



Morphological studies of some Nigerian species of *Sida*

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ABSTRACT

The species of the genus *Sida* have been displaying some certain morphological affinities among themselves but these are so distributed that it is hard to classify into definite allied groups. Eleven Nigerian *Sida* species namely; *S. acuta*, *S. rhombifolia*, *S. veronicifolia*, *S. urens*, *S. stipulata*, *S. scabrida*, *S. ovata*, *S. cordifolia*, *S. alba*, *S. corymbosa* and *S. linifolia* were observed on the basis of macro morphological features of the leaf, stem and reproductive part with a view to obtaining reliable characters for easy identification and delimitation of the species. Materials used were freshly collected samples of *Sida* species from the wild and herbarium specimens. The species were thoroughly observed with the help of binocular lens and carefully measured using thread and 30cm ruler. Artificial key was constructed base on the observation of each species. The result showed that leaf base, leaf apex, leaf shape and habit delimit the studied taxa and features such as leaf margin, leaf arrangement and flower colour strongly characterized *Sida* species in the study. Moreover, the awns rarely exceed 1.5mm.in all *Sida* species and that distinguished them from all other genera in Malvacea family.

Keywords: *Sida*, Malvacea, Key, Morphology and species

Introduction

The genus *Sida* belong to the family Malvaceae which contains flowering plants estimated at 244 genera with 4225 known species (Amitha and Sincy, 2019). Most of them are heliophylous wood taxa growing in exposed waste lands. *Sida* is an heterogeneous taxa from the period Theophrastus as the generic name was used to denote *Nymphaea* and other aquatic plants at the point of time. It was linnaeus who restricted the genus to Malvaceous members (Leistner, (2000). The genus *Sida* Linn.is larger and one of the more complex genera of the family Malvaceae. The members are mostly annual or perennial herbs, but in the tropics they are shrubs or rarely soft woody trees. The stem is fibrous and the herbaceous portions are more or less covered with stellate hairs. The plant parts are often mucilaginous. Generally, leaves of *Sida*

are simple, petiolate, leaf blade cordate, elliptic, linear, rhomboid, ovate, serrate. Stipules thread like to lanceolate, foliar nectaries absent. Flowers are small, axillary or subterminal, solitary or clustered to racemes, panicles or umbels. Bracteoles absent, pedicel slender,epicalyx absent. Calyxcomplanate or cup shaped with 5 fused sepals. Corolla mostly yellow, creamy white, orange or sometimes dark yellow. Petals 5, free, connate at base. Staminal column included, filament tube pubescent or glabrous with numerous anthers at apex. Capitulate stigma ovary 5 to 10 loculed each with one ovule, pendulous. Styles branches as many as carpels. Stigma capitulate, fruit schizocarpic (Keay, 1989).

The genus is represented by eleven species in Nigeria. It is a relatively small group in the flora but contains species of economic and



medicinal values (Keay 1989). The species of *sida* have been traditionally used as ayurvedic, Unani, and homeopathic of medicine (Raju and Rani, 2016). A lot of authors have reported different uses of these species, among which Anami and Jespin (2017) reported its uses for curing diarrhea, dysentery, gastrointestinal, urinary infections, malaria and other fevers, skin ailments, cardiac and neural problems, asthma, bronchitis and tuberculosis. Ajeet (2018) remarked that *Sida rhombifolia* yielded fibres found superior to jute. According to Alka *et al.* (2012), a cold infusion of the leaves of *Sida acuta* has been found to be a common remedy for gonorrhoea. The root is bitter and the infusion is used as an appetizer and stomach tonic. The leaves when mashed in water are used as an enema for paralysed children to help them to walk (Ates and Erdogru, 2003). Specifically, extract of *S. acuta* leaves is a potent therapeutic agent in the treatment of male sexual dysfunction (Olivier, 2017). Reports have indicated that its root extract is a potent anti-aging, antihypertensive, anti-tuberculosis and immunomodulating agent (Mohideen, *et al.*, 2002).

