

FICUS

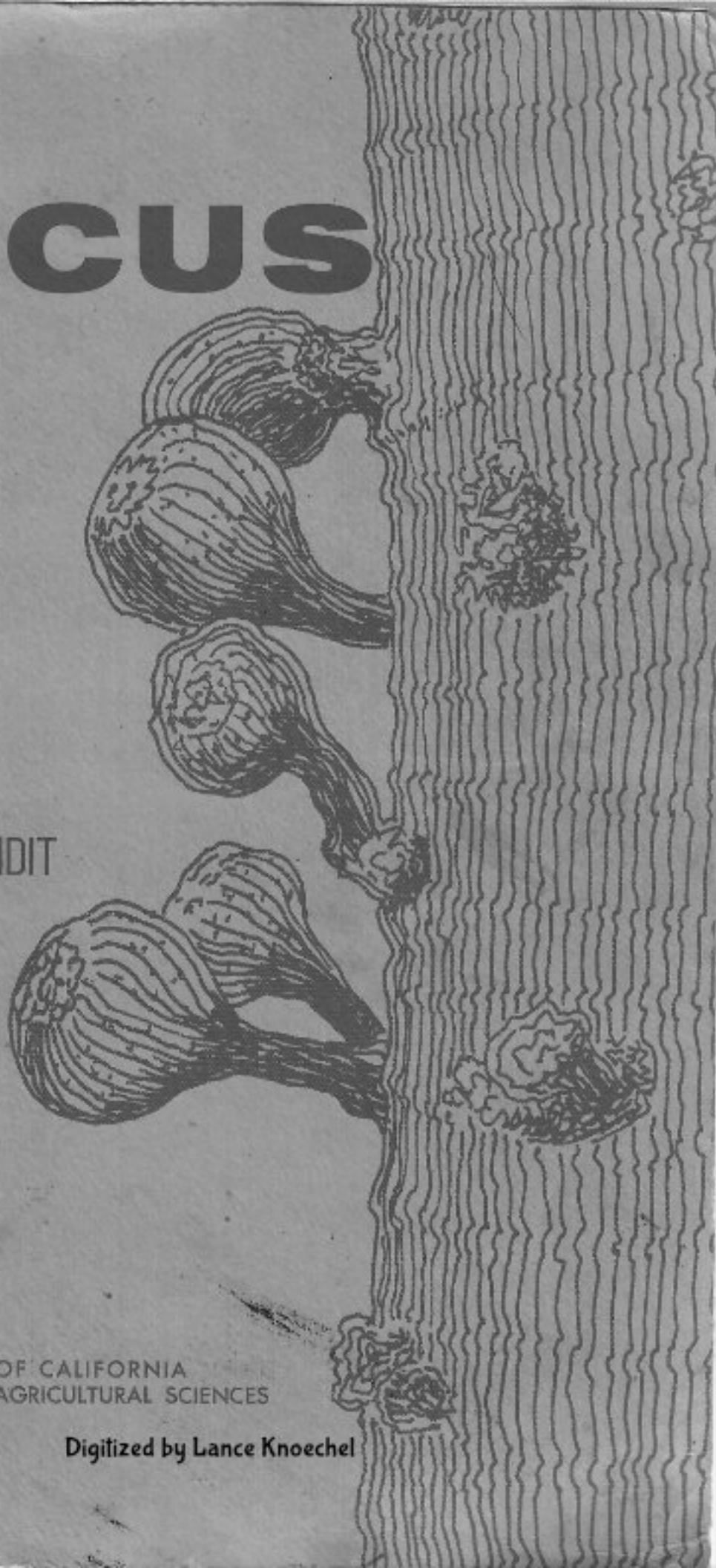
the
exotic
species

IRA J. CONDIT

UNIVERSITY OF CALIFORNIA
DIVISION OF AGRICULTURAL SCIENCES

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FICUS: THE EXOTIC SPECIES

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1969

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PREFACE

SOMEWHAT MORE than fifty years ago, I received an appointment as instructor in the Department of Citriculture, University of California, Berkeley. Soon thereafter, I began research, not so much on citrus as on other subtropical fruits such as the loquat, persimmon, and avocado. Almost from the outset, however, I also became interested in the Common Fig, *Ficus carica*, its varieties, culture, and the problems connected with its fruit development. This interest naturally led to the study of other members of the genus, especially those closely related to the Common Fig or of species which might serve as rootstocks for it. This interest has endured and grown during my subsequent association with the University of California Citrus Research Center and Agricultural Experiment Station at Riverside. Some results of this research, aside from those in the present work, are to be found in the publications listed under my name in the bibliography (numbers 168 through 186a).

Interest in these exotic species of *Ficus* is keen; three examples may be given to indicate the extent of it. In southern California, thousands of trees of the Laurel Fig, *F. microcarpa* [retusa], and its variety *nitida*, have been planted along city streets. For a number of years, wholesale nurseries in Florida and Puerto Rico have been flooding retail markets with marcotted (air-layered) plants of the India Rubber Tree, *F. elastica*, and its variety *decora*, for ornamenting homes and offices. In Hawaii, the rapid growth in popularity of a ground cover, *F. tikoua* or Waipahu Fig, has indicated the possibilities of introducing other species as ornamentals, as unusual botanical specimens, and as sources of latex and other useful substances.

The word "exotic" forms part of the title of this publication, meaning foreign, strange, or brought in from abroad. *Exotica* is the title of a book by Graf (324), which has appeared in three editions, with

a fourth in preparation. In *Exotica 3*, there are illustrations and short descriptions of twenty thousand exotic plants, including fifty-one species of *Ficus* which Mr. Graf has had under cultivation or observation. However, the number of species of *Ficus* treated in *Exotica* is only a small fraction of the total recorded as having once been grown or now being cultivated in various nurseries, arboreta, parks, botanical gardens, or private collections throughout the world.

The present work is based on special studies beginning in 1940. In 1948 and 1949, I visited Cuba and Florida, where I made extensive collections and took notes on the species represented at the Atkins Garden of Harvard University, Cienfuegos; the Fairchild Tropical Garden and the USDA Plant Introduction Station (PIS), both at Miami; and at various other localities. A special grant of two thousand dollars, allocated in 1958, again enabled me to visit Florida, also south Texas, and to spend six weeks each in 1959 and 1960 working with the extensive collections of *Ficus* in the H. L. Lyon Arboretum, Honolulu, and elsewhere in the Islands. In 1965, another two months were spent in Hawaii collecting and identifying specimens available on the University of Hawaii campus, in arboreta, and in parks and gardens.

In the first four chapters of this publication, there are detailed the features peculiar to this confused and confusing group of plants, as gained by personal observation, often aided by reference to articles enumerated in Literature Cited. This material is designed to be of interest to botanists, professional horticulturists, nurserymen, and private gardeners. By consulting accounts of the various species in chapters VI through XVI, botanists will be able to evaluate the nomenclature, to check references to earlier articles as well as illustrations, and to find systematic descriptions of both vegetative and fruit

characters. They should also find the two keys in chapter V helpful in the identification of the 108 species included in my major descriptions. Nurserymen will discover data on habits of growth, eventual size, hardiness, and probable ornamental value. One feature which is rarely found in botanical treatises is the listing, as far as possible, of the pollinating insects which inhabit the figs of species in their native habitats.

In addition to the 108 species fully described, chapter XVI presents briefer accounts of over 170 additional species, which are often found to be interrelated with others in the same chapter or with some of those in the major descriptions. This synonymy in the genus has arisen through the independent efforts of many botanists who were not always aware that a given kind had already been named and described by one or more other workers. This complexity is further increased by the tendency toward variation in many species, some of which have been extensively subdivided. My own descriptions have been based upon personal observation wherever possible, but many data have also been derived from consultation of the works of various cited authors. The

reader will note a few apparent comparative discrepancies in the descriptive notes; these are included for whatever value they may possess as having been given by recognized authorities. Finally, over forty species (so-styled) are casually mentioned in the text which are not described in this work under the names given, but which occur in the quoted writings of earlier botanists.

A very comprehensive bibliography is presented, comprising over 850 titles by some 680 authors. While some writers may not be frequently cited because of their highly specialized accounts, certain others who have covered the entire field are quoted repeatedly. Outstanding among these is Dr. E. J. H. Corner, of Cambridge University, who has contributed splendid efforts toward "unscrambling" the involved synonymy, as a perusal of my descriptions will clearly show. Several other authors have been cited many times because of the great value of their findings to the study.

Finally, the inclusion of fifty text figures, thirty-five plates, and several classified indexes should render the present work of considerable value and convenience to the reader.

ACKNOWLEDGMENTS

THE EXTENSIVE "Literature Cited" section indicates the sources of much of the information presented in this volume. I acknowledge my indebtedness to these writers and to all who have contributed in various ways to the preparation of the manuscript. My gratitude is tendered especially to the following, who have helped to make the publication possible: To Dr. William S. Stewart, Department Director, Los Angeles State and County Arboreta, Arcadia, and other county arboreta and botanic gardens, for contributing the Foreword; to Julius Enderud, Laboratory Technician, my friend and co-worker for more than thirty years, who has faithfully maintained our collection of common and exotic figs for study and kept records of them at Riverside and Arcadia; to Dr. E. J. H. Corner, Botany School, Cambridge University, who has identified various species for us and whose numerous publications are frequently referred to in the text and Literature Cited section; to Dr. Gordon P. De Wolf, Georgia Southern College, Statesboro (now Horticultural Taxonomist, Arnold Arboretum, Harvard University), for his clarification of the nomenclature of various African and American species; to Stanley Kiem, Dr. John Popenoe, and associates, Fairchild Tropical Garden, Miami, Florida, for hospitality and courtesies extended during my visit in 1958; to Dr. Harold F. Winters, New Crops Research Branch, USDA, Beltsville, Maryland, for voluminous correspondence on Plant Introduction (PI) numbers and for obtaining seeds of various species for our collection; to Dr. M. H. Gaskins and associates, U. S. Plant Introduction Station (PIS), Miami, Florida, for courtesies and assistance during my visit in 1958 and for botanical specimens sent for study and illustration; to Norman Maxwell, Agricultural Substation No. 15, Weslaco, Texas, for help during my visit in 1958 and subsequent notes on collections of *Ficus* in south Texas; to L. W.

Bryan, State Forester (now retired), Kailua-Kona, Hawaii, for propagation of several species of *Ficus* for trial, as well as for piloting me in a jeep to the little-known and seldom-visited Arboretum in the Halawa-Nuilii Forest Reserve; to Dr. R. A. Hamilton, Department of Horticulture, Dr. George Gillett, Botany Department, and associates, University of Hawaii; also, Mr. Don Anderson, H. L. Lyon Arboretum, Honolulu, for helping to make my three visits so pleasant and profitable and for furnishing photographs and specimens for illustration and study (even though some of the fruits had to be immersed in a preservative such as vodka for future study!).

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Several librarians have rendered invaluable assistance in checking references used in the text and Literature Cited section, with especial thanks to Mrs. Kathryn Forrest, Citrus Research Center, University of California, Riverside; Mrs. Helen Sharsmith, Senior Herbarium Botanist, Mrs. Virginia Fox, Agricultural Reference Service, and Miss Helen Kaufman, Forestry Library, all three at the University of California, Berkeley; Mrs. Lazella Schwarten, Gray Herbarium, Harvard

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Miss Mary F. Barrett, Bloomfield, New Jersey, contributed immeasurably, both by correspondence and by her excellent publications, to the identification and nomenclature of various species; Dr. Vernon Stoutemyer, Ornamental Horticulture, and Dr. Mildred Mathias, Department of Botany, both of UCLA, assisted by the frequent exchange of correspondence and by the maintenance of several species of exotic figs in the University Botanical Garden; Dr. R. J. Seibert, Director, Longwood Gardens, Kennett Square, Pennsylvania, exchanged information and forwarded specimens; Harry Fulton, Washington, D.C., is thanked for his past cooperation in the study of fig varieties, and recently for checking citations to literature in District of Columbia libraries; my friend and fellow traveler to Florida in 1958, A. J. Basinger, entomologist (retired), Riverside, contributed a number of photographs which help to illustrate the text; the excellent handiwork of Richard H. Burnett, Laboratory Technician, Citrus Research Center, University of California, Riverside, is in evidence in the thirty-five plates which appear in this book. Dennis Kucera, naturalist-photographer at Arcadia (LASCA), has contributed fourteen beautiful photographs which appear as various figures. They depict species which were growing in the Arboretum. In addition, numerous nurserymen and park executives in Florida and California have donated specimens for trial and have welcomed me as a visitor.

Especial thanks are given to the following (some of whom have been mentioned above for other services), who perused portions of the manuscript and have materially helped me to make corrections and additions: Dr. Vernon Stoutemyer and Dr. Mildred Mathias, of UCLA; Mrs. Julia F. Morton, Director, Morton Collectanea, University of Miami, Coral Gables, Florida, who went over the pages with the proverbial fine-tooth comb; Dr. Elizabeth McClintock, Botanist, and Dr. George E. Lindsay, Director, both of the California Academy of Sciences, San Francisco; Dr. R. J. Seibert, Director, Longwood Gardens, Kennett Square, Pennsylvania; and Dr. R. W. Scora, Systematic Botanist, Horticultural Science, University of California, Riverside.

I would be derelict in writing this section if I failed to extend heartfelt appreciation to the stenographers, secretaries, and copyists who spent long and sometimes weary hours transcribing my rough notes to typewritten manuscript pages.

Grant V. Wallace, editor with Agricultural Publications, University of California, Berkeley, an ardent amateur horticulturist who shares my interests, has made a thorough analysis of all portions of this manuscript while preparing it for press, and has contributed quite a number of helpful suggestions, as he did when preparing my earlier *Fig Varieties: A Monograph* (*Hilgardia* 23:11, February, 1955).

Lastly, I am deeply indebted to my understanding wife, Mabel Powell Condit, for her encouragement at times when I sorely needed a stimulus to my ebbing morale.

IRA J. CONDIT
Rossmoor
Walnut Creek, California
January, 1969

CONTENTS

CHAPTER I. THE GENUS FIGUS	
Floral Characters	1
Classification	2
Hybrids	3
Number of Species	4
Characters of the Syconia	4
Figure 1 is shown.	
CHAPTER II. FRUITING AND GROWTH HABITS; DEPENDENCE ON INSECTS	
Axillary Fruits	9
Cauliflory	9
Parthenogenesis	10
Parthenocarp	11
Crops	12
Fig Insects	13
Habits of Growth	15
Figures 2 through 22 are shown.	
CHAPTER III. VEGETATIVE AND BOTANICAL CHARACTERS	
Twigs	26
Bark	26
Pubescence	27
Terminal Buds	27
Stipules	27
Latex	28
Leaves: Macroscopic Characters	29
Leaves: Microscopic Characters	35
Figures 23 through 26 are shown.	
CHAPTER IV. PRACTICAL CONSIDERATIONS AND NOTES ON FOLKLORE	
Climatology	36
Propagation	37
Ornamental Value	39
Economic Utility	43
Pests and Diseases	49
Folklore	50
Figures 27 through 36 are shown.	
CHAPTER V. KEYS FOR IDENTIFICATION	
Part A: Introduction	51
Part B: Key Based on Vegetative Characters	53
Part C: Key Based on Characters of Fruit	67
CHAPTER VI. DESCRIPTIONS: SPECIES 1 THROUGH 7 72	
(See the Index of Species, Varieties, and Synonyms for alphabetical locations of all species.) Figure 37 is shown.	
CHAPTER VII. DESCRIPTIONS: SPECIES 8 THROUGH 17 81	
Figures 38 and 39 are shown.	

CHAPTER VIII. DESCRIPTIONS: SPECIES 18 THROUGH 25	97
Figure 40 is shown.	
CHAPTER IX. DESCRIPTIONS: SPECIES 26 THROUGH 34	111
Figures 41 and 42 are shown.	
CHAPTER X. DESCRIPTIONS: SPECIES 35 THROUGH 46	133
CHAPTER XI. DESCRIPTIONS: SPECIES 47 THROUGH 58	152
CHAPTER XII. DESCRIPTIONS: SPECIES 59 THROUGH 71	167
Figures 43 through 47 are shown.	
CHAPTER XIII. DESCRIPTIONS: SPECIES 72 THROUGH 83	186
Figure 48 is shown.	
CHAPTER XIV. DESCRIPTIONS: SPECIES 84 THROUGH 96	200
CHAPTER XV. DESCRIPTIONS: SPECIES 97 THROUGH 108	216
Figures 49 and 50 are shown.	
CHAPTER XVI. DESCRIPTIONS OF ADDITIONAL SPECIES (ARRANGED ALPHABETICALLY)	233
LITERATURE CITED	265
GLOSSARY OF BOTANICAL TERMS	302
PLATES (I THROUGH XXXV)	307
INDEX OF SPECIES, VARIETIES, AND SYNONYMS	342
INDEX OF GENERIC SUBDIVISIONS	351
INDEX OF FIG INSECTS	352
GENERAL INDEX	355

Short-Form Terms Used in Text

(f.) : Used following a botanical author's name, this stands for "filius" or "son," to indicate that the son, not the father of the same name, described the species.

FHB: Federal Horticultural Board.

HBK: Used after a species name, this means the team composed of Baron Friedrich Wilhelm Heinrich Alexander von Humboldt, German zoologist; Aimé Jacques Alexandre Bonpland, French botanist; and Carl Sigismund Kunth, professor of botany, Berlin. Kunth wrote the text of their work describing a scientific expedition to tropical America in the early nineteenth century, entitled *Nova Genera et Species Plantarum*, listed as (450) in Literature Cited.

HSPA: Hawaiian Sugar Planters' Association.

LASCA: Los Angeles State and County Arboreta, Arcadia.

PI No.: Plant Introduction number, United States Department of Agriculture.

PIS: USDA Plant Introduction Station, Miami, Florida.

Riverside, or University of California with location not specified: This alludes to the University of California Citrus Research Center and Agricultural Experiment Station, Riverside.

UCLA: University of California, Los Angeles.

USDA: United States Department of Agriculture, Washington, D.C.

CHAPTER I

THE GENUS *FICUS*

Floral Characters. It is not the province of this publication to discuss in detail the systematic botany of the genus. However, a few salient features may be given of the genus itself, and of the attempts by various botanists to simplify its taxonomy by dividing it into several subgenera, sections, and even lesser subdivisions. The vegetative characters are extremely variable, and the botanical classification is based primarily on floral characters, a knowledge of which is imperative if one species is to be differentiated from another. Fig flowers are borne on the inside of a hollow receptacle or syconium, and are never perfect. C. F. Saunders (672-673) described the interior of a fig produced by *Ficus pumila*: "While you have it open, notice the remarkable flowers, myriads of them rosily lining the baglike body we call a 'fig'; flowers that are born(e) literally to blush unseen."

The pistillate flowers are either long-styled or short-styled; the latter, adapted to oviposition by a fig insect, are commonly designated "gall flowers." G. King (437) called these "pseudo-female or gall flowers." Corner (191) frequently referred to the short-styled pistillate flowers as "gall flowers," and also to a "gall ovary in the male flower." Condit and Flanders (185) believed the term "gall flower" to be a misnomer, since these insect-inhabited flowers are normal, and show no swellings or excrescences typical of galls. This is correct for the flowers of the Common Fig, *Ficus carica*, but not for the flowers of many other species of the genus. In a recent letter, Dr. E. J. H. Corner stated that in these flowers, "the ovary bellies out abnormally, not with a seed, but with an insect, so that the shape of the ripened ovary distinguishes it from the true fruit with seeds." See Corner (199) for a detailed account of anthers, filaments, perianths, and pistillodes of *Ficus*.

The peculiar association of insects and the fig fruit is discussed in chapter II. The investigations of Solms-Laubach (709) on the male and female flowers of various species of *Ficus* in Java were reviewed by Hemsley (363).

The arrangement or location of the staminate or pistillate flowers in the syconium forms the main basis of botanical classification. In the subgenus *Eusyce*, for example, long-styled pistillate flowers are found only in the syconia of one plant; the short-styled pistillate flowers and the staminate flowers are borne in the syconia of another plant. *Ficus carica*, *F. pumila*, and *F. fulva* are typical of species belonging to this subgenus. In the subgenus *Urostigma*, all three types (staminate, short-, and long-styled pistillate flowers) are found in the same syconium. In the subgenus *Synoccia*, long-stalked staminate flowers are distributed thickly over the whole interior of the syconium among the pistillate flowers and the so-called neuter flowers, which are like sterile male flowers. G. King (437) described these neuter flowers as being without trace of either anther or pistil (stigma). Corner (192) regarded the species of *Synoccia* as "occupying one of the highest states of evolution in *Ficus*. They are climbers, with specialized vegetative systems and elaborate cauliflorous receptacles constructed on the principle of the two-phase development which gives the peduncle, collar, and bractless body." Concerning the flowers of the section *Sycocarpus*, Corner (197) stated that the chief character is the entirely gamophyllous perianth: "In the male flower, the perianth is saccate and covers one or, less often, two stamens. In the gall and female flowers, it is saccate [cupular], and variously reduced to an annulus around the stalk of the ovary; in a few species, it is absent, though the stamens are never naked. The reduction of

the perianth in the gall flower is often much less than in the female flower of the same species."

Fig flowers are proterogynous, the condition of dichogamy in which the stigmas of pistillate flowers are receptive to pollen or to oviposition by a fig insect long before the anthers of staminate flowers mature and shed their pollen. In California, for example, the short-styled flowers of caprifigs are ready for oviposition by *Blastophaga* in mid-April, while the pollen of the staminate flowers is not shed until early in June, an interval of six weeks or nearly two months. F. X. Williams (836) emphasized this in his account of Philippine wild figs when he stated that once having entered a fig, the wasp-pollinator never leaves it and soon dies. Further: "A fig cannot be self-fertilized, inasmuch as the male and female flowers are never in the proper stage of development at the same time in the same receptacle." Very little emphasis has been placed on the floral characters of most fig species introduced into cultivation, because practically all lack the presence of the pollinating insect; therefore, flowers in the syconia seldom reach botanical maturity.

Classification. References to systematic studies of species in the genus *Ficus* are made in various parts of this publication. Some examples are those by Miquel, G. King, Mildbraed and Burret, Elmer, Sata, and Mary Barrett. The latest studies of the taxonomy of Asian and Australasian species are by Corner (196, 197, 199, 199b). He maintains that insufficient attention has been given by other botanists to the names of subdivisions made by Miquel and, as the result of extensive studies of herbarium material (over twenty thousand collections), he succeeded in recognizing every taxon described by Miquel. Some of the subgenera and sections classified by Corner follow. (For a complete listing of all the related terms, as used in this book, see the Index of Subgenera, Sections, Subsections, Series, and Subseries, headed "Generic Subdivisions.")

Subgenus *Urostigma* (Gasp.) Miquel

Figs with interleafing apical bracts. Male flowers generally ostiolar. Ovaries entirely red-brown, or in only the upper half. Cystoliths only on the lower side of the lamina. Petiole often articulate to the lamina. Type: *Ficus religiosa* Linné. (The subgenus *Urostigma* is further divided into seven sections, each with series, subseries, or subsections.)

Subgenus *Pharmacosycea* Miquel

Monoecious. All three kinds of flowers in the same receptacle, without lateral bracts on its body. Gall and female flowers similar, but the female generally sessile, with longer style; ovary white, or with a red spot at the base, sessile. Seed smooth, often keeled over the apex. Trees, rarely shrubs (not epiphytic, creeping, or climbing). Leaves generally entire, and with a gland in the axil of each main basal nerve. Type: *Ficus maxima* P. Miller.

Subgenus *Ficus* Linné, section *Ficus*

This is the group with bistaminate male flowers which has *F. carica* Linné as its type. Some other species included are *F. pseudopalma* Blanco, *F. deltoidea* Jack, and *F. hirta* Vahl.

Subgenus *Ficus* Linné, section *Sycidium*
Miquel

Dioecious. Figs pedunculate or pedicellate, without a collar of basal bracts, rarely sessile; body often with scattered lateral bracts. Male flowers ostiolar. Seed small, lenticular, or shortly oblong, generally with a single keel, smooth or, in a few species, reticulate. Examples of species in the three subsections and the thirteen series are *F. aspera* Forster (f.), *F. semicordata* B. Ham., *F. heterophylla* Linné (f.), and *F. tinctoria* Forster (f.). In the subgenus *Ficus*, Corner also includes five other sections, each with various series and subseries. In the section *Rhizocladus* Endl., series *Plagiostigmaticae* Corner, he placed *F. pumila* Linné, which is usually assigned to the subgenus *Eusyce* Miquel. *Ficus villosa* Blume is placed in the series *Ramentaceae* Corner.

George King (437) gave an excellent account of the efforts made by previous botanists to classify species of *Ficus*, and anyone interested in the details should consult his publication. Linné (473) described 7 species, and was followed by Sprengel (716), who treated 118 species; Blume (92), 93 Malayan species; and Roxburgh (658), 55 species from India. Regarding Vahl's (773) account, King wrote: "In his Enumeration, Vahl put *Ficus* into *Triandria Monogynia*, thus showing that he not only completely misunderstood the sexual arrangements, but that he could never have even counted the stamens." Gasparrini (310, 311) separated the species of *Ficus* into several genera, even putting the caprifig form of the Common Fig into a genus by itself, *Caprificus*. Miquel (538, 539) also published the names of several genera, based solely on floral characters. In his rearrangement of the species, however, Miquel (544) eliminated the separate generic names and reunited the species under 1 genus, *Ficus*, with 6 subgenera, including 406 African and Asian species, 128 from America, and 22 of doubtful origin. G. King (437) followed by arranging species into 2 groups, 3 sections, and 7 subgenera.

Cytological studies in the genus *Ficus* have been reported by Krause (447), Tischler (758, 759), Sugiura (739), and by myself. In my 1928 paper (170), I gave chromosome counts of 7 species; in my 1933 paper (172), counts of 31 species were given. Counts have been made recently of 62 species, a few varieties, and some plants identified only by an accession number, bringing the total to 100 for which chromosome counts are reported. See Condit (184a).

The diploid number of chromosomes is 26 in most species. The variety *decora* of *F. elastica* is a triploid. Five species are tetraploids, with a chromosome complement of 52. All 5 are African, and 4 are mostly restricted to South Africa. In my 1928 paper (170), I pointed out that chromosome characters are not sufficiently distinctive to separate fig from caprifig in *F. carica*. Furthermore, the small size of

the chromosomes and the apparent lack of individuality render such cytological studies of little value in distinguishing one fig species from another unless much higher magnification can be used.

Hybrids. The question arises whether hybridization occurs among the species of *Ficus* in their natural habitats. Corner (196) stated that the series *Auriculatae* consists of one species (*F. auriculata* Loureiro), which is so close to *F. oligodon* Miquel (section *Sycocarpus*) that the two species apparently interbreed in Indo-China. Corner (197) wrote further regarding *F. fistulosa* Blume var. *lucbanensis* Elmer: "I can find no satisfactory specific difference from *F. fistulosa*; yet, if the figs were ridged, var. *lucbanensis* could be referred to *F. septica*. It suggests a hybrid, yet it has not been found in Java or Sumatra, where the two species also overlap."

F. X. Williams (836) reported: "In captivity, fig-pollinating wasps may sometimes be induced to enter other than their own particular species of fig." Also: "In view of the large number of species of wild figs that may occur in a single locality, it is not unreasonable to suppose that hybridization might have taken place there."

In his annual report for 1938, the late E. L. Caum, Associate Botanist of the H. L. Lyon Arboretum, Honolulu, told of a volunteer seedling fig which he judged to be a hybrid, and added: "This brings the total of such putative hybrid figs thus found to be four. . . . None of them has any resemblance to either *Ficus rubiginosa* or *F. macrophylla*, the only two species which are definitely known to be producing viable seed." A personal letter from Mr. Caum, dated August 27, 1946, stated that he had found many volunteer seedlings of *F. rubiginosa* and *F. microcarpa*, including one that very much resembled *F. nota* in leaf characters and cauliflory and another that had long, narrow leaves, very hispid, resembling those of *F. hispida*. However, observations made in the H. L. Lyon Arboretum in 1959 cast doubt on the validity of reports by Mr. Caum on these natural hybrids in *Ficus*.

The artificial production of hybrids by controlled pollination is a different story. A hybrid between *F. pumila* and *F. carica* was reported by Condit (177), apparently the first interspecific hybrid produced in the genus. The possibility therefore suggests itself of hybridizing other species with *F. carica*, the one from which pollen is readily available under cultivation. Pollen may also be secured from the capri-figs borne by *F. palmata* and *F. pseudocarica*. However, these two species are so closely related to *F. carica*, all three being inhabited by the same species of *Blas-tophaga* (*B. psenes*), that they may be considered botanically as one. The account of *F. palmata* (species No. 91) deals with these species and with possible hybrids. See also, the note at end of the section on *F. pumila* (species No. 4) regarding more recent experiments.

Number of Species. Engler (265) estimated the number of species in the genus *Ficus* to be 600. This number has since been given by many authors, including Lyon (484, 485) and Ridley (639, 640). Corner (191) reported "a world total of some 900 living species in ten or eleven subgenera." Verdoorn (779) gave the number as 800. According to Sata (670), the genus consists of about 1,500 species, while Krausel (448) stated that there are over 1,600 species. An actual count of the named species in Volume I and the eleven supplements of *Index Kewensis* shows the number to be 1,887. The actual number of species may be higher, for in all large collections of fig species and among the dried specimens of world herbaria, there are folders bulging with sheets labeled simply "*Ficus* sp." Merrill (528) gave the number as "approaching 2,000, even without splitting hairs on specific differences." However, in a letter dated January 8, 1962, Dr. Corner stated: "Regarding the number of species of *Ficus*, there is much exaggeration. Merrill's estimated 2,000 is certainly erroneous. Most of his Philippine endemics are synonyms." The total number has been more recently augmented by Corner (199c), who described ten new species

from the Solomon Islands. An excellent account of the habits of *Ficus* species and their dispersal was given by Ridley (640).

Numerous fossil species have been reported. For some examples, see Knowlton (441). According to Cain (136), *F. myrtifolia* is a fossil species found in fifteen localities on the eastern shore of the Mississippi Embayment, *F. mississippiensis* in twenty-four localities, and *F. quisumbingi* in parts of the Goshen flora. See also, R. Brown (113), Darrah (223), H. N. Andrews (15), and Puri (613).

However, Chaney (146) wrote as follows about fossil figs: "A heterogeneous medley of genera selected almost at random from the whole of the earth, with a liberal representation of 'figs' and 'laurels,' gave a vague or misleading picture of many of the forests represented by the fossil record. Of nearly 150 fossil species of *Ficus* described from North America, probably more than half are assignable to other and less romantic genera."

Characters of the Syconia

Reference has already been made to the receptacle or syconium, designated in various species by the common name "fig." A syconium (sometimes misspelled "synconium"), the name originally suggested by Mirbel (548), may be defined as a form of inflorescence in which the flowers are borne on the inside wall of a hollow receptacle rather than on the surface of a stalk, as in the mulberry. It is unique in having an apical orifice or ostiole which connects the cavity with the exterior. Good accounts have been given by G. King (437) and by Corner (193). I quote the following from Corner: "In the bread-fruit trees and the mulberries, the flowers are placed on the outside of the fleshy stalk that supports them; in the figs they are, as it were, on the inside. The fig is made by the widening of the inflorescence stalk and the arching-over and contraction of the edge until a cup or vase is formed, with a narrow mouth, like a hollow pear, and the flowers line the inside of the vase. A fig is thus a head of flowers turned outside-in; it is not a flower itself, but a

cluster of flowers within a vase." In an earlier account, Corner (191) stated that there is a close analogy between the receptacle of *Ficus* and the flower head of a Composite, the wall and bracts of one corresponding with the disc and involucre of the other. He added: "The syconium is so characteristic that no one is willing to make *Ficus* a tribe or family and raise its subdivisions to generic or tribal rank."

I agree with King in his distinction between the two parts of the orifice, the umbilicus referring to the outer opening visible at the surface, and the ostiole to that part lined with scales leading to the interior.

Corner (192) reported that the structure of the orifice, as seen in longitudinal sections, seems to offer reliable features, as shown in his illustrations of species in the subgenus *Synoecia*.

The syconium may be sessile (without a stalk), as in *Ficus microcarpa*, *F. monckii*, and *F. altissima*, or may be borne on a peduncle, the length and thickness of which vary in different species. In *F. kerstingii* and on some trees of *F. petiolaris*, the peduncles are slender, and up to 1.2 cm or more in length. In *F. macrophylla*, the peduncles are also 1.2 cm or more long, but are thick, club-shaped, and slightly enlarged at the apex.

The syconia vary widely in size, shape, color, surface characters, basal bracts, umbilicus, and seeds. It should be pointed out that in their native habitats, some species have so-called "seed figs," in which the flowers are all long-styled and mature into syconia which are often edible, with fertile seeds. There are also insect-inhabited figs in which the mature, seedlike bodies are empty, and show large openings from which fig insects have emerged.

Size. Some syconia are described as pea-sized, remaining small even when mature, as in *Ficus ribes*. Others are large, those of *F. auriculata* reaching a diameter of 6.2 cm. F. X. Williams (835) found *F. megacarpa* [aurantiaca] in the Philippines to have the largest fruit he had seen, about 8 cm in diameter. Corner (192) reported for *F. tawaoensis*: "The receptacles, if

really 12 cm [sic] wide and subglobose, must be the largest figs that have yet been found in the genus." See also, Corner (199b).

Shape. In shape, also, syconia vary widely. Corner (192) found the general shape of the receptacle to be so variable that he doubted its value in the identification of any species until it has been proved from many collections. The following terms are used in species descriptions, and are more or less self-explanatory or else defined in the Glossary of Botanical Terms: globose, globular, spherical; subglobose, ovoid, obovate, oblong; oblate, oblate-spherical; urceolate, urn-shaped; turbinate, pyriform. Syconia which are pyriform usually have a fairly well-defined neck. This neck may be short and thick or slender, and of various lengths. In *Ficus malunensis*, the neck is up to 1.2 cm long, about the same length as the fruit stalk or peduncle. The neck may be mistaken for a peduncle in some species, such as *F. tinctoria*, in which the peduncle is very short or entirely missing, while the slender neck is 0.5 cm long. Some trees of *F. benjamina* produce syconia which are globular or oblate, without a neck, while its variety *comosa* bears pyriform syconia with a prominent, thick neck.

Color. In considering or describing color, the maturity of the syconium must be given full attention. In many species, the color of the immature syconium is green, but this color may change gradually to pink or yellow, and eventually to dark red or purplish black. A good example is *Ficus mysorensis*, in which the syconia assume a beautiful orange-yellow color when of full size, becoming almost black at full maturity. *Ficus nigrescens* [tikoua] was so named because of the black or chocolate-brown color of the syconia. Scarlet coloration is typical of the mature syconia of *F. benjamina*, *F. altissima*, *F. bengalensis*, *F. palauanense*, and others, while yellow ones are borne by *F. benjamina* var. *comosa*, *F. vogelii*, and some forms of *F. subcordata*, to mention but a few. Corner (193) referred to *F. dabia*, the Cherry Fig, as one of the most beautiful in the

genus: "The fruiting twigs look as if they were decked with luscious cherries."

In addition to body color, the surfaces of many or most syconia are decorated with flecks of light green (or almost white), pink, or rusty brown. These flecks may be widely or sparsely dispersed over the surface, or densely scattered, and vary in size from tiny specks to large, irregular, spherical, or longitudinal spots. *Ficus virens* is commonly known as the Spotted Fig because of the profusion of bright-colored spots on its syconia.

A character which is worthy of consideration in distinguishing one species from another is the internal color of the receptacle. The stigmas of the pistillate flowers may be uncolored, or tinted more or less brightly with scarlet. Corner (191) stated: "In all but the geocarpic species, in which they are colorless, the bracteoles and perianth are wine-red at first, as in the edible fig." On the contrary, varieties and

seedlings of *F. carica* grown in California invariably show colorless stigmas within the young syconia. However, the stigmas of some seedling figs introduced from Asia as *F. palmata* are pink or scarlet, a coloring which fades out as the fruits enlarge and mature. The syconia of *F. pumila*, *F. auriculata*, and *F. coronata* are brightly colored inside; those of *F. montana*, *F. macrophylla*, and *F. pertusa* are uncolored.

Surface. Surface characters of syconia vary considerably. *Ficus septica* and *F. acanthocarpa* are examples of species in which the syconia are ribbed or roughened, especially toward the apex. Such species as *F. elastica*, *F. microcarpa*, and *F. virens* bear syconia that are glabrous on the surface. The syconia of *F. afzelii* and *F. nekbudu* are densely covered with silky, white hairs. The figs of *F. odorata* are villous-pubescent, while those of *F. ulmifolia* and *F. tinctoria* may be hispid to the touch, or bristly. *Ficus cotinifolia* and *F. bengalensis* have syconia with a surface which may be described as pubescent, tomentose, or slightly pubescent.

Bracts; Involucres. At the bases of most syconia, there are found bracts which are variable in size and shape. In some species, these bracts are early deciduous and are not to be found on the mature fruit, as in *Ficus benjamina* var. *nuda*. In others, the bracts are large, conspicuous, and partly envelop the body of the fruit, as in *F. ovata* and *F. involucreta*. Bracts of *F. aurea*, larger on one side than on the other, produce a lopsided fruit, as shown by figure 1.

G. King (437) found that the basal bracts of *F. hookeri* are united to form a cartilaginous cup which envelops the lower third of the receptacle. King further stated that while young, the receptacles are enclosed in calyptriform involucres which are thrown off early, concluding that, "On the whole, they are too fugacious to found specific characters upon." Standley (718) referred to the bracts by the term "involucre." For *F. radulina*, he gave the involucre as "very small, trilobate, the lobes rounded," and for *F. cotinifolia*, "involucre bilobate, half as long as the receptacle,

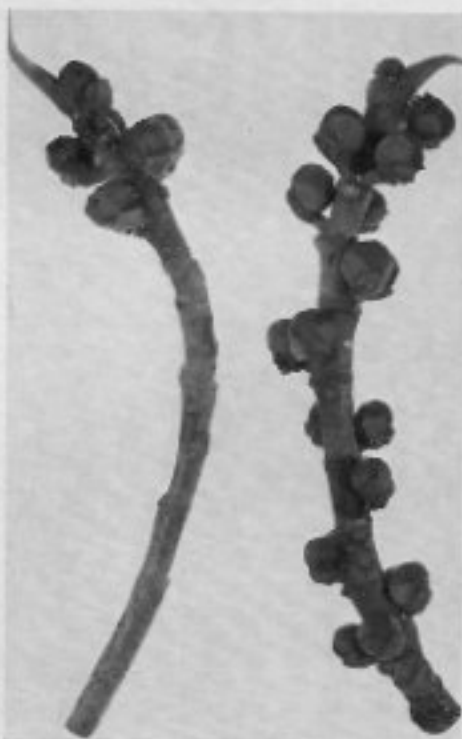


Fig. 1. The bracts of the *Ficus aurea* figs sheathe the body on one side, producing a lopsided fruit.

the lobes rounded to acutish, densely and finely white-sericeous on both surfaces."

Some species show, in addition to basal bracts or involucre, extra bracts on the body of the syconium, as in *F. hispida* and *F. coronata*. Deformed fruits with misplaced scales on the body of the Common Fig were discussed and illustrated by Condit (174). Corner (191, 193) gave good illustrations of receptacles, showing a collar of basal bracts, the body with lateral bracts arranged somewhat in a whorl or spiral, and the orifice with apical bracts. Summerhayes (742) used the position of bracts as a basis for the identification of species. For example, in his key to species of the subgenus *Sycidium*, he placed *F. tinctoria* in the group with basal bracts always at the base of the peduncle, while several other species were characterized by having basal bracts toward the apex of the peduncle, or one or more on the receptacle itself.

Umbilicus. As pointed out by G. King (437), the umbilicus is that part of the eye or orifice which is visible at the apex of the syconium, with scales usually in evidence or sometimes absent, leaving the orifice poriform. The nature of the umbilical scales and size of the opening in varieties of the Common Fig were discussed by Condit (174). Among the many species of *Ficus*, there is much variation in the character and appearance of the umbilicus. It is flush with the surface of many syconia, depressed or sunken in some, and bulging or protruding in others. *Ficus pertusa* shows an apical umbilicus, protruding like the mouth of a jug; in other words, the orifice is depressed and in the center of a craterlike protrusion with the rim at least 0.3 cm in diameter. Standley (718) calls this "an elevated annulus." The umbilicus of some species is poriform, no scales being visible at the surface of the apex, as explained in chapter V, "Keys for Identification."

Seeds. Publications such as those of Gasparrini (312) and Mauri (506) use the French word "graines," which is usually translated as "seeds." In his brief description of *Ficus*, Alphonso Wood (847)

described the fruit (or "syconus") as composed of the enlarged, fleshy receptacles "inclosing the numerous, dry, imbedded achenia." Asa Gray (340) referred to the "syconium or hypanthodium, the fig fruit," the minute flowers of which "ripen their ovaries into very small akenes which are commonly taken for seeds." About a decade later, G. King (437) stated that after fertilization, the fig ovary becomes developed into an achene which tends to be unilaterally emarginate, although many achenes are very distinctly reniform. On the other hand, in his account of *F. hispida*, G. King (439) noted that the perfectly formed female flowers produce fertile seeds. Eisen (253, 254), in his two publications on the Common Fig, employed the word "seed." Ridley (639) referred to the seedlike bodies as achenes. For his *F. burkillii*, he gave the achenes as large, oblong, unequally reniform, and smooth; for his *F. patens*, as oblique, round, stalked, and as long as the sepals.

In his account of Malayan species, Corner (191) wrote in such detail that the following is well worth quoting: "At maturity, the wall of the ovary disintegrates and the seeds are liberated. The hard bodies containing the embryo in the ripe receptacle are not achenes, as they have been called, and by which term one understands an indehiscent, one-seeded fruit, but true seeds. In all, they are about 1 mm long, and they look like the seeds of *Phaseolus* [kidney beans] in miniature. They are subreniform, with the micropyle often surrounded by a prominent ridge in the hilum, more or less laterally compressed, with a narrow keel along the edge opposite the hilum, and with hard, yellowish walls and a mucilaginous outer coat." He further separated Malayan species into three groups, according to the marks on the testa. In *F. canea* [*semicordata*], the seeds are smooth, without a keel, while in others the keel is present, and the sides are either ridged, rough, or tuberculate. In a later report, Corner (192) characterized the seeds of the subgenus *Synoecea* as uniform, with the exception of his *F.*

carri, which has ovoid seeds without a flange. In size, they vary from 1.6 to 2 mm long in *F. punctata*, becoming 2.2 to 3 mm long in *F. apiocarpa* and *F. callicarpa* [*aurantiaca*] var. *parvifolia*. Corner (196) often referred to the sizes and shapes of fig seeds. F. X. Williams (836) stated that the seeds of *F. megacarpa* [*aurantiaca*] and *F. bakeri* are quite elongated and compressed.

In their work on so-called fig seeds, Crane and Baker (208) compared the fig "fruitlet" with the achenes of strawberry, and arrived at this conclusion: "Based upon the fact that the fruitlets of the fig grow and develop morphologically like the fleshy drupaceous fruits, it is proposed that they be referred to as drupelets rather than as achenes, as they have been commonly called." Corner (199) stated that the ovary develops into a drupe. He declared "seed" to be not only "the correct botanical usage, but the practical one," and also described the embryo characters.

