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FOLIAR EPIDERMAL STUDIES ON THREE TAXA OF VERBENACEAE

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The features of matured foliar epidermis, stomata and trichomes are described in *Clerodendrum serratum, Duranta repens* and *Stachytarpheta indica* of Verbenaceae. They showed diversity in size of the epidermal cell and its frequency, size of the stomata and its number, index and stomata type. The epidermal cells are rectangular, irregularly arranged with mostly sinuous anticlinal walls. The cuticle is moderately thick and with or without striations. The basic stomatal types are anomocytic or diacytic. Three types each of glandular and non-glandular trichomes are observed.

Keywords : *Clerodendrum serratum; Duranta repens;* Foliar epidermis; *Stachytarpheta indica;* Stomata; Trichomes.

Introduction

The family Verbenaceae consists of 98 genera and 2, 614 species[1] and are mostly tropical or sub-tropical. Members of this family are mostly shrubs (*Lantana, Duranta, Clerodendrum),* large forest trees *(Tectona),* herbs *(Stachytarpheta, Verbena),* lianes (*Petrea),* mangroves *(Avicennia)* and marshy plants (*Phyla).* Three medicinally useful species *Clerodendrum serratum* (L) Moon, Duranta repens Linn. and *Stachytarpheta indica* C.B. Clarke are selected for this study. *C. serratum* is used in the treatment of malaria, cephalalgia, opthalmia and also for snake bite[2,3]. The leaf juice of *D. repens* is used as larvicide[2] and *S. indica* is used for cardiac troubles by folklore[3]. Hence, keeping in view of their medicinal importance, the foliar epidermal studies of the above species was under taken to prescribe standards for these drugs. Considerable information on the foliar epidermis, stomata and trichomes in this family had been reported by earlier workers[4-18].

Materials and Methods

Leaf material of *Clerodendrum serratum* was collected at Punyagiri and *Duranta repens* and *Stachytarpheta indica* were collected from the Andhra University Botany experimental farm. The matured leaves were fixed in F.A.A. and the epidermal peels from the leaves of three taxa were stained with safranine and mounted in glycerine. These temporary mounts are studied under light microscope. The voucher specimens of the three taxa were deposited in the Herbarium, Department of Botany, Andhra University.

Results and Discussion

The cuticle is smooth and moderately thick in all the three taxa. Cuticular striations are present in *C. serratum* (Fig. 1-A, B) and *D. repens* (Fig. 2-B), but they are absent in *S. indica* (Fig. 3-A). Similar results were recorded in *Duranta* and *Stachytarpheta* by Inamdar[9].

