

FOLIAR STUDIES IN SOME SPECIES OF *SIDA* L. (MALVACEAE)**Sharada B. Kunnur and K. Kotresha****Abstract**

The present study is on eight species of *Sida* L. (Malvaceae) viz., *Sida acuta* Burm. f., *S. alnifolia* L., *S. cordata* (Burm.f.) Borss., *S. elongata* Bl., *S. mysorensis* W. & Arn., *S. rhombifolia* L., *S. rhomboidea* Roxb. and *S. spinosa* L. found in Karnataka state. These were studied in respect to venation pattern and were compared for preparing a key. The major venation pattern is campylodromous in six species and actinodromous in two species. The highest degree of venation order resolved is up to fourth (4°) degree. The laminar shape, base, apex, margin, number of primary (1°) veins, secondary (2°) veins and the venation patterns all vary from species to species. An indented key is provided for the identification of *Sida* L. species.

Key words: Foliar venation, *Sida*, Malvaceae.

Introduction

There are about 200 species of *Sida* L. (Willis, 1973) widely distributed along the tropical and subtropical parts of the world. Among the 17 species (Sivarajan and Pradeep, 1996) represented in India 8 species are collected from Karnataka for the present work. Leaves are generally neglected organs in taxonomic and comparative morphological studies. Recent studies on leaf architecture of dicotyledons Hickey (1973, 1979) had created much interests and put forwarded several investigations in this field as taxonomic importance. In these it had been considered the shape, base, apex and marginal teeth of the lamina and had also given terminology for the venation patterns. A comparative study of leaf architecture throughout the angiosperms had been done and six different classes of major venation patterns are recognized by Melville, (1976). Many investigators (Foster, 1950, 1951, 1952; Datta and Saha, 1968; Chandra *et al*, 1972; Mohan and Inamdhar, 1982, 1984; Seetharam and Kotresha, 1998) had concluded that the studies on foliar venation provide useful taxonomic clues for the identification of different taxa.

Sida L. is one of the very variable and widely distributed genera of the family Malvaceae (Ugborogho, 1983). As a genus *Sida* L. is easily distinguished from other genera by the lack of involucre, calyx morphology (10- costate) and uniovulate mericarps. However, it is a taxonomically difficult group as far as infrageneric classification is considered (Ugborogho, 1980). Several authors have attempted subgeneric classification of the genus. Out of 11 sections recognised by Fryxell (1985), six are represented in India. In the present study, the authors have collected eight species from Karnataka and includes *S. acuta* Burm. f. (Spiny-head *Sida*), *S. alnifolia* L., *S. cordata* (Burm. f.) Borss., (Long-stalk *Sida*). *S. elongata* Bl., *S. mysorensis* W. & Arn., *S. rhombifolia* L. (Common *Sida*), *S. rhomboidea* Roxb. and *S. spinosa* L. (Prickly *Sida*). The eight species fall under three sections namely section *Sidae* (*S. acuta*, *S. alnifolia*, *S. rhombifolia*, *S. rhomboidea*), section *Nelavagae* Borss. (*S. cordata*, *S. elongata*, *S. mysorensis*) and section *Spinosa* Small (*S. spinosa*).

Indian *Sida* L. have been identified on the basis of mericarp morphology (Sivarajan *et al*, 1992). However, classification becomes uncertain when mericarps are damaged or lose their carpel-wall. Therefore, an attempt is made in this study to identify them on the basis of micromorphological characters specially the foliar venation pattern.

Materials and Methods

The eight species of *Sida* L. were collected from Karnataka state (**Table 1; Fig. 1**). All species are heliophilous and wild in habitat. They were identified with the help of relevant floras (Hooker, 1872; Cooke, 1901; Gamble, 1935; Rao and Razi, 1980; Yoganarasimhan *et al*., 1982; Saldanha, 1984; Sharma *et al*., 1984; Keshavamurthy & Yoganarasimhan, 1990; Paul 1993; Seetharam *et al*., 2000; Ramaswamy *et al*., 2001; Bhat, 2003; Manjunath *et al*., 2004) and monograph (Sivarajan and Pradeep, 1996). All the collected species were deposited as voucher

specimens in the Herbarium of Karnatak Science College, Dharwad. The details of the leaf-blade characters as shape, apex, margin, base and the major venation pattern, etc. are furnished in Table 1 based the terminologies adopted from Hickey (1973), Radford *et al.*, (1974) and Melville (1976).

