

## VARIATION OF PHYSICAL AND MECHANICAL PROPERTIES OF *Boscia angustifolia* (A. RICH.) WOOD ALONG RADIAL AND AXIAL STEM PORTION

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### **Abstract:**

*The increasing demand and dwindling supplies of tropical timber wood species in many developing countries necessitates the need to introduce lesser-used species to serve as substitutes. The physical and mechanical properties of Boscia angustifolia, a lesser known wood species, were investigated. The tree of Boscia angustifolia was sampled along the axial direction (base, middle and top) and the radial direction (core, middle and outer). The test samples were prepared in accordance with the British Standard Test Procedures and subjected to some selected physical and mechanical properties. The mean values of moisture content range from 12.13 – 17.04% along the axial and radial plane. The specific gravity of the wood increased from top to base from 0.44 - 0.54. Volumetric swelling and shrinkage along the axial plane range from 4.23 – 10.94% and 7.25 – 8.48% respectively. Water absorption of Boscia angustifolia ranges from 45.34 – 55.47%. The mean values for MOE, MOR and MCS// range from 3502.45 – 9867.84 (N/mm<sup>2</sup>), 32.26 – 65.23N/mm<sup>2</sup> and 19.18 – 29.20N/mm<sup>2</sup> respectively. There was an overall increase in physical and mechanical properties of the wood from the base to the top of the tree and this has a strong relationship with specific gravity. The values obtained from the study compared favorably with those of known wood species. This indicates that different part of the species could be selected and used for different purposes such as for construction, furniture and other interior wood work.*

**Key words:** axial direction; *Boscia angustifolia*; mechanical properties; physical properties; radial direction.

### **INTRODUCTION**

Wood is a versatile and an aesthetically pleasing material as well as the oldest building material used by man. Wood is a by-product of the forest, plantation forest has become the practicable tool for meeting the wood need in the country and for ensuring a stable supply of wood on sustainable basis. In Nigeria, over the years, much exploitation of the forest has been done in order to meet the increasing demand of the teeming population. This has resulted in serious depletion of the forest resources base to the extent that some favored timber species zones has been exploited (Fuwape 2000). The tropical forest of Nigeria is decreasing at an alarming rate today and the demand for wood has continued to increase in proportion to human population. The increasing demand of tropical wood species would continue to be high due to its versatility and affordability over and above other construction materials. The over exploitation of existing forest resources and the disappearance of economic hard wood species are of great concern to the wood scientist, technologist and wood users as well. The supply of quality timber from the natural forest in Nigeria to wood based industries is no more available in the quantities that can sustain the usual large diameter class logs required by these industries (Omiyale 2001).

In Nigeria, wood has always been an essential construction material for both domestic and industrial uses. Wood products in Nigeria are utilized for light construction purpose such as doors, windows, refers, lamp holder, flooring panel (Ajala and Adebawo 2016). The increasing demand and dwindling supplies of tropical timber wood species in many developing countries necessitates the need to introduce lesser-used species to serve as substitutes. Nigeria has established a conservation classification to ensure that the supply of Nigerian hardwood species can be maintained. In practice, this means that harvesting of the better known and commonly used species (like the redwoods, African mahogany and Sapele wood) is more

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limited, and much more encouragement is being given to the harvesting of lesser known species. There is, therefore, little hope for the future of the Nigerian timber trade if diversification of market species is not encouraged to accommodate lesser-known species and to serve as a means for sustainable management of the tropical forest of Nigeria. The introduction of the lesser used species will take pressure off the primary and known wood species (Addae-Mensah 1998). Accordingly, the utilization of lesser-used species is being promoted in many countries to widen the species base of the industry and to reduce the pressure mounted on the forest due to harvesting of the few currently demanded species (Shupe et al. 2005, Smith et al. 2005).

The physical and mechanical properties of wood are important factors used in determining the suitability and application of wood material, these in turn depends on the wood species. The strength of a timber depends on its species and the effects of certain growth characteristics (Yeomans 2003). Different wood species have different strength characteristics, and also within a species these characteristics may vary. Physical properties are the quantitative characteristics of wood and its behavior to external influences other than applied forces. Familiarity with physical properties is important because they can significantly influence the performance and strength of wood used in structural applications. Mechanical properties are the characteristics of a material in response to externally applied forces. They include elastic properties, which characterize resistance to deformation and distortion, and strength properties, which characterize resistance to applied loads. Mechanical property values are given in terms of stress (force per unit area) and strain (deformation resulting from the applied stress) (Winandy 1994). Hence, this research was undertaken to examining the variation of the physical and mechanical properties within the stem of a lesser known wood species, *Boscia angustifolia*.