Various reports have been made of the numbers of seeds found in fig syconia. In *F. carica*, Rixford (645) found that 3 mature Adriatic figs contained, by actual count, 4,800 fertile seeds, an average of 1,600 for each fig. Condit (168) reported that fertile seeds in 11 caprifigged Adriatic figs varied in number from 472 to 1,288. In 1942, the fertile seeds washed from 30 pounds of dried Calimyrna figs weighed 1,096 grams; there were approximately 1,000 seeds to a gram. The *Kew*

Bulletin (1891, p. 100) reported that seeds of the India Rubber Tree are small, that each fig contains about 75 seeds, and that there are about 270,000 seeds in a pound. Following the introduction of fig wasps into Hawaii, fertile seeds have been produced by three species of *Ficus*. Lyon (485) collected all the fruit produced by a single crop of one tree of *F. macrophylla* in 1922, and thus obtained 224 pounds of dry seeds. Half an ounce of these seeds produced 915 seedlings. It was then estimated that if all the seeds had been properly planted, the seedlings from this one crop would have been sufficiently numerous to reforest all the watersheds of the Hawaiian Islands. One syconium of *F. aurantiaca* var. *parvifolia*, received in 1960 from the Philippines, was carefully sectioned at Riverside into 16 parts, and the seeds were counted. According to our count, this single fig contained 12,512 seeds!

The differences between the gall figs and the seed figs of some Malayan species of *Synocia* were given by Corner (192). He reported that the wasps which emerge from the gall figs carry a fair amount of pollen, but after their struggles through the orifice and down the long array of internal bracts of the seed figs, it seems that little pollen can remain on their shiny bodies, and stated: "It is difficult to understand how many hundreds, even thousands, of seeds can be set in one receptacle by ordinary pollination."

CHAPTER II

FRUITING AND GROWTH HABITS; DEPENDENCE ON INSECTS

Axillary Fruits. The majority of *Ficus* species produce their syconia in the axils of leaves of the current season or in the axils of leaf scars of the previous season's growth. In most cases, the syconia are borne either singly or paired (geminate) in the leaf axils. In some species the syconia are always solitary, as in *F. gnaphalocarpa*. Standley (717) used this character in his key to Mexican species, with eight species having solitary receptacles and thirty-three having the receptacles geminate. Such axillary fruits may be sessile or pedunculate. A few species, for example *F. hispida*, have both axillary and cauliflorous figs on the same plant.

Cauliflory. The word "cauliflory" is derived from the Latin for stem-flower, and refers to the production of flowers directly from the main branches or the trunk. Good examples of such flowering and fruiting habits are the Mediterranean Carob, *Ceratonia siliqua* (Leguminosae), and the Brazilian Jaboticaba, *Myrciaria cauliflora* (Myrtaceae). Some fig trees also

are cauliflorous, as shown in figure 2 for *Ficus racemosa*. The syconia of *F. umbellata* and *F. heteropoda* are produced from short, warty tubercles, often in dense, umbel-like clusters (figure 3). Those of



Fig. 3. Cauliflory, the development of fruit or flowers from tubercles on the trunk or larger branches, is well illustrated by this tree of *Ficus heteropoda*. The dense clusters of small red figs greatly resemble lady beetles as seen in a resting aggregation during periods of hibernation, during which they assemble in great numbers. See Condit (179). (Photo by I. J. Condit.)



Fig. 2. The Cluster Fig, *Ficus racemosa*, is well named; the tree in this photograph clearly demonstrates the condition known as "cauliflory": figs borne on the trunk and large limbs. (Photo by A. J. Basinger.)

F. sycomorus (figure 4) and of *F. racemosa* are borne profusely on forked twigs from the trunk and larger branches. G. King (437) characterized trees of the subgenus *Neomorpha* as bearing very large receptacles in fascicles from tubercles on the stem and larger branches. The fruiting branches of *F. capensis* (figure 5), *F. ribes*, and *F. minahassae* often reach a few meters in length, and such branches may reproduce the mother plant by taking root in the ground. Still other species are geocarpic or earth-borne in their habit of fruiting. Corner (191) gave an inter-

esting account of this peculiar position of syconia in the two species, *F. geocarpa* and *F. cuneata* [*semicordata*], the fruiting branches of which may reach 6 m long. These branches grow along the ground, become covered with fallen leaves, or appear to burrow into the loose humus, and produce the syconia singly, in pairs, or rarely in small clusters, nearly all subterranean. Corner (193) said that no one seems to know how the figs are pollinated underground, or whether they are uprooted by pigs, deer, and other animals, although seedlings appear in places where the jungle has been cleared. See also, the illustrated account by Koorders (443). The fruits of *F. auriculata* are often produced in clusters at the base of the trunk, similar to mushrooms in appearance (figure 6). Those of *F. capensis* resemble bunches of grapes (figure 7).

Corner (191) stated that *F. variegata* and *F. viridicarpa* are the most striking cauliflorous species of Malaya. He wrote: "When in fruit, the columnar trunks and massive branches are plastered with the grapelike bunches of receptacles, which sometimes conceal the bark for considerable stretches; in *F. variegata*, they begin a few feet above the ground, and the uppermost are 60 to 70 feet [an average of



Fig. 4. The trees of *Ficus sycomorus* bear their edible fruits profusely, in clusters issuing from the larger limbs.

(Photo by Dennis Kucera.)



Fig. 5. Long fruit-bearing branches of *Ficus capensis* frequently droop and take root where they touch the ground.

(Photo contributed by Dr. Henry Nakasono, University of Hawaii, Honolulu.)

about 20 m] above the crown." Corner stated that *F. viridicarpa* is a finer tree, "with its cauliflory even more spectacular." Of still another species, *F. hispida*, Corner (193) reported: "This coarse little tree offers, when in fruit, one of the most remarkable botanical sights in the East, for its trunk and branches are festooned with ropes of lumpy figs, like the ropes of *Barringtonia* [Myrtaceae] fruits, yet much more bizarre."

Parthenogenesis. Parthenogenesis, defined as a form of apogamy in which an embryo develops from an unfertilized egg, is of common occurrence in some insect groups, but rare in seed-bearing plants. At least two species of *Ficus* have been reported to show parthenogenetic development of fertile seed. G. King (439) published an account of fertilization in *F. hispida*. The majority of perfect female flowers produced fertile seeds, but he was not able to find pollen on any of their stigmas. Another Indian species was studied by Cunningham (215), and I quote from his report: "The development of embryos in *Ficus roxburghii* [*auriculata*] then appears normally to be an asexual process, dependent on hypertrophic budding of a specialized portion of the nucellar parenchyma, and it appears not improbable that the phenomenon is not peculiar to the species, but is the rule in the case of other figs also. . . . In the case



Fig. 6. The figs of *Ficus auriculata* are often found grouped, as shown, at the base of the trunk, closely resembling a cluster of mushrooms. (Photo by A. J. Basinger.)

of *Ficus hispida*, there can be no doubt that it is so." See also, Cunningham (216).

In spite of the above unequivocal statement, various botanists have expressed their doubt or disbelief in the occurrence of the "phenomenon." One such was Van der Pijl (603). Gustafson (348) stated that Van der Pijl sharply criticized the conclusion of Cunningham, and added that this species [*roxburghii*] would have

to be deleted from the list of adventitious embryonic species.

There is, however, a parthenogenetic development of the endosperm in ovules of the Common Fig (*F. carica*), as determined by Tischler (758). My account (171) of the development of fig flowers showed that this endosperm is found in both long- and short-styled flowers of the Common Fig as well as in the case of its near relative, *F. palmata*. Such endosperm furnishes the main subsistence of the fig insect during its larval development. The occurrence of parthenogenetic development of endosperm in other fig species warrants further investigation.

Parthenocarpy. This process, the development of mature fruit without the stimulus of pollination or fertilization of the flowers, is of common occurrence in plants. Examples are the Navel Orange, Oriental Persimmon, and especially the Common Fig. In various publications (e.g., 173, 175), I have discussed parthenocarpy in *Ficus carica*. Stimulative parthenocarpy occurs in caprifigs as the result of ovipo-



Fig. 7. The trunk and massive branches of the Cape Fig, *Ficus capensis*, are draped profusely with the large, grapelike bunches of figs. This specimen is growing and bearing fruit at Arcadia (LASCIA). (Photo by Dennis Kucera.)

sition and subsequent development of larvae of the fig insect. On the other hand, vegetative parthenocarpy occurs without any apparent stimulus in syconia having short-styled flowers as well as in those having long-styled flowers.

The question then presents itself: Does parthenocarpy occur in other species of the genus *Ficus*? Very few data are available on which to base an answer to this question. It is generally true that in most introduced species, the syconia drop when immature for the simple reason that the fig insects which normally stimulate fruit development have not also been introduced. F. X. Williams (836) reported: "Figs that have never been fertilized do not, I believe, attain their full size, and sooner or later fall to the ground in this immature condition." Another question therefore arises: What stage of maturity does a fruit have to reach before it can be said to represent the condition known as parthenocarpy? Pemberton (592) enclosed some figs of *F. macrophylla* in gauze bags to prevent wasps from entering, and found that none of the figs ever matured or developed fertile seeds. On the other hand, Corner (192) described a new species as *F. carri*, and stated: "It seems that the receptacles develop fully, even though unvisited by the wasps." A year later, Corner (193) reported that fig plants are absolutely dependent on insects for the production of fertile seeds; but, he added: "If we prevent, for instance, the wasps from entering the young seed figs by enclosing them in a muslin bag, their flowers will never set seed, though the figs may grow to their full size and ripen." If there are other references to such bagging experiments, I am not aware of them. In a letter dated January 27, 1967, Dr. Corner stated that the seed figs of *F. auriculata* grow fairly large and ripen off [without insects or fertile seeds] in Singapore.

Trees of *F. mysorensis* produce large, orange-yellow to purplish, seedless fruits which are sufficiently pulpy to attract birds. In Florida, even the syconia of *F. elastica* mature sufficiently and contain enough sweet pulp to furnish food for

birds. As in the case of parthenogenesis, more light on the occurrence of parthenocarpy in species of *Ficus* would be very welcome.

In a series of papers, Crane and Blondeau (209), Blondeau and Crane (91), Crane (207), Crane and Warner (210), and Crane *et al.* (211) described the effects of spraying nonparthenocarpic, Smyrna-type figs with growth-promoting substances. Such figs, though not pollinated, matured into seedless or hollow-seeded fruits, equal in size and appearance and almost equal in quality to normal figs produced by caprifigation. In a letter dated November 7, 1947, Dr. David Fairchild (since deceased) wrote that by the use of a hormone spray, the fruits of *F. roxburghii* [*auriculata*] were made to swell up, color red, and to develop a sweet, pleasant taste. More recent attempts to induce parthenocarpic development of fruit on trees of several species in California collections have ended in failure.

Crops. Trees of the Common Fig (*Ficus carica*) annually produce one or two crops of edible figs and three or more crops of caprifigs. Very few records are available of the number or succession of crops produced by other species. Crops of the Sycomore (*F. sycomorus*) are variously reported. Aaronsohn (1) wrote that the tree of that species has several successive flowering periods, and (on authority of the natives) some give seven harvests a year. This is corroborated in a personal letter from the Department of Agriculture, Jerusalem, in 1926. According to T. W. Brown and Walsingham (114), figs are found on Sycomore Fig trees at all seasons. There is a first crop beginning in April, a second in May, a third in June, while afterward there is a continuous but abundant production of fruit during autumn and even throughout the winter. Trees of both *F. daemona* [*hispidia*] and *F. conglomerata* [*semicordata*] were loaded with fruit the year around in the Calcutta Botanic Garden, as reported by Roxburgh (658). Cunningham (215) found that with *F. roxburghii* [*auriculata*], two, if not more, crops certainly

mature in India in the course of a year, one at the end of February and another in late May or early June. According to Corner (193), all the figs on one tree in Malaya "will be in about the same stage of development. To find young, old, and half-grown figs together is exceptional." Some species, such as *F. montana* and *F. deltoidea*, when grown in pots as ornamentals, are practically always found with some axillary fruits.

Fig Insects. Somehow, sometime, during the millennia when the fig inflorescence was evolving from a flat receptacle into a hollow syconium, a symbiotic relationship gradually developed between the fig and an insect generally regarded as specific for each member of the genus. McLean and Ivimey-Cook (489), quoting from an unidentified source, reported that a single species of insect, such as *Blastophaga brasiliensis*, may pollinate more than one species, while others are limited to one species only. This report needs substantiation. Van der Pijl (604) stated: "On the other hand, the genus *Ficus*, each species with its own gall wasp, is still flourishing." The fig plant provides a home and sustenance for the insect during its metamorphoses from egg to adult. The insect, on the other hand, carries pollen on its body, and unwittingly pollinates stigmas of long-styled flowers while searching for suitable flowers in which to oviposit. These insects belong to more than one family and to several genera. According to the catalogues published by Grandj (336) and to other lists of fig insects of the world, there are 42 species belonging to the genus *Blastophaga*, 32 to *Ceratosolen*, 29 to *Secundeisenia*, 8 to *Pleistodontes*, and smaller numbers to some 21 other genera. Publications by Mayr (509), Joseph (424 through 429), Risbec (643, 644), Wiebes (824a, b, c, d), and others have brought the total number of fig insects, either as pollinators or messmates described, to at least 175. It can readily be seen that the total number so far identified is only a small percentage (about 11.5%) in relation to the species of *Ficus* described by botanists. The enormity of the task facing

systematic entomologists for this insect group alone can thus be visualized.

The subject is such a vast one and the literature so extensive that only a brief review of the salient facts applicable to our discussion can be given here. The matter is still more complicated by the fact that the true fig insect is not the only inhabitant of syconia. There are messmates or inquiline, parasites, and predators also found in them. C. F. Baker (46), for example, described 6 species of "guests" and parasites in a single syconium of *Ficus nota* in addition to the fig insect *Blastophaga nota*. (See account of *F. nota*, species No. 93.) For those who wish to pursue the subject further, the following publications will be useful: Grandi (330, 331, 333) and Condit (168) for the Common Fig (*F. carica*); Pemberton (592) for the Moreton Bay Fig (*F. macrophylla*); and F. X. Williams (836). See also, Condit (183, 184) and H. G. Baker (47) on fig insects.

The account by Williams warrants the following quotation: "In the case of the Chinese Banyan (*F. retusa* Linné) studied at Los Baños, it was noticed that the very young fruits, enveloped budlike in several scales, burst their bonds, so to speak, and almost suddenly, at the expense of firmness and solidity, swell to several times their original volume; and it is at this period, when the ostiolar bracts are comparatively loosely arranged, that the wasp enters the receptacle. Only when the fig is fully mature does its ostiolar channel again become somewhat negotiable. It often happens that several species of wasps, parasites or inquilines, or both, issue from the gall seeds in such numbers that the true fig wasps are greatly in the minority, or in certain figs are even altogether absent. The result of their work was apparent in many figs of comparatively large size, and misshapen in being much flattened at the poles, tuberculate, or otherwise malformed."

In 1935, Henry Bird (83), of the Brooklyn Entomological Society, was in Florida, where he noticed some small insects inhabiting the fruit of one of the

two species of wild fig that grow there (either *F. aurea* or *F. citrifolia*). He bred these out, and obtained one species of Diptera and eight species of Hymenoptera, one a *Blastophaga*, presumably an undescribed species.

It should be emphasized again that practically without exception, the species of *Ficus* described in this publication have been introduced either by seeds or cuttings, without the insect which normally inhabits the syconium and brings about flower pollination, which is absolutely necessary for botanical maturity of the fruit with fertile seeds. The four exceptions to the above statement follow: *Blastophaga psenes*, introduced into California for the Common Fig; *Eupristina verticillata* for *F. microcarpa*; *Pleistodontes froggatti* for *F. macrophylla* (figure 8); and *P. imperialis* for *F. rubiginosa*; the last three entering Hawaii in 1920 and 1921. See the account by Judd (431) of these introductions; also, Timberlake (757a). According to Lyon (485), the wasps of *F. macrophylla* are much larger than those of *F. rubiginosa*, and appear to be much stronger on the wing. Further details regarding the Hawaiian introductions are given in the accounts of *F. macrophylla*, species No. 28, and of *F. rubiginosa*, species No. 59.

The introduction of the fig insect into California resulted in the establishment of an industry based upon culture of the Smyrna-type fig, which requires caprifigation in order to set and mature its fruit. The introduction of the three species of fig insects into Hawaii was designed to ensure fertile seeds which, when spread by birds, would provide natural seedlings for reforestation and for the protection of watersheds. The results have not come up to expectations. Seedlings of *Ficus macrophylla* are not commonly found; those of *F. rubiginosa* are often seen growing on palms or walls. The fruits of *F. microcarpa*, however, seem to be eagerly sought by birds, and the fertile seeds are scattered far and wide. These produce seedlings which become bad weeds in undesirable places. It seems fortunate, there-

fore, that most introduced species produce sterile fruits, some of them being objectionable only because the fallen leaves or twigs litter the ground.

Another example of a plan to introduce a fig insect may be given here. It concerns *F. auriculata*, which produces large, edible fruits in India. I quote from a letter written by B. Y. Morrison, Bureau of Plant Industry, Washington, D.C., dated November 17, 1937: "I do not recall any other project which came to nothing and

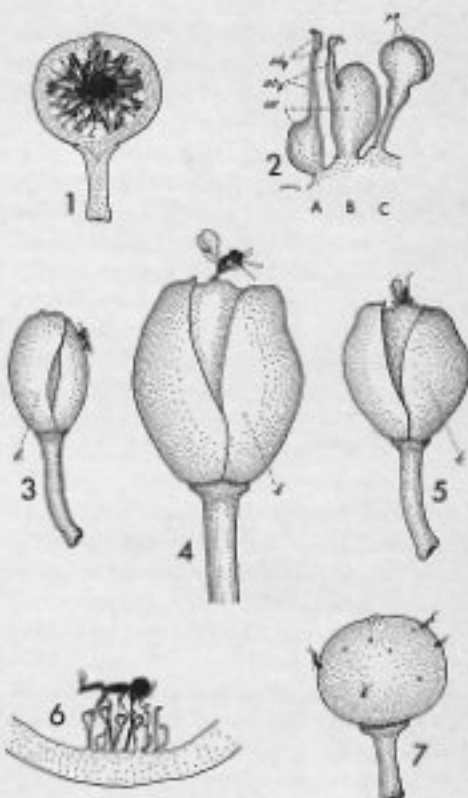


Fig. 8. The tiny fig-pollinating insect, *Pleistodontes froggatti* Mayr, inhabitant of the receptacles of the Moreton Bay Fig, is pictured in various activities, together with some details of the flowers. (1) Staminate and pistillate flowers intermingled. (2) Showing long-styled and short-styled pistillate flowers (A, B) and a young staminate flower (C). (3, 4, 5) Female fig wasp entering the ostiole. (6) The same wasp ovipositing. (7) Adults emerging after having bored their way out of the fig. (Drawing furnished by courtesy of the Hawaiian Sugar Planters' Association.) See the account by Pemberton (592).

upon which were expended so many hours of conversation, consultation, and library research. The whole thing was eventually given up because the Bureau of Entomology and Plant Quarantine insisted upon at least three way stations where the host plant and the insects would have to spend at least a year under observation before they or their succeeding generation might be allowed to come on toward America." Had this project been successful, seedlings of the Roxburgh Fig might have become as weedy in Florida as those of the native Strangling Fig, *F. aurea*, or those of *F. microcarpa* in Hawaii.

Habits of Growth

Few other genera of plants exhibit such a wide variety of fantastic or bizarre growth habits as does the genus *Ficus*. Corner (198) has thus characterized the diversity of fig species: "There are small, almost herbaceous, species about a foot [30 cm] high. There are shrubs, shrubby trees, small trees, and large trees reaching to 150 feet [46 m] high and immensely buttressed. There are twining species, creepers, root-climbers, epiphytes, and that spectacular denizen of the tropical forest, the strangling fig or banyan, which has so successfully exploited the middle and upper layers of the forest. *Ficus* stretches from the floor to the top of the forest, and abounds in all stages of its succession."

Shrubs. Apparently, no native figs are really herbaceous, although the Mistletoe Fig, *F. deltoidea*, as grown in conservatories, has somewhat succulent twigs. Examples of species which have a shrubby habit of growth may be given, although plants naturally vary in habit from shrubs to small trees, as Corner (191) reported for *F. geocarpa* and other members of the subgenus *Covellia* in Malaya. The following species may be cited: *Ficus grossularioides* is an evergreen shrub or small tree; *F. deltoidea* and *F. pyriformis* are shrubs up to 3 m high; plants of the variegated *F. aspera* are small and bushy; *F. cumingii* is an erect shrub or small tree 2 to 3 m high; *F. urceolaris* is a shrub or

small tree up to 4.5 m tall; and *F. subincisa* is a large "undershrub." In Hawaii, some plants of *F. ribes* look like shrubs, and may form dense thickets on account of the numerous suckers or root-sprouts which develop around the primary trunk. Some plants of *F. pseudopalma* are shrub-like in growth (figure 9). *Ficus auriculata* grows definitely as a shrub, with low, spreading branches close to the ground (figure 10). See *F. bambusaeifolia* in chapter XVI as a definite example of shrubby habit. (See page 16 for figures.)

Trees. The size reached by a native fig tree depends largely upon terrain, soil, moisture, and other environmental factors. In Mexico, trees of *Ficus petiolaris* on rocky cliffs grow slowly, and may reach a height of only 4.5 to 6 m, while in the deep, rich soil of river bottoms, they grow to be at least 24 m high. Similarly, trees of *F. palmeri* in Baja California vary greatly in height and spread of branches. Standley (717) gave sizes of other Mexican or Central American species as follows: *F. radulina* and *F. goldmani*, large trees; *F. glabrata* [*insipida*], often 30 to 40 m high; *F. cotinifolia* and *F. padifolia* [*pertusa*], large or small trees; *F. pringlei*, small or medium-sized.

Several authors have mentioned species which reach large or very large dimensions of trunk, height, and spread of branches. Gamble (309): *F. elastica*, a gigantic evergreen tree. Balfour (51, 52): *F. religiosa*, large size, with girth of 7.6 m. Audas (31): *F. macrophylla*, up to 24 m high, with a trunk diameter of 1 to 2 m or more. Koorders and Valetton (446): *F. racemosa*, up to 40 m tall and 2.5 m in diameter of trunk. Gentry (316, with illustration): *F. goldmani*, of immense proportions, 10 m high, 30 m broad, and 3 m in trunk diameter. Elmer (259): *F. apoensis*, trunk perfectly round and straight, 1.8 m through and 22.8 m to its first limbs. Audas (32): *F. rubiginosa*, at entrance to public gardens, Portland, Victoria, Australia, a tree measuring 7.6 m in circumference at its base.

The Moreton Bay Fig (*F. macrophylla*) reaches a very large size, both in its native



Fig. 9. The narrow leaves of the Palm-like Fig, *Ficus pseudopalma*, grow near the tips of the branches. They frequently reach a length of about 1 meter, as shown by these specimens at Miami, Florida, and Hilo, Hawaii.



Fig. 10. These beautiful examples of *Ficus auriculata* are thriving and bearing fruit at Arcadia (LASCA). (Photo by Dennis Kucera.)

habitat and under cultivation. A tree at Orange, California, has a trunk circumference of 6.5 m. Another at Glendora, California, with a girth of about 8.25 m above the buttresses, is regarded as the largest of its kind in California (figures 11 and 12), although the tree at Santa Barbara near the Southern Pacific depot has a much broader crown (figure 13). There is an avenue of these trees in the Botanic Garden at Adelaide, South Australia, about 110 m long (figure 14). The trees were planted in the 1860's at the direction of Robert Schomburgk, the Garden's director. In warm weather, this avenue affords great comfort to visitors, who rest or promenade under the deep shade. See *F. macrophylla* (species No. 28).

A letter from Dr. S. K. Mukherjee, New Delhi, dated June 20, 1961, gave (in substance) the following information about the large banyan in the Calcutta Botanic Garden: The tree is perhaps the largest in India, or even in all of Asia. It suffered severely during the two great cyclones in Bengal in 1864 and 1867, when some of its main branches were broken. The main trunk decayed and had to be



Fig. 11. This magnificent specimen of the Moreton Bay Fig tree, *Ficus macrophylla*, at Glendora, California, has the largest trunk of its kind in the state. (Photo by Dennis Kucera.)

removed in 1925 when it was 15.6 m in circumference, waist high. The circumference of its crown is about 404 m, the maximum height is 31 m, and it covers



Fig. 12. A closer view of the tree shown above in figure 11, illustrating its immense buttresses and surface roots. The trunk is over 8 meters in circumference behind the little girl. (Photo by Dennis Kucera.)



Fig. 13. The most famous, and certainly the largest tree in the extent of its crown in California, is this Moreton Bay Fig growing beside the Southern Pacific station at Santa Barbara. It is an object of great interest to all who visit the city. (Photo by courtesy of the Santa Barbara City Park Department, loaned by Mrs. Katherine K. Muller.)

3.25 acres [1.31 hectare]. It had 947 aerial roots attached to the ground in April, 1959.

Palmer and Pitman (581b) stated: "A fascinating account of a giant wild fig tree in the western Transvaal was given by Moffat." The tree sheltered no fewer than seventeen huts, the topmost 9.1 m from the ground, these being inhabited by the aborigines as protection from lions.

A letter from Ralph D. Cornell, Los Angeles, in 1957, enclosed a photo and

notes on a large banyan at Lahaina, Maui, Hawaii. It covered an area of about an acre [.40 hectare], and had multiple trunks, some at a considerable distance from the central one. In 1965, I found this tree, planted in 1873, to be a historical landmark, attractive to hordes of visitors.

Buttresses are conspicuous features at the bases of some fig trees. According to Corner (193), only three common species in Malaya, *F. variegata*, *F. viridicarpa*, and *F. racemosa*, have buttressed trunks of considerable size. In Florida, trees of *F. racemosa* often show prominent buttresses. Many introduced trees of *F. macrophylla* have massive buttresses, such as the specimen at Glendora, California (figure 12), and others at Ventura and Santa Paula. Paul H. Allen (6) mentioned the conspicuous flying buttresses of *F. lapathifolia* in rain forests. Eggeling (251) gave an illustrated account of *F. mucoso*, stating that it is one of the largest forest trees of Uganda, producing prominent buttresses which sometimes extend as much as 5 m outward. Buttresses of greater or less prominence are displayed by trees of several species in the Lyon Arboretum.



Fig. 14. An avenue of *Ficus macrophylla* in the Botanic Garden at Adelaide, South Australia. (Photo taken in 1964 by Dr. George Zentmyer.)

The buttresses are often accompanied by conspicuous roots, which spread over the ground surface in all directions. This peculiarity offers sufficient reason for condemning the use of such trees for planting near sidewalks, or even in smaller public parks. (See figure 15, showing the use of *F. benjamina* in a larger area, where it has room to expand.) The trees of this species in the Foster Garden and in the Lyon Arboretum, Honolulu, are good examples of surface root spread. For illustrations of the surface roots of *F. elastica*, see Wettstein (821) and Rock (648). For the roots of *F. benjamina*, see Clay and Hubbard (159a). Further notes on surface roots are given in the account of *F. elastica*, species No. 32 of the present book. Aubert *et al.* (28) illustrated a banyan tree on the Island of Réunion, and reported that the trees sometimes become fixed upon steep, rocky slopes, which they grip strongly by spreading out their powerful, tentacular roots, resembling the arms of an enormous octopus, which insinuate themselves into the smallest crevices. Loye Miller (535a) gave an interesting account of wild fig trees growing on rock walls among ruins in Panama.

Leaf Fall. The time and amount of leaf fall in the different species of *Ficus* vary considerably. Typical deciduous species are *F. carica*, its close relatives *F. palmata* and *F. pseudo-carica*, and *F. erecta*. In a tropical climate, however, such as that of Central America, the Common Fig has green foliage almost throughout the year, and then could be called evergreen. According to Corner (192), all the Malayan species of the subgenus *Synoecia* are evergreen. However, many species are called deciduous, even though the branches are bare of foliage for short periods only. Several authors have given examples, which follow. Maiden (494): *Ficus cydoniaefolia* [*parietalis*] is one of the few absolutely deciduous types at Sydney. Maiden (495) called *F. henneana* [*superba* var.] the "Deciduous Fig." Duthie (247): The trees of *F. religiosa* and *F. rumphii* are leafless for a few weeks only in India. C. E. C. Fischer (286): *F. glomerata* [*racemosa*] is a large, deciduous tree at Madras. Richards (637): In Java, a tree of *F. variegata* which appeared quite green and fresh became entirely leafless in four days. Pancho (582): *F. stipulosa* [*caulocarpa*], in the Philippines,



Fig. 15. The wide-spreading system of surface roots produced by the Weeping Fig, *Ficus benjamina*, seen in the Foster Garden at Honolulu. This peculiarity makes it impractical for use in small gardens. (Photo by Dr. H. L. Lyon.)

sheds its leaves and remains bare for a few days, then develops new leaves over most of the crown simultaneously, with the buds conspicuous because of their pink coloration. Ridley (638): Certain plants, such as *F. miquelii*, shed all their leaves at tolerably regular intervals, remaining quite bare for one or two days, when the young shoots begin to unfold; in a few more days, they are quite leafy again. Herklots (371): At Hong Kong, some fig trees have the curious habit of changing clothes at unexpected and unpredictable seasons, such as the middle of December. Within the space of a few days, the old leaves change from green to brown and yellow, and are rapidly exfoliated; within a week, the terminal buds enlarge, protective scales fall, and young, tender, green leaves unfurl. Skene (702) gave Volkens (783) credit for the statement that *F. julva* sheds its leaves two or three times a year.

G. King (437) described *F. lacor* [*virens*] as a truly deciduous species. Holtum (384) discussed the periodic leaf change and fruiting of three species at Singapore: *F. glabella* [*virens* var.], *F. polysyca* [*variegata*], and *F. religiosa*. Corner (191) stated that *F. variegata* is a deciduous species, thus: "The interval between successive leaf changes varies considerably, and may depend upon the incidence of dry and wet weather, which is irregular in Singapore; it is not a facultative habit caused by a prolonged dry season. . . . The production of receptacles appears to have no relation to the leaf cycles."

In Florida, trees of *F. religiosa*, *F. virens*, *F. umbellata*, and *F. afzeli* are devoid of leaves for a short period. The succeeding new foliage of some species is beautifully colored pink or scarlet. Some trees of both *F. pertusa* and *F. cotinifolia* were seen to be bare of leaves at the time of a visit to Mexico in November, 1960.

One reason *F. elastica* and *F. lyrata* are so well adapted to pot culture is that the lowermost leaves persist for long periods. On the other hand, *F. petiolaris* and a few other species drop their lower leaves at an

early stage of growth, leaving the trunk bare and unattractive.

Epiphytes and Stranglers. Epiphyte (from the Greek "epi," upon, and "phyton," plant) means simply one plant growing on another. Some epiphytes, such as mistletoe and dodder (*Cuscuta*), are parasitic. Others use the host plant only as a support or medium on which to grow, examples being orchids, Spanish moss (*Tillandsia*), and many species of *Ficus*. Even the Common Fig is sometimes found growing on a tree or palm where a bird has left the seeds. G. King (437) noted that the famous banyan tree in the Calcutta Botanic Garden began life as an epiphyte on a date palm, of which all trace had disappeared. Hole (381) reported that the epiphytic roots of *F. bengalensis* and *F. religiosa* produce small adsorption roots from the under surface, negatively heliotropic and positively hydrotropic, which cling tightly and penetrate cracks and crevices, but not living tissue.

In King's classification of *Ficus* species into subgenera, the following characters are given with respect to growth habit: *Urostigma*, epiphytal, at least in early life;



Fig. 16. The native fig of Florida, *Ficus aurea*, often gets its start as a strangler on a palm or other host.

(Photo by A. J. Basinger.)



Fig. 17. A larger specimen of *Ficus aurea*, showing how this "vegetable octopus" operates to strangle its host.

(Photo by A. J. Basinger.)

Covellia and *Neomorpha*, never epiphytal; and *Eusyce*, rarely epiphytal. According to Corner (191), some Malayan figs are epiphytes, "with a monstrous kind of radical trunk by means of which they tap the soil fifty or a hundred feet [15 or 30 m] below, and strangle and supplant their original support." This leads to a discussion of fig "stranglers," of which there are many accounts in the literature. (See figures 16, 17, and 18.)

The Florida native fig, *Ficus aurea*, is a good example of a strangler. It was well described and illustrated by Bessey (79), who found it growing on oaks, palmettos, and even on large trees of its own species. Harshberger (358) wrote of *F. aurea* as "the Scotchman which entirely suppresses the tree in the encircling mass of roots." The same cognomen was used earlier by Gosse (323), who referred to one strangler's victim as "a Creole in the embrace of a Scotchman." Safford (663) said: "It may well be designated the snake tree or constrictor of the vegetable world." A good account to the same effect was given by Small (705). In the Everglades National Park, there is a sign which states: "Strangler Fig. The enormous pressure of the roots of the killer was able to stop the circulation of sap in the mature tree, causing its death." The latest account, well illus-

trated, of the Florida Strangling Fig was given by Argo (23a).

Several Mexican species are stranglers, as reported by Standley (717) for *F. mexicana* [*maxima*], *F. bonplandiana* [*obtusifolia*], and *F. padifolia* [*perusa*]. The statement that "the young plant at first climbs the trunk of some tree, often a palm," applies more to vines than to stranglers. Seedlings of the latter generally start aboveground in crotches or leaf sheaths, and grow downward rather than upward from the supporting base.

Strangling figs are common in tropical countries. Two excellent illustrations were given by Whitford (824) of Philippine species which grow as stranglers. Maiden (495) referred to strangling figs as "hemiepiphytes, whose trees are vegetable octopuses, and the plant, whatever its size, that gets within its clutches is doomed unless surgically released by the hand of man."

In Kenya, central Africa, E. H. Wilson (842) found *F. hochstetteri*, an enormous tree of subtly devastating habits, which starts life "on the breast of a hospitable neighboring tree, and later strangles it



Fig. 18. A typical attack upon two palms by a strangling fig which was observed at Puerto Vallarta, Mexico.

(Photo by Ralph D. Cornell.)

within the folds of its own huge bulk." One of the most familiar examples of a strangling fig in Borneo is the Waringin, *F. benjamina* form *waringiana*, according to Browne (117). Burkill (124) gave *F. indica* [*sandaica*] as one of the most common tree-strangling figs in Malaysia. An account of *F. lepreurii* as a strangler was given by C. J. Taylor (749).

One of the best and most detailed accounts of strangling figs was written by Corner (193), and is briefly summarized thus: Seedlings from seeds deposited by birds, monkeys, or frugivorous bats grow into epiphytic bushes, the roots of which spread down the supporting host tree, form side roots, and encircle the trunk. These roots slowly crush the host's bark against the wood, and thus gradually ring or strangle it until it becomes stunted and finally dies—a process which may continue over a hundred-year period. See also, Emeneau (263a).

When strangling figs grow on timber or ornamental trees or in other undesirable places, they become weeds. In the words of Browne (117): "To the forester, some figs are weeds that are rather difficult to eradicate." Corner remarked: "Considering how vigorous they are and how easily their seeds are distributed, it is a problem why strangling figs do not occur on most big trees in the forest." According to D. Brandis (102), *F. cordifolia* often embraces other trees and thus kills them; also, *F. parasitica* [*tinctoria* var.] encircles the stems of other trees with its anastomosing roots. See the illustration by Kerner (435) showing encircling fig roots. The common banyan of India, *F. bengalensis*, and the sacred *F. religiosa*, appear spontaneously on tombs or old buildings, and as epiphytes on trees, often entirely enveloping their stems and eventually killing them. See Mountnorris (559), G. Watt (815), and Duthie (247). According to Graham (325), some species of *Clusia* are called "strangling figs" because they resemble the latter so closely, although they are members of a different family (Guttiferae, or its synonym, Clusiaceae).

Maiden (495) described a seedling of *F. rubiginosa* in the Sydney Botanical Garden which grew on a 2-meter hardwood fence and "absorbed" nearly a panel of the fence before the plant was removed. As stated earlier, *F. microcarpa* seedlings have sprung up in all the Hawaiian Islands, becoming serious weeds as they grew on walls, buildings, and on trees as stranglers. The *National Geographic* for October, 1964, page 532, gave an excellent photo of a serpentine banyan tree binding, with wooden fetters, a serene stone giant statue of Lokesvara (a "future Buddha"), guarding the gateway to Ta Som Temple, Angkor Wat, Cambodia.

The danger of confusing an epiphytic fig with its host was emphasized by Corner (197): "*Ficus darkeana* King consists of the twigs and leaves of *F. tinctoria* Forst. var. *parasitica* (Willd.) Corner with figs of *F. racemosa* L., and from the description is clearly a mistake of collecting the epiphytic *F. tinctoria* and the cauliflorous figs of its host as being one plant: it is a fudge." Finally, anyone interested should consult the illustrated article by Emeneau (263a), entitled, "The Strangling Figs in Sanskrit Literature." It features *F. religiosa*, sometimes called the "upside-down tree," for it is rooted above on another tree and thence lets roots down to the ground.

Aerial Roots; Banyans. As Corner (193) stated, some strangling figs develop aerial roots from their branches and even from their twigs. These dangle in the air, gradually grow downward, and take root if they touch the soil, when the whole aerial root stiffens and becomes tight as a bowstring. They then form the so-called "pillar" or "prop" roots characteristic of banyans. Talbot (747) found that the roots of *F. bengalensis* did not develop properly on the hard laterite soil near the seacoast of India. Burkill (124) stated that the aerial roots of *F. altissima* are tough, and are used for rough cordage.

The common name "banyan," as defined by Yule and Burnell (850), was applied to the banyans or traders who displayed their wares or even built a temple

under one of the sacred trees of India. Various fig trees which have multiple trunks have since been designated as banyans. *Ficus altissima* is sometimes called the False Banyan because it develops only a few of the innumerable pillars that are characteristic of certain other species (figure 19). According to Corner (193), only one Malayan species, *F. retusa* [*microcarpa*] has the banyan habit. In Hawaii, Lyon (484) observed several varieties of this Chinese Banyan (as it is sometimes called), the trees showing considerable variation in the development of prop roots. The development of aerial roots by *F. bengalensis* was also found by Lewis (469) to be "by no means uniform. At Tangally, for example, on one side of the bay, trees will be found with comparatively few aerial roots, while on the opposite shore they are abundant."

The following poetic description of a banyan tree is from Southey's "The Curse of Kehama" (711):

"'Twas a fair scene wherein they stood,
A green and sunny glade amid the wood,
And in the midst an aged Banian grew.
It was a goodly sight to see,
That venerable tree;
For o'er the lawn, irregularly spread,
Fifty straight columns propped its lofty head,
And many a long, depending shoot,
Seeking to strike its root,
Straight, like a plummet, grew towards the
ground."

Other examples of the banyan type of growth may be cited: Roxburgh (658), "The trunk of *Ficus infectoria* [*virens*] sometimes drops roots of considerable magnitude"; Holdridge (380), "One of the striking characteristics of *F. laevigata* is the presence of aerial roots, and from the huge side branches of *F. elastica*, such roots hang down"; Standley and Steyermark (726), "Banyan trees are scarcely, if at all, known in Central America, but in Mexico some species occasionally develop aerial roots." Of *F. padifolia* [*per-tusa*], a Mexican species, Standley (717) wrote: "With age, it forms a very broad crown, from the branches of which aerial roots descend and enter the ground, thus developing new trunks and forming a tree



Fig. 19. The Lofty Fig or False Banyan, *Ficus altissima*, often sends out numerous aerial roots which will eventually develop into multiple "prop" or "pillar" trunks when they reach the ground.

(Photo by A. J. Basinger.)

of the familiar banyan type of Asia and Africa." A photograph I took in 1947 shows a tree of *F. pertusa* in a field of sugar cane near Los Mochis, Sinaloa, Mexico, with the original trunk missing or hard to locate, but with multiple trunks and branches spreading over half an acre [.20 hectare] of ground. A correspondent informed me that at Puerto Vallarta, Jalisco, the prop roots or trunks, some 30.5 cm in diameter, are used by builders for supports in place of ordinary posts.

In the dry atmosphere of California, aerial roots are seldom found. If they do form on some trees, the growing tip usually dries out long before the root touches the ground. Trees of *F. rubiginosa* in coastal districts sometimes produce aerial roots profusely, but seldom, if ever, become banyan-like. If *F. elastica* develops any aerial roots from its branches in California, no such cases have been brought to my attention. It is surprising, therefore, to a California resident to find that the India Rubber Tree commonly grows as a banyan in Florida (figure 20). One of the largest fig trees in that state is an immense specimen of *F. elastica* growing at 10041



Fig. 20. In southern Florida, trees of *Ficus elastica* may frequently develop multiple trunks, as observed with this one at Fort Myers, Florida. See Condit (179).

(Photo by L. J. Condit.)

S.W. 168th Street, corner of S.W. 99th Avenue, at Perrine, South Miami. The tree has many trunks, and a branch spread of over 30.4 m.

Climbers; Lianas. Some fig species are being used as ground covers because of the prostrate nature of growth and the fact that the stems root at the nodes. *Ficus montana* is thus employed in Florida in a small way. The Waipahu Fig, *F. tikoua*, is being used as a ground cover in Hawaii (figure 21). A seedling of the hybrid, *F. pumila* x *F. carica* (Condit 177), spreads over the ground, and shows the possibilities of further hybridization between these and other species. See Nehrling (576) on climbing species of *Ficus*.

Fig plants may grow prostrate in early life, but later become climbers. In his revision of the subgenus *Synoecia*, Corner (192) reported that all the species are root climbers, with tufts of short, adventitious roots. The plants start from seeds on the ground, first trailing over the ground or rocks until they reach a support such as a living tree, then climbing to 50 m or more. In the Philippines, *F. callicarpa* [aurantiaca] var. *parvifolia* grows as a typical liana. Elmer (263) described this variety as having stems as thick as a man's wrist, subterete, sometimes extended in a

ropelike fashion 9 m or more before branching; then, much rebranched, with the young growing parts forming rootlets which cling tightly to the trunks of trees. Elmer (256) further distinguished lianas from cleavers (in the sense of "clingers") when he stated: "One or two of our species are lianas, and on the Island of Luzon one powerful cleaver is known." In his popular account of banyans, Verrill (780) compared the writhing lianas to giant serpents and the fig trees to loathsome octopi.

The method by which *F. pumila* becomes attached to a support is analogous to that found in species of *Ampelopsis* described by several botanists, including Gray (340), Kerner (435), Strasburger (735), and Sachs (662). The tendrils of *Ampelopsis* have cushionlike discs or pads at their tips; these pads, according to Kerner, "become cemented to the substratum by means of a sticky fluid secreted from the cells of the disc." *Ficus pumila* does not have tendrils tipped by a pad but, as stated by Kerner, develops fascicles of short roots at the nodes. Careful examination of these roots shows that each is blunt, and apparently exudes a cementing substance which enables it to cling so tightly to a wall that pieces of plaster usually adhere when the vine is torn loose. Marie Neal (572) reported that *F. pumila* grows on stone walls, to which it clings closely "by means of a rubbery exudation from the roots." Steiner (731) noted that this



Fig. 21. The Waipahu Fig, *Ficus tikoua*, is planted extensively in Hawaii, both as a ground cover plant and as a partial covering or drapery for a wall.

(Photo by Dr. R. A. Hamilton.)



Fig. 22. Some seedlings develop bulbous bases, probably as a provision to carry them through dry periods. Left, *Ficus cotinifolia*; right, *F. petiolaris*.

vine clings by an exudation which slightly dissolves the surface of its support. McLean and Ivimey-Cook (489) found that the roots secrete a gummy substance which firmly cements them to their support. (See figure 37, page 76.)

