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Asian Journal of Plant Science and Research, 2013, 3(3):117-120

ISSN : 2249-7412
CODEN (USA): AJPSKY

Foliar epidermal features and their taxonomic significance in *Rotala* L. (Lythraceae)

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ABSTRACT

The present study deals with the epidermal diversity in nine species of Rotala L. belonging to the family Lythraceae. The leaves are small, variable in shape, size and amphistomatic. The upper epidermal cells are generally larger than the lower epidermal cells; the anticlinal cell walls are wavy or sinuous. The stomata are anisocytic and anomocytic. A peculiar wall thickening at polar end of the stomata is noted in Rotala serpyllifolia. The 2-celled glandular trichomes occur in R. malampuzhensis and the scales in R. floribunda.

Keywords: Leaf, epidermal diversity, *Rotala* species

INTRODUCTION

The *Rotala* is an aquatic, amphibious, tropical and subtropical genus with a considerable amount of phenotypic plasticity. In India 19 species have been reported Cook, [1], besides two more new species added by Joseph and Sivarajan [2] from peninsular India. Anatomical characters play as an increasingly significant role in systematic Davis and Heywood, [3]. The leaves of the plants provide a variety of such anatomical features besides the morphological ones. The study on epidermal characters in the genus *Rotala* is comparatively few Solereder, [4]; Metcalfe and Chalk, [5]; Panigrahi,[6] therefore the present investigation is undertaken.

MATERIAL AND METHODS

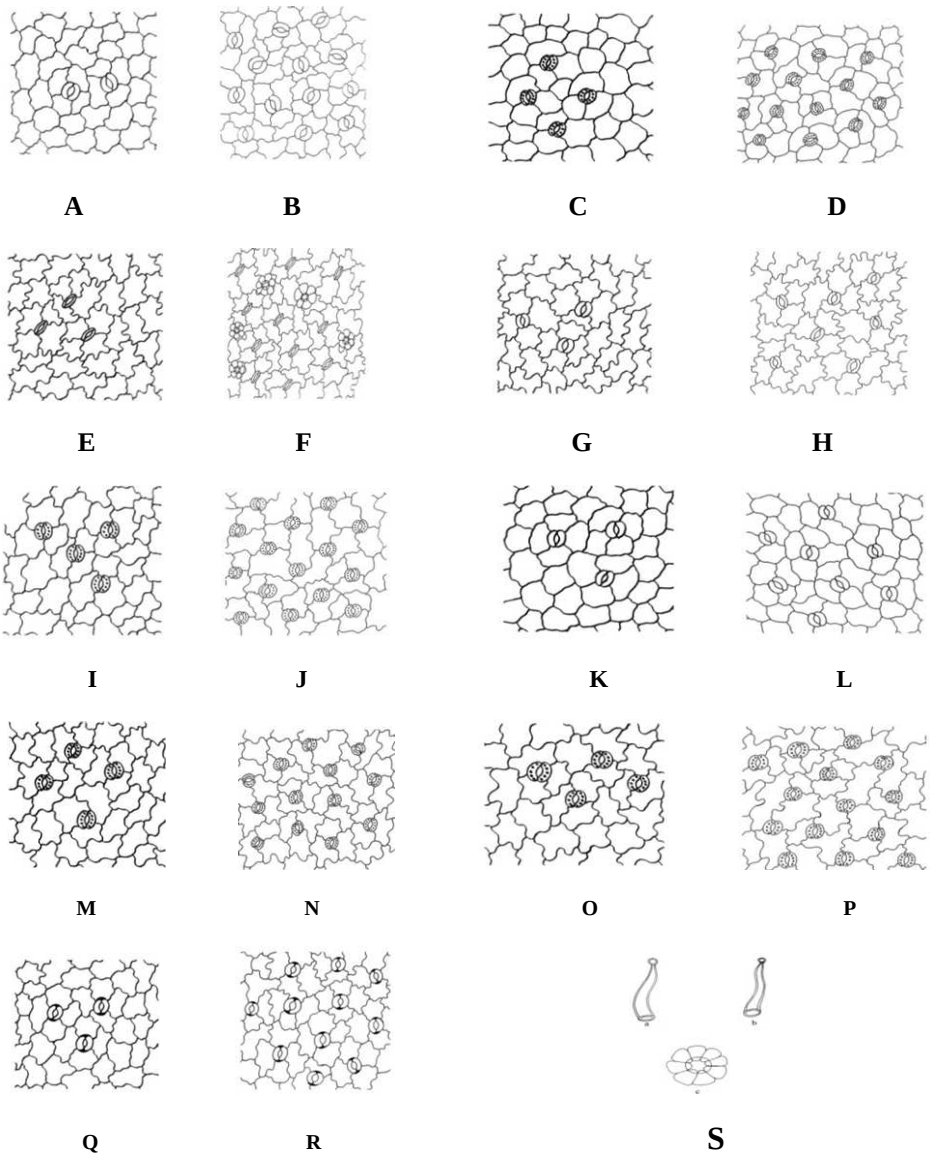
The nine species of *Rotala* i.e. *Rotala densiflora* (Roth.ex.Roem. et Schult.) Koehne, *Rotala fimbriata* Wight, *Rotala floribunda* (Wight) Koehne, *Rotala indica* (willd.) Koehne, *Rotala malampuzhensis* R.Vasudevan Nair, *Rotala occultiflora*, Koehne, *Rotala rotundifolia* (Buch.-Ham. ex Roxb.) Koehne, *Rotala rosea* (Poir.) cook and *Rotala serpyllifolia* (Roth) Bremek. Were collected from Kolhapur, Kinwat and Kannad of Maharashtra state. The epidermal peels of fresh and fixed leaves were removed by conc. Nitric Acid solution (HNO_3), some by simple hand peeling and stained with one percent aqueous solution of saffranin and then mounted in glycerin. The stomatal index is calculated by the formula as defined by Salisbury[7-8].