*Boscia angustifolia* is a shrub or small evergreen tree of 10 –14m high. It is found in all savanna types and in deciduous wood bush land in West Africa. It usually grows in sites such as hills, laterite outcrops and cliffs and sometimes dry riverbeds. The wood is hard and is used in production of charcoal for gun powder. It is also used in carpentry and water storage vessels (Orwa et al. 2009). However, there is dearth of information on the physical and mechanical properties of *B. angustifolia*. This will be useful to know if the wood could be used in constructions, furniture making and so on. The right and efficient use of *B. angustifolia* therefore demands full knowledge of its physical and mechanical properties which can only be obtained through scientific research.

## OBJECTIVE

The main objective of the study was to determine the variations in the selected physical and mechanical properties of *Boscia angustifolia* along the stem portion with a view of establishing the use of this lesser known species for construction and other structural applications.

## MATERIALS AND METHODS

### Collection wood specimen

Two defect-free trees of *Boscia angustifolia* were harvested from Onigambari Forest Reserve, Ogun state, Nigeria. They were converted to three bolts from 50cm in length from the base. The three bolts were collected from the top (90%), middle (50%) and base (10%) of the merchantable lengths of the trees. The average diameter of the top, middle and base of the wood are 810.16cm, 1021.02cm and 1158.24cm respectively. The bolts were partitioned into three equal zones, namely inner wood, middle wood and outer wood along the radial planes as in Ogunsanwo and Onilude (2002).

### Preparation of wood blocks

The bolts were converted into 6cmx2cmx2cm and 30cmx2cmx2cm dimensions for physical and mechanical properties respectively for each sampling height (top, middle and base) such that the wood grains aligned with the longitudinal axis (BSI 1957). A total of 108 test samples of dimensions 6cmx2cmx2cm and 78 test samples of dimensions 30cm x 2cm x 2cm were collected from each tree to give a total of 372 test samples. The test blocks were dried in the oven at 103°C for 24 hours, weighed and subsequently stored in air-tight bags.

## Physical properties

### Determination of moisture content

Moisture content (M.C.) is a measure of the amount of water contained in wood and is expressed as a percentage of its oven dry weight. The lower the percentage of moisture content, the drier the wood. The moisture content was determined according to Clause 2 of BS 373: 1957, and calculations made according to Appendix A of the same code using equation 1.

$$\text{M.C} = \frac{W_g - W_d}{W_d} \times 100 (\%) \quad (1)$$

where: M.C – moisture content of specimen at the time of test;  
W<sub>1</sub> – initial weight (g);  
W<sub>0</sub> – oven-dry weight (g).

#### Specific Gravity

The specific gravity (SG) of the *Boscia angustifolia* wood samples were obtained using the standard procedure of ASTM D 2395-14. The dimensions of test specimens were measured in a number of places to ensure a precise indication of volume and the masses were determined to a precision of ±0.2%. SG was calculated using equation 2:

$$\text{Specific gravity at moisture content } M (S_M) = \frac{K m_D}{V_D} \quad (2)$$

where: K – constant determined by the units used to measure mass and volume:  
- 1000 mm<sup>3</sup>/g when mass is in g and volume is in mm<sup>3</sup>.  
M<sub>0</sub> – oven-dry mass of specimen;  
V<sub>0</sub> – oven-dry volume of specimen.

