



Plant Archives

Journal homepage: <http://www.plantarchives.org>

DOI Url : <https://doi.org/10.51470/PLANTARCHIVES.2024.v24.no.1.061>

COMPARATIVE WOOD ANATOMICAL PROPERTIES OF *ARTOCARPUS* SPECIES WITH SPECIAL REFERENCE TO THEIR IDENTIFICATION

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(Date of Receiving-23-11-2023; Date of Acceptance-01-02-2024)

ABSTRACT

The study was based on the wood anatomical characteristic of five economically important indigenous *Artocarpus* species viz. *A. heterophyllus*, *A. chama*, *A. hirsutus*, *A. gomeziana* and *A. lakoocha*. The standard acclaimed principle used to record the wood characteristics as per feature list provided by International Association of Wood Anatomists for hardwood identification. This study showed that all the species have some similar wood microstructural features such as diffuse porosity, indistinct growth rings, alternate inter vessel pits, solitary, simple perforation plate and rays multiseriate with occasionally uniseriate. These common characteristics help to recognize genus within family. However, some dissimilarity in wood features helps to identify species within genus. Fibres was both septate and non septate except absence of septation in *A. heterophyllus* and *A. hirsutus*. *A. heterophyllus* recognized on the basis of irregular band of parenchyma and presence of palisade/gash like VRPs. *A. gomezianus* identified on be basis of ray characteristics broad rays with maximum width of 75 – 90 µm, the tallest ray less than 1000 µm in height and size of IVPs is ranged 4-12 µm while the rest species was >12 µm. Therefore, the qualitative and quantitative wood microscopic features can be used for reliable identification of *Artocarpus* species.

Key words : *Artocarpus* spp., IAWA, Axial Parenchyma, VRPs, Identification key.

Introduction

Artocarpus J.R. Forst. is the third largest genus of family Moraceae after *Ficus* and *Dorstenia* and largest in the tribe 'Artocarpeae'. Moraceae consists of five tribes namely Moreae, Artocarpeae, Dorstenieae, Castilleae and Ficeae (Berg, 2001). Among them is the Artocarpeae tribe, also called the breadfruit tribe, which includes a variety of genera viz. *Artocarpus*, *Hullettia*, *Paratocarpus*, *Prainea*, *Batocarpus* and *Clarisia* (Datwyler and Weiblen, 2004; Clement and Weiblen, 2009). It belongs to the subfamily Artocarpoideae, tribe Artocarpeae which is included in Urticaceae (Hooker, 1885; Corner, 1952) or in Moraceae (Engler and Prantl, 1897; Rendle, 1938; Lawrence, 1951 and APG, 2016). The genus *Artocarpus* is essentially a tropical genus with about 50 species that are distributed from India to China (Corner, 1952; Jarrett, 1959a). The Indo-Malayan region

of South East Asia contains 45 species of the genus *Artocarpus* (Raturi *et al.*, 2001). In India, the genus comprises 7-8 species of large trees (Raturi *et al.*, 2001), of these five species viz. *A. chama*, *A. lacucha*, *A. heterophyllus*, *A. hirsutus* and *A. gomezianus* were studied for their wood anatomy.

The wood of many species of *Artocarpus* is of great economic importance. *A. hirsutus* yields one of the best types of wood called "Aini", *A. chaplasha* yields "Chaplash" "Artocarpin" an important drug produced by the heartwood of this species. Because of the high demand of edible fruits two species of this genus, *A. altilis* and *A. heterophyllus* are cultivated all over the tropics (Raturi *et al.*, 2001).

Wood anatomy of the Moraceae and allied families has been studied in detail by Tippon (1938) and Record and Hess (1940). The information is limited on anatomical

studies of genus *Artocarpus* provided by Gamble (1922), Purkayastha (1996) and Raturi *et al.* (2001). Topper and Koek Noorman (1980) reported presence of latex ducts, Singh *et al.* (2017) described the comparative wood anatomy of four *Artocarpus* species from north-east India and developed an identification key on the basis of regional samples.