According to Corner (192), the vines of *F. apiocarpa* show no differences other than size between leaves on its aerial branches and those that creep on the ground. Many fig vines, however, exhibit in their foliage the condition known as dimorphism (i.e., the production of two different forms on the same plant). This condition is so prominent on vines of *F. pumila* that some observers might conclude that there were two distinct plants, or even species, when shown the detached leafy twigs. In his account of Malayan climbing figs, Corner (192) stated: "One may conveniently use the terms *bathyphyll* and *acrophyll* for the two kinds of leaf. *Bathyphylls* are the leaves, usually small, which are borne on the lower, creeping stems and are themselves flattened against the substratum on which the vine grows. *Acrophylls* are the normal, adult leaves, borne on free-hanging twigs from the main stems of the vine." It can readily be seen that much confusion may result unless specimens for identification of such climbers include both types of leaves. In fact, this dimorphism is so well shown in *F.*

megacarpa that Corner has classified it as only a variety of *F. callicarpa* [*aurantiaca*], with smaller, rather differently shaped leaves. Corner further described four varieties of *F. callicarpa* [*aurantiaca*], the distinctions being based partly on the shape and size of leaf blades. He concluded that all species of *Synoecia*, other than *F. apiocarpa* (with one possible exception), possess *bathyphylls*, "and are thus clearly in a higher state of vegetative, or scandent, evolution."

Bulbous Bases. Seedling plants of some fig species develop prominent, bulbous bases, as shown in figure 22. Such swollen stems have been observed in young seedlings of both Mexican and South African figs. This peculiarity even occurs in seedlings of *Ficus elastica*, as shown in the illustrated account by Troup (765). He stated: "By the time the fifth leaf appears, a swelling is noticed below the root-collum, which goes on increasing in size." He added that the bulbous swelling gradually disappears with age. It is not clear whether this is an adaptation of the plant to carry it through long periods of drought. The swelling forms at the base of the stem, and is apparently a different structure from that described and figured by Went (818) for a tropical species of *Ficus*. In the latter case, the tuberlike swellings are confined to the roots.

CHAPTER III

VEGETATIVE AND BOTANICAL CHARACTERS

Twigs: Pith. In most species of *Ficus*, the young twigs are filled with a solid or homogeneous pith, as in *F. carica*. A few species, however, have twigs which are hollow or devoid of pith, as shown in chapter V (keys). Regarding *F. fistulosa*, Corner (191) wrote: "Young twigs are hollow, easily snapped." Various botanists, including D. Brandis (102) and Bentham and Mueller (77), have reported that the young, luxuriant stems of *F. hispida* are hollow. Introduced trees of *F. mallowcarpa*, studied in Cuba and California, have hollow twigs; at least, in the internodes of vigorous twigs. The same is true of *F. nota* grown at Miami, Florida, and of *F. variegata* at Honolulu. A new species was described from Borneo by Corner (192) as *F. dens-echini*, growing as a root-climber, with the twigs hollow. *Ficus salomonensis* was illustrated by Corner (199a) as a species with "wide pith."

Twigs: Thickness. In general, the thickness of young twigs depends to a great extent upon size of leaf. *Ficus cumingii*, *F. benjamina*, *F. salicifolia*, and *F. ribes* are examples of small-leaved species with slender twigs, 0.3 cm or less in thickness. On the other hand, trees of *F. nekbudu*, *F. afzelii*, and *F. umbellata* have large leaves, and young twigs up to 1.5 cm in diameter.

Bark. Characters of bark, such as color, surface, lenticels, and leaf scars, naturally vary considerably in the different species. Very young twigs are commonly green, and in a few species the green color persists for several nodes. Generally, however, the bark color changes very soon to gray, silvery-gray, tawny, or to various shades of chocolate-brown. Lely (463) described the bark of *Ficus iteophylla* as smooth, of a creamy color, with a few gray scales scattered here and there over it, giving it a mottled appearance. G. King (437) referred to the bark of *F. pomifera*

[*oligodon*] as smooth and white, and to that of *F. roxburghii* [*auriculata*] as brown. Corner (193) thus described the coloring of the mature bark of several Malayan figs: *F. benjamina*, light gray; *F. caulocarpa* and *F. variegata*, "pale pinkish brown"; *F. indica* [*sundaica*], grayish white; and *F. glomerata* [*racemosa*], "pinkish gray, pinkish buff, or pale brown." Corner (191) also described the bark of the last species as "smooth, light-grayish fawn, appearing grayish white from a distance." The two Mexican species, *F. petiolaris* and *F. palmeri*, both have very light gray or yellowish bark. The rather vague terms used in describing bark color, as well as those employed earlier for fruit color, would seem to suggest the desirability of using more exact terms based on color charts.

Large, well-established trees in arboreta show a gradual transition from bark characters of twigs to those of the framework branches and the trunk. Lenticels, more or less prominent on young twigs, generally become corky and rough as they increase in age. In some cases, these lenticels crack longitudinally; in others, they spread or become fissured crosswise. The trees of many species have the older bark roughened or made warty by the raised and corky lenticels. In *F. semicordata*, the lenticel spots are more or less obscured by the exfoliating epidermis. In *F. racemosa* and *F. sycomorus*, the bark of the lower trunk flakes off in large scales. Florida trees of *F. odorata* have the older bark light gray in color, mottled with silvery-gray or white patches resembling lichens. According to Lely (463), the bark of older trees of *F. gnaphalocarpa* is very distinctive, with light-green patches where scales have fallen. The older branches of certain fig trees are marked by closely placed, narrow rings, somewhat raised and roughened. These more or less concentric

rings apparently start from fissures which occur on young twigs, and which gradually become prominent as the branch increases in diameter.

Pubescence. The bark surface of twigs and older branches approximates closely the surfaces of petioles and leaves with respect to pubescence or lack of it. Glabrous branches are characteristic of such species as *Ficus elastica*, *F. microcarpa*, *F. benjamina*, and many others. Descriptive terms for pubescence are explained in the Glossary.

The twigs of *F. doliaria* are densely clothed with a rusty pubescence. *Ficus minahassae* has petioles and young twigs clothed with prominent, sharp hairs, each emerging from a reddish-brown papilla; these hairs produce a stinging sensation when touched to tender skin. Twigs of *F. sycamorus* can be recognized by the fringe or circle of long, slender hairs just below each node, as observed by Hutchinson (407) and other botanists. Hutchinson described the branchlets of *F. stuhlmannii* as "fairly stout, ribbed, pilose with whitish or slightly fuscous hairs, especially when young." In some species, the pubescence on twigs is early deciduous, while in others it persists for several nodes, as in some forms of *F. rubiginosa*.

Terminal Buds. Characters of terminal buds, such as color, length, and pubescence, especially when dormant, are of value in the identification of figs, as shown in the keys to species in chapter V. Green or slightly tawny color of bud is characteristic in some species under cultivation, examples being *Ficus microcarpa* var. *rigo*, *F. pretoriae*, and *F. obtusifolia*. Colored terminal buds are found on trees of *F. monckii*, *F. ovata*, and *F. archeri*. However, the color factor is not entirely reliable for use in a differentiating key, for on a single plant of *F. microcarpa* var. *nitida*, both green and colored buds may sometimes be observed. The color of buds in potted plants of *F. elastica* is very variable, ranging from green to pink, scarlet, or even purplish.

In length of the terminal bud, species also vary widely. Some fig trees with twigs

up to 1.5 cm thick, as given under "Twigs" for three species, have remarkably small and short dormant buds; 1.3 cm long or less in *F. afzelii*. Buds of *F. pertusa*, *F. superba* var. *hennecana*, and *F. vogelii* are mostly much less than 2.5 cm long. Buds of *F. macrophylla* and *F. watkinsiana* are up to 7.6 cm long; of *F. elastica*, up to 15.2 cm; and of *F. obliqua* var. *petiolaris*, up to 4 cm. *Ficus cotinifolia* and *F. gnaphalocarpa* have short, plump buds. Cultivated trees of *F. tinctoria* have buds that are more or less flattened. In some species, such as *F. amplissima*, the buds gradually narrow from a plump base to a sharp apex. The new growth of some figs proceeds from an axillary terminal bud, so that the twigs are more or less zigzag in appearance, as in *F. benjamina* var. *comosa*, plate XIV, A2. Surface characters of buds, such as pubescence, are treated under "Stipules."

Stipules. As G. King (437) stated, stipules are universally present in *Ficus*, although usually "very fugacious," i.e., very early deciduous. He further recognized three distinct kinds of stipules, the most typical and common kind occurring in pairs, one on each side of the bud. The second kind, the so-called "intrapetiolar," is characterized by a sort of leaf scale, which completely covers the young leaf and falls off as the latter expands. An example is the familiar *F. elastica*, which is almost unique among the members of the genus in having a single sheathing stipule (figure 23). The third kind of stipule, according to King, is really a leaf scale, "present in considerable numbers as covering the leaf buds in such truly deciduous species as *F. infectoria* [*virens*], as well as in those which, although not deciduous, make their growth only during clearly defined periods." The distinction between the first and third kinds, however, is not clear, and may be practically ignored in the present account. King gave the following examples of stipules: *Ficus xylophylla*, stipules coriaceous, broadly ovate-acute; *F. forstenii*, stipules in pairs, coriaceous; *F. elastica*, stipule single, subsistent, colored, almost half as long as the leaves;

F. fulva, stipule single, convolute, broadly ovate, with a truncate base and acute apex, externally covered with deciduous yellow hairs.

Griffith (342) stated that stipules are mere scales or buds, and that they are not necessarily double organs. Further, he reported that the stipules of *Ficus elastica* are single organs and, in every respect as to development, analogous to leaves, being scales with incurved margins. See also, the account by Lubbock (481), with notes on *F. infectoria* [*virens*] and *F. elastica*.

The surface of stipules, like the surface of bark, is approximately that of leaves, petioles, or twigs, i.e., glabrous to various degrees of pubescence. Since stipular surface is well covered in the keys for identification in chapter V and in the descriptions of species, only a few exam-



Fig. 23. The terminal buds of *Ficus elastica* (right) are almost unique in having but one sheathing stipule, while practically all other species of *Ficus* have two opposite stipules (left).

ples are given here. *Ficus microcarpa*, *F. benjamina*, and *F. pertusa* have glabrous stipules; *F. altissima* and *F. bengalensis* have them puberulent or slightly pubescent; and *F. sycomorus* and *F. cotinifolia* have silky-white, hairy stipules. In some figs, the stipules are glabrous except for a fringe of hairs along the margins. They vary in length from 1.6 cm in *F. pertusa* to 20 cm or more in *F. elastica*. Corner (193) stated that in saplings, the stipule of the latter species may be even a foot [30 cm] long. As already stated, stipules are early deciduous in most species. However, in the following species the stipules persist for several nodes: *F. racemosa* (PI No. 163, 290), *F. variegata*, *F. gnaphalocarpa*, and *F. minahassae*.

G. King (437) described *F. bracteata* as having long-persistent, prefoliar stipules, borne on the apices of the twigs and surrounding the densely tomentose young fruit. In an account of *F. lyrata*, W. W. (786) reported plants to have dark-brown, persistent, bractlike, boatshaped stipules, about 5 cm long, set so as to hide the stem.

Latex. Latex cells, found in *Ficus* and in several other groups of plants, are single cells which grow among tissues, much as the hyphae of a fungus grow between the cells of a host. They are found in most parts of the fig plant and in all species of the genus. The latex usually oozes from cut tissues as a white exudation which soon coagulates when exposed to the air. G. King (437) stated that all the Indo-Malayan species of *Ficus* contain "milky juice" except *F. leucantatoma* [*septica*], in which the juice is pale buff. Ridley (639) reported that the latex of *F. ramantacea* [*radicans*] is yellow and bitter. *Ficus fistulosa* also has pale yellow latex, according to Corner (191). The latex of *F. sycomorus* and *F. gnaphalocarpa* is white at the first exudation, but soon turns yellow on exposure to the air. See Asenjo (25) for the properties of the latex of *F. pumila*. The economic and medicinal uses of fig latex are discussed in chapter IV. See also, Condit (174) for an account of latex in *F. carica*. Corner (199) stated: "The function of latex is unknown, yet it

permeates as a capillary system giant moraceous trees from root-tip to stem-tip, and it is initiated in the embryo."

Leaves: Macroscopic Characters

Arrangement. Phyllotaxy or leaf arrangement in *Ficus* is predominantly alternate and simple, in five spiral rows. Intervals between leaves depend upon the vigor of growth and the length of the internodes. When the growth is slow and the internodes short, the leaves are mostly near the tips of the branches, as in *F. pseudopalma*. Hutchinson (407), in his description of *F. vogelii*, reported, "the leaves mostly crowded toward the ends of the branches," and Talbot (747) used the same description for the leaves of *F. tomentosa* and *F. asperrima*. Opposite leaves are found on some branches, at least of *F. hispida* (a synonym of which is *F. oppositifolia*), on vigorous shoots of *F. cumingii*, and of *F. congesta*.

Symmetry. An important character in the classification of fig species is that of the symmetry of leaf blades. Symmetrical blades are those which are equilateral, i.e., the two parts of the blade on either side of the midrib are practically identical. Asymmetrical blades are those which are inequilateral, one side of the blade being larger or different from the other, especially at the base. Examples of species having inequilateral leaves are *F. tinctoria*, *F. ulmifolia*, *F. aspera*, and *F. coronata*. The term "auriculate" is used to describe the base of some leaves, such as those of *F. odorata* and *F. semicordata*, both of which have the blades prominently auricled on one side. Of the forty-seven leaf illustrations given by Jane Philpott (602), only three show blades that are more or less inequilateral. According to Corner (192), the asymmetry of the leaf base is most marked in species with bathyphylls (juvenile leaves) and stomatal pits, and is practically absent from species lacking these features.

Size. Species of *Ficus* characterized by very small leaf blades are *F. perforata* (3.8 to 5 cm long), *F. pumila* var. *minima* (3.8 cm long), and *F. aurantiaca* var.

parvifolia (5.7 cm long and 4.4 cm broad). Large leaves are produced by *F. lyrata*, *F. auriculata*, and *F. nekbuda*, to cite only three examples. According to Corner (193), the largest leaves produced by a Malayan species are those of *F. fulva* (on saplings, 25.5 to 51 cm long and 20 to 30.5 cm broad; on adult trees, 13 to 30.5 cm long and 6.5 to 18 cm broad). The smallest are those of the Waringin, *F. benjamina* form *warangiiana* (3 to 11.5 cm long and 2 to 5 cm broad). In a letter dated May 8, 1961, Dr. Corner wrote that he had rediscovered on Bougainville Island the extraordinary *F. salomonensis* Rechinger. It is a small tree, with few, stout branches and leaves almost 2 m long, in enormous rosettes. Jane Philpott (602) found the blade areas of forty-seven species to range from 3.2 square centimeters for *F. repens* [*pumila*] to 542 square centimeters for *F. pseudopalma*. Mary Barrett (68) gave the following measurements for large blades: "14½ × 9¾ inches (*F. lyrata*), 14 × 7 inches (*F. vogelii*); for smaller blades 4½ × 1¾ inches (*F. retusa* var. *nitida*), and 2¼-5½ × 1½-2½ inches (*F. benjamina*)." [The English-system measurements given above are here converted to metric ones for consistency with the present book's style: 37 × 25 cm (*F. lyrata*), 35.5 × 18 cm (*F. vogelii*); for smaller blades 11.5 × 4.5 cm (*F. retusa* var. *nitida*), and 6-14 × 3-6.5 cm (*F. benjamina*).]

My studies of exotic figs under cultivation show that the species having the largest leaf surface is *F. auriculata*, with length of 40.6 cm and width of 37.5 cm. In Honolulu, *F. malunensis* produces leaves up to 33 cm long and 20.3 cm broad. Leaves of *F. afzelii* were up to 63 cm long on young trees, but only half that length on mature branches.

Shape. Typical shapes of fig leaves were illustrated by G. King (437), Koorders and Valetton (446), Mowry (561), Corner (192), Eggeling (251), Jane Philpott (602), and Mary Barrett (68).

The terms used in describing the shapes of fig leaves are as variable and as much in need of revision for the sake of ac-

curacy as are the terms just cited for color, under "Bark" and "Terminal Buds." Such words as ovate, oval, oblong, and lanceolate are more or less self-explanatory, but such compound descriptive terms as elliptic-oblong, obovate-oblong, deltoid-ovate, or orbicular-ovate leave much to the imagination, and invite perusal of a glossary. Such a glossary, given in this publication, attempts to define terms used in the descriptions. Furthermore, an illustration of a typical leaf is given in the series of 35 plates for most species found in the keys (chapter V). As any student of plant taxonomy realizes, however, there is such variation in leaves of a species or in leaf specimens from a single tree that a series of leaf forms would be better for illustration than would a single leaf. A good example is the figure in Condit (169), in which are pictured various leaf forms from one Kadota fig tree. See also, Mauri (506), who figured nine to ten leaves for each of several varieties of Kabylean figs that he studied.

This variability in the leaves of *Ficus* has caused confusion in describing fossil plants. For example, Chaney (146) wrote that if all dicotyledons had leaves as variable in form as *Ficus*, the paleobotanist might well despair of reaching sound conclusions regarding the identity of fossil foliage.

Richards (637) reviewed the investigation made by Holtermann (383) on the so-called drip-tip leaves of trees in rain forests. Species of *Ficus* inhabiting wet zones had, without exception, drip-tips that were more or less long, while those in dry zones had obtuse leaves. The drip-tip apex, as found in such species as *F. religiosa*, is an adaptation for the rapid drying of the leaf surface. Observations showed that such leaves dried more quickly than leaves without drip-tips.

Dimorphism. Diversity of foliage in some climbing figs has already been discussed in chapter II, under "Climbers; Lianas." This peculiarity in tree-like species is especially exemplified in the leaves of vigorous sucker growth and those of mature branches of two introduced figs,

F. cumingii and *F. ulmifolia*. On a single small tree of the first-named species, some leaves are linear, with basal lobes; some are lanceolate, with irregular marginal lobes; while others are oblong-lanceolate, with their margins entire. *Ficus ulmifolia* is so extremely variable in leaf characters as to make incongruous the selection of any single leaf as typical of the species. Both Merrill (519) and W. H. Brown (116) characterized the leaves of this species as variable in shape, oblong to subentire, undulately lobed, or coarsely toothed, sometimes deeply or narrowly lobed. Corner (193) reported that the sapling leaves of *F. alba* [*grossularioides*] and *F. hirta* are three- to five-lobed, but that the adult leaves are entire or merely toothed. Corner (196) stated that the main twigs of *F. otariophylla* [*subulata*] of New Guinea bear large leaves (30 × 9 cm), but that the side branches bear abruptly small leaves. A similar rapid change from large to small leaves occurs also on the branches of *F. virgata* Reinwardt ex Blume. According to Van Steenis (775), polymorphy in the habit and foliage of *F. quercifolia* [*montana*] and *F. heterophylla* is almost unbelievable.

Surface. The surface of fig leaves may be smooth or glabrous, as in *Ficus altissima*, *F. microcarpa*, and *F. macrophylla*, and it may be dull or glossy. On the other hand, the leaf surface may be puberulent, pubescent, or scabrid, especially on the lower side. The leaves of *F. bengalensis* are usually so velvety-pubescent that one can often recognize them by the sense of touch alone. As pointed out in the keys for identification of species (chapter V), the pubescence may be present on mature leaves or found on young leaves only. In *F. doliaria* and the variety *pubescens* of *F. mysorensis*, the tomentum is prominent, very dense, and rusty-brown in color. In *F. bussei*, the leaves are pubescent on both the upper and lower surfaces, and the margins are fringed with long, white hairs. The leaves of *F. petiolaris* may be recognized by the presence of tufted, white hairs in the axils of basal veins on the lower surface.

The scabrid condition of some fig leaves is so pronounced that they are actually used as substitutes for sandpaper! According to Turgano (767), the rough and sandy leaf surfaces of *F. ulmifolia* and *F. pseudopalma* indicate the occurrence of abundant silica in the spinose hairs. An illustration of the scabrid leaf surfaces of *F. exasperata* was given by F. W. Andrews (14). He found that the lower leaf surfaces of *F. salicifolia* are conspicuously warty. Britton and Wilson (109) reported that the upper leaf surfaces of *F. laevigata* [*citrifolia*] bear many minute, elevated papillae, or sometimes pores.

The lower leaf surfaces of a few figs are characterized by a rusty appearance caused by an exudation of scurf from the epidermis. The scurf on the leaves of *F. rubiginosa* and *F. macrophylla* can readily be rubbed off. In the latter species, it is not found on young plants, but is very apparent on older leaves as observed from below. C. F. Saunders (672-673) wrote of it: "I find pleasure in looking at the under surface of leaves through a pocket lens—a tessellated pavement, it seems, of warm brown blocks outlined in green."

Hairs on the surfaces of fig leaves are either unicellular or multicellular, as described and illustrated by Condit (174) for *F. carica*. According to Jane Philpott (602), the leaves of *F. villosa* are covered with multicellular hairs on both surfaces.

Hydathodes. Some fig species show small, white spots on the upper surfaces of their leaves (figure 24). These are actually hydathodes, or epidermal structures specialized for the secretion of water. In G. King's account of *Ficus* (437), mention was made of some leaves having the upper surfaces "minutely dotted." The reference by Solereder (708) to "the peculiar small pits, warts, or spots (forming hydathodes)" found in many species of *Ficus* is reiterated by Metcalfe and Chalk (531). According to Molisch (551), scattered hydathodes on the upper leaf surfaces of *F. javanica* appear as orange-colored spots. (See figures, page 32.)

A good general account of hydathodes was given by Haberlandt (350). He stated

that the disc-shaped epithem hydathodes which occur in species of *Ficus* and other Moraceae are provided with a large number of small water stomata. The epithem is usually shut off from the adjoining green mesophyll by a parenchymatous bundle sheath, the cells of which frequently have their inner walls cutinized. The energy employed in the process of secretion is supplied by the glandular hydathode cells themselves; they also develop the force which causes water to exude. The exudation pressure in the water-conducting system merely supplies the stimulus which sets the pumping action of the hydathodes going. According to Meyer and Anderson (532), the water exuded from hydathodes is not pure, "but contains at least traces of solutes, including sugars, amino acids, and mineral salts."

The presence or absence of hydathodes would seem to have value in the identification of species. However, I agree with Solereder (708) that so much variation is found to occur in a single species with respect to hydathodes that this is an unreliable taxonomic character (figure 25). Furthermore, in at least one species it appears to be a juvenile character only. Observations made in 1959 on seedlings of *F. microcarpa* and its variety *nitida* in Hawaii invariably showed hydathodes to be present on the leaves of young seedlings, while the leaves of older plants were entirely devoid of them. The leaves of *F. elastica* show no hydathodes on the upper surface, while the variety *decora* has the spots sparingly distributed in the marginal areas only. Hydathodes are found on some leaves of *F. religiosa* but not on others, even on the same plant. Among the species which show hydathodes either sparsely or densely scattered over the leaf surface are *F. avi-avi*, *F. urceolaris*, *F. minahassae*, and *F. septica*.

Venation. Most species of *Ficus* have pinnately veined leaves, with a prominent midrib and lateral veins extending on either side toward the margin. There are commonly one to three, or even four, basal veins, spreading more or less di-

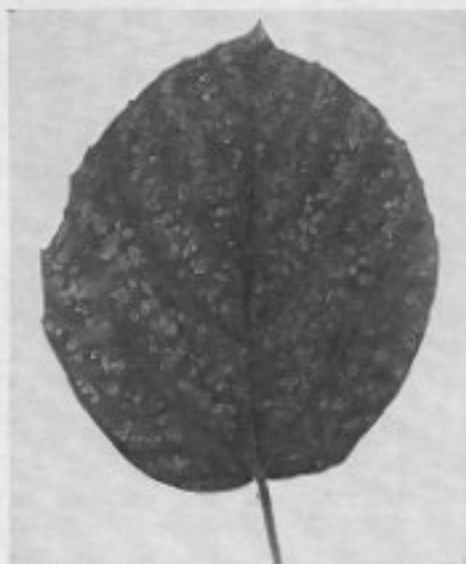


Fig. 24. These spots shown on a leaf of *Ficus auriculata* are formed by the exudation from hydathodes that has been drying on the surface. The text on page 31 explains the water-secreting function of hydathodes.

rectly from the apex of the petiole. The number of lateral veins varies from a few (3 to 5 in *F. soldanella* and *F. sycomorus*, 5 or 6 in *F. kerstingii*, as well as in *F. petiolaris*) to many (25 to 30 in *F. elastica* and 15 to 20 in *F. subcordata*). The lateral veins are often prominent and well elevated above the lower leaf surface. On the other hand, they are sometimes flush with the surface and are difficult to count, because indistinct or intermediate veins are found between the primary laterals. Usually, the lateral veins form an arch or loop in the marginal area, one end of the loop connecting with the adjoining veins.

Standley (717) reported that for several species, the lateral veins are "arcuately anastomosing near the margins." Eggeling (251) said of some species, "lateral nerves looped to form a crenate line near the margin." In several cases, Mary Barrett (67) referred to lateral veins as "forked and confluent near the margin, making a deeply indented marginal vein." Some botanists pay considerable attention to the angle formed by the lateral veins as they extend outward from the midrib.

Ficus elastica is an example of a species in which the lateral veins practically diverge at right angles from the midrib, and are almost parallel with each other. Standley (717) gave the following angles of divergence: *F. mexicana* [*maxima*], 70 degrees; *F. cotinifolia*, ascending at about 45 degrees; and *F. crassiuscula* [*insipida*], 60 to 85 degrees. Mary Barrett (67) reported lateral veins of *F. lacor* [*virens*] to ascend at an angle of 60 to 70 degrees, and those of *F. roxburghii* [*auriculata*] at an angle of 45 degrees. The lateral veins are either straight and unbranched, as in *F. subcordata*, or somewhat branched, as in *F. sycomorus*.

On the lower leaf surfaces of some figs appear reticulations or areolae between the lateral veins, a condition to which Mary Barrett (68) has applied the term "herringbone pattern." In her description of *F. mysorensis*, she characterized the interveins as "showing a herringbone network with a zigzag meeting line." Henkel (366) gave the following: for *F. pretoriense*, "veinlets strongly reticulate on both sides"; for *F. sycomorus*, "veinlets slender, flexuous between the lateral veins"; and



Fig. 25. Light-colored hydathodes are densely distributed over the upper surfaces of some fig leaves, but are very sparsely scattered in other species.

for *F. soldanella*, "veinlets lax and wavy, and somewhat prominent below." Corner (192) reported that the leaves of four species of *Synoecia* are "simply tessellate on the under sides, with flat areolae between the reticulate veins."

Palmately veined leaves are borne by trees of *F. fulva* (figure 26) and *F. carica*; also, by the lobed leaves of the latter's near relatives, *F. palmata* and *F. pseudocarica*. The entire or nonlobed leaves sometimes borne by these species are pinnately veined, with one prominent basal pair plus six or seven pairs of laterals.

Margins. Blade margins of fig leaves may be entire, undulate (wavy), serrate, dentate, crenate, incised, or lobed. For typical shapes of leaves, see the plates referred to in descriptions of species.

Petioles. Examples of descriptive terms for petioles follow: Elmer (262), for *F. pseudopalma*, "petiole very short but stout, yellowish-brown, much thickened and somewhat compressed"; Elmer (258), for *F. palauanense*, "petiole 3 to 5 cm long, glabrous, thick, after falling leaving prominent scars"; Corner (192), for *F. punctata*, "petiole 1.5-9 mm long, 1 mm wide, slender, becoming brown and scurfy" (referring to dried specimens); Mary Barrett (68), for *F. vogelii*, "petioles reddish brown, scurfy, 1-6 inches long (mostly 2-4); thick." [Metric conversions for Mary Barrett's measurements: 2.5-15 cm and 5-10 cm.]

The characters of petioles which seem to be worthy of note are length, thickness, color, surface, and cross section. The Latin description by Linné (473) for *F. religiosa* used the expression, "foliis perpetuo mobilibus," literally, "perpetual motion," because the long, slender petioles allow the blades to flutter in a breeze as do those of the Quaking Aspen (*Populus tremuloides*). The terms "somewhat compressed" and "deeply grooved" aptly describe the petioles of many species, as employed in the present publication. Although the petioles of some figs are terete or round in cross section, most show the upper surface to be flattened and more or less channeled. For example, Elmer (259) gave the peti-



Fig. 26. The deeply lobed leaves of the Stinging Fig, *Ficus fulva*, closely resemble those of the Common Fig, *F. carica*.

ole of *F. calophylloides* [*subcordata*] as 2.5 cm long, glabrous, and deeply grooved along the upper side. The petiolar surface generally follows closely that of leaf veins or young twigs, being glabrous, puberulent, or pubescent. The color of the petioles commonly approximates that of the midrib. However, in some species the color is rusty-brown or dark, and this shade often terminates abruptly at the base of the midrib.

A character used by some botanists is that of the insertion or junction of petiole and blade. Kurz (455), for example, described *F. lacor* [*virens*] as having "a long petiole, jointed at the apex." G. King (437) included this character in his key separating three species: *F. tsiela* [*amplissima*], the lamina never jointed; *F. infectoria* [*virens*], lamina indistinctly jointed; and *F. geniculata*, lamina distinctly jointed to the petiole. Corner (193) referred to *F. caulocarpa* as having a stalk distinctly jointed to the blade. Most au-

thors, however, ignore this jointing of blade and petiole, apparently regarding it as a character too unreliable for taxonomic consideration.

Color. The green color of fig leaves is generally more intense on the upper than on the lower surface. It is therefore usually repetitious to state, in describing leaves of most species, "green above, lighter below," etc. There are, however, several exceptions which warrant consideration. One example is *Ficus nymphaeifolia*, the leaf blades of which are, as Linné (474) reported, "subtus albida," or whitish beneath. Other more striking examples are *F. dryepondtiana* and *F. canoni* [equals *aspera*], having leaves that are green above and purplish beneath, a condition affected by the intensity of light. According to Corner (196), in Java the leaves of *F. montana* Burman (f.) var. *purpurascens* (Blume) Corner are also purple or violet beneath. The lower leaf surface of a few species, such as *F. natalensis*, *F. perforata*, and *F. thonningii*, is more or less aureous.

Varieties of the India Rubber Tree, *F. elastica*, have been selected on account of the scarlet coloration of the new foliage. Juvenile leaves of some fig species are almost or just as brightly colored as the autumn foliage of some maples or of *Liquidambar*. Trees of *F. virens* and *F. religiosa* are deciduous for short periods, then are sometimes decorated with brilliant pink or red as the leaves expand. The young leaves of *F. auriculata* are especially brilliant and ornamental after a period of dormancy. Both Eggeling (251) and Burt-Davy (131) referred to the bright coloration of leaves on trees of *F. ingens*. A color illustration of this species with its "blazing red" foliage was given by Sima Eliovson (255).

The ornamental value of some species is enhanced by the bright color of the midrib and lateral veins, a condition which again varies according to the individuality of plants and to degrees of light or shade. Species which have veins more or less scarlet in color are *F. petiolaris*, *F. soldanella*, and *F. kerstingii*. The midrib and

primary veins of *F. septica* are very light green to almost white.

Variation. Variegated forms of several species have long been grown and offered in the trade as ornamental plants. *Ficus parcelli* is a cultivar, probably the variegated form of *F. aspera*. Variegated and normal green leaves are often found side by side on plants of *F. rubiginosa* "variegata." Other species with forms which are grown on account of their variegated foliage are *F. elastica*, *F. radicans*, and *F. pumila*. See illustrations by P. Fischer (287).

Texture. Some of the terms used in describing leaf texture are coriaceous, subcoriaceous, chartaceous, thin, brittle—often with modifying adjectives. The leaves of *Ficus elastica*, *F. wathinsiana*, and *F. subcordata* are more or less thick and rubbery in texture. The coriaceous leaves of *F. nebbudu* and *F. vogelii* are somewhat brittle. Corner (192) thus described the leaf textures of various species: *F. apiocarpa*, "coriaceous-chartaceous, rather thick"; *F. carri*, "very coriaceous"; *F. cataupi*, "rigidly chartaceous, drying coriaceous and brittle." Elmer (258, 262) employed the term "submembranous" for *F. satterthwaitii* [congesta], *F. minahassae*, and *F. glomerata* [racemosa]; and "thick and very rigid" for *F. palauanense*.

Wax Glands. Wax glands or nectaries are found on the lower leaf surfaces of some species of *Ficus*. They are especially prominent on the leaves of *F. deltoidea*. Special studies of these glands have been made by various botanists, including Mirabella (546) and Renner (630), both with illustrations; also, by Metcalfe and Chalk (531). Renner reviewed Mirabella's work, and published figures of glands found in certain species, including *F. bengalensis*, *F. religiosa*, *F. glomerata* [racemosa], *F. canoni* [equals *aspera*], *F. urophylla* [heteropleura], *F. cunea* [semicordata], *F. roxburghii* [auriculata], *F. hispida*, and *F. diversifolia* [deltoidea]. He also classified species found in the Munich Herbarium into seven groups, with respect to the location of glands. The function of wax glands in species of *Ficus* is apparently

speculative, and deserves more careful study, especially when one is working with fresh material.

Leaves: Microscopic Characters

The positive determination of certain *macroscopic* characters of leaves, such as pubescence, requires the use of a hand lens, but *microscopic* characters can usually be determined only after the preparation of thin sections and their study by the use of a compound microscope. Corner (192) reported that in most species, the areolae on the lower leaf surface "are packed with white, hairy pits in which the stomata are confined," and that these pits are subepidermal in origin. He further stated: "I am convinced that the microscopic structure of the leaves will have an important place in the future classification of *Ficus*, though I have given the problem little more than the most superficial attention."

Corner (196) again emphasized this when he wrote: "Until one can identify leaves, in particular from microscopic structure, it is commonly impossible to identify many types." With reference to the series *Fibrosifoliae* in the section *Sycidium*, Corner determined: "This group is abundantly distinct in the microscopic feature of sclereid-like fibers excurrent from the vascular bundle sheaths and permeating the whole mesophyll between upper and lower epidermis. It is a feature which can be observed very easily and quickly in a minute fragment of dried leaf tissue cleared by placing in a drop of dilute potash on a slide and warming for a minute; the fibers appear like white worms under a low power of the microscope." The type species of this series is *Ficus obscura* Blume. (See note under *F. angustifolia* in chapter XVI.)

In Corner's key to the natural classification of species, the leaves of Division 1

lack stomatal pits, while stomatal pits are present in Division 2. Few, if any, other botanical keys for identification of fig species include references to microscopic characters, and no further consideration will be given to them except to present a short account of lithocysts. However, attention should be called to the publication by Jane Philpott (602), which described the blade tissues of forty-seven species of *Ficus*, including epidermis, palisade cells, spongy mesophyll, and vascularization.

Lithocysts; Cystoliths. Many, if not most, species of such plant families as Urticaceae, Moraceae, and Acanthaceae develop, in the epidermis of the leaf, large specialized cells termed "lithocysts," inside of which are found peculiar calcified bodies known as "cystoliths." These have been studied and described by various botanists, including Kohl (442), Renner (631, 632), Solereder (708), Haberlandt (350), Berg (78), Flora Scott (684), and Katherine Esau (268). Their occurrence in the Common Fig (*Ficus carica*) was discussed and illustrated by Condit (174). Turgano (767) believed that the location and shape of lithocysts have some taxonomic significance in separating different species of *Ficus*. He found that the more lengthened lithocyst with bulging body is common in *F. elastica*, while the more rounded one with compressed body is characteristic of the thin, compact-tissued leaves of *F. nota*. Corner (196) recognized the importance of cystoliths. Under the section *Urostigma*, he found "cystoliths only on the lower side of the lamina," but under the section *Leucogyne*, cystoliths on the upper side only. However, the study of such microscopic characters as lithocysts must be left to specialists who have the proper equipment. They are referred to here merely to suggest sources of information in case a student should wish to pursue the matter further.

CHAPTER IV

PRACTICAL CONSIDERATIONS AND NOTES ON FOLKLORE

Climatology

Weather conditions which affect exotic fig trees are wind, rainfall, heat, drought, and especially frost. Very little need be said about wind damage or resistance to wind because the species are so diverse in their habits and adaptability. *Ficus perforata* has been recommended for seacoast planting because the trees are resistant to salt spray. E. H. Walker (794) suggested that the best use for *F. tinctoria* is as a windbreak. In the Philippines, Pancho (582) found that trees of *F. indica* [*sundaica*] and *F. retusa* [*microcarpa*] were both very resistant to strong winds. At Riverside, leaves of the following species have been badly damaged by gusty winds up to fifty miles per hour: *F. auriculata*, *F. coronata*, *F. aspera*, *F. pertusa*, *F. hispida*, and *F. coccolifolia*. Six species showed no leaf injury by wind: *F. altissima*, *F. rubiginosa*, *F. benjamina*, *F. microcarpa* var. *rigo*, *F. obliqua* var. *petiolaris*, and *F. elastica*.

In the so-called rain forests of tropical countries, wild figs of various species luxuriate and attain large sizes as trees or lianas. Troup (765) wrote of *F. elastica*: "The chief factor which determines the natural distribution of the tree appears to be excessive humidity, which also denotes an equable climate; actually, it is found typically in warm, steamy localities, though it ascends to altitudes which are moderately cool, and where fairly severe frost must also certainly be encountered." Howard and Proctor (398) stated, on the authority of Von Faber (783a), that several species of *Ficus* require aluminum for the normal development of the tree.

Many species are notably resistant to extremes of heat and drought, as Aaronsohn (1) recorded for *F. sycamorus*. According to Maiden (494), as quoted by Pemberton (592), trees of *F. macrophylla*

will grow among rocks where scarcely anything else will grow; they will stand being buffeted by fierce winds and being hacked and otherwise ill-used. In Australia, *F. rubiginosa* thrives in very dry localities. Pardy (583) stated that *F. sonderi* Miquel (species No. 67) usually occurs in granite areas of the hotter and drier parts of Southern Rhodesia. To quote again from Troup (765): "It is interesting to note that in the abnormal drought of 1907 and 1908 in the forests of Oudh [India], the epiphytic figs proved conspicuously drought-resistant." He found that the Pipal (*F. religiosa*) proved to be especially hardy, as was the case in the severe drought of 1899 and 1900 in the Indian peninsula.

During the course of my travels in Mexico, I have observed trees, especially of *F. petiolaris*, growing, as Standley (717) recorded, on dry slopes and often on the face of cliffs. Even toward the close of a long dry season, the trees are apparently able to burst forth with a new series of leaves and receptacles. Shreve (694) reported that the only tree suited to gain foothold on the upper walls of steep barrancas in Baja California is *F. palmeri*.

Most species of *Ficus* are indigenous to tropical or subtropical regions, and can hardly be expected to thrive where winter temperatures drop many degrees below freezing. However, species which are deciduous during a dormant season may be uninjured by temperatures down to 15° F. or even lower if the trees become really dormant. Examples are *F. carica*, *F. palmata*, and *F. erecta*. Plants of such species as *F. auriculata* and *F. virens*, which have a short period of dormancy, are much less hardy than the three species just mentioned. Species which are evergreen, or nearly so, vary considerably in cold-hardiness. Experiences in California and Florida during several seasons of low tem-

peratures have given some indication of the comparative hardness of exotic figs. Examples of species which are tender and susceptible to damage by a drop of only a few degrees below freezing are *F. doliaria*, *F. hispida*, and *F. minahassae*. Some species, such as *F. benjamina* var. *schlechteri*, show distress or even severe damage to foliage from chilling at night temperatures several degrees above 32° F.

John E. Dinsmore, Jerusalem, in a letter dated December 25, 1938, stated: "*Ficus sycamorus* will endure no frost, and hence is never found in the hill country." The scarcity of large trees of *F. elastica* in southern California indicates that this species is less resistant to cold damage than are trees of *F. macrophylla* and *F. rubiginosa*, both of which mature into magnificent specimens. The Evergreen-vine Fig or Climbing Fig (*F. pumila*) is seldom injured by heavy frosts if it is protected by buildings or other supports, although Binder *et al.* (81) stated that new growth had been nipped by frost in California with the thermometer down to 20° F. They added that all varieties of *Ficus* should be moved under lath by mid-December. At Orlando, Florida, a low temperature of 24° F. on December 12, 1957, caused severe damage to a tree of *F. obtusifolia* but less to *F. elastica* and *F. microcarpa*. In a report on winter hardness of plants, Bowden (100) concluded that in most cases, the differences in degree of hardness of related species are not correlated with chromosome-number differences. Four species of *Ficus*, all diploid, were grown at Blandy Farm, Virginia. See Mason (501a) for susceptibility of three species to frost. Further notes on hardness are given with my descriptions of various species.

Propagation

Woody cuttings of the Common Fig (*Ficus carica*) root so readily that no other method of propagation is used commercially. Soft-wood cuttings taken during the growing season also take root if handled properly. The propagation of other species may be easily accomplished, or

may require special methods. As reported by Hutchins (405), Dalziel (221), Eggeing (251), and Standley and Steyermark (726), the large branches of some fig trees take root when planted like posts in the ground. In Honolulu, Lyon (485) found that cuttings placed in soil in the Arboretum rooted better in some cases than those in sand or soil in a special nursery. Lyon (484) cited *F. hispida* as an example of a species which produces suckers from its roots, and added: "While the banyan walks over the landscape, the rough-leaved fig crawls under it."

The experience of propagators in California has shown that most species are easy to root from soft-wood cuttings placed in a mist propagating chamber. Nearly all of forty species growing outdoors at Riverside were rooted in an ordinary cutting bed, but a few defied all efforts to grow them from cuttings. The selection of wood and the season when cuttings are made seem to be important factors in the successful propagation of figs. Tip cuttings of *F. elastica* with four or five leaves are thus rooted by some nurserymen. The same species can also be propagated by leaf-bud cuttings (leaf, bud, and a short section of stem), but plants from such cuttings are slow in reaching marketable size, and are also undesirable because the lower leaves are small as compared with those produced in other ways. Henrard (366a) reported trials on the propagation of *F. elastica* var. *decora* in perlite and other media. The methods of taking cuttings of this variety were recently treated by D'Haese (230d).

A recent report from Honolulu stated that *F. malauensis* is very difficult to propagate by cuttings. In California, cuttings of *F. macrophylla* taken from large, outdoor trees seldom form roots in a propagating medium, but similar cuttings from plants growing under lath or glass soon develop good root systems. Lateral twigs from potted indoor plants of *F. sundaica* are found to root very readily. In April, 1961, six tip cuttings were taken from each of thirty-three different outdoor fig plants at Arcadia (LASCA) and placed in



Fig. 27. Young plants of a number of species of figs, such as *Ficus lyrata* in this photo, are frequently propagated by the marcottage or "mossing" method.

(Photo by Dennis Kucera.)

sand under a mist spray. Cuttings of some species callused, but did not produce roots on removal from the sand at the end of six weeks. The following rooted well: *F. auriculata*, *F. virens* var. *wightiana*, *F. insipida*, *F. variegata*, *F. nota*, and *F. sycamorus*.

A common method of producing new plants from many tropical species is known as marcottage, mossing, or air-layering (figure 27). In China, branches of guava, citrus, or lychee of considerable size are thus rooted. Harold Loomis, Miami, Florida, in a 1958 conversation, told of his experience in rooting a limb of *F. sycamorus* 15 cm in diameter by enclosing it between two halves of an oil drum filled with moss. Troup (765) told of rooting branches 1.5 to 3 m long in India. The marcottage method is used extensively with *F. elastica* var. *decora* in Florida and elsewhere. The mother plants are grown close together in open fields, and are kept small by marcottage of new shoots about 40 cm long.

