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Epidermal Morphology of two species of *Alternanthera* Forskal

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Abstract

The foliar epidermal studies were carried out on *Alternanthera philoxeroides* (Mart.) Griseb. and *A. sessilis* (L.) DC. with the aim of determining the patterns of variation in their epidermal characteristics and assessing their value in species identification and classification. The characters of diagnostic importance in the identification of *Alternanthrea philoxeroides* are the micro hairs, which are sparsely distributed in both abaxial and adaxial epidermis. whereas *A. sessilis* lack hairs. Relatively significant higher stomatal size , epidermal cell size, epidermal hairs in *Alternanthrea philoxeroides* and there differences with *A. sessilis* could be useful and more appropriate measure in revealing species diversity . Both taxa showed inter species similarities in anomocytic stomata.

Key words: Epidermal morphology, Alternanthera, Tripura

INTRODUCTION

The use of epidermal characters such as stomatal types, frequency and index, trichome types, etc. seems to be increasing rapidly in classification because epidermal characters correlate with gross morphological features in most cases. Those are often known to be much valuable at the levels where classical methods of cytology and genetics cannot be applied (Stace 1965). In dicotyledons, the systematic values of epidermal and cuticular features have been indicated. Many workers showed that leaves possess many morphological attributes of potential taxonomic significance and are often diagnostic at the genus and species levels (Edeoga 1991; Arroyo 1985; Mbagwu & Edeoga 2006). The shape of epidermal cells, types and arrangement of stomata and size and shape of trichomes are important systematic parameters. In recent time, leaf epidermal features have received considerable attention by taxonomists (Stace 1980; Ayensu 1970). Epidermal features were widely studied from three main perspectives: ontogenetic, phylogenetic and taxonomic (Mbagwu *et al* 2007). Of all the non-reproductive structures, leaf is the most widely used organ in plant taxonomy (Stace 1965, 1984). Srivastava (1978) described the leaf epidermis as the second most important character after cytology for solving taxonomic problems.

Alternanthera Forskal (Amaranthaceae) is a genus of approximately 80 herbaceous widely distributed cosmopolitan species. While 16 species of Alternanthera *was* recorded from tropics and subtropics, while only two species, *Alternanthrea philoxeroides* (Martius) Grisebach and *A. sessilis* (L.) DC. are recorded from Tripura. *A. philoxeroides* is populary known as *Jaldaroga* and its tender shoot is used as vegetable by local tribe community (Bhowmik *et al* 2008). *A. sessilis* is populary known as *Haicha* and is used medicinally by the local tribals (Majumder & Datta 2007). The size of whole plant and its leaves varies greatly with the moisture content of the environment. In the drier localities the plants are smaller with much reduced. Its stem is fistualr at lowert lower part (Deb 1983). The aim of the present study is to determine the patterns of variation in epidermal characteristics and to assess their value in species recognition and classification and also for establishing the taxonomic relationships between these two species of *Alternanthera*.

MATERIALS AND METHODS

Fresh leaves of *Alternanthrea philoxeroides* and *A. sessilis* were collected from the wild habitat and their identity were confirmed using *The Flora of Tripura state* (Deb 1981). Fully differentiated mature leaves were washed in tap water, choked and sample were taken separately from apical (A), middle (M) and basal (B) regions for epidermal preparation . Epidermal peeling was taken out from respective parts of laminar pieces according to Chandra *et al* (1996). These peelings were properly dehydrated through alcohol grade and stained with 1 % safranin, mounted in glycerin with cover slip and observed under microscope.

RESULTS AND DISCUSSIONS

The results of this investigation showed some similarities and differences that are taxonomically important. Characteristic presence of multicellular hairs on both surface of *Alternanthera philoxeroides* leaf was recorded , whereas no hairs are found on either surface of *A. sessilis*. Hairs on adaxial surface of *A. philoxeroides* are slightly longer (478.05 ± 60.66) than those on abaxial surface (463.69± 75.82.) Metcalfe (1954) pointed out that certain characters of the epidermis such as micro-hairs, shape of the subsidiary cells of the stomata, and silica bodies are important taxonomically. The quantitative epidermal characters recorded in these two taxa are shown in Table -1. Stoma occurs on both lamina-surface of these two species. The average size of epidermal cells (Length x Breadth) of upper epidermis in *A. philoxeroides* is 79.79 ± 9.49 × 30.71 ± 7.31 µm, whereas that of *A. sessilis* is 75.68 ± 8.68 ×32.56 ± 4.87 µm. Similarly, average size of lower epidermal cell in *A. philoxeroides* is 90.00 ± 14.40 ×31.39 ± 6.19 µm and is 67.17 ± 8.83 × 22.00± 4.25 µm in *A. sessilis*. Thus differential epidermal cell size of upper and lower lamina epidermis for two species of *Alternanthera* could be useful in taxonomic treatments. The use of leaf epidermal characters to elucidate the problem of recognition and identification of some members of the family Costaceae, Onagraceae, Fabaceae (s.s.) and Melastomataceae is reported earlier by several workers (Edeoga & Eboka 2000; Mbagwu & Edeoga 2006). The Epidermal Cell Frequency /per mm ^{2} of upper epidermis A. *philoxeroides* is 300.29 ± 32.54, in *A. sessilis* it is 283.77 ± 45.29 . However higher epidermal frequency (346.90 ± 50.08 ***) on lower surface of *A. sessilis* is recorded as compared to 247.78 ± 55.83 of A. *philoxeroides*. Higher stomatal size on both surface of lamina is recorded in *A. philoxeroides* (US-91.21± 10.93, LS- 112.83 ± 31.24) and as compared to *A. sessilis* (US-48.08 ± 8.94 , LS-45.62 ± 6.12) and found to be highly significant (P d" 0.01). The shape of epidermal cells, types and arrangement of stomata and size and shape of trichomes are important systematic parameters (Mbagwu *et al* 2007). Higher stomatal frequency on lower surface of leaf of *A. sessilis* (202.95 ±41.54) as compared to A. *philoxeroides* (130.97 ± 26.09) also found which is highly significant at P d" 0.01 level . The use of stomatal type, frequency and index in classification seems to be valuable at the levels where classical methods cannot be applied (Stace 1965).The significance of foliar morphological characters in differentiation of many plant taxa at species level have also been reported (Dehgan 1980; Baruah & Nath 1997; Baruah *et al.* 1999). However the stomatal index and chlorophyll contents does not vary among the spices. The present study reveals that some of the characters, which are of not different significantly in the two species, may be typical of the genus despite the presence of many other anatomical variations. The present record of leaf epidermal characteristics of these two species provides important taxonomic evidence.

