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Physiological, medical importance and microscopic characterization of selected medicinal plants

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Abstract

Epidermis is the outermost, protoderm derived layer of cells covering the leaf. The epidermis and its waxy cuticleprovide a protective barrier against mechanical injury, water loss, and infection. Various modified epidermal cells regulate transpiration, increase water absorption, and secrete substances. The colonization of land by terrestrial plants was enabled by the evolution of specialized pores (stomata) on the leaf epidermis that regulate the exchange of water vapour and CO2 between the leaf interior and the atmosphere. Research was based on micro examination of some selected medicinal plants that carried out in the old Botanical of the Agriculture University Faisalabad. In some selected dicot plants leaves two type of epidermis were observed. The upper one called the adaxial and lower one called abaxial. In dicots plants following shapes of the shapes of the cell and stomata are observe anomocytic type in that guard cells are surround by many similar in size and shape to the epidermal cells means here no subsidiary cells are found. Crucuferious type show that guard cells are surrounded by three subsidiary cells of unequal size. Paralytic type show that guard cells accompanied by one or more subsidiary cells parallel to axes. Diacytic type in which stomata surround by the two subsidiary cells. These shapes of the cells were observed under the microscope.These observations lead to evolutionary medicinal importance and of various morphological characterization of this selected medicinal plant.

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Introduction

The evolution of stomata at least 400 million years ago enabled plants to transform their epidermis into a dynamically permeable layer that could be either water-tight under dry conditions or highly permeable to photosynthetic CO_2 during favorable conditions. The combination of adjustable stomata with an internal water transport system was a turning point in plant evolution that enabled vascular plants to invade most terrestrial environments. Today, the leaves of vascular plants possess arrays of densely packed stomata, each one comprising a pair of adjacent guard cells. High turgor pressure deforms the guard cells to form an open pore, which allows rapid diffusion of atmospheric CO_2 through the epidermis into the photosynthetic tissues inside the leaf (Doyle *et al.*, 1986).

Stomatal Spacing represents a fundamental principle of stomatal patterning on leaves. The guard-cell pairs of most land plants are typically separated from each other by at least one pavement epidermal cell, thereby following the one-cell spacing rule. One-cell spacing occurs even in taxa where stomata are clustered closely together in 'islands' that share a single underlying stomatal chamber, such as Begonia and Cinnamomum (Zhao *et al.*, 2006).

Epidermis is the outermost, protoderm-derived layer of cells covering the leaf. The epidermis and its waxy cuticle provide a protective barrier against mechanical injury, water loss and infection. Various modified epidermal cells regulate transpiration, increase water absorption, and secrete substances. The colonization of land by terrestrial plants was enabled by the evolution of specialized pores (stomata) on the leaf epidermis that regulate the exchange of water vapour and CO_2 between the leaf interior and the atmosphere. Crucially, stomata solved the functional dilemma of facilitating CO_2 diffusion into the leaf for photosynthesis while also limiting the outward diffusion of water vapors (Crane *et al.*, 1997).

Stomata are frequently absent in the epidermis overlying vein paths due to the tight packing of parenchyma cells extending to the epidermis from the vascular bundle sheath. This is a general feature in large veins that protrude beyond the thickness of the leaf lamina, but thinner veins that do not protrude can also involve a column of tightly packed cells that extend from the vascular bundle sheath to the epidermis. This bundle sheath extension (BSE) precludes mesophyll airspace, thereby excluding stomata. In angiosperms, major veins occur at very low densities over the leaf (Sack *et al.*, 2012).

Asymetrical cell division In terms of stomatal development, a critical factor in determining whether development is mesogenous or perigenous is whether formation of the GMC is preceded by a highly polarized (asymmetric) mitosis. In mesogenous and mesoperigenous development, an asymmetric division of a stomata precursor cell produces two daughter cells that differ in size, shape and fate. These daughter cells are a (typically smaller) specialized precursor cell (a meristemoid and astomatal-lineage ground cell (SLGC). Thus, an apparently fundamental question in understanding the evolution of stomata patterning is whether perigenous or mesoperigenous development is ancestral (Doyle *et al.*, 1986).

