

Lecture 5

Trends in Plant Taxonomy Part 3

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Plant Taxonomy ii

Course code: 322 Bot

Hours:

Lecture --- 2 hrs., practical --- 2 hrs.





Plant Anatomy

- Plant Anatomy or phytotomy is the general term for the study of the internal structure of plants.
- Structural divisions: Plant anatomy is sometimes divided into the following categories:

Flower anatomy [Calyx, Corolla, Androecium, Gynoecium]; Leaf-; stem-; seed/fruit-; wood- and root- anatomy.



ANATOMY IN RELATION TO TAXONOMY

- The use of anatomical characters in taxonomy began with the development of the microscope which provided the biologist a new tool to observe the internal structure of organs and tissues.
- All parts of a plant provide numerous features which have been used for taxonomic purposes. Some anatomical features are very diagnostic and are commonly used in routine identification.
- Anatomical characters are most important in studies for classification especially when trying to determine relationships among large groups of plants, often at higher taxonomic levels – they are less often used for identification and aren't often mentioned in floras.

Importance of Anatomical Characters in Taxonomy

- Anatomical characters are conserved and stable and thus can be used as a "Taxonomic Character" for Plant Systematics of Plant Taxonomy.
- Anatomical characters of all the plant parts can be used such as the characters of stem, root, leaves, bark, stomata, trichomes, internal parts etc.
- Anatomical features can be used in Taxonomy for:
 - 1. The **identification** of plants
 - 2. Establishing genetic relationships
 - 3. Solving taxonomic **problems**



Advantages of Anatomical Characters

- The anatomy of the fragmentary materials (such as a piece of wood) can be performed, thus we don't require the complete portion of the specimen.
- Anatomical studies of herbarium specimens can be studied.
- High range of anatomical character variability is available among plants.
- Most of the anatomical characters are conserved (do not change).
- Anatomical characterization can be done without any sophisticated instrumentation.



Anatomical Characters used in Plant Systematics

- 1. Trichomes
- 2. Stomata and Epidermal Features
- 3. Leaf anatomy
- 4. Stem anatomy
- 5. Sclereids and Fibres
- 6. Cambium
- 7. Wood Anatomy



(1). Trichomes

- The characters of trichomes are used to compare closely related taxa.
- Features of trichomes used: glandular, non-glandular, unicellular, multicellular, shape and size of trichomes etc.
- Examples:
 - 1. Non-glandular trichomes: Lauraceae, Moraceae
 - 2. Stellate hairs– Malvaceae
 - 3. Mucilage hairs *Rumex*
 - 4. Stinging hairs Urticaceae
 - 5. Silica hairs Grasses





Fig. 37.22. Trichomes of different types.





Stellate Hairs

Stinging Hairs



(2). Stomata and Epidermal Features

- Features like types of stomata and distribution of stomata are commonly used. The SEM (Scanning Electron Microscope) features of stomata and epidermis are used for comparison.
- Some families are specific for their stomata such as:
 - 1. Anomocytic Stomata Ranunculaceae
 - 2. Anisocytic Stomata in Brassicaceae
 - 3. Diacytic Stomata in Caryophyllaceae
 - 4. Paracytic Stomata in Rubiaceae
 - 5. Graminaceous Stomata in Poaceae (dumbbellshaped guard cells).







Stomata of Grasses





Stomata of Grasses with Dumbbell Shaped Guard Calls

- About 35 different types of stomata have been described from vascular plants and most of them can be used as taxonomic evidence.
- The Sunken stomata in plants indicate its xerophytic habitat.
- **Stomatal Index**: The percentage of stomata form to the total number of epidermal cells is called the stomatal index.
- Stomatal Index = $(S/(S + E)) \times 100$
- Stomatal index can also be used as a criterion for classification and identification of plant groups.
- **Stomatal distribution on leaves** are specific and based on the leaves are classified into Epistomatic leaf (stomata on the upper surface), Hypostomatic leaf (stomata on the lower surface) and Amphistomatic (Stomata on both the surface of the leaf).



Sunken Stomata (Stomata situated deep in the epidermis)



(3). Leaf Anatomy

- The leaf is perhaps the most varied organ of the angiosperms and provides many anatomical characters of potential taxonomic significance.
- Leaf anatomy is extensively used in the systematics of the Cyperaceae family.
- Characters of leaf anatomy used in plant taxonomy are: The gross anatomical architecture of the leaf (dicot and monocot).







(4). Stem Anatomy

- Gross anatomy of dicot and monocot stem can be used in systematics.
- The commonly used anatomical criterions of the stem in plant taxonomy are:

Features of epidermis, hypodermis, distributing of **collenchyma**, **sclerenchyma**, variations in the endodermis, characteristics of piths, storage region, number – shape and distribution of **vascular bundles**.

- Examples:
 - 1. Biocollateral vascular bundles in Cucurbitaceae.
 - 2. Accessory cortical and medullary bundles in **Nyctaginaceae**.
 - 3. Anomalous secondary thickening in Bignoniaceae.
 - 4. Included phloem in Amaranthaceae.
 - 5. Anomalous secondary thickening in monocots.





Centella

Cucurbita







Anatomical Remarks to Taxonomy

- The structure of xylem in trees more primitive than in herbs.
- Anatomical studies found the orders *Geraniales* and *Sapindales* are similar in xylem structure then put them in one order *Pennatae*.
- There are many families has anatomical character through it found the relationship between them.
- Out of these characters inner phloem that found in families
 Solanaceae and Convolvulaceae, families Apocynaceae and
 Asclepiadaceae have latex vessels, this explains their connection and they belong to one order.



The structure and sequence of vessel bundles are important anatomical character paid dicotyledonous as of monocotyledon.