Table 1: Numerical representation of epidermal morphology of two species of *Alternanthera*

Epidermal character (Mean ±SD)	Leaf Surface	*Alternanthera philoxeroides*				*Alternanthera sessilis*			
		Apex	Middle	Basal	Mean	Apex	Middle	Basal	Mean
Stomata frequency (per mm)	*US*	113.27 ± 20.48	185.84 ±12.51	53.09 ± 7.91	117.40 ± 16.19 ^{NS}	115.04 ± 20.18	134.51 ± 5.52	99.11 ± 10.32	116.22 ± 21.40
	LS	146.90 ± 21.38	106.19 ± 23.07	139.82 ±10.32	130.97 ± 26.09	233.63 ± 29.93	237.17 ± 24.65	138.05 ± 12.01	202.95 ±41.54***
Stomatal Index	*US*	31.3 ± 3.98	37.61 ± 1.77	13.99 ± 1.83	27.63 ± 10.35	31.96 ± 5.28	28.91 ± 1.87	26.48 ± 2.09	29.12 ± 4.12 ^{NS}
	LS	32.75 ± 2.34	35.11 ± 4.44	35.91 ± 1.85	34.59 ± 2.88	40.93 ± 1.01	36.95 ± 2.54	31.47 ± 2.06	36.45 ± 4.35 ^{NS}
Stomatal size (μm^2) Length × Breadth	*US*	93.70 ± 4.52	85.22 ± 6.06	94.67 ± 9.56	91.21± 10.93 ***	53.12 ± 8.76	45.95 ± 10.91	45.26 ± 2.21	48.08 ± 8.94
	LS	119.92 ± 29.30	123.90 ± 38.72	94.67 ± 9.45	112.83 ± 31.24 ***	48.29 ± 7.13	42.65 ± 5.14	45.92 ± 4.90	45.62 ± 6.12
Cell Frequency /per mm^2	*US*	267.25 ± 34.22	307.96 ± 10.32	325.66 ± 10.32	300.29 ± 32.54	244.25 ± 16.42	330.97 ± 32.92	276.10 ± 21.86	283.77 ± 45.29
	LS	300.88 ± 34.04	192.92 ± 15.92	249.54 ± 15.22	247.78 ± 55.83	336.28 ± 34.50	403.54 ± 19.06	300. 88 ± 23.87	346.90 ± 50.08 ***
Cell size (µm) Length ×Breadth	*US*	(83.6 ± 6.22) × (36.96 ± 7.15)	(70.4 ± 9.23) × (24.64 ± 4.49)	85.36 ± 3.52)× (30.52 ± 3.65)	(79.79 ± 9.49)× (30.71 ± 7.31)	(84.48 ± 7.54)× (33.44± 5.97)	(69.52 ± 5.13) × (30.08 ± 2.78)	(73.04 ± 4.49)× (33.44 ± 5.70)	(75.68 ± 8.68)× (32.56 ± 4.87)
	LS	(94.96 ± 10.26) × (26.4 ± 4.82)	(78.32 ±8.53) × (35.2 ± 4.82)	(96.72 ± 15.40) × (32.56 ± 5.28)	(90.00± 14.40) × (31.39 ± 6.19)	(62.48± 9.80) × (20.24 ± 2.15)	(65.12 ± 7.57) × (21.12 ±3.29)	(73.92 ± 3.29) × (24.64 ±5.35)	(67.17± 8.83) × (22.00± 4.25)
Size of hairs (µm)	*US*	531.04 ± 50.35	428.36 ± 33.57	474.76 ± 26.97	478.05 ± 60.66	Absent	Absent	Absent	Absent
	LS	537.84 ± 43.50	441.56 ± 40.11	411.68 ± 42.02	463.69± 75.82	Absent	Absent	Absent	Absent

US: Upper Surface , LS : Lower Surface , *** : Highly Significant at P d 0.01

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