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VARIABILITY IN WOOD ELEMENTS OF SOME SPECIES OF FICUS GROWING IN BAGHDAD CITY

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ABSTRACT

To investigate the element properties of *Ficus* wood growing in Iraq, this experiment has conducted on two species of the genus planted in Baghdad region. Wood specimens were taken from five trees representing each of *F. nitida*and *F. religiosa*. Specimens offered wood resembling four height levels and two radial positions (outer and inner). Wood samples were separated according to treatment combination, macerated and tested microscopically. Three properties were investigated (fiber length, fiber wall thickness, and vessel diameter). Results showed that the two species had around the same fiber length, but with wall thickness and vessel diameter *F. religiosa*was the superior. Little addition was found in fiber length of wood near to bark compared to inner wood. Longitudinally, fiber length and vessel diameter were increased as the height increased up to the third level after which declining in dimension has occurred.

Keywords: ficus, species, wood, fiber, vessel, variation.

INTRODUCTION

The genus *Ficus* is distributed throughout the world primarily in subtropical and tropical regions (Corner, 1965; Berg, 1989; Berg and Corner, 2005). It is made up of close to 1000 species throughout tropical and warm temperate regions with greatest diversity in SE Asia, Malesia and tropical South America. In Australia *Ficus* includes a large number of indoor ornamental plants and garden and roadside trees such as *F. elasticaRoxb.* exHornem.*, F. religiosa*L.*, and F. microcarpa* L. (Mubo and others, 2004).It is also considered one of the most diversified genera with regard to its habits (deciduous and evergreen trees, shrubs, herbs, climbers and creepers) and life forms (free standing tree, epiphytes, semi-epiphytes in the crevices, rheophytes and lithophytes) (Chaudhary and others, 2012). (deciduous and evergreen trees, shrubs, herbs, climbers and creepers) and life forms (free standing tree, epiphytes, semi-epiphytes in the crevices, rheophytes and lithophytes) world primarily in subtropical and tropical regions (Corner, 1965; Berg, 1989; Berg and Corner, 2005) In Iraq only one species from the genus - *Ficuscarica* - has established throughout the whole country, mainly for fruit purposes. The wood of this species has no local economic importance. *Ficusreligiosa* and *Ficusnitida* has longer stems and could have a merchantable importance but their distribution isstill limited for ornamentals. . It is found throughout the plains of India upto 170 m (The Ayurvedic Pharmacopoeia of India).

In their natural habitats, *F. religiosa*trees, 7-10 m tall,(i.e. not far from that of trees in Iraq), evergreen, without aerial roots, milky latex present; bark ashy-grey, smooth when young, wood is diffuse porous with pores solitary (Observation),whitish, moderately hard. Leaves pendulous, pink in young stage, 24-30 cm long, spirally arranged (Kumar and others, 2011). While *F. nitida* are free standing trees or epiphytes, ca. 20 m tall, evergreen, aerial roots few, thin in bunches, 3-4 m long, not touching the ground. Stem profusely branched, greyish white with smooth bark and profuse white milky late. Leaves 7.8-9.9 cm long, alternate, spirally arranged.

While the environmental conditions of Iraq are so diverse from that of the natural habitat, some different changes in plant characteristics are expected. *F. religiosa* under Iraqi conditions thrives well and could resisted very hot summer seasons which dominated during last decade. In opposite, *F. nitida* strongly suffered and many of large trees could not survive especially that having no sufficient water.

The lack of studies on *Ficus*wood for trees growing under Iraqi conditions created the need for adequate knowledge about it; therefore this research is one step toward the target. The two species *F. religiosa*and *F. nitida* were the mater of study. Variation in the main properties of wood elements between them and among the stem were studied for trees under Baghdad region conditions.

MATERIALS AND METHODS

Five trees from eachone of the two species; *F. religiosa*and *F. nitida,*were selected to represent the whole region of Baghdad city. They were similar in size as much as possible. Wood specimens were collected from four height levels starting from ground upwards with 1.5m intervals. Specimens were taken by increment borer instrument; it was incised through the trunk from bark to pith. Three wood specimens were collected at each height level.

Specimens were divided into two parts; inner, which was closer to pith region, and outer, which was closer to bark. The three parts of each position representing certain height level were collected together, refined and gently mixed. Maceration has conducted on the small particles using Franklin, 1945 method. Macerated elements were stained by safranin, and then sufficient number of slides were prepared.