Morphological study is one of taxonomical tools useful in the visual identification of plant species. Generally, plants show natural variation in their form, structure and appearance (Adeniran *et al.*, 2020). Basically, those variations could be seen and observed in the leaves, flowers, and other organs like stems and can also reveal similar variations. Plants morphology deals with external features such as development, form and structures of plant. It also observes both the vegetative as well as the reproductive structures of plants for taxonomic diagnosis (Anami and Jespin (2017).

Amitha and Sincy, (2019) emphasized that morphological characters of plants can be used to compare, measure and describe the differences or similarities that exist in plant taxa and such characters are used for plant identification, classification and descriptions. Plants represent one of the important elements of biodiversity. Practically Nigeria remains to be explored from the taxonomic point of view considering changes that took place in last few decades owing to heavy agriculture, urbanization, industrialization and other such factors. There are taxonomic complexities within the genus. Leaves are usually neglected in taxonomic and comparative morphological studies. As Metcalfe and Chalk (1950) reported, leaves are considered as most varied organ anatomically in angiosperms which provides a variety of morphological and anatomical features that can be employed as useful taxonomical characters. Morphological characters such as leaf shapes, sizes, arrangements are found instrumental in solving taxonomic problems and its significance have been long recognized by various workers (Jan *et al.*, (2011); Mbagwu *et al.*, (2007); Ashwathy and Krishnakumar, (2020))

The present study is designed to have a thorough study on the description, macro-morphology, and preparing an artificial key that would delimit and characterize the *Sida* species.

Materials and Methods

Collection of samples

Species of *Sida* were collected from various locations in Nigeria such as Ilorin (latitude 6° 30' and 7° 24'N and longitude 3° 24' and 3° 54'E); Kaba (latitude 11° 0' and 11° 42'N and longitude 7° 42' and 8° 54'E); Ibadan (latitude 6° 36' and 5° 0'N and longitude 3° 30' and 8°



0'E) and Ijebu-Ode (latitude 6° 42' and 7° 24'N and longitude 3° 24' and 3° 54'E) among others during flowering period. The specimens were identified and authenticated in Forest herbarium Ibadan. Freshly collected specimens were washed and the plant parts separated carefully and observed. Macro-morphological studies were carried out with the help of binocular lens. The existing voucher specimens of *Sida* deposited at the Forest Herbarium Ibadan (FHI) were also used for the study. Prior to data collection, the available specimens were carefully examined and the choices of characters were determined following Chukwuma *et al.* (2016) procedures.

Morphological studies

The number of morphological characters observed were 14 and these include leaf shape, leaf apex, leaf base, leaf margin, habit, leaf surface, flower colour, leaf arrangement, types and number of carpels, tubercle at the base of the petiole, type of stipules, length of petioles shape of calyx, length of awn, and length of sepals are features important in the classification of the species. These diagnostic features have been based mainly on the set of specimens retained in the forest herbarium, Ibadan. These characters were measured by using thread and 30cm ruler. A key was constructed base on the observation of characters of each species.

Results and Discussion

Table 1: Morphological characteristics of the genus *Sida*

Species	L. shape	L. apex	L. base	L. margin	Habit	L. surface	Flower colour	L. arrangement
<i>S. acuta</i>	Lanceolate to linear	Acute	cuneate	serrated	erect	Sparingly pubescent	yellow	Alternate
<i>S. rhombifolia</i>	Obovate to elliptic	Acute	cuneate	serrated	erect	Sparingly pubescent	Orange yellow	Alternate
<i>S. veronicifolia</i>	Ovate to cordate	Acute	cordate	serrated	creeping	pubescent	yellow	Alternate
<i>S. urens</i>	ovate	Acute	cordate	serrated	creeping	pubescent	yellow	Alternate
<i>S. stipulata</i>	Elliptic to ovate	Acuminate	cuneate	serrated	erect	pubescent	yellow	Alternate
<i>S. scabrida</i>	Elliptic	Acuminate	cuneate	serrated	Straggling	pubescent	yellow	Alternate
<i>S. ovata</i>	Ovate to elliptic	Acuminate	cuneate	serrated	erect	pubescent	yellow	alternate
<i>S. cordifolia</i>	Ovate to sub orbicular	obtuse	cordate	serrated	erect	pubescent	yellow	Alternate
<i>S. alba</i>	Oblong to rounded	acuminate	cuneate	serrated	erect	pubescent	Lightly yellow	alternate
<i>S. corymbosa</i>	Rhombic to elliptic	acuminate	cuneate	serrated	erect	pubescent	yellow	Alternate
<i>S. linifolia</i>	Linear to lanceolate	acute	cuneate	entire	erect	Slightly pubescent	yellow	Alternate



