



# **Manual of Leaf Architecture**

**Morphological description and categorization  
of dicotyledonous and net-veined monocotyledonous  
angiosperms**

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# INTRODUCTION

Since the time of Linnaeus the identification and reconstruction of relationships between plants have been based largely on features of the reproductive organs. Although flower and fruit characters have proved very useful in both botany and paleobotany, there are situations in which these organs are not available for study. For example, leaf compression and impression fossils are the most common macroscopic remains of plants, but they are generally not attached to other plant organs. Because of their abundance and dense stratigraphic occurrence, fossil leaves can provide an enormous amount of information about the composition and diversity of past floras - if they can be used to recognize species reliably and assign them to higher taxa. Tropical botanists also find themselves confronted with the need to identify and classify plants using vegetative characters because so many long-lived tropical plants flower infrequently and irregularly. In spite of the success of Linnaeus's sexual system and its descendants, there is a great need to be able to identify and classify dispersed leaves. The overall purpose of this manual is to help you do that.

The problem of working with isolated leaves is a long-standing one in paleobotany. Lacking both an accepted system of terms for describing leaf form, and a knowledge of the systematic distribution of leaf features among living angiosperms, and in many cases faced with poorly preserved fossils, most early workers focused on overall characters of leaf shape and size that ultimately have not proven very useful in recognizing species or higher taxa. Names of living genera were widely applied to fossils so that there are, for example, many taxonomically valid fossil species of *Ficus*, *Populus*, and *Aralia* based on poorly preserved leaves with only vague similarities to the living members of these genera. Late nineteenth and early twentieth century angiosperm paleobotanists left a legacy of poorly defined taxa with botanically misleading names.

In the last half of the twentieth century two new approaches have helped rectify this problem. One has been to study multiple organs, including leaves, thought to represent the same plant species, either because they are preserved in attachment or because they occur together at many localities. This approach allows traditional characters of flowers and fruits to be used in defining extinct taxa and determining their relationships (e.g., Manchester 1986). Studying characters of multiple organs of the same plant allows fossil taxa to be described more comprehensively and systematic relationships to be established with greater certainty than can be gained from leaves alone. However, there are many types of fossil leaves that have not been found attached to or consistently associated with other organs. The second approach has been to identify systematically informative leaf features (Hickey and Wolfe 1975, Wolfe 1989, Hickey and Taylor 1991) that allow species to be recognized on the basis of dispersed leaves; these features may also permit the fossil to be assigned to a family or higher taxonomic category. This approach has been used principally in dicotyledonous angiosperms with complex vein systems. Among living dicots, foliar characters may or may not offer conclusive evidence of the generic or higher-level affinities of a plant, but generally they do allow even closely related species to be distinguished (e.g., Merrill 1978).

The main goal of this manual is to define and illustrate for the reader an unambiguous and standard set of terms for describing leaf form and venation, particularly of dicots. This manual also provides a template and set of instructions that show how descriptive information can be entered into a standardized database of fossil and extant leaves. The Leaf Architecture Working Group (LAWG) adopted and in some cases added or modified the definitions and terms found in this manual and developed its format.



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