Three of fiber properties were measured; fiber length, vessel diameter, and fiber wall thickness. Experiment was analyzed as factorial CRD with three factors; first: wood species, with 2 levels, second: height position, with 4 levels, and radial position, with 2 levels.

Each treatment combination has replicated 5 times. Number of measurements was 30-40 readings for each replication from which arithmetic mean was calculated. Experiment has analyzed as factorial CRD with 3 factors (wood species: 2 levels, radial position: 2 levels, and height position: 4 levels).

Statistical analysis has subjected using Statistica program (99 Edition) to test significant factors and using Duncan Multiple Test for the difference between treatments.

RESULTS AND DISCUSSIONS

The difference in fiber length between the two species (*F. nitida* and *F.religiosa*) was not significant while the position of wood specimen affected significantly either longitudinally or radially (Tables 1, 2). Wood nearest to bark appeared longer fibers than that adjacent to pith. The result was applied on the two tree species. Similar results were obtained on many other species by a lot of workers (Zha *et al*., 2005; Choudhury, *et al*. 2009; Ohshima *et al*., 2003). Some of them has explained that the reason is the presence of older cambial region at the outer portions which has the ability to produce longer cells (Tsoumis, 1968).

Table-1. Variation in fiber length (µm) according to species and radial position of wood.

Variable	Species	Height				Mean
		1	2	3	4	
Wood Species	*Ficusnitida*	1119.56 (c)	1166.90(bc)	1671.09 (a)	1167.09 (bc)	1281.16
	Ficusreligiosa	1170.78(bc)	1303.32(b)	1315.37 (b)	1264.45(bc)	1263.48
Radial Position	Inner	1149.4(c)	1200.8(c)	1384.7 (b)	1151.9 (c)	1221.7
	Outer	1140.9(c)	1269.4(bc)	1602.2 (a)	1279.5 (bc)	1323.0

Note: Values having same letter are not statistically different at p≤0.05.

Table-2. Interaction between wood species, radial position and height level on wood fiber length (µm).

Species	Radial position	Height				Mean
		1	2	3	4	
Ficusnitida	Inner	1152.4 (de)	1055.4 (e)	1536.2 (b)	1055.5 (e)	1199.9
	Outer	1086.8 (e)	1278.3(cde)	1806.9 (a)	1278.5 (cde)	1362.6
Ficusreligiosa	Inner	1146.5 (de)	1346.2(bcd)	1233.2 (cde)	1248.3 (cde)	1243.5
	Outer	1195.1(cde)	1260.5(cde)	1397.5 (bc)	1280.4 (cde)	1283.4
Mean		1145.2	1235.1	1493.45	1215.675	1272.4

Note: Values having same letter are not statistically different at p≤0.05.

Variation of fiber length longitudinally in trunk followed a certain pattern; it has increased from bottom to the third level and then decreased at the last upper level (Table-2). This behavior is not unfamiliar, many researchers found similar trend but at a variable heights and different species. Some authors found unfixed pattern to the effect of height on fiber length (Bhat *et al*., 1989; Idu and Ijomah, 1996; Jorge *et al*., 2000). Treatment combination of *F. nitida* and outer position with the third height level resulted in maximum fiber length (1807 µm), while the minimum (1055 µm) has occurred in the same species at the second and fourth height level but for the inner wood.

Fiber wall thickness was found to be highly different between the two wood species. *F. religiosa* fibers had thicker walls by about 40% as compared with *F. nitida* (Table-3). The radial position of wood has not affected significantly. The trend was about similar in any of the two species (Table-4). The third height level has appeared to be superior upon others but only in case of *F. religiosa*; it possessed a mean of 5.080 µm fiber wall thicknesses. Minimum mean was obtained (2.757 µm) in the inner wood of *F. nitida* at the third height level, too.

Table-3. Variation in fiber wall thickness (µm) according to species and radial position of wood.

