A Novel Technique for Epidermal Morphology of Leaf

Ratikanta Maiti*
Vibha Seeds, Inspire, Plot#21, Sector 1, Huda Techno Enclave,
High Tech City Road, Madhapur, Hyderabad, Andhra Pradesh (500 081), India

Article History

Manuscript No. 15
Received 21st April, 2010
Received in revised form 1st may, 2010
Accepted in final form 13th may, 2010

Correspondence to
E-mail: ratikanta.maiti@gmail.com

Keywords
Epidermis, epidermal peeling, epidermal morphology, epidermal study

Abstract

The article describes a novel technique for morphological study of leaf epidermis in the field condition. Epidermal study provides a basis for taxonomic interrelationship of larger groups such as family. It helps in identification and differentiation of crop cultivars/varieties. The technique is referred to as epidermal peeling. It can directly be done on leaf or stem of plant. This easy to do method involves application of sticky solution of thermocol dissolved in xylene on leaf surface, semi-drying of solution, pressing of transparent cellophane tape on it, and pasting of cellophane on slide for observing epidermal tissue system under microscope. The method is scientific, easy to handle, and quick; helps to observe epidermis with stomata in natural open state without damaging structure; and useful for studying stomatal conductivity and gaseous exchange including the study of stomatal index, trichome density as well as density of glands and crystals.

1. Epidermis

Leaf is covered on its both surfaces by a single layered epidermis. Outer layer of epidermis is usually thick covered with a waxy substance called cutin (cuticle layer). Since outer wall of epidermis is thick and cutinized, water can not pass through it rapidly. Thus, epidermis controls transpiration to a great extent in xerophytic plants due to the presence of thick waxy cuticle, sunken stomata, and thick layer of closely packed palisade cells. Drought tolerant cultivars possess few or no stomata on upper leaf surface, but many on lower surface for gaseous exchange. Epidermis also prevents the entrance of pathogens into the interior of leaf. Another function of the epidermis is protection of soft internal tissues of leaf from mechanical injuries.

Stomata are small openings in epidermal layer. They are found in abundance in lower epidermis of dorso-ventral leaf. Very few are present in upper epidermis and sometimes absent altogether. Each stoma remains surrounded by two semi-lunar (bean shaped) guard cells in dicots. Four main types of stomata which occur in dicotyledons are Ranunculaceous or Anomocytic, Cruciferous or Anisocytic, Rubiaceous or Paracytic, and Caryophyllaceous or Diacytic. Monocots have dumb-bell shaped guard cells (gramineous type). Coniferous stomata are sunken, and appear suspended from subsidiary cells arching over them. Stomata facilitate in exchange of gases between leaf and environment. Evapo-transpiration of water also takes place through stomata. All the epidermal cells except guard cells are colourless.

Some of the epidermal cells in most of the plants grow out in the form of hairs or trichomes. They may be unicellular or multicellular. Hair may be of several types such as stinging, lactiferous, bladder like, mucilage, arachnoid, calcified or silicified, non-glandular shaggy, glandular shaggy, non-glandular tufted, stellate glandular, branched glandular, and capitate sessile hairs.

Generally, a dense covering of woolly trichomes controls the rate of transpiration. They also reduce heating effect of sunlight, and aid in the protection of plant body from outer injurious agencies, pathogens and insects.

2. Importance of Epidermal Study

Epidermal study provides evidence concerning taxonomic interrelationship of larger group such as family, or helps to establish real affinities of genera of uncertain taxonomic status. Trichomes—whole family may frequently be recognized by the presence of one or more distinctive type of hairs; stomata— different types identified in different families; and epidermal cells differ considerably in size, shape and outline in different plants; and epidermal cells—vertical or horizontal partitions are of specific or almost generic value, since these features are of restricted occurrence. Density of non-glandular trichomes is related to insect resistance such as shoot-fly tolerance in sorghum and other crops. Presence of glandular hairs may be related to the preference or non-preference of oviposition by insects or having medicinal significance, etc.

3. Methodology

Leaf morpho-anatomical characteristics help in identification and differentiation of crop cultivars/varieties of plants which can be achieved through epidermal peeling process—a non-conventional technique used in epidermal study. This procedure can directly be done on the leaf or stem of plant on field. So, one can get stomata without closing, and in natural condition of epidermal system.

- Take small amount of xylene [$C_6H_4(CH_3)_2$] in glass petriplate.
- Gradually dissolve thermocol in xylene stirring with glass rod.
- Add step by step thermacol to the solution and stir with glass rod until it turns into honey like solution (gummy).

