

# Morphological Characteristics of Different *Ficus* Species Found in Samaru-Zaria, Nigeria

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## Abstract

The genus *Ficus* is an important genetic resource due to its high economic and nutritional values. It is also an important part of biodiversity in the rainforest ecosystem. The leaf shape is variable, even among the leaves on the same tree and such characters as acuminate tips and cordate bases are seldom constant. The research was aimed to determine the morphological characteristics of leaves from eight different *Ficus* species found in Zaria in wet and dry season. Macromorphological characters such as leaf type, leaf shape, leaf apex, leaf margin, leaf arrangement and leaf base were examined. Macromorphological characters show leaf arrangement to be alternate in all the species. The leaf apices are acute, obtuse and Acuminate, with leaf base been cordate and obtuse, having a leaf margin of serrate, entire and scalloped, with the shapes of the leaf cordate, ovate and elliptic. Quantitative examination of the foliar characteristics in both wet and dry season showed a significant difference in the leaf number among all the species except for *Ficus reliogosa*, *Ficus capensis* and *Ficus elastica* having *P* values 0.938, 0.963 and 0.873 respectively. Leaf length also varies significantly among all species except for *Ficus reliogosa*, *Ficus polita*, *F. platyphylla* and *F. natalensis* while leaflet width also varies significantly among all the species except for *Ficus platyphylla*. Petiole length was also significant among the species except for *Ficus elastica* (*P* value 0.417) The findings from this research revealed that the macromorphological characteristics of *Ficus* species in Zaria during wet and dry season indicate a significant variation across species.

**Keywords:** Morphological, Foliar, *Ficus* species, Wet and dry season

## INTRODUCTION

The genus *Ficus* Linnaeus (Moraceae) was first published in System Nature by Carolus Linnaeus in 1735 (Frodin, 2004) ranked it as the 21st largest genus of among seeded plants. *Ficus* is a large genus in the family Moraceae, is composed of over 1, 000 members of species of woody trees, shrubs, vines, epiphytes and hemi epiphytes and is distributed in tropical and subtropical regions. Approximately, 800 species are present in Tropical and Subtropical regions of the world (Adebayo *et al.*, 2009).

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The specific identification of many of the species can be difficult, but figs as a group are relatively easy to recognize. Many have aerial roots and a distinctive shape or habit, and their fruits distinguish them from other plants. The fruit fig is an enclosed inflorescence, sometimes referred to as a syconium, an un-like structure lined on the inside with the Figs tiny flowers (Condit, 1969).

The genus *Ficus* has followed several curious lines of evolution. The taxonomy of this group is still puzzling, because of the extreme morphological variability and ambiguous boundaries between taxa (Sonibare *et al.*, 2004). The leaf shape is variable even among the leaves on the same tree and such characters as acuminate tips and cordate bases are seldom constant (Keay 1989) These extreme variations and unclear boundaries between varieties create misleading identifications of *Ficus* species varieties. The diversity in the genus *Ficus* has resulted in a number of taxonomic problems leading to misidentification of the species. These misidentifications have gross implications for the effective use of the species for their medicinal benefits. Species delimitation is an integrative field that depends on increasingly diverse data types, yet it remains rife with arguments and opposing approaches. The use of leaf morphological features is found to be of immense interest in taxonomy and have been used by many authors in plant identification (Nwachukwu *et al.*, 2007).

## **MATERIALS AND METHODS**

### **Study Site**

The research was conducted in Zaria metropolis at latitude 11<sup>0</sup>,11<sup>1</sup> N and longitude 7<sup>0</sup>,73<sup>1</sup> E in the Northern Guinea Savannah zone of Nigeria, the area is characterized by a distinct wet and dry season with an elevation of 613m above sea level. The area has an average annual temperature range of 15.3- 36.25 °C and receives an average of 1050 mm of rainfall annually. The area is characterized by shorter grasses and the trees are fewer and more scattered.

### **Collection of Plant Materials**

Leaves and fruits of eight (8) species representing the Genus *Ficus* of the family Moraceae was collected from wild and cultivated lands of the study location. The species include: *Ficus polita*, *Ficus capensis*, *Ficus elastica*, *Ficus platyphylla*, *Ficus sycomorus*, *Ficus glumosa*, *Ficus reliogosa* and *Ficus natalensis*. These species were collected from different areas of Zaria metropolis, North-western Nigeria and the coordinates of the sampling collections were taken and documented (Table 1). The species were authenticated at the Herbarium section of the Department of Botany, Faculty of Life Sciences, Ahmadu Bello University Zaria, Kaduna Nigeria.



