Comparative tracheary elements characteristics of *Canarium schweinfurthii* Engl. and *Dacroydes edulis* (G. Don) H.J. Lam growing in derived savanna and rainforest regions of Edo state, Nigeria

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ABSTRACT: Histomorphological characteristics of two woody plants belonging to the family Burseraceae Kunth growing naturally and abundantly either in the rainforest and derived savanna habitats of Edo state, Nigeria is reported. *Canarium schweinfurthii* Engl grows only in the rainforest habitats. *Dacryodes edulis* (G. Don) H.J. Lam occurs in both rainforest and derived savanna habitats. Both woody plants are well known for their sweet and edible fruits. The two taxa exhibit medium length (350-800µm) vessels with medium sized diameters (100-200µm). *Canarium schweinfurthii*, growing only in the rainforest areas has large sized (>200µm) vessel diameter. Vessel members of the two plants are thick-walls with simple pits arranged in rows. Fibres in the two plant species are of medium lengths (900-1600µm), moderately thick-walled (3-5µm) non pitted, non septate except in *Canarium schweinfurthii*, where septate were encountered fibre / vessel length ratio in both taxa is greater than 1 indicating that they are hypogenetically advanced and specialized. Runkel ratio of taxa is less than 1. Comparing *Dacryodes* species growing in rainforest with those in the derived savanna habitats, there is plasticity in the tracheary element dimensions (fibres and vesels) but no significant variations were encountered in their tracheary element dimensions. Higher mean maximum and minimum values in vessels (lengths and diameters) and fibre lengths were encountered in the rainforest plants, except in fibre lengths of *D. edulis* occurring in the derived savanna habitat where higher mean minimum values were obtained. [Nature and Science. 2009;7(6):90-96]. (ISSN: 1545-0740).

Keywords: Tracheary elements, *Canarium schweienfurthii*, *Dacryoyes edulis*, rainforest, derived savanna, Edo state

INTRODUCTION

Willis and Airy-Shaw (1973) reported 500 burseraceous species in the tropics of the 900 woody taxa reported in Nigeria by Keay *et a*l, (1964) and Gill (1992). Only 50 timber species are being commercially exploited. The possible reason for this low value is that no enough is known about the characteristics, qualities and the uses to which the other could be put (Gill 1992)

Relevant contributions to the tracheary element characteristics of hardwood species include Akachuku (1987), Baas *et al* (1983), Gill and Okoegwale (1990), Gill and Onuja (1982, 1984), Gill *et al*, (1985) Okoegwale and Idialu (1998). Gill *et al* (1985), reported medium length (mean 270.64µm) vessels with medium sized (138.72µm) diameters, slightly broad tails, simple perforations transversely situated at the end walls and simple slit-like round pits arranged in rows along vessel length in *Dacryodes edulis*. They also reported long (mean 1665.35µm) moderately thick-walled fibres with no pits and septations in *Dacryodes* species. According to Akachuku (1987), density is largely determined by diameter and wall thickness of cells and the proportion of thick-walled tissues (vesses and fibres) and is the best singular indication of wood quality and its suitability for various purposes.

For plant species growing in both rainforest and derived savanna environment's Okoegwale and Idialu (1998), reported higher maximum and minimum values for vessel and fibre lengths of woody leguminous plants in the rainforest than in the derived savanna counterparts. These are important parameters for the determination of strength qualities and end-use of wood. It was also reported that there were significant variations in fibre wall thickness in the same plant growing in the two ecological zones which they claimed to be of relevance in comparing wood density.

The purpose of this study was to ascertain the nature of plasticity of tracheary elements (vessels and fibres) of *Canarium schweinfurthii* Engl and *Dacryodes edulis* (G. Don) H. J. Lam growing naturally and abundantly in either the rainforest or both rainforest and derived savanna habitats of Edo state, Nigeria known commonly for the their sweet and edible fruits. It is also to assess the qualities, potentialities and phylogenetic trend of their wood and the effects of ecological variations on the tracheary elements (vessles and fibres) on *Dacryodes edulis* growing naturally in both rainforest and derived savanna habitats.

Derived savanna is a forest outlier or ecotone bordering guinea savanna, part of original forest which transformed to this type of vegetation as a result of biotic or edaphic factors resulting from population pressure. It is found at the edge of the forest.