Laborers are given instructions as follows: From the terminal bud, count back 7 leaves; remove leaves 8, 9, and 10; take off a ring of bark; tie on a bamboo stick to prevent breakage; wrap in damp moss; cover with aluminum foil; leave for about a month. The rooted branch is then cut off, inspected, and if found with perfect leaves, wrapped in a paper sleeve and shipped to the wholesaler, who usually pots the plants and gets them established before offering them to the retail trade. In California, some marcotted leafy plants have been offered for sale with the ball of moss immersed in water only. Such plants, when potted by the purchaser, soon become established and make normal "rubber plants" for the home or office. According to P. V. Taylor (751), the commercial production of *F. elastica* var. *decora* in Florida developed into a big business; in 1960, one nursery was shipping at the rate of 50,000 mossed, rooted cuttings per month. Growers in Puerto Rico are also propagating this species on a large scale. Directions for propagating potted plants of *F. elastica* or *F. lyrata* by mossing were given by Melady (511).

The introduction of new fig species or of certain especially desirable kinds is mostly accomplished by the use of fertile seeds. The word "fertile" is here emphasized, because experience has shown that some receipts of fig seeds are found to consist only of hollow shells with large openings through which insects have made their exit. Fertile seeds, of some species at least, retain their viability for several years, as found by extracting seeds from dry herbarium specimens. The growing of seedlings from fertile seeds offers no special difficulties to a good propagator. The seedlings will naturally display more or less variation. From a given lot of seedlings, there is always a chance that superior plants may be selected, as appeared to be the case with the variety *decora* from seedlings of *F. elastica*. An interesting illustrated account of the germination of seeds and development of seedlings of *F. elastica* was given by Troup (765). Furthermore, he gave

detailed instructions for the propagation of this species from seeds, cuttings, and layers. Advertisements offering seeds of the variety *decora* may be questioned as to authenticity or fertility of the seeds. It is apparently not an indigenous plant, but is a cultivar with receptacles not productive of fertile seeds.

Propagation of fig trees by budding or grafting is practicable, and may be followed in some cases. The use of *F. racemosa* and *F. gnaphalocarpa* as nematode-resistant rootstocks for *F. carica* was discussed by Condit (176). (See also, the accounts of the above two species in this book, numbered 82 and 100, respectively, for further data on nematode resistance.) Both Foussat (296) and Grignan (343) gave accounts of grafting *F. elastica* on roots of the same species. In a letter dated February 7, 1958, P. R. Montagnac wrote from Madagascar that he had succeeded in grafting *F. carica* on *F. avi-avi*, and that *F. cocculifolia* was also a good "supporting graft." See also, Montagnac (554). This latter species is thriving at Riverside, California, and some varieties of the Common Fig grafted on it are growing vigorously and even maturing fruit the same season the graft is made (figure 28). The stock, however, is somewhat tender, and suffers injury at about 26° F. Mounding dirt around the graft union should avert such injury. (See related comment under *F. racemosa*, species No. 82, and *F. cocculifolia*, species No. 107.)

Experimental work on the congeniality of various species of *Ficus* is being conducted. Results so far are meager, but show that the following combinations are more or less successful: *F. sycomorus* on *F. gnaphalocarpa*; *F. carica*, *F. palmata*, *F. oligodon*, and *F. sycomorus* on *F. cocculifolia*.

Ornamental Value

The ornamental value of fig trees is treated to some extent under my descriptions of the various species. Mention has already been made of the strikingly beautiful foliage of certain kinds. Only a few

specific references to the value of fig trees for ornament will be given here. Roxburgh (658) referred to *Ficus tsiela* [*amplissima*] as being found everywhere in the lowlands of India, where it becomes nearly as large as *F. religiosa* and is equally good for shade. In Guatemala, Standley (721) found trees of both *F. glabrata* [*insipida*] and *F. padifolia* [*per-tusa*] to be "the handsomest of all the figs." (See figure 29.) Both Dalziel (221) and Eggeling (251) reported that in West Africa, *F. polita* is one of the best shade trees, usually forming a dense spherical or umbrella crown. Among his "Wayside trees of Malaya," Corner (193) distinguished *F. dubia* (the Cherry Fig) as one of the most beautiful in the genus, the fruiting twigs looking as if they were decked with luscious cherries. He termed *F. superba* a magnificent tree which should be brought into cultivation. Again,



Fig. 28. Varieties of *Ficus carica*, the Common Fig, when grafted onto the Adabo, *F. cocculifolia*, will grow and produce fruit even in the first year. This specimen was produced at Riverside.

(Photo by Dennis Kucera.)



Fig. 29. This beautiful specimen of *Ficus pertusa* ornaments a cemetery at Tepoztlán, Mexico, near Cuernavaca.

(Photo by I. J. Condit.)

in Guatemala, Standley and Steyermark (726) stated that *F. costaricana* is probably the species most seen as a shade tree planted about houses in Antigua, where tourists are also urged to view avenues lined with it. According to Paul H. Allen (6), *F. goldmani* is one of the most common and characteristic local trees near Palmar, Golfo Dulce, Costa Rica; it is frequently used for living fence posts and for shade. Sturrock and Menninger (737) listed species adapted to southern Florida, giving notes on the ornamental value of each.

Various species, such as *Ficus glomerata* [*racemosa*], are used as shade for coffee plantations in India, according to Rao (622a).

Whatever may be reported above or elsewhere as to the ornamental value of various species of *Ficus*, it should be



Fig. 30. Rows of *Ficus altissima* are freely used for planting along broad avenues in cities of south Florida.

(Photo by A. J. Basinger.)

stated, as Menninger (512) pointed out, that very few are suitable for planting along the usual, often narrow, city street. The huge buttresses of *F. macrophylla* and similar kinds, the surface roots of *F. elastica*, and the multiple trunks of *F. bengalensis* and *F. altissima* are reasons sufficient for their elimination from lists of street trees. Where there is a divided highway with parking strip in the center, as in southern Florida, the roots of *F. altissima* (figure 30) and *F. religiosa*



Fig. 31. A few streets in Miami are bordered by the graceful, drooping trees of the Weeping Fig, *Ficus benjamina*.

(Photo by A. J. Basinger.)

cause damage to the pavement and even to curbs, so that root pruning must be practiced, as the illustration indicates. This may weaken the trees sufficiently to cause them to topple over during windstorms. Trees of *F. benjamina* planted along Coral Gables and other Miami streets have broad crowns with drooping branches, and must be kept within bounds by judicious pruning (figure 31). An interesting account of the tremendous surface root formation of *F. elastica* in Ceylon is given with the description of that species (No. 32).

In another case, the curb space along Miracle Mile in Coral Gables, Florida, has been planted wisely (so it would seem) to a slender palm rather than to an unruly fig tree. On the other hand, Watkins (809) regarded the trees of *F. retusa* [*microcarpa*] lining a major highway in Cuba as an excellent example of plant utilization, an opinion with which



Fig. 32. These trees of *Ficus microcarpa* var. *nitida*, planted in front of the Richfield Oil building at Los Angeles, are examples of what is being done to adorn the streets of several southern California cities.

(Photo courtesy of the Richfield Corporation, loaned by Michael J. Elliott.)

I heartily concur, for I remember seeing them along the same highway in 1949.

Little and Wadsworth (476a, with illustration) had this to say about the Indian Laurel for ornament and shade: "In some places, this tree is considered objectionable because of its size, the litter of the numerous fruits, or because of a thrips insect which deforms the foliage and may irritate the eyes of persons beneath the tree." (Referring to *F. microcarpa*.)

In recent years, hundreds of trees, mostly of *F. microcarpa* var. *nitida*, have been planted along city streets in southern California. The Los Angeles *Mirror News*, the Miami (Florida) *Herald*, May 25, 1958, and *Sunset Magazine*, September, 1961, described these trees and the methods used to plant them. See also, Roewekamp (652a). Briefly, the job consists in cutting a square through the cement sidewalk or curb space, excavating the dirt to a depth of 1 to 1.2 m, placing crushed rock in the bottom for drainage, filling in with fresh soil, providing means of irrigation and fertilization, planting the tree, surrounding the trunk with a metal protector, and covering the open space with metal grating. Means are being sought for dwarfing the trees in order to

keep the tops, and especially the trunks, within bounds. In some cities, such as Riverside, the trees are being planted in large containers resting on the sidewalk. (See figures 32 and 33, illustrating the two methods.)



Fig. 33. This tree in the Plaza Mall at Riverside is typical of *Ficus microcarpa* var. *nitida* when used as shown.

(Photo by Dennis Kucera.)



Fig. 34. *Ficus microcarpa* var. *nitida* at the McKinley School, Honolulu, is kept within bounds by systematic pruning. (Photo by Dr. R. A. Hamilton.)

The planting of specimen trees in parks is another matter. Beautiful trees of various species are to be found in such locations as Bay Front Park and Fairchild Tropical Garden, Miami, Florida; Ala Moana Park and Foster Garden, Honolulu; Balboa Park, San Diego, California; and Hillside Park, Santa Barbara, California. (As examples, see the account of *F. macrophylla*, species No. 28; also, figure 13 in chapter II.)

In Mexico and other areas with suitable climates, street or specimen trees are often pruned heavily or sheared to various shapes (figures 34, 35). Foster and Foster (295) found that in Brazil, trees of *Ficus microcarpa* var. *nitida* were very commonly used for shade, and were pruned into all sorts of animal shapes. Plants of *F. benjamina* are being grown in hedge form at Miami and Coral Gables, Florida, and the tops are cut back each year to a height of 4.5 m. In Havana, the use of sheared plants of *F. retusa* [*microcarpa*] to protect the marble slabs in a cemetery was described by Watkins (309): "As I had never heard or read any reference to this unusual form of topiary art, my first view of it left a vivid and lasting impression. Two trees of *F. retusa* are planted by the foot of the slab, and the tops are trained and sheared to make a perfect canopy of green foliage over the grave, casting shade to protect the stone against

cracking and bleaching in the tropical sun."

The comments by Riedel (642) regarding the use of fig trees in Santa Barbara are worth quoting: "Of the many forms in which this genus is represented, only those of moderate size can interest the average gardener of this region, be they shrubs, trees, or vines. The larger-growing trees, while famous the world over, and most capable of lending distinction to our landscapes, can nevertheless be employed in but a few instances. Our well-known *F. macrophylla* has amply demonstrated this. The size of these trees and their wide-spreading root system greatly limit their usefulness in ornamental gardening. Practically no other plants will grow in competition with them or in their shade, excepting possibly some epiphytic bromeliads and orchids. Pot plants standing in a nursery lath house have been invaded by the roots of rubber trees 200 feet [62 m] distant, and robbed of all their nourishment. Most rubber trees, like most *Eucalyptus*, grow out of scale to the average garden, and are effective only in large-scale landscaping, such as might have been possible on roadsides had our highway rights-of-way been 1,000 feet [307 m] instead of 100 feet [31 m] or less." (Metric conversions are approximate.)

Condit (180) treated the subject under the following headings: Hardiness, Meth-

ods of Propagation; and Figs—as Vines, as Pot Plants, as Avenue or Street Trees, and as Specimen Trees.

Economic Utility

This subject is so vast that a whole volume might be required if it were treated in detail. Space is given here for only some of the highlights, under the headings, Wood, Edibility, Livestock Fodder, Medicinal Value, Latex, Paper and Cloth, and Miscellaneous Uses and Properties.

Wood. In general, the wood of fig trees is soft, and is lacking in usefulness or durability. However, a few citations regarding the wood of various species may be of interest. D. Brandis (102): *Ficus infectoria* [*virens*], wood reddish or brownish white, 30 pounds weight per cubic foot [13.6 kg per 28.317 cu dm], not durable; also, *F. religiosa*, wood pinkish white, with narrow, concentric bands of lighter color, open grained, not strong or durable, medullary rays marked, showing like narrow, horizontal bands on a vertical section, 34 to 44.5 pounds weight per cubic foot [15.42 to 20.18 kg per 28.317 cu dm]. J. G. Baker (48): Wood of *F. nautarum*, durable and used for

canoes. F. M. Bailey (42): *F. watskinsiana*, wood of a light color, fairly close grained, easily worked, may be useful for packing cases. Duthie (247); also, Burkill (124): Wood of *F. religiosa* moderately hard, sometimes used for packing cases or burned for charcoal. Record and Mell (623): *Ficus* trees of tropical America "are considered as weeds of the forest, the wood sappy and likely to rot before drying." Gagnepain (306): *F. damit* [*rumphii*], trunk used by natives to make boats of a single piece. Audas (31): *F. macrophylla*, soft wood with a beautiful, wavy figure, very difficult to season. Burkill (124): *F. bengalensis*, wood moderately hard, without heartwood, durable under water and used for well curbs, as well as for tent and yoke poles; also, *F. retusa* [*microcarpa*], one of the best of fig woods. Reyes (633): Characters of wood, chemical composition, and uses of a number of Philippine species. Eggeling (251): *F. brachypoda* [listed in chapter XVI], cultivated for the sake of its poles, which are used for building huts, the stems being first barked and dried; also, *F. mucoso*, trunks used for making canoe-like troughs in which beer is brewed. Sata



Fig. 35. When it is shaped by suitable clipping, *Ficus benjamina* may be used in hedge rows, or even in cylindrical form, as it appears here at a driveway entrance in Coconut Grove, Florida. (Photo by A. J. Basinger.)

(670): *F. konishii* [variegata var.], highly valued for timber because the tree grows to an immense size and the wood is white, hard, and fine grained. E. H. Walker (794): *F. gibbosa* [tinctoria], wood for cheaper timber, chopping blocks, wooden mortars; and in Taiwan for refining camphor and making utensils. Browne (117): A general description of fig wood for species growing in Borneo. Baumann (72): Wood of *F. sycamorus* is very soft and porous, but is yet very durable and a great favorite with coffin makers. A. L. Howard (397): An account of the wood of various species of *Ficus*. Desch (226): The general characters of several Malayan figs for timber, showing a magnified transverse section of the wood of one species.

Edibility. The one species of *Ficus* which produces both fresh and dried figs in large commercial quantities is *F. carica*. Its close relative, *F. palmata* of India (species No. 91), is said to be cultivated in the hills for both fodder and fruit. According to D. Brandis (102), the figs of *F. roxburghii* [auriculata] are edible, and are offered for sale in bazaars.

Other references to the edibility of fig fruits follow. Bennett (75): Ripe fruits of *F. habrophylla* [listed in chapter XVI] are purplish red, and excellent for tarts and preserves. F. M. Bailey (42) and Gagnepain (306): Several species are named which are noted for edibility. Elmer (256): "None of the Philippine figs are edible"; but Wester (820), for *F. nota*: "Figs fleshy and juicy, quite sweet, with the aroma of the cultivated fig." Duthie (247): The fruit of *F. glomerata* [racemosa] is much eaten, both raw and cooked, and constitutes a valuable food supply during times of famine. Sturtevant (738): Several quotations are given from various sources regarding edible figs. Lyon (484): With the first heavy crop of *F. macrophylla* in Honolulu, many people gathered fruits as fast as they fell, and some reported that they made excellent pies and puddings. [A report unsubstantiated in later years.] Ward (806) [his account, slightly paraphrased]: "I found a

creeping fig in Burma with little edible marbles for fruit, most of which had already been eaten by natives; but I did find one, and very good it proved." Standley (717, 720): The fruits of *F. podifolia* [pertusa] are edible, as are those of *F. cotinifolia*, when eaten raw or preserved with sugar. Burkill (124): Figs vary enormously in palatability, from the best, such as *F. carica*, *F. ulnifolia*, and *F. roxburghii* [auriculata], to figs which seem to be untouched by any bird or animal. Corner (193): The figs of *F. cuneata* [semicordata] are edible, and remind one of gooseberries. Eggeling (251): The fruits of *F. vasta* [listed in chapter XVI] make good eating when gathered freshly fallen and half dried in the sun; or when completely dried, then stored, and eaten when stewed. Sata (670): Children in Formosa (Taiwan) were frequently seen eating the figs of *F. retusa* [microcarpa]. Irvine (412): The fruits of *F. capensis* are edible when not ant-ridden, as are the young aerial shoots, though the figs have not much taste and are used for feeding canaries. Schnell (677b): The fruits of *F. platyphylla* [umbellata], *F. polita*, and *F. vallis-choudae* are eaten. Note also, the accounts of the edible fruit of *F. pseudopalma* (species No. 92), given by F. X. Williams (835, 836).

It should be emphasized here that there is considerable difference between edibility and palatability. Many fruits, including figs, are eaten by native peoples, but they are not always palatable to foreigners, as the following comments by various authors indicate. Burkill (124): "No European could stomach them." Roxburgh (658), on the fruits of *F. glomerata* [racemosa]: "I have often tasted them, but to me they are disagreeable." Standley (717), on *F. palmeri* [listed in chapter XVI]: "The fruits are said to be edible, but with the small amount of pulp and the hairy indument, they cannot be very palatable." See also, Standley and Steyermark (726). Lane-Poole (457): "I saw one native fig which was not very nice, though the natives seemed to enjoy it." Verdoorn (779): "A handful of fruits

of *F. pretoriae* is supposed to make good eating, provided one does not mind consuming a quantity of small insects, for these are almost invariably present." Corner (192): "All animals seem to scorn these delightful objects"; also, "Gall figs [insect-inhabited] are naturally dry and distasteful, full of insects, while seed figs, juicy and fragrant but inedible, lie rotting on the ground so that birds shed [figurative] tears of disappointment over them." Codd (165), on *F. sycomorus*: "Though eaten by the natives to some extent, the figs are usually too full of insects to be attractive." Laomala (481b): "In the Gilbert Islands, the figs of *F. tinctoria* are one of the famine foods."

It may seem inconceivable that even the tender shoots and leaves of some fig trees are eaten in certain tropical countries. For example, the young twigs of *F. infectoria* [*virens*] are used in curries, according to D. Brandis (102) and Duthie (247). Ochse (580) told of several species of which the tender terminals are used either raw or cooked. Even the buds of *F. elastica*, still enclosed within their reddish bracts, are utilized in this way. Ochse also stated that the very young leaves of *F. hirta* and certain other species, notwithstanding their hairiness and roughness, are eaten raw, as "lablab" [a garnish], with rice in the East Indies; the sweetish receptacles are also eaten as a delicacy by the native children. In most Melanesian islands, the young leaves of a number of native species are popular as a vegetable, according to Barrau (57). Pancho (582) reported that in the Philippines, the young shoots of *F. pseudopalma* and *F. variegata* are used as a salad. Schnell (677b) stated that the leaves of *F. glumosa* are eaten in soup in Africa. Elmer (259) thus described the use of Davao figs in the Philippines: "The natives in this region make use of the soft, pulpy, and fibrous wood from the stems of the liana-like climbers belonging to the *Synocia* group. The stem is cut up into small chunks, and is chewed by them with their betel nut, lime, and *cuyo* or tobacco leaf. The soft wood fiber makes

their chewing ration last longer, sometimes all day, but usually they take several chews a day."

Livestock Fodder. The leaves of the Common Fig are often harvested late in the season, and are used to supplement fodder for cattle in Mediterranean fig districts. In my notes of October, 1923, on fig culture in southern Portugal, I find the following: "We saw several places where boys and girls were picking the leaves off branches or raking them up dry or partly dry, and hauling them away for storage until used for cattle feed."

Several authors refer to the use of fig leaves for stock feed. Elephants and cattle "greedily eat" the leaves of *F. bengalensis* in India, according to G. Watt (815). See also, Troup (765): "used for elephant fodder and extensively lopped." Several other Indian species, such as *F. religiosa*, *F. rumphii*, *F. virens*, and *F. auriculata*, are also utilized for cattle feed, as reported by Duthie (247). According to Singh (701), the green leaves and figs of *F. glomerata* [*racemosa*] are much liked by cattle, with the practical side effect that the more the trees are lopped, the better the growth of vigorous branches. According to Francis (300), the leaves of *F. macrophylla* are readily eaten by stock in Australia. Both Anderson (10) and Everist (271) reported that nearly all Australian fig trees furnish food for cattle, the leaves of the Sandpaper and Moreton Bay figs being most commonly available. Standley (721) wrote that in El Salvador, the leaves of *F. padifolia* [*pertusa*] are fed to mules, who get fat on them. Standley and Steyermark (726) stated that in Yucatán, the leaves of *F. cotinifolia* furnish fodder for horses and mules. According to Dalziel (221), the leaves of several species are used for stock feed, and trees of *F. gnaphalocarpa* may even be planted to furnish such fodder. French (302) stated that the leaves of *F. sycomorus* are fed green to sheep.

Medicinal Value. Numerous accounts refer to the utilization of various parts of fig trees for their curative properties. Dalziel (221) stated that "the medicinal

uses for *Ficus* are probably trivial," but he proceeded to list such uses for several African species. Others who have treated the subject for various native figs follow: Ainslie (4), Drury (243), Murray (567), Dymock (250), Dutt (248), Kirtikar and Basu (440), J. M. Watt and Maria Breyer-Brandwijk (816), McClure (488), Burkill (124), Burkill and Haniff (125), Standley (722), Singh (701), Quisumbing (615), Frisbey *et al.* (303), Irvine (412), Manjunath (497a), Webb (817), and Hurst (404).

Various maladies are thought to be alleviated or cured by the use of figs, including fevers, sterility, toothache, stomach-ache, leprosy, wounds, diabetes, and piles. According to Russell *et al.* (661), trees of *F. benjamina*, planted along streams in Cuba, prevented mosquitoes from breeding, thus helping to control malaria. The alkaloids and saponins of several Malayan species were reported by Amarasingham *et al.* (9).

A commercial product, a proteolytic enzyme known as ficin, is obtained from the latex of several species of *Ficus*. Its presence and properties in the latex of *F. carica* have been discussed by Condit (174). Other references to its occurrence in fig species and its medicinal uses may be found in *Chemical Abstracts* and other abstracting journals, as well as in the following sources: Robbins (646), Walti (796), Faust (278), Faust and Thomen (279), Jaffe (417), and Herriott (373). See also, the United States Dispensatory (234), page 1691, for an account of *leche de higuera* or ficin.

The Central American species, *F. glabrata* [*insipida*], is one of the sources of ficin. Standley and Steyermark (726) wrote of it: "In its native regions, it has long been known that the copious white latex that issues from the trunk or branches when cut has anthelmintic properties, and in recent years the latex has attracted the attention of local and foreign physicians. In some of the hospitals of Panama and the Atlantic Coast, it is the practice to give a dose of it to all or most patients entering for hospitalization, on the well-

grounded assumption that they need a vermifuge." De Wolf (230) commented that the south Brazilian name for *F. insipida*, "*figueira purgante*," and Miquel's epithet, "vermifuga," suggest that its medicinal usage is widespread. According to Christy (156), the vermifugal properties of *F. doliaria* are owing to the presence of doliarine, a sort of vegetable pepsin, analogous to, and perhaps identical with, the papain of the papaya. An item in *Science News Letter*, July 20, 1957, page 39, entitled, "Enzyme Aids Healing," tells about the use of ficin. It speeds the treatment of burned human skin by dissolving the damaged skin protein. Of the numerous species of *Ficus* in tropical countries, there may be, and probably are, others besides *F. insipida* with latex rich in ficin. A number of more effective drugs have been introduced, and ficin is not listed in late textbooks on pharmacology. However, recent catalogues of enzymes offer both ficin and ficin 2x (similar to papain), and refer to the book on enzymes by Smith and Kimmel, 1960.

Latex. Fig latex has several useful properties other than medicinal ones. Chief of these is, or has been, the production of rubber, primarily from *Ficus elastica*. The history of this species and its production of caoutchouc, or rubber, was given by William Roxburgh (658), who in 1810 was superintendent of the East India Company Gardens near Calcutta. Upon receipt of a rattan basket containing honey, and wondering why the honey did not leak out, he found that "the inside of the vessel was smeared over with the juice of a tree which grew in the mountains." He obtained plants, and in 1814 listed them as *F. elastica*, with a brief description only. See Roxburgh (657). For many years, this species was cultivated for the production of rubber, but it has been superseded by *Hevea brasiliensis* (Euphorbiaceae), which provides more and better latex. Strettel (736) journeyed to Burma in search of *F. elastica*, and published a description of the process used in the preparation of caoutchouc. See also,

Drury (243), Gamble (308), and Holland (382), although many other accounts are to be found. According to Howard and Powell (397a), this species was introduced into the West Indies for rubber production.

Various other species have been used for rubber to some extent. In his account of Liberia, Johnston (423) stated that the wealth of forest in rubber-producing trees was without parallel in Africa. He listed four kinds of *Ficus*, but their specific names were not given. In the same region and in other parts of Africa, a material known as "Lagos rubber" was once obtained from the latex of *F. vogelii*, as related by Moloney (553), Millson (537), Silver (695), Holland (382), Dalziel (221), and Y. M. Henry (368). Wilde-man (828) recorded his observations on this rubber at the head of the Congo, and found that a tree 3 m in circumference and 25 m in height allowed the collection in one trip of 5.35 kg of fresh caoutchouc. Dalziel (221) reported that the latex of *F. gnaphalocarpa* had been exported as gutta-percha; also, that the latex of *F. platyphylla* [umbellata] was known in the trade as "Balata." Burkill (124) included *F. consociata* as one of the rubber-producing species. According to Sparhawk (712), trees of *F. benjamina* var. *schlechteri* have also been tapped for rubber. Marañón and Cabato (498) reported analyses and rubber content of twenty-three species of Philippine figs. Foxworthy (297) stated that numerous species of Malayan figs produce rubber of low grade which is not profitable to collect.

In his book on rubber, Polhamus (607a) included several species of *Ficus*, and reported that there were 1,950 acres [789 hectares] of trees planted in the mandated territory of New Guinea. Moyle (561a) listed a large number of rubber-producing species, and gave references to his sources of information.

Spinden (714) noted that in the tenth to twelfth centuries A.D., a Mexican tribe cultivated wild fig trees for the production of rubber in the area now known as southern Veracruz and Tabasco.

Miscellaneous uses are reported for fig latex. A birdlime used for catching or snaring birds may be prepared from the latex of some species. (See under *F. dusenii*, species No. 76.) According to Burkill (124), the wax in the latex of Malayan species, particularly *F. variegata*, is used in batik dyeing. The latex of *F. altissima* is "full of resin, the clot carrying 65 per cent along with 30 per cent of caoutchouc." Standley (720) stated that the milky sap of *F. cotinifolia* contains rubber, and that it is reported to be employed for adulterating chicle. A substance known as "Godang wax" was once obtained from several species, the best known being *F. variegata*, according to Howes (399). This was prepared by heating the latex after water had been added; the brown wax which rose to the surface was removed, bleached, and sold for use in batik work and in candles. See also, the account by Katherine Esau (268) of laticifers and their latex content.

Paper and Cloth. The bark of several species of *Ficus* has long been used by aborigines for the manufacture of paper and cloth. The *Amatl* paper of Mexico, upon which ancient manuscripts were written, was made from the bark of *F. padifolia* [pertusa] and *F. petiolaris*, as recorded by Hunter (403). A good account of the method used in making paper from various species of *Ficus* in Mexico was given by Christensen (154a). The process is much the same in various localities. The following account by Eggeling (251) for *F. natalensis* is explicit:

"For the preparation of cloth, the bark is removed in a single sheet by means of two horizontal cuts and one vertical cut. The cylinder of bark is then softened in steam for an hour or two before being beaten out on a wooden anvil with a set of grooved wooden mallets. During the cloth-making process, the original width of the bark is increased some five times, and its length by about a tenth, so that a strip of bark 10 feet long and 2 feet broad will yield a sheet of cloth 11 feet long and 10 feet broad. [Metric approximations: 3 m; 60 cm; 3.30 m; 3 m; in that order.]

"After the beating operation is completed, the cloth is spread out in the sun, darkening in a few days to a rich red-brown, the depth of the tint depending on the period of exposure. When it has colored sufficiently, the cloth is dampened and kneaded by hand till soft, and is then frequently decorated with stenciled patterns.

"Bark is not usually harvested till a tree has attained a girth of at least 18 inches [46 cm], the first crop of bark being inferior to later gatherings. It is said that a well-tended tree will survive as many as forty annual strippings, the great essential being that the naked stem is protected from the sun as soon as the bark is removed. The general practice is to wrap the trunk in green banana leaves immediately after stripping, this covering being replaced in a few days by a plaster of wet cow-dung which is left on the tree till it flakes off naturally.

"In the heyday of barkcloth making in Uganda, before the advent of cheap woven goods, over fifty varieties of *Mutuba* were recognized in Buganda alone. Of these, *Sango* (from a place of that name in Buddu) was reputed to yield the best cloth, *Butana* being another good strain."

An account of bark cloth from *F. natalensis* was given by Dalziel (221), who stated that the strips of cloth are sewed together and stenciled with a black dye. According to O. W. Barrett (69), the bark of *F. nekbuda* produces a good bark cloth, used for making sarongs, or bags for shipping "ground-nuts." F. W. Andrews (14) listed *F. glumosa* var. *glaberrima* of the Sudan as the "Barkcloth Tree." The fiber of *F. palauanense* is made into a very strong rope, as reported by W. H. Brown (116), who added: "On account of its great strength, toughness, and durability, the fiber is used for making wild-hog traps." Several African species were listed by Lebrun and Boutique (462) as sources of bark utilized for cord and cloth. An excellent and detailed account of the making of tapa cloth was published by Brigham (105). See also, S. Parkinson (587) and Uphoff (769), who reported that the

bark of *F. prolata* (listed in chapter XVI) is used for making tapa cloth.

In the *National Geographic* for February, 1960, appears a photograph of an African pygmy pounding a piece of bark for cloth. About ten kinds of native fig trees provide such material, and a surprising softness marks the finished product.

A number of other authors have also recorded the use of fig bark for fiber. Talbot (747): The bark of *F. infectoria* [*virens*] yields a useful fiber. Duthie (247): The fiber from *F. hispida* is suitable for rope, and *F. cuneata* [*semicordata*] furnishes a strong fiber. Audas (31): The roots of *F. stenocarpa* [see *F. coronata*, species No. 98] yield a strong and durable fiber which is used for fishing nets. Burkill (124): The aerial roots of *F. altissima* are used for cordage, the tough bark of *F. benjamina* for rope, that of *F. consociata* [listed in chapter XVI] for book-binding, and that of *F. variegata* for loin-cloths. A. E. W. King (436) gave an excellent and detailed account of the mechanical properties of Philippine bast-fiber rope, referring to several species of *Ficus*. Foxworthy (297): *F. chartacea* yields a bast fiber that is used by the Malaysians.

Miscellaneous Uses and Properties.

A few other uses for fig trees or their parts may be briefly reported. Roxburgh (658) found that next to mulberry leaves, silkworms favored those of *F. religiosa* for food. This was also recorded by Drury (243) for the same species. Dalziel (221) listed *F. platyphylla* [*umbellata*] as a host for wild silkworms. He also stated that the bark and roots of *F. populifolia* [listed in chapter XVI] are used by some tribes in Borneo as secondary ingredients in the manufacture of an arrow poison yielded by *Strophanthus* (Apocynaceae). Burkill (124) reported that the latex of some Malayan species of *Ficus* is sometimes irritant, but does not reach the toxic effect of two South American species, *F. atrox* and *F. venenata*. He added that *F. edelfeltii* [listed in chapter XVI] contains a poisonous albumen in the latex that is fatal to frogs. See also, Hurst (404) and

Webb (817), on poisonous plants. The leaves of various figs are used for smoking along with opium, according to Burkill (124), who credited Heyne (374) with the statement that people who chop and mix the leaves for this *tikas* often get a peculiar skin complaint. Sata (670) stated that the dried fruits of *F. pumila* var. *ankotsang* secrete a pectin when soaked in water.

The sandpapery leaves of some species are reported to be actually used to scour wood and metal surfaces. These include *F. exasperata*, *F. scabra* [*coronata*], *F. asperifolia* [equals *exasperata*], *F. ampelias*, and *F. odorata*. Dalziel (221) reported that African women express grief by scraping their breasts and backs with the harsh leaves of *F. asperifolia* until they bleed. An unusual use is given by Burkill (124) for *F. canca* [*semicordata*]. The juice from crushed leaves is put into water with gold; this alters the surface tension so that the gold dust does not float.

Pests and Diseases

The insect pests and plant diseases which attack trees of exotic figs are treated mainly under the descriptions of affected species in this book. The roots of several species are found to be infested by the root-knot nematode, *Heterodera fici*, which causes the development of cysts or knots. Sher (692) recorded that large populations of this pest are found on the roots of the India Rubber Tree throughout California, but apparently with little, if any, deleterious effect on the health of the host plant.

As recorded by Pirone *et al.* (605), nematodes were first found in the United States on nursery plants of *Ficus elastica* at San Bernardino, California, in 1954. Root knots have been found on the following species in California: *F. aurea*, *F. benjamina*, *F. erecta*, *F. superba* var. *henniana*, *F. virens*, *F. pseudopalma*, and *F. watskinsiana*. Two species, *F. racemosa* and *F. gnaphalocarpa*, are either resistant to, or immune from, the attacks of nematodes, and have therefore been used to a limited extent experimentally for resistant

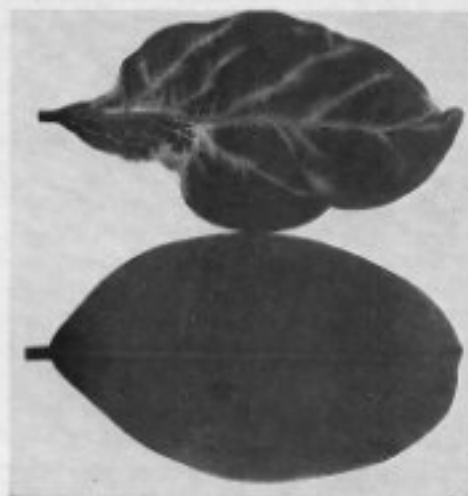


Fig. 36. Mosaic virus, prevalent on the leaves of the Common Fig, has also been observed on other species, such as *Ficus altissima* (top), which is shown compared with a normal leaf (bottom).

stocks, as discussed in their respective descriptions (Nos. 82 and 100). However, according to Birchfield *et al.* (82), *F. glomerata* [*racemosa*] is found to be a host plant of the burrowing nematode, *Radopholus similis*.

A leaf mosaic, described by Condit and Horne (186, 186a) on foliage of the Common Fig, was designated by them as *Ficivir caricae*. In California, the mosaic was found to be spreading from the leaves of *F. carica*, and has been detected on the foliage of *F. altissima*, *F. bengalensis*, *F. doliaria*, *F. virens*, *F. citrifolia*, and *F. amplissima*. (Figure 36 shows *F. altissima*.)

Plants of the Common Fig (*F. carica*) were grown in Florida in 1958 from cuttings imported from Italy and received from California, but were found to be infected and badly injured by the mosaic virus. Burnett (129, 129a) reported the following species as susceptible to mosaic: *F. lucescens* [*racemosa*], *F. retusa* [*microcarpa*], *F. rubiginosa*, *F. jacquiniifolia* [*perforata*], *F. quercifolia* [*montana*], *F. kerstingii*, *F. garciniaefolia* [*subcordata*], *F. stricta*, and *F. coccinifolia*. All showed leaf distortion and reduction in leaf size. Infected leaves mar the ornamental value

of the plant, and such specimens should be destroyed to prevent further spread of the virus. Flock and Wallace (288) have demonstrated that mosaic of the Common Fig is transmitted by the fig mite, *Aceria ficus*.

In Mysore, India, according to Gamble (309), trees of *F. glomerata* [racemosa] are frequently attacked, "as are also other species, like *F. mysorensis* and *F. asperifolia* [exasperata], by a scale insect, *Dactylopius adonidum* L., with which is often associated a black, fungoid growth." In Honolulu (1960), banyan trees were seen to have foliage densely blackened by sooty mold resulting from infestation by a scale insect. This unattractive appearance was recorded by Rock (648). Infestation by a species of thrips (*Gynaikothrips ficorum* Marchal) is recorded under *F. microcarpa* (species No. 46).

The root-rot fungus, *Armillaria mellea*, attacks the roots of various species of *Ficus*, including *F. asperifolia* on the Gold Coast, according to the list of host plants given by Raabe (616).

Folklore

In a chapter entitled "The Fig in Song and Story" by Condit (174a), I have discussed *Ficus carica* as a sacred tree, its occurrence in Bible times, its phallic significance, its importance as an emblem of fertility, and reference to it by ancient writers and poets. Other fig species have also been

regarded as sacred or are venerated for certain reasons. Standley and Steyermark (726) reported that fig trees commonly figured in the poetry and romance of Central America, and "the trees, occurring as they do about many dwellings, become intimately associated with daily life, and often are regarded with affection." They also related a legend based on the fruits and flowers of fig trees. As pointed out in its description in this book (species No. 20), *F. religiosa* was so named by Linné because of the religious esteem in which it was held by the people of India. *Ficus sycomorus* was regarded as a sacred tree by the ancient Egyptians and, according to Dalziel (221), *F. thoningii* is a sacred or emblematic tree among several tribes in northern Nigeria. Batterscombe (71) stated that in Kenya, trees of *F. hochstetteri* are held in reverence, and the Africans are "averse to cutting down large specimens; the facts that it sends roots down to the soil, and that the spirits of the departed are credited with taking up their abode in the thick crowns, are sufficient to protect it from damage." Driberg (241) related that in Uganda, there is a cult which favors trees of *Ficus* and *Kigelia* (Bignoniaceae) especially for rain-making. Those who wish to pursue the matter further will find much information on sacred trees in works by Neckam (573), Folkard (289), Fergusson (283), Mrs. J. H. Philpot (601), and Frazer (301).

CHAPTER V

KEYS FOR IDENTIFICATION

PART A. INTRODUCTION: SURVEY AND PROBLEMS

Attempts to prepare keys for the identification of species warrant the following quotation from a review by R. M. Page (581a) of a book on mushrooms: "The two most important requisites for a useful field manual are workable keys and adequate illustrations. One disadvantage to artificial keys of the type found in this book is the fact that the user does not know whether he is getting warm or not, so that if he makes a mistake, he is lost. He is also lost if the key is misleading." Many are the times I have been misled in my efforts to identify wildflowers by using keys prepared by systematic botanists. On the other hand, the use of such keys has often unveiled certain characters which led to the proper identification of the specimen in question. No one realizes better than myself the inadequacies of the two keys presented for species of *Ficus*. They are offered in the hope that some workers, at least, will be able to make use of them in distinguishing the species of this confused and confusing group. Apropos here also is the statement of Corner and Stearn (200): "The following key [to *Ficus*] attempts to supply a guide to the species most likely to be found in collections, but is based on leaf characters, which are subject to much variation, instead of fruit characters, which are more reliable but unlikely to be available."

A review of the basic characters found in some keys for identification of *Ficus* may be of interest. Rafinesque (622) asserted that, no one else having thought to revise the genus, he would do it by habit of growth and by the visible parts, chiefly the outer characters of the fruit, called by others the receptacle. Most taxonomists, however, agree that the genus is properly classified into subgenera by the location and structure of the staminate and pistillate flowers borne on the internal wall of

the receptacle. Botanists who have based their keys for identification of figs primarily on floral structure include Bentham and Mueller (77), Haines (352), Ridley (639), Diels (231), and Sata (670). Elmer (256, 259) reproduced the sectional characters given in the key by G. King (437), but found that by use of the key it was exceedingly difficult to bring a species into its rightful section. The specimen may or may not have staminate flowers. Elmer added: "The fig flowers are not very easily classified by the amateur; the stamens of certain species are hard to find or even to recognize when they are present. So, I have come to feel that if even a less scientific or natural classification could be evolved from the external appearances, it would prove no less serviceable." The comprehensive key presented by Elmer therefore employs external characters in classifying figs of Davao, P.I.

The character of the ostiole has been used to some extent as a basis for classification. For example, Hutchinson (407), in his key to subgenera, gave two groups, as follows: Ostiole with the bracts visible from outside and spreading transversely across the orifice; and, Ostiole porelike and more or less two-lipped, with all the bracts descending abruptly and not visible from outside. Others who used much the same characters in their keys were Mildbraed and Burret (534), Fawcett and Rendle (280), Burt-Davy (131), Aubréville (29), Eggeling (251), and Lebrun and Boutique (462). Keys in which the receptacle is the primary character in separating fig species into groups were given by G. King (437), D. Brandis (102), Duthie (247), Standley (717), H. Collett (167), Burt-Davy (131), and Mary Barrett (67) for the variants of *Ficus benjamina*. A key to the figs of Panama by De Wolf (230) is based mostly on fruit.

Corner (191) presented two keys for identification of fifteen species of Malayan figs, one based on characters of the receptacle and the other on vegetative characters. In his key to species under *Synocia*, Corner (192) used leaf and other vegetative characters for the most part. Other botanists who have used vegetative characters in keys to *Ficus* are J. D. Hooker (388), C. E. Parkinson (585), Osmaston (581), Chien and Cheng (151), and C. E. C. Fischer (286). Corner (194) expressed himself very definitely on this matter of botanical keys, and I quote from his article: "It seems that keys which are not based on floral structure are deemed artificial, and therefore unbecoming to a learned work. This view, I contend, is thoroughly mistaken, and rather the academic lingering of the Linnean system, based on herbs, than on scientific procedure. As a principle in a tropical flora, floral characters should never be used in keys, and those of fruits only when they are obvious." The keys published by Corner (199b) to subgenera, sections, and species of *Ficus* are based mainly on specimens from their native habitat, and are inexact, but help in naming sterile specimens from cultivated plants.

Experience in the preparation of two keys for identification of Common Fig varieties has convinced me there is no better way to discover minute characters which separate one kind from another. See Condit (178). The same is true of the keys found in this publication. They are certainly not infallible, but as indicated above, there are few, if any, botanical keys which are not misleading in some respects. They must all be used with close attention to details of plant anatomy.

In evaluating the data presented in the keys that follow, compared with the descriptions of species that occur throughout this book, the reader is asked to bear in mind the infinity of variations that occur in this fantastically variable genus. Not only do characters vary within a given species, but some species intergrade, possibly because of hybridization, so that a definite description is often difficult to de-

velop. One must strike an average in certain cases. Every effort has been made to make the descriptions accurate, but the difficulties encountered are not always surmountable, for the reasons given.

Suggestions for Use of Keys

Fig plants are variable, and it is therefore necessary to include some species under more than one category. Young specimens have different characters from older ones, especially in foliage. A hand lens is essential in examining the plants, particularly for pubescence, which is sometimes confined to buds or stipules. Hydathodes are distinguishable to the naked eye as white or light spots on the upper surface of the blade. If present at all, they may be either prominent or inconspicuous, numerous or few, and may be widely scattered or sometimes confined to the border area. They are often difficult to distinguish in dried leaves, and may not be in evidence. The lateral veins counted are those which extend from the midrib to the marginal space and connect with the angle at the base of an arc. Stipules of the terminal bud may be ignored if the plants are dormant; they are best examined as the buds expand and open. Most species have two stipules borne opposite, one larger or longer than the other, at the base of the bud. *Ficus elastica* (also its varieties) is almost unique in having only one sheathing stipule.