The genus *Artocarpus* needs more anatomical description. Therefore, we attempted to provide first time a detailed wood anatomical study of two species *A. gomezianus* and *A. hirsutus* along with three other *viz.*, *A. lakoocha*, *A. heterophyllus* and *A. chaplasha* on the basis of samples collected throughout the country. In this present work, attention is focused on the wood microstructural variations among the five species of genus *Artocarpus* and the comparative analysis of observations of present study with the previous work.

Materials and Methods

The present study based on the examination of 33 wood samples from five species of genus *Artocarpus* housed in the Xylarium of the Forest Research Institute, Dehradun (DDw). The individual specimen details are given in Table 1, along with the accession numbers and localities.

For microscopic examination, A Reichert microtome was used to slice 15-20 μm thick cross, radial longitudinal and tangential longitudinal sections. The sections were stained with Heidenhain's Haematoxylin and Safranin and mounted following an internationally recognized standard lab protocol, including passing through different grades of alcohol 30-100% and Xylene for making permanent slides. The fibre and vessel quantitative characteristics were determined by macerating the radial chips of wood with the help of Schultz's method (30% Nitric acid and a pinch of potassium chlorate) (Yadav *et al.*, 2023)

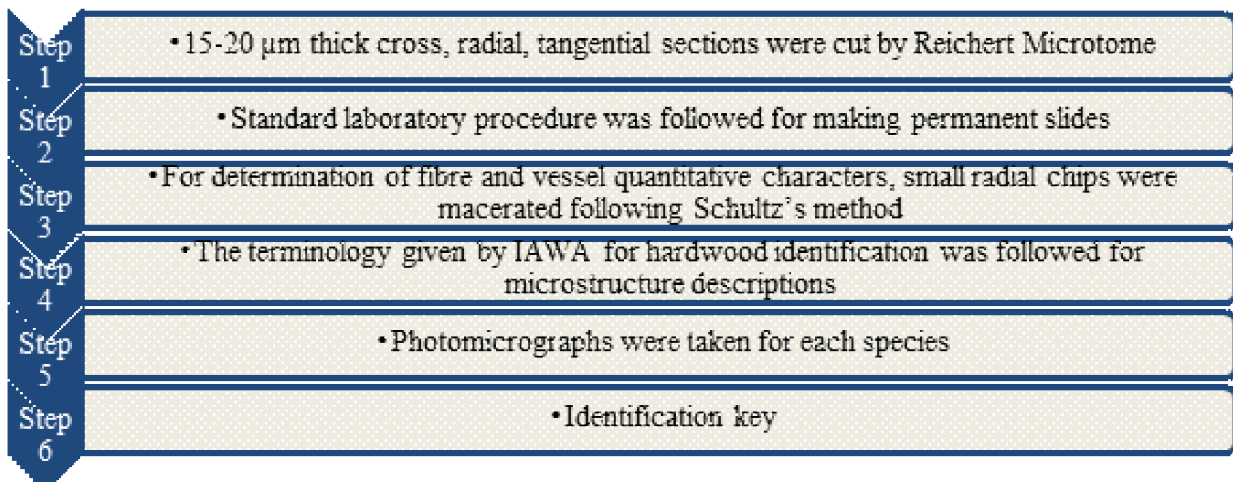
For microstructure, the terminology given by the International Association of Wood Anatomists (IAWA, 1989) was followed for writing the description. Photomicrographs were taken with the help of Carl Zeiss compound light microscope (Scope.A1.Axio) equipped with Carl Zeiss camera for each species from transverse, radial longitudinal, and tangential longitudinal sections showing diagnostic features for each taxon. The data was analyzed by software SPSS 16 and Microsoft excel 2007.

Flow chart of methodology used in present study is given in Flow chart 1.

Results and Discussion

Almost all species of *Artocarpus* have similar general features of wood *i.e.* sapwood yellowish-white to grayish white or gray, heartwood yellowish brown to golden-brown with darker streaks, turning dark brown on exposure, lustrous when fresh, soft to moderately hard to hard, light to moderately heavy to heavy (sp. gr. 0.33 – 0.85), straight to interlocked- grained and coarse textured.