MATERIALS AND METHODS

Wood samples of *Canarium schweinfurthii* growing naturally only in the rainforest habitat and *Dacryodes edulis* growing in both rainforest and derived savanna habitats of Edo state, Nigeria and whose ages were not ascertained were obtained. The ecological zones are located between latitude 6^0 and 7^0 5^1 and longitude 5^0 and 7^0E wood samples were collected from plants whose girths ranged from 8.0-15.0 centimeters at 1.3 meters above ground level i.e 1.3 metres diameter at breast height (d.b.h). Wood samples were air –dried for 10 days before they were made into chips. Maceration of chips was carried out using the procedure of Gill *et al* (1983) and Okoegwale and Gill (1990). Wood chips obtained, were placed in a test tube containing 10-15 m of 60% nitric acid and left overnight. It was then boiled for 5-10 minutes. The macerated materials were washed several times with distilled water. Macerated materials were not centrifuged as described by Gill *et al* (1983) and Okoegwale and Hill (1990). A diluted (1%) drop of 1.1 glycerol-safranin solution was added before placing the coverslip. Linear measurements (length and diameter, lumen diameter, wall thickness) of vessels and fibres were made on calibrated microscope. Average values were based on 100 measurements. A t-test distribution was used to analyse results.

RESULTS

Table 1. Morphological characteristics of vessel and fibres of *Dacroydes edulis* (G. Don) H.J. Lam growing in derived savannah and rainforest regions of Edo state.

	SAVANNA	**RAINFOREST**
Plant tissue type	**Morphological characteristics**	**Morphological characteristics**
VESSELS		
Length	Medium, ranges from196.7-408.54µm, mean 368.10µm	Medium, ranges from 205.4-455.6µm. mean 380.66µm.
Diameter	Large-sized, ranging from 98.72-192.3µm ,mean 140.16µm	Medium-sized, ranges from 106.4-204.6µm. mean 166.0µm.
Wall thickness	Thick and ranges from 4.60-13.80µm mean 8.28µm.	Thick; ranges from 4.40-12.70, mean 6.35µm.
Tail length	Length, ranges from 9.6-24.9µm, mean 16.1µm	Ranges from 9.4-34.1µm. mean 18.6µm.
Perforation plate	Simple located in transverse and walls	Simple: transversely located at the end walls
Pit	Simple and arranged in rows	Simple: arranged in rows
FIBRE		
Length	ranges from 6.10-12.82µm, mean 9.02µm	Medium; ranges from 980.91-1260.48µm. mean 1152.38µm.
Diameter	Large-sized, ranging from 11.09-18.46µm ,mean 14.82µm	Ranges from 12.56-20.80µm. mean 16.0µm.
Lumen diameter	ranges from 6.10-12.82µm, mean 9.02µm	Ranges from 6.48-1.51µm. mean 9.45µm.
Wall thickness	Moderate; ranges from 2.13-4.67µm mean 3.71µm.8.15µm.	Moderate: ranges from 2.56-5.10µm. mean 4.65µm.
Pit	Absent	Absent
Septae	Absent	Absent
Fibre vessel: Length ratio	2.74	3.02
Runkle ratio	0.82	0.98

Table 2: Morphological characteristics of vessels and fibres of *Canarium schweinfurthii* Engl growing in the rainforest region of Edo state.

DERIVED SAVANNA	
Plant Tissue Type	**Morphological Characteristics**
VESSELS	
Length	Medium, ranges from 286.0-570.4µm mean 400.33µm
Diameter	Large-sized, ranging from 256.1-311.6µm mean 282.40µm.
Wall thickness	Thick, ranging from 4.0-11.10µm mean 6.0µm.
Perforation plate	Simple, located in transverse and walls.
Pits	Simple and arranged in rows
FIBRE	
Length	Medium, ranges from 952.30-1271.18µm. mean 1003.23µm.
Diameter	ranging from 12.96-36.34µm. mean 26.86µm.
Lumen diameter	Ranging from 14.36-27.14µm. mean 20.47µm.
Wall thickness	Moderate, ranging from 3.58-8.15µm. mean 3.29µm.
Pits	Absent
Septae	Present
Fibre vessel: length ratio	2.51
Runkel ratio	0.32

Table 1. Fibre/vessel/ length ratio of *C. Schweinfurthii* and *Dacryodes edulis* growing in rainforest and derived savanna