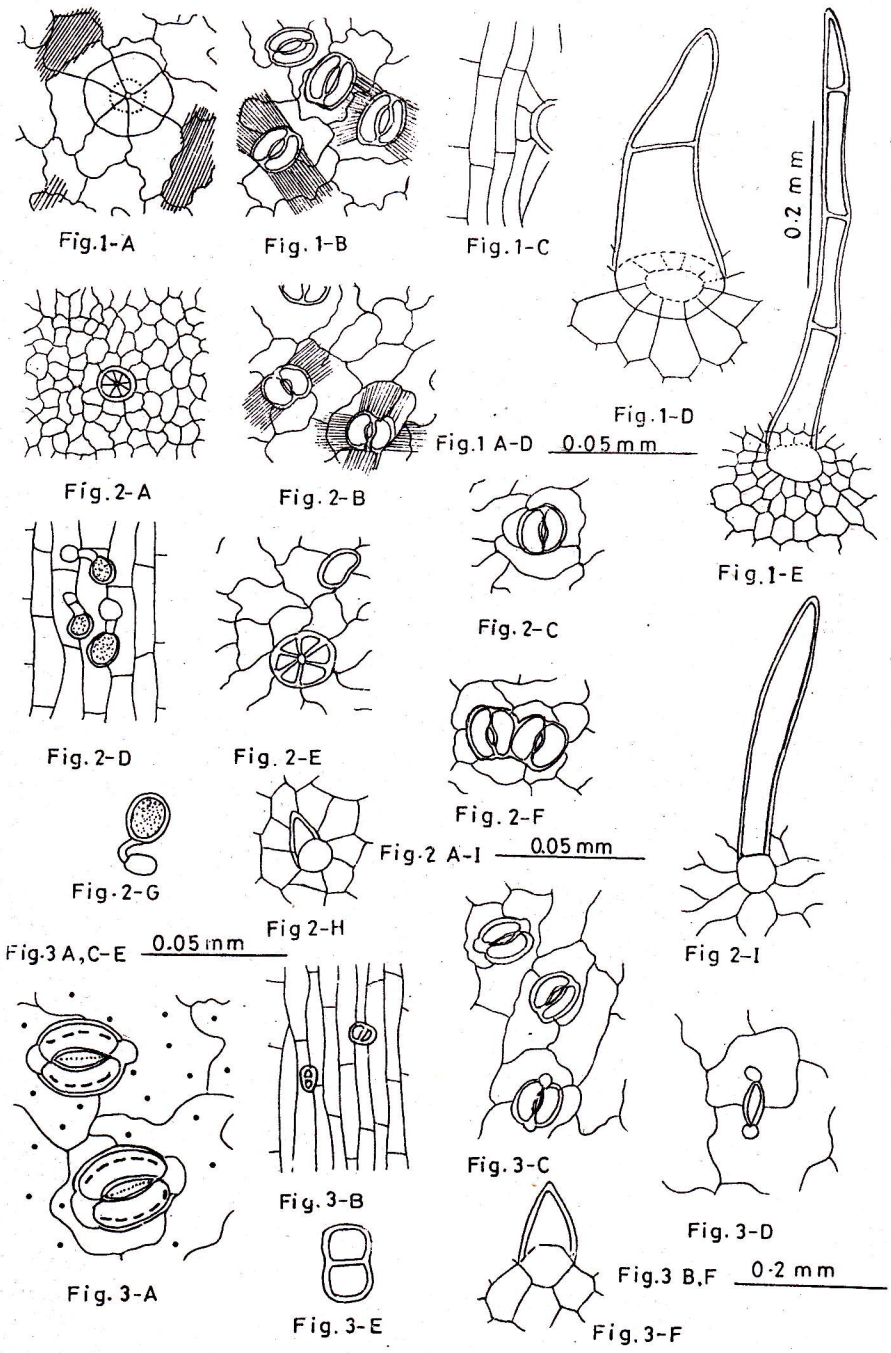
The epidermal cells are rectangular, irregularly arranged and their number on the adaxial surface is more compared to the abaxial surface (Table 1). Such a feature was also recorded by Solereder[4] in some members of Verbenaceae. The anticlinal walls of the epidermal cells are wavy to sinuous in all the three taxa presently investigated. Easu[19] reported that the anticlinal walls of the epidermis were straight in woody taxa and wavy to sinuous in herbaceous taxa. But in *C. serratum* and *D. repens* which are shrubs, the anticlinal walls are wavy to sinuous.

The costal cells are distinct and oriented parallel to long axis of all categories of veins including alveolar veins. They are mostly rectangular, elongated and occasionally trapezoidal (Fig. 1-C, Fig. 2-D and Fig. 3-B). Besides that, the stomata are associated with the costal cells on adaxial surface only is *S. indica* (Fig. 3-C). Bhat *et al.*[20] and Padma Rao and Ramayya[16] also reported such stomata in costal cells on adaxial surface only in *C. nerifolium.* However Easu[19] opined that the costal cells are devoid of stomata. The costal cells are studded with trichomes.

The basic stomatal type is anomocytic and is well pronounced in both *C. serratum* (Fig. 1-B) and *D. repens* (Fig. 2-B) with rare occurrence of anisocytic stomata in the latter (Fig. 2-C), while in *S. indica* (Fig. 3-A) only diacytic stomata are observed. In addition certain stomatal abnormalities like stomata with single guard cell, contiguous stomata and both the guard cells rendering non functional (cicatrice) are found among these members (Fig. 2-E, F; Fig. 3-D). These abnormalities encountered now, were also reported earlier[8,9] in some of the taxa of Verbenaceae. The presence of polar cuticular nodules over the stomata towards the poles in *S. indica* (Fig. 3-A) noticed now were not reported earlier in *Stachytarpheta* or any other taxa of Verbenaceae. Therefore it is a valid observation

Table 1. Qualitative and quantitative features of the foliar epidermis of the three taxa of Verbenaceae.

