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Suitability of *Gmelina arborea* (Roxb.) wood for making talking drum in Nigeria

[1]Aiyeloja, A. A., G. A. Adedeji[1] and L. A. Adebisi[2]
[1]*Department of Forestry and Wildlife Management, University of Port Harcourt, Nigeria*
[2]*Department of Forest Resources Management, University of Ibadan, Nigeria*

Abstract: *After human voice and other social media, talking drum is perhaps the most popular medium of communication in southwestern Nigeria. Available articles on talking drums are oriented towards culture, melody and communication with little information on the biological material used in making them. Also, scarcity of Cordia millenii which hitherto was the choice species for drums carving necessitated the assessment of the suitability of Nigerian grown Gmelina arborea as alternative wood for making drums. A talking drum made in 1972 from a 7-year-old Gmelina tree was examined. In order to ascertain the physical properties of G. arborea, samples of a 12-year-old G. arborea wood were used to determine the wood density (WD) and the coefficient of variation (CV).G arborea has WD of 476±0.20kg/m^3 and CV of 6.86% which is close to that of C. millenii: 436.51±14.39kg/m^3 and European Spruce: 450kg/m^3. The examined drum exhibited excellent degradation resistance to insects and splitting for over 40 years as attested to by the respondents. This study identified Gmelina arborea as excellent substitute for Cordia millenii for talking drums and other drums in Nigeria. Establishment of more plantations in order to ensure regular supply of wood for carving and other wood-based industries is advised.*

Keywords: *Cordia millenii, entertainment industry, Ibadan, talking drum, wood density*

I. Introduction

After human voice and of recent other social media, talking drum is perhaps the most popular medium by which most southwestern Nigerians communicate, share ideas, views, thoughts and policies.. More so, it finds wider applications in entertainment, praise singing, fun, folklore and leisure [1]. Talking drums are the most popular and distinguished tone instruments in southwestern region of Nigeria. They earn distinction among all drums because of their "voices" and broad applications. Talking drums belong to the most representative musical instruments in Nigeria. They can be used without any local legislative restriction unlike deities and gods drums. Creativity in utilization of talking drums has immensely increased the popularity of Nigerian culture and entertainment industry beyond Nigeria shore. To a large extent, the voices are directly and largely dependent on the specific wood species used. The sound from the talking drum has both a base and treble tone and it is principally dependent on length and thickness of the wooden frame neck. Formerly, the length of the hourglass shaped talking drum was 6 by 14 inches but with the inclusion of talking drum in modern music, the length was reduced to 11 inches. However, the longer talking drum (6 by 14 inches) is still in use today especially in Kwara State and among the Fulanis.

Human lives have become so much dependent on woods for the provision of money, papers, cooking utensils, canoes, furniture, shelters and drumset among others. Providing much of the developmental values that humans need, woods are the pillar of human culture across the globe. Traditionally, humans have also utilized wood species in decorations, and as inspiration in the arts of making many sculptural artifacts of historical values. As regard to culture and entertainment industry, woods are very vital as many modern musical instruments have been derived from woody materials. The acoustical properties of wood used for musical instruments have been previously reported to be highly related to the wood density [2-5]

Modifications of acoustical properties to supersede the excellent properties of wood from advances in structural sciences and technology have not been reported. Hence, wood remains the principal material for musical instrument production worldwide [5]. In spite of the variety of timber species in the forests, *Cordia millenii* was specifically chosen to produce drums. It was in general use and was classed conservatively for drum carving purpose in southwestern Nigeria. A similar choice of *Cordia millenii* locally known as Tweneboa or Tweneduro in Ghanan was traditionally used for drums especially Atumpan drum [6] which performs similar function as talking drum in Nigeria. The choice of *Cordia millenii* was based on the inherited indigenous knowledge and it has been the standard drum making species for many years without any effort of domestication. In the meantime the species became scarce due to multiple uses by the carving and other wood based industries. The shortage of this species had forced the carving industry to employ many unsuitable species for drums production which eventually render unsatisfactory services to users.