S. corymbosa



S. stipulata



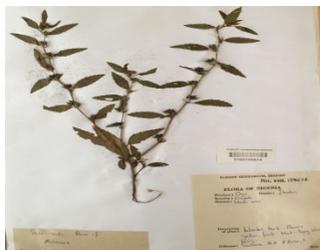
S. ovata



S. alba



S. rhombifolia



S. acuta



S. cordifolia



S. scabrida



S. urens



S. vernicifolia



S. linifolia

Plate 1: Photographs of *Sida* species in Nigeria



Table 2: Diagnostic characters of the genus *Sida*

Species	Length of Sepals (mm)		No. of Carpels		Length of Awm (mm)			
	3-5	5-8	4-5	5-9	9-12	5-1	1-1.5	1.5-5
<i>S. acuta</i>		+		+				+
<i>S. rhombifolia</i>		+			+			+
<i>S. veronicifolia</i>		+				+		
<i>S. urens</i>		+	+					+
<i>S. stipulata</i>		+		+				+
<i>S. scabrida</i>		+		+				+
<i>S. ovata</i>		+		+				+
<i>S. cordifolia</i>		+			+			+
<i>S. alba</i>	+		+					+
<i>S. corymbosa</i>		+		+		+		
<i>S. linifolia</i>		+		+				

Morphological characteristics of the genus *Sida* was shown in Table 1. Leaf shape of *Sida* species showed different variations from one species to another. The leaf apex of *S. acuta*, *S. rhombifolia*, *S.veronicifolia*, *S. urens* and *S. linifolia* were confined to acute while others like *S. corymbosa*, *S. alba*, *S.ovata* and *S. scabrida* confined to acuminate; however, *S. cordifolia* distinguished itself from other studied taxa by having obtuse tip. This report is similar to Anami and Jespin (2017) who reported *Sida acuta* as species having leaves with acute tip; *Sida cordata* a peculiar habit of being prostrate and the leaves cordate (heart) shaped in India. *Sida* species showed uniform characteristic in leaf margin, leaf arrangement and flower colour. The habit of *Sida* species such as creeping and straggling were common to *S. veronicifolia*, *S.urens* and *S. scabrida* and these separated them from other species with erect habit. This is concur with Amitha and Sincy (2019) who reported the habit of *Sida* species structure as erect and prostrate

plant. Flowers were light yellow in all the species. The leaf base of the species studied was cuneate except in *S. veronicifolia*, *S. urens* and *S. cordifolia* that are cordate (Table1).

Many plant groups show great diversity in their indumentum, some of which is taxonomically significant (Plate 1). In *Sida*, two basic types of hairs are found: unicellular (long simple hairs) and multicellular (stellate hairs). This agreed with Ajitha *et al.*, (2012) who reported that the stem of *Sida* generally is pubescent with simple stellate hairs. The preponderance of dense long simple hairs in *Sida corymbosa* has been very useful in separating it from other related species.

In Table 2, two different kinds of carpels have been observed in *Sida*: beaked and awned. These are mixed in some species. The length of awns ranges from 0.5mm to 5mm, and varies a little in the same species. The length of the awns of *S. cordifolia* which varies from



1.5 to 5mm separate it from other related species in the group (Table 2). In all the other species, the awns rarely exceed 1.5mm. The number of carpels in all the herbarium specimens of the *Sida* ranges from 4 to 12. The variation in some specimens could probably be attributed to abortion in the early stages of development. However, *S. alba* has five carpels as a constant feature. In table 2, length of sepals in all the *Sida* species vary from 5-8mm except in *S. alba* with 3-5mm and that separated it from other species.

