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TAXONOMIC DIVERSITY IN EPIDERMAL CELLS (STOMATA) OF SOME SELECTED ANTHOPHYTA UNDER THE ORDER LEGUMINALES (CAESALPNIACEAE, MIMOSACEAE & FABACEAE) BASED ON NUMERICAL ANALYSIS: A SYSTEMATIC APPROACH

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ABSTRACT
The Stomata diversity (size, shapes, types and orientation) in the foliar epidermis has great value in plant systematic studies. A comparative micro-morphological study of stomata of 45 genera belonging to 3 families viz. Fabaceae (19 genera and 24 species), Caesalpniaceae (6 genera and 11 species) and Mimosaceae 8 genera and 10 species) under the order Leguminales was done. The selected species showed diversity in the habits and habitats also. Among the 45 selected species the 19 species are terrestrial and trees, 5 species are shrubs, 12 species are herbs, 7 species are climbers and 2 species are fully in marshy habit. Leaf clearings and cuticular preparations were examined with light microscopy. Out of the 45 selected species, 31 species showed amphistomatic and 14 species showed hypostomatic and on the other hand the most diversified stomata were observed tree species. The maximum numbers of tree species have hypostomatic which reflects that the habits and stomata appearance on foliar epidermis might be greatly co-related. The size and shapes of stomata are also varied in the tree species which bear larger size of stomata in respect of other habits and habitats. Three types of stomata were observed viz. paracytic (64.1%), anisocytic (46.6%) and anomocytic (33.3%). Among these 3 types of stomata the paracytic type of stomata are very common and than other. The structure, shape and size of stomata varied among the different families and even within the family in between the various genus and species also.

KEY WORDS: Taxonomic diversity, epidermal cells, Anthophyta, amphistomatic, hypostomatic, paracytic, anisocytic, anpmocytic, Leguminales, numerical analysis (NA), systematic approach.

INTRODUCTION

Small openings, many of which are found in the epidermal layers of plants, allowing access of Co_2 and egress for water, are stomata. Stomata are surrounded by guard cells, which control the pore size. Stoma is usually termed for the opening in the epidermis through which gaseous exchange takes place between intercellular spaces of the sub epidermal cells and the atmosphere. The stoma was first studied by Stresburger followed by Vesque (1989) who recognized 4 broad categories of stomata based on the presence and arrangement of accessory cells as well as their mode of development. Leaf epidermal anatomical features such as stomata, trichomes are useful anatomical tools. Stomatogenesis has long been studied by morphologists, physiologists and taxonomist .The morphology and ontogenies of taxa are important in intra generic systematics. Diversity in stomata types, even on the same surface of an organ, indicates the weakness in using stomata as a taxonomic character. (Pant & Kidwai, 1964). In spite of diversity, the most frequent stomata type can be used as a taxonomic character (Gopal, 1970). Despite the immense economic importance of the legumes and the physiological importance of the stomatal apertures, reports on the frequency and the structure of the stomata are lacking or incomplete for many species. On the basis of arrangement of epidermal all neighboring the guard cells, more than 25 main types of stomata in dicots have been recognized (Metcalfe & Chalk, 1979). Stace (1980) reported 31 different types of stomata among cotyledonous plants. But the present study is based on the paper of Metcalfe and Chalk (1950) who described the 4 types – i.e. Anisocytic, Anomocytic, Diacytic and Paracytic.

MATERIALS AND METHODS

The plant specimen belonging from the families Papilionaccae, Mimosaccae, and Caesalpiniaccae under order Leguminales were collected for studies of stomata. The species identification of the selected material were determined according to standard literature. The work has been done in the months of February to April, (2010-2011). The foliar epidermal peals were taken from the middle of both surfaces of mature leaves, (except in case of *Acacia mangium* and *Acacia auriculiformis* phyllode were taken and foliar stipule was taken in case of *Pisum sativum*).

Source

The plant materials are mostly collected from different parts West Bengal and few are collected from various parts of India**.**

Isolation of epidermis

Epidermis of leaf isolated from both fresh and dry plant specimen. The mature leaves were fixed in FAA solution (acetic acid: alcohol: formalin: water = 2:5:1:12) for 24 hours and washed in 70% ethanol. Three circular disk samples were cut from an area adjacent to the midrib of each leaf. Disk sample were boil in 5% aqueous solution of KOH for 5-10 minutes. Epidermal peals were stepped

and stained with 1% in 50% aqueous ethanol, saffranin and temporary mount in glycerin. Stomata frequency counts are made and camera lucida drawing and counting the number of stomata in each field (0.001386 cm^2). The stomata frequency was based on average obtained from observations of 3 microscopic fields. Stomatal index (I) was calculated by the following formula using the no. of stomata(s) and epidermal cells is in a unit area. [I=S/(S+E)]

After preparing slides, were observed under light microscope (40x Olympus) and phase contrast microscope for detail analysis and obtaining better picture as well as measuring the length and breadth of stomata including guard cells. Stomatal types were observed. The method of pairing affinity or similarity index described by Sokal and Sneath and Romero et al. was used to analyse the data of free amino acid composition and determine the pairing affinity between the three families. The degree of pairing affinity (P.A.) between two families was calculated according to the following formula:

$$P.A.= \frac{\text{Stomatal type common to the 2 families}}{\text{Total stomata type in the 2 families}} \times 100$$