Put simply, anomocytic stomata often equated with haplocheilic stomata were traditionally considered to represent the ancestral type, at least among seed plants. Conversely, paracytic stomata often equated with syndetocheilic stomata and mesogenous or mesoperigenous development considered derived. This evolutionary hypothesis was based partly on the widely held assumption that relatively simple morphologies such as anomocytic stomata are primitive, and partly because all Palaeozoic seed-plant lineages are anomocytic. Paralytic stomata are one of the features that group bennettites with angiosperms in morphological cladistics analyses of seed plants. However, the lateral subsidiary cells of paralytic stomata can be either perigene, as in grasses or mesogene, as in some other angiosperms such as Magnolia and in the early diver gentpteridophyte Equisetum (Rudall *et al.*, 2013).

Stomata have played a key role in the Earth System for at least 400 million years. By enabling plants to control the rate of evaporation from their photosynthetic organs, stomata helped to set in motion non-linear processes that led to an acceleration of the hydrologic cycle over the continents and an expansion of climate zones favorable for plant life. Global scale modeling of land–atmosphere interactions provides a way to explore parallels between the influence of vegetation on climate over time, and the influence of spatial and temporal variation in the activities of vegetation in the current Earth System on climate and weather. Studies of Stomatal valves on the leaves of vascular plants not only prevent desiccation but also dynamically regulate water loss to maintain efficient daytime water use. This latter process involves sophisticated active control of stomata aperture that may be absent from early-branching plant clades. To test this hypothesis, we compare the stomata response to light intensity in 13 species of ferns and lycophytes with a diverse sample of seed plants to determine whether the capacity to optimize water use is an ancestral or derived feature of stomata physiology. We found that in seed plants, the ratio of photosynthesis to water use remained high and constant at different light intensities (Zhao *et al*., 2006).

Pillitteri *et al*. (2007). The medicinal plants contain specific sequences of DNA that can be barcode with special agents founds in specific parts of plants (Ahmad *et al*., 2019).

The main purpose of this study is to carry out research on medicinal plants with microscopic of dicot leaves. Stomata play a crucial role in productivity and survival of land plants by regulating photosynthesis, respiration and transpiration through controlling exchanges of CO_2, O_2 and water vapors between the interior of the leaf and the atmosphere. Stomata clusters such as groups of two or more stomata that make direct contact have been found only in a few plant species to data, while stomata clustering have been found to be a very common phenomenon in Cinnamomumcamphora in our observations. The ontogeny of stomata clusters, their distribution on leaves and their density under different soil moisture conditions were surveyed.

Materials and methods

Description of the site

This research was carried out to examine the microscoscopic examination of selected medicinal plants that were particularly selected for this research with particular emphasize on leaves. The samples were screened and collected from prestigious research center old botanical garden of the Agriculture University Faisalabad, Pakistan.In this research, the epidermis of dicots plants is the tubular and irregular in shape.

Description of Experimental Materials

Freshed and smooth leaves lacking many leaf hairs cells were collected. The microscopic slides were carried out for microscopic examination of adaxial and abaxial surface of dicots leaves. Leaves were carefully cutting from the surface or tear the leaf from the edge and blended the leaves.

Sample Analysis and Microscopic Examination

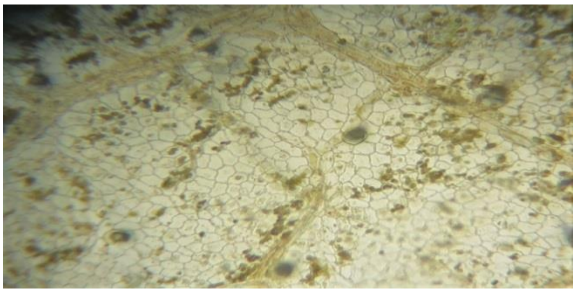
The epidermal cells and layer were separated from the leaves and then placed and placed on microscope slide. Specifically designed camera called digital camera was used to confine microscope descriptions of the leaf surfaces. Placing water proofed cover slip on leaves then viewed under the compound light microscope procedure adapted from literature (Ohashi *et al*., 2011). The shape of adaxial and abaxial of unstained epidermis was helpful to close the iris diaphragm a little to increase contrast and see the cell clearly.