#### Determination of volumetric swelling and volumetric shrinkage

Wood blocks of dimension 6cmx2cmx2cm were used to determine volumetric shrinkage and volumetric swelling according to ASTM – 1037 (1999). The wood blocks were soaked in water for 48 hours in order to get them conditioned to moisture content above fiber saturation point (FSP). Specimens were removed one after the other, their dimensions in wet conditions were taken to the nearest millimeter using a digital veneer caliper. The blocks were air dried for 24 hours and then oven dried at 105°C for 24 hours. The oven-dried blocks were then weighed and the dimensions were measured again along the points marked earlier using the same veneer caliper. The green to oven dry shrinkage in radial and tangential directions of the same blocks was determined, expressed as a percentage of the saturated dimension to its oven dry dimension. Volumetric swelling and volumetric shrinkage were calculated according to equation 3 and 4 respectively.

$$S = \frac{V_2 - V_1}{V_1} \times 100 \quad (\%) \quad (3)$$

where: S (%) – Volumetric swelling coefficient;  
V<sub>1</sub> – volume of wood before soaking;  
V<sub>2</sub> – volume of wood after soaking.

$$S = \frac{D_s - D_o}{D_o} \times 100 \quad (\%) \quad (4)$$

where: S – % Volumetric shrinkage coefficient;  
D<sub>s</sub> – dimension of saturated condition;  
D<sub>o</sub> – dimension of oven-dried condition.

#### Water Absorption

Wood blocks of *Boscia angustifolia* with dimension 6cmx2cmx2cm were soaked in a distilled water for 168h in order to condition the wood samples to moisture contents above fibre saturation point (FSP). Afterwards, the samples were removed, weighed and oven-dried in order to calculate water absorption values (WA) using equations 5 according to ASTM- 1037 (1999).

$$\text{WA } (\%) = \frac{W_2 - W_1}{W_2} \times 100 \quad (5)$$

where: WA (%) – Water absorption;  
W<sub>2</sub> – wet weight of the specimen after soaking in water (g);  
W<sub>1</sub> – oven-dry weight (g).

#### Mechanical properties

##### Modulus of Rupture (MOR)

Modulus of rupture is a parameter for measuring static bending strength of wood. It measures the equivalent of stress in the extreme fibers of the point of failure. Wood samples were cut into 30cmx2cmx2cm

dimension according to the British standard 373 (1989) and tested on an elastic beam apparatus. The loads were applied until failure of the sample occurred. The load at which each test sample failed was recorded. The MOR was calculated using equation 6.

$$\text{MOR} = \frac{3PL^2}{2\Delta db^2} \text{ (N/mm}^2\text{)} \quad (6)$$

where: P – Load that failed the test sample (N);  
L – span for the test sample (mm);  
B – Width of the test sample (mm);  
D – Thickness of the test sample (mm).

#### *Modulus of Elasticity (MOE)*

The modulus of elasticity was calculated from the values obtained from the load deflection graph during the test for MOR. The MOE was calculated using equation (7).

$$\text{MOE} = \frac{3PL^3}{4\Delta db^2} \text{ (N/mm}^2\text{)} \quad (7)$$

where: P – Maximum load at failure (N);  
L – Span of the material (mm);  
D – Depth;  
B – width of the board sample (mm);  
 $\Delta$  - Deflection of beam center at proportional load.

#### **Statistical Analysis**

The data obtained from the testing procedures were analyzed using one-way analysis of variance (ANOVA) with a statistical analysis software SPSS version 14. The data of the physical properties were separated using the Duncan Multiple Range test at  $\alpha$  0.05.

## **RESULTS AND DISCUSSION**

### **Physical properties**

#### *Moisture content*

Moisture content and specific gravity are among the properties that affect the usage of wood as raw materials. Hence, special reference must be given to these properties. The results of moisture content and specific gravity of *Boscia angustifolia* in axial and radial positions are presented in Table 1. The moisture content of the wood specimen in the axial direction of the top of the wood ranged from 12.28 - 13.63%. It increases from the core to the outer part of the wood. However, in the middle of the wood in the axial direction, there is no significant difference in the moisture content of the wood in all the radial positions which ranged from 16.32 - 17.04%. This gives an impression that there is no different in moisture content of both sapwood and heartwood of this species. In the base of the wood in the axial direction, the moisture content ranged from 12.3 - 14.12%. The moisture content decreases from the core of the wood to the outer part of the wood in the radial direction, though there is no significant difference in the moisture content of the base wood along the radial plane. The decrease in the moisture content from the core to the outer part may be due to the presence of extractives in the core (heartwood) of the species. This is in contrary to Shupe et al. (1995) who reported in his work that moisture content increase along the radial plane from core to outer wood. The higher moisture content observed in the middle portion of *B. angustifolia* may be due to lots of active and mature cells in the middle portion of the merchantable height of the tree. The higher moisture content observed in the middle portion of tree is also contrary to the results of Nyrfaizah et al. (2014) who reported highest moisture content at the top of the *Neolamarckia cadamba species* compared to other portion of the merchantable height of the tree.