Variable	Species	Height				Mean
		1	2	3	4	
Wood Species	*Ficusnitida*	3.302 (d)	2.803 (e)	2.852 (de)	2.799 (e)	2.939
	Ficusreligiosa	4.351 (c)	4.872 (ab)	5.080 (a)	4.517 (bc)	4.70
Radial Position	Inner	3.607 (a)	4.039 (a)	4.050 (a)	3.797 (a)	3.873
	Outer	4.024 (a)	3.789 (a)	3.868 (a)	3.510 (a)	3.798

Note: Values having same letter are not statistically different at p≤0.05.

Table-4. Interaction between wood species, radial position and height level on fiber wall thickness (µm).

Species	Radial position	Height				Mean
		1	2	3	4	
Ficusnitida	Inner	3.241 (e)	2.802 (e)	2.757 (e)	2.830 (e)	2.908
	Outer	3.964 (de)	2.819 (e)	2.947 (e)	2.768 (e)	3.125
Ficusreligiosa	Inner	3.978 (d)	5.138 (ab)	5.346 (a)	4.762 (abc)	4.806
	Outer	4.725 (abc)	4.605 (bcd)	4.814 (abc)	4.272 (cd)	4.604
Mean		3.977	3.841	3.966	3.658	3.861

Note: Values having same letter are not statistically different at p≤0.05.

Vessel diameter was significantly dependent upon wood species. Diameters of *F. religiosa* were wider than that of *F. nitida* by about the same percent as that obtained with fiber wall thickness (Table-5). The radial position showed an interacted effect; when it was taken as a mean for the two species, it showed no effect. But when it was observed separately (Table-6), it was easily concluded that for one species a certain height level within a specific radial position resulted in higher or lower significant values. Vessels with maximum width (334.0µm) were obtained in the third height level of inner wood of*F. religiosa*, while 125.8 µm was the narrowest vessel element which was obtained in treatment combination of *F. nitida* with outer wood with the first height level. The table also shows that mean value of the third height level gave widest vessels upon others.

DISCUSSIONS

It is well known that the change in environmental conditions leads to deep variations in wood properties. Therefore, the obtained variations in wood element geometry comparing with those studied in other environments than in Iraq was expected. Field observation in Baghdad region referred that *F. nitida*

Tabl-5. Variation in Vessel diameter (µm) according to species and radial position of wood.

Variable	Species	Height				Mean
		1	2	3	4	
Wood Species	*Ficusnitida*	169.7 (d)	165.7 (d)	207.7 (c)	162.2 (d)	176.3
	Ficusreligiosa	262.1 (b)	293.7 (ab)	312.6 (a)	273.4 (b)	285.4
Radial Position	Inner	225.4 (b)	215.3 (b)	285.2 (a)	196.6 (b)	230.6
	Outer	206.3 (b)	243.8 (ab)	235.0 (b)	237.1 (b)	230.5

Note: Values having same letter are not statistically different at p≤0.05.

Table-6. Interaction between wood species, radial position and height level on vessel diameter (µm).

Species	Radial Position	Height				Mean
		1	2	3	4	
Ficusnitida	Inner	213.4 (cd)	144.2 (de)	236.2 (c)	144.2 (de)	184.7
	Outer	125.8 (e)	186.6 (d)	178.9 (d)	176.3 (d)	166.9
Ficusreligiosa	Inner	237.5 (c)	286.5 (b)	334.0 (a)	248.9 (bc)	276.7
	Outer	286.7 (b)	300.9 (ab)	291.1 (ab)	297.9 (ab)	294.2
Mean		215.9	229.6	260.1	216.8	230.6

Note: Values having same letter are not statistically different at p≤0.05.

suffered more than *F. religiosa* at hot summer. So, we consider that element dimension in the tables of the first species do not resemble the actual values of wood elements for trees in their normal habitats. In contrary, *F. religiosa* values were not far from that obtained by some authors (Sharma and others, 2014, Ogunkunle and Oladele, 2008 and that of *F. carica* (Barbaros Yaman, 2014).

Radial and longitudinal variation in wood element among the stem is often dependable upon the age of cambium layer, hence fiber length at layers near the bark might be longer than that near to pith. That is what we have obtained when outer wood exceeded inner one by about8%. Longitudinally, other factor may act together with aforementioned one, the distance between wood sample and crown. Parts of stem near to crown may be under the effect of growth hormones resulted in more element dimension. Although, authors findings are in unalike pattern, but the general trend was with declining of dimension with height. Such result has not obtained in this experiment might because of short stems and or because of the unfavorable environmental conditions.

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