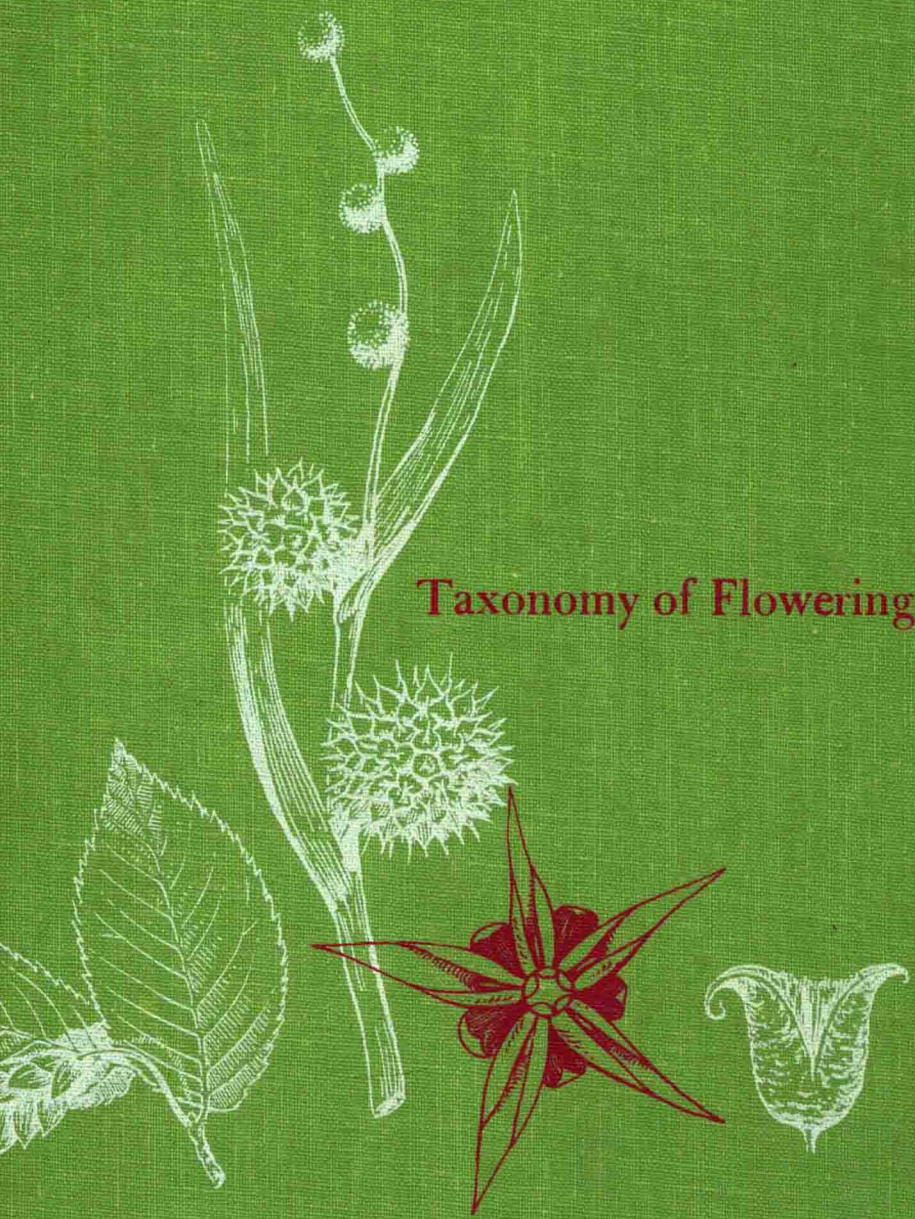
Taxonomy of Flowering Plants



Second Edition

Taxonomy of Flowering Plants

C. L. PORTER *University of Wyoming*

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TAXONOMY OF FLOWERING PLANTS

A SERIES OF BOOKS IN BIOLOGY

Editors: Ralph Emerson, Donald Kennedy, Roderic B. Park, George W. Beadle (1946–1961), Douglas Whitaker (1946–1966)

A flowering branch of the Tulip-tree, or Yellow Poplar, *Liriodendron tulipifera* L. The Magnolia Family, of which this plant is a member, is often regarded as one of the most primitive of all families of flowering plants. The scientific name, meaning "the lily tree that bears tulips," is highly descriptive.

TO

all who have ever wondered
"What plant is that?"
and especially to Marj,
this book is fondly dedicated.

PREFACE

ALTHOUGH most branches of botany have long been adequately served by an array of suitable texts, plant taxonomy, the oldest branch, has not been so fortunate. Until quite recently it has been necessary to improvise text material for classwork; and even now we are faced, for the most part, with a choice between texts that are really reference books for advanced students and much abbreviated texts that have had much of the meat of the subject deleted from them. It is my hope that this book will help to fill that gap.

To this end I have attempted to put together such a factual and simplified account of basic principles as is needed by students in a beginning course in taxonomy, together with illustrated descriptions of more than a hundred families of flowering plants representative of the North American flora. Only the flowering plants, or angiosperms, are included, for the vascular cryptogams (ferns and fern allies) and the gymnosperms are often dealt with in separate courses in morphology and dendrology, and for those groups excellent texts are available. In my experience, a study of the basic principles and of selected angiosperm families alone provides ample material for the average beginning course in taxonomy, which is given for a minimum of one semester but preferably extends throughout one school year.