Microscopically, the wood is diffuse porous, pores being of conspicuous size and is uniformly distributed in all *Artocarpus* species. Growth ring boundaries are indistinct or absent, vessel are solitary as well as radial multiple of 2-5 pores, SVOs round to angular, intervessel pits alternate, simple perforation plate and vessel ray pits are much reduced bordered to apparently simple. Mean vessel length, vessel diameter and vessel frequency given in Table 3 range from $347.2 \pm 59.2 \mu\text{m}$ (*A. lakoocha*) to $413.5 \pm 72 \mu\text{m}$ (*A. chama*), $151.07 \pm 58.53 \mu\text{m}$ (*A. heterophyllus*) to $204.11 \pm 81.6 \mu\text{m}$ (*A. hirsutus*) and range of vessel frequency 1 – 16 per square mm (maximum in *A. heterophyllus*). There are of prominent tyloses in the old vessels of *A. heterophyllus*.



Flow chart 1

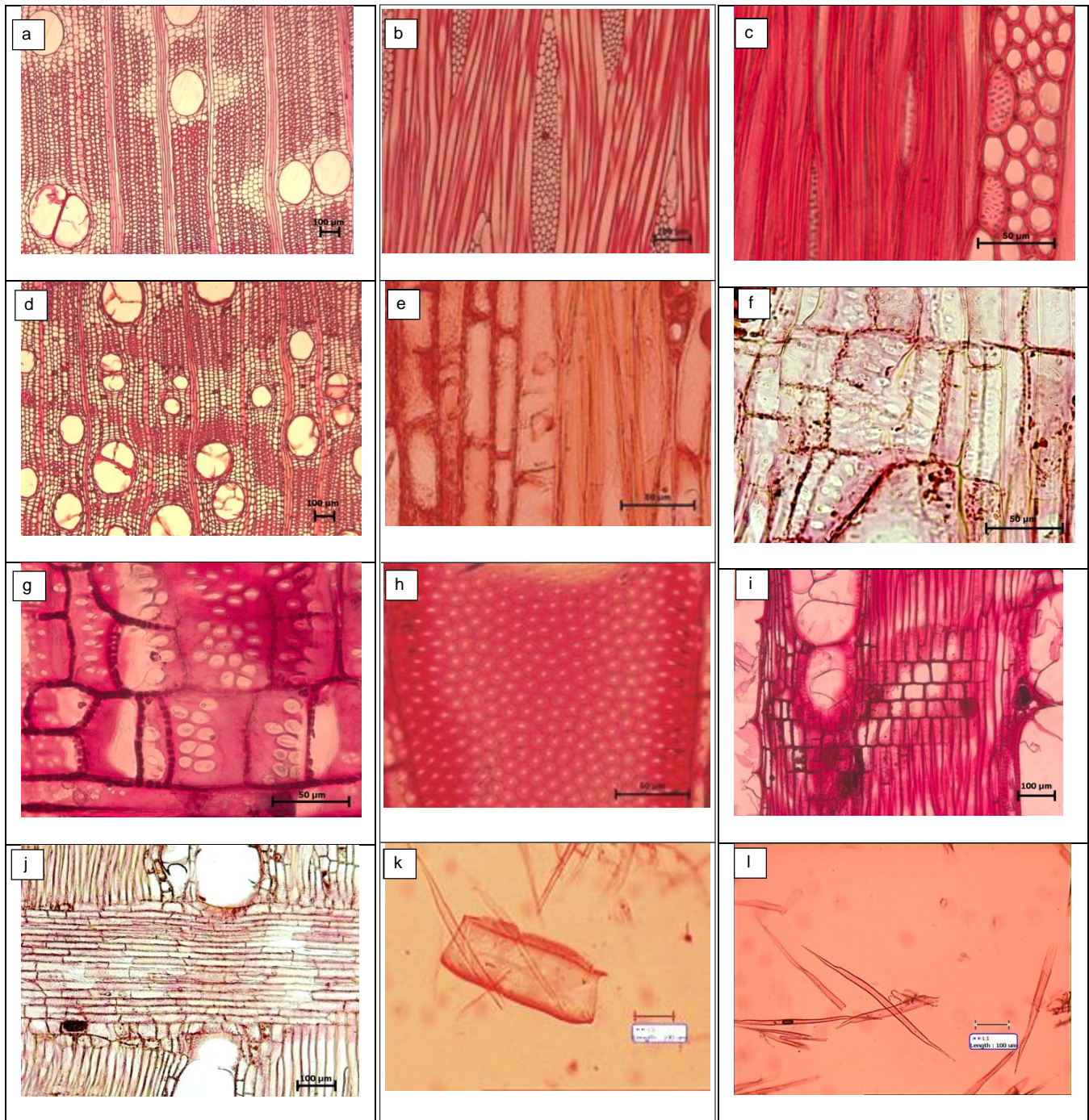


Fig. 1 (a-l) : a) *Artocarpus chama* (DDw 5762) TS showing vasicentric, aliform and confluent parenchyma (5x) b) *Artocarpus chama* (DDw 5762) TLS showing multiseriate rays 4-10 seriation with radial latex duct (10x) c) *Artocarpus gomezianus* (DDw 7085) TLS showing septate fibre and sheath cells with silica (40x) d) *Artocarpus heterophyllus* (DDw 756) TS showing irregular bands of parenchyma (5x) e) *Artocarpus heterophyllus* (DDw 756) TLS showing crystals in parenchyma cells (40x) f) *Artocarpus heterophyllus* (DDw 2444) RLS showing rounded to palisade VRPs (40x) g) *Artocarpus hirsutus* (DDw 5778) RLS showing rounded VRPs same in size as IVPs (40x) h) *Artocarpus lakoocha* (DDw 5889) TLS showing polygonal IVPs (40x) i) *Artocarpus lakoocha* (DDw 5889) RLS showing mix ray composition (10x) j) *Artocarpus heterophyllus* (DDw 2444) RLS showing homogenous rays (10x) k) complete vessel to measure vessel length (10x) l) fibre length at 10x.

Fibres are non septate with simple to minutely bordered pits. Septate fibre present except in *A. heterophyllus* and *A. hirsutus*. The fibre thin to thick

walled; spiral thickening in fibres. The mean fibre length, fibre diameter and fibre wall thickness vary from $1300 \pm 303 \mu\text{m}$ (*A. lakoocha*) to $1646.3 \pm 467 \mu\text{m}$ (*A. hirsutus*),

Table 1 : List of wood samples housed in Xylarium (DDw), FRI, Dehradun.