Observations

The plants of the species of *Rotala* are chiefly herbaceous and annuals. The leaves are sessile or sub-sessile. They are linear to lanceolate, obovate-spathulate to oblanceolate, ovate to orbicular and ovate to elliptical.

The leaves are amphistomatic. The upper epidermal cells are larger than the lower ones in all species of *Rotala*. The anticlinal cell walls in upper epidermis are comparatively thick. These cell walls are undulating or sinuous in both the epidermis. The number of stomata is more on the lower surface whereas few stomata occur on the upper surface. A peculiar wall thickening at polar end of guard cells is observed in the leaves of *Rotala serpyllifolia* [Figs. QR]. The stomata are anomocytic in *Rotala densiflora*, *R. floribunda*, *R. indica*, *R. occultiflora*, *R. serpyllifolia* [Figs. AB,

EF, GH, KL, QR] whereas anisocytic in *R. fimbriata*, *R. malampuzhensis*, *R. rotundifolia*, and *R. rosea* [Figs. CD, IJ, MN, OP].Trichomes are 2-celled and glandular in the leaves of *R. malampuzhensis* [Fig. S] and in the form of scales in *R. floribunda*. [Fig. S]



Figures:

A B - *R. densiflora*, C D – *R. fimbriata*, E F – *R. floribunda*,

G H – *R. indica* I J - *R. malampuzhensis*, K L – *R. occultiflora*,

M N – *R. rotundifolia*, O P - *R. rosea*, Q R- *R. serpyllifolia*,

S – *R. malampuzhensis* & *R. floribunda* S – Trichomes

A C E G I K M O Q - Adaxial epidermis. B D F H J L N P R -Abaxial epidermis.

The maximum number of stomatal index occurs in abaxial surface of leaf as in *Rotala serpyllifolia*, while minimum in *R.occultiflora* , whereas in adaxial surface the maximum number of stomatal index is noted in *R.serpyllifolia* and the minimum in *R. floribunda* [Table: 1]. The stomatal index of other plants are given in Table No. 1.