Plate i: *Ficus natalensis* Hochst



Plate ii: *Ficus glumosa* Delile



Plate iii: *Ficus reliogosa* L.



Plate iv: *Ficus elastica* Roxb. ex Hornem.



Plate v: *Ficus polita* Vahl



Plate vi: *Ficus platyphylla* Del.



Plate vii: *Ficus capensis* Thunb.



Plate viii: *Ficus sycomorus* L.

Table 1: Locations of *Ficus* species in Samaru-Zaria, Northern Guinea Savannah

S/N	Species	Latitude	Longitude	Voucher NO	Habit	Collection site
1	<i>F. capensis</i>	11°18' 86"	7°59'58"	ABU01618	Tree	ABU S/ farm
2	<i>F. natalensis</i>	11°16'37"	7°62'22"	ABU021116	Tree	Area G. ABU
3	<i>F. glumosa</i>	11°02'68"	8°09'50"	ABU021117	Tree	Nearls ABU
4	<i>F. elastica</i>	11°09'56"	7°38'3"	ABU017011	Tree	PLSC ABU
5	<i>F. reliogosa</i>	11°18'69"	7°59'83"	ABU05674	Tree	Shika R/Zar
6	<i>F. polita</i>	11°50'57"	8°34'25"	ABU02665	Tree	FLSC ABU
7	<i>F. sycomorus</i>	11°09'53"	7°37'56"	ABU016123	Tree	BZ/F ABU
8	<i>F. platyphylla</i>	11°14'07"	7°64'01"	ABU016178	Tree	ABU Bot. G.

KEY: NEARLS: Nigerian Agriculture Research and Liaison Service; PLSC: Plant Science Department; ABU BZ/F: Area BZ/F Ahmadu Bello University Zaria; ABU Bot. G: Ahmadu Bello University Botanical Garden; FLSC ABU:

Faculty of Life Sciences Ahmadu Bello University Zaria; Shika R/Zar: Shika Road Zaria; ABU S/Farm: Ahmadu Bello University Shika Farm; Area G ABU: Area G Ahmadu Bello University Zaria.

### **Macromorphological Studies of *Ficus* Leaves**

Fifty (50) samples of matured leaf per species was used for the assessment of macromorphological characters. The characters include leaf length, leaf breadth, petiole length was assessed using a meter rule; this was carried out following the technique of Soladoye *et al.* (2010). The leaf type, leaf shape, leaf apex, leaf margin, leaf arrangement, and leaf base were physically examined and recorded.

### **Data Analyses**

The macromorphological characters of the leaves was subjected to analysis of variance (ANOVA) to test for significance. Duncan's Multiple Range Test (DMRT) was used to separate the means. T-test was carried out to compare the quantitative morphological characters between the species in the two growing seasons.

## **RESULTS AND DISCUSSION**

### **Macromorphological Examination of *Ficus* Species Found in Samaru-Zaria**

The result for the leaf qualitative morphological features of eight (8) species of *Ficus* found in Zaria is detailed in Table 2. The shapes and forms of all the examined species showed a range of variation and similarities, the shape of all the eight species were cordate except for *F. natalensis* which was ovate and *F. elastica* was elliptic in shape. Similarly, the leaf base of all the species examined were cordate except for *F. elastica* which was obtuse (round). The margins of the leaves observed also varies from entire, serrate, sinuate and scalloped. Also, the leaf apex of all the species varies from acuminate, obtuse and acute; *F. polita*, *F. elastica*, *F. reliogosa* and *F. glumosa* had an acuminate leaf apex while *F. natalensis* and *F. sycomorus* possess obtuse leaf apex. Acute leaf apex was observed on *F. platyphylla* and *F. capensis* and all the leaf arrangement of all the eight species of *Ficus* examined in the study area are alternate. The alternate arrangement in all the species could be attributed to the close similarities in the growing region or environmental condition (Fatimah *et al.*, 2014). Some variations observed among the species such as the leaf shape, leaf margin and leaf apex could be as a result of their growing habitat and genetic makeup as some are found in the natural habitat where there is less availability of water during the dry season could warrant them to adjust to this condition and tends to have serrated leaf margins to reduce transpiration rate (Liu *et al.*, 2019).