RESULTS AND DISCUSSION

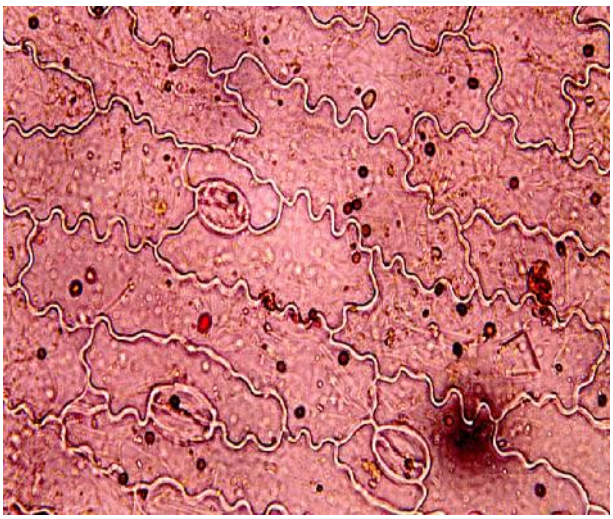
The result in this investigation is summarized in tables which include stomata count, stomata type, stomatal index, stomata measurement (length and breadth). The total 24 species under 19 genera belonging to the family Fabaceae, 10 species under 8 genera belonging to the family Mimosaceae and 11 species under 6 genera belonging to the family Caelsalpiniaceae were studied. In Caesalpiniaceae, all the investigated tree species bear hypostomatic leaves i.e. stomata present only at the abaxial surface of leaves (Table No.-II). Majority of non woody plants studies are found to bear amphistomatous leaves i.e. bears stomata on both surfaces. In Mimosaceae, out of our studied plant specimens maximum are amphistomatic except *Samanea saman, Adenanthera pavonina* (Fig. No- 3.c)*, Laucaena glauca,* thease tree species have hypostomatous leaves (Table No.-III). In Fabaceae, great diversity of stomata was observed. Out of our study, maximum species bears amphistomatous leaves except *Abrus precatorius*, *Erythrina indica*, *Butea frondosa, Glycyrhiza glabra*, *Phaseolus vulgaris* and *Desmodium gangeticum* which have hypostomatous. In the study of stomata type of Fabaceae, observed great diversity (Table No.-I). Out of 24 species, 9 species show anomocytic stomata along with anisocytic stomata, 7 species shows both anisocytic and paracytic types of stomata, but anomocytic and paracytic stomata are together never found. In case of *Abrus precatorius* and *Cicer arietinum,* has anomocytic stomata and *Phaseolus vulgaris* bears anisocytic stomata and *Arachis hypogea* (Fig. No- 1.e), *Butea frondosa*, *Erythrina indica, Phaseolus mungo*, *Canavalia lineate* (Fig. No- 1.c,d) bears only paracytic stomata (Table No.-I). In *Pisum stivum* (Fig. No.-a, f) the stipule is taken for examination and it shows anisocytic and paracytic stomata like other Fabacious members but the epidermal cells are found too large in length. In this investigation it is found that most of the Fabaceaeous herbs like *Trifolium repens*(Fig. No- 1.b), *Abrus precatorius, Cicer arietinum, Crotolaria pallida, Indigofera tinctoria, Melilotus alba, Melilotus indica, Desmodium gangeticum* bear both anisocytic and anomocytic stomata except *Arachis hypogea* and *Tephrosia purpurea*. In Caesalpiniaceae, most of the species have paracytic stomata except *Caelsalpinia bonduc*, *Delonix regia* and *Cassia siamea*. Where as, a mixture of anomocytic and paracytic stomata are found in *Tamarindus indica* as well as both anisocytic and paracytic stomata are found in *Cassia sophera* and *Cassia alata.* On the other hand only anomocytic stomata are found in *Caelsalpinia bonduc* and *Delonix regia*. Anisocytic type of stomatas was rarely found (Table No.-II). In case of Mimosaceae, all the species have paracytic stomata, but a mixture of anisocytic and paracytic stomata are found in phyllode of *Acacia auricliformis* and leaves of *Laucaena glauca*. Anisocytic, anomocytic and paracytic stomata are found to present togetherly in *Calliandra umbrellata* (Table No.-III). Comparatively, stomata are larger in Fabaceaeous members than Caesalpiniaceaeous and Mimosaceaeous members. In our investigation it was found, *Saraca asoca* [28.11 ×15.98 μm^2] (Fig. No- 2.d) has largest stomata any of the studied members of Caesalpiniaceae, while *Acacia mangium* [33.91 × 25.94 μm^2] (Fig. No- 3.a) has largest stomata belonging to Mimosace. But, in Fabaceae *Erythrina indica* [38.49 × 26.81 μm^2] (Fig. No- 1.h) has the largest stomata on the other hand smallest stomata were found in *Cassia fistula* [13.74 × 11.66 μm^2] belongs to the Caesalpiniaceae. From the present investigation it is quite clear that no specific stomata type is typical for any family and there is any does not seen and there is not significant relationship on the basis of stomata size and growth habit but in Fabaceae it is found that most of the herbs bear anisocytic and anomocytic type of stomata except *Arachis hypogea*. In inter-specific level, in *Acacia auriculiformis, Acacia mangium* (Fig. No- 3.a) and *A. catechu* bears paracytic stomata, but *Acacia auriculiformis* also bears anisocytic stomata (Table No.-III). Out of 6 species of *Cassia* except *Cassia siamea,* has paracytic stomata. In *Cassia siamea* has anomocytic stomata, *Cassia alata* and *Cassia sophera* bears anisocytic stomata along with paracytic stomata (Table No.-II). In the family Fabaceae *Crotolaria pallida* and *Crotolaria retusa* (Fig. No- 1.g) bear both anisocytic stomata, while *Crotolaria pallid*a along with anisocytic ones bear paracytic stomata also. In *Phaseolus mungo* (Fig. No- 1.i) and *Phaselous vulgaris* expresses no similarity. In the *Sesbania*, all investigated specieses bear anisocytic type of stomata, while *Sesbania grandiflora* and *Sesbania aculeate* (Fig. No- 1.j) bears anomocytic stomata also (Table No.-I).