The maximum number of stomatal frequency occurs in abaxial surface [lower epidermis] of leaf as in *Rotala occultiflora*.[38.1/mm^2] while minimum number in *Rotala fimbriata* [23.6/mm^2] whereas in adaxial surface [upper epidermis] the maximum number of stomatal frequency is noted in *R.floribunda*[27.7/mm^2] and the minimum in *R.rosea* [19.4/ mm^2] [Table: 2]. The stomatal frequency of other plants are given in Table No.2.

Table: 1 Showing stomatal index of following plants in adaxial and abaxial surfaces

Sr. No.	Name of the Plant	Leaf adaxial [Upper epidermis] in µm			Leaf abaxial [Lower epidermis] in µm		
		Minimum	Maximum	Average	Minimum	Maximum	Average
1	*R. densiflora*	2.0	4.0	3.0	4.0	10	7.4
2	*R.fimbriata*	4.0	9.0	6.1	6.0	11	9.0
3	*R.floribunda*	1.0	3.0	2.0	5.0	12	8.1
4	*R.indica*	1.0	6.0	2.3	6.0	12	9.6
5	*R.malampuzhensis*	5.0	8.0	6.4	8.0	12	10.7
6	*R.occultiflora*	2.0	8.0	4.4	4.0	10	7.0
7	*R.rotundifolia*	2.0	4.0	3.0	6.0	10	7.6
8	*R.rosea*	1.0	3.0	2.1	4.0	10	8.1
9	*R.serpyllifolia*	4.0	10	8.1	10	12	11.4

Note: Figure related to minimum 10 counts.

Table: 2 showing stomatal frequency [per mm^2] of following plants in adaxial and abaxial surfaces

Sr. No.	Name of the Plant	Leaf adaxial [Upper epidermis] per mm^2		Leaf abaxial [Lower epidermis] Per mm^2	
		On /around vein	Intercostal	On/around Vein	Intercostal
1	*R. densiflora*	A	20.2	A	30.9
2	*R.fimbriata*	A	20.3	A	23.6
3	*R.floribunda*	A	27.7	A	32.0
4	*R.indica*	A	24.1	A	30.5
5	*R.malampuzhensis*	A	25.5	A	36.3
6	*R.occultiflora*	A	27.5	A	38.1
7	*R.rotundifolia*	A	22.9	A	29.1
8	*R.rosea*	A	19.4	A	30.4
9	*R.serpyllifolia*	A	20.8	A	37.3

DISCUSSION

The leaves in *Rotala* are not only variable in size and shape but also show diversity in their epidermal structure. The anticlinal cell walls are wavy or sinuous on both the epidermis. However abaxial epidermis reveals more sinuous nature of anticlinal walls in *R. floribunda and R.indica*. The stomata are anomocytic or anisocytic. Sometimes both the types of stomata occur on the same surface of the leaf in a few plants. Diacytic type of stomata is dominant in *Cuphea* Amarasinghe et. al. [9]; Kshirsagar, [10].

A peculiar type of wall thickening of guard cells at the polar ends in *R. serpyllifolia* is interesting and notable. Such a wall thickening is recorded in *Gaura* of the family Onagraceae by Ansari and Vaikos, [11] and also in some dicotyledonous and monocotyledonous taxa Kaufman et al [12]; Raju et al.[13]; Bansod, [14]; Bangar, [15]. Bansod [14] showed variations in the polar ends of guard cells as protruding pouch like or 'T' shaped thickening. Two types of trichomes as 2-celled glandular in *R. malampuzhensis* and scale like in *R. floribunda* are noted.

Based on the epidermal features and also considering some other anatomical parameters of the leaf, like guard cell ledges, palisade layers etc. Kshirsagar [10] species of the genus *Rotala* can be segregated.

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