#### *Specific gravity*

The specific gravity (SG) of the wood in along the bole height from top to base ranged from 0.44-0.54 and was significantly affected by tree position. The base wood has the highest specific gravity and there is no significant difference in the values along the radial plane. There is significant difference in the specific gravity of the wood in the top when moving from the core to the outer part of the wood. The SG reduces from core to middle and then increases from the middle to the outer wood. Similar pattern of variation was reported for *Casuarina equisetifolia* (Chowdhury et al. 2007, Ali 2010). This is a general trend since wood density is usually higher at bottom due to the higher compaction of the stump tissues exerted by overlapping cells along the bole and tree crown (Ali 2010).

Table 1

**Mean values of Moisture content and specific gravity of *Boscia angustifolia* in axial and radial position**

<b>Axial</b>	<b>Radial</b>	<b>Moisture Content (%)</b>	<b>Specific Gravity</b>
	Core	12.28±0.67 <sup>a</sup>	0.47±0.07 <sup>b</sup>
Top	Middle	13.36±2.54 <sup>a</sup>	0.44±0.02 <sup>a</sup>
	Outer	13.63±4.93 <sup>a</sup>	0.52±0.00 <sup>c</sup>
	Core	16.32±2.78 <sup>b</sup>	0.44±0.02 <sup>a</sup>
Middle	Middle	16.93±4.86 <sup>b</sup>	0.52±0.07 <sup>c</sup>
	Outer	17.04±2.01 <sup>b</sup>	0.49±0.01 <sup>b</sup>
	Core	14.12±1.20 <sup>a</sup>	0.51±0.02 <sup>c</sup>
Base	Middle	13.68±5.93 <sup>a</sup>	0.51±0.05 <sup>c</sup>
	Outer	12.13±2.91 <sup>a</sup>	0.54±0.01 <sup>c</sup>

Mean with the same alphabet are not significantly different from each other at  $\alpha = 0.05$ .

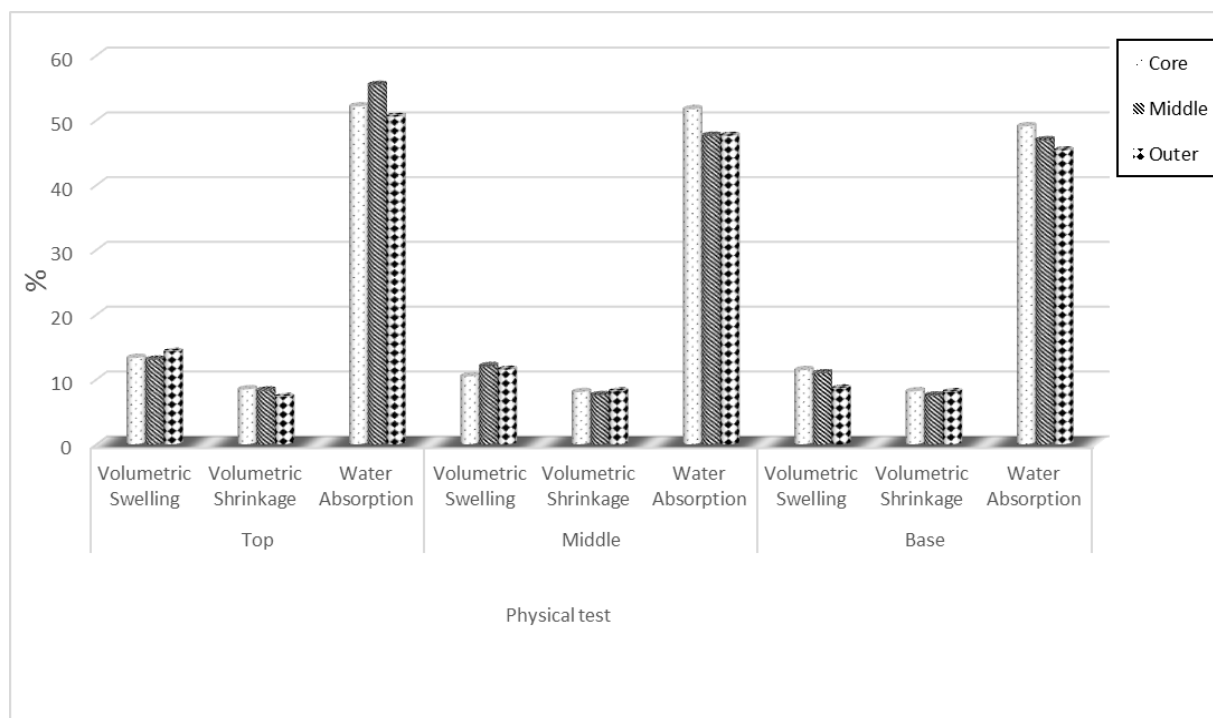
The specific gravity of *B. angustifolia* is still on the average when compared to other common wood species. According to Eyma et al. (2004), specific gravity of some common wood species were reported as *Ceiba pentandra* Gaertn, 0.204; *Triplochiton scleroxylon* K. Schum, 0.315; *Terminalia superba* Engl. Et Diels, 0.554; *Fagus sylvatica*, 0.573; *Eucalyptus globulus* Labill, 0.705. Moreover, the results of this study compares favorably with other reported findings of specific gravity of lesser used wood of medium density wood. Shupe et al. (2005) reported that specific gravity of some lesser used wood for *Ilex tectonica*, 0.55; *Calophyllum hrasiliense*, 0.69, *Virola koschnyi*, 0.50; *Huetea cubensis*, 0.46; *Vochysia guaternalensis*, 0.47, *Terminalia Amazonia*, 0.73. A greater specific gravity essentially means fewer cell cavities and more cell walls in the wood. It is important to note that the higher the value of the specific gravity of the wood the greater the strength properties (Green et al. 2003; Desch and Dinwoodie 1981). *B. angustifolia* falls in the category of medium density wood. The medium density wood can mostly be use in the structural work that do not require high strength, manufactures of furniture and other materials that do not carry heavy loads (Jamala et al. 2013).