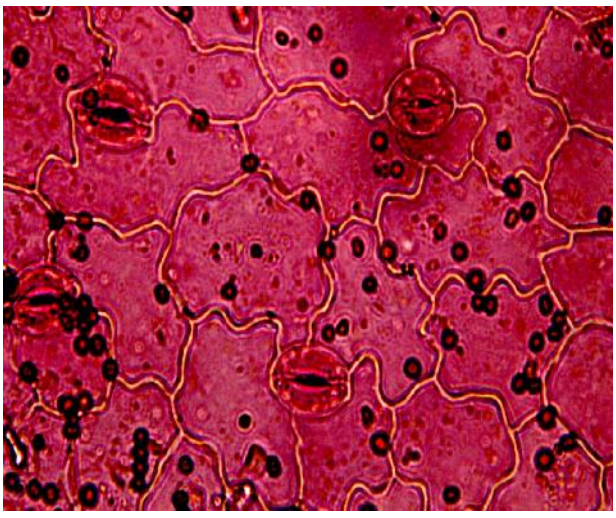
TABLE: 1. Quantitative and qualitative stomata characteristics of Fabaceaeous members

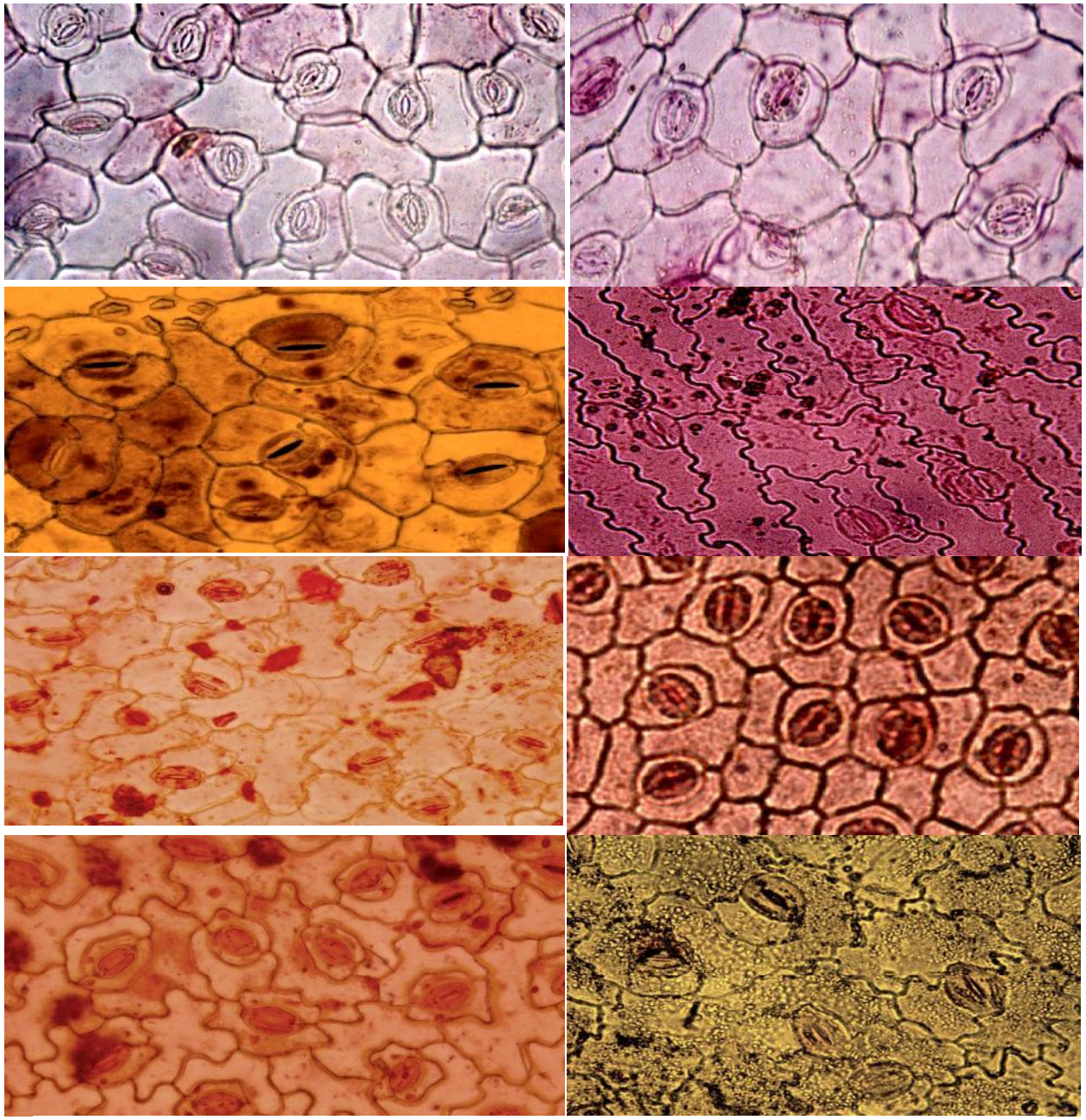
Sl. No.	Name of plants	Growth habit	Surface of leaflet	Percentage of stomatal index (SI)	Stomata count/cm^2	Length×breadth of stomata with guard cell (μm^2)	Types of stomata present			
							Anomocytic	Anisocytic	Paracytic	Diacytic
1.	*Abrus precatorius* L.	Climber	Ad.	0	0	0	+	+	-	-
			Ab.	7.9	5040	23.93×14.37				
2.	*Arachis hypogea* Linn.	Herb	Ad.	25	7913	28.54×19.46	-	-	+	-
			Ab.	27	7194	28.76×20.01				
3.	*Butea frondosa* Roxb.	Tree	Ad.	0	0	0	-	-	+	-
			Ab.	13.5	16547	28.48×18.49				
4.	*Cicer arietinum* L.	Herb	Ad.	9.6	5755	23.51×19.69	+	-	-	-
			Ab.	17.9	12230	24.98×16.96				
5.	*Clitoria ternatea* L.	Climber	Ad.	9.8	3597	22.54×15.52	-	+	+	-
			Ab.	24.4	7194	23.67×13.86				
6.	*Crotolaria pallida* Ait.	Herb	Ad.	24.6	1079	26.53×13.51	-	+	-	-
			Ab.	25	1151	20.46×13.73				
7.	*Crotolaria retusa* L.	Shrub	Ad.	21	7194	30.51×20.04	-	+	+	-
			Ab.	28	1007	31.86×20.01				
8.	*Dalbergia sissoo* Roxb.	Tree	Ad.	5.1	2158	24.29×12.51	+	-	-	-
			Ab.	14.9	1151	23.72×13.58				
9.	*Erythrina indica* Lamk.	Tree	Ad.	5.5	3597	38.49×26.81	-	-	+	-
			Ab.	24.4	1582	26.25×18.93				
10.	*Glycyrrhiza glabra* L.	Shrub	Ad.	0	0	0	-	+	+	-
			Ab.	14.3	9353	19.12×14.43				
11.	*Indigofera tinctoria* L.	Herb	Ad.	18.8	9353	20.46×14.87	+	+	-	-
			Ab.	18.7	1151	19.85×15.33				
12.	*Melilotus alba* Lamk.	Herb	Ad.	17.2	3597	30.43×22.64	+	+	-	-
			Ab.	16.6	5036	27.65×23.08				
13.	*Melilotus indica* All.	Herb	Ad.	16.5	1079	19.47×16.75	+	+	-	-
			Ab.	19.4	9353	23.86×17.53				
14.	*Pisum sativum* L.	Climber	Ad.	13.3	2878	30.12×20.42	-	+	+	-
			Ab.	11.8	2878	29.44×22.15				
15.	*Phaseolus vulgaris* L.	Climber	Ad.	10.7	2158	26.21×16.42	-	-	+	-
			Ab.	25.8	1079	28.52×18.49				
16.	*Phaseolus mungo* L.	Climber	Ad.	20.9	1007	25.41×16.06	-	+	-	-
			Ab.	28.4	1510	26.99×14.53				
17.	*Canavelia lineata* Dc.	Climber	Ad.	15.9	7194	28.05×22.58	-	-	+	-
			Ab.	29.6	1366	28.21×22.03				
18.	*Lathyrus odoratus* L.	Climber	Ad.	13	2158	25.54×19.18	-	+	+	-
			Ab.	40.8	5128	27.29×19.08				
19.	*Trifolium repens* L.	Herb	Ad.	8.8	3597	21.35×16.21	+	+	-	-
			Ab.	20.3	1151	24.43×18.21				
20.	*Sesbania sesban* Merrill.	Shrub	Ad.	21.1	1079	26.49×18.39	-	+	-	-
			Ab.	16.6	9353	26.52×17.73				
21.	*Sesbania aculiata* Pers.	Herb	Ad.	18.6	9353	27.21×20.34	+	+	-	-
			Ab.	25.3	1438	30.35×22.71				
22.	*Sesbania grandiflora* Pers.	Shrub	Ad.	21.4	1295	26.03×16.56	+	+	-	-
			Ab	23.1	1510	24.66×22.67				
23.	*Tephrosia purpurea* Pers.	Herb	Ad.	12.7	1223	18.53×13.95	-	+	+	-
			Ab.	13.9	1366	26.52×17.73				
24.	*Desmodium gangeticum* Dc.	Herb	Ad.	0	0	0	+	+	-	-
			Ab.	8.7	1798	17.63×11.24				