Minimum of 10 leaf-blades of about the same size and age were taken for each studied species.

Leaves were scanned in HP Scanjet 7400C, scanning mode on grey scale colour. The photographs were then used as templates for tracing the venation pattern.

Observations and Discussion

The leaves of *Sida* L. are simple, entire, symmetrical, with the range of laminar shapes as rhomboid, obdeltate, cordate, ovate, elliptic or orbicular and obovate. The base ranges from cuneate, obtuse, cordate to rounded. The apex varies from acute, emarginate to acuminate. The margin of leaf-blade is serrate, or irregularly serrate or crenate. In all the studied taxa, the venation pattern resolved is upto quarternary (4°) veins order. The primary (1°) veins being the thickest and range from 5-7 in all the studied species. The mid-primaries run almost straight in all the studied species. However, the two lateral primaries on either side of the mid-primary run straight in *S. acuta*, *S. rhombifolia*, *S. rhomboidea* and *S. spinosa* while these are curved in *S. alnifolia*, *S. cordata*, *S. elongata* and *S. mysorensis*.

Simple trichomes are sparsely distributed as seen on both the surfaces of *S. acuta*, whereas *S. alnifolia* and *S. rhomboidea* have stellate trichomes. In *S. rhombifolia* there is both simple as well as stellate trichomes. *S. mysorensis* shows complex multangulate trichomes. *S. cordata* has simple and complex multangulate trichomes. In *S. elongata* adaxial surface is with only simple trichomes but the abaxial surface shows the presence of both simple and multangulate trichomes. *S. spinosa* on adaxial surface shows only stellate trichomes, abaxial surface shows both simple and stellate trichomes.

According to Hickey and-Wolfe (1975), the leaves of Malvales are simple and the venation is of actinodromous type. Recently, Bhat *et al*, (1988) working on Malvaceae (other than *Sida* L.) recorded actinodromous and pinnate type of venation. In the present study on *Sida* L. the venation is either campylodromous or actinodromous (Fig. 2).

According to Hickey and Wolfe (1975) the pinnate type might have evolved through the suppression of lateral primaries of the actinodromous category in the Malvales. Taking this into consideration the authors are of the opinion that, lateral primaries of the actinodromous might have converged and given rise to campylodromous type of venation (it may be, to increase the lamina surface). In this connection, it is interesting to note that in *S. rhombifolia* (Fig. 2f) and *S. spinosa* (Fig. 2h) some of the lower secondaries tend to be thicker than the others but certainly distinct from the mid-primary veins. Thus the present findings are in support of the suggestion of Saibaba and Shanmukha Rao (1990), that the venation pattern in *Sida* L. may possibly form a link between pinnate and actinodromous types of venation.

Bhat *et al*, (1988) worked on Malvaceae (other than *Sida* L.) and the venation order resolved is up to 6°. Saibaba and Shanmukha Rao (1990) have also worked on leaf venation in Indian *Sida* L. and highest degree of vein order resolved is up to fifth (5°) degree, venation type is pinnate or actinodromous.

Studies on foliar epidermis by Prakasa Rao *et al*, (1986) have revealed that *S. rhombifolia* is distinct from other three species viz. *S. acuta*, *S. cordata*, *S. cordifolia* (supported by cytology and morphology of the plant). According to them trichomes are absent in *S. acuta*.

Based on the above foliar micromorphological characters, an indented key provided for the identification of *Sida* L. species.

Indented Key :

1. Actinodromous
 2. Apex acute, trichomes simple on both surfaces.....*Sida acuta*
 2. Apex emarginate, trichomes simple and complex (stellate).....*Sida rhombifolia*
1. Campylodromous
 3. Base cordate / rounded
 4. Cordate base, trichomes simple or / and complex (multangulate)
 5. Apex acute, trichomes complex (multangulate) on both surfaces.....*Sida mysorensis*
 5. Apex acuminate, simple and complex (multangulate) on both surfaces.....*Sida cordata*
 4. Rounded base, trichomes complex (stellate) on adaxial, simple and complex . (stellate) on abaxial surface.....*Sida spinosa*
 3. Base other than cordate / rounded
 6. Apex acute.
 7. Primary veins 7, trichomes simple on adaxial, simple and complex (multangulate) on abaxial surface.....*Sida elongata*
 7. Primary Veins 5, trichomes complex (stellate) on both surfaces.
.....*Sida rhomboidea*
 6. Apex not acute.....*Sida alnifolia*

Conclusion

The present study, however does not agree with the earlier findings about the absence of trichomes in *Sida acuta*, because simple trichomes are sparsely distributed on both the surfaces of the leaf. The *Sida acuta* and *Sida rhombifolia* have more affinity than the other studied species.