Tubercule are hooked projections at the base of the petiole. This character is peculiar to *S. alba*. Morphologically, *S. alba* and *S. rhombifolia* are closely related but the presence of tubercules and the constant number of carpels (5) in *S. alba* have been used for the separation of *S. alba* from *S. rhombifolia* (without tubercules and 9-12 carpels) (Table 2). There are intrapetiolar, subulate, lanceolate and filiform stipules (Plate 1). They are generally persistent in all the species and when they eventually fall, they do not normally leave very prominent scars on the stem. Stipules have been found to be variable in *S. corymbosa* (subulate to linear-lanceolate), *S. linifolia*, *S. stipulata*, *S. acuta* and *S. rhombifolia* (filiform to linear-lanceolate), even at base of the same leaf. Short stipules of about 3mm, are peculiar to *S. urens* and *S. veronicifolia* (Plate 1). This present investigation coincides with the observations of Sivarajan *et al*, (1992) and Kumar, (2016)

A tentative key to the Nigerian species of *Sida* Linn.

- 1. Leaves cordate:
- 2. Stem straggling, weakly pilose, flowers solitary or few in lower and upper axil

together with long filiform pedicel over 1 cm. long.....*S. veronicifolia*

2. Stem erect or decumbent, densely pilose or with short dense hairs:

3 Flowers often clustered, pedicel under 1 cm..... *S. urens*

3. Flowers solitary in the lower axil, clustered above with pedicel 0.7-2.5cm. long. Carpels with awns up to 4mm. long exceeding the calyx and covered with appressed hairs.....*S. cordifolia*

1. Leaves not cordate:

4. Leaf margin entire. Linear lanceolate *S. linifolia*

4. Leaf margin not entire but crenate-dentate and not linear lanceolate:

5. Lower surface of leaves greyish-green to ash grey, softly tomentose:

6. Base of petiole with tubercule, carpels 5.*S. alba*

6. Base of petiole without tubercule: Carpels 7-8; Calyx sub-globose.....*S. ovata*

5. Lower surface of leaves pale green-brownish grey and rarely tomentose:

7. Stem densely pilose, leaves covered above with long appressed hairs. Carpels beaked or with short awns 0.5-1mm. long. Stipules to

Lanceolate.....*S. corymbosa*

7. Stem and leaves not densely pilose but densely or minutely stellately hairy to glabrous
Carpels awned.

8. Leaf lamina lanceolate to elliptic lanceolate; Carpels 5-9.

9. Leaf lamina similarly pale green on both surfaces, elliptic-lanceolate, up to 7.5cm. long



and 2.5cm. Broad. Flowers pale yellow.

Branches many*S. stipulata*

9. Leaf lamina not similarly pale green on both surfaces, distinctly lanceolate, up to

7.7cm. long and 2.8cm.broad. Flowers pale yellow. Branches many.....*S. acuta*

8. Leaf lamina often elliptic to obovate elliptic, carpels 9-12.

10. Stem mostly procumbent, rarely erect. Plant often dwarfs. Leaf lamina mostly elliptic

Up to 3.5 cm. long; Flowers pale orange and solitary, pedicel 3-4 mm. long,

not articulated..... *S. scabrida*

10. Stem erect, terete, grey or brown. Plant not dwarf. Leaves obovate to obovate elliptic

Lower surface may or may not be stellately tomentose.

Conclusion

The present study provides the basic information and the interrelationship between the different plant species of *Sida* which are currently found in Nigeria. The study which revealed a number of important macro-morphological characters, and these characters exhibit interesting interspecific variations that are of significance for identification. Much variation is found in the leaf shape, leaf base, habits, number of carpels and length of awns of the *Sida* species. However, the species are grouped together base on their leaf margin, leaf arrangement, leaf apex, leaf surface and flower colour. The above documented information is very important in taxonomic identification and authentication which may even serve as guide for their classifications.

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