Taxonomy in Relation to Anatomy

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Introduction

- Modern taxonomists consider that the gross morphological characters are not always sufficient to provide means of differentiation in determining the genetically and evolutionary relationship between taxa.
- To achieve this the taxonomical evidences from anatomy, embryology, palynology, cytology, palaeobotany, ecology, biochemistry etc. are discussed.
- Dr. V. Puri has said “One of the most significant modern trends in plant taxonomy is towards a synthesis between the older methods, outlook and more recent developments in our knowledge of plants”.

Plant Taxonomy : Anatomy

- **Plant Taxonomy** is the branch of science which deals with the identification, nomenclature and classification of plants.

- **Anatomy in relation to plant taxonomy** viz.

  Vegetative Anatomy: Parts of plant body that serve to maintain its individual life e.g. leaf, root, stem

  Floral Anatomy: Essential parts of the flower means for reproduction

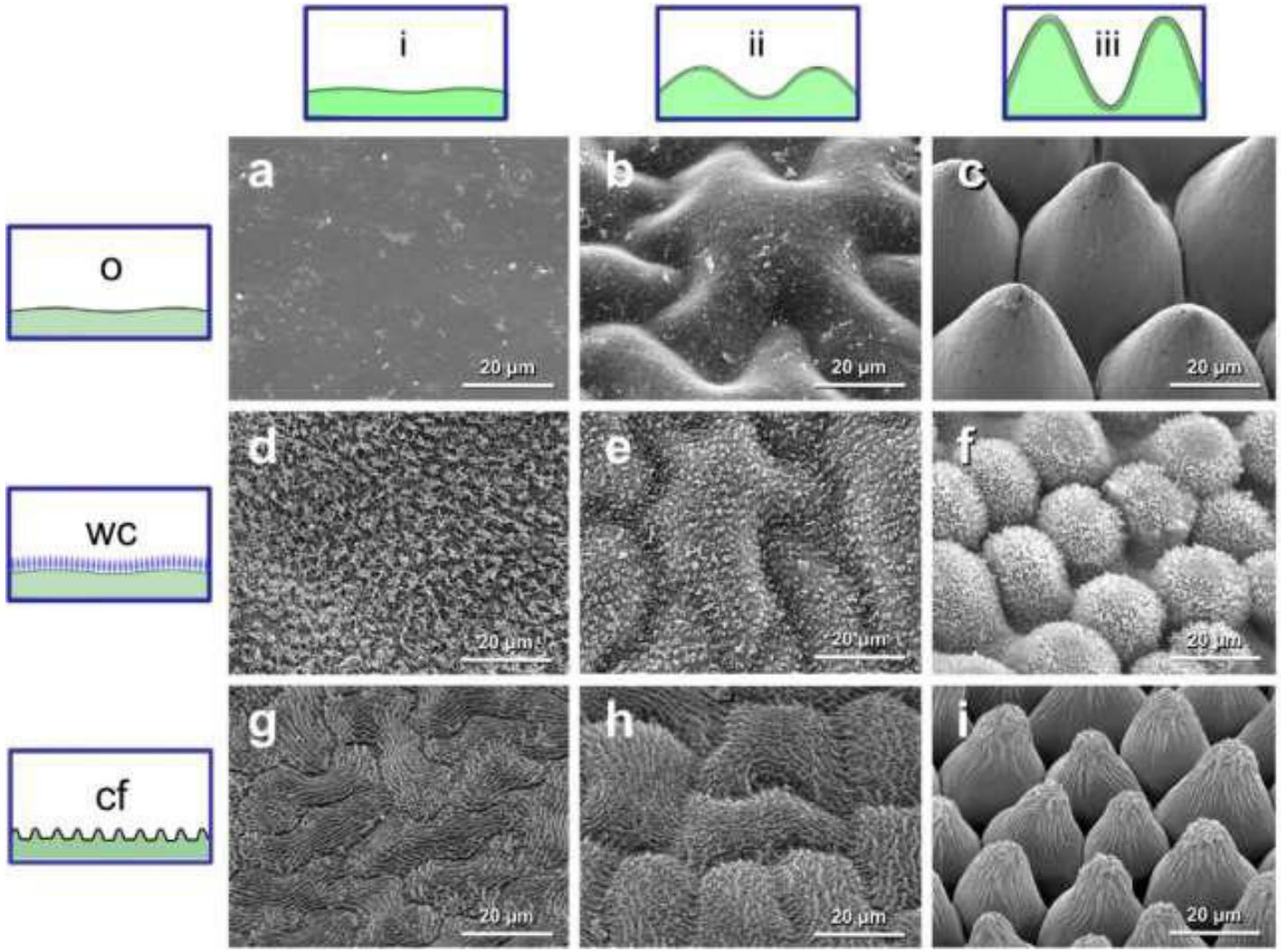
