotica* (Linn.) Wild.

rings are indistinct. Vessels medium to small, few to moderately few, mostly solitary or in radial multiples of two, three or more, occasionally in clusters; filled with dark brown gummy deposits.

• Colour:- Heartwood pinkish brown to reddish brown, lustrous; Sapwood wide.

• Durability:- Very durable

• Uses:- Used in constructional work for posts, beams, rafters, bridges, door and window shutters and frames. Also used for agricultural implements, tool handles, tent accessories cart building, parts of hulls of boats, legs of bedsteads, sports goods and charcoal. The tree yields pale yellow to brown gum used in confectionery, medicines and calico printing.

2. *Adina cordifolia* (Roxb).

• Family - Rubiaceae

• Trade Name:- Haldu

• General feature:- Medium to very large tree, 15-35 m in height, 2-3.5 in girth and up to 110 cm in diameter. *Adina cordifolia* (haldu) has heart wood that is deep yellow. Wood is light to moderately heavy and has a fine texture. Vessels are small, solitary and in radial multiples of two to three.

• Colour:- Sapwood pale yellowish or yellowish white. Heart wood is deep yellow turning reddish or brownish on exposure.

• Durability:- Non-durable

• Uses:- It is one of the best turnery and carving wood and is largely used for class I ply wood and folding chairs and camp furniture and house hold fitments.

3. *Prosopis juliflora* DC.

• Family - Leguminosae (Mimosae)

• Trade Name:- Keekar

• General feature:- It is a small to medium-sized tree usually unarmed, attaining a height of 9-12 m and girth of 90 cm. *Prosopis juliflora* DC (Keekar) is a hard to very hard wood. Heartwood dark brown to purplish-



Fig. 2: *Adina cordifolia* (Roxb).



Fig. 3: *Prosopis juliflora* DC.

brown. Vessels moderately large to small, visible to the eye, 45-190 μm in diameter (mean 115 μm , few to moderately numerous

- Colour:- Sapwood distinct from heartwood. Heartwood dark brown to purplish-brown and

- Uses:- The mesquite pods are sweet and edible and flowers are the source of honey. The gum obtained is used as an adulterant or substitute for gum Arabic. The wood takes paint and polish well. It is cheaply valued for fuel and charcoal but locally can be used for tool handles, agricultural implements and cheap furniture.

4. *Mangifera indica* Linn.

- Family - Anacardiaceae

- Trade Name:- Mango wood

- General feature:- *Mangifera indica* (mango wood) is a moderately hard and heavy wood. It has yellowish white to greyish brown and somewhat lustrous wood. Growth rings are fairly distinct. Wood is moderately hard and heavy. Vessels are large to medium, often filled with tyloses, numerous and solitary or in radial multiples of 2-3.

- Colour:- Yellowish white to greyish brown, sap wood and heart wood not distinct or sometimes heartwood distinct and dark brown; somewhat lustrous.

- Durability:- Non-durable

- Uses:- Ceiling boards, window frames, general purpose class I plywood, furniture and cabinets, block boards, match splints and boxes, boat and ship buildings, bobbins, bent wood articles, shoe-lasts.

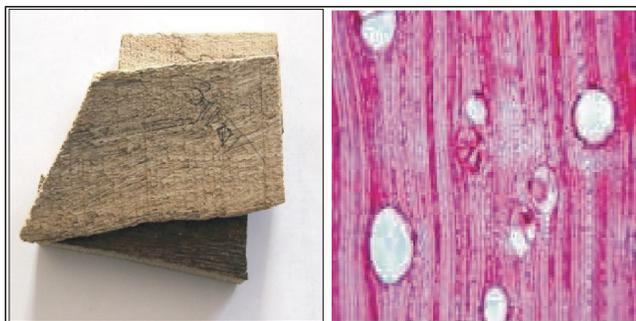


Fig. 4: *Mangifera indica* Linn.



Fig. 5: *Eucalyptus tereticornis*.

5. *Eucalyptus tereticornis* Sm

- Family - Myrtaceae

- Trade Name:- Eucalyptus

- General feature:- Large, about 25-45 m in height, 3-6 m in girth and 40 cm in diameter. Bark smooth, whitish or ash coloured and deciduous. *Eucalyptus tereticornis* Sm. (Mysore gum) is a very hard and heavy wood. Heartwood is pale brown to reddish brown. Vessels medium sized, visible to the eye, moderately numerous (5-20 per mm^2), mostly solitary, open or filled with abundant tyloses, kino-like deposits sparse to moderately abundant.

- Colour:- Heart wood pale brown to reddish brown fairly well demarcated from the sapwood. Sapwood light greyish-brown or pale red

- Durability:- Moderately durable

- Uses:- Mainly used for fuel, paper and pulping, suitable for packing cases and boxes, beams, columns, power transmission poles and posts. It is now being used by some paper mills in North India in mixture with other raw materials. It is also used for rayon grade pulp by some mills. It is highly suitable for construction work, furniture and stakes.

6. *Azadirachta indica* A. Juss

- Family - Meliaceae

- Trade Name:- Neem

- General feature:- Medium to large tree with a height of 15-20 m with a clear bole of 7 m and diameter of 50 cm. *Azadirachta indica* A. Juss (Neem) is a moderately heavy wood. Heartwood is reddish brown, aromatic and

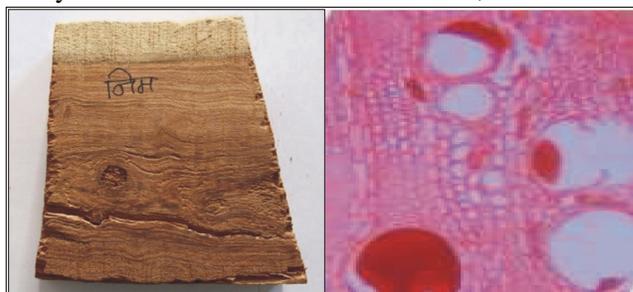


Fig. 6: *Azadirachta indica* A. Juss.