#### Volumetric Swelling

The results of the volumetric swelling and shrinkage of *Boscia angustifolia* in axial and radial position are presented in Fig. 1. The volumetric swelling of the wood along the axial position varies between 8.17 – 13.34%, 10.94 – 13.03%, and 8.57 – 4.23% for the core, middle and outer respectively. The analysis of variance (Table 2) showed that there is no significant difference in the volumetric swelling of the wood along the bole height but there is significant difference in the volumetric swelling along the radial position. This shows that there is similar pattern of swelling from the bottom to top of the wood. However, the patterns of swelling is significantly affected by the heartwood due to presence of the extractives. The larger difference in swelling between the core and outer wood (heartwood and sapwood) observed in this species can be associated with the greater difference in wood specific gravity between these parts of wood, as density is an essential factor that significantly influences swelling (Mantanis et al. 1994). The values for the volumetric swelling fall within same range with the values reported by Jamala et al. (2013) for some tropical hardwood species. He reported 10.46% for *khaya ivorensis*, 6.44% for *Triplochiton scleroxylon*, 11.36% for *Celtis mildbraedii*, 10.12% for *Meliceae excelsa* and 7.50% for *Afzilia africanum*. However, the base portion of the tree in this present study had the lowest volumetric swelling indicating that their uses and application cannot be much affected by moisture or rainfall when used for outdoor purposes.

#### Volumetric shrinkage

Volumetric shrinkage of the wood (Fig. 1) along the axial positions (top-base) also ranged between 8.17 – 8.48%, 7.53 – 8.28% and 7.25 – 8.12% for the core, middle and outer wood respectively. The analysis of variance (Table 2) showed that there is no significant difference in the volumetric shrinkage of the wood from the top to base whereas there is significance difference from the core to the outer part of the wood. The volumetric shrinkage for the outer wood is significantly higher that the core and middle wood. This shows that the shrinkage was somehow higher in sapwood. These values are lower than the values reported by Jamala et al. (2013), who reported that volumetric shrinkage of 12.94%, *Khaya ivorensis*; 6.90%, *Triplochiton scleroxylon*; 12.29%, *Celtis mildbraedii*; 9.19%, *Meliceae excelsa* and 7.57%, *Afzilia Africana*.