Plant Taxonomy : Anatomy

- Epidermis
- Stomata
- Trichomes
- Stem anatomy
- Nodal anatomy
- Leaf anatomy
- Sclereids
- Specialized cell and cell content
- Wood anatomy

Plant Taxonomy : Anatomy - Epidermis

- Shape, wall thickness, wall sculpturing and inclusions in the epidermal cells.
- Papillate epidermal cells in Graminae
- Presence and distribution of silica bodies in Cyperaceae
- Sclerification of the wall of epidermal cells in some genera of Compositae
- Presence of very narrow epidermal cells in Stylidiaceae
- Sharma and Shiam (1984) described the taxonomic importance of silica bodies in 22 Indian species of *Cyperus.*

Plant Taxonomy : Anatomy - Epidermis



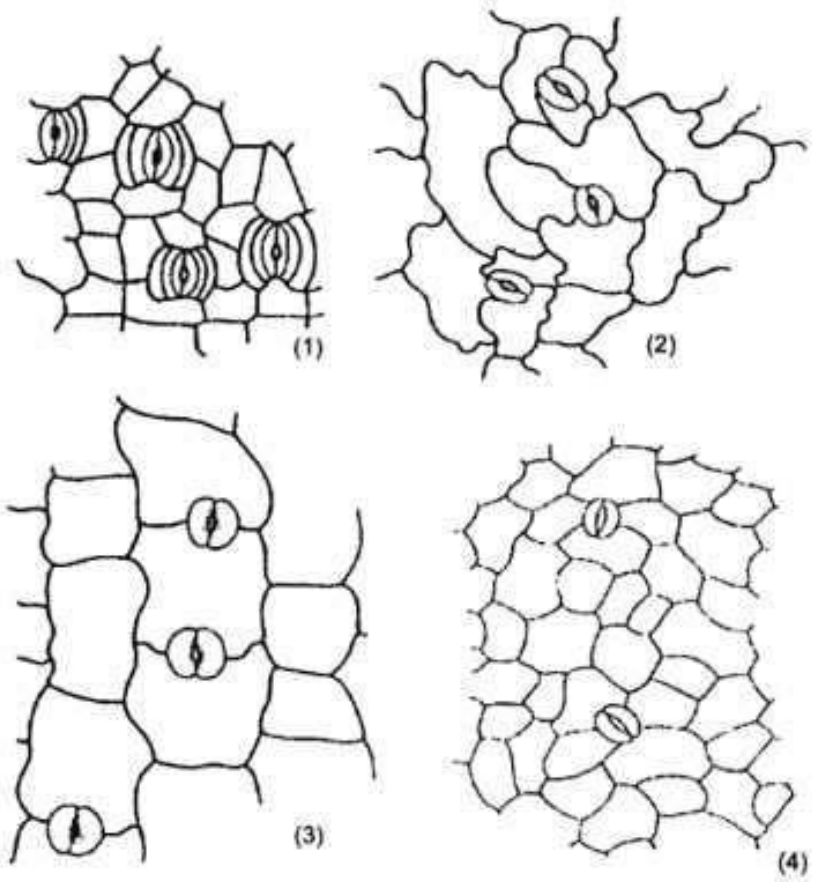
Plant Taxonomy : Anatomy - Stomata

- Morphology and development of different stomatal types is important in assigning taxa of uncertain affinities to proper position.
- Morphology and ontogeny, number and arrangement of subsidiary cells and their relationship with other epidermal cells are characters of taxonomic significance.

