A Study on Plant Structure

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ABSTRACT

This paper propose image processing algorithms to recognize The Plant structure in Plant Kingdom. Anatomy is one of the oldest disciplines of plant science, and there is a huge amount of accumulated knowledge. At the same time, anatomy is highly important as a linking medium between several key branches of modern plant science. Detailed anatomical studies, these days using X-ray microtomography, allow much more detailed understanding of plant fossils and thus facilitate the accumulation of greatly extended non-molecular data sets. The use of anatomy is one of most efficient ways of increasing the number of characters in data sets employed to link fossil and extant plants. This link is essential for achieving the ambitious goal of acquiring a holistic knowledge of plant evolution combining the direct, but fragmentary evidence from the fossil record and the indirect, though highly informative data of molecular phylogenetics and phylogenomics. Anatomy is one of key tools of evo-devo research. Indeed, analyses of gene expression patterns are performed using anatomical techniques. More importantly, developmental biology of plants explores functioning of plant meristems and aspects of cell and tissue differentiation, the topics that have a long history of research in the framework of plant anatomy. Anatomy provides detailed information of the developmental processes in extant and extinct plants. Obviously, the detailed knowledge assembled through centuries of anatomical research has great perspectives of use in evolutionary developmental biology. Many theories developed in plant anatomy can be tested using molecular tools (e.g. Povilus et al., 2020), but it is important to pose the questions. Anatomy has many implications for plant physiology and ecology and provides an excellent tool for investigating historical aspects of these disciplines, including those related to climate change.

KEYWORDS: Plant Cell, Root, Stem, Leaf, Apoplast, Function.

INTRODUCTION

Plant anatomy describes the analysis and alignment of the cells, tissues and organs of plants in affiliation to their development and function. Higher plants alter awfully in their admeasurement and appearance, yet all are complete of tissues classed as dermal (delineating boundaries created at tissue surfaces), arena (storage, support) or vascular (transport). These are organized to analysis three abundant organs: roots, which action mainly to accommodate anchorage, water, and nutrients; stems, which accommodate abutment and leaves, which aftermath aliment for growth. Organs are abnormally adapted to accomplish functions altered from those intended, and absolutely the flowers of angiosperms are alone collections of leaves awful adapted for reproduction. The advance and development of tissues and organs are controlled in allotment by groups of beef alleged meristems. This addition to bulb analysis begins with a description of meristems, again describes the analysis and action of the tissues and organs, modifications of the organs, and assuredly describes the analysis of fruits and seeds and how these are adapted for dispersal. It presents an analogy of the structures of a archetypal plant. Angiosperms are one of the most diverse groups of plants that vary greatly in morphology, size, habitat, and longevity. Agriculture is almost entirely dependent on angiosperms. Besides providing food and fiber, angiosperms are important sources for pharmaceuticals, lumber, paper, and biofuel. Understanding the origins, mechanisms, and functions of morphological diversity in flowering plants is one of the fundamental questions in plant biology. Modern approaches to studying plant development integrate classical knowledge in plant anatomy and development with molecular genetics and genomics tools. Among powerful tools, analyses of mutants that affect developmental processes have shed new light on our understanding of the complexity of plant development. More recently, high-throughput, genome-wide phenomic screens in Arabidopsis (***Arabidopsis thaliana***; for review, see Alonso and Ecker, 2006), and large-scale gene expression-profiling technologies (for review, see Rensink and Buell, 2005) generated a huge amount of data in plant science. These tools and resources have the potential to contribute to efforts to link genes with developmental morphology (i.e. genotype with phenotype) and make an impact on our understanding of functions of genes involved in plant development. However, an accurate interpretation of the function of genes that control various aspects of plant development must be embedded in detailed knowledge of the anatomy and morphology of a plant. Explicitly, the structural features of plant cells, tissues, and organs need to be correctly understood and uniformly described. Accurate and standardized nomenclature for plant anatomy and morphology is also required for comparative purposes (i.e. for comparisons of genes involved in plant development among related or evolutionarily distant taxa).