Woods may lose their excellent acoustical property when degraded by degradation agents or having technical defects such as splitting, checking, twisting etc. Therefore, sound stems devoid of knots and reaction woods are usually chosen. Drums are usually kept indoors after use thus ensuring protection against weathering which could causenegative impact on the acoustical properties of drums. All wood species talk but indigenous knowledge had established that *C. millenii* (Omo) talks excellently without impediment. Splitting, warping and other related defects are sources of impediment in other woods. Wood resources for carving industry especially drums production are already scarce due to consequence of overexploitation. The efficient management and conservation of wood resources are critical to the continued survival of man on this planet. Wood species chosen for carving and drums production in Nigeria has evolved from religion to economic reasons [7; 8; 9]. While these and many other studies offered spiritual and economic explanations, this study went further by comprehensively exploring the technical properties underlying the suitability of a specific wood species for talking drum making. Gmelina arborea is considered as one of the most widely cultivated and distributed exotic species in Nigeria and many people have benefited from the wood. Hence, this study explored the suitability of *G. arborea* wood as substitute for indigenous *Cordia millenii* for production of talking drums in Ibadan, southwestern Nigeria.

II. Materials and Methods

Study Area and wood species

The study was carried out in Ibadan ($7^{o}23'47"$N and $3^{o}55'0"$E) between December, 2013 and November, 2014. Ibadan falls within the humid region which is characterized by wet and dry seasons. Between March and October, the area is under the influence of moist maritime south-west monsoon winds which blow inland from the Atlantic Ocean, marking the rainy season. The dry season occurs from November to February when the dry dust-laden winds blow from the Sahara desert. The area experiences high relative humidity and generally two rainfall maxima regimes during the rainfall period of March to October. The mean temperatures are highest at the end of the harmattan (averaging 28°C), that is from the middle of January to the onset of the rains in the middle of March. Even during the rainfall months, average temperatures are relatively high, between 24°C and 25°C, while annual fluctuation of temperature is about 6°C [10].

Gmelina arborea Roxb. (Family: Verbenaceae) is a fast growing tree introduced to Nigeria in the early 60s. The drum that was examined in this study was made from thinning of 7-year-old tree grown in the Forestry Research Institute of Nigeria Jericho Ibadan in April, 1972. The trees had attained a DBH of 10 inches (25.4cm). Its suitability as a talking drum frame material was studied in Ibadan after 42 years.

Carving of wood and drum production

The hourglass drum frame with a neck at the centre (Fig. 1) was carved from a solid 7-year *Gmelina arborea* wood. The neck was 5 inches long while each of the both jaws was 3 inches. The carved frame was air dried under shade and room temperature. The carved frame was intermittently hand tested for desirable acoustical value in the course of drying until the expected acoustical property was realized. Thereafter, the drum frame was conditioned under room temperature for about one week before application of cow fat as sealant into the inner part of the frame. The cow fat was used as stabilizer and retardant of the occasional movement of moisture into the inner part when having contact with moisture sources. Goat skin was processed with the pulp of *Lagenaria breviflora* fruit (Tagiri, Yoruba Nigeria) into leather. The use of *Lagenaria breviflora* fruit pulp was not limited to depilation capability but also impacted preservative property against leather boring insects.

After processing the goat skin into fine leather, the two ends of the drum frame were covered with the leather sheets and connected to each other in varying degree of tautness by strings stretched all round the drum. *G. arborea* wood showed high resistance to twisting and splitting during machining, carving and tautness of the strings. The drum was periodically tested by master drummer and kept in clement environment devoid of moisture contact.

Determination of wood density

In order to ascertain the physical properties of *G. arborea*, samples of a 12-year-old *G. arborea* wood obtained from the Department of Forest Resources Management Wood Workshop Unit were used to determine the density as the ratio of oven dry weight to the wet volume of the wood. The coefficient of variation (CV) was also evaluated for the 20 samples (replicates) randomly selected and used.

Survey of alternative wood species used for drums

Social surveys and interaction studies were carried out in 3 major drums producing towns of southwestern Nigeria to elicit information on the present alternative wood species employed in drum production between December, 2013 and November, 2014. The towns were Imeko in Ogun State, Oyo in Oyo State, and Osogbo in Osun State.

