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Leaf venation studies in the species of *Ipomoea* Linn

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Abstract
The minor venation pattern in certain species provides taxonomic and evolutionary clues. Foliar venation patterns act as device for the identification of various species in the present investigation minor leaf venation pattern of 16 South Indian species of *Ipomoea* were studied. The study reveals that the *Ipomoea* species shows simple, linear curved, once, twice and thrice branched minor leaf venation with polygonal leaf areole. Size of the leaf areole is concerned highest length and breadth is reported in *I. coptica.*

Keywords: *Ipomoea*, foliar venation, areole, polygonal

Introduction
Taxonomic evidence as such can be had, in a general sense from any part or phase of development of the plant. Although much importance is attached to the purely morphological characters in the classification. Much evidence can, however be had from other characters as well, other than the reproductive phase. There are a few characters which were rather neglected. It is particularly noteworthy that certain organ or features of the plants are inherently more conservative than others and therefore it may be argued that there should have more dominant role in the classification and phylogeny. Endomorphic characters such as anatomy have as much of equal importance as exomorphic features. While epidermal characters are of greater value in identification of some taxa, there can be little doubt that greater attention to characters other than those pertaining to flowers would certainly improve in many cases. Although purely epidermal character used in the identification or classification would entail a few disadvantages, it may be pointed out that wherever other characters could show any differences, the epidermal characters may be of some value in identification and classification. The study of the epidermal features of most of the living angiosperm has received little attention. There are only a few reports of the epidermal studies in the family. That too confined to the development of stomata (Pant and Banerji, 1965; Shah, 1967) [10, 11].
Singh *et al.*, (1978) [12] described leaf architecture in Berbidaceae and discussed bearing of the circumstances of the family. They concluded that in leaf architecture of *Holboellia* and *Podophyllum* stand apart from other taxa of the family and this support their view of removal to a separate family. Foster, (1959) [4] suggested that open dichotomous venation of the ranalian genus *Kingdonia* may be primitive within angiosperms. The minor venation pattern in certain species of Compositae provides taxonomic and evolutionary clues (Carlquist, 1959) [2]. He also described the foliar venation pattern in the Rutaceae and devices a key for the identification of various species on the basis of these characters.
Hickey and Wolfe, (1975) [7] provided the first systematic summary of dicot leaf architectural features and they demonstrated that a number of lower order leaf architectural feature, including leaf organization, configuration of first three vein orders and characteristics of leaf margin are significant systematic indicators within dicotyledons. Levin, (1929) emphasized the taxonomic value of vein let areas. He pointed out that veinlet number is nearly constant for a species and it can be used as a valuable character. Carlquist, (1959) [2] reported that minor venation pattern in certain species of Compositae provides taxonomic and evolutionary clues.

Materials and Methods
Foliar venation studies were carried out in all the species studied. The venation pattern of leaves were traced out, from fresh leaves. The minor venation pattern were observed by clearing the leaves based on the method of Foster, (1959) [4] with modification by Hickey (1973) [6]. First the leaf materials were washed thoroughly in tap water, then the veins of the leaves were stained by immersing the base of the petiole in safranin stain for overnight. Then washed the leaves in water and boiled them in 50% ethyl alcohol in a water bath. The materials were transferred to 5% sodium hydroxide and kept in the oven at 40 to 50°C for 6 to 10 days for clearing. After clearing, the specimens were washed thoroughly in water to remove all the traces of sodium hydroxide. The leaves were examined for their major and minor venations.
The minor venation pattern was studied with the help of microphotographs. The terminology and description of leaf architecture were done based on the leaf architectural studies by Hickey (1973) [7]. The data regarding the nature of major venation pattern and the nature of minor venation pattern including the nature of areole and vein lets were recorded

Table 1: Particulars of minor leaf venation pattern

Name of the taxa	Minor leaf venation pattern	Shape of leaf areole	Size of leaf areole	
			Length (µm)	Breadth (µm)
Ipomoea alba	Simple, curved, once and twice branched	Polygonal	181	78
Ipomoea aquatica	Simple, linear, curved, once and twice branched	Polygonal	201	127
Ipomoea batatas	Simple, linear, curved, once and twice branched	Polygonal	189	67
Ipomoea cairica	Simple, curved, once branched	Polygonal	146	112
Ipomoea carnea sub sp. *fistulosa*	Simple curved, once and twice branched	Polygonal	206	131
Ipomoea coptica	Simple, curved, once and twice branched	Polygonal	241	171
Ipomoea digitata	Simple, curved, once and twice branched	Polygonal	151	81
Ipomoea hederacea	Simple curved, once branched	Polygonal	211	128
Ipomoea hederifolia	Simple, linear curved, once, twice and thrice branched	Polygonal	191	134
Ipomoea horsfalliae	Simple, linear, curved, once branched	Polygonal	119	61
Ipomoea indica	Simple, linear, curved, once branched	Polygonal	119	61
Ipomoea obscura	Simple curved, once and twice branched	Polygonal	149	91
Ipomoea pes – caprae sub sp. *brasiliensis*	Simple,linear, curved, once, twice and thrice branched	Polygonal	154	67
Ipomoea purpurea	Simple,linear, curved, once and twice branched	Polygonal	227	151
Ipomoea quamoclit	Simple curved, once branched	Polygonal	161	79
Ipomoea staphylina	Simple curved, once and twice branched	Polygonal	209	129