Recommended Procedures

Note the following vegetative characters:

1. Habit of plant: trailing or treelike.
2. Margin of leaf blades: entire or more or less dentate.
3. By the use of a hand lens, note the presence or absence of pubescence on buds, leaves, or twigs. Pubescence may be deciduous, present on young parts only, or persistent.
4. Color and length of terminal bud when dormant.
5. Form of blades, especially at base: equilateral or inequilateral.
6. Apex of blades: acute or obtuse.

7. Elevation and number of veins on lower surface of blades, basal and lateral; also, angle of divergence from midrib.

8. Presence or absence of hydathodes.

If fruit is present, note characters:

1. Location: in axils of green leaves, in axils of leaf scars, on large branches, or on trunk.

2. In leaf axils: single or geminate.

3. Size and shape.

4. Sessile or stalked.

5. Surface characters: smooth, pubescent, ribbed, etc.; flecks of white, light color, or other color.

6. Over-all (basic) color of surface.

7. Umbilicus.

8. Bracts: at base or on body of fruit.

9. Internal cavity: size, color of flowers, and nature of flowers if practicable.

Example of Procedure, Using Vegetative Key

Habit of plant: trailing, NO; erect, YES.

Leaves: opposite, NO; alternate, YES.

Foliage: variegated, NO; not variegated, YES.

Twigs: hollow, NO; not hollow, YES.

Blades green (not purple) below, YES.

Leaves not cupped at base, YES.

Leaf margins: entire, NO; not entire, YES.

Trees: deciduous, NO; evergreen, YES.

Leaf blades asperous or scabrous, YES.

Shape of blades: inequilateral, NO; equilateral, YES.

Base of blades cordate, YES.

Pubescence on young twigs silky-white, YES.

Identification: *Ficus gnaphalocarpa*.

PART B. KEY TO IDENTIFICATION OF SOME SPECIES OF FICUS BASED ON VEGETATIVE CHARACTERS

A. Habit of Plant Scandent, Trailing, or Climbing, Often Clinging to a Support by Means of Aerial Rootlets

1. Leaf margins entire.

2. Twigs and lower leaf surfaces densely villous; figs clustered on axillary tubercles... (1) *F. villosa*

2. Twigs and lower leaf surfaces not densely villous, but sometimes pubescent.

3. Blades tapering to an acute or bluntly acute apex.

4. Leaves inequilateral, lanceolate, commonly variegated. (2) *F. radicans* "variegata"

4. Leaves equilateral, ovate; young twigs slightly hispid, rooting near nodes when on the ground; figs axillary, spherical, 0.5 cm in diameter, green. (3) *F. hederacea*

3. Blades not tapering, but broad and rounded or obtuse at apex.

5. Leaves small, up to 2.6 cm long or somewhat more on fruiting branches; blades inequilateral.

6. Petioles rusty-brown, pubescent; buds pubescent; figs green, 3.6 cm in diameter.

(4) *F. pumila* var. *minima*

6. Petioles green, glabrous (sometimes pubescent); buds practically glabrous; figs russet, globose, 3.8 cm or more in diameter. (5) *F. aurantiaca* var. *parvifolia*

5. Leaves larger, especially those on fruiting branches, leathery, equilateral or only slightly inequilateral at base; figs green, densely pubescent, up to 6.2 cm long and 3.6 cm in diameter; the interior is scarlet. (4) *F. pumila*

1. Leaf margins not entire.

7. Surface of leaves more or less hispid; margins finely serrate; figs borne on prostrate stems rooted to the ground, pyriform, very dark (almost black). .. (6) *F. tikoua*

7. Surface of leaves not hispid.

8. Margins irregularly lobed or indented; blades 7.5 to 15 cm long; figs axillary, urn-shaped, up to 0.8 cm long and 0.5 cm in diameter, with pink scales at apex.

(7) *F. montana*

8. Margins crenate or lobed; blades small, more or less star-shaped.

(4) *F. pumila* var., or *F. sarmentosa*

A. Habit of Plant More or Less Erect; Shrubs or Trees

9. Leaves opposite at some nodes, especially toward tips of twigs.
10. Young twigs hollow, i.e., pith not solid, but more or less missing from internodes.
11. Leaves hispid; terminal buds, twigs, and fruits densely pubescent; petioles short; blades elliptical, up to 15 cm broad; figs axillary, up to 2.5 cm in diameter (or mostly in panicles on large branches or on leafless twigs). (8) *F. hispida*
11. Leaves glabrous above, with a few hairs on veins below, more or less crenately toothed; buds glabrous except at base; twigs smooth, indistinctly rusty; figs prominently decorated with rusty flecks, up to 5 cm in diameter. (9) *F. congesta*
10. Young twigs not hollow, but with solid pith.
12. Leaf margins often variously and irregularly toothed; blades linear to lanceolate; figs small, mostly less than 1.1 cm in diameter. (10) *F. cumingii*
12. Leaf margins serrate; blades elliptical, almost or quite equilateral, but often slightly unequal at base; figs with prominent umbilicus, the scales scarlet. (96) *F. coronata*
9. Leaves alternate.
13. Foliage variegated with green, white, or yellowish patches of color.
14. Texture thick and rubbery; leaf margins entire.
15. Plants pubescent, at least on petioles and terminal buds; leaves medium-sized. (59) *F. rubiginosa* "variegata"
15. Plants glabrous; stipule of terminal bud single, elongated; leaves large. (32) *F. elastica* "variegata"
14. Texture thin or chartaceous; leaf margins dentate; blades pubescent below, the base inequilateral, cordate, with narrow or closed sinus; figs also variegated, pubescent, 1.8 cm in diameter. (11) *F. aspera* "parcelli"
13. Foliage not variegated.
16. Twigs more or less hollow when young, with little or no pith.
17. Leaf blades large, up to 40 cm long, with length not much greater than breadth; plants shrubby, spreading. (104) *F. auriculata*
17. Leaf blades smaller, considerably longer than broad.
18. Surface of very young leaves and petioles pubescent, also veins below; buds up to 2.5 cm long; veins prominent, with midrib often pink; figs oblate, up to 3.1 cm in diameter, densely pubescent, axillary or in clusters from large branches. (94) *F. mallotscarpa*
18. Surface glabrous throughout; buds up to 6 cm long; veins prominent, the midrib and laterals almost white above; figs 2 cm in diameter, smooth or somewhat ribbed, geminate, axillary, or in clusters on the trunk and larger branches. (12) *F. septica*
16. Twigs not hollow, but with solid pith.
19. Blades fiddle-shaped or lyrate, narrowed to the cordate base, broadest above the middle, up to 45.6 cm long, green; stipules persistent for several nodes; figs axillary, sessile, spherical, up to 3 cm in diameter. (17) *F. lyrata*
19. Blades not fiddle-shaped; lower leaf surface purplish or maroon in some lights; lateral veins 7 to 9 pairs; figs 2.5 cm or more in diameter, in fascicles on the large branches. (13) *F. dryepandiana*

B. Margins of Leaves Entire, Sometimes Wavy or Undulate

(Turn to next "B" heading for "Margins Not Entire.")

C. Plants Glabrous, Without Trace of Rusty Lower Leaf Surface, Pubescence, or Puberulence on Buds or Any Vegetative Parts; Young Twigs Not Hispid to the Touch

(Turn to next "C" heading for "Plants Pubescent.")

1. Sheathing stipule of terminal bud 1 only; this is readily determined as the bud opens because the stipule is often several cm long; leaf blades large, and rubbery in texture. . . . (32) *F. elastica*
1. Sheathing stipules either not in evidence, or when the bud opens, found to be 2 in number, opposite, with one commonly broader at the base or longer than the other.
2. Apex of blade more or less sharply acute or acuminate, sometimes conspicuously cuspidate, not rounded or obtuse. (Turn to next "2" subdivision for "Apex bluntly acute," etc.)
3. Blades with breadth almost or quite as much as length, with base cordate, truncate, or subacute.
 4. Terminal dormant buds maroon to purplish red.
 5. Margins undulate; 7 or 8 pairs of lateral veins, spaced 1.8 to 2.5 cm apart; twigs stout, 0.8 cm thick; terminal buds up to 3.8 cm long; figs in axils of fallen leaves or in clusters from woody tubercles. . . . (18) *F. umbellata*
 5. Margins not undulate; 5 or 6 pairs of lateral veins, often colored light scarlet like the midrib; terminal buds slender, 2 cm long; figs commonly fascicled, in axils of leaves or leaf scars. . . . (19) *F. kerstingii*
 4. Terminal dormant buds green, tawny, or only slightly colored.
 6. Acumen or cusp often one-third the length of blade, appearing as a tail-like appendage; base of blade mostly truncate; figs small, axillary. . . . (20) *F. religiosa*
 6. Acumen or cusp from one-tenth to one-twentieth the length of blade.
 7. Base subcordate; midrib somewhat colored, often light scarlet; 2 basal veins plus 5 or 6 pairs of laterals; figs fascicled, borne in axils of green leaves or in axils of scars of fallen leaves. . . . (19) *F. kerstingii*
 7. Base rounded to subacute; midrib not colored; shape of blade somewhat triangular; 5 to 7 lateral veins; figs sessile, axillary; the small umbilicus flush with surface of apex; scales green. . . . (21) *F. rumphii*
3. Blades elliptical, oval, to linear or lanceolate.
 8. Lateral veins more or less elevated on lower surface.
 9. Terminal dormant buds short, up to 1.8 cm long, but usually less.
 10. Terminal buds green or somewhat tawny.
 11. Blades much longer than wide (i.e., linear); base and apex both acute; figs tiny, green, 0.4 cm in diameter. . . . (22) *F. celebensis*
 11. Blades elliptical, not linear.
 12. Leaves inequilateral at base, very variable, from a few to 18 cm long, acuminate at apex, narrowed toward base or rounded; lateral veins 5 to 7, widely separated; color below much lighter than above, somewhat aureous; figs up to 1.1 cm in diameter, axillary, sessile, or with a very short peduncle, the neck commonly slender and prominent, easily mistaken for a peduncle. . . . (16) *F. tinctoria*
 12. Leaves equilateral.
 13. Petioles stout, mostly under 5 cm long, greenish white; lateral veins 8 to 10; texture of blade coriaceous; apex of blade acute, base rounded or subcordate; hydathodes lacking; figs green, on very short peduncles, densely spotted, 0.7 cm in diameter; umbilicus slightly protruding from rounded apex. . . . (23) *F. pretoriae*
 13. Petioles more slender; texture of blade chartaceous, lateral veins 7 to 10; figs pedunculate to sessile (or nearly so), oblate to globular, green to almost white, or shaded pink at maturity, with conspicuous, scarlet flecks; up to 1.1 cm in diameter. . . . (24) *F. tirens*
 10. Terminal buds reddish purple; blades with obtuse apex and shallowly subcordate base; lateral veins 6 to 8 pairs; figs sessile, spherical, 0.7 cm in diameter. . . . (25) *F. monckii*
 9. Terminal dormant buds longer, at least 2.5 cm, but usually more.
 14. Texture of blade chartaceous.
 15. Lateral veins not over 8 or 9 pairs.
 16. Blades triangular; lateral veins 5 to 7; figs sessile, axillary. (21) *F. rumphii*

16. Blades ovate, up to 30 cm long; lateral veins 8 or 9; twigs somewhat hollow when young; figs axillary, or in clusters on larger branches. (12) *F. septica*
15. Lateral veins more than 8 or 9 pairs.
17. Lateral veins up to 24 pairs, well elevated; petioles up to 5 cm long; figs solitary, up to 3.6 cm in diameter, on peduncles up to 1.1 cm long. (26) *F. insipida*
17. Lateral veins up to 20 pairs, only slightly elevated; petioles up to 2.5 cm long; figs sessile. (See descriptions of three varieties; the key can merely average them.)
(27) *F. subcordata*
14. Texture of blade coriaceous.
18. Lower surface becoming rubiginous or rusty-brown in age; figs up to 1.8 cm in diameter, slightly protruding at apex, the surface smooth or sparsely puberulent, on thick peduncles up to 1.5 cm long. (28) *F. macrophylla*
18. Lower surface not rubiginous in age, or only slightly so.
(28) *F. macrophylla* var. *columnaris*
8. Lateral veins practically flush with lower surface of blade.
19. Lateral veins at least 15; commonly more; difficult to count.
20. Hydathodes sparsely scattered near margin.
21. Apex of blade acute, bluntly acuminate but not cuspidate; midrib commonly tinged with pink or scarlet; figs pedunculate, 1.8 cm in diameter, with apex protruding and nipple-like, the surface finely pubescent. (29) *F. xanthioides*
21. Apex of blade more or less abruptly cuspidate.
22. Blades elliptical, 12.5 to 17 cm long and 5 cm broad, green at all stages; buds green; branches weeping; figs reported to be sessile, axillary, geminate, globular, yellow, 1.8 cm in diameter, and glabrous. (30) *F. stricta*
22. Blades broadly elliptical to oval, large, usually distinctly colored with shades of scarlet; buds also scarlet; figs small, oblong.
(32) *F. elastica* var. *decora*
20. Hydathodes lacking, or present only on some plants or leaves.
23. Terminal dormant buds green or slightly tawny.
24. Stipule single, sheathing, linear-lanceolate, several cm long. (32) *F. elastica*
24. Stipules double, on opposite sides of the bud.
25. Base of blade broad, rounded; figs sessile, oblate-spherical, 1.5 cm or more in diameter, with prominent, overlapping basal bracts. (See descriptions of three varieties; the key can merely average them.) (27) *F. subcordata*
25. Base of blade narrowed, often somewhat decurrent; figs reported to be crowded in pairs, sessile, globular, axillary, glabrous, yellowish red, about 0.8 cm in diameter.
(31) *F. sundaica*
23. Terminal dormant buds variable, but usually brown to scarlet; stipule single, sheathing, linear.
26. Blades elliptical, green or somewhat colored; hydathodes lacking; figs sessile, oblong, 1.1 cm long, seldom found on young plants or small trees. (32) *F. elastica*
26. Blades broadly elliptical to oval, usually scarlet when young; hydathodes (if present) few, only near margin. (32) *F. elastica* var. *decora*
19. Lateral veins less than 15.
27. Blades narrowly elliptical to lanceolate; hydathodes (when present on some leaves) scattered thickly over surface; petioles up to 3.6 cm long; figs 0.7 to 1.1 cm in diameter, with prominent surface markings; umbilicus in center of a broad, craterlike depression. (33) *F. pertusa*
27. Blades oval to broadly elliptical or obovate.
28. Venation indistinct; veins hard to count, but up to 12 pairs; apex of blade acuminate, the acumens up to 1.8 cm long. (Four varieties of the type follow.)
(34) *F. benjamina*
29. Leaves small, on slender, zigzag, wiry twigs; figs very small, green or yellowish. (34-E) *F. benjamina* var. *exotica*

29. Leaves medium-sized, glossy; figs about 1.1 cm long, scarlet.
(34-A) *F. benjamina* var. *benjamina*
30. Leaves medium-sized; figs orange-yellow, pyriform, up to 1.8 cm in diameter (34-C) *F. benjamina* var. *comosa*
30. Leaves larger; figs as in 34-C above ... (34-F) *F. benjamina* var. *schlechteri*
28. Venation more or less distinct; veins readily counted.
31. Blades obovate, tapering to a narrowly rounded base; hydathodes few, marginal; figs pedunculate, spherical, silky-pubescent, 0.7 cm in diameter (35) *F. iteophylla*
31. Blades not obovate, but elliptical or oval.
32. Base of blade broad, rounded, and inclined in some to be shallowly subcordate.
33. Texture coriaceous (23) *F. pretoriae*
33. Texture chartaceous, surface glossy; figs up to 0.8 cm in diameter, the umbilicus flush or slightly depressed (36) *F. marianensis*
32. Base rounded, not at all subcordate.
34. Blades commonly subacute at the base, or even decurrent.
35. Blades oval, bulging or rounded at middle, mostly under 15 cm long; texture subcoriaceous; petioles slender, up to 5 cm long; figs sessile, densely spotted, 1.1 cm in diameter.
(37) *F. amplissima*
35. Blades oval, not bulging at middle, mostly 15 cm or more long; petioles stout; figs sessile, 1.8 cm in diameter; involucre at base conspicuous, enveloping one-half to two-thirds of the body. (38) *F. involucreta*
34. Blades not subacute at the base; apex bluntly acuminate; texture subcoriaceous; figs 0.8 cm in diameter, on short, club-like peduncles (39) *F. obliqua*
2. Apex of blade bluntly acute, obtuse, or rounded; sometimes prolonged.
36. Lateral veins flush with lower surface; hardly at all elevated.
37. Lower leaf surface somewhat aureous.
38. Blades with black spot or gland in the angles of vein or veins on lower surface; leaves small, seldom over 3.6 cm long. (Two forms; see the description.)
(45) *F. deltoidea*
38. Blades without the black spot just noted.
39. Blades obovate; lateral veins 10 to 12 pairs.
(35) *F. iteophylla*
39. Blades elliptical.
40. Leaves small, seldom over 10 cm long.
41. Petioles slender, up to 5 cm long; blade narrowed from broad middle toward base; lateral veins 5 to 8 pairs; figs 1.1 cm in diameter, light scarlet when mature; umbilicus small.
(40) *F. natalensis* or *F. volkensii*
41. Petioles short, up to 1.1 cm long, jointed at the blade; blades oval to obovate; veins obscure, 6 to 10 pairs; figs up to 0.7 cm in diameter, on peduncles up to 0.7 cm long, the umbilicus slightly protruding. . . (41) *F. perforata*
40. Leaves larger, up to 14 cm long and 5.5 cm broad; lateral veins 10 to 15; figs sessile, 0.5 to 1.5 cm in diameter, the surface faintly pubescent, with scattered white flecks; umbilicus small, nipple-like. (42) *F. thonningii*
37. Lower leaf surface not aureous.
42. Terminal dormant buds mostly less than 2.5 cm long.
43. Texture chartaceous to thin coriaceous.
44. Lateral pairs of veins 8 to 14; terminal buds minutely puberulent; figs 0.8 cm in diameter, sessile, with a pseudostalk extending upward along one side like a hand-clasp. (43) *F. aurea*

44. Lateral pairs of veins 9 or 10; terminal buds glabrous; figs 2.3 cm in diameter, on peduncles 0.3 to 0.7 cm long, with basal bracts minute . . . (44) *F. superba* var. *hemsiana*
43. Texture more or less coriaceous or rubbery.
45. Blades small, seldom over 5 cm long.
46. Foliage dimorphous, two distinct shapes occurring on same plant: one spatulate, broadest above the middle; the other elliptical, broadest at the middle; hydathodes prominent; angles of veins on lower side with black spot or gland; figs up to 0.8 cm in diameter, on peduncles 1.8 cm long. (45) *F. deltoidea*
46. Foliage not dimorphous, but more or less uniform. (41) *F. perforans*
45. Blades larger, commonly more than 5 cm long.
47. Leaves oval, the apex bluntly acuminate, the base slightly narrowed to rounded; figs up to 1.5 cm in diameter; trees with branches somewhat drooping. (46) *F. microcarpa* var. *retusa*
47. Leaves elliptical, tapering to an acuminate apex and an acute base; figs up to 0.8 cm in diameter; tree upright, fairly dense in habit of growth.
42. Terminal dormant buds 2.5 cm or more long. (46) *F. microcarpa* var. *nibida*
48. Apex of blade broad and rounded, the base narrowed or subacute; midrib very light green to almost white above and below; figs sessile, with a broad, cushionlike base; umbilicus small. (47) *F. microcarpa* var. *rigo*
48. Apex of blade tapering more or less to an obtuse tip.
49. Blades seldom over 15 cm long. (Two species, similar in leaf characters and best distinguished by fruit characters.)
50. Figs spherical, up to 0.8 cm in diameter, on stout peduncles up to 0.7 cm long; flecks on surface indistinct. (39) *F. obliqua* var. *petiolaris*
50. Figs spherical or oblong, up to 1.5 cm in diameter, on stout peduncles up to 0.8 cm long; flecks of green or white distinct, and widely scattered over body. (59) *F. rubiginosa* var. *australis*
49. Blades larger, mostly over 15.3 cm long, and often up to 30.5 cm long.
- 50a. Leaves broadly oval. (28) *F. macrophylla* and var. *columnaris*
- 50a. Leaves elliptical (29) *F. waukinsiana*
36. Lateral veins more or less prominent; somewhat elevated on lower surface.
51. Base of blades decidedly cordate or subcordate.
52. Lower leaf surface glaucous to greenish white; terminal dormant buds tawny to pink or scarlet; figs axillary, sessile, globular, up to 2.5 cm in diameter, puberulent to glabrous. (48) *F. nymphifolia*
52. Lower leaf surface green, not glaucous.
53. Blades orbicular, the breadth practically equal to the length.
54. Entire leaf surface (and all vegetative parts) glabrous; hydathodes conspicuous, densely scattered; veins green or greenish white; laterals 6 to 8; figs spherical, 0.8 cm in diameter, sparsely pubescent. (49) *F. avi-avi*
54. Leaf surface apparently glabrous, but shows sparse pubescence under hand lens along veins below; hydathodes (if present) few and scattered; lateral veins elevated below, green to pink or scarlet, 3 to 6 pairs; terminal dormant buds green, glabrous. (50) *F. soldanella*
53. Blades oblong-lanceolate, up to 20 cm long; hydathodes lacking; stipules deciduous; leaf texture coriaceous. (See description.) (51) *F. wildemanni*
51. Base of blade rounded, or if subcordate, very shallowly so; sometimes acute or narrowed.
55. Terminal dormant buds green or somewhat tawny.
56. Lateral veins 12 to 24; terminal buds up to 7.5 cm long; figs solitary, pedunculate, 1.8 to 3.6 cm in diameter. (26) *F. insipida*
57. Leaves inequilateral at base, very variable in shape and size, up to 18 cm long; figs axillary. (See subdivision 12 preceding for *F. tinctoria*, species No. 16.)
57. Leaves equilateral.
58. Petioles up to 6.2 cm long, puberulent when young; figs sessile, 1.1 cm in diameter, glabrous. (52) *F. costaricana*

58. Petioles 2.5 cm long.
59. Petioles green. (25) *F. monckii*
59. Petioles rusty or brown.
60. Rusty color of petioles sharply delineated from base of green midrib; lower surface of blades inclined to be puberulent or scabrid on veins; figs solitary, pedunculate, up to 2.5 cm in diameter. (53) *F. maxima*
60. Rusty color of petioles not sharply delineated from midrib; upper surface of blades glossy; figs solitary or geminate, pedunculate, 1.5 cm in diameter, prominently ribbed. (54) *F. haullii*
55. Terminal dormant buds tawny, brown, or scarlet.
61. Leaves large, 20 to 25 cm long; obovate, broadest above middle.
62. Midrib greenish white to almost pure white above; blades decidedly narrowed toward base; figs up to 1.8 cm in diameter, on stout peduncles; surface puberulent. (78) *F. obtusifolia*
62. Midrib not greenish white; blades somewhat contracted toward base; figs up to 2.5 cm in diameter, finely pubescent. (55) *F. urbaniana*
61. Leaves smaller (as a rule); blades not obovate.
63. Blades shallowly subcordate at base.
64. Length of blades about twice the width; shape oval; lateral veins 6 to 8; figs 0.7 cm in diameter, sessile or shortly pedunculate; basal bracts small. (25) *F. monckii*
64. Length of blades over twice the width; lateral veins 8 to 12; figs 1.8 cm in diameter, partly enclosed in a cup-shaped involucre of basal bracts. (56) *F. ovata*
63. Blades rounded at base, on slender petioles up to 10.5 cm long; figs 1.1 cm in diameter, on slender peduncles up to 1.5 cm long, mostly with reddish-brown flecks which are sometimes raised and papillate; umbilicus prominent, pink, and nipple-like. (57) *F. citrifolia*

**C. Plants Pubescent or Puberulent, Scabrous, or Rubiginous (Rusty)
on Either Young or Mature Parts or Both, as Determined
by the Use of a Hand Lens**

1. Plants bushy or shrubby, deciduous in winter; leaf texture chartaceous; hydathodes densely scattered over the upper surface; figs solitary, pedunculate, up to 0.8 cm in diameter. (58) *F. erecta*
1. Plants more or less upright and treelike.
2. Pubescence, puberulence, and rubiginous or scabrous conditions present on mature leaves, especially on veins below or on petioles.
3. Veins on either side of midrib hardly at all elevated, practically flush with the lower surface.
4. Lateral veins 16 to 20; midrib very light green or almost white above, sometimes tinged with scarlet; terminal buds green or slightly rusty, finely pubescent; rubiginous character of lower surface of leaves found only on older or more mature trees; figs up to 1.8 cm in diameter, smooth or sparsely puberulent, prominently decorated with yellowish-green flecks; trees and leaves more or less uniform in characters. (See subdivision 18 preceding for more on this species.) (28) *F. macrophylla*

4. Lateral veins 8 to 12.
5. Trees variable in leaf and fruit characters.
6. Pubescence rusty, very conspicuous on twigs and leaves; young leaves with a more or less purplish coloration. (59) *F. rubiginosa* var. *pubescens*
6. Pubescence prominent on buds, twigs, and leaves; lower leaf surface with a rusty-scarlet scurf which is readily rubbed off. (59) *F. rubiginosa* var. *rubiginosa*
6. Pubescence not so conspicuous; mature leaves almost glabrous. (59) *F. rubiginosa* var. *australis*
- (Figs of the above three forms are variable, but generally pedunculate, 1.1 cm or more in diameter, rusty-green or yellow, the greenish flecks somewhat raised, the surface therefore pebbly.)
5. Trees uniform in leaf and fruit characters; buds green to slightly pink, up to 3.1 cm long, glabrous or puberulent; petioles pubescent when young; mature leaves glabrous above, pubescent only on veins below; figs sessile, glabrous, 1.1 cm in diameter. (60) *F. archeri*
3. Veins on either side of midrib more or less prominent, elevated above the lower surface.
7. Leaf blades inequilateral at base.
8. Terminal buds somewhat flattened; young twigs zigzag; figs small, with a slender neck which is readily mistaken for a peduncle. (16) *F. tinctoria*
8. Terminal buds not flattened.
9. Base auricled, with one lobe prominent and overlapping the petiole, the apex cuspidate, the surface somewhat hispid; figs up to 1.8 cm in diameter, borne on fruiting branches that may reach 6 m in length, silky-pubescent, and scarlet inside. (14) *F. semicordata*
9. Base not auricled, but rounded or acute.
10. Juvenile and adult leaves much the same in shape and other characters; blades lanceolate, the base acute, the apex sharply acuminate; figs 0.7 cm or less in diameter, borne in clusters on forked branches from the trunk or larger limbs, often strongly ribbed at apex, the surface puberulent. (61) *F. ribes*
10. Juvenile and adult leaves variable on same tree, those on sucker wood often linear, with hastate base and 35 or more lateral veins; the mature lobes up to 15 cm long, oval to elliptical, the base rounded, the apex variable, often prominently acuminate, the acumens up to 2.5 cm long; figs axillary, sessile or on very short peduncles, up to 1.1 cm in diameter, umbilicus prominent and pink, and the interior white. (15) *F. ulmifolia*
7. Blades equilateral at base.
11. Blades broadly ovate, the length not much more than the width.
12. Axils of basal veins on lower surface with prominent tufts of white hairs, especially near the juncture of petiole and blade; base prominently cordate, the veins often pink or scarlet; figs up to 1.1 cm in diameter, on peduncles 0.7 to 2.5 cm long, the surface puberulent, decorated with prominent pink or white flecks. (62) *F. petiolaris*
12. Axils of lateral veins not showing tufts of white hairs.
13. Pubescence not found on twigs, but along leaf veins on lower surface, especially visible with a hand lens; lateral veins elevated below but not above, green to pink or scarlet. (50) *F. soldanella*
13. Pubescence found on twigs.
14. Nodes of young twigs fringed with white, silky hairs; blades cordate at base, rounded at apex, lateral veins 3 to 5; figs 2.5 cm in diameter, from tubercles in dense, leafless clusters on framework branches. (63) *F. sycomorus*
14. Nodes of young twigs pubescent, but not fringed with white hairs.
15. Terminal dormant buds short, up to 1.1 cm long, densely pubescent with white, silky hairs; base of blades rounded to subcordate, apex rounded; lateral veins 5 to 7; figs axillary, sessile, 0.5 to 1.1 cm in diameter, green, with reddish-brown flecks, sparsely puberulent, becoming glabrate at maturity. (64) *F. cotinifolia*
15. Terminal dormant buds longer, 2.5 cm or more, reddish brown; blades coriaceous, the lower surface velvety-pubescent to the touch or nearly glabrous, the pubescence visibly present only on veins; figs sessile, 1.8 cm in diameter, scarlet, the surface pubescent. (65) *F. bengalensis*

11. Blades elliptical or oval, somewhat longer than wide.
16. Base cordate; sinus usually narrow.
17. Sinus closed and lobes overlapping; terminal buds practically glabrous, 0.8 cm long, green; figs reported to be subglobose, whitish-pubescent, axillary, 1.8 to 2.5 cm in diameter, on peduncles about 1.1 cm long. The bilabiate ostiole lacks external bracts.
17. Sinus either open or closed, but lobes not overlapping. (66) *F. bussei*
18. Stipules more or less persistent, becoming dry, brown, and papery; terminal buds green, 2.5 cm long; figs reported to be axillary, crowded at ends of young branchlets, geminate, sessile, subglobose, villous, 1.1 cm in diameter. (67) *F. sonderi*
18. Stipules deciduous; terminal buds green or brown, pubescent, up to 1.1 cm long; figs sessile, up to 2.3 cm in diameter, pubescent. (This is merely an average of several varieties; see the description for details. See subdivision 51 following.) (85) *F. trigonata*
16. Base rounded, truncate, or if subcordate, very shallowly so.
19. Apex of blades rounded, obtuse, or bluntly acute.
20. Terminal dormant buds short, up to 1.1 cm long.
21. Leaves large, up to 25 cm long; twigs with a conspicuous fringe of white, silky hairs at base of terminal bud or at first node; petioles stout, up to 15 cm long, chocolate-brown; figs 1.1 cm in diameter, orange-yellow, puberulent. (68) *F. vogelii*
21. Leaves medium-sized, mostly under 15 cm long, shallowly cordate at base, softly pubescent above and below; figs reported to be axillary, solitary or geminate, sessile, globose, densely tomentose, 1.1 cm in diameter.
20. Terminal dormant buds longer, up to 2.5 cm or more. (69) *F. stuhlmannii*
22. Lateral veins 5 to 9.
23. Leaf base may be truncate, with surface dull above. . . . (65) *F. bengalensis*
23. Leaf base rounded, with surface glossy above. (89) *F. altissima*
22. Lateral veins 9 to 12; blades elliptical, the lower surface with white, silky hairs; hydathodes (if present) thickly scattered; figs on peduncles about 0.7 cm long, densely silky-pubescent, up to 1.8 cm in diameter.
19. Apex of blades acute or acuminate. (70) *F. lapathifolia*
24. Terminal dormant buds 1.8 cm or more long.
25. Apex gradually acute; terminal buds scarlet; blades slightly obovate, the base subcordate (71) *F. drupacea*
25. Apex abruptly acuminate.
26. Tomentum or pubescence dense on young twigs, buds, and petioles; commonly rusty-brown. (72) *F. mysorensis* var. *pubescens*
26. Tomentum less prominent, not rusty; leaf apex with acumens often 1.1 cm long; lateral veins 12 to 14; figs sessile, up to 4.3 cm long, orange-yellow to scarlet or purplish black, the surface roughened by raised white or pink flecks. . . . (72) *F. mysorensis* var. *subrepanda*
24. Terminal dormant buds shorter, 1.5 cm or less long.
27. Lateral veins at least 12.
28. Blades large, 30 cm or more long, commonly obovate-lanceolate; apex abruptly and shortly acuminate, base narrowed, rounded, or slightly subcordate; figs sessile, densely crowded in leaf axils near terminal bud, yellowish, the surface covered with silky, white hairs. (73) *F. afzelii*
28. Blades medium, up to 15 cm long, oval to obovate; apex acuminate, base rounded or broadly acute; figs oblong, 0.8 cm in diameter, scarlet, the surface with hairs somewhat stinging to the touch. (74) *F. acanthocarpa*
27. Lateral veins fewer than 12.
29. Young blades densely clothed below with a soft, woolly felt or scarf which is easily rubbed off; apex bluntly acute to abruptly acuminate, base narrowed; figs sessile, 1.8 cm in diameter, orange-yellow, with conspicuous, greenish-white flecks. (75) *F. payapa*
29. Young blades not densely clothed with woolly felt.
30. Leaves large, up to 25 cm long and 12.5 cm broad; texture coriaceous, and surface glabrous, except for some white hairs on veins below; figs sessile, 1.1 cm in diameter, orange-yellow, densely clustered in leaf axils and on older, leafless branches. (68) *F. vogelii*

30. Leaves medium, up to 15 cm long; texture chartaceous to subcoriaceous, the surface glabrous above and mostly so below; figs reported to be sessile, 1.8 cm in diameter, yellow, and glabrous. (76) *F. dusenii*
2. Pubescence, puberulence, or scabrid condition on young parts only (buds, twigs, petioles, leaves); leaf blades glabrous above and below when mature.
31. Leaves linear-lanceolate, the length 6 to 10 times that of width; twigs slender, willowlike; terminal buds 0.8 cm long, slightly puberulent; figs reported to be axillary, geminate, globose, 0.7 cm in diameter, tomentose. (77) *F. salicifolia*
31. Leaves not linear-lanceolate.
32. Leaves more or less oblanceolate or obovate, broadest above the middle.
33. Blades large, 15 cm or more long, gradually narrowing to a rounded or acute base; lateral veins 8 to 10, about 1.8 cm apart; terminal buds 2.5 cm or more long; figs up to 1.8 cm in diameter, on stout peduncles, the surface puberulent. (78) *F. obtusifolia*
33. Blades smaller, mostly under 15 cm long, narrowing to an obtuse base; lateral veins 10 to 12 pairs, hardly elevated; terminal buds 1.1 cm long, green, the stipules persistent; figs up to 0.7 cm in diameter, on slender peduncles 0.7 cm long, densely silky-pubescent. (35) *F. iteophylla*
32. Leaves not oblanceolate, but elliptical or oval.
34. Lateral veins more or less flush with lower surface; hardly at all elevated.
35. Apex of blades abruptly cuspidate, the cusp up to 1.1 cm long; terminal buds densely cottony-pubescent, the outer scales dry and brittle; figs reported to be sessile, or nearly so, 0.7 cm in diameter, geminate or up to 4 in the axils of fallen leaves, and reddish, with light dots. (79) *F. geniculata*
35. Apex of blades not cuspidate.
36. Lower leaf surface more or less aureous.
37. Stipules persistent for several nodes; leaves up to 12.5 cm long; lateral veins 8 to 10; figs pedunculate, 0.7 cm in diameter and length. (80) *F. burkei*
37. Stipules deciduous; leaves up to 14 cm long and 5.5 cm broad; lateral veins 10 to 15; figs sessile, 0.5 to 1.5 cm in diameter, the surface with scattered white flecks and faintly pubescent. (42) *F. thonningii*
36. Lower leaf surface not aureous.
38. Terminal dormant buds mostly less than 2.5 cm long.
39. Buds silky-pubescent; blades up to 12.5 cm long; lateral veins 7 to 9; figs geminate, axillary, closely set, 0.7 cm in diameter, densely pubescent. (81) *F. spragueana*
39. Buds minutely puberulent; blades with apex obtuse or slightly acuminate, the base rounded to subacute; lateral veins 8 to 14; figs sessile, 0.8 cm in diameter, yellow when mature, puberulent, nearly half embraced by the sheathing involucre. (43) *F. aurea*
38. Terminal buds mostly over 2.5 cm long. Two species similar in vegetative characters and best separated by fruit characters; leaves subcoriaceous, glossy above.
40. Leaf blades with or without hydathodes scattered in marginal areas; midrib often pink; figs oblong, 1.8 cm in diameter, the apex protruding, nipple-like (29) *F. watskinsiana*
40. Leaves without hydathodes; figs globular to oblong, 0.8 cm or less in diameter, the apex rounded. (39) *F. obliqua* var. *petiolaris*
34. Lateral veins somewhat elevated above lower surface.
41. Texture chartaceous.
42. Stipules may be persistent for several nodes; figs in clusters on the trunk and larger branches. (PI No. 163,290 et al.; see the description of this species.) (82) *F. racemosa*
42. Stipules early deciduous.
43. Surface of young twigs densely silky or puberulent; terminal buds short, up to 1.1 cm long, densely white-silky; see subdivision 15 preceding for rest of description. (64) *F. cotinifolia*
43. Surface of young twigs not densely silky.
44. Apex of blade commonly abruptly acuminate; petioles slender, up to 5 cm or more long; figs axillary, sessile, or with a very short peduncle, prominently decorated with scarlet flecks; umbilicus slightly protruding, with pink scales. A variable species. (24) *F. sirens*

44. Apex of blade acute or acuminate, but hardly cuspidate; leaves with a silvery sheen on the upper surface; figs up to 3.5 cm in diameter, borne in branched clusters from the trunk and larger limbs. (82) *F. racemosa*
41. Texture coriaceous or subcoriaceous.
45. Blades acuminate at apex, or cuspidate.
46. Apex of blades acuminate; terminal buds up to 7.5 cm long, glabrous; twigs densely sericeous, this persisting for several nodes; lateral veins 12 to 15 pairs; hydathodes (when present) uniformly scattered; figs axillary, solitary, 2 cm in diameter, on peduncles 0.7 cm long. (83) *F. radulina*
46. Apex of blades cuspidate.
47. Terminal dormant buds 2.5 cm or more long.
48. Lateral veins 12 to 14 pairs; figs geminate. (72) *F. mysorensis* var. *subrepanda*
48. Lateral veins 6 to 8 pairs; the basal pair often extends upward at an acute angle to about half the length of blade; base of blade rounded or broadly acute; figs geminate or solitary, sessile, oblong, up to 2.3 cm long and 1.5 cm broad, scarlet at maturity; umbilicus with prominent, straw-colored scales. (84) *F. palmanense*
47. Terminal buds shorter, 1.5 cm or less long; lateral veins 6 to 10; figs sessile, 2.5 cm long and 1.8 cm in diameter, orange-yellow, with conspicuous, greenish-white flecks which are slightly raised or pimply. (75) *F. payapa*
45. Blades rounded or obtuse at apex.
49. Terminal dormant buds under 2.1 cm long.
50. Blades large, up to 30.5 cm long and 15 cm broad. Two species very similar in leaf and fruit characters; young twigs thick, 1.1 cm in diameter; leaves with rounded or shallowly subcordate base; venation prominent, laterals 5 to 9; figs with interior scarlet.
51. Young twigs smooth, gray, and pubescent. (The key merely shows an average of several varieties; see the description for details. The present species is West Indian. See subdivision 18 preceding. (85) *F. trigonata*
51. Young twigs densely white-hairy. (An African species.) (86) *F. nekhuda*
50. Blades mostly smaller, 20.2 cm or less long.
52. Buds 1.1 cm long, with silky hairs closely appressed; base of blades rounded to truncate or shallowly subcordate; lateral veins 8 or 9 pairs; figs pyriform, pubescent, up to 4.5 cm long and 2.5 cm broad. (87) *F. malayensis*
52. Buds 0.7 cm long, pubescent; base of blades rounded; lateral veins 10 to 12 pairs; figs axillary, solitary or geminate, pedunculate, globular to oblong, green, pubescent, without prominent flecks, 2 cm in diameter. (88) *F. callosa*
49. Terminal dormant buds 2.5 cm or more long.
53. Blades broad, the length less than twice the width.
54. Leaf bases truncate, rounded, or shallowly subcordate; surface dull above, velvety-pubescent below. (65) *F. bengalensis*

54. Leaf bases broadly rounded, not subcordate; surface glossy above; terminal buds tawny to reddish brown, pubescent; young petioles and twigs also pubescent; figs sessile, scarlet, up to 1.5 cm in diameter. (89) *F. altissima*
53. Blades elliptical, at least twice as long as broad.
55. Apex acuminate (see subdivision 46 preceding). (83) *F. radulina*
56. Apex rounded or slightly acuminate; texture coriaceous, brittle; young twigs and terminal buds somewhat pubescent; figs up to 2.5 cm in diameter, on peduncles up to 2.5 cm long, spherical to oblate, densely puberulent. (90) *F. goldmanii*

B. Margins of Leaves Not Entire, but Serrate, Crenate, or Variouslly Lobed or Notched

1. Trees deciduous in winter in subtropical climates.
2. Blades more or less deeply lobed and then palmately veined.
3. Twigs glabrous or only slightly puberulent when young; figs variable in size and shape; green, yellow, or purplish when mature; edible. Numerous varieties. *F. carica*
3. Twigs velvety-pubescent; blades nonlobed, 3- to 5- or 7-lobed, or sometimes deeply dissected or lacinate; figs edible but mostly acidic, strong in flavor, very seedy, medium- to small-sized, green or purplish black when mature. (91) *F. palmata*; *F. pseudo-carica*
2. Blades not lobed; pinnately veined. (Various forms of the three species listed in subdivision 3 preceding.)
1. Trees evergreen, or if deciduous, for short periods only.
4. Leaves bunched at top of slender stem or trunk like those of some palms; blades up to 1 m long and only about 15 cm broad, the upper margins coarsely dentate; figs urn-shaped, ribbed, 3.6 cm long and 2.3 cm broad. (92) *F. pseudopalma*
4. Leaves not bunched at top of stem; not palmlike.
5. Young twigs hollow, not completely full of pith.
6. Leaves opposite on some twigs or at some nodes.
7. Leaf surface hispid, prominently sandpapery; terminal buds and young twigs densely pubescent or hispid; figs axillary, geminate, or more often in fascicles or panicles on larger branches; interior white. (8) *F. hispida*
7. Leaf surface glabrous or slightly pubescent below; terminal buds glabrous, or pubescent at base; petioles smooth; figs in large clusters on trunk and larger branches; interior scarlet. (9) *F. congesta*
6. Leaves alternate.
8. Blades large, up to 40 cm long, almost as wide as long; plants shrubby, spreading. (104) *F. auriculata*
8. Blades smaller, considerably longer than wide.
9. Stipules persistent for several nodes. (106) *F. variegata*
9. Stipules deciduous.
10. Blades up to 25 cm long, variable, from obovate and narrowed toward base to subcordate or cordate, with narrow sinus and overlapping lobes; terminal buds 2.5 cm long, pubescent, somewhat flattened or angular; figs mostly in fascicles from large branches, the sterile ones up to 3.5 cm in diameter, globose to oblate-spherical, the surface pubescent but glossy, the interior scarlet. (93) *F. nota*
10. Blades more or less uniform in shape, the apex abruptly apiculate or blunt, the base rounded or shallowly subcordate; terminal buds silky-pubescent; figs sometimes axillary, or more often in crowded panicles on trunk or framework branches, up to 3.1 cm in diameter, on peduncles 1.1 cm long, oblate, silky-pubescent on the green or slightly violet surface; interior mostly white. (94) *F. mallotocarpa*
5. Young twigs not hollow; completely full of pith.
11. Leaf blades asperous or scabrous, harsh or sandpapery to the touch (at least when young).
12. Leaf blades inequilateral, especially at the base in some specimens.
13. Leaves variegated, texture thin; figs also variegated.
- (11) *F. aspera* "parcelli"