The content of the text is based on the assumption that the students have had at least some introduction to plant science, such as that provided by the usual beginning course in botany. It is particularly aimed at undergraduate students in such practical fields of study as agronomy, range management, forestry, and wildlife management and conservation. This has necessitated a short, concise treatment and the omission of the detailed discussion and elaboration that are found in the published research of many taxonomic experts of the past century. Perhaps I have been guilty of oversimplification in attempting to get at the essence of a complex subject. Those who feel that this is true, as well as more advanced students, will find numerous references to pertinent literature. By delving into at least some of it, the student will gain a better and more detailed knowledge of some of the classical work accomplished in this field.

The text has been divided into three major parts: Part I, dealing with historical and theoretical aspects and with terminology and morphology; Part II, dealing with orders and families of monocotyledons; and Part III, dealing with orders and families of dicotyledons. In practice I have used Parts I and II as the basis

of one semester's work and Part III as the basis of a second semester's work. The instructor may or may not wish to follow this sequence.

One method of learning families, proved by a goodly number of classes over the years, is the study of floral diagrams and flower sections, together with other illustrative material, such as habit sketches or photographs and illustrations of fruits. This has called for the development of a system of diagrams not usually found in texts of this sort. These pictorial aids impress the minds of students with the varied floral morphology of plant families much better than conventional descriptions do. It is generally possible to identify a family by its floral diagram alone. In attempting to become acquainted with the flora of any region, one must first learn to recognize *families* rather than a great diversity of genera and species. These may come later with added field experience.

These pages have had a slow evolution. In the beginning they were merely outlines that I used as guides when conducting classes in taxonomy some thirty years ago; but at the insistence of the suffering students, who had difficulty in taking down notes from the blackboard, they gradually took the form of mimeographed notes distributed to classes in lieu of a textbook. These notes have been revised repeatedly as need arose until they now form the basis for this text. In drafting the final manuscript I have incorporated numerous suggestions of my colleagues. The drawings have been prepared by Mr. Evan Gillespie from sketches I have furnished, and I have added some of my own photographs to supplement the drawings.

In this second edition the text has been updated by taking into account some of the newer aspects of taxonomy, and additional references to some of the recently published literature have been added. A few illustrations have been improved or changed, and a few have been added.

I am indeed grateful to the many persons who have offered helpful suggestions, and I shall welcome further comments from students and fellow teachers.

July 1966 C. L. PORTER

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Part I

HISTORY, PRINCIPLES AND METHODS

CHAPTER 1

The Aims of Taxonomy

"It has been already suggested, and forcibly enough, that plant taxonomy was not invented in any school, or by any philosopher; that it is everywhere as old as language; that no plant name is the name of an individual plant, but is always the name of some group of individuals, and that all grouping is classifying."—Edward Lee Greene in *Landmarks of Botanical History* (1909), page 106.

Plant taxonomy has two aims: (1) to identify all the kinds of plants; (2) to arrange the kinds of plants into a scheme of classification that will show their true relationships.

The first aim requires us to make a complete inventory of all the plants on the face of the earth. This is not an insurmountable task, but—largely because our knowledge of many tropical regions is far from complete—it is still a long way from accomplishment. But even the fully explored and more civilized parts of the globe still present problems in plant identification, particularly in such perplexing groups as the genus *Lupinus* (Lupines) of western North America.

Anyone can learn, with a little practice, to identify a goodly number of things, be they people, dogs, rocks, or plants. The ancient civilizations produced people who could recognize and name many hundreds of stars and even arrange them into constellations. This was pure taxonomy. People have always needed to name things in order to have a means of communication. In scientific work it is essential that we be able to apply names with precision, for the validity of

much research hinges on the identification of the materials involved. For botanists it is often necessary to identify materials beyond the species level, for minor differences in the kinds of plant under investigation may mean a major difference in the results. By furnishing such identification to others, the taxonomist serves other branches of science in a basic way. *All specialists and all botanical laboratory scientists should realize the importance of accurate identification of the materials with which they work.*

The second aim of the taxonomist is to seek out the evidence that will enable him to understand the relationships among groups of plants —among the lesser groups, or taxa, such as species and their subdivisions, and among the larger groups such as genera, families, and orders. To do this effectively, the taxonomist must utilize the methods and resources of all the major fields of botanical investigation. The *morphologist* gives him an understanding of form and structure, including such refinements as comparative anatomy and embryology. The *physiologist* can point out requirements for existence (such things as "physiological species" seem to occur in plants—groups that appear to be identical but differ in their requirements). The *ecologist* can furnish information about the relationships between plants and their environment, about how environment may affect form and structure, and about the selective action of the environment in determining which plants will survive. The *geneticist* and the *cytologist* contribute information concerning inheritance and reproduction as well as chromosome number and morphology, enabling the taxonomist to judge better whether he is dealing with distinct species or with lesser categories. *Biochemistry* is used effectively to solve taxonomic riddles, while some workers use *statistics* and *computers* in dealing with plant characters.

In cultivating these fields of investigation, the taxonomist must be able to call on others for assistance. *Geology* (particularly historical geology) furnishes information about past life, climates, and changing land forms, and this enables the taxonomist to interpret plant distribution and to understand something of the long history and evolution of plant life on the earth. A knowledge of *physical geography* is useful when he studies plant distribution and migration, whether local or world-wide, and it also points out what physical barriers to interbreeding may be present.

All this does not imply that the taxonomist is always an expert in all the fields mentioned; but it indicates the diversified knowledge that may be useful to the student.

Taxonomists are sometimes criticized for continually changing the