Plant species	Habitat	d.b.h.(cm)	Vessel means length ±SD (µm)	Level of significance	Vessel mean diameter ± SD (µm)	Level of significance	Vessel wall thickness ± SD(µm)	Level of significance	Vessel tail length (µm)	Vessel perforation type	Pits/pattern of arrangement	Fibre mean length ±SD(µm)	Level of significance	Fibre mean diameter ±SD(µm)	Level of significance	Fibre mean lumen diameter ±SD(µm)	Fibre mean wall thickness ± SDµm)	Level of significance	Pits	Septate	F/v length ratio	Runkel ratio
Canarium schweinfurthii Engl	F	15	400.33±187.0		282.4 ±90.5		6.0 ±2.1		116.0 ±58.22	SIMPLE TRANSVERSE	Simple round in	1003.23 ±4		26.86 ±12.1		20 ±13.1	3.29 ±1.11		-	+	2.51	0.32
Dacroydes edulis (G.Don) H.J. Lam	F	8	380.66±161.58	NS 0.33	166.0 ±49.17	NS 1.56	6.35± 2.0		18.6± 7.54		Simple round in rows	1152.38 ±518.57	NS 1.10	16.0± 6.33	NS 0.62	9.45± 4.18	4.65 ±2.11	NS 1.84	-	-	3.20	0.98
	DS	8	368.10±128.9		140.46+58.41		6.30± 2.60		16.10 ±6.71		Simple round in rows	1006.56 ±452.66		14.82 ±8.30		9.02± 4.11	3.71 ±1.88		-	-	5.01	0.82

F - rainforest habitat
DS - derive savanna habitat
d.b.h. - diameter at breast height
M(µm - microns
\+ - present
\- - absent
NS - Not significant
SD - Standard deviation