13. Leaves not variegated.
14. Leaf blades narrowed toward base.
15. Branches slender, very flexible and wiry; leaf blades up to 10.5 cm long, the margins subentire to serrate or crenate; figs axillary, or in fascicles on leafless twigs, globose, up to 0.7 cm in diameter, hispid or harshly papillate. (95) *F. ampelas*
15. Branches slender but hardly wiry; leaf blades up to 20.4 cm long, the margins irregularly and coarsely serrate; figs axillary, urn-shaped, 0.8 cm in diameter, with a neck which may be confused with the short peduncle, the green or yellow surface studded with short, harsh hairs and a few misplaced scales; umbilicus prominent, with pink scales. (96) *F. arceolaria*
14. Leaf blades rounded, cordate, or subcordate at base.
16. Leaf base conspicuously cordate, one lobe much more prominent than the other, commonly overlapping the petiole.
17. Leaf margins remotely or indistinctly crenate to almost entire; apex cuspidate, the cusp 1.1 cm long; figs on pendulous fruit sprays that may reach 3 m in length in extreme cases; single or geminate, sessile, up to 1.8 cm long and broad, the surface densely sericeous, with some misplaced scales and roughened by excrescences; exterior chocolate-brown, interior strawberry; umbilicus prominent, flush with rounded apex, open at center, with pink scales. (14) *F. semicordata*
17. Leaf margins finely serrate or shallowly crenate; apex acuminate; figs axillary, solitary or geminate, 1.5 cm in diameter, on pubescent peduncles 0.7 cm long, surface densely villous, interior scarlet. (97) *F. odorata*
16. Leaf base rounded, or if subcordate, only shallowly so.
18. Juvenile and adult leaves variable on same tree, the juvenile often linear, with hastate base and sharply acute apex; figs axillary, up to 1.1 cm in diameter, sessile or very shortly pedunculate, the surface bristly-pubescent, with misplaced scales. (15) *F. ulmifolia*
18. Juvenile and adult leaves much alike; base mostly rounded; blades elliptical, almost or quite equilateral, often slightly unequal at base. (98) *F. coronata*
Two subspecies of *F. coronata* are recognized:
Figs densely white-pubescent; umbilicus tufted with upright, scarlet scales. *F. stephanocarpa*
Figs sparsely pubescent; umbilicus broad, with pink scales. *F. stenocarpa*
12. Blades equilateral.
19. Leaf base rounded, subacute, or if subcordate, very shallowly so.
20. Leaves variable, unlobed and lobed on same or different branches or trees, 10 to 25 cm long; lateral veins 4 to 10; figs up to 2.5 cm in diameter, sessile or shortly pedunculate, bristly on the surface. (99) *F. hirta*
20. Leaves mostly uniform in shape. (98) *F. coronata*
19. Leaf base cordate.
21. Pubescence on young twigs and petioles silky-white; terminal buds plump, 1.1 cm long; basal sinus of blades broad and open, or sometimes narrow and closed; leaf texture stiffly subcoriaceous, brittle, upper surface somewhat hispid; figs axillary, solitary, 2.5 cm in diameter, on peduncles up to 2 cm long, densely tomentose. . . (100) *F. gnaphalocarpa*
21. Pubescence on young parts rusty or scarlet-brown at base, often producing a stinging sensation when touched; terminal buds 4.5 cm long; basal sinus of blades narrow, the lobes often overlapping; leaf texture chartaceous; figs tiny, in masses or capitules on leafless, ropelike branches 1 m or more long produced from the trunk or framework limbs. (101) *F. minahassae*
11. Leaf blades not asperous or scabrous above.
22. Leaves linear, the margins irregular or sparsely angular; twigs slender, drooping; figs axillary, small, 0.4 cm in diameter. (22) *F. celebensis*
22. Leaves not linear.
23. Leaf blades somewhat inequilateral.
24. Leaf shapes more or less uniform, some falcate, with one side more rounded than the other; growth habit shrubby, with a thicket of sprouts from the base;

- figs up to 0.7 cm in diameter, borne profusely in clusters on long, forked branches produced from the trunk and larger limbs; some of these branches take root in the ground, giving rise to additional sprouts. (61) *F. ribes*
24. Leaf shapes and habit of growth variable, resulting in many forms or varieties; leaf margins practically entire to angular; venation prominent below, the 5 to 7 laterals widely spaced; figs axillary. (16) *F. tinctoria*
23. Leaf blades equilateral.
25. Leaves commonly 3- to 5-lobed or entire on same plant.
26. Lower leaf surface white-tomentose; adult leaves small, elliptical; juvenile leaves larger, cordate or 3- to 7-lobed; figs sessile, globose, geminate, up to 1.1 cm in diameter, orange, finally becoming dark red, interior strawberry. (103) *F. grossularioides*
26. Lower leaf surface bristly or tomentose, not white.
27. Leaves very variable, deeply lobed or unlobed on same or on different branches, longer than broad; figs up to 2.5 cm in diameter, sessile or shortly pedunculate, yellow-hairy. (99) *F. hirta*
27. Leaves entire or shallowly lobed, orbicular; figs sessile, 2 cm in diameter, tawny-brown, densely pubescent. (102) *F. fulva*
25. Leaves not lobed.
28. Leaf blades broad, suborbicular or broadly ovate, the length barely greater than breadth.
29. Habit shrubby, spreading, usually branching near base; new growth mahogany-red, very ornamental; leaves large, up to 40 cm long; figs up to 6.2 cm in diameter, commonly in dense clusters at base of trunk or on unbranched spurs from large limbs, pyriform, pubescent, with conspicuous white or rusty flecks, interior scarlet. (104) *F. auriculata*
29. Plants upright, treelike; new growth not brightly colored.
30. Leaves large, similar to those of the above shrubby form, not mahogany-red when young; figs green, on large branches from tubercles, interior scarlet. (104) *F. auriculata*
30. Leaves smaller, up to 22.7 cm long; figs up to 3.6 cm long and 3.1 cm in diameter, also borne from tubercles. The interior is pink. (105) *F. oligodon*
28. Leaf blades considerably longer than broad.
31. Stipules commonly persistent for several nodes; leaf veins below not colored; petioles somewhat rusty; figs 2 to 3.5 cm in diameter, borne in profusion on branched, leafless twigs from trunk and larger limbs, the surface velvety-pubescent to practically glabrous, interior white, surface sometimes variegated.
31. Stipules deciduous. (106) *F. variegata*
32. Veins below commonly pink to scarlet; petioles purplish brown; figs up to 3.1 cm in diameter, axillary or in crowded panicles from trunk or larger branches, which are often leafy at the tip; surface silky-pubescent, interior white or light pink. (94) *F. malotocarpa*
32. Veins below not colored.
33. Leaf margins are crenate, but almost entire (or somewhat undulate) toward apex; veins more or less white-hairy; figs not yet found on cultivated trees at LASCA, even though 9 m tall, but reportedly borne on short, leafless branches. (See the account of species No. 107 for a brief report on seedlings at Riverside; a good description also appears there.) (107) *F. coccolifolia* and subsp. *sakaloverum*
33. Leaf margins coarsely crenate; surface glabrous above and below, or sparsely pubescent on the midrib; terminal buds and young twigs pubescent; figs up to 2.5 cm long and 2 cm in diameter, borne profusely on much-branched, leafless stalks from trunk and larger branches; spherical or pyriform, with or without a short neck, on peduncles 1.1 cm long; surface green, puberulent, with flecks of white; umbilicus small, prominent, in center of a depression, with pink scales; interior pink or white. (100) *F. capensis*

PART C. KEY TO IDENTIFICATION OF SOME SPECIES OF FICUS
BASED ON CHARACTERS OF FRUIT

(Specimens Studied Were Mostly Sterile, Devoid of Fertile Seeds)

1. Figs borne on a vine-like, scandent, or trailing plant.
 2. Figs axillary.
 3. Diameter 2.5 cm or more. (4) *F. pumila*
 3. Diameter 1.1 cm or less.
 4. Figs urn-shaped. (7) *F. montana*
 4. Figs spherical. (3) *F. hederacea*
 2. Figs mostly on tubercles; occasionally axillary.
 5. Diameter 2.5 cm or more. (5) *F. aurantiaca*
 5. Diameter less than 2.5 cm.
 6. Surface chocolate-brown to black. (6) *F. tikona*
 6. Surface green to orange-yellow. (1) *F. villosa*
1. Figs borne on a tree-like, shrubby, or bushy plant.
 7. Plants cauliflorous, i.e., figs not axillary or only partly so, mostly on the trunk or larger branches.
 8. Figs in fascicles or small, unbranched clusters from tubercles.
 9. Interior white or pink.
 10. Diameter 1.1 cm or less; color orange-yellow. (68) *F. vogelii*
 10. Diameter 2.5 cm or more. (13) *F. dryepandiana*
 9. Interior scarlet. (18) *F. umbellata*
 11. Surface chocolate-brown when mature; figs obovate-spherical; peduncles very short. (18) *F. umbellata*
 11. Surface green; figs pyriform; peduncles up to 2.5 cm long. (105) *F. oligodon*
 8. Figs on branched twigs from trunk or larger limbs.
 12. Fruiting branches ropelike, often over 1 m long; figs in masses, capitula, or heads 2.5 cm or more in diameter; figs tiny, 0.3 cm in diameter, red. (101) *F. minabassae*
 12. Fruiting branches not ropelike.
 13. Interior white.
 14. Sizes small, 0.7 cm or less in diameter. (61) *F. ribes*
 14. Sizes larger, over 1.1 cm in diameter.
 15. Scales of umbilicus green or greenish.
 16. Misplaced scales common on neck and body of figs; the latter are oblate, spherical, or short-turbinate, up to 2.5 cm in diameter; leaves opposite or alternate. (8) *F. hispida*
 16. Misplaced scales not found on figs, which are 2.5 cm in diameter, covered with a dense, white tomentum. (63) *F. sycomorua*
 15. Scales of umbilicus not green, but shades of pink or scarlet.
 17. Hairs on body of figs give slight stinging sensation when touched; fruiting spurs short. (74) *F. acanthocarpa*
 17. Hairs do not sting when touched.
 18. Umbilicus prominent, in center of a depression; scales pink; figs up to 2.0 cm in diameter, interior sometimes pink. (108) *F. capensis*
 18. Umbilicus prominent, in center of a depression; scales scarlet; figs up to 3.1 cm in diameter and 3.6 cm long, surface green to slightly violet, with white flecks. (94) *F. mallotocarpa*
 13. Interior strawberry.
 19. Scales of umbilicus green.
 20. Surface green, becoming scarlet when mature. (93) *F. nota*
 20. Surface green, even when mature; fleshy, misplaced scales often occur near apex of figs. (9) *F. congesta*
 19. Scales of umbilicus not green, but some shade of red.
 21. Figs large, up to 6.2 cm in diameter; neck prominent, often ribbed; umbilicus large, depressed. (104) *F. auriculata*

21. Figs medium-sized, less than 5 cm in diameter; umbilicus flush, or only slightly depressed.
22. Surface densely sericeous; peduncles stout, up to 0.5 cm long. (14) *F. semicordata*
22. Surface finely puberulent; peduncles swollen toward apex or junction with the fruit, up to 1.8 cm long. (82) *F. racemosa*
7. Plants not cauliferous; figs in axils of green leaves or leaf scars.
23. Figs not geminate, solitary in leaf axils.
24. Figs small, less than 1.1 cm in diameter. (58) *F. erecta*
24. Figs larger, over 1.1 cm in diameter.
25. Interior scarlet to light strawberry.
26. Misplaced scales common on body and peduncle; surface densely villous-pubescent. (97) *F. odorata*
26. Misplaced scales—none on body.
27. Surface puberulent when young. (83) *F. radulina*
27. Surface glabrous. (26) *F. insipida*
25. Interior white.
28. Surface tomentose.
29. Umbilicus small, less than 0.2 cm across, flush with surface; scales greenish white. (88) *F. callosa*
29. Umbilicus prominent, the rim 0.8 cm across, the opening star-shaped, with scarlet scales. (100) *F. graphalocarpa*
28. Surface glabrous.
30. Body prominently ribbed; umbilicus prominent but sunken, with green scales. (54) *F. humili*
30. Body not ribbed; umbilicus protruding, nipple-like. (26) *F. insipida*
23. Figs commonly geminate in leaf axils, but sometimes solitary.
31. Figs sessile.
32. Surface glabrous.
33. Body somewhat oblique, one side sheathed by an involucre like a handclasp. (43) *F. aurea*
33. Body not oblique, but symmetrical.
34. Interior scarlet or pink. (60) *F. archeri*
34. Interior white.
35. Figs ovoid or oblong, 1.1 cm long, seated on a prominent pad. (32) *F. elastica*
35. Figs globose, or somewhat oblate to pyriform.
36. Surface green, even when mature.
37. Figs very small, less than 0.5 cm in diameter, with prominent, slender neck. (22) *F. celebensis*
37. Figs slightly larger, 1.1 cm or less in diameter.
38. Body with neck readily mistaken for a peduncle. (16) *F. tinctoria*
38. Body without a neck.
39. Umbilicus somewhat, or very slightly, depressed. (25) *F. monckii*
39. Umbilicus flush with the surface.
40. Flecks inconspicuous. (47) *F. microcarpa* var. *rigo*
40. Flecks conspicuous, well scattered over body.
41. Figs enclosed for one-half to two-thirds their length by a prominent involucre; surface puberulent when young. (64) *F. cotinifolia*
41. Figs not so enclosed; surface glabrous. (46) *F. microcarpa* and var. *nitida*
36. Surface yellow or orange-yellow.
42. Figs pyriform.
43. Neck slender, readily mistaken for a peduncle; body up to 1.1 cm in diameter. .. (16) *F. tinctoria*
43. Neck thick and prominent; body commonly over 1.1 cm in diameter or length. (34-C) *F. benjamina* var. *comosa* and (34-F) *F. benjamina* var. *schlechteri*

42. Figs oval to oblong.
44. Sines up to 2.5 cm long and 1.8 cm in diameter. (75) *F. payapa*
44. Sines larger, over 2.5 cm long; dark yellow or scarlet to nearly black. (72) *F. mysorensis*
36. Surface yellow or shades of red to purplish black.
45. Figs 1.1 cm or less in diameter.
46. Body partly sheathed on one side by a green involucre, therefore asymmetrical; surface yellow. (43) *F. aurea*
46. Body not so sheathed; symmetrical.
47. Figs scarlet to almost black. (34) *F. benjamina*
47. Figs not bright scarlet.
48. Surface mahogany, maroon, or light red. (37) *F. amplissima*
48. Surface not light red.
49. Color green, becoming purplish. (20) *F. religiosa*
49. Color green, becoming reddish brown, especially on upper half of fruit. (21) *F. rumphii*
45. Figs over 1.1 cm in diameter.
50. Body sheathed for one-half or two-thirds its length by involucre.
51. Umbilicus depressed, with nipple in center; scales reddish brown. (56) *F. orata*
51. Umbilicus protruding, tightly closed; scales brown. (38) *F. involucreata*
50. Body not sheathed by involucre.
52. Exterior bright scarlet.
53. Umbilicus prominent, 0.7 cm across; scales straw-color. (84) *F. palmanense*
53. Umbilicus fairly prominent, 0.4 cm or less across; scales almost concealed in a porelike depression. (89) *F. altissima*
52. Exterior not bright scarlet, but pink to yellowish or green. (27) *F. subcordata*
32. Surface pubescent, puberulent, or scabrid.
54. Exterior green to gray-white.
55. Interior white.
56. Surface densely silky-pubescent. (86) *F. nekibudu*
56. Surface faintly pubescent as seen with a hand lens. (42) *F. thoningii*
55. Interior strawberry. (85) *F. trigonata*
54. Exterior yellow to orange-yellow or brown.
57. Interior white.
58. Figs 0.5 to 1.1 cm in diameter.
59. Neck prominent, readily mistaken for a peduncle. (16) *F. tinctoria*
59. Neck absent. (68) *F. vogelii*
58. Figs larger, 2.5 cm or more in diameter, without neck. (72) *F. mysorensis*
57. Interior strawberry or darker red.
60. Surface velvety, or minutely puberulent. (18) *F. umbellata*
60. Surface silky-pubescent.
61. Figs crowded in dense clusters below leaves, often angular, 2.5 to 4.3 cm in diameter. (73) *F. afzelii*
61. Figs not so crowded.
62. Surface tawny-brown, densely pubescent; figs 2 cm in diameter, the interior scarlet; leaves entire or shallowly lobed, orbicular.
62. Surface not tawny-brown. (102) *F. fulva*
63. Figs orange, becoming red when mature; leaves white-tomentose below, entire or lobed. (103) *F. grossularioides*
63. Figs yellow when mature; leaves variable, lobed or unlobed on same branch. (99) *F. hirta*
54. Exterior scarlet, or shaded with scarlet.
64. Surface bristly-pubescent, with misplaced scales on neck and basal part of body. (15) *F. ulmifolia*
64. Surface minutely pubescent.
65. Pubescence present on young figs, but almost absent on mature ones; scales of umbilicus almost concealed in a porelike depression. (89) *F. altissima*

65. Pubescence present on both young and mature figs; umbilicus with depressed center. (65) *F. bengalensis*
31. Figs pedunculate.
66. Surface glabrous.
67. Exterior green.
68. Interior white.
69. Figs 1.1 cm or less in diameter.
70. Body with slender neck which is readily mistaken for a peduncle; no peduncle in evidence; figs tiny, 0.4 cm in diameter. (22) *F. celebensis*
70. Body lacking a neck, or neck very short; peduncle present.
71. Figs globular to oblate-spherical, small, up to 0.7 cm in diameter. (41) *F. perforata*
See also, in "Vegetative" section of key at subdivisions 13 and 33 under subheading "B," and in its text account. . . (23) *F. pretoriae*
71. Figs spherical to oblong, 0.5 cm or more in diameter; umbilicus protruding from apex. (39) *F. obliqua*
69. Figs over 1.1 cm in diameter.
72. Umbilicus prominent, in center of a depression, 0.5 cm across; scales dark green. (12) *F. septica*
72. Umbilicus small; scales pink. (44) *F. superba*
68. Interior strawberry.
73. Figs 1.1 cm or less in diameter, decorated with scarlet flecks. (24) *F. virens*
73. Figs larger, over 1.1 cm in diameter, with scattered brown flecks; commonly fasciated. (19) *F. kerstingii*
67. Exterior yellow; interior strawberry. (45) *F. deltoidea*
67. Exterior shows shades of scarlet, mahogany, greenish purple, or purplish black.
74. Interior strawberry.
75. Figs large, ribbed, with broad apex, the center sunken. (92) *F. pseudopalma*
75. Figs smaller, up to 1.1 cm in diameter, globular; umbilicus porelike. (50) *F. soldanella*
74. Interior white.
76. Figs about 1.1 cm (or less) in diameter.
77. Apex protruding above the surface.
78. Protrusion like the mouth of a jug. (33) *F. pertusa*
78. Protrusion nipple-like. (57) *F. citrifolia*
77. Apex not protruding; flush with surface. (36) *F. mariannensis*
76. Figs commonly over 1.1 cm in diameter.
79. Umbilicus in center of a depression 0.5 cm across; scales dark green. . . (54) *F. hawill*
79. Umbilicus small, slightly protruding from rounded apex. (28) *F. macrophylla*
66. Surface pubescent, puberulent, or scabrous.
80. Body variegated with green and pink bands; diameter 1.8 cm. (11) *F. aspera* "parcelli"
80. Body not variegated; the color uniform.
81. Interior strawberry.
82. Apex with umbilicus flush, not protruding.
83. Figs small, mostly under 1.1 cm in diameter. (10) *F. cumingii*
83. Figs larger, up to 2.5 cm in diameter. (87) *F. malanensis*
82. Apex with umbilicus protruding.
84. Umbilicus with distinct rim, 0.3 cm across. (90) *F. goldmanii*
84. Umbilicus prominent, the pubescent and commonly pink or scarlet scales upright; body of fig with misplaced scales on surface.
81. Interior white. (98) *F. coronata*
85. Figs over 1.1 cm in diameter or length.
86. Surface densely rusty-pubescent; umbilicus small, slightly protruding (59) *F. rubiginosa*

86. Surface puberulent to sparsely pubescent.
87. Peduncle stout, 0.3 cm or less long. (78) *F. obtusifolia*
87. Peduncle thick, angular, 1.5 cm long, enlarged toward the apex. (29) *F. nutkinsiana*
85. Figs 1.1 cm or less in diameter or length.
88. Surface hispid or bristly-pubescent.
89. Body and neck with misplaced scales on the surface; umbilicus pink, in a craterlike depression. (15) *F. ulmifolia*
89. Body and neck without misplaced scales.
90. Umbilicus prominent; leaves linear, opposite or alternate on same branch. (10) *F. caningii*
90. Umbilicus with center depressed; leaves ovate-elliptic or lanceolate to oblanceolate, never opposite. (95) *F. ampelae*
88. Surface not hispid or bristly.
91. Figs densely silky-pubescent.
92. Umbilicus slightly protruding from apex; red flecks on surface, obscured by pubescence. (35) *F. iteophylla*
92. Umbilicus small, flush with apex; body covered with white, silky pubescence. (81) *F. spragueana*
91. Figs not silky-pubescent, but puberulent.
93. Umbilicus slightly protruding, bilabiate, each lip purplish; scales not in evidence. (49) *F. aci-aci*
93. Umbilicus protruding, but not bilabiate; scales are in evidence.
94. Colored flecks densely scattered, pink or white; peduncle slender, 0.7 to 2.5 cm long. (62) *F. petiolaris*
94. Colored flecks loosely scattered, greenish white; peduncle 0.5 cm long. (80) *F. burkei*

CHAPTER VI • Species 1 through 7

1. *Ficus villosa* Blume (Villous Fig)

(Plate I, A)

The Villous Fig, *Ficus villosa*, was described by Blume (92) from Malaya. Miquel (542) and G. King (437) both referred to it as a scandent shrub, while Ridley (639) called it a strong climber. Elmer (257, 259) found it to be a much-branched, scandent shrub in the province of East Leyte, although it had also been collected in Tayabas, Philippine Islands. Corner (197, 199b) described three varieties of *F. villosa*, while J. G. Watson (810) gave a list of Malayan names for the species.

Some accounts of this fig were given under the synonym *F. barbata* Wallich. André (12) stated that it was introduced into France in 1832; the leaves being slightly barbed along the margins gave rise to the specific name. It is reported to be a common pest on trees at Singapore; also, that the creeping shoots of young plants with thinner leaves and very villous branches represent Wallich's *F. barbata*. Mowry (560) reported that plants grown in certain places as *F. villosa* were apparently of some other unidentified species. A specimen obtained from Florida in 1939 lacked the prominent pubescence that is characteristic of the species. Nehrling (574) stated that he had grown *F. barbata* in his garden at Gotha, Florida, but that the plant was killed by frost in 1917. It had long, trailing shoots, with leathery, ovate-oblong, hairy leaves about 15 cm long. Scions introduced from France in 1932 under PI No. 101,343, but not propagated, were labeled *F. villosa* Blume, the Shaggy Fig, a common name ascribed to the species by Kelsey and Dayton (434).

The one known place (possibly the only one) where this species has been grown in the United States is the Missouri Botanical Garden at St. Louis. Unfortunately, all attempts to propagate it failed, and the plant was lost during recent reconstruction of the conservatory.

Other brief accounts have been given, as follows: Backer (35) stated that the plants can be distinguished from other Javanese species by the densely villous receptacles, crowned by a tubiform beak which is hairy on the inner side and is often concealed by the long hairs on top of the fruit. Chittenden (152, per Preston) reported *F. villosa* [*barbata*] as excellent for covering walls inside hothouses. According to Setyodiwiryo (689), it is being grown at Bogor, Indonesia. Riedel (641) found it listed in 1910 nursery catalogues.

The following brief description is made from nonfruiting material received from St. Louis and from the various accounts just cited: The branches, petioles, and undersurfaces of the leaves are densely villous. The leaf texture is coriaceous (chartaceous, according to Elmer); the leaves are ovate, acute, rounded, or somewhat cordate at the base. The margins are entire and somewhat revolute. The blades are 12.6 to 25.2 cm long and 7.5 to 12.6 cm broad. Venation is prominent, with 7 to 9 pairs of laterals, well elevated on the lower surface. The figs are in fascicles from short, axillary tubercles, green to orange-yellow, and globose or flattened at the apex. The umbilicus is sunken.

This species is worthy of further trial as a vine in conservatories or in warm, outdoor locations.

2. *Ficus radicans* Desfontaines

(Plate II, C)

A species of *Ficus* was described by Desfontaines (228) with the specific name *radicans*. Although Dr. Corner informed me in a letter dated July 4, 1963, that *F. radicans* Desf. is *F. sagittata* Vahl, Desfontaines' name *F. radicans* is being retained in the present work. *Ficus ramentacea* Roxb. is also a synonym. See Corner (199b). Roxburgh (658) described an Indian species as *F. radicans*, but Rade (618) referred to it as *F. radicans* Desf. A variegated form has also been in cultivation for a long time. Mildbraed and Burret (535) stated that *F. radicans* "variegata" belongs (probably) to the species described by Desfontaines, but not to that described by Roxburgh, and they included Desfontaines' species among those of "unknown origin." N. Taylor (750) and Riedel (641) reported it as a trailing plant, sparingly used in hanging baskets, but with its habitat and botanical background unknown.

Plants described by Roxburgh as *F. radicans* grow as scandent shrubs or vines, rooting upon walls, bushes, and trees in the manner of European ivy. H. O. Forbes (291) stated that the semiparasitic *F. radicans* delights in clinging to the tallest trees of the forest. He described the fruits as being "large as an orange," and put forth throughout the whole extent of the stem in profusion. The *Kew Index* refers this species of Roxburgh to *F. rostrata* Lamarck, which is here treated under *F. hederacea*, species No. 3, following.

It is the variegated form commonly listed as *F. radicans* "variegata" which is best known and most widely cultivated. It was introduced into England by the firm of William Bull, Chelsea, London, which exhibited it at a Royal Horticultural Society meeting in 1897. (See *Gardener's*

Chronicle, 22:185, 1897; also, Royal Horticultural Society of London *Proceedings*, p. CLVI, 1897-98, for notes and illustration.) It was also illustrated by De Smet (229), Pynaert (614, in color), P. Fischer (287), and Graf (324).

According to Nehrling (574), both *F. radicans* and the form "variegata" have been grown in Florida. Crevasse (213) included *F. radicans* among "Ground Covers for Florida Gardens." He reported it as much more suitable than *F. pumila* for a ground cover, but not so hardy, yet tolerating a temperature as low as 26° F. without injury. See also, L. H. and Ethel Z. Bailey (45) and Chittenden (152, per Potter). An introduction was made from England in 1901 under PI No. 7,355, labeled *F. radicans*.

The following brief account concerns plants of the variegated form grown in California: Plants are vinelike, clinging to supports by tendril-like roots from the nodes. Terminal buds are slender, 1.1 cm long, green, and glabrous. The translucent stipules are thin, and persistent for several nodes. Fimbriate bracts are also found at some nodes. Twigs are slender, pubescent, and green, gradually becoming darker.

Leaves are alternate, inequilateral, 5 to 10.5 cm long and 2.5 to 3.6 cm broad, ovate to broad-lanceolate, with acute or acuminate apex, subcordate base, and narrow sinus. There are 8 pairs of lateral veins, the lowest pair basal. The texture is thinly chartaceous, the surface glabrous above and below, the margin entire, and the petiole short, up to 1.1 cm long, and pubescent. The central part of the blade is light green, but along base and margins it is white.

No fruit has been seen on pot plants of the variegated form.

3. *Ficus hederacea* Roxburgh (Scandent Fig)

(Plate I, E)

The specific name of the Scandent Fig (*Ficus hederacea*) was proposed by Corner (197) for the well-known climber, *F. scandens*. The latter was described by Roxburgh (658) as a scandent shrub from India, running up and over small trees and other plants. The specific name was twice antedated by *F. scandens* Lamarck (1788—*F. pumila* Linné), and by *F. scandens* B. Ham. (1826—*F. virens* Aiton), as given in a letter from Dr. Corner dated December 30, 1959.

The common name shown in the heading is here applied to it as given, even though there are a number of other species with scandent habit.

Descriptions of the species as *F. scandens*, with illustrations, were given by Wight (826), G. King (437), and F. M. Bailey (43); without illustrations, by Miquel (542), Drury (242), G. King (438), D. Brandis (102, 103), Gamble (308, 309), F. M. Brandis (104), Kanjilal (432), F. M. Bailey (42), T. Cooke (189), Duthie (247), Troup (765), Parker (584), Haines (352), Osmaston (581), L. H. and E. Z. Bailey (45), and Chittenden (152, per Potter).

F. M. Bailey (40) described a new variety, *australis*, of this species as a tall, woody climber, differing but little in characters from the description by Roxburgh. The species *F. rostrata* Lamarck should also be considered here. PI No. 67,703 represents an introduction of this species from Sumatra in 1926, with this notation: "This attractive, bright-orange fruited fig is one of the smallest fruited varieties we have seen. With the exception of the color, this small shrub resembles a holly."

Plants labeled *F. rostrata*, received from the Longwood Gardens near Philadelphia in 1963, thrived and bore fruit at Riverside. They had originally been assigned PI No. 275,919, from Belgium in 1961. Specimens were submitted to Dr. Corner, who identified them as *F. hederacea* Roxburgh. (See related comment under *F. rostrata*

in chapter XVI.) G. King (437) stated that the typical *rostrata* has sessile receptacles, whereas those of the form which Roxburgh called *radicans* have peduncles 1.1 to 1.8 cm long. King's plate of *F. rostrata* shows foliage quite different from that of *F. radicans* in general cultivation under that name.

Several other descriptions of *F. rostrata* Lamarck were given by D. Brandis (103), Burkill (124), Ridley (639), Blume (92), and J. G. Watson (810).

Fruiting plants of *F. hederacea* [*scandens*] have been collected for herbarium specimens in Cuba, Florida, and California. The following description is made from this material, in comparison with the accounts of others: The plants are scandent, with branches trailing and taking root at the nodes. The twigs are 0.25 cm thick, rusty-gray, and somewhat hispid. The terminal buds are green or slightly tawny, 0.5 cm long, and very slightly puberulent.

The alternate, equilateral leaves are up to 10 cm long and 5 cm broad, but mostly smaller, short-oval, entire, with the apex acuminate and the base rounded. Venation is fairly prominent, with midrib elevated below and flanked by 1 prominent pair of basal veins plus 4 or 5 pairs of laterals. The texture is coriaceous. The upper surface is glabrous, glossy, and deep green. Hydathodes, if present, are somewhat raised, giving a slightly hispid surface. The petioles are commonly curved, 1.1 cm long, rusty-brown, the color abruptly changing to green at the base of the midrib, with the surface pubescent or somewhat scabrid. Kerner (435) illustrated inequilateral leaves of *F. scandens* growing on a wall. He stated that the mosaic-like fitting together of larger and smaller leaves appeared to be combined with the lack of symmetry of the leaf base in short-stalked leaves.

The figs, axillary and single or geminate, are spherical, 0.5 cm in diameter,

and green, with scattered white flecks on the scabrid-puberulent surface. The peduncles, slightly enlarged at the apex and with flaring bracts, are 0.8 cm long and

pubescent. For a small fig, the umbilicus is prominent, with scales of a darker green than the body. The internal color is tawny to light pink.

4. *Ficus pumila* Linné (Climbing Fig)

(Plate I, C1-2; Plate IV, B1-4)

Ficus pumila, described by Linné (473), is another species lacking a suitable common name. It may be called the Evergreen-vine Fig, but various other species could also be thus designated. Bryan (120) termed it the "Hug-me-tight vine." It was cultivated in England by Philip Miller (536), and described by him in 1807. Under the name *F. repens*, it was introduced by Sir Joseph Banks into England, and according to Aiton (5), another introduction was made as *F. stipulata* Thunberg. W. Wilson (846) gave his experience with this vine at the Cambridge University Botanic Garden, where it had been growing for at least thirty years.

It is evident that various specific names are involved, as is the case in the accounts of many other fig species. According to the *Kew Index*, *F. repens* Hort. = *F. pumila*; *F. pumila* Hooker = *F. hispida*; *F. repens* Willd. = *F. heterophylla*; and *F. stipulata* Thunberg = *F. pumila*. Hamilton (353) stated that *F. denticulata* Willd., *F. repens* Willd., and *F. aquatica* Koen. are distinguished by circumstances of no great consequence. Hance (355) also referred to *F. stipulata* and *F. pumila* as two very closely allied species, so near that he could not tell them apart when checking nonfruiting specimens. Good accounts with excellent illustrations in color of *F. stipulata* were given by Lemaire (464), J. D. Hooker (386), and André (11); without illustrations, by Råde (618). Corner (197) classified this species in subgenus *Ficus*, section *Rhizocladus*, and stated: "This section has never been employed, but it is a good one for most climbing figs usually assigned to section *Ficus* (*Eusyce*)." See also, Corner (199b).

Other accounts, with illustrations, have been given by W. G. (305), G. King (437), Schneider (677), Sata (670),

Schröter (680, in color), and Graf (324); without illustrations, by Desfontaines (227), Roxburgh (658), Bentham (76), Bentham and Mueller (77), Masters (502), Gérôme (317), Troup (765), Domke (236), Marie Neal (572), Steiner (731), Parodi (588), Boutard (99), and Yuncker (853). See also, *Index Londinensis* for references to a few other illustrations. The properties of latex were given by Asenjo (25). Mathias and McClintock (504) listed *F. pumila* with the common name, "Big Leaf."

Ficus pumila is widely distributed in Asiatic countries, from India to China and Japan. Naturally, considerable variation occurs among seedlings, and several have been recorded. The one best known is the variety *minima*, which has leaves and fruits much smaller than those of the typical species. Good accounts of it were given by Carrière (141) from plants originating in Japan. A variety with variegated leaves was designated *F. repens* "panachée" by an anonymous writer (19a) as a very decorative plant growing in the Cambridge Botanic Garden, Massachusetts. It has not become so popular as some other variegated plants. See the short account by P. Fischer (287). Dr. John L. Creech (212), USDA, found what he believed to be a variety of *F. pumila* growing in Japan with very small, 3- to 5-lobed leaves, and introduced it under PI No. 235,261. See the note on *F. sarmentosa* in chapter XVI, "Additional Species," for further comment on this introduction.

One reference to plants of this species having lobed leaves is that of Wight (826), who listed *F. repens* with variable, 3-lobed leaves. Chien and Cheng (151) described *F. pumila* var. *ellipsoidea*, with oblong, ellipsoid receptacles having impressed lenticles on the surface. Encke (264) de-

scribed a variety as *serpyllifolia*, with leaves still smaller than those of the variety *minima*, with the margins indented.

A species was described by Makino (497) as *F. awkeotsang*, a name derived from the jelly cakes called *aw-keot-sang* which are made from the dried fruits in Formosa [Taiwan]. A detailed description, with illustration, was given by Sata (670). Plants grown from seeds from Formosa in 1959, through the courtesy of Dr. R. A. Hamilton, Honolulu, have practically the same vegetative characters as those of *F. pumila* var. *minima*, although Sata stated that the two are easily distinguishable. Li (470) gave a short account of *F. awkeotsang*, but Corner (197) considered it to be merely a variety of *F. pumila*.

Dimorphism in the leaves of fig plants has already been discussed in the introductory chapters. *Ficus pumila* has long been recognized as an excellent example of foliar dimorphism. G. King (437) stated that considerable confusion had arisen in the nomenclature of this species on account of dimorphism of its leaves, but that its synonymy had been carefully disentangled by Maximowicz (507). An anonymous writer (19) and Masters (502) both discussed and illustrated the small leaves which cling to the support, as contrasted with large leaves on standard fruiting branches, free from their support.

According to Butterfield (132), *F. repens* was grown by the Pacific Nursery of F. Ludemann, San Francisco, in 1874. Nehrling (574) grew it at Gotha, Florida, as early as 1893. *Ficus repens* was introduced from China in 1927 under PI No. 70,976, and *F. pumila* in 1932, 1933, and 1958 under PI Nos. 99,173, 105,607 (China), and 235,261 (Japan). Franceschi (298) reported it as common in 1895 at Santa Barbara, California, according to Riedel (641), who wrote of it: "Pretty when young, and merely forming a tracery, it becomes meaningless and even objectionable when, with fruiting, the growth becomes coarser and the leaves longer." Elizabeth Urquhart (770) recommended the variety *minima*, and stated:

"This little vine has tiny leaves like baby hands reaching out for something to cling to, and it lends itself beautifully to the small rock garden, where it maintains a perfect scale effect to be achieved by no other climbing rock plant." She also referred to *Ficus "repens minima japonica"* which, as far as is known, does not grow outside of Japan and a few California gardens. In 1958, I found *F. pumila* growing in a veritable jungle at the Palmer Nursery, Osprey, Florida, with the vines running riotously on the ground, on logs, and to the tops of native trees.

The evergreen vines of *F. pumila* generally grow on buildings and cling close to walls (figure 37); therefore, they are protected from winter cold, and seldom suffer frost damage. A leaf disease caused by the attacks of a nematode, *Aphelenchus olesistus*, was reported by Lüstner (482).



Fig. 37. The Climbing, or Evergreen-vine, Fig (*Ficus pumila*) is frequently planted as a wall covering for public buildings, such as the church pictured.

(Photo by Dennis Kucera.)

The following description is derived mostly from plants growing in southern California, although it may be said of this plant, in common with some others, that it is so well known as to need no description: The climbing vines, attached to the support by holdfasts, have a dark, rusty bark, scurfy on the surface. The terminal buds, 1.1 cm long, green in color, and pubescent, have short, pubescent stipules, persistent for several nodes.

The alternate, equilateral, or nearly symmetrical leaves are oblong to oval, 7.5 to 10.5 cm long and 3.6 to 4.3 cm broad on fruiting branches. The leaf blades have a rounded apex, a rounded or slightly subcordate base, coriaceous texture, and entire margins, with surface glabrous or very sparsely pubescent below. Venation is prominent below, and the veins are well elevated, with one indistinct basal pair and another conspicuous pair, the latter extending at an acute angle to over one-half the length of the blade, plus 3 to 5 short pairs of laterals. Reticulations be-

tween the veins are very conspicuous, appearing like latticework under a hand lens. The petioles are variable, up to 2.5 cm in length, pubescent, green at first, soon becoming brown or rusty; this color ends abruptly at base of midrib.

The axillary fruits, mostly single, are borne on thick peduncles 1.1 cm long, and are green in color. They are oblong or somewhat cylindrical in shape, with a broad apex, protruding at the center 1.1 cm or more, the base contracted and neck distinct, the whole body up to 6.2 cm in length and 3.6 cm in diameter. The green or grayish-white surface is often densely marked with white flecks toward the apex, commonly roughened on the body by up-raised or puffy skin, and densely pubescent. The umbilicus is rather loosely closed by lanceolate, white-pubescent scales. The interior is scarlet.

Hybridization of *F. pumila* and *F. carica*, as reported in chapter I under "Hybrids," was repeated in 1965, and seedlings are being observed at Riverside.

5. *Ficus aurantiaca* Griffith var. *parvifolia* Corner

(Plate I, F1-2)

This species was classified by Corner (197, 199b) as *Ficus aurantiaca* Griffith var. *parvifolia* Corner. It was described and illustrated by Griffith (342) in 1854. The species *F. megacarpa*, described by Merrill (515) as endemic to the Philippines, must also be considered here. Merrill (518, 524) gave other short accounts of this species, and cited *F. elliptica* Miq. as a synonym. That specific name, however, was invalidated by the earlier *F. elliptica* HBK. Other accounts of *F. megacarpa* were given by Elmer (256, 258, 262, 263), D. Brandis (103), Sata (670, with illustrations of leaves, fruit, and flowers), Li (470), and J. G. Watson (810, for Malayan names).

Corner (192) described *F. callicarpa* Miquel [*aurantiaca*], with three new varieties, and stated: "*Ficus megacarpa* is only a variety of *F. callicarpa* [*parvifolia*], with smaller, rather differently shaped leaves." According to Corner, its

distribution occupies "the central and northern part of western Malaysia, in the widest sense of the term. It is remarkable that the typical state [*F. callicarpa*], so common in Malaya, should be absent from the Philippines, and yet the species should be abundantly represented there by a variety which is absent from Malaya."

F. X. Williams (835) recorded notes and gave illustrations of *F. megacarpa* growing as stout, cable-like vines, often 9 cm thick, on tree trunks up to 970 m elevation on Mt. Maquiling, Laguna, P.I. Fairchild (275) found it in the same locality, growing as an immense climber with a spreading top, producing large leaves and quantities of fuzzy, red fruits as large as billiard balls. Grandj (334, 336) described *Blastophaga contubernalis* as the insect which inhabits the fruits in the Philippines.

Two early introductions of *F. megacarpa* have been made, the first in 1930

under PI No. 90,720 and the second in 1939 as PI No. 134,991, both as seeds from the Philippines. One seedling became established in an orchid house near Coconut Grove (Miami), Florida, but was neglected because it was mistaken for the common *F. pumila* var. *minima*. Another has been growing since 1941 on a pump house in the garden of Dr. L. M. Simonson, Lantana, Florida, where it also resembles the vine of *F. pumila*. It has not shown any damage from cold weather. Three plants were received from Florida in 1941, and grew luxuriantly in a humid greenhouse in California, but failed to become established in dry outdoor atmosphere. Late in 1959, three mature fruits were received at Riverside from the Philippines, and their fertile seeds were distributed for trial. Some of these, forwarded to Washington, were assigned PI No. 263,045. (See also, *F. terasonensis* Hayata, listed in chapter XVI.)

The following description is made from pot plants and from accounts of bearing vines by various botanists: In its native habitat, the species grows as a liana, sometimes extending in ropelike fashion for 9 m or more before branching, with foliage very variable on young and mature branches and on different plants. On

pot plants, aerial roots, some fimbriate or hairlike, grow from nodes and attach themselves to a support. The twigs are slender, green, and sparsely pubescent.

The alternate leaves are small and decidedly inequilateral, 5.7 cm long and 4.4 cm broad, with margins approximately parallel at the middle and the broad side rounded at the base. The apex is rounded and obtuse. Venation is indistinct, with 4 or 5 pairs of laterals spreading from the midrib on the broad side. The surface is slightly pubescent at first, later becoming practically glabrous. The petioles are short and pubescent (sometimes glabrous). According to Corner (192), the mature leaves are broadly elliptical, generally inequilateral or rounded-cuncate to shallowly cordate at the base, and 6.2 by 3.6 cm in size.

The fruits, borne in clusters on the older branches from stalks 6.2 cm long, issuing from rigid tubercles or sometimes in the axil scars of fallen leaves, are globose, and up to 7.7 cm in diameter. When fully ripe, they are orange-colored or russet, and pubescent. Mature dried fruits, received from the Philippines in 1959, were 5 cm long and 3.8 cm or more in diameter, with a neck 0.4 cm long, and borne on a short peduncle.

6. *Ficus tikoua* Bureau (Waipahu Fig)

(Plate I, B1-2)

Ficus tikoua, described and illustrated by Bureau (123), is a good example of a species which, like the Prodigal Son of New Testament fame, was once lost but was found again. In 1933, an introduction was made from Yunnan Province, China, at 970 m altitude, under PI No. 105,604. Plants were distributed in 1935 to twenty-two addresses in Florida and to the late H. L. Lyon in Honolulu, who left them with the city nursery, which planted several on the bank of a reservoir. A few years later, specimens were brought to Colin Potter, at the Foster Garden, for identification. Having lost the PI number and not recognizing the species, he gave it a local name, Waipahu Fig, after the

suburb where the plants were growing. During the intervening years, the species has been tested and found to be a promising ground cover.