- Significance of stomata has been confirmed in the taxonomy of

  Graminaeae, Epacridaceae, Combretaceae, Rubiaceae, Acanthceae, Umbelliferae, Papilionaceae, Araliaceaea, Myrtaceae, Cyperaceae

Plant Taxonomy : Anatomy - Stomata

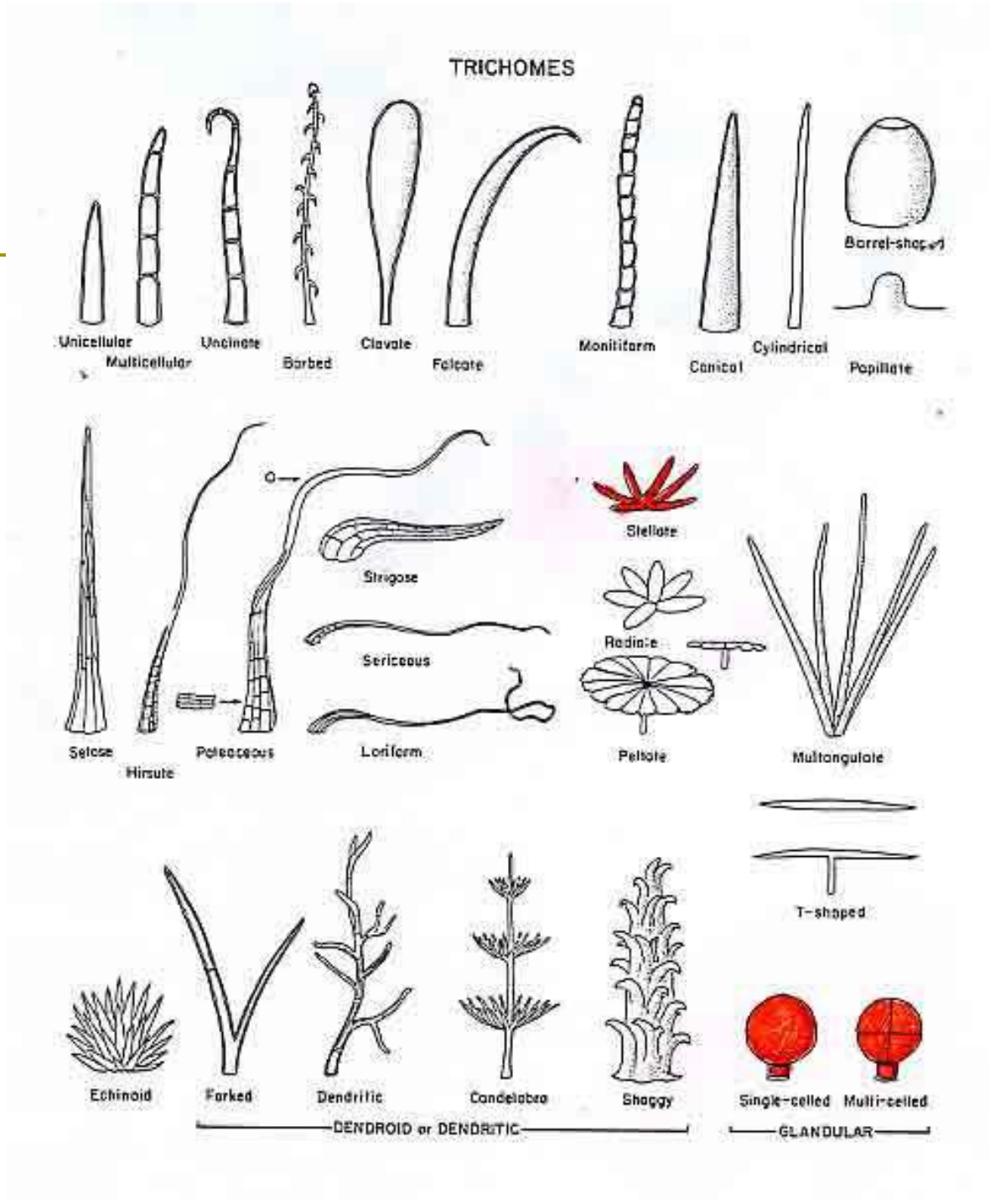


Gambar 33. Berbagai tipe stomata. (1) Acacia; Rubiaceous atau tipe parasit. (2) *Brassica;* Cruciferous atau tipe anisosit. (3) *Dianthus;* Carryophyllaceous atau tipe diasit. (4) *Pelargonium;* Ranunculaceous atau tipe anomosit (Fahn, 1989: 160).