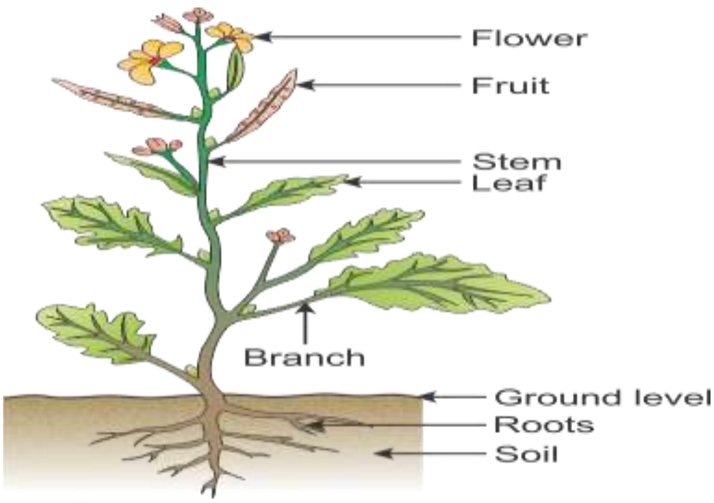
OBJECTIVES-

To study Of Plant Structure
To study of Plant Tissue
To study of Vascular Bundle

Research methods used-

In the present research, research method in used Internet surveys, other famous book, writers and authors.

ANALYSIS-



Parts of a plant

(a) Root, stem and leaf

The paradigmatic plant has three principal parts which are readily apparent from a study of its gross form. They are the root, the stem, and the leaves. The leaves are chlorophyll-containing organs of photosynthesis which make up the green aerial canopy so characteristic of higher plants. Their basic job is to hold a disperse photosynthetic pigment system somewhat perpendicular to an incident photon beam so that the pigment can transduce the energy of the incoming photons into a form in which it can be used to synthesize sugar from water and atmospheric carbon dioxide. In order to carry out this task, the leaf must have a means of admitting carbon dioxide into its interior. But, in the process of this admission, it will lose water vapor, thereby inducing a transpiration stream and bringing about sap ascent. The roots have as their principal function the gathering of mineral nutrients and water from the soil. However, they also serve to anchor the plant firmly, thereby assuring -

(i) that the roots do not become separated from the soil
(ii) that the resources spent in developing the plant's leaf system to optimize absorption of incident sunlight not be wasted by a sudden shift of plant position.

The stem has as its principal function the support of the leaf system. That is, its primary job is to position the leaves so that they get an adequate amount of light. However, in carrying out this task, it separates the source of photosynthate from the source of water and minerals. Therefore, it must also serve as a conducting pathway, bearing sugar downward to the heterotrophic tissue of the roots and water upward to the transpiring tissue of the leaves. Both downward transport and leaf support are largely peripheral to the concerns of this review, and attention will be focused on the upward transport and the conducting elements within the stem rather than upon the stem as a whole.

(b) Apoplast and symplas

The plant is composed of cells each of which is surrounded by a primary wall of loosely meshed cellulose fibres. In addition, the cell may also lay down a complex cellulosic secondary wall between its primary wall and plasmalemma. Both types of walls may contain, in addition to cellulose, the high polymeric carbohydrates pectin and hemicellulose, the aromatic high polymer lignin, and a great number of other less abundant high haolecular weight organic compounds. In the bulk tissues (mature parenchyma) the cells are seldom packed in the closest apposition; while some of the resultant intercellular spaces seem poorly wettable and are filled with air, others are filled with water. A concept which goes back at least as far as MiJnch (1930) is that the cells, by virtue of complex cytoplasmic bridges called plasmodesmata, are more often than not in direct communication with one another. The totality of such communicating cells is called the symplast and is frequently believed to constitute a pathway for certain kinds of transport. The totality of the plant outside the plasma membranes (including cell walls, interocllular spaces and cells no longer alive) is called the apoplast; it is the principal pathway of the ascending sap. Cells of a tissue called xylem contribute specialized transport tissue to the apoplast by elongating in orderly columns, elaborating sturdy lignified walls, and dying. The remaining hollow cell wall units, each called a tracheary element, contribute to an elaborate conduit system which ramifies throughout the plant. In addition to carrying water, these tracheary elements contribute importantly to the mechanical support of the plant.

2. Anatomy of the Young Root:-

(a) Epidermis and cortex

The outermost layer of the young root is called the epidermis; in highly schematized form, it is shown in Fig. 1. Just behind the apical regions, its cells frequently have tubular outgrowths called root hairs which

(i) extend their surfaces

and

(ii) help to bring them into

intimate contact with the porous capillary matrix of the surrounding soil. It is the epidermal surface near the tip through which the transpired.water enters the plant; its pathway is frequently assumed to be predominantly apoplastic. The next few layers of cells inside the epidermis are known collectively as the cortex and are normally characterized by having significant intercellular air spaces. Water transport in the cortex is commonly thought to be apoplastic.

