Chapter 3

Leaf Features

As we observe the behavior of leaf growth, we have to under stand the physiology of plant leaves. A model of plant leaves which can be used for generate the venation and shapes of the leaves will base on the basic of leaf structure. This chapter will describe all of the interesting features used to determine the leaf model.

3.1 Basic Terminology

The features of a leaf can be used to identify plants. This section describes the names of each part of a leaf referred in this thesis. A basic leaf structure is consisted of the primary vein (midrib), the secondary vein, petiole, margin, base, and apex.

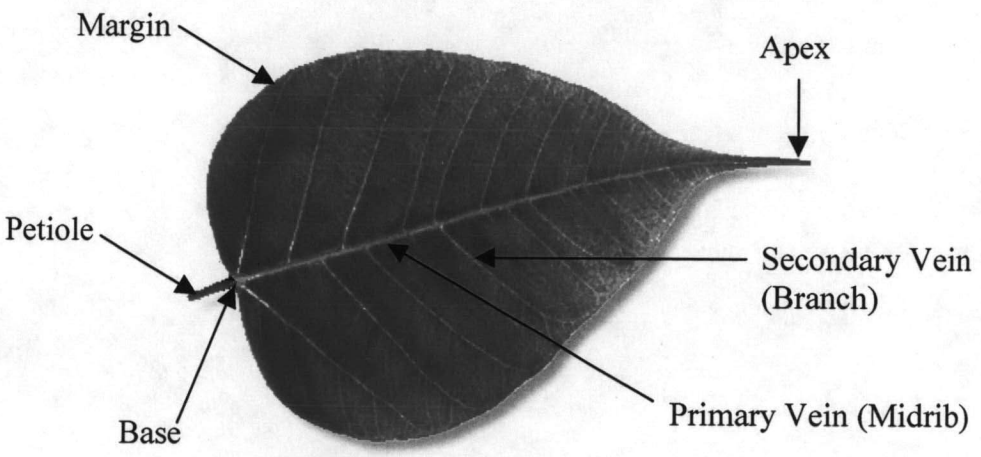

Figure 3.1: A basic leaf structure.

primary vein (midrib) - the widest vein of the leaf or the middle vein of the leaf. Primaries usually originate at or above the petiole.

secondary vein (branch) - the next narrower class of veins after the primary.

petiole - the stalk of the leaf.

margin - the edge of the leaf.

base – bottom of the leaf.

apex - top of the leaf.

3.2 Types of Leaf Shape

The first step in identifying a plant is to look at its leaves and determine the shape of their blade. Leaf shapes come in a variety and are usually characteristic of its tree species [35]. Types of leaf shape we are interested are illustrated in Figure 3.2.

Lanceolate - Lance-shaped, tapering from the base to an apex; much longer than wide.
Oblong - Long and wide with nearly parallel sides.
Elliptical - Football (American) shaped - a flatten circle, usually more than twice as long as wide.
Ovate - Egg-shaped with the broadest part toward the base.
Cordate - Heart shaped with a basal sinus.
Obcordate - Heart shaped.

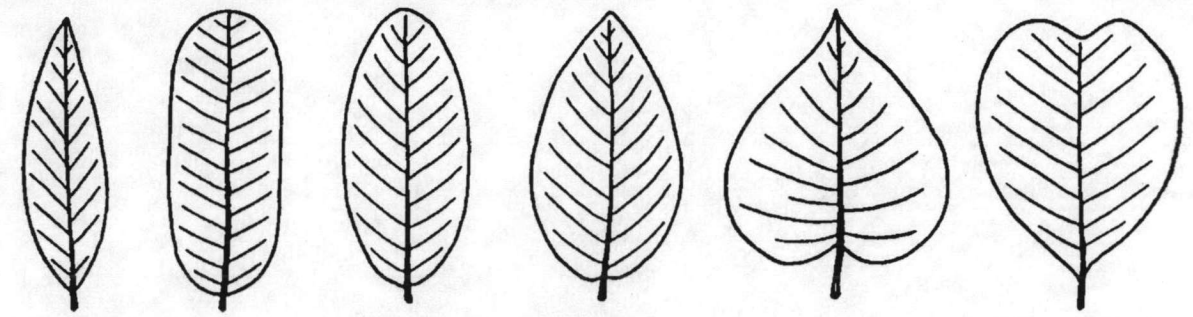

Figure 3.2: General leaf blade shape.

3.3 The Leaf Development

There are two stages of leaf development: initial stage of leaf formation and growth stage [36]. Though variations in morphology exist between the shoots of monocot and dicot plants, the initial stages of leaf formation are the same (Figure 3.3).

Leaf formation starts immediately behind the top meristem (1) with anticlinal divisions(with the division plane at right angles to the surface; the division in parallel to the surface) in the cell layers under the epidermal layer (red in 2). After the first divisions also periclinal (at right angles to the surface) divisions occur the epidermis as well as in the layers underneath (blue in 2). The result is a small bulge (3) that will further develop into a leaf. From this point on, leaf growth differs between dicots and monocots.

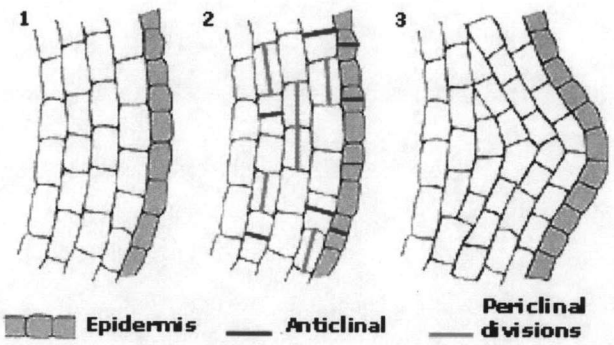

Figure 3.3: An initial stage of the leaf formation.

In dicot leaves. The first step of the development is called leaf morphogenesis. The leaf is formed its shape and its structure at the first time. The initially formed bulge further elongates by mitotic cell divisions throughout the bulge. Next, at the top of the extended bulge, cells start to divide a single plane causing the bulge to broaden. Depending on the species, division activity may decrease or even cease completely. Thus, the typical irregularly shaped leaf blade of dicots is formed. The lower part of the extended bulge will develop into the leaf stalk or petiole.

The primary vein of a leaf, which is composed of the vascular tissues, is formed firstly. The vascular tissues of the leaf are branched from the stem. The primary vein grows from the leaf base to its apex, and then the secondary veins are branched out from the primary veins.

The second step of leaf development is the growth of the leaf. The rate of leaf growth is depends on two factors, the rate of cells division, and the rate of cell spanning rate. The development in dicot leaves will growth in two directions: along the midrib and across the leaf blade.

In monocot leaves, the development is the growth along the leaf length. The initial bulge further elongates by mitotic cell divisions until a certain size is reached. Then, growth stops. Only cells in a small zone at the basis of the leaf further divide. This how the typical long arrays of cells and the parallel venation of monocot leaves arise. The top of the extended bulge develops into the leaf blade. Leaf growth may continue without limitation as long as the meristem exists. As a result, grasses can resume growth after mowing or grazing. This behavior is common to all monocots.