Plant Taxonomy : Anatomy - Trichomes

- Trichomes types and their distribution are useful characters in distinguishing various genera of Fabaceae and Icacinaceae.
- Position of ***Nyctanthes*** in Oleaceae has been confirmed by Inamdar (1967) on the basis of the structure and ontogeny of trichomes.
- Trichomes have been the main basis of the formation of generic key for the Indian members of Compositae.

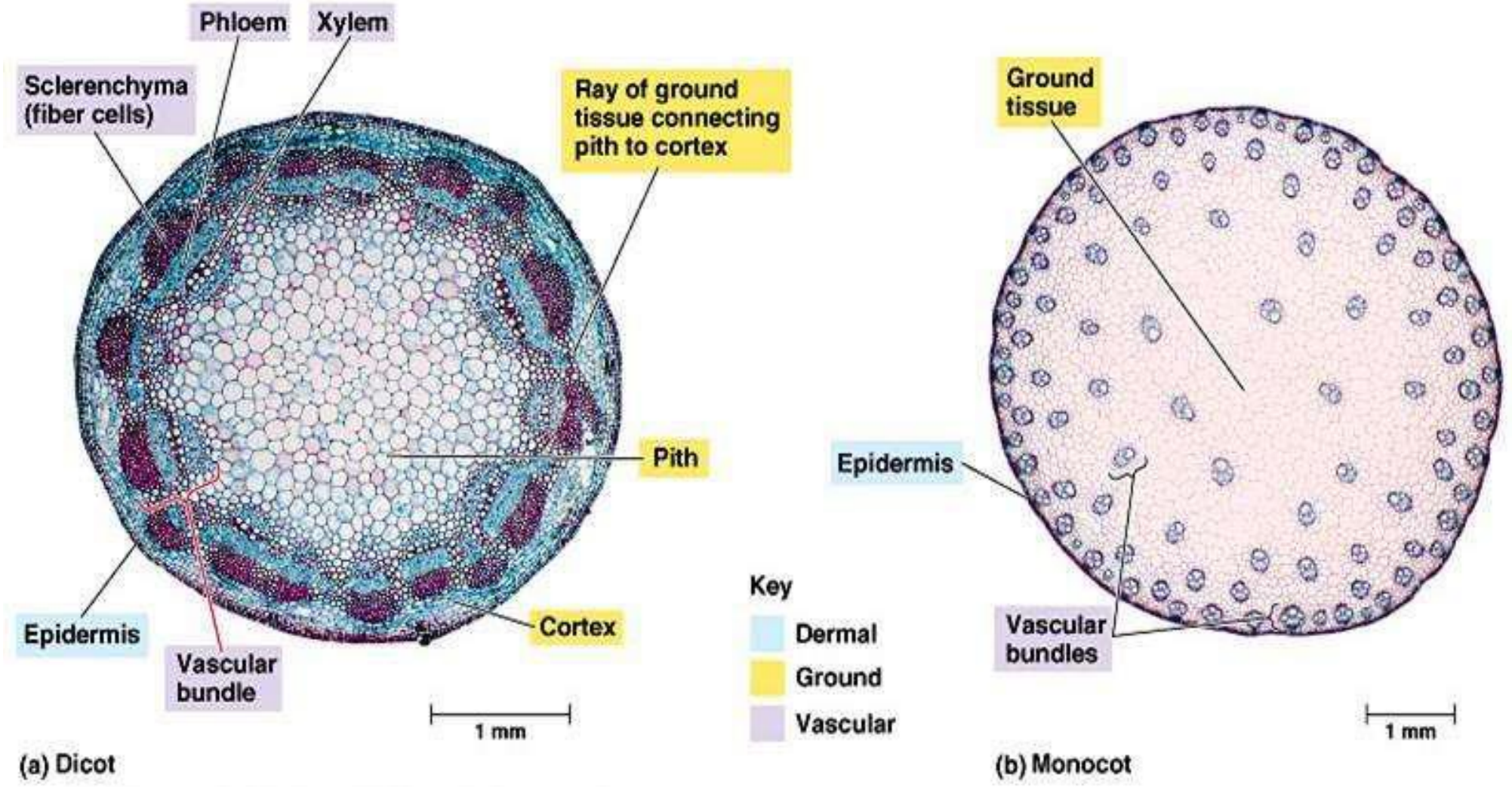
Plant Taxonomy : Anatomy – Trichomes



Plant Taxonomy : Anatomy – Stem Anatomy

- Stace (1970) has shown that anatomy of the stem can be used to distinguish the majority of its British species.
- ***Dioscorea*** species are distinguished on the basis of stem anatomy.
- Transformation of cortex into transfusion tissue in ***Casuarina***
- Structure of stem endodermis in families such as Ateraceae and Piperaceae
- Presence of bicollateral vascular bundles in two alternate rings in Cucurbitaceae
- Occurance of cortical and medullary bundles in some families such as Amaranthaceae, chenopodiaceae and nyctaginaceae, are some of the features of taxonomic importance.