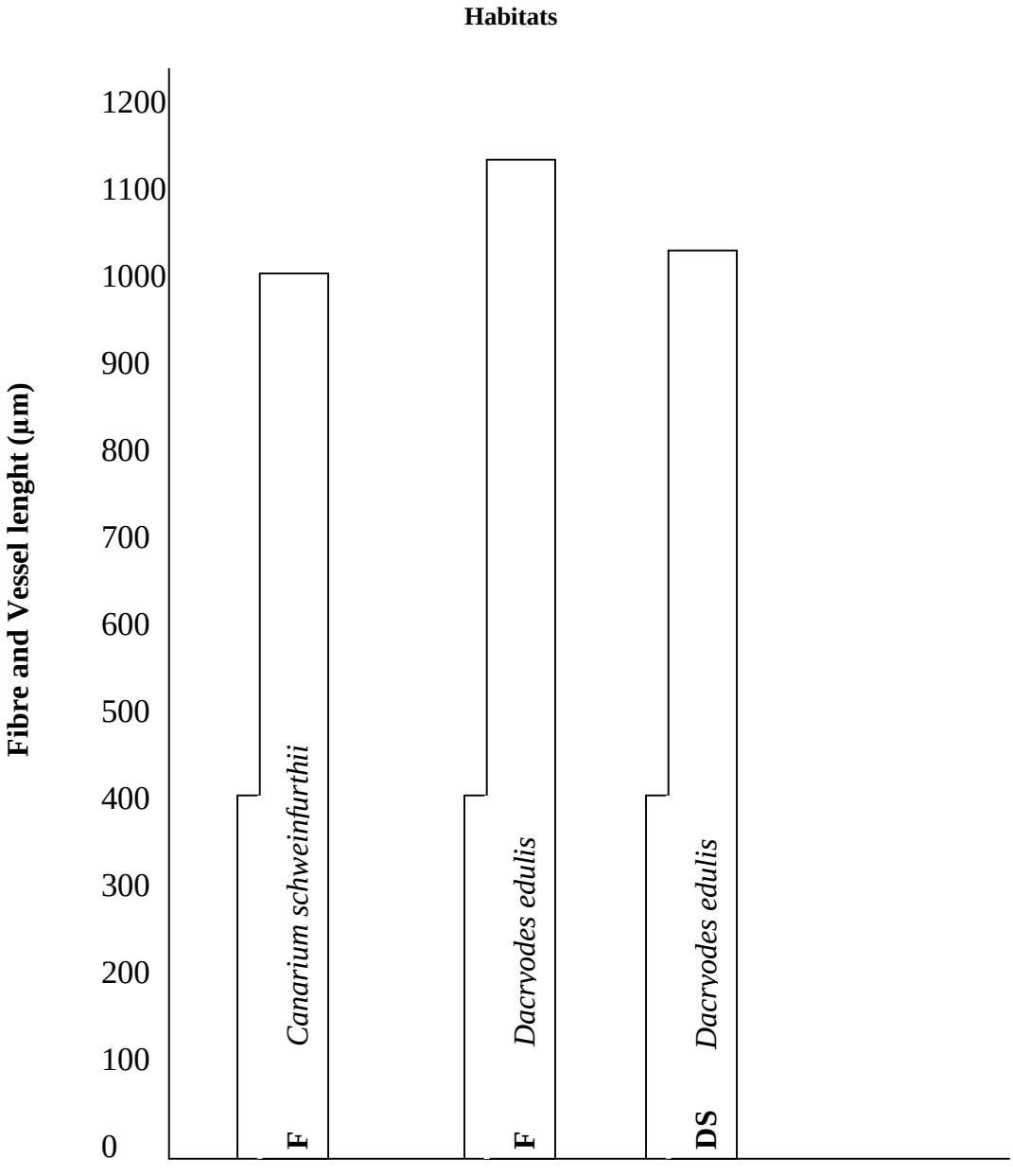

Fig 1. Fibre/vessel length ratio of *C. schweinfurthii* and *Dacryodes edulis* growing in rainforest and derived savanna.

DISCUSSION

Earlier, Gill and Onuja (1984) reported medium length vessels with large diameters in *Canarium schweinfurthii* while Gill *et al* (1985) reported vessel of medium lengths with medium-size diameters in *Dacryodes edulis*

In the present investigation, vessel members of *Canarium schweinfurthii* growing only in the rainforest zone are of medium length, mean 400.33± 187.0µm with large diameter of mean 282±90.5µm. *Dacryodes edulis* growing in the rainforest zone possess vessles of medium length, mean 380.66± 161.58µm. but medium size diameters of mean 166.0±49.17µm. occurrence of these dimensions is in line with Gill and Onuja (1984) and Gill *et al*. (1985), who reported the same in *C. schweinfurtii* and *D. edulis* respectively.

In *D. edulis* growing in the derived savanna habitat, vessel members are of medium length, mean 368.10+ 128.9µm. with medium-sized diameter of mean 140.16±50.41µm. This is in agreement with studies carried out by Gill *et al.* (1985) on *D. edulis.*

Taxa vessels are thick-walled in both vegetation zones, with a mean vessel wall thickness of 6.0±2.0µm. reported in *C. schweinfurthii* growing in the rainforest zone while *D. edulis*, vessel mean wall thickness of 6.35±2.0µm. and 6.35± 2.6µm. were recorded in rainforest and derived savanna habitats respectively.

Tailed-vessels were encountered in both vegetation zones *C. schweinfurthii* had a mean tail length of 116.0±58.22µm. in the rainforest habitat while *D. edulis* growing in both habitats had mean tail lengths of 18.60±7.54µm. and 16.10±7.1µm. occurring respectively in the rainforest and derived savanna areas.

The presence of tails in the plant species is in agreement with Gill and Onuja (1984) and Gill *et al.* (1985) who reported same in *C. schweinfurthii* and *D. edulis*.

Vessel members in the plant species are of simple perforation types in the two ecological zones and are transversely situated at the end walls. With simple pits occurring in them. This also agrees with Gill and Onuja (1984) and Gill et al. (1985).

However, Gill and Onuja (1984) reported simple slit-like pits arranged in rows along vessel lengths of *C. schwenfurthii* occurrence of septate fibres in *Canarium schweinfurthii* apart from been taxonomic, may be a new record for the taxon.

Fibre/vessel length ratio in the two plant species is greater than 1 and ratio approaching 10 is phylogenetically advanced and specialized and suitable for different uses.

Runkel ratio in all the taxa is below 1 indicating thus that the plants investigated are not suitable for high grade pulp as this is an important parameter in pulp industry.

Plasticity is a stronghold phenomemon in tracheary elements (vessels and fibres) of *Dacryodes edulis* growing in both rainforest and derived savanna areas, as no significant variations were encountered in these element dimensions.

However, higher mean maximum values in vessel and fibre lengths are reported in taxa growing in the rain forest than in the derived savanna habitats.

From the foregoing, woods of investigated taxa can be considered to be suitable for various uses but are however, not suitable for high grade pulp because of their relative low fibre lengths and runkel ratio.

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