TABLE II. Quantitative and qualitative stomata characteristics of Caesalpiniaceaeous members

SL. No.	Name of plants	Growth habit	Surface of leaflet	Percentage of stomatal index (SI)	Stomatal count/cm^2	Length×breadth of stomata (with guard cell)	Types of stomata present			
							Anomocytic	Anisocytic	Paracytic	Diacytic
1.	*Caesalpinia bonduc* (L.)Roxb.	Shrub	Ad.	0	0	0	+	-	-	-
			Ab.	9.44	8633	26.31×16.10				
2.	*Cassia alata* L.	Shrub	Ad.	12.5	7914	23.89×20.27	-	+	+	-
			Ab.	8.3	6475	18.48×12.36				
3.	*Cassia fistula* L.	Tree	Ad.	0	0	0	-	-	+	-
			Ab.	16.8	11511	13.74×11.66				
4.	*Cassia occidentalis* L.	Shrub	Ad.	21.7	12950	23.11×16.49	-	-	+	-
			Ab.	28.7	14388	22.98×17.09				
5	*Cassia siamea* Lamk.	Tree	Ad.	0	0	0	+	-	-	-
			Ab.	22.6	13670	23.49×15.32				
6.	*Cassia sophera* L.	Shrub	Ad	18	11511	24.85×15.24	-	+	+	-
			Ab	23.1	19424	22.54×15.29				
7.	*Cassia tora* L.	Shrub	Ad.	23.3	10072	22.10×13.06	-	-	+	-
			Ab.	24.3	12950	23.28×15.66				
8.	*Tamarindus indica* L.	Tree	Ad.	5.5	3597	20.92×16.89	+	-	+	-
			Ab.	20.4	13699	20.36×15.58				
9.	*Saraca asoca* (Roxb.)de wilde.	Tree	Ad.	0	0	0	-	-	+	-
			Ab.	18.5	13235	28.11×15.98				
10.	*Peltiphorum inerme* (Roxb) Lianos Ex Fernendex.	Tree	Ad.	0	0	0	-	-	+	-
			Ab.	18.4	6475	22.74×17.18				
11.	*Delonix regia* Raf.	Tree	Ad.	0	0	0	+	-	-	-
			Ab.	11.4	15108	21.19×16.08				







