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Leaf architectural studies in some plants

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Abstract

The shape and structure of leaves vary considerably from species to species of plant, depending largely on their adaptation to climate and available light, but also to other factors such as grazing animals, available nutrients, and ecological competition from other plants. For the present investigation 14 different plants were selected from the college campus, 12 different qualitative and quantitative parameters were selected. All plants showed considerable variations.

Keywords: Leaf architecture, Venation, Qualitative and Quantitative features

Introduction

A leaf is an organ of a vascular plant and is the principal lateral appendage of the stem. The leaves and stem together form the shoot. Leaves are collectively referred to as foliage, as in "autumn foliage". Some leaves, such as bulb scales are not above ground, and in many aquatic species the leaves are submerged in water. Veins constitute one of the more visible leaf traits or characteristics. The veins in a leaf represent the vascular structure of the organ, extending into the leaf via the petiole and provide transportation of water and nutrients between leaf and stem, and play a crucial role in the maintenance of leaf water status and photosynthetic capacity. Angiosperms have greatest diversity in vein structure but share key architectural elements, that is, a hierarchy of vein orders forming a reticulate mesh (Hickey, 1973; Ellis *et al*., 2009; McKown *et al*., 2010). Typically there are three orders of lower-order veins, known as ‘major veins’, often ribbed with sclerenchyma (Esau, 1977). One or more first-order veins run from the petiole to the leaf apex, with second-order veins branching at intervals, and third-order veins branching between. The major veins can be distinguished from minor veins, typically present only in angiosperms, which include up to four additional orders of smaller, reticulate higher-order veins. Major and minor veins can be distinguished by their distinct timing of formation, and differences in gene expression during development, sizes and branching in the mature leaf, and in cross-sectional anatomy (Esau, 1977; Haritatos *et al*., 2000). In several lineages, particularly the monocotyledons, a grid-like ‘striate’ venation is typical, including several orders of longitudinal veins of different sizes, with small transverse veins connecting them (Ueno *et al*., 2006).

Objectives of the study

1. To study the leaf architecture of major plants inside college campus
2. Study the major and minor venation pattern
3. Analyze and compare the data

Materials and Methods

For the present investigation 14 different plants were selected from the college campus. For studying the leaf architecture study the parameters such as chief leaf type, phyllotaxy, insertion, kind of leaf, duration of leaf fall, shape of leaf, , petiolate, margin of leaf, major and minor leaf venation, length and breadth of leaf were studied.

Collected specimens are studied by using manual methodology for analyzing the basic parameters. Foliar venation studies were carried out in all the species studied. The venation pattern of leaves was traced out, from fresh leaves that were covered by a carbon sheet facing upwards. A white paper was placed over the carbon sheet and was rubbed with the base of a pencil. By this process an accurate impression of the vein pattern was obtained on the side of the white paper facing the carbon sheet. The pattern was then transferred to drawing sheets. The minor venation pattern was observed by clearing the leaves based on the method of Foster, (1959) with modification by Hickey (1973).

Observations

In the present investigation leaf architectural studies of 14 species were evaluated. The data recorded were showed in Table:-1 to 2. For the parameter type of leaf type , insertion, presence of petiole, kind of leaf , leaf minor and major venation all the members showed same type of data. In the case of phyllotaxy 6 members recorded opposite and remaining members have alternate type. In the case of duration of leaf fall the members such as *Codiaeum variegatum*, *Ficus benjamina* reported deciduous type and all other member have same type. The parameter shape leaf, 5 shapes such as Oval, Elliptic, Ovate, Oblong, Deltoid were recorded. In the case of *Hibiscus rosa-sinensis* have serrate type of leaf all other samples have entire leaf type. In the case of quantitative feature length and breadth is concerned considerable variation was also recorded.

Table :-1 Qualitative features of leaf architecture

Name of the plant	Chief Leaf type	Phyllotaxy	Insertion	Kind of leaf
Anacardium occidentale	Foliage	Alternate	Cauline	Simple
Artocarpus heterophyllus	Foliage	Alternate	Cauline	Simple
Cinnamomum zeylanicum	Foliage	Opposite	Cauline	Simple
Coleus blumei	Foliage	Opposite	Cauline	Simple
Codiaeum variegatum	Foliage	Opposite	Cauline	Simple
Diospyros mespiliformis	Foliage	Alternate	Cauline	Simple
Ficus religiosa	Foliage	Alternate	Cauline	Simple
Hibiscus rosa-sinensis	Foliage	Alternate	Cauline	Simple
Ixora coccinea	Foliage	Opposite	Cauline	Simple
Lagerstroemia indica	Foliage	Alternate	Cauline	Simple
Magnolia virginiana	Foliage	Alternate	Cauline	Simple
Mangifera indica	Foliage	Alternate	Cauline	Simple
Syzygium aromaticum	Foliage	Opposite	Cauline	Simple
Vinca minor	Foliage	Opposite	Cauline	Simple

Table :-2 Qualitative and quantitative features of leaf architecture

Name of the plant	Duration of Leaf fall	Shape of leaf	Petiolate	Margin of Leaf	Leaf venation-major	Leaf venation-minor	Length of Leaf (cm)	Breadth of Leaf (cm)
Anacardium occidentale	Persistent	Oval	+	Entire	Reticulate	Unicostate	6.2	5.1
Artocarpus heterophyllus	Persistent	Oval	+	Entire	Reticulate	Unicostate	8.3	6.1
Cinnamomum zeylanicum	Persistent	Oval	+	Entire	Reticulate	Unicostate	9.2	5.1
Coleus blumei	Persistent	Ovate	+	Entire	Reticulate	Unicostate	5.6	4.7
Codiaeum variegatum	Deciduous	Elliptic	+	Entire	Reticulate	Unicostate	5.7	4.5
Diospyros mespiliformis	Persistent	Oblong	+	Entire	Reticulate	Unicostate	8.1	5.6
Ficus benjamina.	Deciduous	Deltoid	+	Entire	Reticulate	Unicostate	7.1	5.6
Hibiscus rosa-sinensis	Persistent	Deltoid	+	Serrate	Reticulate	Unicostate	6.3	5.6
Ixora coccinea	Persistent	Elliptic	+	Entire	Reticulate	Unicostate	6.4	5.9
Lagerstroemia indica	Persistent	Oblong	+	Entire	Reticulate	Unicostate	8.9	7.8
Magnolia virginiana	Persistent	Elliptic	+	Entire	Reticulate	Unicostate	7.9	6.3
Mangifera indica	Persistent	Elliptic	+	Entire	Reticulate	Unicostate	8.9	5.6
Syzygium aromaticum	Persistent	Oblong	+	Entire	Reticulate	Unicostate	9.5	6.1
Vinca minor	Persistent	Elliptic	+	Entire	Reticulate	Unicostate	5.1	3.5

Discussion

Anatomical studies of leaf venation have shown that ornamentation of the veins and the course of traces in the lamina are useful additional characters for the identification of species of Euphorbia (Sehgal & Paliwal 2008). Dede (1962) also described the foliar venation patterns in Rutaceae, proving them to be useful for the identification of various species. Hickey (1973) stated that leaf venation is correlated with plant evolution and has systematic significance in plant identification and classification. Indeed, leaf venation plays a very important role in the identification of incomplete plants, e.g., sterile specimens, archaeological remains and fragmentary fossils of non-reproductive organs.

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