Fig. 1: Hourglass drum frame from *Gmelina arborea* wood

III. Results And Discussion

Suitability of Gmelina arborea wood for making talking drum

G. arborea wood was easy to machine, turn and dig without anysignificant wear to the crude tools used. The crude tools used were similar with those documented by reference [11] which included Adze, Digging rod, Gouge, Chisel etc. This workability was likely due to the fine andless open structures as well as the moisture content of the wood and the consistency of wood density. The drum frame dried fairly quickly with no defects. It is noteworthy that for 42 years, the drum made from local *G. arborea* wood apparently showed resistance to wood borers, splitting, even with exposures to sunlight and the drum remained stable and sound (Fig. 2). Resistance to wood borers could be probably attributed to appreciable amount of Alkaloids present in *G. arborea* wood as reported by [12] and age. This resistance to both wood borers and splitting demonstrates the suitability of the species for drum production.

Fig.2: 42-year-old talking drum made from *G. arborea* wood

The suitability of the species for making talking drum was further assessed by comparing its wood basic density with those of the acceptable species used for western musical instruments across the globe and with *Cordia millenii* which is culturally considered as prime wood for drum production in southwestern Nigeria. Density of a material has often been considered to be the important factor that governs the sound absorption behaviour of the material. At the same time, cost of an acoustical material has been as well reported to be directly related to its density [3]. The 12-year old G. arborea wood hadbasic density of 476±0.20kg/m^{3}and coefficient of variation (CV) of 6.86%whichwas in congruity with the reported 480kg/m^3 [13]. It also has comparable basic density with those reported for *C. millenii* - 436.51±14.39kg/m^3, [14] and European Spruce 450kg/m^3, [4] which were considered as reference species for western classical stringed musical instruments in Nigeria and Europe respectively, and all were under low density classification (≤ 490kg/m^3). This result also compared well with the Sitka spruceas indicated in Table 1. Therefore, *G. arborea* wood is considered as most suitable for drum production and ready substitute for *C. millenii* in Nigeria. The wood density has harmonious relationship with acoustical output. Sitka Spruce has been a preferable tone wood because of the combined emphases of lower young modulus and shear modulus, better value for vibration parameter and higher value for acoustic conversion efficiency [5]. High density woods were reduced to low density woods by application of wood decay fungi to improve the acoustic properties of resonance wood for violins in Germany [2]. This further confirmed and agreed with the universal applicability of some specific low density wood species for musical instruments.

Table 1: Vibroacoustic properties of woods, a plastic, and metals

Parameters	Sitka spruce*	Amboyna wood	Bamboo	Acrylic	Aluminum	Steel
Density (kg/m^3)	470	870	700	1200	2700	7800
Young modulus (GPa)	12	20	15	5.3	71	210
Shear modulus (GPa)	1.1	1.6	1.3	1.9	27	210
Elastic modulus	11	12.5	11.5	2.8	2.6	2.5
Quality factor	131	155	140	17	980	1370
Longitudinal speed (m/s)	5100	4800	4600	2100	5130	5190
Wave resistance (MPa.s/m)	2.4	4.2	3.2	2.5	13.8	40.4
Vibration parameter (m^4/kgs)	11	5.5	6.6	1.75	1.9	0.67
Transmission parameter (10^{5}m/s)	6.7	7.4	6.4	0.36	50.3	71.1
Acoustic conversion efficiency	1420	855	920	30	1860	912

Source: Reference [5]

*** Species used for western musical instrument**

The results of social surveys and interactions revealed the scarcity of *C. millenii* in the three states but confirmed the wide utilization and acceptance of G. arborea as suitable substitute for production of drums generally. The bigger girth stems was employed and observed to be used for deity and small god special drums (Fig. 3). However, the recent scarcity of G. arborea has forced the wood carvers to explore non-suitable species like *Tectona grandis, Funtumia elastica, Alstonia congensis, Celtis zenkeri, Anogeissus leiocarpus*. The explanations by the master drummers in the surveyed areas were expressive of other species being not suitable in that they could easily split when they mistakenly fall. Giving economic explanations for the utilization of the above species, both the wood carvers and master drummers admitted that these species were highly vulnerable to splitting and other drying defects. The study revealed that *G. arborea* wood drum commanded highest price of ₦5000.00 (five thousand naira) as compared to other alternative species. This was expected because G. arborea lumber (wood) has been highly prized and renowned for several unique characteristics and applications.