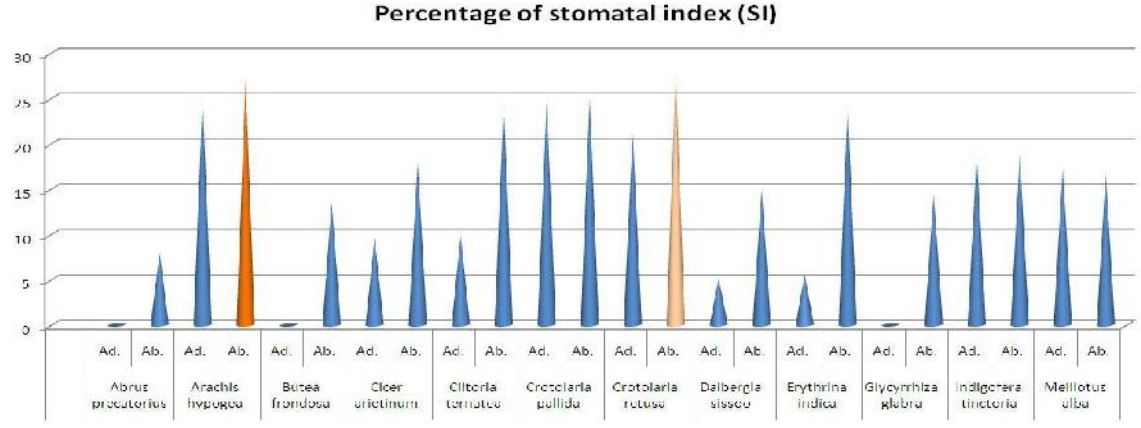
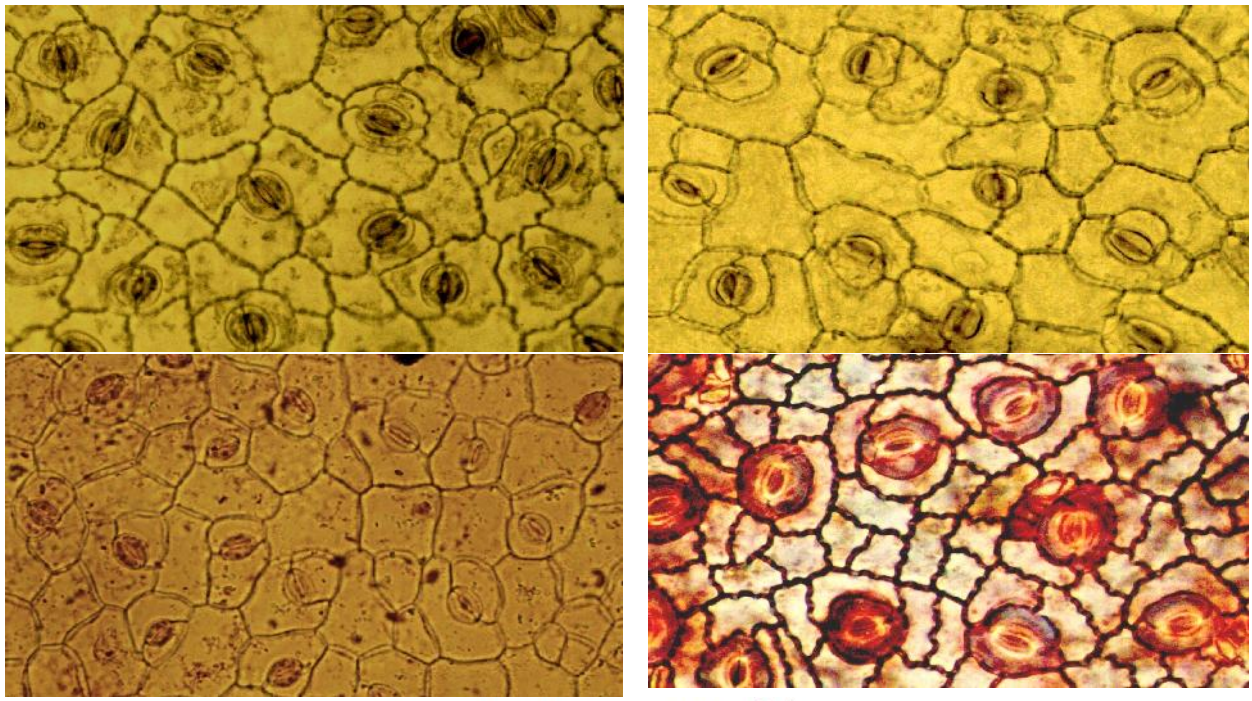

Percentage of stomatal index (SI)
30
25
20
15
10
5
0
Ad.
Ab.
Abrus precatorius
Arachis hypogea
Butea frondosa
Cicer arietinum
Clitoria ternatea
Crotolaria pallida
Crotolaria retusa
Dalbergia sissoo
Erythrina indica
Glycyrrhiza glabra
Indigofera tinctoria
Melilotus alba

FIGURE 1: Leaf epidermis showing stomata of Fabaceaeous members. **a.** *Pisum sativum* (adaxial surface). **b.** *Trifolium repens*(abaxial surface). **c**. *Canavellia lineata*(abaxial surface). **d.** *Canavellia lineata*(adaxial surface). **e**. *Arachis hypogea* (adaxial surface). **f**. *Pisum sativum*(abaxial surface). **g.** *Crotolaria retusa* (adaxial surface). **h.** *Erythrina indica* (abaxial surface). **i.** *Phaseolus mungo* (abaxial surface). **j.** *Sesbania aculeata* (abaxial surface). **k**. Percentage of stomatal index (S.I.) of Fabaceaeous members in graph -Part: 1. **l**. Percentage of stomatal index (S.I.) of Fabaceaeous members in graph-Part: 2. **m.** Stomatal count/cm^2 of Fabaceaeous members in graph-Part: 1. **n.** Stomatal count/cm^2 of Fabaceaeous members in graph-Part:2.