### **Quantitative Leaf Morphological Characters of *Ficus* Species Found in Samaru-Zaria.**

The result for the leaf morphological features of *Ficus* species examined in Zaria during the dry season is presented in Table 3. The result showed that the eight species possess leaflets number which varied from 4 leaflets as observed on *F. glumosa* to 11 leaflets as observed on *F. elastica*. The leaflets length varied from 10.04 cm length in *F. natalensis* to 30.26 cm length in *F. platyphylla*. Similarly, the width of the leaves varies from 6.69 cm as observed on *F. natalensis* to 19.30 cm as observed on *F. platyphylla* while the length of the petiole also varies from 1.78 cm as observed on *F. glumosa* to 21.77 cm as observed on *F. reliogosa*.

Similarly, the leaf morphological features of the eight species of *Ficus* examined in Zaria during the wet season as detailed in table 4 revealed that the leaflet number varies from 5 leaflet as observed on *F. capensis* to 17 leaflets as observed on *F. natalensis*. The leaf length varies from 9.87 cm as observed on *F. natalensis* to 30.68 cm as observed on *F. platyphylla*, similarly, the leaf length width varies from 5.68cm as observed on *F. capensis* to 20.14 cm as

observed on *F. platyphylla*. Also, the length of the petiole varies 3.03 cm as observed *F. sycomorus* to 28.53 cm as observed on *F. reliogosa*.

The quantitative data of *Ficus* species in Zaria during the dry season showed that the leaflet number of *Ficus elastica* have the highest leaflet number (11) which was significantly higher than all the other species. This could be attributed to the fact that *Ficus elastica* commonly known as rubber plant has a waxy nature which enable it to retain water in the dry season thereby allowing it leaves not to drop easily. Also, this plant have a robust root system which extend far down deep into the soil to absorb water at varying levels to adopt to the harsh environmental condition of the dry season (Chantarasuwan *et al.*, 2016).

However, during the wet season, the leaflet number was higher in *Ficus natalensis* (17). This is as a result of the closer branching pattern of these species as oppose to all other species. Corner *et al.*, 2005 also report that some species of *Ficus* such as *Ficus virens* showed a closer branching pattern as oppose to other species resulting in higher leaflet meters.

The leaflet length in both wet and dry season is longer in *Ficus platyphylla* (30.26 cm and 30.68 cm respectively) than all the other species as well as the leaflet breadth is also significantly wider in this species in both the season. These could be as a result of the heavily branching pattern and the species of these fig is reffered to as broadleaf fig (Ronsted *et al.*, 2008)

*Ficus reliogosa* have the longest leaf petiole of 21.77cm to 28.53cm in both the seasons. These could be attributed to the spines or prickles growing on the stems leading to the leaf not to emerge till the petiole length is long enough to avoid disturtion of the primordial leaves by the spines. Berg, 2007 also reported that the variations in the length of some species in *Ficus* (*Ficus rumphii* and *Ficus amplissima*) could be as a result of some morphological modifications to certain environmental conditions.

Table 2. Macromorphological features of *Ficus* species found in Samaru-Zaria Northern Guinea Savannah

S/N	NAME OF TAXA	LEAF APEX	LEAF ARRANGEMENT	LEAF BASE	LEAF MARGIN	LEAF SHAPE
1	<i>F. capensis</i>	Acute	Alternate	Cordate	Serrate	Cordate
2	<i>F. natalensis</i>	Obtuse	Alternate	Cordate	Entire	Ovate
3	<i>F. glumosa</i>	Acuminate	Alternate	Cordate	Entire	Cordate
4	<i>F. elastic</i>	Acuminate	Alternate	Obtuse/rounded	Entire	Elliptic
5	<i>F. reliogosa</i>	Acuminate	Alternate	Cordate	Scalloped	Cordate
6	<i>F. polita</i>	Acuminate	Alternate	Cordate	Entire	Cordate
7	<i>F. sycomorus</i>	Obtuse	Alternate	Cordate	Serrate	Cordate
8	<i>F. platyphylla</i>	Acute	Alternate	Cordate	Sinuate	Cordate