S. no.	Species	Acc. No.	Locality	Sp. gr.
1.	<i>Artocarpus chama</i> Buch.-Ham. = <i>A. chaplasha</i> Roxb.	DDw 7224	Chittagong, Bangladesh	0.33
2.	<i>Artocarpus chama</i> Buch.-Ham.	DDw 729	Cachar, Assam	0.51
3.	<i>Artocarpus chama</i> Buch.-Ham.	DDw 7310	Now-gong , Assam	0.62
4.	<i>Artocarpus chama</i> Buch.-Ham.	DDw 7341	Jalpaiguri, West Bengal	0.53
5.	<i>Artocarpus chama</i> Buch.-Ham.	DDw 7344	Jalpaiguri, West Bengal	0.49
6.	<i>Artocarpus chama</i> Buch.-Ham.	DDw 7387	Chittagong, Bangladesh	0.58
7.	<i>Artocarpus chama</i> Buch.-Ham.	DDw 7555	Kamrup , Assam	0.56
8.	<i>Artocarpus chama</i> Buch.-Ham.	DDw 7576	Kamrup , Assam	0.36
9.	<i>Artocarpus chama</i> Buch.-Ham.	DDw 8183	New forest, FRI Dehradun, UK	0.52
10.	<i>Artocarpus chama</i> Buch.-Ham.	DDw 8264	Kurseong, West Bengal	0.38
11.	<i>Artocarpus gomezianus</i> Wall. ex Trécul	DDw 7085	Andamans	0.73
12.	<i>Artocarpus gomezianus</i> Wall. ex Trécul	DDw 7086	Andamans	0.85
13.	<i>Artocarpus heterophyllus</i> Lam. = <i>A. integrifolia</i> L.f.	DDw 598	Darjeeling, West Bengal	0.51
14.	<i>Artocarpus heterophyllus</i> Lam.	DDw 756	South Kanara, Karnataka	0.65
15.	<i>Artocarpus heterophyllus</i> Lam.	DDw 806	Myanmar	0.46
16.	<i>Artocarpus heterophyllus</i> Lam.	DDw 2444	Siliguri, West Bengal	0.60
17.	<i>Artocarpus heterophyllus</i> Lam.	DDw 5818	Kanara, Karnataka	0.71
18.	<i>Artocarpus heterophyllus</i> Lam.	DDw 7408	Chennai, Tamil Nadu	0.67
19.	<i>Artocarpus heterophyllus</i> Lam.	DDw 8051	Wyanad, Kerala	0.65
20.	<i>Artocarpus heterophyllus</i> Lam.	DDw 8184	New Forest, FRI, Dehradun, UK	0.43
21.	<i>Artocarpus heterophyllus</i> Lam.	DDw 8252	Kurseong, West Bengal	0.52
22.	<i>Artocarpus hirsutus</i> Lam.	DDw 744	South Kanara, Karnataka	0.57
23.	<i>Artocarpus hirsutus</i> Lam.	DDw 758	South Kanara, Karnataka	0.63
24.	<i>Artocarpus hirsutus</i> Lam.	DDw 1090	Chennai, Tamil Nadu	0.49
25.	<i>Artocarpus hirsutus</i> Lam.	DDw 1208	Karnataka	0.56
26.	<i>Artocarpus hirsutus</i> Lam.	DDw 1219	North Kanara, Karnataka	0.66
27.	<i>Artocarpus hirsutus</i> Lam.	DDw 5778	Coorg, Karnataka	0.59