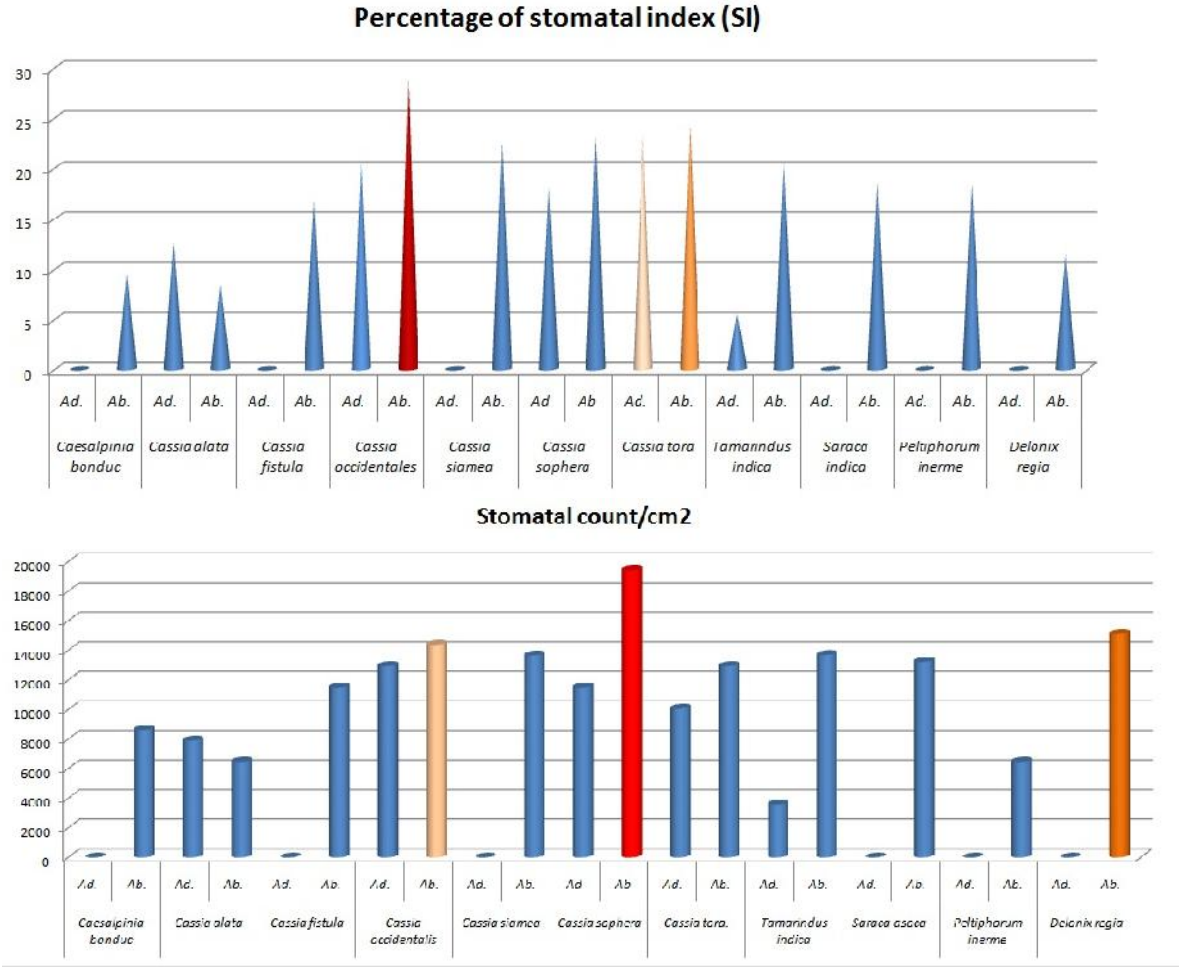


FIGURE 2: Leaf epidermis showing stomata of Caesalniaceaeous members. **a.** *Cassia occidentalis* (abaxial surface). **b.** *Cassia occidentalis* (adaxial surface). **c.** *Cassia tora* (abaxial surface). **d**. *Saraca asoca* (abaxial surface). **e.** Percentage of stomatal index (S.I.) of Caesalniaceaeous members in graph. **f.** Stomatal count/cm^2 of Caesalniaceaeous members in graph.

In this investigation it is found that most of the Fabaceaeous members bear stomatal index percentage from 21 to 30((Fig. No- 1.k, l). In these investigated Fabaceaeous members some groups of interrelated species are found. *Abrus precatorius* and *Desmodium gangeticum* are interrelated. *Tephrosia purpurea*, *Butea frondosa, Dalbergia sissoo, Glycyrrhiza glabra and Pisum sativum* bear almost same stomatal index percentage. *Cicer arietinum, Indigofera tinctoria*, *Melilotus alba*, *Melilotus indica*, *Trifolium repens* and *Sesbania sesban* show same stomatal index percentage. *Arachis hypogea, Clitoria ternatea, Crotolaria pallida, Erythrina indica, Sesbania sesban* and *Sesbania grandiflora* are in same group having almost same stomatal index percentage. *Phaseolus mungo, Phaseolus vulgaris, Crotolaria retusa* and *Canavelia lineata* show same characteristics of stomatal index percentage. *Lathyrus odoratus* is distantly related to other investigated species of Fabaceae. In inter specific relationship *Phaseolus vulgaris* and *Phaseolus mungo, Melilotus alba* and *Melilotus indica* have more or less equal percentage of stomatal index. Although *Sesbania aculiata* and *Sesbania grandiflora* have more or less equal number of stomatal index percentage but *Sesbania sesban* bears a distant relationship with them. *Crotolaria pallida* and *Crotolaria retusa* show distant relationship with each other.

TABLE - III. Quantitative and qualitative stomata characteristics of Mimosaceaeous members