Name of the species	Epidermal Cell complex					Stomatal complex					Trichome complex			
											Non-glandular			Glandular
	Shape	Nature of anticlinal walls	Frequency (sq. mm)	Size (μm) Length	Size (μm) Width	Distribution and type of stomata	Frequency (sq. mm)	Size (μm) Length	Size (μm) Width	Index	Frequency	Length	Frequency	Length
Clerodendrum serratum														
Adaxial	Rectangular to elongated	Wavy to sinuous	1427	36.63	19.98	-	-	-	-	-	32	461	28	33
Abaxial	Irregular	Wavy to sinuous	1187	39.96	23.31	Hyposto-matous, anomocytic	250	24.97	21.64	17.39	18	438	20	36
Duranta repens														
Adaxial	*Irregular*	*Wavy*	*1875*	*26.64*	*13.32*	-	-	-	-	-	*very scanty*	*92*	*4*	*27*
Abaxial	Rectangular to irregular	Wavy to sinuous	1708	29.97	19.98	Hyposto-matous, anomocytic	157	21.64	16.65	8.36	Very scanty	172	6	22
Stachytarpheta indica														
Adaxial	Rectangular to irregular	Wavy to sinuous	343	56.61	26.64	Amphisto-matous, diacytic	125	28.32	26.62	26.75	Scanty	169	12	25
Abaxial	Irregular	Wavy to sinuous	312	57.94	26.64	Amphisto-matous, diacytic	114	28.30	26.64	26.64	Scanty	132	12	30



Figs. 1, 2, 3, Foliar epidermal characters .

Fig. 1. *Clerodendrum serratum;* Fig. 2. *Duranta repens;* Fig. 3. *Stachytarpheta indica;* Figs. 1-A, B; 2 B: Cuticular striations and note peltate trichome; Figs. 1-C; 2 D; 3-B : Costal cells are oriented parallel to long axis; Fig. 3-C: Stomata are associated with costal cells; Figs. 1-B; 2-B : Anomocytic stomata; Figs. 2-C; 3-A : Anisocytic and diacytic stomata respectively; Fig. 2-E : Stomata with single guard cell; Fig. 2-F : Lateral contiguous stomata; Fig. 3-D : Cicatrice; Fig. 2-A, G : Peltate and capitate trichomes; Fig. 3-E : Discoid trichome; Fig. 1-D, E : Non-glandular conical trichomes; Fig. 2-I : Unicellular conical trichome; Figs. 2-H; 3-F : Prickle-like trichomes.

in Verbenaceae.

Leaves are amphitrichous in all the three taxa. Both glandular and non-glandular trichomes are observed. Only peltate type of glandular trichomes are present in *Clerodendrum* (Fig. 1-A), whereas peltate and three-celled, uniseriate, capitate types are present in *Duranta* (Fig. 2-A, G). However in *Stachytarpheta* they are discoid and two-celled (Fig. 3-E). Among the non-glandular trichomes conical two to four-celled type are present in *Clerodendrum* (Fig. 1-D, E).Simple, unicellular, long and conical (Fig. 2-I) and simple, unicellular, short prickle-like trichomes are seen in *Duranta* (Fig. 2-H) while simple, unicellular, short prickle type only are observed in *Stachytarpheta* (Fig. 3-F). Earlier studies have also reported both glandular and non-glandular trichomes in some of the taxa of Verbenaceae[7,9-15,18].

In conclusion the genera *Clerodendrum* and *Duranta* are characterized by small-sized epidermal cells and stomata, hypostomatous nature, anomocytic stomata, peltate type of glandular trichomes and presence of cuticular striation in epidermal cells. *Stachytarpheta* shows large-sized epidermal cells and stomata, amphistomatous nature, diacytic stomata, absence of cuticular striations and peltate type of trichomes. Therefore, it appears that the two shruby genera *Clerodendrum serratum* and *Duranta repens* possess closer relationship when compared to the herbaceous genus *Stachytarpheta indica.*

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