**Table 3. Quantitative data of *Ficus* species Leaves found in Samaru-Zaria during Dry Season**

Morphometrics	<i>F. capensis</i>	<i>F. natalensis</i>	<i>F. glumosa</i>	<i>F. elastica</i>	<i>F. reliogosa</i>	<i>F. polita</i>	<i>F. sycamoros</i>	<i>F. platyphylla</i>
Leaflet number	5.92±0.24 <sup>d</sup>	9.06±0.53 <sup>b</sup>	4.10±0.16 <sup>e</sup>	11.08±0.57 <sup>a</sup>	9.94±0.61 <sup>b</sup>	7.72±0.32 <sup>c</sup>	6.16±0.21 <sup>d</sup>	5.96±0.24 <sup>d</sup>
Leaf let length (cm)	12.84±0.18 <sup>e</sup>	10.04±0.13 <sup>f</sup>	10.35±0.17 <sup>f</sup>	21.99±0.97 <sup>c</sup>	23.30±0.38 <sup>b</sup>	16.00±0.31 <sup>d</sup>	12.32±0.13 <sup>e</sup>	30.26±0.67 <sup>a</sup>
Leaf let width (cm)	7.34±0.08 <sup>ef</sup>	6.69±0.85 <sup>f</sup>	8.71±0.19 <sup>d</sup>	12.78±0.58 <sup>b</sup>	12.57±0.16 <sup>b</sup>	11.17±0.22 <sup>c</sup>	7.56±0.10 <sup>e</sup>	19.30±0.42 <sup>a</sup>
Leaf petiole (cm)	2.96±0.11 <sup>f</sup>	3.94±0.12 <sup>e</sup>	1.78±0.07 <sup>g</sup>	4.82±0.32 <sup>d</sup>	21.77±0.60 <sup>a</sup>	8.43±0.33 <sup>c</sup>	4.14±0.18 <sup>e</sup>	11.49±0.20 <sup>b</sup>

KEY: Values are mean ± standard error of means of 50 replicates

Means with the same superscript along each row are not significantly different at P≥0.05

**Table 4. Quantitative data of *Ficus* species Leaves found in Samaru-Zaria during Wet Season**

Morphometrics	<i>F. capensis</i>	<i>F. natalensis</i>	<i>F. glumosa</i>	<i>F. elastica</i>	<i>F. reliogosa</i>	<i>F. polita</i>	<i>F. sycamoros</i>	<i>F. platyphylla</i>
Leaflet number	5.94±0.3 6 <sup>f</sup>	17.48±0.8 9 <sup>a</sup>	14.72±0.5 5 <sup>b</sup>	11.20±0.4 9 <sup>c</sup>	10.00±0.46 cd	9.14±0.29 d	7.10±0.24 ef	7.38±0.29 e
Leaf let length (cm)	9.99±0.2 4 <sup>e</sup>	9.87±0.26 e	16.94±0.4 9 <sup>d</sup>	19.07±0.7 8 <sup>c</sup>	24.00±0.40 b	16.61±0.3 5 <sup>d</sup>	10.67±0.1 8 <sup>e</sup>	30.68±0.4 3 <sup>a</sup>
Leaf let width (cm)	5.68±0.1 5 <sup>g</sup>	7.07±0.16 f	9.41±0.29 e	11.16±0.4 8 <sup>d</sup>	13.49±0.22 b	12.32±0.2 6 <sup>c</sup>	8.80±0.16 e	20.14±0.3 1 <sup>a</sup>
Leaf petiole (cm)	2.49±0.0 8 <sup>e</sup>	3.51±0.09 e	5.61±0.14 d	4.50±0.24 de	28.53±0.89 a	11.41±0.6 8 <sup>b</sup>	3.03±0.09 e	8.71±0.23 a

KEY: Values are mean ± standard error of means of 50 replicates

Means with the same superscript along each row are not significantly different at P≥0.05

**Comparison of Quantitative Leaf Morphological Characters of *Ficus* Species Found in Samaru-Zaria in Wet and Dry Season.**

The comparison of quantitative leaf morphological characters of *Ficus* species across the wet and dry season (Table 5) showed that the leaflet number of all the species in wet and dry season varies except for *Ficus reliogosa*, *Ficus capensis* and *Ficus elastica* while the leaflet length and width also vary between the seasons in all the species except for *Ficus platyphylla*. Similarly, the leaf petiole varies among the species in the two (2) seasons except for *Ficus elastica*.