The scene now changes to the Atkins Garden in Cuba, which I visited in 1949. There I found a trailing fig with the above PI number, and obtained a specimen for the herbarium at Riverside. Material collected in Hawaii in 1959 was traced to the number specified, and comparison with the herbarium specimen showed the two to be very similar. Ground-cover plants imported from Hawaii and found in a nursery in California provided fruiting material which was sent to Dr. E. J. H. Corner at Cambridge, England. He iden-

tified it as *F. tikoua* Bureau, indigenous to south China, Tibet, Assam, and northern Indonesia (conceivably, to some intervening areas), and stated that it belongs to the subgenus *Eusyce*.

This species is synonymous with *F. nigrescens* King and *F. bonatii* Léveillé. The description and illustration by G. King (437) fit the cultivated plants very closely, except for the shape of the leaves, which are broadly ovate in his figure but obovate in the ground covers. King gave the specific name *nigrescens* because of the black or very dark color of the fruit, according to a Mr. Clarke, "who alone had collected it." It was placed by King in the subgenus *Sycidium*, its affinities being clearly with *F. heterophylla*, *F. quercifolia* [montana], and *F. ampelas*. (See the first-named species in chapter XVI, and the other two as species Nos. 7 and 95.) See also, the account of *F. nigrescens* by D. Brandis (103), and a brief illustrated account in *Sunset Magazine* for September, 1961. Forbes and Hemsley (290) gave localities for *F. tikoua*.

Fresh material from plants in Hawaii and California provided the following description: The plants trail over the ground and take root along the stems, with their loose ends hanging over the edge of a wall. (See figure 21 in chapter II.) The terminal buds are short, 0.5 cm long, glabrous, and reddish brown. The twigs are short-jointed, 0.5 cm in diameter, and are chocolate-brown when mature.

The alternate, equilateral leaves are variable in size, up to 6.8 cm long and 4.3 cm broad, obovate, broadest above the middle and slightly narrowing toward the

rounded or very shallowly subcordate base, with the apex obtuse or indistinctly acute. Venation is prominent, the veins well elevated below, with 1 basal pair plus 5 pairs of laterals. The texture is harsh and subcoriaceous. The surface is hispid above but less so below, with the veins showing a soft pubescence. Hydathodes are loosely scattered over the upper surface. The margins are finely serrate. The petioles are 1.1 to 2.1 cm long, chocolate-brown, and narrowly channeled above, with a scurfy surface.

The figs are borne on prostrate, rooted stems, partly or entirely concealed by ground litter somewhat like peanuts, according to Bureau (123), who employed the term "souterrain" (subterranean). They occur singly or in pairs, although one is often abortive, according to G. King (437). They are borne mostly on bracteolate tubercles, but may be in the axil scars of fallen leaves. The peduncles are slender, up to 0.5 cm long. The shape is pyriform to urceolate, with broad apex. The size is 1.1 cm long and 0.8 cm in diameter. The surface is smooth, or has inconspicuous, scattered, and low protuberances. The color is dark chocolate-brown to black. The umbilicus is somewhat roughened by a corrugated border, its scales hardly visible. The interior is pink.

The success of *F. tikoua* as a ground cover has already been demonstrated in Hawaii. In California, it develops rapidly outdoors, but has not so far found a place in the retail market for ornamental plants. At Riverside, it thrives in summer heat and sunshine, and has not been seriously injured by 1 or 2 degrees below 32° F.

7. *Ficus montana* Burman (f.) (Oakleaf Fig)

(Plate I, D1-2)

This species is best known as the Oakleaf Fig (*F. quercifolia*), described by Blume (92). Corner (196, 199b), however, classified it in subsection *Sycidium*, series *Copiosae*, as *F. montana* Burman (f.). He added: "This is undoubtedly the correct name for *F. quercifolia* Roxb.," though Burman's type has been misnamed

F. ampelas. Rade (618) made comments on *F. quercifolia* Roxb., with *F. inconstans* Miq. and *F. humilis* Raf. in parentheses. According to Roxburgh (657, 658), it is an extremely variable species, indigenous to a wide area, from Burma to the Malay Peninsula, Sumatra, Java, and the Philippines. G. Cooke (188) gave a good illus-

tration of the leaves and fruit, and reported that it had been introduced into England. It was a small-growing plant, fruiting when less than 60 cm high, with leaves so much like those of an oak that they were deceptive at a short distance. Voigt (782) described it as *F. denticulata* Vahl, with *quercifolia* Roxb. as a synonym. G. King (437) also gave a good illustrated description of the species, with *humilis* as a variety. Ridley (639) stated that it is a creeping shrub, variable in all points, and that the species may eventually have to be broken up. He gave the variety *inconstans*, described by Miquel (540), as a small, slender shrub. See the note under *F. purpurascens* in chapter XVI.

Other accounts were given by Wight (826), Miquel (542), G. King (438), D. Brandis (103), Elmer (257, 258), Clercq (162), Backer and van Slooten (36), Koorders (444), Bonstedt (96), Burkill (124), and Graf (324, with illustration). See J. G. Watson (810) for Malayan names.

According to Ochse (580), the leaves, in spite of their roughness, are eaten raw as "lablab" [garnish] with rice, and the sweetish receptacles are consumed as a delicacy by children in Java. Grandi (336) listed *Blastophaga tentacularis* as the insect which inhabits the receptacles and brings about pollination.

Riedel (641) reported that the Oakleaf Fig was offered by Franceschi at Santa Barbara in 1908, but that the plants did not thrive when planted. In 1932, scions of *F. quercifolia* were introduced from Paris under PI No. 101,330. Nehrling (574) recorded it as a tender species at Gotha, the only plant in Florida at that time. Plants have been growing at the Bronx Park (New York) Botanical Gardens and at the Missouri Botanical Garden in St. Louis for many years. They are now found more or less commonly in Florida. Angelina La Rosa (458) reported

it as growing in the Palermo (Sicily) Botanic Garden.

This species was propagated at Riverside from cuttings received from the Bronx Park Botanical Gardens in 1930, and distributed to various nurseries for trial. At the time of writing, increased interest has been shown in the Oakleaf Fig as an ornamental pot plant. The young plants are precocious, bearing small fruits at intervals in the leaf axils.

The following description has been made from specimens growing in pots at Riverside and Los Angeles: The branches, hollow when young, according to Elmer (258), are mostly prostrate or sprawling, with brown, puberulent bark. The inactive buds are up to 0.8 cm long, minutely pubescent, and reddish brown, with the new growth green.

The leaves are alternate, equilateral, oblong, 7.5 to 15 cm long and 5 to 7.5 cm broad, with the apex acute and the base rounded or sometimes subcordate. The margins are irregularly lobed or indented. Venation is prominent below, with 1 pair at the base of the midrib plus 6 to 10 pairs of laterals. The texture is subcoriaceous; the surface is glabrous above and scabrous below. The petioles are slender, up to 1.8 cm long, scabrid, and channeled above.

The axillary fruits, single or geminate on slender peduncles up to 1.1 cm long, are urn-shaped, up to 0.8 cm long and 0.5 cm in diameter, with a slender, somewhat flattened neck. The surface is densely studded with rough, white flecks. Tubercles owing to misplaced scales are common on the peduncle and green body of the fruit. The umbilicus is broad and craterlike, with pink, pubescent scales. The interior is white.

The Oakleaf Fig has a limited use as a ground cover in protected places and for planting in hanging baskets. The plants are attractive because of the oaklike leaves and the rather abundant axillary fruits.

CHAPTER VII · Species 8 through 17

8. *Ficus hispida* Linné (f.) (Opposite-leaf Fig)

(Plate IV, A1-4)

Ficus hispida, described by Linné (f.) (476), is not the only species with opposite leaves, but it is the one most commonly recognized as having that character. The synonym, *F. oppositifolia*, was used by Griffith (342), Roxburgh (658), Wight (826), Drury (243), Miquel (539), and others. Common names also applied to the species are Rough-leaved Fig, Bristly-leaved Fig, Rough Rubber Tree, Devil's Fig, Stiff-haired Fig, and Milk Tree. This species is widely distributed, from India to Burma and Australia. Illustrated accounts of it have been issued by the following: Ettinghausen (269), G. King (437), Talbot (747), Corner (191, 193), Koorders and Valetton (446), Bose (98), Lyon (485), McCann (487, in color), Worthington (849), and Manjunath (497a). Accounts without illustrations were by Blume (92), Thunberg (755), P. Miller (536), D. Brandis (102, 103), Kurz (455), Bentham and Mueller (77), Dymock (250), F. M. Bailey (42), Duthie (247), H. Collett (167), Troup (765), Gamble (309), Lyon (484), Ridley (639), C. E. Parkinson (585), Parker (584), Haines (352), Osmaston (581), C. E. C. Fischer (286), Lewis (469), Burkill (124), Grant and Williams (339), Alston (8), Naik (569), and Benthall (75a).

The systematic account by Mary Barrett (67) of *F. hispida* stated that it is one of the species with opposite leaves, but "In spite of this distinguishing character, the other features of the leaves show such variability that many synonyms have accumulated. None, however, is sufficiently distinctive to constitute a variety." Corner (197, 199b) classified this species in the subgenus *Ficus*, section and subsection *Sycocarpus* Miq., and gave, as a synonym, *F. scabra*, described and illustrated in color by Jacquin (416).

An excellent account of the receptacles, the male, female, and gall flowers, as well as "the fertilization of *Ficus hispida*" was published by G. King (439). He found fig insects issuing from the receptacles, and stated that they were a species of *Blastophaga*. The species, however, was described by Mayr (510) as *Ceratosolen marchali*. See the reference to this species by Grandi (336). Grandi (337) also recorded *Philotrypesis pilosa* Mayr as being an inhabitant of these figs in Java and India. See also, chapter II, under "Parthenogenesis."

PI Nos. 6,889, 54,892, 80,081, 93,590, and 101,318 all represent importations of *F. hispida*.

The brief account in Inventory No. 70 of No. 54,892 follows: "A hardy shrub, or small tree, collected in Queensland by C. E. Pemberton" [seeds, 1922]. Also: "A moderate-sized, rapid-growing tree, native throughout India from the Punjab to Malacca and Ceylon. The somewhat pear-shaped, paired, or clustered fruits are yellowish when ripe; they sometimes hang on elongated branches, and often reach, or even penetrate, the soil. The fruit, seeds, and bark are valuable medicinally, and the foliage is used for fodder." The foregoing quotation is adapted from Kirtikar and Basu (440).

Ficus daemona Vahl, introduced into the Calcutta Botanic Garden, is listed by the *Kew Index* as equal to *F. hispida*. See Roxburgh (658). See also, *F. saemocarpa*, in chapter XVI, for a brief key applying to *F. hispida*; also, *F. trachyphylla*.

According to Inventory No. 107, plants of this species were forwarded by the late G. W. Groff, Canton, in 1931, "a wild fig which gives promise as a stock." These plants were probably obtained from a small tree in the Groff yard on the Lingnan University campus, where I saw it

growing during my residence there in 1934-35. It was included in the list given by Sauer (671) of the trees growing there in 1947.

Both seeds and rooted plants of PI No. 80,081 have been received in California. Plants became established at Riverside, the Huntington Botanical Garden in San Marino, and at the UCLA Botanical Garden. At Riverside, the plants showed only slight frost injury in 1944 at 29° F. However, when the temperature dropped to 26°, both leaves and twigs were badly injured, as they were also in 1962.

According to Riedel (641), the 1900 catalogue of the Franceschi Nursery, Santa Barbara, California, offered *F. hispida* (as *oppositifolia*) for sale. Some were planted on Eucalyptus Hill and others were sold to an estate in Hollywood. A plant was once growing at the Vavra Estate, maintained until 1959 by UCLA. Several trees have been growing and bearing fruit for many years in the Lyon Arboretum, Honolulu. Two plants propagated from cuttings by Dr. R. A. Hamilton, Honolulu, and forwarded in 1960 have again become established in Cali-

formia. According to Setyodiwiryo (689), the species is cultivated at Bogor.

The following description is made from notes taken on fruiting trees in Florida, California, and Hawaii, in comparison with other accounts: The plants are bushy, spreading, or treelike, without aerial roots or buttresses, the young twigs hollow or devoid of pith, green, becoming chestnut-brown, and hairy-pubescent. The lenticel scars are rusty-brown and prominent. The buds are 1.1 to 2.5 cm long, densely pubescent, with lanceolate stipules.

The equilateral leaves are opposite on some branches, alternate on others, from a few up to 30.5 cm long and 15 cm broad, oval to oblanceolate, with the apex bluntly acute or narrowly acuminate to cuspidate, and the base broadly rounded to shallowly subcordate. The membranous or chartaceous blades, hispid above, with scattered hydathodes or papillae, each bearing a stiff hair, are therefore rough and prominently sandpapery. Venation is prominent, with 1 or 2 basal pairs plus 5 to 9 pairs of laterals, some lateral veins branching before reaching the margin. The margins are finely serrate. The thick



Fig. 38. Fruit-bearing twigs of five species of *Ficus*. From left to right: *F. virens*, *F. burkei*, *F. pertusa*, *F. soldanella*, and *F. hispida*.

petioles, from 2.5 to 7.5 cm long, are finely pubescent to white-hairy or even hispid, very slightly flattened, but not channeled above.

The figs are occasionally in axillary pairs, but are more often in fascicles on the larger branches or on leafless, branched twigs up to 1 m long from the framework or trunk. (Figure 38 shows figs borne on such a twig. The reader is referred to the descriptions of species Nos. 24, 33, 50, and 80 for notes on the remaining four kinds shown in the photograph.) The oblate, spherical, or short-turbinate figs, borne on densely pubescent peduncles that are often 2.5 cm long and enlarged at the apex, are 1.1 to 2.5 cm in diameter, with the surface densely pubescent and marked by widely scattered flecks of white.

The three basal bracts are conical, green, with scarious margins. There are commonly misplaced bracts on the fruit surface, these also green, with scarious margins. The broad umbilicus, 0.5 cm or more across, with depressed center, is bordered with green bracts similar to those on the surface. The outer color is green or yellow. The interior is white.

In Burma, the ripe fruits are eaten raw and made into jam, according to Grant and Williams (339). On the other hand, Chopra (153) included this species in a list of important plants that are poisonous to man and livestock.

Ficus hispida cannot be recommended for ornamental planting. However, it is suitable for inclusion in collections of plants and for its botanical characteristics.

9. *Ficus congesta* Roxburgh (Congested Fig)

(Plate XXIV, A1-4)

In his description of *Ficus congesta*, Roxburgh (658) reported that the fruits "are heaped on radical and cauline, short, leafless branchlets or panicles," which apparently accounts for the specific name. The description by Wight (826) followed closely that of Roxburgh. It was placed in the subgenus *Covellia* by Miquel (540, 542), but later (544), he listed it as *F. congesta* Roxburgh. G. King (437) included this in his list of doubtful and imperfectly known species, but thought it was near *F. fistulosa* Blume. (See notes on the latter in chapter XVI.)

Corner (197, 199b) classified *F. congesta* in the subgenus *Ficus*, section *Sycocarpus* Miq., series *Tuberculifasciculatae* Sata, subseries *Congestae* Corner. He stated: "Miquel and King regarded this as an uncertain species, but there is now abundant material to show that it is one of the important, common, and variable species of central and eastern Malaysia."

One of the synonyms given by Corner is *F. satterthwaitei*, described by Elmer (257) from specimens collected in the province of Leyte, Philippine Islands. The species was reported to be quite rare in that area, where it inhabits the woods of

the fertile valley of the Bangon River. The name was given in honor of G. W. Satterthwaite, a teacher in Leyte. It was also described in two other accounts by Elmer; the first (259) of Davao Province, where trees were scattered in light woods at 970 m altitude; the second (260) of the Sibuyan area, where it was collected along the banks of the Patoos River at an elevation of 228 m. Elmer (263) further reported it as a variable species, growing in forested flats or ravines at about 456 m elevation. F. X. Williams (836) stated that this is "another dioecious species, taller and more sylvan in habitat than *F. nota*, but related to it." See Sata (670) for notes on synonymy and distribution, and Merrill (524) for local names. Rehder (627) listed *F. congesta* Léveillé and Vaniot from eastern Asia.

The original account by Roxburgh (658) stated that trees of *F. congesta* were introduced into the Botanic Garden at Calcutta in 1802 and in 1809. By 1832, they were 20 to 30 m high, with straight trunks and few branches, and dark-brown, smooth bark. This species has long been grown in Hawaii from seeds received from the Philippines as *F. satterthwaitei*. Seeds sent

to California from Manila in 1934 failed to germinate. Rooted plants were obtained in California from L. W. Bryan, Hilo, in 1939 and again in 1940, but the plants failed to survive a temperature of 26° F in an outdoor nursery at Riverside in 1946. PI No. 144,040 represents an introduction of *F. satterthwaitei* from the Philippines in 1942.

The following description is made from pot plants and from large trees in the Lyon Arboretum, Honolulu (HSPA Nos. 1,545 and 1,775), and at the Wahiawa Botanic Garden, Oahu, in comparison with other accounts: In their native habitat, the trees are 6 to 9 m high, with trunks 60 cm in diameter, sometimes crooked and gnarled. In the Arboretum, trees are 6 m high and have a 7.6 m spread of branches, with trunks 45 cm in diameter. The young twigs are green, smooth, indistinctly rusty, and more or less hollow or devoid of pith. Terminal buds are 1.8 cm long, green, mostly glabrous, but pubescent at the base. The mature bark is grayish brown and smooth, with rusty rings. There are very few aerial roots, found mostly at the base of the trunk.

The leaves tend to be toward the ends of twigs, but are not clustered. They are mostly alternate, although both alternate and opposite arrangements are sometimes found on the same young twig. Their shape is equilaterally oval, with a somewhat recurved, short, acute apex and a rounded, obtuse, or subacute base. The sizes vary considerably, ranging from 7.5 to 25 cm long and 3.6 to 10.5 cm broad. The margins are entire to crenately toothed, or coarsely wavy along the upper edges. The surfaces are glabrous, except for occa-

sional bristly hairs on the veins below. The texture is subcoriaceous to chartaceous. The veins are prominent below, well elevated, with 1 or 2 basals plus 8 or 9 arcuate laterals. Hydathodes are well scattered over the upper surface. The blades are green above and much lighter below; when very young, they are maroon. The petioles are stout, 1.1 to 3.6 cm long, and smooth, except for concentric, slightly rusty, rings.

The Congested or Satterthwaite Fig tree is cauliflorous, producing its fruit in large clusters from tubercles on the trunk and larger branches. The single or geminate figs, with prominent, scurfy, or white-hairy peduncles 1.8 to 3.6 cm long, are attached to thick twigs that are sometimes quite long. Wight (826) reported the fruit as sessile, but his figure 644 shows peduncles 1.1 cm long. The figs are oblate to broadly turbinate, with or without a short neck, and are up to 5 cm in diameter and 2.5 cm long, with the apex broad and somewhat sunken, marked with concentric ridges between the center and the border. Fleshy misplaced scales are found on the apex of many figs. The umbilicus is 0.8 cm across, with the center depressed. The scales are green. The surface is mostly smooth, but is prominently decorated with widely scattered, rusty flecks; it is often indistinctly ridged or striped. The color is light green outside; the interior is scarlet. Staminate flowers are massed at the apical end of some receptacles, and cling together in a disc when cut in cross section.

The ornamental value of *F. congesta* is questionable, and the trees are probably too tender to frost to be recommended for general planting.

10. *Ficus cumingii* Miquel (Cuming Fig)

(Plate II, D1-2; Plate XXXV, C1)

According to Merrill (519), the Cuming Fig, *Ficus cumingii*, is widely distributed in the Philippine Islands, where it flowers and sets fruit throughout the year. The original description by Miquel (539) credits the specific name to its discoverer, Cuming. Other accounts are by Miquel

(542), G. King (437, with illustration), Elmer (256, 262, 263), Merrill (524), and Li (470). Gates (313) reported *F. cumingii* as a small tree in the "panang" on Luzon Island, and suggested that it might be only a variety of *F. ulmifolia*. The species belongs to the subgenus *Sycidium*.

F. X. Williams (836) did not identify the insect which inhabits its fruits, but stated that the Cuming Fig is a dioecious species. See the account by Corner (196) of three varieties of *F. cumingii*, and by Corner (199b) of five varieties.

A species introduced into the United States from the Philippines in 1925 as PI No. 65,840 was later identified as *F. cumingii*. Although the account stated that the fruits were edible and delicious, it also reported: "This is probably not of promise as a commercial fig, owing to the smallness of the fruits, the tenderness of the skin, and the scant fecundity, but it may have possibilities as a stock or for breeding purposes."

Plants of PI No. 65,840 were transferred to Riverside from the University of California at Berkeley in 1933, with a heavy attack of root knot caused by nematodes. Other plants were received from Florida in 1942. Some, planted in a nursery row, were slightly damaged by frost at a temperature of 26° F. in 1946. In 1948, they were killed by still lower temperatures. Small trees were found growing at Miami (PIS) in 1949, and again in 1958. See also, the note under *F. philippinensis* in chapter XVI.

The following description has been made from the Florida specimens, in comparison with other accounts: The habit is that of a much-branched shrub or small, erect tree. The twigs are very slender, pubescent or scabrid, and green. The terminal buds are tiny, 0.2 cm long, and sharp-pointed; the margins of the stipules are pubescent.

The leaves are very variable, alternate and opposite on the same individual; the

juvenile leaves resemble those of *F. ulmi-folia* (species No. 15) which, Merrill (524) stated, intergrades with *F. cumingii*. The blades are generally equilateral, narrowly lanceolate or oblanceolate, often with a halberdlike base or, as King reported, "occasionally with a triangular lobe near the base at one or both sides." From the middle, the blade gradually narrows to an acuminate or cuspidate apex. The midrib is flanked by 1 prominent basal pair of veins and from a few to 6 or 8 pairs of laterals on the leaves of fruiting branches to as many as 36 pairs on linear, juvenile leaves. The margins are also variable, from entire or nearly so to remotely dentate or sinuate. The texture is chartaceous; the surface is scabrous above and below. Hydathodes, thickly scattered over the upper surface, are each armed with a stiff hair or spine, which augments the scabrid effect. The petioles are 1.1 to 2.5 cm long, and scabrous. (See chapter III, under "Dimorphism.")

The axillary, single or geminate figs, on short, scabrous peduncles 0.2 cm long, are oblate-spherical to slightly turbinate, with a short neck, and are very small, mostly less than 1.1 cm in diameter, with a scabrous, green surface. White flecks are present, but are very scattered and inconspicuous. The umbilicus is rather prominent for such a small fig, and is bordered by pink scales. The staminate flowers are strawberry-red; the pistillate ones, white.

Ficus cumingii can hardly be considered as an ornamental, and it does not seem to be useful for breeding purposes or for a rootstock. It therefore may be relegated to botanical gardens or to special collections of exotics.

11. *Ficus aspera* Forster (L.) (*F. parcelli* Veitch) (Mosaic Fig)

(Plate II, A1-3)

The Mosaic Fig, like other variegated plants, is a sport from some native species. In fact, Corner (196) stated: "*Ficus parcelli* is merely the variegated state of *F. aspera*, but there are few collections of this species, and none that is good. Indeed, it is difficult to know how it differs from

F. scabra Forst., except in the larger, vil-lous figs and the more copious veining." (See under *F. coronata*, species No. 98.)

Ficus parcelli, the Mosaic Fig, was described and illustrated by Veitch, according to *Kew Index* (ex Cogn. and Marchal, Pl. Ornam. 3, t. 47, 1874), as "a hand-

some stove plant received through Messrs. Baptist and Sons of Sydney, whose collector, Mr. Parcell, discovered it in the South Sea Islands." An earlier account, with illustration, was given by Dallière (219). An illustration of the plant, with its variegated leaves, was published by Regel (626). See also, Rafarin (620). Veitch (777) reported it from South Australia, growing 4.5 m high, and as striking a variegated bush as could well be imagined, the numerous fruits flushed with red. A tree 7.6 m high, growing at Port Elizabeth, South Africa, was figured in *Gardener's Chronicle*, January 2, 1904, page 13.

According to F. M. Bailey (37), plants of *F. parcelli* were growing in the Brisbane Botanic Garden in 1885. Jarry-Desloges (419) gave a short but good account, with an illustration of it as grown in France. Nehring (574, 575) reported this species to be one of the most showy foliage plants of northern conservatories and botanical gardens in the United States, but stated that it was rarely seen in Florida. According to Arnold (24), it was once very popular as a foliage plant in England, appearing in most flower shows in earlier years. Riedel (641) stated that it was offered by C. F. Franceschi, Santa Barbara, California, in 1900, and that in Hawaii the plants lose much of their variegation when grown in full sun. Interest in the species by commercial nurseries has not been great, as it is not adapted to outdoor culture because of its tenderness to frost. However, it does make an attractive specimen when grown in a container in a protected patio. See the short account in *Sunset Magazine* for September, 1961, under the common name "Clown Fig"; also, in the following: *Flore des Serres*, Ghent, 22:13, tab. 2273, 1877; *Floral*

Magazine (n.s.), London, tab. 124, 1874; Råde (618); *American Florist* 29:1290, 1908; Pope (608); P. Fischer (287); and Graf (324); the last two with illustrations.

The following description is made from indoor and outdoor specimens in California and from trees in the Lyon Arboretum, Honolulu, planted in 1940 and noted in 1959; also, from trees at the Kamehameha School, Honolulu: The plants are bushy, or grow as small trees, with twigs finely pubescent and green or pink, and the terminal buds are less than 1.1 cm long.

The alternate, inequilateral leaves are up to 30 cm long, oval, acuminate at the apex and broadly cordate at the base, with one lobe much larger than the other, the two somewhat overlapping. Venation is prominent, well elevated below, with 7 or 8 pairs of laterals. The texture is thinly chartaceous, the surface finely pubescent below but slightly hispid above because of the sharply projecting and densely scattered hydathodes, and the margin coarsely dentate. The basic color is light green, alternating with white. The petioles are 1.1 to 1.8 cm long, thick, and pubescent.

In Hawaii, the trees are cauliflorous, with some fruits produced on warty tubercles found on the trunk and larger branches. Small plants in patios or conservatories have fruits axillary, single or geminate. Such fruits have a slender, green peduncle 1.1 cm long, swollen at the apex. The shape is spherical, with or without short neck; size, 1.8 cm in diameter. The surface is pubescent, green or striped green and white, turning pink or scarlet at maturity. The umbilicus is 2 mm broad, with a rimlike border, the scales pink. The interior is white.

See also, comment under *F. canoni* in chapter XVI.

12. *Ficus septica* Burman (f.) (Wavy-leaf Fig)

(Plate V, A1-3)

In this account of *Ficus septica*, described by N. Burman (f.) (128), the species *F. leucantatoma* Poirét and *F. hauili* Blanco should also be considered. In describing *F. leucantatoma*, Lamarck

and Poirét (456) credited Willdenow (834) with an earlier description and illustration as *F. venosa*. The illustrated account by G. King (437) gave the distribution as Java and other Malayan islands,

with the statement that "It is sometimes cultivated in the tropics and in stoves in Europe, on account of its handsome, white-nerved leaves, under the names *F. eburnea* and *F. venosa*." A short description (with figure) of *F. leucantatoma* from Java was published by Koorders and Veleton (446). Merrill (524) stated: "Our representative of *Ficus leucantatoma* Poir., *F. septica* Burm." Backer (35) came to the same conclusion. Corner (197, 199b) described and listed *F. septica* Burman (L) var. *cauliflora*, also var. *salicifolia*. According to Roxburgh (658), *F. rapiiformis* [*leucantatoma*; *septica*] was introduced into the Calcutta Botanic Garden from the Moluccas in 1798, and in five years the trees were 3 to 6 m high. See Maximowicz (507). PI No. 3,447 represented an introduction of *F. leucantatoma* from Sicily in 1899. Two lots of seeds were received at Riverside in 1957, one under PI No. 237,169 from the Philippines labeled *F. hauili*, and the other from Taiwan. No plants were secured from either lot.

Ficus hauili, described by Blanco (88), was treated by many botanists as a distinct species, but the late E. D. Merrill, in a personal note sent in 1949, stated that it is merely the Philippine representative of *F. septica*, and may as well be reduced. See also, Merrill (516). However, it is treated in the present work in a separate account, as species No. 54.

Two illustrations of *F. septica* were cited by Stapf (728): Reede (624, see Hasskarl 359), and Rumphius (660, see Merrill 522). P. Miller (536) treated *F. venosa* under his No. 11, as the Waved-leaf Fig Tree, and his No. 28 as *F. septica*. Burkill (124) reported *F. septica* as "a fig of Java and parts of Malaysia which, because of its foliage prettily veined with white, is in cultivation, but under the names *F. leucantatoma* Poir. and *F. venosa* Willd." He stated that it has medicinal properties, and can be used in a mixture with opium. Summerhayes (743) placed this species in the section *Covellia*, and wrote: "I do not understand on what grounds Diels [see our reference No. 231]

transferred this species from the section *Covellia* [in which it was placed by King under the name *F. leucantatoma* Poir.] to the section *Sycidium*." Sata (670, with illustrations) reported that *F. septica* has considerable garden value, especially in greenhouses. See also, Li (470).

An anonymous writer (17) stated that *F. eburnea* Hort. had been displayed by a Belgian firm at the International Horticultural Exhibition, St. Petersburg, Russia. Also, a Mr. Bull, of Chelsea, exhibited plants of the same species at the Royal Horticultural Society's showing in London, April 6, 1869. The writer stated that *F. eburnea* from New Granada was one of those free-growing plants which required a good deal of space; the beautiful leaves figured were about 37 cm long and ovate-acuminate. Råde (618) illustrated the growth habit of this species. Chittenden (152, per Potter) described *F. eburnea* as a plant with shining green leaves, with the main veins ivory-white. Kelsey and Dayton (434) called it the Ivory Fig. See also, Graf (324, with illustration).

In the course of my studies of exotic figs in Cuba, Florida, and California, I failed to find any established specimens of *F. septica*; but in Honolulu, I was shown some of these trees growing in dooryards and beside the Kamehameha School.

The following descriptive notes were made from the trees at Honolulu: Two trees at the school are spreading, with low-branched trunks, shallow surface roots, and dark-green, glossy foliage. The latex is distinctly yellow when fresh, and sometimes emits an unpleasant odor. The dormant buds are 5 to 6 cm long, glabrous, and green. The young twigs are more or less hollow or devoid of pith, 0.8 cm thick, and glabrous, with prominent, elongated lenticels below the nodes, some being rusty. The mature branches are gray, with rusty lenticular scars.

The alternate (sometimes opposite, according to King), equilateral, ovate leaves are from a few to 30 cm long and 12.6 to 22 cm broad, with the apex bluntly acute

to cuspidate, the cusp 1.1 cm long, and the base broad and rounded or shallowly subcordate. Venation is prominent, with the veins well elevated below, and the midrib and laterals almost white above. There are 2 short basal pairs plus 8 or 9 laterals which are widely spaced, 3 to 3.6 cm apart. The texture is chartaceous, the margins are entire and somewhat wavy, and both surfaces are glabrous (glossy above). Hydathodes are sparsely scattered between the veins; as P. Miller (536) stated, "impressed with dots on the upper surface." The petioles are stout, up to 0.3 cm thick, and 0.5 to 4.3 cm long, green at first, becoming rusty-gray, with the epidermis showing horizontal rings that are more or less fissured. They are very slightly flattened above, not channeled.

The trees are very prolific, the fruits being produced in clusters on the trunk and larger branches or geminate in the leaf axils. The green peduncles average

0.5 cm thick, and are practically glabrous. The figs are oblate, flattened at base and apex, 2 cm in diameter and 1.5 cm from base to apex. The surface, smooth or more or less ribbed, is prominently decorated with white flecks, some becoming rusty. The basal bracts are small, green, and spreading. The surface is green at first, but becomes reddish brown at maturity. According to King (437), the surface has 10 to 12 vertical ridges and many white, rough warts. The prominent umbilicus is in the center of a depression 0.5 cm across, with the scales dark green. The interior is white.

As the foregoing statements indicate, *F. septica* has long been grown as an ornamental, both indoors and outdoors. The plants are probably tender to frost. The species is worth testing on the United States mainland, but in temperate regions only. See the brief note under *F. casearia* in chapter XVI.

13. *Ficus dryepontiana* Gentil (Dryepont Fig)

(Plate III, A1-3)

Louis Gentil (315) described and illustrated in color a species of *Ficus* named in honor of Dr. Gustave Dryepont, Director of the Company of Kasai in Africa, who had collected several interesting specimens of the African flora. This species, *F. dryepontiana*, is indigenous to the region of Luabala. It was cultivated as an ornamental there and elsewhere in the Congo. According to Gentil's account, the plant is easily propagated by cuttings and grows rapidly. See Wildeman (828), Hutchinson (407), Holland (382), *Revue Horticole Belgique* 33:301 (1933), Corner and Stearn (200), Encke (264), and Graf (324). Lebrun and Boutique (462) gave a good account of this species, including citations to references by Mildbraed and Burret (535), Wildeman (827), and Lebrun (460). It is placed in the subgenus *Bibracteatae*, section *Fasciculatae*, and is separated from other species by its rugose receptacles, persistent stipules, and leaves being reddish purple on the lower surface. Holland (382) stated that it was cultivated

in the Royal Botanic Gardens at Kew and in the Brussels Botanic Garden.

The Dryepont Fig was listed in the 1950 catalogue of Louis van Houtte Père, La Pinte, Belgium, a firm which has since ceased operation. A Florida nurseryman obtained plants from the Belgian firm, and had a fine specimen growing outdoors until the winter of 1957-58, when it froze back to the trunk. However, plants had been propagated, and were grown in pots in 1958. The original tree recovered, and bore fruit in 1962. A young tree is growing at the Fairchild Tropical Garden, Miami, Florida, in the shade of palms. A rooted cutting from this tree was received in 1962 at Riverside, and is being grown as a pot plant. It produced several figs in 1964 (figure 39). See also, under *F. hirta*, species No. 99.

The following description is from notes taken of plants in Florida, in comparison with other accounts, especially that by Lebrun and Boutique (462): Native

plants are epiphytic, with stipules persistent for several nodes. The leaves, on petioles 4.3 to 6.2 cm long, are glabrous, oval-oblong or elliptical, entire or somewhat undulate at the margins, and are 12.6 to 30.5 cm long by 6.2 to 10.5 cm broad. The apex is acuminate, the acumens up to 1.8 cm long, and the base is rounded or cordate. The blade is dark green and glabrous above but reddish purple below, with fine puberulence along the veins. The lateral veins number 7 to 9 pairs, and diverge from the midrib at an angle of 45 degrees.

The figs, borne in fascicles on the older branches on peduncles 1.8 cm long, are globular, more or less rugose, puberulent or pubescent, 2.5 cm or more in diameter, and prominently adorned with flecks of white. The umbilicus is bilabiate, without external bracts. Internally, the meat is pink, styles white, and stigmas pink.

This is a species which warrants wider distribution and trial, especially for pot culture. It is unique among figs on account of the bright coloration of the lower leaf surface, but this brilliancy of color



Fig. 39. Two pot-grown plants, both of which are producing fruit. Left, *Ficus dryepontiana*; right, *F. hirta*.

depends upon light intensity. The trees are probably too susceptible to frost damage for outdoor culture, except in warm or protected situations.

14. *Ficus semicordata* B. Ham. (Wedgeleaf Fig)

(Plate V, B1-3)

Corner (196, 199b) has classified this species in the subsection *Sycidium*, series *Prostratae*, as *Ficus semicordata* B. Ham. ex J. E. Smith (707 in the present Literature Cited section). He added that the specific name for it had been *F. cunia*, of uncertain etymology, but that it was spelled "cunea" on the labels of Hamilton's specimens.

In his account of *F. cunia*, Roxburgh (658) reported it as "a native of Nepal; from thence Dr. Buchanan sent seeds to the Botanic Garden at Calcutta at the close of 1809; the only tree which was reared was about twenty feet [approx. 6 m] high, uncommonly well clothed with long, spreading branches down to the ground, and constantly loaded with fruit." The above explains the citation of authorship by Wight (826) and by Drury (243) as "Buch. Roxb.;" also, Kurz (455) as *F.*

cunia Buch. The illustrated account by G. King (437) ascribed it to "Ham. MSS.," while *Kew Index* and Parker (584) gave "Buch. Ham. ex Roxburgh." Miquel (544) gave it as *F. cunia* "Buch. ap. Roxb.;" H. Collett (167) and Osmaston (581) as "Buch.-Ham.;" Ridley (639) as "Ham. in Roxburgh.;" D. Brandis (103), Troup (765), and Haines (352) simply as "Ham.;" Puri (613) gave *F. cunia* Buch.-Ham. as a fossil species from India.

G. King (437, 438) described the tree of *F. cunea* as small, ranging from sub-Himalayan forests and hills of central India to Burma, up to an elevation of 1,300 m. He added that it is not very variable considering its wide distribution. The form named *conglomerata* by Roxburgh was reported to have broader, smoother leaves and more globular recep-

tacles than the typical *cunea*. In the Calcutta Botanic Garden, it was reported to be loaded with fruit throughout the year. D. Brandis (103, with illustration of leaves and fruits) described it as a glabrous shrub or small tree, often creeping. According to Gamble (309), it is a pretty species, recognized at once by the long leaves with an unequal, semisagittate base. He added: "The fruit is eaten and is good, though somewhat insipid." The specific name apparently comes from the Latin *cuneus*, or wedge, in allusion to the shape of the leaf. It therefore seems appropriate to call the species the Wedgeleaf Fig. See the notes by Prain (610).

Grandi (336) recorded *Ceratosolen gravelysi* as a fig insect inhabiting the fruits of *F. cunea* in Ceylon. Joseph (429) described *Eukochelela cunia* and *Sycoryctes trifemmenais* as new species from these figs in India.

No record has been found of the introduction of this species into the United States mainland. In 1931, seeds were introduced into Hawaii by the late H. L. Lyon as HSPA No. 5,912 from Dehra Dun Forest, India, and several bearing trees were found in the Lyon Arboretum in 1959 and 1960.

I give the following description from my notes on these trees: The trees, 6 m high with a spread of 7.6 m, lack buttresses or aerial roots. The terminal buds are 2.5 cm long, densely pubescent, and green or rusty. The young twigs are densely sericeous on a dark-gray to brown background; the mature ones are rough and scurfy, with lenticel spots obscured by the exfoliating epidermis.

The alternate leaves, prominently inequilateral, especially at the base, are variable in size, from 5.0 to 20.0 cm long and 3.6 to 8.6 cm broad. They are irregularly oval, with one side broad and the margin 3.0 to 5.0 cm from the midrib; the other narrower, with the margin 1.8 to 3.6 cm from the midrib. The apex is cuspidate, the cusp gradually narrowed to 1.1 cm in length, and the base auricled, with one lobe prominent and overlapping the petiole. Venation is prominent, with the

veins well elevated below. There are 3 or 4 basal pairs on the broad auricle plus 8 or 9 pairs of laterals. Hydathodes are present and well scattered. Both surfaces are somewhat hispid, the lower one being densely sericeous, especially on the veins. The texture is subcoriaceous. The margins are remotely or indistinctly crenate to practically entire. The petioles are 1.1 to 1.8 cm long, commonly arcuate, with the brown, rough surface sericeous.

This is an example of a cauliflorous or geocarpic species. Corner (193) stated: "And, in *F. cunia*, while the lower runners may have all their figs underground, those arising from short heights up the trunk bear figs copiously on their aerial as well as underground parts, and the runners from the lower branches are modified into hanging fruit-sprays, as in *F. hispida*." See also, the illustrated account by Corner (191). Some bearing branches of trees in the Lyon Arboretum are 7.5 cm thick at the base, and extend, with many forks, to a length of over 3 m. The individual receptacles are single or geminate, on a fairly stout peduncle 0.5 cm long, and are densely sericeous. They are oblong or globose, without a neck, and up to 1.8 cm in length and diameter, with the surface roughened by excrescences and a few misplaced scales. The basal bracts are prominent, flaring, triangular, and sericeous. The prominent umbilicus is flush with the rounded apex (or nearly so), and open at the center, with pink scales. The external color is chocolate-brown; the internal color is strawberry.

The Wedgeleaf Fig is, like the Gooseberry Fig (*F. ribes*), more curious than ornamental. It does have a place in botanical gardens because of its cauliflorous habit and the copious production of fruit. On the other hand, Burkill (124) called it an ornamental tree, and reported that there is a variegated race in gardens of Malaya. He added that the fruit is edible and sweetish, and is one of the famine foods in India. Haines (352) stated that the trees are in fruit most of the year, and that lac-producing scale insects are often

cultivated on the branches. Ward (805) found *F. cuneata* in Burma to have curiously lopsided leaves and luscious fruits borne on long, whiplike shoots which trailed over

the ground. Grant and Williams (339) reported that trees are nowhere cultivated in Burma, but that the wild fruits are eaten when ripe and are also made into jam.

15. *Ficus ulmifolia* Lamarek (Elmleaf Fig)

(Plate V, C1-4)

The Elmleaf Fig, *Ficus ulmifolia*, described by Lamarek (456), is another of the confused and confusing species of the genus. G. King (437) wrote that he had seen no authentic specimen of it, and added that Miquel (542) described it, but apparently without having seen it, and that his description did not agree with that of Lamarek. The accounts by Merrill (519, 524) gave *F. sinuosa* Miq. as a synonym. He stated that it occurs throughout the Philippines in thickets up to 1,500 m elevation, and is very common and exceedingly variable, intergrading with *F. cumingii* Miq. and with *F. blepharostoma* Warb. In his check list, Corner (199b) included three synonyms: *F. difformis* Lam., *F. sinuosa* Miq., and *F. blepharostoma* Warb. See the key under *F. odorata*, species No. 97, for characters separating it from *F. ulmifolia*.

The common name, Elmleaf Fig, indicates that it bears leaves similar to those of an elm, but there are other figs which might just as well be given this name.

F. X. Williams (835) reported that *F. ulmifolia*, perhaps the commonest fig growing in the Philippine lowlands, "is scarcely more than a shrub, and appears more subject to the attacks of insect borers, leaf and fruit feeders, than any other species." Other accounts are by Willdenow (834), Miquel (544), Merrill (518), W. H. Brown (115, with illustration, and 116), Gates (313), Ochse (580), and Sata (670).

Elmer (263) listed the species only, and placed it in the section *Axillares* (*A. Nonglabratae*). The insect which inhabits fruits of the Elmleaf Fig in the Philippines was stated by Grandi (336) to be *Blasphaga browni* Ashmead.

In 1913, *F. ulmifolia* was introduced from the Philippines under PI No. 35,449,

with this note by C. F. Baker: "Occasional individual trees of this small fig give very sweet and very palatable fruits. It should certainly be a subject for some breeding and selection work." Nehrling (575) referred to Baker's report, and stated that the species should be tried as a fruit tree in south Florida gardens. PI No. 50,699 represented seeds introduced from Java via Honolulu in 1920, with notes by A. Schwarz adapted from Lamarek and Poiret (456). Another introduction was made by the Fairchild Expedition (275) as PI No. 135,433, and trees have become established at Miami, Florida (PIS). According to Riedel (641), *F. ulmifolia* was offered by nursery catalogues in 1915. Seeds obtained from Manila in 1928 by the University of California produced seedlings, and by 1935 one tree was growing in the UCLA Botanical Garden. Others were found at the Huntington Botanical Garden, San Marino; at Balboa Park, San Diego; and plants are also growing at Riverside.