Fig. 3: Wood carver designing specialized deity drum using Gmelina wood

Implications for massive plantation

Gmelina arborea was initially underrated and believed to be narrowed to a fibre pulp utility as proposed in the original objective of management. Since 1998, when the wider range of its suitable applications was revealed, logs for the many Nigerian wood based industries have been supplied predominantly from *Gmelina* plantation forests. The continued reliance on World Bank Assisted project *Gmelina* plantation forest for future supply of logs has now resulted into deficit, because efforts have not been placed towards establishing more industrial plantations. In order to ensure regular supply of *G. arborea* wood for varied applications including drums production, government should revamp the dying plantations and embark on massive establishment of new ones.

IV. Conclusion

Workability and wood density of *G. arborea* were in suitable range for typical drum references species. The studied species was reputed to have superior acoustical property couple with long service year than any other alternative species, thus suitable for drum production in place of traditional scarce drum making species. Considering the place of talking drum in entertaining industry globally, regular supply of the timber would not only promote the industry but also would provide improved economic incentive to the Forestry and industrial sectors of Nigeria.

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References

[1]. Agun, F. 2014. The talking drum – The talking drum Kalangu, Gangan, Odondo drum. Hubpages article retrieved on 15th November, 2014 from http://tony55.hubpages.com/hub/The-Talking-Drum-The-Talking-Drum-Kalangu-Gungun-Odondo-drum

[2]. Spycher, M. 2007. The application of wood decay fungi to improve the acoustic properties of resonance wood for violins. Published Ph.D thesis, Faculty of Forestry and Environmental Science, Albert-Ludwigs Universitat, Freiburg imBreisgau, Germany, 255pp

[3]. Seddeq, H. S. 2009. Factors influencing acoustic performance of sound absorptive materials.Australian Journal of Basic and Applied Sciences, 3(4): 4610-4617

[4]. Iris, B. 2012. Acoustical properties of wood in string instruments soundboards and tuned idiophones: Biological and cultural diversity. Journal of the Acoustical Society of America, 131(1):807-818.

[5]. Yoshikawa, S. and Walthan, C. 2014. Woods for wooden musical instruments. ISMA 2014, Le Mans, France, pp 281-286

[6]. Kemevor, A. K. 2014. Traditional Ingenuity in Ghanaian Atumpan Drum Construction (From Locally Obtainable '*Cordia millenii*'). Arts and Design Studies, 22: 59-69

[7]. Asch, M. 1956. Drums of the Yoruba of Nigeria. Folkways Records and Services Corp., NYC, USA 10023, 10pp

[8]. Idamoyibo, A. A. 2014. The media, the reconstruction ofdrumming, and the tradition of thedùndúnand the bàtáensemble ofthe Yorùbá in South Western Nigeria. TYDSKRIF VIR LETTERKUNDE, 51(1): 132-141

[9]. Faleyimu, O. I. 2014.Determinant of profitability in the wood carving industry in Oyo State, Nigeria. Journal of Sustainable Development in Africa,16(1): 1-11

[10]. Ajayi, O., Agbola, S. B, Olokesusi, B. F., Wahab, B., Taiwo, O. J., Gbadegesin, M., Taiwo, D.O., Kolawole, O., Muili, A., Adeola, M. A., Olutade, O. G., Shiji, F. and Abiola, N. A. 2012. Flood Management in an Urban Setting: A Case Study of Ibadan Metropolis. Special Publication of the Nigerian Association of Hydrological Sciences, pp 65-81

[11]. Adu-Agyem, J., Sabutey, G. T. and Emmanue, M. 2013. New trends in the ahwiaa wood carving industry in Ghana: implications for art education and socio-economic growth. International Journal of Business and Management Review, 1(3): 166-187

[12]. Adedeji, G. A. and Aiyeloja, A. A. 2014. Preference and suitability of Nigeria grown *Gmelina arborea* Linn. Roxb. And *Vitex doniana* Sweet woods for beekeeping in Imeko, Nigeria. International Journal of Scientific and Engineering Research (IJSER), 5(5): 1484-1493

[13]. Ogunsanwo, O. Y., Adeleye, I. G. and Anjah, G. M. 2011. Technical efficiency of chain sawmilling in Ogun State, Southwest Nigeria. Int. J. Biol. Chem. Sci. 5(3): 861-869

[14]. Falemara, B. C., Owoyemi, J. M., and Olufemi, B. 2012. Physical Properties of Ten Selected Indigenous Wood Species in Akure, Ondo State, Nigeria**.** Journal of Sustainable Environmental Management (JSEM), 4: 16-23