**Fig. 1.**  
**Volumetric swelling, shrinkage and water absorption of *Boscia angustifolia* in axial and radial position.**

However, a contrary result was reported for the variation in shrinkage with tree height and was found to decrease from bottom to top in heartwoods of both ncurri and ntholo wood (Ali 2010). The shrinkage variation could be attributed to combinations of many factors including presence of ray tissue, which provides a restraining influence in the radial direction, frequent pitting on the radial walls, domination of latewood in the tangential direction and differences in the amount of cell wall materials (Poku et al. 1991). Since observed shrinkage values of *B. angustifolia* are low, this indicates that the species is highly homogeneous and dimensionally stable and could be used for outdoor purposes.

**Water Absorption**

The results of water absorption of *B. angustifolia* is presented in Fig. 1. The values for water absorption along the bole height from top to base ranged from 49.09 – 52.15%, 46.93 – 55.47% and 45.34 – 50.55% for the core, middle and outer respectively.

**Table 2**  
**Analysis of variance of volumetric swelling, volumetric shrinkage and water absorption of *Boscisa angustifolia* in axial and radial direction**

Sources	Dependent Variable	Df	Sum Squares	of Mean Square	F	Sig.
<b>axial</b>	Volumetric Swelling	2	33.127	16.564	1.59	0.231
	Volumetric Shrinkage	2	0.031	0.015	0.117	0.89
	Water Absorption	2	136.235	68.118	8.544	0.002*
<b>radial</b>	Volumetric Swelling	2	105.931	52.965	5.085	0.018*
	Volumetric Shrinkage	2	1.313	0.657	4.971	0.019*
	Water Absorption	2	52.857	26.429	3.315	0.059
<b>axial*radial</b>	Volumetric Swelling	4	95.777	23.944	2.299	0.099
	Volumetric Shrinkage	4	2.569	0.642	4.863	0.008*
	Water Absorption	4	48.388	12.097	1.517	0.239

<b>Error</b>	Volumetric Swelling	18	187.494	10.416
	Volumetric Shrinkage	18	2.378	0.132
	Water Absorption	18	143.512	7.973
<b>Total</b>	Volumetric Swelling	26	422.329	
	Volumetric Shrinkage	26	6.291	
	Water Absorption	26	380.993	

\* Significance ( $p < 0.05$ )

It is observed that the pattern of variation across the radial position of the top wood is inconsistent because it increases from the core to the middle and then decreases to the outer wood. However, the water absorption for the middle in radial direction decreases from the core to the outer wood. This same pattern was also observed in the base of the wood, water absorption decreases from core to outer wood. The result of analysis of variance (Table 2) shows that there are significant differences in the pattern of variation along the axial but no significance difference along radial plane. The variation in the water absorption along the bole could be attributed to different extractive content of the wood at this different position. The higher the extractive content, the lower the water absorption. This is in line with the findings of Choong and Achmadi (1991) who stated that Fibre Saturated Point (FSP) may be lower in wood with high extractive contents, such as in many tropical species.

### Mechanical properties

#### Modulus of Elasticity (MOE) and Modulus of Rupture (MOR)

The results of MOE of *Boscia angustifolia* along the axial and radial direction are presented in Table 3. The mean values for MOE ranges from 3502.45 – 9867.84 (N/mm<sup>2</sup>). The base - core wood has the highest MOE value and is significantly higher than other MOE values along the radial direction. The top - outer has the lowest value (3502.45N/mm<sup>2</sup>) in MOE. However, there was no significant difference in the MOE values for the wood in middle across the radial positions. Likewise, there was no significant difference in bottom of the wood radially. The average MOE for this species is even higher than values reported for some common species such as Teak (6753N/mm<sup>2</sup>), Accacia (7844N/mm<sup>2</sup>) and *T. cattapa* (7751N/mm<sup>2</sup>) (Prihatmaji et al. 2010). Interestingly, the values obtained in this study for MOE are in the same range with the values reported by Jamala et al. 2013 for the selected wood species in the tropical rainforest in Ondo State Nigeria. He reported MOE values of 7088.69N/mm<sup>2</sup> for *Celtis mildbraedii*, 6311.58N/mm<sup>2</sup> for *Azelia Africana*, 8192.54N/mm<sup>2</sup> for *Khaya ivorensis*, 5765.63N/mm<sup>2</sup> for *Meliceae excelsa* and 39337.5N/mm<sup>2</sup> for *Triplochiton scleroxylon*. MOE has a strong relationship with SG (Table 1). It can be seen from Table 1 that the specimen has higher S.G at the base and also the highest MOE is seen in the base of the species.