28.	<i>Artocarpus lacucha</i> Buch.-Ham. = <i>A. lakoocha</i> Roxb.	DDw 740	South Kanara, Karnataka	0.72
29.	<i>Artocarpus lacucha</i> Buch.-Ham.	DDw 794	Kamrup , Assam	0.55
30.	<i>Artocarpus lacucha</i> Buch.-Ham.	DDw 810	Myanmar	0.46
31.	<i>Artocarpus lacucha</i> Buch.-Ham.	DDw 1402	Chittagong, Bangladesh	0.65
32.	<i>Artocarpus lacucha</i> Buch.-Ham.	DDw 2445	Siliguri, West Bengal	0.72
33.	<i>Artocarpus lacucha</i> Buch.-Ham.	DDw 2553	Myanmar	0.71

24.75 ± 5.2 µm (*A. gomezianus*) to 30.8 ± 5.13 µm (*A. hirsutus*) and 3.6 ± 0.85 µm (*A. chama* and *A. heterophyllus*) to 4.45 ± 0.73 µm (*A. gomezianus*). For evolutionary consideration, we have drawn the value of VL/VD and Fibre vessel length ratio. The fibre vessel length ratio range from 3.41 (*A. heterophyllus*) to 4.27 (*A. gomezianus*), low value of FL/VL indicates the

primitiveness of the taxa and vice-versa.

The distribution of wood parenchyma is vasicentric, paratracheal and aliform or aliform to confluent. In addition, vasicentric with irregular bands of parenchyma observed in *A. heterophyllus*. Parenchyma with of 3-4 cell and 5-8 cells per strand, occasionally two cells per

Table 2 : IAWA code of anatomical features of five species of *Artocarpus*.

Species name	Microscopic features
<i>Artocarpus chama</i> Buch.– Ham.	2, 5, 13, 22, 27, 30, 31, 42, 47, 53, 56, 58, 61, 66, 69, 72, 79, 80, 81, 83, 91, 92, 96, 98, 102, 104, 106, 110, 115, 132
<i>Artocarpus gomezianus</i> Wall. ex Trecul	2, 5, 13, 22, 26, 30, 31, 42, 47, 53, 56, 58, 61, 66, 69, 72, 79, 80, 81, 83, 91, 92, 93, 96, 98, 102, 106, 110, 115, 132
<i>Artocarpus heterophyllus</i> Lam.	2, 5, 13, 22, 23, 27, 30, 31, 32, 42, 47, 53, 56, 58, 61, 66, 69, 72, 79, 80, 81, 83, 91, 92, 93, 96, 97, 98, 102, 104, 106, 110, 115, 132, 137, 141, 163
<i>Artocarpus hirsutus</i> Lam.	2, 5, 13, 22, 23, 27, 30, 31, 43, 46, 53, 56, 58, 61, 66, 69, 73, 79, 80, 81, 83, 91, 92, 93, 96, 97, 98, 102, 106, 107, 110, 115, 132
<i>Artocarpus lakoocha</i> Buch.– Ham.	2, 5, 13, 22, 23, 26, 30, 31, 42, 46, 53, 56, 58, 61, 65, 66, 69, 72, 79, 80, 81, 83, 91, 92, 93, 96, 98, 102, 105, 106, 107, 110, 113, 115, 132