Plant Taxonomy : Anatomy – Stem Anatomy



Plant Taxonomy : Anatomy – Nodal Anatomy

- According to Dickison (1975) correlations of nodal anatomy with some other features might help significantly in tracing the phylogeny of angiosperms.
- Philipson (1968) attempted to use nodal anatomy as an aid to taxonomy.
- Sinnott(1914) considered the trilacunar node as primitive and unilacunar and multilacunar nodes as advanced.
- According to Paliwal and Anand (1978) majority of dicotyledons possess trilacunar nodes.
- Unilacunar nodes are found in Laurales, caryphyllales, Ericales, Ebenales, Primulales, Myrtales and a few Tubiflorae and Asteridae members.
- Multilacunar nodes are found in Magnoliales, Piperales, Trochodendrales, Umbellales and Asterales.

Plant Taxonomy : Anatomy – Nodal Anatomy

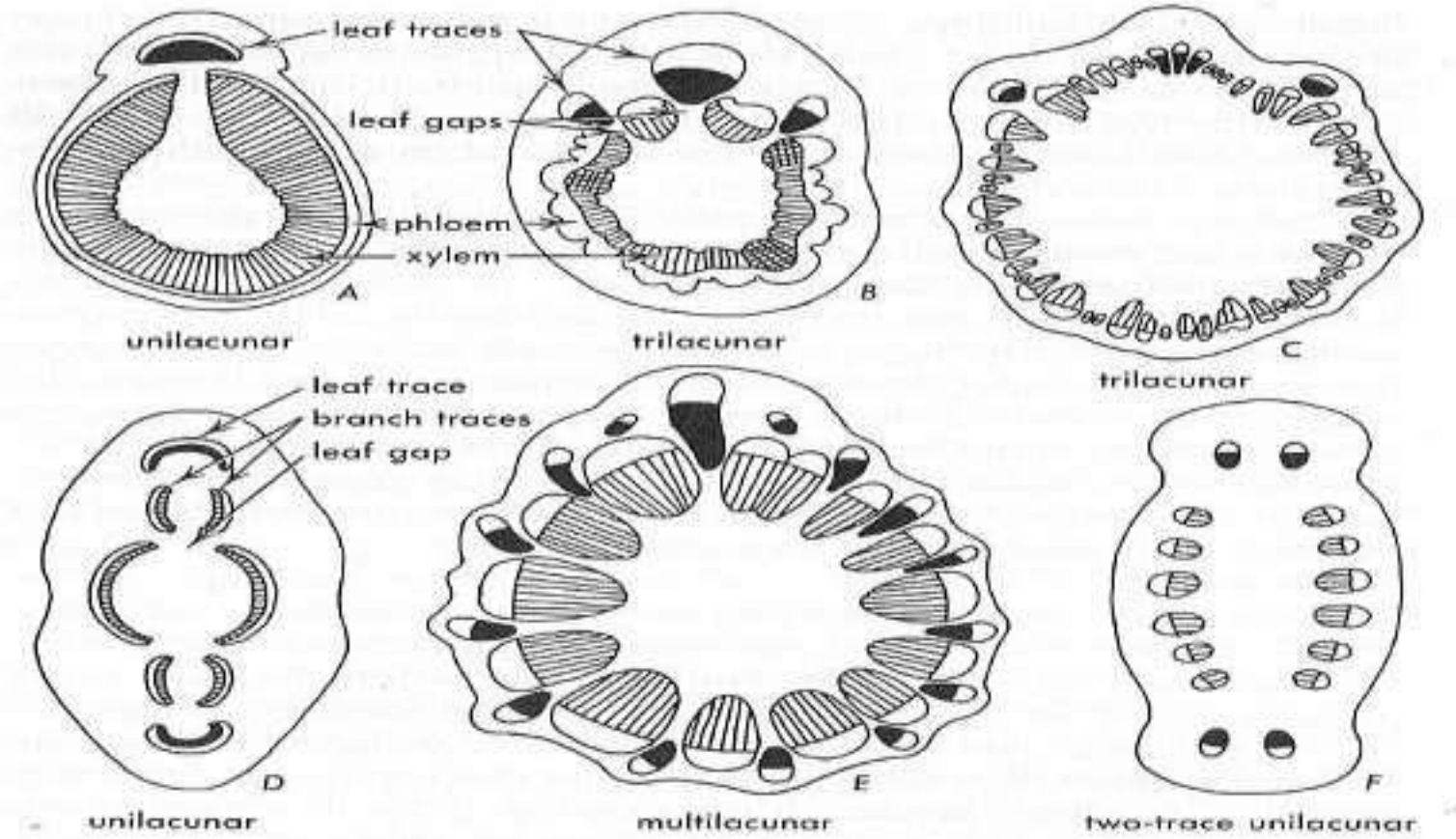
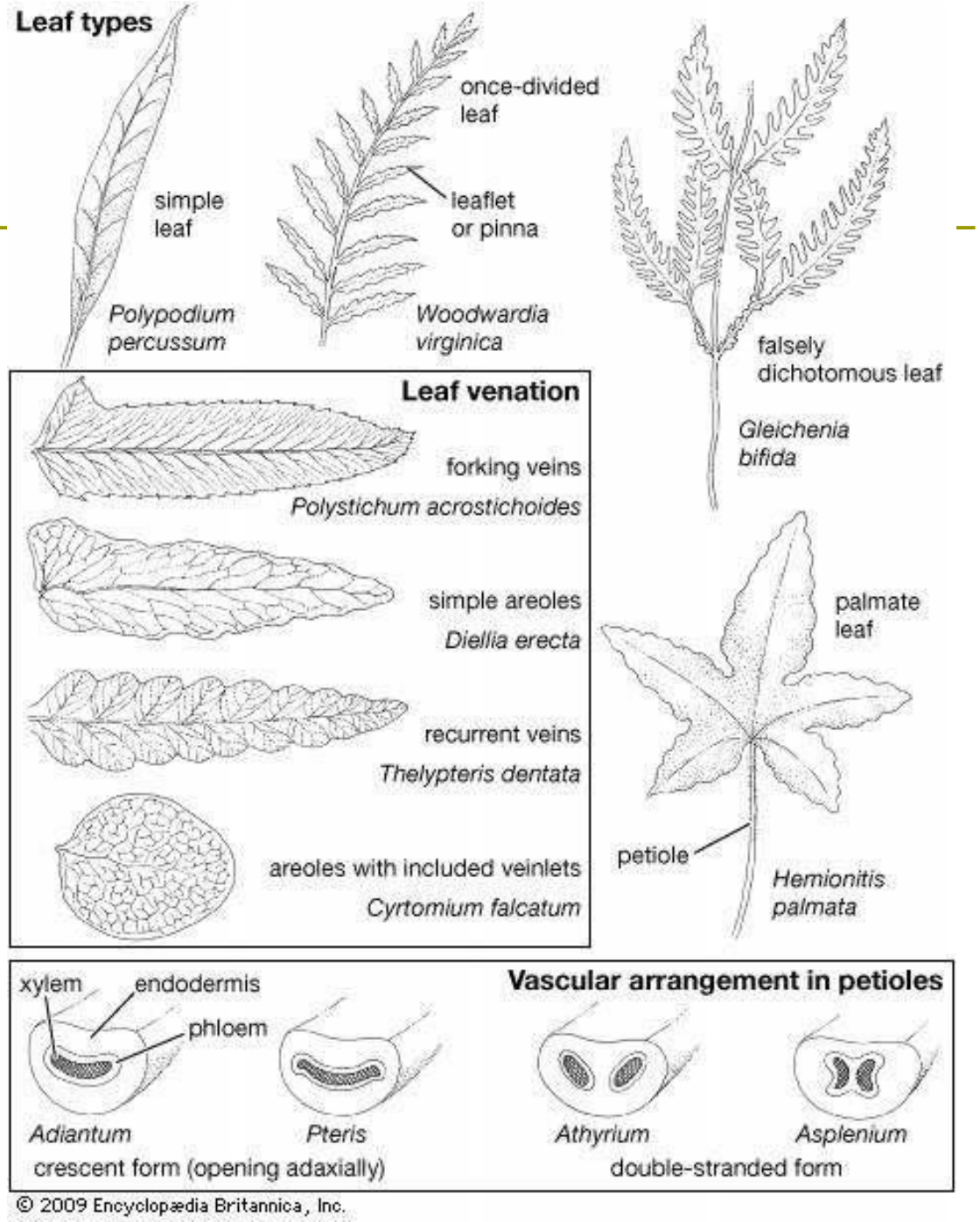