The mean values for MOR as presented in Table 3 range from 32.26 – 65.23N/mm<sup>2</sup> along the axial and radial positions. The highest value for MOR was seen in the base - outer of the wood while the top – middle has the lowest. However, there was no significant difference in the MOR values for top of the wood across the radial positions.

Table 3

Mean values of MOE, MOR and MCS// of <i>Boscia angustifolia</i> in axial and radial position				
Axial	Radial	MOE(N/mm <sup>2</sup> )	MOR(N/mm <sup>2</sup> )	MCS// (N/mm <sup>2</sup> )
	core	4204.90±1807.00 <sup>a</sup>	35.34±5.64 <sup>a</sup>	19.18±3.5 <sup>a</sup>
Top	middle	5939.64±3489.04 <sup>b</sup>	32.26±0.00 <sup>a</sup>	21.56±6.8 <sup>a</sup>
	outer	3502.45±678.48 <sup>a</sup>	36.34±0.00 <sup>a</sup>	19.99±1.15 <sup>a</sup>
Middle	core	6102.03±2543.14 <sup>b</sup>	49.76±0.00 <sup>c</sup>	25.87±4.75 <sup>b</sup>
	middle	5027.66±0.00 <sup>b</sup>	45.84±0.00 <sup>b</sup>	26.00±10.61 <sup>b</sup>
	outer	5070.51±3097.67 <sup>b</sup>	48.75±6.73 <sup>bc</sup>	21.80±6.3 <sup>a</sup>

	core	9867.84±1667.19 <sup>c</sup>	50.35±11.52 <sup>c</sup>	29.20±3.24 <sup>c</sup>
Base	middle	8889.29±200.96 <sup>c</sup>	54.09±3.6 <sup>c</sup>	28.62±0.39 <sup>c</sup>
	outer	8019.05±4965.19 <sup>c</sup>	65.23±0.00 <sup>d</sup>	25.60±0.00 <sup>b</sup>

Mean with the same alphabet are not significantly different from each other at  $\alpha = 0.05$

The result is different from the report of Macchao and Cruz (2005) who reported that there was a clear increase in MOE and MOR throughout the radial direction, from pith to the bark which was due to the transition from juvenile to mature wood. Panshin and de Zeeuw (1980) reported that SG is a good predictor of wood strength. Variability in wood strength for *B. angustifolia* also followed a similar pattern as that of SG. This variability may be due to a combination of many factors including the inherent variability within the tree, growth and environmental conditions and presence of high extractive contents (Choong et al. 1989).

#### Maximum Compressive strength (MCS//)

The mean values for MCS ranges from 19.18 – 29.20N/mm<sup>2</sup> along the axial and radial directions are presented in Table 3. The top - core wood has the lowest value for MCS// while the overall MCS// for both along the stem and across the stem was 29.20N/mm<sup>2</sup>. This value is lower than reported values for species with similar specific gravity. The compression strength values for *Boscia angustifolia* fall in the same range for overall mean values reported by Ajala and Ogunsanwo (2011), who reported 27.45N/mm<sup>2</sup> for *Aningeria robusta* wood. There were slight but significant variations in the MCS// along the stem portion of the specimen. This variations may be as a results of the amount of growth rings that are present in the wood species and this has an influence in determining the strength properties of wood (Careira 2003).

#### CONCLUSION

This study has presented an attempt to publicize one of the lesser known wood species by providing information about the physical and mechanical properties within the stem portion. The results revealed that there were significant differences in the moisture content of the wood species along the axial direction but not in radial portion. Also, there was a slight but significant difference in the specific gravity of the tree from base to top portion. In addition, the volumetric swelling and shrinkage and water absorption also varied along the axial portion. Moreover, there were significant difference in the mechanical properties of the wood longitudinally. MOE, MOR and MCS// were higher at breast height than at the top and these have a strong relationship with specific gravity. It can be concluded that the physical and mechanical properties along the stem varies within *B. angustifolia* species thereby making it a useful species. Therefore, all these points should be taken into consideration in deciding cutting pattern of logs and their uses for structural purposes.

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