The comparison of quantitative leaf morphological characters of *Ficus* species found in Zaria during wet and dry season showed a significant difference of the leaflet number in all the species except for *Ficus reliogosa*, *Ficus capensis* and *Ficus elastica*. This could be attributed to the ability of these species to retain their growth pattern (*Ficus elastica*) in both wet and dry season. However, the leaflet length also showed a significant difference in all the species except for *Ficus reliogosa*, *Ficus polita*, *Ficus capensis* and *Ficus glumosa* which could be attributed to those species not to show a significant difference or variations in their leaf morphology due to environmental conditions (Berg and Corner, 2005).

Table 5. Comparison of Quantitative leaf Morphological characters of *Ficus* species found in Samaru-Zaria during wet and dry season

Species	LN			LL (cm)			LW (cm)			LP (cm)		
	Wet	Dry	P-value	Wet	Dry	P-value	Wet	Dry	P-value	Wet	Dry	P-value
<i>F. reliogosa</i>	10±0.07	9.94±0.09	0.937766	24.00±0.06	23.30±0.05	0.202978	13.49±0.03	12.57±0.02	0.001177	28.53±0.13	21.77±0.08	1.15×10 <sup>-8</sup>
<i>F. polita</i>	9.14±0.04	7.72±0.05	0.001525	23.30±0.05	15.10±0.04	1.76×10 <sup>26</sup>	12.32±0.04	11.17±0.03	0.00106	11.41±0.10	8.43±0.05	0.00181
<i>F. sycomorus</i>	7.1±0.03	6.16±0.03	0.004016	10.67±0.03	12.32±0.12	9.68×10 <sup>-11</sup>	8.80±0.02	7.56±0.01	3.18×10 <sup>-9</sup>	3.03±0.01	4.14±0.03	7.11×10 <sup>-7</sup>
<i>F. platyphylla</i>	7.38±0.04	5.96±0.03	0.000341	30.68±0.06	30.26±0.09	0.598188	20.14±0.04	19.30±0.06	0.107642	8.71±0.03	11.50±0.03	1.3×10 <sup>-14</sup>
<i>F. capensis</i>	5.94±0.05	5.92±0.03	0.963393	9.99±0.03	12.84±0.03	4.24×10 <sup>-15</sup>	5.68±0.02	7.34±0.01	1.91×10 <sup>-15</sup>	9.99±0.03	2.96±0.02	1.28×10 <sup>-37</sup>
<i>F. natalensis</i>	17.48±0.13	9.06±0.07	5.12×10 <sup>-12</sup>	9.86±0.04	10.04±0.02	0.527903	7.07±0.02	6.69±0.01	0.03596	3.51±0.01	3.94±0.02	0.005261
<i>F. glumosa</i>	14.72±0.08	4.1±0.02	6.18×10 <sup>-26</sup>	16.94±0.07	10.35±0.02	6.08×10 <sup>-19</sup>	9.41±0.04	8.71±0.03	0.04415	5.61±0.02	1.78±0.01	2.17×10 <sup>-35</sup>
<i>F. elastica</i>	11.2±0.48	11.08±0.00	0.873288	19.07±0.11	21.10±0.14	0.020589	11.16±0.07	12.78±0.08	0.034048	4.50±0.03	4.82±0.04	0.416939

Keys: Values are mean ± standard error of means of 50 replicates, values with P-values greater than 0.05 were not significantly different

LN= leaflet number

LL= leaflet length

LW= leaflet width

LP= leaf petiole

### CONCLUSION AND RECOMMENDATION

The finding from this research revealed that the macromorphological characteristics of *Ficus* species showed the leaf arrangement of alternate, leaf shape of cordate and elliptic, leaf margin of serrate, entire, scalloped and sinuate while the leaf base is cordate or obtuse with leaf apex of acute, acuminate and obtuse. Quantitative morphological characteristics of the *Ficus* species in Samaru Zaria during wet and dry season indicate a significant variation among all the species. Macromorphological characteristics such as leaf arrangement, leaf shape, leaf margin, leaf apex, length of petiole and number of leaves should be used as a guiding tool towards the identification of plant species.

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