Table 3 : Dimensions of xylem elements in *Artocarpus* species.

Features		<i>Artocarpus chama</i> (μm)	<i>Artocarpus gomezianus</i> (μm)	<i>Artocarpus heterophyllus</i> (μm)	<i>Artocarpus hirsutus</i> (μm)	<i>Artocarpus lakoocha</i> (μm)
Vessel Length	Range	250–600	250–700	220–650	170–700	200–500
	Mean \pm SD	413.5 \pm 72	364.7 \pm 116.5	380.47 \pm 85.43	388.26 \pm 108	347.2 \pm 59.6
Vessel diameter	Range	60–320	70–270	50–320	60–380	50–330
	Mean \pm SD	172.9 \pm 59.9	180 \pm 54.45	151.07 \pm 58.53	204.11 \pm 81.6	165.7 \pm 64
Vessel frequency	Range	1–13	2–13	1–16	1–8	1–8
	Mean \pm SD	4.19 \pm 2.0	6.43 \pm 3.08	5.8 \pm 3.17	3.72 \pm 1.68	4.16 \pm 1.93
Inter-vessel pits (IVP)	Range	8.01–16.02	8.01–129.7	6.67–13.35	6.67–13.35	6.67–13.35
	Mean \pm SD	11.56 \pm 1.81	9 \pm 1.33	10.30 \pm 1.53	10.13 \pm 1.62	9.61 \pm 1.43
Fibre length	Range	850–2200	1150–2000	800–1980	680–3350	700–2080
	Mean \pm SD	1442 \pm 250	1566 \pm 219.7	1301.1 \pm 242.4	1646.3 \pm 467	1300.5 \pm 303
Fibre diameter	Range	16.02–45.4	13.35–40.05	12.08–40.05	13.35–42.7	16.02–40.05
	Mean \pm SD	28.33 \pm 5.66	24.75 \pm 5.26	25.74 \pm 5.45	30.84 \pm 5.13	26.61 \pm 5.04
Fibre wall thickness	Range	1.34–6.0	2.67–6	2–63.5	2–6.67	2–6.67
	Mean \pm SD	3.63 \pm 0.85	4.45 \pm 0.73	9 \pm 0.83	4.10 \pm 1.014	3.95 \pm 0.88
Vessel ray pits	Range	8.01–13.35	6.67–12	5.34–12.01	5.34–13.35	5.34–13.35
	Mean \pm SD	10.19 \pm 1.64	9.21 \pm 1.58	9.07 \pm 1.62	9.49 \pm 1.69	9.06 \pm 1.63
F/V ratio		3.5078	4.27	3.41	4.24	3.745

parenchyma strand.

Rays are mostly multiseriate 4–10 seriate, occasionally uniseriate or 1–3 cells wide; Rays are homocellular (all ray cells are either procumbent or square or upright) in few sample of *A. chama*, *A. heterophyllus* and heterocellular in all species of *Artocarpus*, rays are composed of body ray cells procumbent with one row or two rows of upright or square marginal cells. Mean ray height and ray width of uniseriate rays range from 197.5 \pm 87.7 μm (*A. heterophyllus*) to 250.5 \pm 102 μm (*A.*

lakoocha) and 15.3 \pm 3.9 μm (*A. gomezianus*) to 19.8 \pm 4 μm (*A. lakoocha*), respectively. Ray height and width of multiseriate ray vary from 450.6 \pm 182 μm (*A. gomezianus*) to 545.5 \pm 226 μm (*A. hirsutus*) and 52.3 \pm 11.9 μm (*A. gomezianus*) to 69.91 \pm 18 μm (*A. chama*), respectively (Table 4). Radial latex ducts which producing latex is present in all species except *A. gomezianus*. Occasionally few sheath cells present. Vitreous silica is present in fibres and vessels of *A. chama*. There is no mineral inclusion except *A. heterophyllus* in which

Table 4 : Dimensions of ray parenchyma in *Artocarpus* species.