Results and discussions

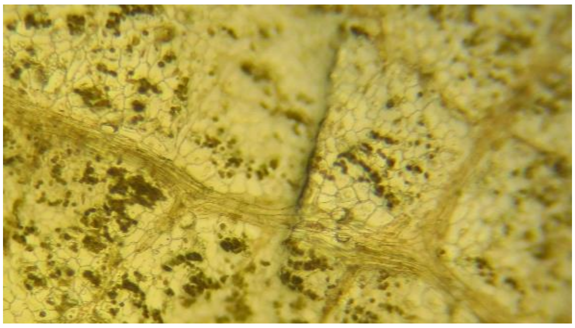
Epidermal cells and stomatal shapes were observed under careful microscopic. The cells of epidermis called epidermal cells comprised stomata that evenly dispersed on adaxial and abaxial epidermal surfacesthat show the presence of the guard cells, specialized cells and different structure of the epidermis. In the dicots plants the epidermis are the tubular and irregular in shape. Mesogenous stomata in which the subsidiary cell have origin with guard cells. Other is the Perigenous which develop from the protodermal cells.

Scientific name: Brachychitonpopulneus
Common name: kurrajong, bottletre
Family name : Malvaceae

Fig. 1(A). Leaf Shape.



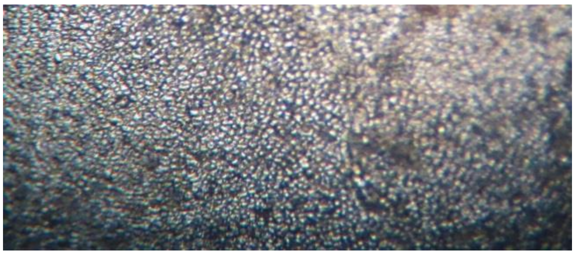
(B) Epidermis: Adaxial surface.



(C) Epidermis: Abaxial surface.

Scientific name: *Citrus limon*
Common name: mango, Aam
Family name: Anacardiaceae

Fig. 2(A). Leaf Shape.

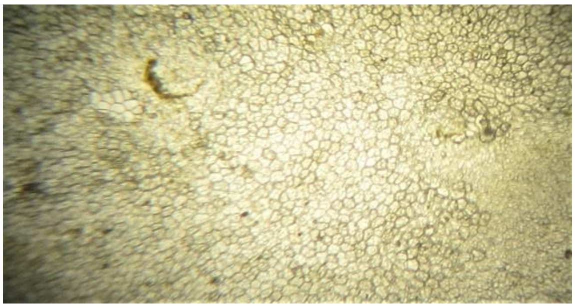


(B) Epidermis: Adaxial surface.

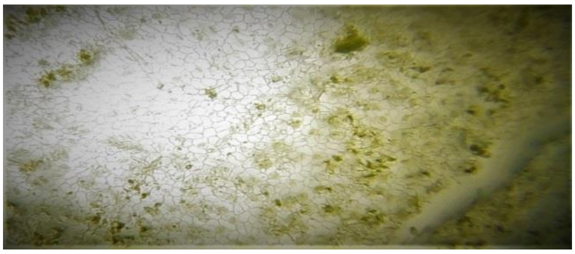
(C) Epidermis: Abaxial surface.

Scientific name: Hameliapatne
Common name: firebush, hummingbird bush, scarlet bush
Family name: Rubiaceae

Fig. 3(A). Leaf Shape.



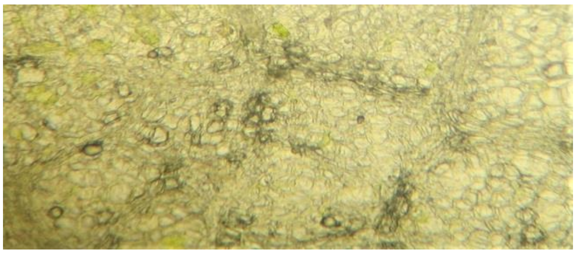
(B) Epidermis: Adaxial surface.