(b) Casparian strip

Along the inner edge of the cortex there is a layer of cells known as the endodermis. The endodermal cell wall is impregnated with the high-polymeric lipid suberin in a band which completely encircles each cell within its radial and transverse walls. The totality of these endodermal bands constitutes a distinctive water repellent layer (the Casparian strip) which blocks apoplastic flow of water. Hence, in order to cross the Casparian strip, the transpiration stream must follow a symplastic route, entering the endodermal cells on their distal axial faces and leaving them on their proximal axial faces.

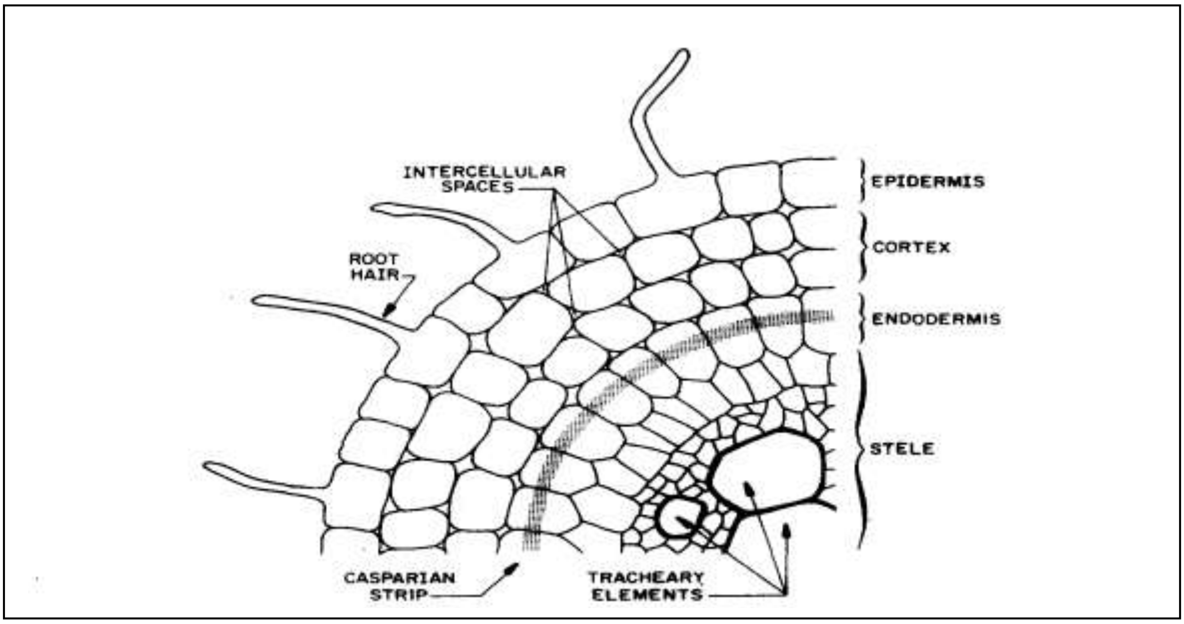


Fig. 1

(c) Vascular cylinder (stele)

Inside the endodermis, the flow is believed to become apoplastic once again and to move into the tracheary elements. Files of these structures extend all the way to the leaves and provide an obviously low resistance pathway to within a few cell diameters of the sites of evaporation. The stele also contains the pathways of living cells (phloem; not shown in Fig. 1) down which carbohydrate nutrient moves from the leaves to the roots.

(d) Older root and stem

Behind the young elongating root tip is the older portion of a root, which grows by increasing in diameter rather than in length. A cylindrical layer of dividing cells, initially located within the stele, proliferates xylem on its inner surface and phloem to the outside. The old epidermis is shed as the cells within divide and expand, and a protective bark forms. The xylem accumulated by lateral proliferation is of course known as wood. The older root merges gradually into the stem. Young stems may have a fairly complex distribution of xylem, but such complexity is largely peripheral to the problems of sap ascent. The older portion of a stem, like that of a root, develops by thickening rather than by elongating; as in the root, this is accomplished by a cylindrical layer of tissue which lays down xylem cells (and tracheary elements) at its inner surface.

3. Anatomy of the Tracheary Elements

(a) General

The anatomy of the stem as a whole and of the xylem in particular can be quite complex and fortunately is largely peripheral to the problems of sap ascent: what does matter is the structure of the tracheary elements and their interconnections. There are. two types of tracheary elements, the tracheids and the vessel members. Both are relatively elongated, are nonliving at maturity, and possess a secondary cell wall to which additional rigidity has been imparted by deposition of the phenylpropanoid polymer lignin. In regions of the plant that are undergoifig elongation, the lignin is deposited in helices or series of annuli, with the result that the elongating neighboring cells can stretch the tracheary elements. In regions which have finished elongating, lignification of the cylindrical walls is much more complete, but numerous elliptical or circular regions called pits remain unlignified and highly permeable to water.