Features		<i>Artocarpus chama</i> (μm)	<i>Artocarpus gomezianus</i> (μm)	<i>Artocarpus heterophyllus</i> (μm)	<i>Artocarpus hirsutus</i> (μm)	<i>Artocarpus lakoocha</i> (μm)
Ray height (Uniseriate)	Range	60-520	60-550	65 – 500	70 – 580	90 – 580
	Mean \pm SD	235.6 \pm 100	229.6 \pm 98.24	197.5 \pm 87.72	233.3 \pm 98.7	250.5 \pm 102
Ray width (Uniseriate)	Range	10.68-34.71	9.34-24.03	9.34 – 29.37	10.68–26.7	12 – 33.37
	Mean \pm SD	18.79 \pm 4.63	15.39 \pm 3.94	18.44 \pm 4.73	17.44 \pm 3.87	19.89 \pm 4.09
Ray no. of cells (Uniseriate)	Range	2 – 15	2 – 12	2 – 12	2 – 15	2 – 13
	Mean \pm SD	6.17 \pm 2.58	5.34 \pm 2.10	5.37 \pm 2.02	6.12 \pm 2.83	5.26 \pm 2.23
Ray height (Multi seriate)	Range	100 – 1350	200-850	120 – 1050	180 – 1180	140 – 11504
	Mean \pm SD	513.9 \pm 206	450.66 \pm 182	459.40 \pm 191.1	545.5 \pm 226	62.5 \pm 199.5
Ray width (Multiseriate)	Range	29.37-122.8	29.37- 72.09	32.04 – 106.8	34.71-74.7	34.71 – 128
	Mean \pm SD	69.91 \pm 18.09	52.33 \pm 11.91	62.87 \pm 15.34	53.16 \pm 10.6	68.05 \pm 21.49
Ray no. of cells (Multiseriate)	Range	4 – 58	9-50	5 – 45	7 – 54	6 – 53
	Mean \pm SD	21.8 \pm 8.9	23.36 \pm 10.72	21.04 \pm 8.97	23.46 \pm 10.6	20.58 \pm 9.29
Ray frequency	Range	2 – 7	3-7	2 – 8	2 – 7	2 – 7
	Mean \pm SD	4.3 \pm 1.12	5.26 \pm 1.172	4.66 \pm 1.04	4.55 \pm 1.15	4.45 \pm 1.01

presence of prismatic crystal in non chambered axial parenchyma cells.

The above given result of present study reveals the wood microstructure of five *Artocarpus* species. Wood of all selected species shows some similar qualitative characteristics *i.e.*, diffuse porosity, growth ring boundaries indistinct, simple perforation plates, aliform parenchyma, vessels ray pits are much reduced bordered to apparently simple with dissimilar features. The results of present investigation somehow followed the wood anatomy of genus *Artocarpus* described by Pearson and Brown (1932), Metcalfe and Chalk (1950), ter Welle *et al.* (1986b), Raturi *et al.* (2001) and Singh *et al.* (2017). The qualitative wood anatomical features of present study follows the finding of previous studies except some disagreement.

Pearson and Brown (1932) examined the wood macrostructure and microstructure of the three species *i.e.*, *A. lacucha*, *A. hirsutus* and *A. chaplasha*. However, their sample size was limited to only one sample of each species of this family. In present study we have provided the wood microstructure of 5 species of *Artocarpus*, three species similar to Pearson and Brown (1932) except *A. heterophyllus* and *A. gomezianus*. Also the anatomical descriptions based on the more than 5 wood samples for each species except *A. gomezianus*. The qualitative wood microstructures were similar in both studies. However, some differences were observed in the

maximum width of broad rays and height of multiseriate rays in present study was in *A. lacucha* 128 μm and 1180 μm , while Pearson and Brown (1932) reported maximum width upto 120 μm and height 1000 μm in *A. chaplasha*. These differences might be site-specific according to microclimate, soil features, topography, etc. of the region from where the samples were originally collected (Yadav and Gupta, 2023).