Fig. 16.5. Cross sections of stems with different types of nodal structure. Leaf traces are indicated by blackened xylem regions. *A, Spiraea. B, Salix. C, Brassica. D, Veronica. E, Rumex. F, Clerodendron.* (*A–E*, after Esau, *Plant Anatomy*, John Wiley and Sons, 1953.)

Plant Taxonomy : Anatomy – Petiole Anatomy

- Metcalfe and Chalk (1950) and HOWARD (1963).
- According to Howard, families, genera and even species may be identified by petiole characters, such as its position on stem, presence or absence of stipules, its vascularization, nodal structure, number of traces, etc.
- Petiole anatomy of 64 species of Baphia of Leguminosae, some species of Phlomis and Eremostachys of Labiate provide clear support of use of petiole anatomy in the taxonomy of these genera.

Plant Taxonomy : Anatomy – Petiole Anatomy



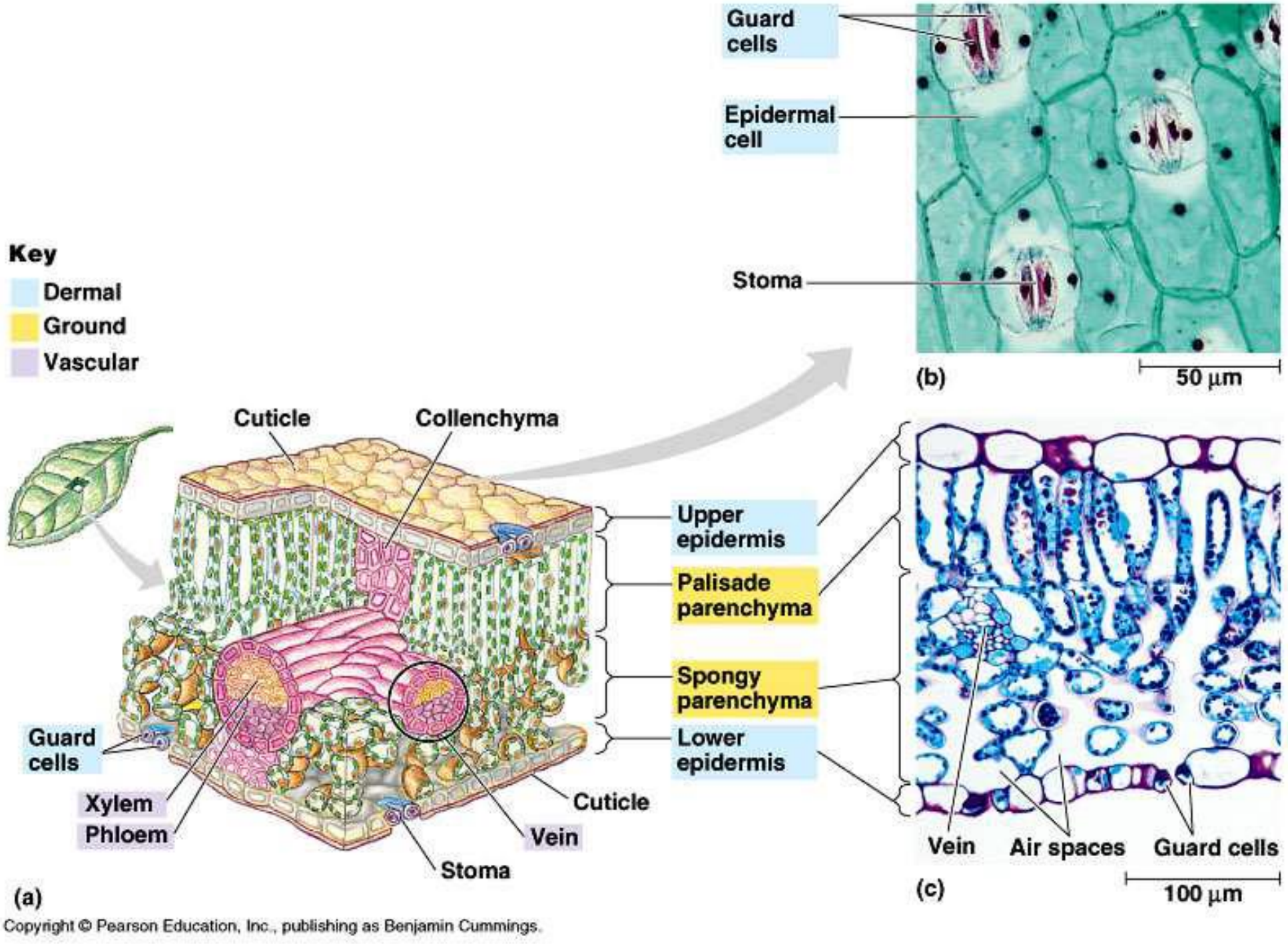
Plant Taxonomy : Anatomy – Leaf Anatomy

- Koyama (1967) and Govindrajalu studied the leaf anatomy of several species of Cyperaceae and formulated keys to identify various species of ***Cyperus, Fuirena***, etc.

- Leaf anatomy has been widely used in several taxonomically different groups such as Euphorbiaceae, Cyperaceae and Graminae of Angiosperms and Coniferae of Gymnosperms, Patterns of distribution of sclerenchyma in ***Carex*** and ***Festuca*** have been used in distinguishing species.

- Sclerenchyma is also used in differentiating two genera of Velloziaceae viz, ***Vellozia*** and ***Barbacenia***.

Plant Taxonomy Anatomy – Leaf Anatomy



Plant Taxonomy : Anatomy – Sclereids

- Sclereids are the cells with very thick lignified walls.
- They are extremely rare in monocots, except in certain genera of Araceae, Agavaceae, Arecaceae and a few other families.
- In dicots, they are more common in woody form then in herbaceous ones.
- Rao and Das (1981) have shown their taxonomic value in about 30 species of ***Limonium.***