(b) Tracheids

The tracheid is the phylogenetically more primitive of the two types of tracheary elements. It is an elongated roughly cylindrical cell which tapers slightly at the ends; a typical length is perhaps 4 mm and a typical width 50 t~m. In nonelongating tissue its surface is densely covered with bordered pits (Fig. 2) through which it is interconnected with other tracheids. Simple (non-bordered) pits connect it with nonconductive cell types.

(c) Vessel members

With phylogenetic specialization, tracheids gave way to long, narrow vessel members which were quite similar to tracheids except for the important specialization that--in addition to lateral connections to other vessel members by way of bordered pits--they also were connected end to end, the end walls between two members having developed into an oblique plate with numerous large perforations. Longitudinal files of vessel members which interconnect by way of their perforations are called vessels and can, in phylogenetieially advanced species, be meters long. Ultimately, however, the vessels do end and vessel to vessel communication is by way of bordered pits. With continued specialization, vessel members have become shorter (as little as a few hundred micrometers) and broader (up to 500/~m), and the oblique end plate with numerous perforations has given way to a nearly transverse one with one large perforation that virtually eliminates the plate.

(d) Bordered pits

In the walls of contiguous tracheary elements in tissue which has finished elongating there are apposing areas where the secondary walls are absent from both cells over a zone in which the primary walls appear modified to facilitate the passage of xylem sap. Such a region is called a bordered pit-pair and is illustrated in axial cross-section in Fig. 2; a stunning electron micrograph of a transverse cross-section may be seen on the cover of Milburn's (1979) textbook. The seemingly loose mesh of fibrils in the primary walls through which sap (but not air-water interfaces) can pass is termed a margo. A central thickening in the margo (the torus), though invariably illustrated because the bordered pit of the conifer has traditionally been considered a prototype, is actually not a terribly prevalent feature: as Bailey (1958) explained, " . . . i t should be more generally recognized that the Coniferales... differ from most of the vascular land plants in having tracheary pitmembranes with central thickenings or tori". It can be hypothesized that the bulk of the hydraulic resistance resides in the pit membrane (margo) and that the bordered pit is an adaptation which decreases the resistance of this membrane by permitting increase of its area while at the same time sacrificing but little of the structural rigidity imparted to the tracheid by its secondary wall. If the pit were unbordered, a large membrane area could conceivably effect a serious weakening of the wall.

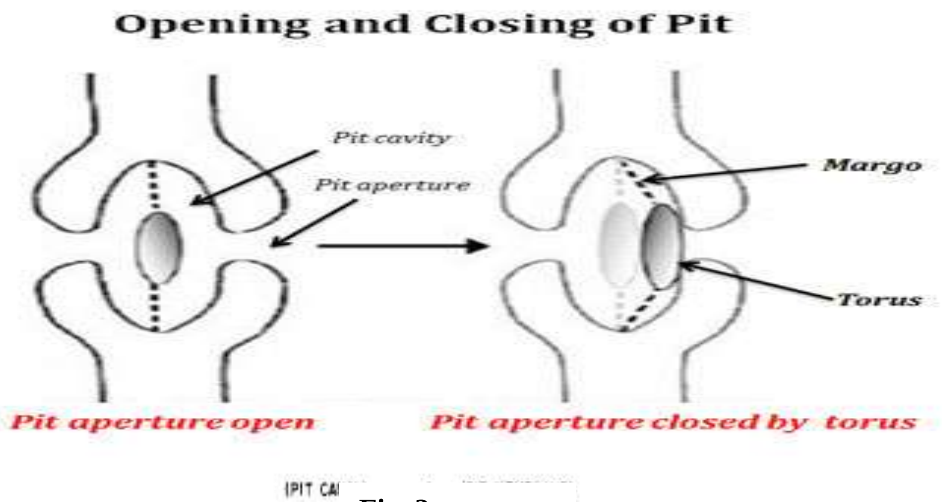


Fig. 2

(e) Perforation plates

In plants with vessels, the end walls laid down between abutting vessel members during the process of differentiation are partially lysed away prior to the death of the protoplasts; this leaves a contiguous series of vessel members, each separated from its neighbors only by perforation plates. During evolution, pitted end walls were replaced first by end plates with sets of parallel open or thin areas (scalariform or barred plates), then by plates with larger open areas and fewer bars, and then by simple perforation plates with but a single large opening. Presumably these modifications progressively reduced the hydraulic resistance of the vessels. Putatively regressive modifications of this line of evolution which serve to increase hydraulic resistance have led, for example, to reticulate plates and foraminate (i.e., containing numerous circular pores) plates.