The qualitative characteristic of wood in present study is more or less similar with the finding of ter Welle *et al.* (1986) except major quantitative variations. The present study agrees with the presence of vitrous silica in fibre and vessels in *A. heterophyllus*.

Most of the findings of present study were agreed with the finding of Singh *et al.* (2017), they have worked upon four species of *Artocarpus* from the North Eastern India. This study was based on the wood samples from erstwhile India that covers different climatic conditions while the study of Singh *et al.* (2017) is based on the regional wood samples from NE India only which is more or less similar climate. The maximum diameter of vessel in present study was 380 μm (*A. hirsutus*) and maximum fibre length up to 3350 μm also in *A. hirsutus* however the study of Singh *et al.* (2017) reported the extreme broad vessel with diameter up to 797 μm in *A. heterophyllus* with maximum fibre length of 2564 μm (*A. nitidus*). There is no report available on detailed wood microstructure of *A. gomezianus* however the gross

structure was provided by Raturi *et al.* (2001). The detailed wood microstructure of *A. gomezianus* reported first time in this present study.

Interestingly, within the wood there is two type of variation qualitative (fixed or constant) and quantitative (variable with climatic and edaphic conditions). The variations exist among the recorded wood characteristics between selected *Artocarpus* species helps to develop a reliable identification key.

Species identification key to the genera *Artocarpus*

1. Axial parenchyma is vasicentric or short wings to form Lozenge aliform upto winged aliform and confluent, prismatic crystals are absents, palisade/gash like VRPs absent.....(2)

1. Axial parenchyma is vasicentric, paratracheal to form like irregular bands of parenchyma, prismatic crystals are present in parenchyma cells, palisade/gash like VRPs present***A. heterophyllus***

2. Broad rays with maximum width of 100 – 130 μm , the tallest more than 1000 μm in height, size of IVPs >12 μm (3)

2. Broad rays with maximum width of 75 – 90 μm , the tallest less than 1000 μm in height, size of IVPs 4-12 μm ***A. gomezianus***

3. Maximum tangential diameter of the largest vessels 320 – 350 μm , maximum length of fibre element is less than 2500 μm , average maximum diameter of the fibre 25 – 30 μm , rays 1-8 (mostly 5 - 8) seriate.....(4)

3. Maximum tangential diameter of the largest vessels 360 – 385 μm , maximum length of fibre element is more than 2500 μm , average maximum diameter of the fibre 30 – 38 μm , rays 1-5 (mostly 4-5) seriate***A. hirsutus***

4. Maximum vessel frequency is less than 10, shape of inter vessel pits polygonal, mix ray compositions of procumbent/square/upright ray cells absent***A. lakoocha***

4. Maximum vessel frequency is more than 10, shape of inter vessel pits round to oval, mix ray compositions of procumbent/ square/upright ray cells present.....***A. chama***

Conclusion

Most of the previous literature based on limited sample size and regional wood samples. However, the present work based on 33 wood samples belongs to erstwhile India. Complete data on wood microstructure of selected species of genus *Artocarpus* has been generated according to the feature list given by the International Association of Wood Anatomists for

hardwood identification. The wood anatomy of *A. gomezianus* species is reported first time in this present work. All the selected indigenous species have similar gross/general wood features with the variations in microscopic anatomical features. The qualitative wood features are largely consistent while the quantitative variations were observed between or within species, such as differences in the width of broad rays and the height of multiseriate rays, which may be attributed to site-specific factors. With the help of recorded wood microstructural features develop an identification key for the selected species of *Artocarpus* genera. *A. heterophyllus* is easily identified due to presence of palisade-gash like vessel-ray pits with irregular bands of parenchyma while rest of three further separated out on the basis of other wood anatomical features. This data will be helpful as a base data resource in further research on the genus *Artocarpus*.

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