Plant Taxonomy : Anatomy – Specialized Cells & Cell Content

- Microscopic characters of cell content such as strach grains ***(Solonum tuberosum***)
- Proteins bodies (some Cactaceae)
- Albuminoids (***Laportea***)
- Large silica bodies (Musaceae, Arecaceae and Zingiberaceae)
- Calcium oxalate crystals (Eichhornia, Allium)
- Cystoliths (Moraceae and Urticaceae)
- Tanniniferous cells (Xyridaceae) are important diagnostic tools, and at time prove extremely helpful in delineating species, genera and families.

Plant Taxonomy : Anatomy – Wood Anatomy

- Some important wood elements of taxonomic importance are: Vessel elements, Vascular rays, Axial parenchyma, Presence or absence of stroried wood, Presence or absence of latex vessels, resins, gums, crystals etc.
- Wood anatomy has prompted the allocation of *Amborella, Tetracentron* and *Trochodendron* to their respective independent families.
- Placement of Myristicata close to Lauraceae, delimitation of different subgenera of Quercus of Fagaceae, and non-inclusion of Calycanthaceae in Rosales or Myrtales are all supported by the wood anatomy.

Plant Taxonomy : Anatomy – Wood Anatomy

Plant Taxonomy : Anatomy – Floral Anatomy

- Floral anatomy of Annonaceae, Calycanthaceae and Menispermaceae confirms that all these families originated from Ranunculaceae.
- Uniformity in floral vasculature of Solanaceae and Scrophulariaceae suggests that both should be included in one single order, Scrophulariales.
- Separation of *Paeonia* from Ranunculaceae and its inclusion under a separate family Paeoniaceae was supported by the floral anatomical studies. Formerly, Cyperaceae and Graminae were treated together in one single order. But Hutchinson(1973) treated them separately in Cyperales and Graminales because of their floral anatomy.
- *Lilaea,* earlier included under family Scheuchzeriaceae, was later separated in an independent family Lilaeaceae.

Plant Taxonomy : Anatomy – Floral Anatomy