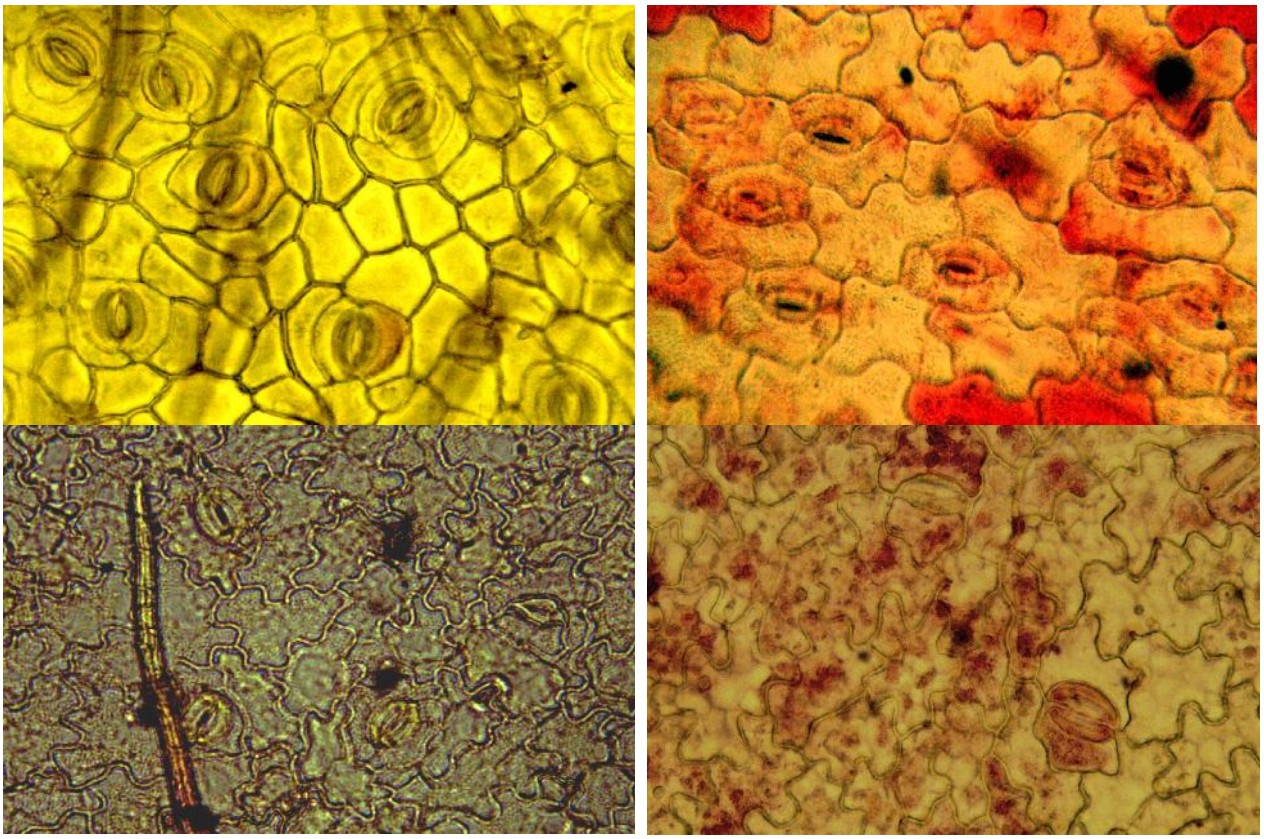
Sl. No.	Name of plants		Surface of leaflet	Percentage of stomatal index (SI)	Stomatal count/cm^2	Length×breadth of stomata(with guard cell)	Types of stomata present			
							Anomocytic	Anisocytic	Paracytic	Diacytic
1.	*Acacia auriculiformis* A. cunn.	Tree	Ad.	11.3	15108	22.54×16.38	-	+	+	-
			Ab.	11.6	17986	20.55×16.84				
2.	*Acacia mangium* willd.	Tree	Ad.	11.7	6493	33.91×25.94	-	-	+	-
			Ab.	18.8	9353	33.85×21.97				
3.	*Acacia catechu* willd.	Tree	Ad.	4.7	2886	21.68×10.34	-	-	+	-
			Ab.	16	8633	24.69×18.73				
4.	*Mimosa pudica* L.	Herb	Ad.	14.9	5051	22.44×13.97	-	-	+	-
			Ab.	26.3	10791	24.67×14.49				
5.	*Calliandra umbrellata* Benth.	Shrub	Ad.	3.7	2164	23.76×16.85	+	+	+	-
			Ab.	17.6	17266	21.96×14.80				
6.	*Samanea saman* (Jack) Merr.	Tree	Ad.	0	0	0	-	-	+	-
			Ab.	25	17986	17.09×10.73				
7.	*Pithecolobium dulce* Benth.	Tree	Ad.	5.5	12165	25.73×15.85	-	-	+	-
			Ab.	6.9	4316	25.67×14.52				
8.	*Adenanthera pavonina* L.	Tree	Ad.	0	0	0	-	-	+	-
			Ab.	15.8	8633	22.13×16.22				
9.	*Neptunia oleracea* Lour.	Herb	Ad.	39.8	23741	23.71×15.58	-	-	+	-
			Ab.	24.5	9353	26.94×17.13				
10.	*Laucaena glauca* Benth.	Tree	Ad.	0	0	0	-	-	+	-
			Ab.	13.7	10072	23.14×15.92				

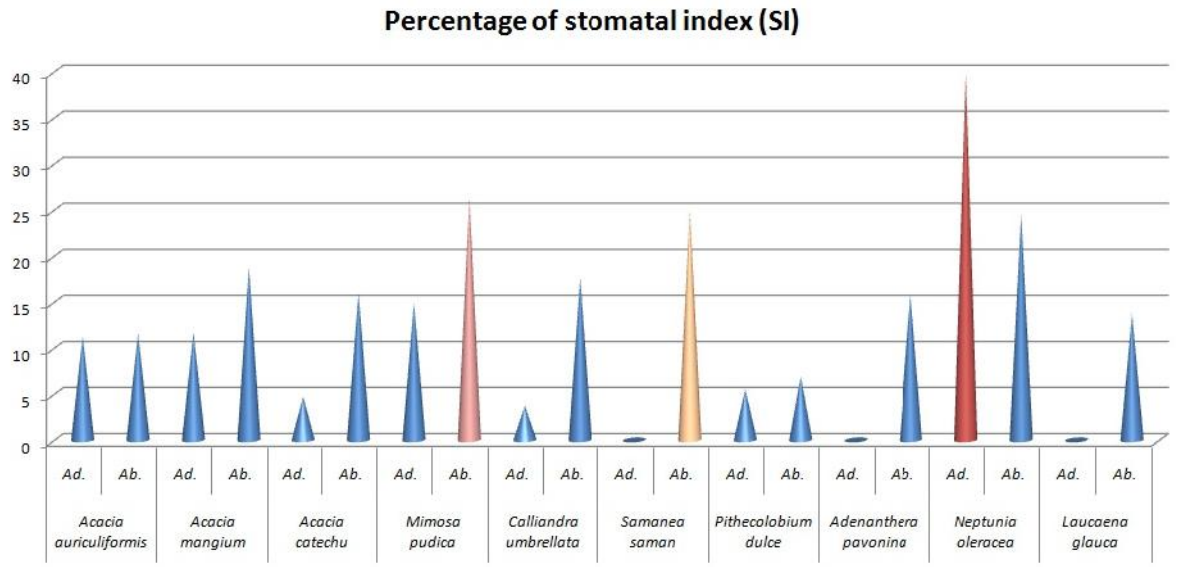
TABLE-IV: Pairing affinity values % among the three Families based on the presence of various types of stomata

	Fabaceae	Caesalpiniaceae	Mimosaceae
Fabaceae	100		
Caesalpiniaceae	66.33	100	
Mimosaceae	33.33	63.33	100