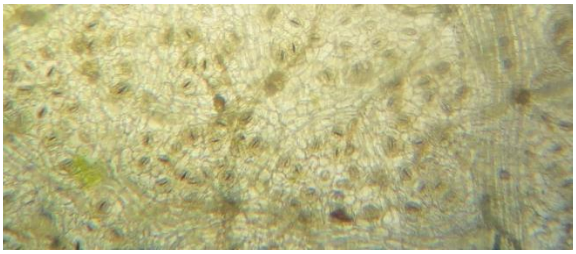
(C) Epidermis: Abaxial surface.

Scientific name: Bombaxceiba
Common name: cotton tree, Simbal tree
Family name: Malvacea

Fig. 4(A). Leaf Shape.



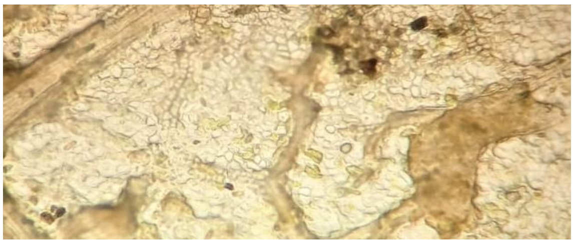
(B) Epidermis: Adaxial surface.



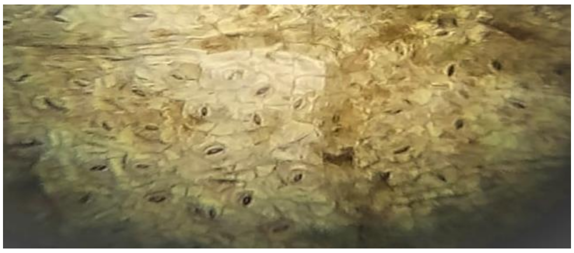
(C) Epidermis: Abaxial surface.

Scientific name: Brachychiton*populneus*
Common name: kurrajong
Family name : Malvaceae

Fig. 5(A). Leaf Shape.



(B) Epidermis: Adaxial surface.



(C) Epidermis: Adaxial surface.

Different type of the stomatal shapes has been observe during the research works that are similar in shape to the shape of the dicots plants epidermis shown. These are like the anomocytic type in that guard cells are surround by many similar in size and shape to the epidermal cells means here no subsidery cells are found. Crucuferious type show that guard cells are surrounded by three subsidery cells of unequal size. Paracytic type show that guard cells accompanied by one or more subsidiary cells parallel to axes. Diacytic type in which stomata surround by the two subsidery cells. These shapes of the cells are shown under the microscope.

Stomatal responses to light have been characterized in angiosperms such as Arabidopsis. In these plants, stomatal opening is mediated by two light signalling cascades, BL-dependent and photosynthesis-induced responses. Both responses are observed in angiosperms, but no comprehensive analysis has been done on the evolution of stomatal response across phylogenetically divergent species of vascular plants. Recent studies indicated that the stomata responses to CO_2 and abscisic acid are absent in Polypodiopsida and lycophytes, and the stomata aperture of these plants is regulated by passive control of guard cell turgor by leaf water status differing from angiosperm (Mcelwain *et al.*, 2016).

Various leaf micro morphological characters were observed within resurrection ferns here and appear to be associated with the environmental conditions of the habitat and depict the desiccation tolerance properties of these ferns. The epidermal cells characteristics were different in terms of size, and number and some similar features observed in all species were the shape of cells and pattern of anticlinal cells walls among the species. All the studied species exhibited curved and wavy anticlinal walls and shapes of the epidermal cells are irregular. The shape of anticlinal walls is considered as environmental adaptation, usually curved ((Norfaizal *et al*., 2018).

Conclusion

The recent research efforts describe the microscopic assessment of microscopic examination dicots leaves. Diverse range and major types of various shapes of stomata experimentally abaxial, adaxial shape of epidermis and anomocytic type, crucuferious type, paracytic type and diacytic type observed using the specifically designed compound light microscope. Major prediction is stoma that present in the abaxial, adaxial surfaces of the leaves. These observations clearly helpful for plants during basic food making process photosynthesisand in stress conditions to maintain the water usage.

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