4. Anatomy of the Leaf

(a) Basic structure

The arrangement of tissue in a portion of a representative leaf is shown in Fig. 3. The possible variations in leaf morphology are enormous, but all leaves contain the principal features shown: minor veins of xylem which terminate in tracheids; photosynthetically active parenchyma (called mesophyll in the commonest leaf type); and an epidermis which contains stomata and is covered by a cuticle.

(b) Minor veins and their terminations

The pathways of the transpiration stream, which are often highly localized in the young stem, ramify extensively in the leaf thereby carrying water to every part of this water-losing organ. The pattern of ramification (or veination) of the leaf has been subjected to extensive morphological scrutiny and can be quite complicated. The smaller terminal veins of higher plants usually end in tracheids with helically thickened walls. The permeability and ultrastructural characteristics of these terminal tracheary elements seem not to have been extensively investigated, although presumably they are similar to other tracheary elements; and clearly they are permeable to water and to sufficiently small molecules.

(c) Cell wall

When the transpiration stream has left the minor veins, it is believed to flow chiefly through the primary cell walls and intercellular spaces of the photosynthetic parenchyma. The parenchymal cell wall is holopermeable; that is, it is permeable to water and to micromolecules up to about 1 nm in diameter but not to macromolecules or colloidal particles. Further, it can be penetrated but not crossed by still larger particles up to a limit of about 6 nm. Hence, the fibrils of the (primary) wall should be assigned characteristic spacings in the 1-5 nm range. And it is from interstices of roughly these dimensions that the transpiration stream ultimately evaporates.

(d) Cuticle

Wherever the cell wall comes in contact with the ambient air, there is a pronounced tendency for it to become adcrusted with hydrophobic substances to form a cuticle which inhibits seriously the flux of ater into the atmosphere

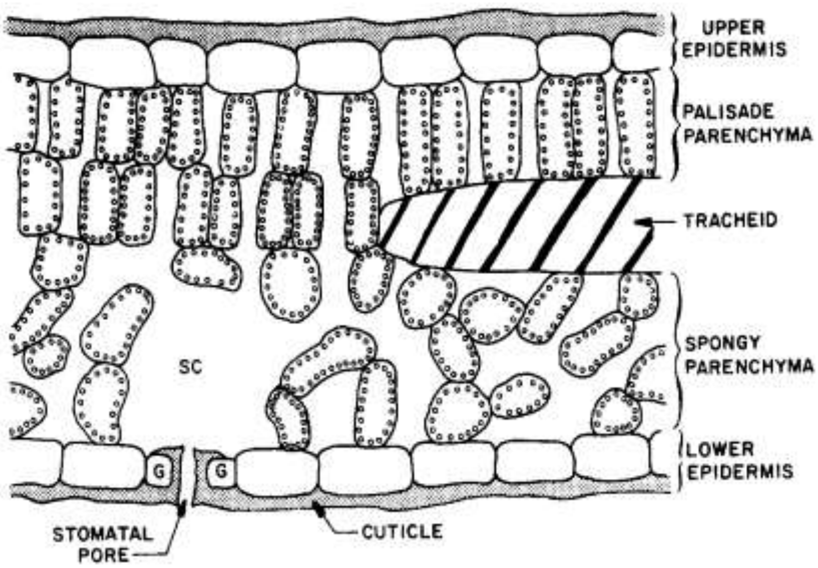


Fig. 3

(e) Stomata

The water in the cell walls, although not readily able to escape through the cuticle, can and does evaporate into the intercellular spaces in general and (Fig. 3) into the substomatal chamber in particular. Whenever the two guard cells have expanded to open the normally closed stomatal pore, the water vapor in the chamber diffuses down its concentration gradient and is lost into the ambient air, thereby terminating the transpiration stream. Further details may be obtained from the monograph of Meidner and Mansfield (1968).

CONCLUSION-

A brief study on Plant Structure and function of various types of plant cell. The plant have the some part of his structure like- root, stem, leaf, flower and seed. This are have same cellular level on plant cell is have epidermal cell, cortex, endodermis, pericycle or vascular bundle. Plant cell wall covered by cellulose and other element.

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