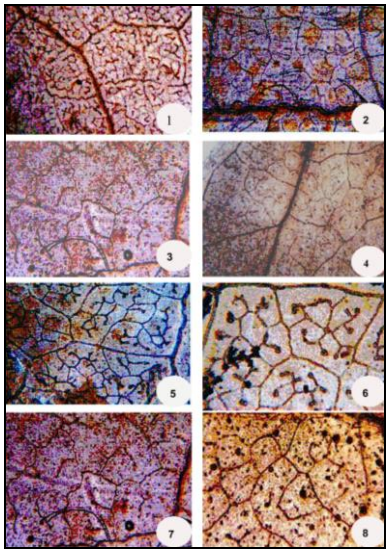

Plate 1

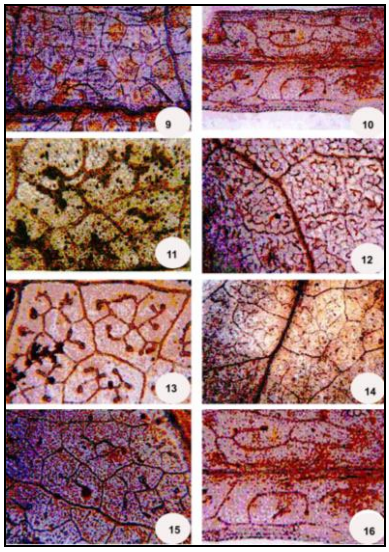

Plate 2

Results and Discussion

During the present investigation, major and minor leaf venation were analysed. Among the 16 *Ipomoea* species selected for the study, *I.alba*, *I. carnea* sub sp. *fistulosa*, *I.coptica*, *I. digitata*, *I.obscura*, *I.staphylina* shows simple curved once and twice branched minor leaf venation. Meanwhile *I. aquatica*, *I. batatas*, *I.hererifolia*, *I. horsfalliae*, *I.indica*, *I.pes-caprae* sub sp. *brasiliensis*, *I.purpurea* shows simple linear once, twice thrice branched minor leaf venation pattern. Polygonal shaped areole was recorded in all species. Size of the leaf areole is concerned highest length is reported in *I. coptica* and *I.indica* and *I. horsifalliae*. Breadth of the areole is concerned higher is reported in *I. coptica* and lower in *I.indica* and *I. horsfalliae.*

Banerji and Das, (1972) [1] have shown that minor venation pattern is useful in the distinction of the Indian species of *Acer*. The size of areoles, number of terminations per areole and characteristics of branches provide useful taxonomic characters. Hickey, (1893) [7] published the most comprehensive system of descriptive terminology of leaf form and venation pattern of dicotyledonous leaf. Data obtained from leaf architectural features, particularly venation pattern have been successfully utilized for systematic and evolutionary considerations. Gupta, (1961) [5] could not establish any direct correlation between the size of areole and number of vein endings in the family Euphorbiaceae. They divided the genus *Euphorbia* on the basis of venation pattern and grouped it into various species. According to him veinlets number and veinlet termination number are inversely proportional to the area of lamina and their absolute numbers are constant for a species.

Hall and Melville, (1951) [8] pointed out that the number of veinlets in conjunction with other histological characters could be used as taxonomic criteria. The use of architectural pattern is gaining significance in phylogeny and classification of angiosperm. The leaves of various dicotyledonous taxa of angiosperms possess consistent and recognizable patterns of architectural organizations. In recent years these characters have been successfully used by several workers in the diagnosis of fossil as well as living material (Dilcher, 1974) [3].

Conclusions

The study of the morphological variation of plants and the causes and consequences of this variation provide the bulk of taxonomic evidence. These include information from morphology, external or macro morphological characters and internal or micro-morphological characters such as

pollen and epidermal features. Morphometric methods are known to be effective in analyses leading to recognition and discrimination of groups and for evaluation of ontogenetic and phylogenetic changes in plants

Recommendations

Botanists realized the importance of micromorphological characters inadequate for identifying taxa. Micro-morphological features such as epidermal, anatomical, embryological and palynological character in biosystematics. The importance of leaves as taxonomic entities can be preserved for longer period of time. Pollen grains and seeds are not influenced by environmental conditions and hence it provides dependable systematic evidence. Minor leaf venation patterns are useful for identifying and classifying different plant species. Variation in minor leaf venation are acts as a marker of plant systematics and also helpful for cataloguing South Indian species of *Ipomoea*.

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