- Take the solution with little finger and apply only once on lower and upper surfaces in the middle of the leaf in between midrib and leaf margin.
- Allow the leaf to semi-dry the solution.
- Put a transparent cellophane tape on the semi-dried area of leaf and press lightly.
- Remove the tape gently and paste on the labelled microscopic slide.
- Observe the slide under low and high power for observation of epidermal tissue system (Figure 1).

4. Advantages

- Scientific method and easy to handle.
- Quick and time saving.
- One can observe epidermis with stomata in natural open state without damaging of epidermal structure. It may be useful for studying stomatal conductivity and gaseous exchange.
- Helps in studying the stomatal index, trichome density as well as density of glands and crystals.

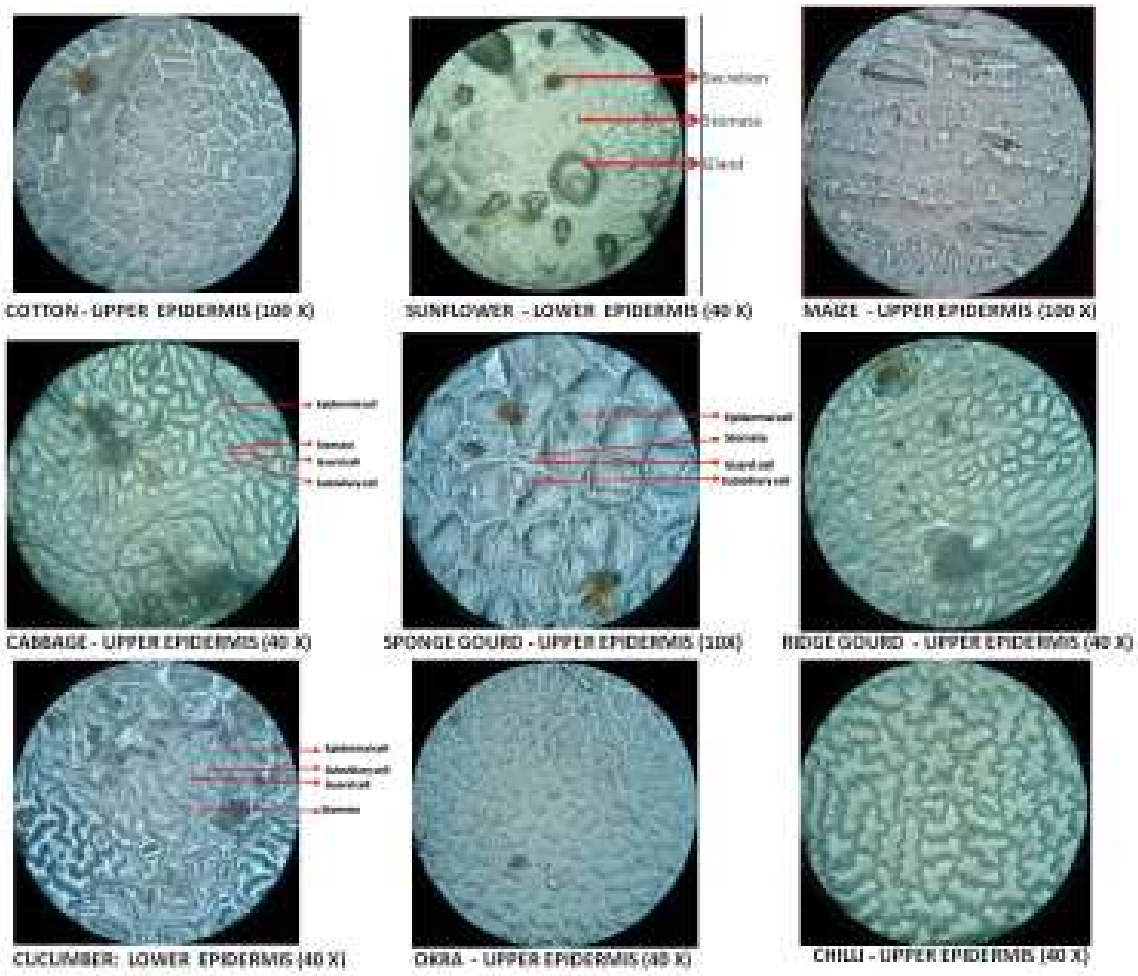

Figure 1: Epidermis of some field and vegetable crops shown under microscope