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TABLE 1. DATA SHOWING FOLUR CHARACTERS IN <i>SIDA</i> L. SPECIES									
SI	Name of species	Locality	Shape	Base	Apex	Margin	No. Of 1° veins	Angle range between 1° and 2° veins	Vein pattern
Nc									
1	<i>Sida acuta</i> Burm.f.	JSSD Campus	Rhomboid	Cuneate	Acute	Serrate	5	Moderate	Actinodromous (Perfect reticulate)
2	<i>Sida alnifolia</i> L.	KUD Campus	Obdeltate	Obtuse	Emarginate	Irregularly Serrate	5	Moderately acute	Campylodromous
3	<i>Sida cordata</i> (Burm.f.) Bross.	CBND	Cordate	Cordate	Acuminate	Serrate	7	Moderately acute	Campylodromous
4	<i>Sida elongata</i> Blume	KUD Campus	Ovate	Cordate	Acute Acuminate	Irregularly Crenate Serrate	7	Acute narrow	Campylodromous
5	<i>Sida mysorensis</i> W.& A.	KUD Campus	Ovate	Cordate	Acute	Serrate	7	Moderately acute	Campylodromous
6	<i>Sida rhombifolia</i> L.	KUD Campus	Dimorphic Orbicular or Elliptic	Cuneate or Rounded or Acute	Slightly Emarginate	Serrate Crenate	5	Moderately acute	Actinodromous
7	<i>Sida rhomboidea</i> Roxb	CBND	Obvate	Cuneate	Acute	Serrate	7	Acute-arrow	Campylodromous
8	<i>Sida spinosa</i> L.	KUD Campus	Ovate	Rounded	Acute	Serrate	7	Acute-arrow	Campylodromous
JSSD - Janata Shikshana Samiti, Dharwad; KJDD - Kamatak University, Dharwad; CBND - Channa Basaveshwar Nagar, Dharwad									

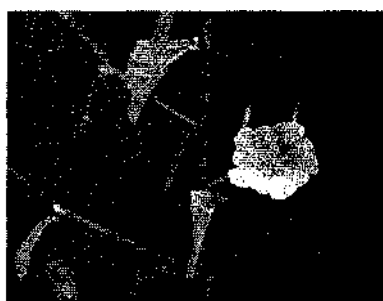
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Figure 1 Studied taxa of *Sida*a. *Sida acuta* Buftm. f.

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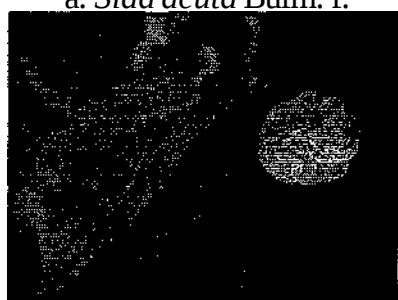
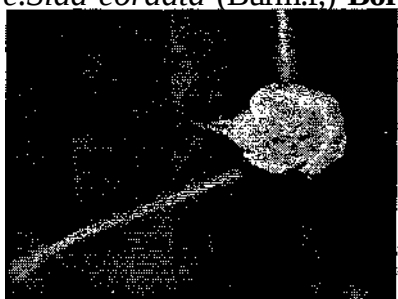
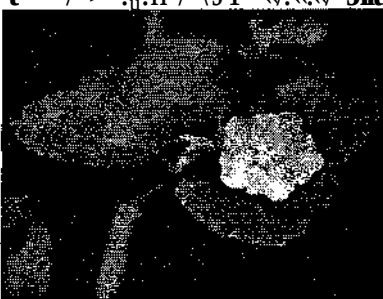
c. *Sida cordata* (Burm.f.) Borss. t' ^ / > .n / \JI "«'««/ Jilue. *Sida myrsotis* Wight & Arnf. *Sida rhombifolia* L.g. *Sida rhomboides* L.h. *Sida spinosa* L.

Figure 2. Venation Pattern