Fig. 7: *Terminalia arjuna* Bedd.

slightly lustrous. Distinct growth rings. Vessels medium sized, few and occurring in solitary or in radial multiples of two to three, often in clusters and filled with reddish gummy deposits.

- Colour:- Heartwood reddish brown, aromatic, moderately lustrous. Sapwood is yellowish white, yellowish brown or greyish yellow.

- Uses:- Used in light construction, furniture, doors and window frames boards and panels, cabinets, boxes and crates. Also used for agricultural implements, tool handles, musical instruments, cigar boxes, matches, ply wood, veneers, carving and toys.

7. *Terminalia arjuna* Bedd.

- Family - Combretaceae
- Trade Name:- Arjun sadada

- General feature:- Large evergreen tree with spreading crown and drooping branchlets, 18-24 high and over 3 m in girth. *Terminalia arjuna* (Neermaruthu) is a hard and heavy wood. Wood is diffuse-porous. Growth rings delimited by fine concentric lines of soft tissues which are distinct only under hand lens. Vessels are large, distinct to the eye, few, more or less evenly distributed solitary or in radial multiples of 2-3, partially filled with tyloses and also reddish-brown gummy deposits in the heartwood.

- Colour:- Sapwood is reddish-white and the heartwood, which is sharply delineated from the sapwood, is brown to dark brown variegated with darker coloured streaks.

- Uses:- The timber is mainly used for agricultural implements, water troughs; boat building, cart making and pit props. It is also used for constructional purposes like



Fig. 8: *Dalbergia sissoo* Roxb.

door and window frames. It is also used for block boards and plywood. As the trees are found on river banks, they are often not felled for fear of erosion.

8. *Dalbergia sissoo* Roxb.

- Family - Leguminosae (Fabaceae)
- Trade Name:- Sissoo

- General feature:- Small to large up to 30 m in height with curved or crooked and buttressed stem. Bark grey or brown. Heartwood of *Dalbergia sissoo* (Shisham) is golden brown to dark brown. Hard and moderately heavy wood. Growth rings are distinct, Vessels are large and few in early wood and small and few in late wood, often filled with dark, gummy deposits.

- Colour:- Heartwood golden brown to dark brown with deep dark streaks, soon becoming dull, clearly demarcated from the pale brownish to white sapwood.

- Durability:- Very durable, highly resistant to termites

- Uses:- First class timber for cabinetry and furniture, paneling and flooring. It yields a very strong veneer cut on a rotary machine which is also highly decorative.

9. *Tectona grandis* Linn.f

- Family - Verbenaceae
- Trade Name:- Teak (Sag)

- General feature:- The tree is large to very large, 25-45 m in height and upto 190 cm in diameter, *Tectona grandis* (teak) has golden brown heart wood with black streaks. The early wood vessels are large and few, compared to the late wood vessels which are small and numerous.

- Colour:- Sapwood and heartwood sharply demarcated. Heartwood golden brown when fresh or dark brown on exposure occasionally with black streaks with a waxy feel, lustrous sometimes with white glistening deposit, distinct aromatic odour with the smell of leather. Sapwood white, pale yellow or grey.

- Durability:- Very durable, highly resistant to termite damage.

- Uses:- A versatile wood. Used extensively for ship



Fig. 9: *Tectona grandis* Linn.

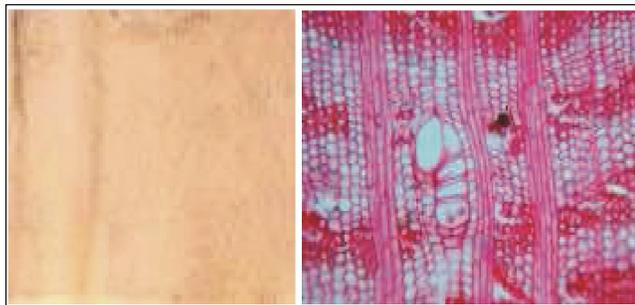


Fig. 10: *Ficus bengalensis* L.

and boat building, class I general purpose plywood, cabinet making. Building construction poles and cross arms, textile mill accessories, musical instruments, mathematical, engineering and drawing instruments and bus bodies. It is used for doors and windows in house construction.

10. *Ficus bengalensis* L.

- Family - Moraceae
- Trade Name:- Banyan
- General feature:- Large tree with spreading branches attaining a height of 30 m. Bark greyish white, smooth. *Ficus bengalensis* L. (Banyan) is light to moderately heavy wood.
- Colour:- Creamy white to greyish white when first exposed turning grey or pale brownish grey with age, discolours rapidly by sap stain; heartwood and sapwood not distinct.
- Uses :- Third class wood used for making tea boxes, toys and for light packing cases. The wood of aerial roots can be used for tent poles, cart yokes.

Conclusion

Native timbers that have gained acceptance for various uses are rather limited as compared to the large number of tree species found in the forests. Probably one major factor which prevents wider utilization of many potential species is the user's bias with regard to the quality of these woods. The present study indicates that such a bias is unfounded and a good proportion of secondary tree species have got the potential to become reasonably good substitutes for common commercial timbers for purposes like joinery, furniture, turnery and structural applications.

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