In Caesalpiniaceae most of the investigated members bear stomatal index percentage from 16 to 25 (Fig. No-2.e.).
In inter specific relationship it is found that *Cassia siamea, Cassia sophera* and *Cassia tora*(Fig. No- 2.c) are closely connected but *Cassia fistula, Cassia alata* and *Cassia occidentalis* (Fig. No- 2.a, b) are distantly related. *Cassia alata* are closely related with *Caesalpinia bonduc. Cassia fistula, Tamarindus indica*, *Saraca asoca and Peltiphorum inerme* are inter related with each other.
In Mimosaceae most of the investigated members bear stomatal index percentage from 11 to 20 (Fig. No-3. e.). In inter specific relationship it is found that *Acacia auriculiformis*(Phylode) and *Acacia mangium*(Phylode) bear almost equal stomatal index percentage unlike *Acacia catechu*. *Mimosa pudica* and *Neptunia oleracea* are closely related. In this study it is found that generally tree species have lesser stomatal count/cm^2 than Caesalpiniaceae and Mimosaceae. In Fabaceae *Butea frondosa* bears highest stomatal count (16547/ cm^2) in the abaxial surface of leaf (Fig. No-1.m, n.). In Caesalpiniaceae *Cassia sophera* bears highest stomatal count (19424/ cm^2) in the abaxial surface of leaf (Fig. No-2.f.). In Mimosaceae *Neptunia oleracea* bears highest stomatal count (23741/ cm^2) in the adaxial surface of leaf

(Fig. No-3.f.). According to our investigation it is quite clear that Fabaceae are interrelated with Caesalpiniaceae than Mimosaceae (Fig. No.-4). The dendogram (Fig. no.-4) constructed on the basis of the presence of various types of stomata (table-I, II, III.). It places Caesalpiniaceae between Fabaceae and Mimosaceae. This is because Fabaceae shows higher degree of pairing affinity (Table-IV) with Caesalpiniaceae (66.33%) than Mimosaceae (33.33%).





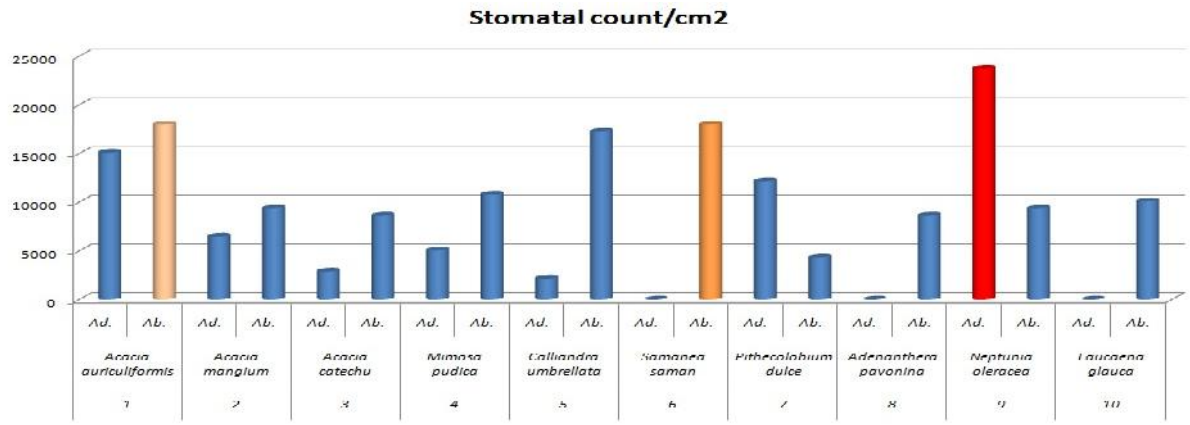


FIGURE 3: Leaf epidermis showing stomata of Misosaceaeous members. **a.** *Acacia mangium* (adaxial surface). **b.** *Mimosa pudica* (adaxial surface). **c.** *Adenanthera pavonina* (abaxial surface). **d.** *Pithecolobium dulce* (abaxial surface). **e.** Percentage of stomatal index (S.I.) of Misosaceaeous members in graph. **f.** Stomatal count/cm^2 of Misosaceaeous members in graph.

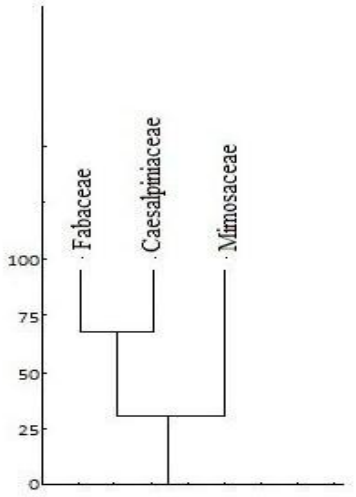


FIGURE 4: Dendogram representing average linkage relationship among three families Fabaceae, Caesalpiniaceae and Mimosaceae as revealed by the pairing affinity values % based on the presence of various types of stomata.

CONCLUSION

Investigation mainly focused on comparative study of quantitative and qualitative stomata characters of 45 genera belonging to 3 families viz. Fabaceae, Caesalpniaceae and Mimosaceae under the order Leguminales. By studying the dendogram it was found that the three families studied canbe placed in two clusters based on presence of various types of stomata. The family Fabaceae is closely related to the family Caesalpiniaceae than Mimimosaceae but they are derived from a common ancestral stalk. The stomatal type is not typical for any of the family. There is no relationship between the stomata size and growth habit. Carpenter and Smith (1975) had established such a relationship involving stomata size and growth habit. "Xerophytic species have much smaller stomata than mesophytic species". Fabaceae showed maximum level of diversity of stomata. In Caesalpiniaceae and Mimosaceae, most of the species showed paracytic stomata. There is a mixture of stomata in some species are observed also. Maximum tree species bear hypostomatous leaves, but others terrestrial species are generally amphistomatous. Average area of stomata is larger in Fabaceae than the other members of Caesalpiniaceae and Mimosaceae. In classifying different families on the basis of stomatal structure which acts as taxonomic and systematic marker, but those cases stomata diversity in less (Paliwal, 1966, 67). However, the stomatal features may prove to be of little taxonomic value unless the developments of different stomata types are studied. Shah and Gopal (1969) stated that, in the family Fabaceae different types of stomata follow a similar pattern of development. A greater number of information on these taxa will be helpful to understand the taxonomic and systematic value of stomata type and distribution pattern.

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