The following description has been made from notes on trees growing in Cuba and Florida in 1949 and 1958 and in Honolulu in 1959, in comparison with other descriptions: In native thickets, the species grows as a shrub or tree 4.5 m high; under cultivation, as a small tree, with a trunk 16 cm in diameter. There are no aerial roots from the branches, which have a smooth, light-gray bark. The twigs are slender, scabrid, and rusty-green, with the terminal buds very short, 0.5 cm or less long, and scabrid-pubescent. The vigorous young twigs are hollow (devoid of pith).

Reference has been made in chapter III, at "Dimorphism," to the extreme variability of leaves in this species, especially between juvenile and mature leaves of the

same tree. The juvenile leaves are up to 16 cm long, linear, often only 1.1 cm broad, with a sharply acute apex and a hastate base, and venation showing 1 basal pair of veins plus 35 or more lateral pairs. The mature leaves are 5 to 15 cm long and 2.5 to 4.3 cm broad, oval to elliptical, with the apex variable (often prominently acuminate), the acumen up to 2.5 cm long, the base rounded, often inequilateral, and the venation having 1 basal pair plus 8 to 10 laterals. The texture is harsh and subcoriaceous. The surface is hispid above and below. According to Fairchild (276): "So harsh and rough are the leaves of this fig tree that they are used to polish wooden surfaces like table tops and cabinets." Hydatodes are loosely scattered on the upper surface between veins. The margins are hispid, and are armed with short, rigid

bristles. The petioles are 0.5 to 1.1 cm long, sometimes prominently curved, and bristly.

The axillary figs, single or geminate, are sessile or on a very short peduncle, up to 1.1 cm in diameter, globular to pyriform-turbinate, with or without a slender neck, and with the base broad and rounded, with the apex protruding. The prominent pink umbilicus is in a craterlike depression. Misplaced scales are commonly found on the neck and basal part of the fruit. The surface is bristly-pubescent, lacking prominent markings, and green, becoming scarlet or nearly so when mature. The interior is strawberry, or may be white.

Frost damage to trees in south Florida was practically negligible in 1958-59, although trees of several other species were severely injured.

16. *Ficus tinctoria* Forster (f.) (Dye Fig)

(Plate II, E1-2)

Ficus tinctoria, described by Forster (f.) (294), owes its specific and common names to the fact, as F. B. H. Brown (111) stated, that the juice from its fruit, mixed with fruits of *Cordia* (Boraginaceae), is used in making a dye for cloth or to paint the faces of actors or warriors. Corner (196) wrote of it: "I distinguish four subspecies, three of which fill large geographical regions, but with intermixture or overlapping at the boundaries." The subspecies *tinctoria* is the insular state of the species as opposed to the continental. Summerhayes (742) gave the distribution of *F. tinctoria* as French Polynesia, Cook Islands, Fiji, and Tonga, and concluded: "All the material referred to *F. tinctoria* which I have seen from regions to the west (for example, New Guinea) belongs, in my opinion, to other species." Corner (195) stated: "It is perhaps the most widespread of all species of the genus." A list of four subspecies and two varieties, with key to classification, was given by Corner (199b).

The illustration of *F. tinctoria* given by Seaman (686) was reproduced by Brigham (105) in his account of the making

of bark cloth, for which this species is used. Other illustrations are listed in *Index Londinensis*. According to Wilder (829), trees of *F. tinctoria* are common in all districts of Rarotonga, even on the highest hills and mountains, and are cultivated by the natives about their dwellings. In the Philippines, this species is a seacoast plant, as reported by Elmer (260). *Ficus tinctoria* subsp. *swinhoei* (King) Corner (199b) is a type from Taiwan and Mindanao, first described and illustrated by G. King (437). See also, the account of *F. swinhoei* by Sata (670) under *F. tinctoria*.

Ficus gibbosa (*F. tinctoria* subsp. *gibbosa* [BL] Corner [199b]) was first described by Blume (92) as a species from Batavia. G. King (437, 438) referred to the leaves as usually inequilateral or gibbous toward the base at one or both sides, hence the specific name. Gibbous also means humped, which apparently accounts for the common name Humped Fig. According to G. King (437), this is a very widely distributed and highly variable species, found in India near the bases of all the hill ranges, in Burma, the Malay

Peninsula, and in Hong Kong. King recognized and illustrated four forms or varieties: *F. gibbosa typica*; var. *cuspidifera*; var. *parasitica* (incorrectly, according to a letter from Dr. Corner dated December 30, 1959); and var. *tuberculata*.

Corner (193), who described and illustrated *F. gibbosa* with the common name Humped Fig tree, stated: "It develops more aerial basketing roots than any other Malayan species, except perhaps *F. elastica*." However, there are no pillar or prop roots. Summerhayes (743) reported that the plants of a certain affinity "are best referred to *F. gibbosa* Blume. *Ficus tinctoria*, to which Diels [231 in our bibliography] reduces *F. gibbosa*, is a Pacific island species, not occurring farther west than the Bismarck Archipelago." Other descriptions of *F. gibbosa*, with illustrations, were given by Miquel (542), Maiden (494), Clercq (162), Talbot (747), Kirtikar and Basu (440, after King), Sata (670), and E. H. Walker (794); without illustrations, by G. Watt (815), Talbot (746), Prain (610), D. Brandis (103), Gamble (309), C. E. Parkinson (585), Ridley (639), Haines (352), Osmaston (581), C. E. C. Fischer (286), Lloyd and Aiken (477), and Glassman (320). Yuncker (852, 853) found these trees to be abundant in all the Manua Islands, and frequently seen in Tonga.

Ficus tinctoria, subsp. *gibbosa*, var. *rigida* (Miquel) Corner: According to Corner (196), this is the state of the species in southeast Asia and western Malaysia, but it intergrades with others in boundary regions where proper classification is a problem. The combination *F. gibbosa* var. *rigida* was used by Miquel (544). Furthermore, *F. rigida* Miquel (539, 544), but not of Jack (414), was classified as a variety of *F. subgelderii*, a new species, by Corner (196). (See the latter species in chapter XVI.) In his illustrated account, G. King (437) stated that there were two specimens of *F. rigida* at Kew, both with immature receptacles. Koorders and Valetton (446) described and illustrated *rigida* as a variety. The subspecies *parasitica* is wild only on the

Asiatic continent. In central Malaya, it gives place to the subspecies *gibbosa*, and from the Philippines and Moluccas eastward, to the subspecies *tinctoria* (Corner, in a letter dated May 16, 1960). According to *Kew Index*, *F. parasitica* Koenig ex Willd. equals *gibbosa*. Duthie (247) gave an account of *F. parasitica* with reference to other accounts, and its distribution as throughout India and Ceylon to Burma. In his key to species, Alston (8) separated two species as follows:

Leaves densely hispid. *F. asperima*
Leaves subglabrous. *F. parasitica*

The latter he described, with illustration, as a common epiphyte on trees in the jungle. Worthington (849) gave an illustration and short account of *F. parasitica*. See also, Prain (610). Swezey (744) described two new species of insects from *F. tinctoria* in Guam, one lepidopterous, the other homopterous. See also, the account of *F. excelsa* in chapter XVI.

Ficus tinctoria variety *anastomosans* (Wall. ex Kurz) Corner is a type from Burma and Thailand. It was described by Kurz (455) as an evergreen, low, creeping shrub, with all softer parts more or less rough-pubescent, leaves coarsely sinuate and almost lobed, receptacles the size of a pepper-kernel, scabrous-pubescent.

Corner (196), in commenting on the above subspecies and varieties, stated: "There is no specific difference in fig, flower, seed, or leaf, and it is possible to form a continuous series." Specimens sent to Dr. Corner were identified by him as follows: HSPA No. 2,591, growing in the Lyon Arboretum, is *F. tinctoria* Forst. (f.); a tree in the same Arboretum labeled *F. asperima*, with PI No. 123,528 (India, 1937), is identical with *F. tinctoria* Forst. (f.) subsp. *parasitica* Willd.; a specimen of PI No. 105,605 (China, 1934) grown at Miami (PIS) as *F. gibbosa* is identified as *F. parasitica* Willd. PI No. 74,593 from Guam (1927) is listed in the Inventory as *F. tinctoria*. In 1926, the Fairchild-Dorsett Expedition collected seeds of *F. gibbosa* in Sumatra and forwarded them under PI No. 67,564, with

the following description: "A handsome, medium-sized tree, with a single trunk, large, glossy leaves, and orange berries 1.1 cm in diameter." Cuttings labeled *F. gibbosa* were obtained from Egypt in 1931 and assigned PI No. 92,951. PI Nos. 72,596 and 94,300 represented introductions of seeds in 1927 and 1931 from Java as *F. rigida*, one bearing this notation: "An epiphytic shrub or small tree, with narrow, leathery leaves about 15 cm long. The orange-yellow fruits, 1.1 cm in diameter, are white-spotted and sessile, in pairs near ends of branches." A few seedlings were obtained, but failed to thrive in pots at Riverside and were discarded. (See related comment under *F. subgelderi* in chapter XVI.) PI No. 78,577 was obtained from Guam in 1929, and No. 137,965 came from Celebes in 1940. Remarks included with the latter introduction follow: "A pendulous tree, up to 18 m high, with yellow-green leaves, lighter green underneath, up to 20 cm long and 9 cm broad. The orange-colored, jug-shaped fruits, 1.5 cm in diameter, are borne in the axils of leaves." PI No. 139,363, from the Moluccas in 1940, is also identified as *F. tinctoria*.

The following description is made from specimens studied in Florida, Cuba, and Honolulu, in comparison with other accounts: The trees are generally small and spreading, with no aerial roots. The terminal buds are somewhat flattened, 1.1 cm long, glabrous, and reddish brown. The young, zigzag twigs are green at first and sparsely pubescent, later becoming gray and somewhat scabrid, with prominent lenticel scars.

The alternate leaves are inequilateral, especially at the base, up to 18 cm long

and 7 cm broad, obliquely oblong-oval (according to Summerhayes) to oval-lanceolate, with the apex acute to cuspidate and the base narrowed or rounded. Venation is fairly prominent; the veins are elevated below, with 1 basal pair plus 5 to 7 laterals. The blade outline is somewhat angular, much like that of some species of *Ilex* (holly). Worthington (849) described it as "four-sided, a most peculiar shape." The texture is subcoriaceous. The surface is mostly glabrous (often rough or hairy on one or both sides of the leaf, according to the key by Summerhayes), with scattered hydathodes. The color is light green, becoming yellowish green or aureous on drying, especially on the lower surface, as mentioned by Mary Barrett (58). The petioles are 1.1 to 1.8 cm long, often curved, and rusty-brown, the color ending abruptly at the base of the green midrib.

The figs are axillary, geminate or single, sessile or with a very short peduncle, and up to 1.1 cm in diameter. The body is globular, with a prominent, very slender neck which may be readily mistaken for a true peduncle. The color is green to yellowish green or yellow, with quite prominent flecks of lighter green. The surface is smooth, sometimes studded with nipple-like protuberances, or may be very sparsely pubescent. The umbilicus is prominent and slightly protruding. The interior is white.

Plants of the Dye Fig, originating with PI No. 78,577 from Guam in 1929, were grown both in pots and in the open at Riverside, but failed to survive a temperature of 26° F. in 1946. The species has no particular features which recommend it for ornamental planting.

17. *Ficus lyrata* Warburg (Fiddleleaf Fig)

(Plate VI, A1-2)

The Fiddleleaf Fig was described by Warburg (797) as *Ficus lyrata*, using specimens collected in Africa in 1890. It has also been treated by various botanists as *F. pandurata* Hance (354). Although the latter name is appropriate, it is not

valid, for the original description applies to a Chinese shrub with quite different leaves.

Accounts of this species by Wildeman (828) and Mary Barrett (65, 68) are summarized here. Seeds sent to France in

1895 from Africa produced seedlings which were widely distributed for trial. Some, sent to the Colonial Garden of Nogent, were called *Ficus pandurata*, but the name was not publicized. In 1903, Sanders and Sons, of St. Albans, England, and Bruges, Belgium, exhibited plants at Ghent as *F. pandurata* Hort., with enough description to constitute publication. Introductions into the United States aroused interest, as exemplified by illustrated accounts in the following: *American Florist* 23:239 (1904) and 26:263 (1906); *Gardening* 16:34 (1907); *Garden Magazine* 8:268 (1909); and by Apgar (23). See also, historical accounts by W. Watson (814, with plates), Domke (236), and Maximowicz (507). Srivastava (716a) has recently classified *F. pandurata* (Hort.) Sanders as *F. willemanniana* (our species No. 51).

A brief review of various accounts under the specific name *pandurata* may be in order. The description, with illustration, by G. King (437) did not apply, for it concerned *F. pandurata* Hance and not *F. pandurata* Hort. Mowry (561) briefly described and illustrated it (erroneously as the species of Hance) as a large tree in Florida, usually with a well-rounded head. According to Chien and Cheng (151), a species listed as *F. pandurata* in Chekiang Province, China, had the leaves variable, even on the same branch, but their determination needs verification. Nehrling (574, 575) reported it as perfectly hardy in south Florida, thriving with great vigor and soon forming large specimens. He regarded it as "the finest and most beautiful of all rubber trees for street planting." Daisy Abbott (2) found it to be an ideal plant for the busy housewife, "for its wants are simple." Jenkins and Wilson (421) wrote: "The Fiddle-leaved Rubber Plant has an air of distinction that far surpasses the old-fashioned, droopy type. Here indeed is the perfect tall plant, with clean, straight lines for the light, empty corner of the library or sun room." Trees of the Fiddleleaf Fig are planted rather frequently in the parks and gardens of Central America, according to Standley

and Steyermark (726). Noble and Merkel (578) stated: "The plants can stand chilling almost to freezing, and will grow in sun or shade." It was illustrated and briefly described by Rade (618). See also, comment under *F. formosana* and *F. sagittifolia* in chapter XVI.

The following accounts, in addition to those just cited, were given under the specific name of *lyrata*: Hutchinson (407), Hutchinson and Dalziel (410), and Holland (382) described the species as a tree, at least 12 m tall when full grown, planted in villages or along avenues in Africa. Aubréville (29) and Walden (791) illustrated and briefly described it. This species is planted for shade along avenues in coastal towns, and is treated as a sacred tree in forest areas of Ghana, according to Irvine (412). See the illustration and brief description by Graf (324), who listed a variety "Craig," patented in 1956; also, Melady (511). As described by Watkins (809), it is an excellent street tree in Cuba. Pancho (582) reported it in 1958 as of recent introduction among the cultivated figs of the Philippines.

In 1908, plants labeled *F. pandurata* were listed under PI No. 23,435 from Massachusetts. PI Nos. 101,322 and 101,324 represent scions from France in 1932, but it is doubtful if any survived. PI No. 221,185 (Florida, 1930) was listed as *F. pandurata*.

Hutchinson (407) followed Mildbraed and Burret (535) in placing *F. lyrata* in the subgenus *Bibracteatae*, section *Axillares*. The species is well distributed in tropical Africa. Other names are Banjo Fig and Lyrato-leaved Fig.

Although it is most widely known for culture in pots, the Fiddleleaf Fig, as already indicated, grows well as an outdoor specimen tree in mild climates. Thrifty trees have been observed at Brownsville, Texas; Miami, Florida; the Atkins Garden at Cienfuegos, Cuba; Honolulu, Hawaii; and various parts of southern California. The hardiness mentioned by Nehrling and by Noble and Merkel is somewhat questionable. The trees in a canyon near Los Angeles, California, were badly dam-

aged when the temperature fell to 27° F., or slightly lower, in 1948. At Miami, Florida, trees were seriously injured during the cold winter of 1957-58.

Ficus lyrata grows as a small tree, with neither buttresses nor aerial roots. The bark is gray, shreddy, or broadly fissured with longitudinal cracks. The twigs are stout, 1.1 cm in diameter, with prominent lenticels, and stipules which persist for several nodes. W. W. (786) described and illustrated the plant and leaves, and referred to "the large, dark-brown, boat-shaped stipules, about 2 inches [5 cm] long, set so as to hide the stem." The buds are short, and are concealed by dry, brown bud scales. The alternate, equilateral leaves, often up to 45 cm or more long and 30.5 cm broad, are oblanceolate or fiddle-shaped, with a rounded apex which is sometimes obtusely acuminate at the center, and a cordate base. The sinus

is narrow, with the lobes meeting or nearly so, and often overlapping. Venation is prominent, the veins well elevated below, with 1 prominent and 2 small basal pairs plus 3 to 5 branching laterals. The texture is coriaceous and brittle, the surface is glabrous and glossy (very finely puberulent when young), the margins are entire and slightly undulate, and the color is dark green. The petioles are stout, up to 7.5 cm long, slightly flattened above but not channeled, glabrous, and green at first, becoming rusty.

The axillary, sessile figs, single or geminate, are 2.5 to 3 cm in diameter, spherical, sometimes slightly oblique, with large, conspicuous white flecks scattered over the green surface, which is slightly roughened or pebbled, and puberulent. For such a large fruit, the umbilicus is small and inconspicuous, with small bracts. The interior is white.

18. *Ficus umbellata* Vahl (Broadleaf Fig)

(Plate VIII, B1-4)

Vahl (773) described an African species of *Ficus* as *F. umbellata*, with leaves cordate, acuminate, glabrous, and with pedunculate fruits in umbels on adult branches. Mildbraed and Burret (535) classified it in subgenus *Bibracteatae*, section *Caulocarpae*.

Hutchinson (407), also Hutchinson and Dalziel (410), separated it from *F. polita* Vahl by branch and leaf characters, and stated that its shortly pedunculate fruits are produced in fascicles on the older branches, remote from the leaves. The species was included by Holland (382) among his "Useful Plants of Nigeria." He reported that the local name, "Nyedua," means "to grow around," suggestive of its epiphytal nature. Irvine (412) gave it as "Gyedua" (shade tree). According to Aubréville (29), trees of the "Popo," as *F. umbellata* is called on the Ivory Coast, are commonly planted in villages, reaching 15 m in height. As shown in his figure, the ovoid-globular fruits are slightly pubescent, and are pedunculate, up to 3 cm long. Aubréville (30) also stated that the leaves of this species greatly resemble those of *F. kerstingii* (our species No. 19), *F. discifera*, and *F. platyphylla*. See also, Lebrun (460) and Schnell (677a); also, *F. ovata*, our species No. 56.

This account of *F. umbellata* must be linked to the descriptions of *F. platyphylla*, described by Raffeneau-Delile (621). Fairchild (273) called attention to beautiful specimen trees of *F. platyphylla* growing on the Gold Coast, "with enormous leaves and a shade one would love to lie under." On the ground were hundreds of decaying figs, from which seeds were obtained and forwarded to the United States. One introduction was numbered PI 73,118, and another was 75,751, both from Africa in 1927. Fairchild (273) reproduced photographs of the large African

tree, as well as of a seedling growing in south Florida. This and other seedlings have grown into large trees since 1930, 9 to 12 m high. Trees were also found growing in the Lyon Arboretum, Honolulu, in 1959, as well as on the University of Hawaii campus. In Florida, specimen trees in Miami are located at the city cemetery and the Plant Introduction Station (PIS). The common name Broadleaf Fig has been given to this species, although "Kano Rubber Tree" might be more applicable. Seeds which I obtained from French West Africa in 1947 were assigned PI No. 161,332.

A plant of *F. platyphylla*, PI No. 75,751, was received in 1931, and was later increased by cuttings at Riverside, both in pots and in the open ground. The outdoor plants were killed by temperatures down to 26° F. One potted plant grew very slowly, and produced fruits at intervals from tubercles on the stem. After being transplanted to Arcadia (LASCA), it made a good growth, but the fruit buds remained dormant. The identity of bearing plants seen in the localities mentioned was questioned because the fruit buds were not in the axils of green leaves, as described in some accounts, but from tubercles of leaf scars on older wood. Specimens from fruiting trees grown in Florida and Hawaii as *F. platyphylla* have recently been identified as *F. umbellata*.

Cultivated trees grow upright, with some aerial roots close to or clasping the trunk. They show no buttresses (or only medium-sized ones) near the ground. The twigs are stout, at least 0.8 cm thick, glabrous, green, becoming silvery-gray, with prominent rings at the nodes, conspicuous corky lenticels, and large leaf scars. The terminal dormant buds are up to 3.8 cm long and 0.5 cm thick at the base, tapering to a sharp apex, glabrous, and reddish brown.

The alternate, equilateral, ovate leaves, up to 30 cm long and 20 cm broad, have an acuminate apex, the acumen 1.1 cm or more long, a broadly cordate base, and the sinus open (or closed on some blades). The texture is chartaceous, the margins are entire (often undulate), and the surface is glabrous; according to Lely (463), with velvety hairs; and Mildbraed and Burret (535), with the under surface soft, and hairs short and obscure. Venation is prominent, the midrib flanked by 2 or 3 pairs of basal veins and 7 or 8 lateral pairs. The green color is often tinged with reddish brown, especially on the veins below. The petioles are up to 15 cm long and

0.4 cm thick, glabrous (very slightly pubescent when young), slightly channeled, and green or chocolate-brown on the upper surface.

Figs received from Honolulu and Florida are borne on short tubercles located in the axils of old leaf scars, on branches 1.1 cm thick. They are spherical to obovate, 1.8 cm in diameter, and dark brown, with small, light-colored flecks scattered over the velvety or minutely puberulent surface. The umbilicus is small and bilabiate, without external scales. The figs are either sessile or very shortly pedunculate. The three basal bracts are closely appressed to the body. The interior is strawberry to scarlet.

19. *Ficus kerstingii* Warburg

(Plate VII, C1-3)

Ficus kerstingii was described by Warburg ex Mildbraed and Burret (535). Both *F. arbutifolia* and *F. catalpaefolia*, described by Miquel (539), are synonymous names. In appearance, the leaves of *F. kerstingii* closely resemble those of a *Catalpa*. They are also somewhat similar in shape to those of *F. soldanella* Warburg (species No. 50).

According to Hutchinson (407), this species is likely to be confused with *F. mituensis* Warburg (a variety of *F. afzelii*), but may be distinguished by the shortly acuminate leaves with the midrib continuous to the apex, and the peculiar, shieldlike bracts at the base of the receptacle. A brief description was also given by Hutchinson and Dalziel (410), who stated that it often grows on rocky hills, and is sometimes planted. Dalziel (221) gave this brief account: "A small to medium-sized tree of forest strips, planted in villages. The figs are about one-half inch [1.3 cm] long, stalked, two or three together at the ends of the shoots." It is widely distributed in tropical Africa. The species was classified by Hutchinson in the series *Caducae*, section *Axillares*, and subgenus *Bibracteatae*. Aubréville (30) gave a brief account of it, with an illustration of leaves and fruiting twigs, while Irvine (412) recorded it as a shade tree.

PI No. 101,320 represents scions of *F. kerstingii* introduced from Paris in 1932. Plants from rooted marcots were received from Florida in 1937, 1958, and 1963, and were grown in pots at Riverside.

The following description was made from studies of trees in Cuba and Florida: The tree is deciduous in Cuba, with new foliage appearing and fruits dropping in late January, the trunk 30.5 cm in diameter, the bark silvery-gray and narrowly fissured, and aerial roots produced from the framework branches. The short-jointed twigs are glabrous, green at first, becoming brown, then gray, with small, fairly prominent lenticels. The terminal buds are also glabrous, 2 cm long, slender, and green to dark-colored. The new growth is green.

The alternate, equilateral leaves are up to 15 cm long and 9.3 cm broad, with the apex broadly and abruptly cuspidate, the base cordate, and the sinus wide open. The texture is chartaceous; rigidly so, or subcoriaceous, according to Hutchinson (407). The margins are entire, and the surface is glossy and glabrous above. Venation is prominent, the midrib flanked by 2 basal pairs of veins plus 5 or 6 pairs of laterals, the tertiary veins forming innumerable areoles or reticulations. The midrib and some lateral veins are often

light scarlet. The petioles are up to 10.5 cm long, slightly flattened and channeled above, glabrous, and somewhat jointed at the base of the blade.

The figs, commonly fascicled in the axils of leaves or leaf scars, have a slender peduncle 1.1 cm long, are oblate-spherical in shape, up to 2.7 cm in diameter, and 2.5 cm from base to apex. The surface is green, glabrous, and decorated with widely scattered brown flecks. The umbilicus is flush with the surface, and is practically

the same color as the body. The interior is pink to light scarlet (white on pot-grown plants). Hutchinson described the basal bracts as forming a one-sided, saucer-shaped involucre, closely appressed to the base of the receptacle, nearly 0.5 cm broad, glabrous, with undulate margin. This character has been prominent on figs produced at Riverside.

Ficus kerstingii has no particular qualities to recommend it for culture as an ornamental. Its hardiness is not known.

20. *Ficus religiosa* Linné (Bo Tree; Peepul; Pipal)

(Plate VII, A1-3)

According to Mrs. J. H. Philpot (601), the Peepul has been venerated above all other trees "by the special injunction of Gautama [Buddha] as that under which he had achieved perfect knowledge." The veneration given it by the people of India was so significant that Linné (473) described the species as the "religious tree," *Ficus religiosa*. Balfour (51) stated that the Bo Tree affords great shade, and is sacred to Buddhists because "Sakyamuni [Buddha] died under its canopy." For an illustrated account of the sacred Bo Tree, see Fergusson (283). The species is found growing in a wild state in sub-Himalayan forests from the Punjab eastward, sometimes attaining a girth of 7.6 m. It is one of the strangler figs and, although destructive to forest trees, is difficult to eradicate because the Hindus look upon killing it as a great sin. However, the branches are commonly cut for cattle, elephant, and camel fodder, chiefly by Moslem attendants. These trees have spread all over India, Burma, and Ceylon by seeds and cuttings. In south India, the trees are planted about 12 m apart and used for shade in coffee plantations.

A Bo Tree sent to Anuradhapura, Ceylon, has produced the oldest historical tree known. Planted in the year 288 B.C., an almost continuous record has been kept of the tree and of the successive steps taken to preserve it throughout the intervening centuries. On April 23, 1941, T. H. Parsons wrote from Peradeniya, Ceylon, that

the above statement is literally correct. He stated: "It is doubtful if the life of any individual specimen of *Ficus* exceeds 150 years in the tropics, but such trees are maintained by means of suckers and shoots, and in this instance it has no doubt been the case. The material tree at present would therefore be part and parcel, as it were, of the original tree brought from India in 288 B.C." According to Molisch (552), these trees may live to be 2,000 to 3,000 years old.

Time Magazine for August 9, 1948, stated that word was spread among Buddha's followers that the sacred Bo Tree was withering and the prognosis was bad. Just as generations of them had done before, they poured gallons of milk around the trunk as the only remedy known. According to McLean and Ivimey-Cook (489), there is a Bo Tree at Dean-Pitya in Ceylon under whose shade stands a whole village of over a hundred huts.

Other accounts of *Ficus religiosa* were given by the following authors (those marked by an asterisk include illustrations): Thunberg (755), Joannis Loureiro (478a), Hamilton (353), Blume (92), Roxburgh (658), Schlechtendal (676,* in color), Miquel (542), Tennant (752), N. H. H. (349*), Drury (243), Kurz (455), Gamble (309), G. King (437,* 438), D. Brandis (103), Talbot (747*), Bamber (53), Koorders and Valetton (446*), Rock (648), H. Collett (167), Haines (352), C. E. C. Fischer

(286), Nehrling (574, 575), Lewis (469), Burkill (124), Mowry (561*), Corner (193*), McCann (487,* in color), Benthall (75a), Bose (98*), Pancho (582), Marie Neal (572), Cowen (204*), Parsa (589), Mary Barrett (67,* 68*), Parodi (588), Graf (324*), Manjunath (497a*), and Merrill (527). G. Watt (815) gave a long list of references, as well as notes on use of the plant for gum, dyes, tanning, fiber, medicine, food, fodder, and wood. A good account of a chemical examination of the fruit was published by Reinherz (629), while Dymock (250) reviewed its medicinal properties. Galil (306a) reported on pollination of the flowers.

As recorded by Grandi (336), *Blastophaga quadriceps* was described by Mayr (509) from fruits of *F. religiosa* in Malacca to Ceylon. Joseph (427) also records the same species from India. Grandi (336) also recorded *Eupristina saundersi* from the figs in India.

Aiton (5) reported that this species was cultivated by Philip Miller in England in 1731 under the name Poplar-leaved Fig. It has been introduced several times into the United States. PI Nos. 32,806 and 81,823 represent introductions of seeds from India in 1912 and 1929. Trees had become established much earlier, for Riedel (641) stated that Dr. C. F. Franceschi catalogued it in 1900, with the notation that trees are hardy enough in southern California, but slow-growing and small. An introduction in 1900 from France was given PI No. 4,400. Cuttings were received from Egypt in 1931 under PI No. 92,953. Trees have been grown in Hawaii for a long time. Lyon (484) told of several fine specimens planted in gardens and along the streets of Honolulu, the largest being on the grounds of St. Louis College, and many were grown in the forest. He stated that it is inadvisable to use them above 650 m elevation, because they are severely attacked by a weevil locally known as the Olinda beetle (*Pantomorus godmani*) which strips off the foliage.

In Florida, the Bo Tree has been widely planted as an ornamental. The Royal Palm Nursery (659) stated in its 1939 cata-

logue: "This beautiful *Ficus* is a valuable lawn and street tree, and makes a handsome subject in protected areas." Several fine specimens are growing at Miami (PIS); also, along streets and avenues in the Miami area.

In California, trees of this species do not thrive nearly so well as in Florida or Hawaii, and but few large specimens are found. The species is being tested outdoors, and young trees are thriving at Arcadia (LASCA), Monrovia, Los Angeles, Santa Barbara, Yorba Linda, and Riverside.

In Florida, these trees show neither aerial roots nor prominent buttresses at the base. The twigs are slender, green at first, becoming gray, and glabrous. The bark on mature branches is somewhat shreddy. The dormant terminal buds are up to 2.5 cm long, glabrous, and green. The new growth is also green. The most distinctive character of the tree is its foliage; the alternate leaves are borne on slender petioles, and rustle in the wind like those of some poplars (e.g., the Quaking Aspen, *Populus tremuloides*), as mentioned by Corner (199a). The equilateral blades are broadly conical, up to 17 cm long and 12.5 cm broad, with a broad base, rounded or truncate. The apex is abruptly narrowed into a conspicuous structure, best described as an acumen, but often referred to as a tail-like appendage. This is up to 6.2 cm long, a good example of a "drip-tip" leaf. Venation is traceable on both upper and lower surfaces of the blade, with 1 or 2 basal pairs of veins at the base of the midrib, plus 8 to 10 pairs of laterals, these flush with the lower surface but slightly elevated above. The surface is glabrous and glaucous, and the texture is rather thin and papery. A few hydathodes may be present on the upper surface, but some plants, or even leaves on the same plant, seem to be devoid of them. The margin is entire and somewhat undulate. The petioles are slender, and greenish yellow to almost white. This is possibly the only exotic fig in which natural retting of the leaves has been observed. After decomposition of the tender parts of the

blade, the venation is clearly delineated (as in figure 40). See Clay and Hubbard (159a).

The figs are axillary, sessile, usually geminate. They are small, 1.1 cm or less in diameter, oblate, glabrous, with scarlet flecks on a green to purplish background. The basal bracts are broad and conspicuous. The interior is white. The floral morphology and embryology of *F. religiosa*

have been treated in detail by Johri and Konar (423a).

Troup (765) described *F. religiosa* as one of the frost-hardy species of India. The tree is semideciduous or, according to Manjunath (497a), "a large, deciduous tree." The mature leaves often turn yellow and drop, but before the branches are bare, pale pink new foliage develops, and figs appear in the leaf axils. While the



Fig. 40. A naturally retted leaf of the Bo Tree, *Ficus religiosa*. See Clay and Hubbard (159a). (Photo loaned by courtesy of Horace F. Clay, University of Hawaii, Honolulu.)

trees are somewhat hardier than certain more tropical species, young trees in California have suffered severe frost damage, and can hardly be expected to thrive except in warm localities. The following un-

desirable features of this species as a street tree in Cuba and Florida are noted: It is deciduous for a short period, the fruits are fleshy and create litter, and the root system clogs drain pipes.

21. *Ficus rumphii* Blume (Rumphius Fig)

(Plate VII, B1-2)

The description of this species is credited to Blume (92). Its nomenclature was elucidated by Merrill (521). Rumphius (660) described and illustrated a fig species as *Arbor concilliorum*, but this was later classified by Corner (199b) as *Ficus rumphii*. According to Roxburgh (658), *F. cordifolia* is synonymous with it. He stated that it may be easily distinguished from *F. religiosa* by the leaves, which are narrower in proportion to the length, with a much shorter acumen, while the base of the blade has a small projection rather than being truncate or slightly cordate. Further, the fruits are perfectly globular and not, as in *F. religiosa*, vertically compressed.

See the account of *Ficus cordifolia* by Dymock (250).

In his key, Parker (584) separated the two species as follows:

Acumen short, petiole channeled or flattened, *F. rumphii*
Acumen long, petiole terete . . . *F. religiosa*

Corner (196) regarded *F. religiosa* to be the typical species of the section *Urostigma*. He placed *F. rumphii* in a new section, *Leucogyne*, with the male flowers dispersed away from the ostiole.

According to Troup (765), the trees of *F. rumphii* are smaller and less handsome than those of *F. religiosa*. They are frequently epiphytic, and are consequently ranked among noxious forest trees. Burkill (124) reported that *F. rumphii* is often planted as a roadside tree in Malaya, and that its branches may meet across a road that is 18 m wide. The species is widely distributed in India, up to 1,615 m elevation, and extends to Malaya. According to Dunn and Tutchter (245), it is cultivated at Macao.

Descriptions of *F. rumphii* or of *F. cordifolia*, with illustrations, have been given by Rumphius (660), Wight (826), G. King (437), Koorders and Valeton (446), Kirtikar and Basu (440), Haberlandt (351), and Benthall (75a); without illustrations, by Voigt (782), Miquel (542), Drury (242), D. Brandis (102, 103), Kurz (455), G. King (438), G. Watt (815), Prain (610), T. Cooke (189), Clercq (162), Duthie (247), Talbot (746, 747), Bamber (53), H. Collett (167), Lyon (484), Gamble (309), C. E. Parkinson (585), Haines (352), Ridley (639), Heyne (374), Gagnepain (306), and Manjunath (497a).

At least two introductions of *F. rumphii* by seeds have been made from India, one in 1948 by the University of California (Riverside) from Allahabad, and the second about 1954 by a Los Angeles nursery. After growing a considerable number of seedlings, the nursery discontinued propagation of the species, which was considered to be of small ornamental value compared with *F. religiosa*. A few plants of the earlier introduction were distributed for trial. Seeds labeled *F. cordifolia* Roxburgh [*F. rumphii*] were received from India in 1948, but failed to germinate.

According to Rock (648), the Rumphius Fig is (or was) represented in Honolulu by a single specimen tree in the Foster Garden, which is probably the same tree listed by Lyon (484). However, in 1959, two large trees, one of *F. religiosa* and one of *F. rumphii*, were noted on the campus of the University of Hawaii, the latter at the east entrance of Hemenway Hall. Notes made on this tree form the main basis for the following description:

The terminal buds are green, glabrous, and up to 2.5 cm long (or 6.2 cm on young

trees). The twigs are also green and glabrous when young, becoming gray, the epidermis cracking lengthwise, and lenticel scars scarcely noticeable.

The alternate, equilateral leaves are 7.5 to 14.4 cm long and up to 9.3 cm broad, triangular, and broad below the middle, gradually narrowing toward the tip. The apex is cuspidate, the cusp about 1.8 cm long; the base is subacute, and almost or quite decurrent in some individuals. Venation is prominent; the veins are fairly well elevated below, with 1 to 3 basal pairs plus 5 to 7 laterals and a few indistinct, intermediate ones. The texture is chartaceous, the margins are entire and somewhat undulate, the surface is glabrous above and below (sometimes minutely punctulate, as noted under species No. 37), and the color is green, with the veins very light green. The petioles are slender, 7.5 to 11.5 cm

long, very slightly flattened (if at all), furrowed above, and yellowish white.

The figs are axillary, single or geminate, sessile, oblate-spherical, often flattened in the same axis as the twig, and 1.1 cm long and broad. The surface is glabrous, with prominent, white flecks loosely scattered. The color is green at first, becoming reddish brown on the upper half of mature fruits. Green, fleshy, early-deciduous bracts are found at the base of immature fruits. The umbilicus is small, flush with the apex, and shows green scales. The interior is white.

As indicated by Troup (765), the trees of *F. rumphii* display no distinctive characters which are superior to those of *F. religiosa* for ornamental planting. Both species are somewhat "messy" because of the copious production of fruit, which falls and litters the ground.

22. *Ficus celebensis* Corner (Celebes Fig)

(Plate VI, C1-2)

In the *Fairchild Tropical Garden Bulletin*, February, 1947, there appeared a short account of an unnamed species of *Ficus* brought from Celebes by Dr. David Fairchild. The account stated: "In contrast to most other members of the family, this tree has a more shapely form and shows no disposition to crowd its neighbors. Its leaves are narrow and dark green in color, it is comparatively slow-growing, and seems among the hardest of its [related] species." The Dade County Nursery, on Red Road, Miami, Florida, recognized the possible value of the species, and had a number of fine plants growing in March, 1949. Plants were listed and illustrated by Graf (324) as *F. nerifolia* J. E. Smith, which is classified by Corner (199b) as a distinct species. (See under *F. nemoralis*, chapter XVI.)

The identity of this fig, grown for more than a decade as "*Ficus* sp., Celebes," was determined in January, 1960, when specimens were sent to Dr. E. J. H. Corner, at Cambridge, England. His letter read thus: "Your *Ficus* from Celebes, introduced by David Fairchild, is *F. ir-*

regularis Miquel, with characteristic lanceolate leaf. It is known only from the district of Minahassa (about nine different collections of wild plants), where it was first collected by J. E. Teysmann and evidently brought by him into cultivation in Bogor. Thence it has been spread as cuttings from gall-trees to many places, via the Singapore and Calcutta Botanic Gardens. It is related to *F. tinctoria* Forster (f.), but it never has aerial roots and is not an epiphyte or strangler. Unfortunately, *F. irregularis* Miquel is a later homonym of *F. irregularis* Steudel, which probably equals *F. tinctoria*, and so I am going to make the new name *F. celebensis*, but it will remain in horticulture as *F. irregularis*." Corner (196) further stated: "This willowlike tree is now cultivated in several parts of the tropics and subtropics, but its identity is generally not known. Hence, this inevitable name-change will not be serious." See also, Corner (199b), as well as remarks under *F. brassii* in chapter XVI.

The original description of *F. irregularis* (not Steudel's) was made by Miquel

(544). An excellent illustrated account was published by G. King (437), who quoted Teysmann and De Vriese (753) as follows: "Cultivated in the garden of the palace of the Sultan of Johore, where I have seen it growing. It is a most charming tree, with a singularly graceful, weeping habit." King found the species to be poorly represented in herbaria. He separated it from *F. cumingii* in a key, as follows:

Leaves entire, or gibbous toward the base. *F. irregularis*
 Leaves serrate-dentate. *F. cumingii*

At the Subtropical Experiment Station, Homestead, Florida, a tree of this species has long been grown as *Ficus* "regularis," the spelling apparently a corruption of *irregularis*.

Its hardiness has been definitely questioned, for the Homestead specimen was severely damaged in February, 1958, at 26° F. The tree suffered injury again in 1959, for Vice-Director Ruehl wrote on November 30: "The *Ficus* species from Celebes has just lost about one-third of its leaves as the result of a cold front passing over south Florida yesterday. The temperatures were not particularly low (40-42°), but were accompanied by winds of 20 to 40 miles per hour, with brief gusts of higher velocity."

The Celebes Fig has been growing in California since 1947, when one plant was received from the Fairchild Tropical Garden. It has since been distributed, and potted plants have been observed at Los Angeles, Yorba Linda, Santa Barbara, and Riverside.

The trees of *F. celebensis* are small, with a pendulous habit. All vegetative parts are glabrous. The terminal buds are slender, sharp-pointed, 1.5 cm long, and green. The twigs are slender, green at first, but soon becoming gray and brown, with the surface scurfy. The new growth is green. Some twigs have enlargements or swellings which develop cracks up to 5 cm long and 0.2 cm across. These seem to be characteristic of the species, and are not the result of insect injury.

The alternate leaves, equilateral or slightly inequilateral at the base, are 7.5 to 12.6 cm long and up to 1.8 cm broad, linear-lanceolate, with the apex gradually and sharply acute and the base narrowed. The basal veins are indistinct, but the laterals, slightly elevated below, number 16 to 20. The texture is thinly subcoriaceous, the margins are entire or irregularly undulate, and the surface is smooth. The petioles are up to 1 cm long, slightly curved, and green, becoming brown, with the color line sharply defined at the base of the blade.

The figs are axillary, single or geminate, globular, with a slender neck which may be mistaken for a peduncle, the latter not in evidence. They are tiny in size, only 0.4 cm in diameter, green, with brown flecks widely scattered over the glabrous surface. The basal bracts are inconspicuous.

Judging from experience with trees of *F. celebensis* in the comparatively mild climate of southern Florida, this species is not a promising candidate for outdoor planting except in warm and protected locations.

23. *Ficus pretoriae* Burt-Davy (Wonderboom)

(Plate IX, B1-2)

The Wonderboom, described and illustrated by Burt-Davy (130) as *Ficus pretoriae*, was confused in some accounts with *F. salicifolia* Vahl, which is not a synonym and occurs farther to the north of Africa.

Synonymy of the species has been clarified by Hutchinson (407, 408) and by Burt-Davy (131). According to Burt-

Davy and to a letter from Dr. L. E. W. Codd dated November 16, 1959, the type plant of the Wonderboom is the giant specimen growing near Apiespoort, Pretoria. The tree is 22 m high, and has a maximum spread of at least 52.5 m. A writer in *Nature* (183:1023, 1959) quoted the statement that this tree "is the most

remarkable example of its species in Africa, and a National Monument." A special issue of the *Transvaal Fauna and Flora*, No. 7 of 1956, devoted space to it, with articles by Behrens (74), D. G. Collett (166), and Mogg (550). Behrens compared the spread of the tree with that of the strawberry by the bending and rooting of its overground stems. A visitor once described the process in the Wonderboom as "walking out radially to produce offspring at each step." The new trunks grow up until the formerly single tree looks like a miniature forest. Other accounts, with illustrations, have been given by Marloth (500), Verdoorn (779), Hutchinson (409), and Palmer and Pitman (581b); without illustrations, by Henkel (366), Mary Payton (591), Eggeling (251), and F. White (823).

Ficus pretoriae belongs to the subgenus *Urostigma*. According to Verdoorn, it is found in northern, eastern, and western Transvaal, and as far south as Pretoria. It also occurs in Natal, and extends northward to Somaliland.

PI No. 137,595 represented an introduction as seeds from Pretoria in 1940. Another lot in 1942 was assigned the number 144,310. Trees of the Wonderboom were found growing at Miami (PIS) in 1949 and again in 1958. Several plants were also growing and bearing profusely at Arcadia (LASCA) at the time of writing.

The following description has been made from notes taken on the above plants, in comparison with the various accounts cited: The tree is evergreen,

spreading; the branchlets are mostly short, glabrous, and green or purplish when young; the bark is gray and finely creased, with corky lenticel scars; aerial roots are lacking. The terminal buds are 1.8 to 3.6 cm long, glabrous, and green (scarlet-brown on some plants). The stipules are linear-lanceolate, about 2.5 cm long, and glabrous.

The alternate, equilateral leaves are 7.5 to 20.2 cm long and up to 7.5 cm broad, ovate-elliptical, often broadest below the middle, the apex acute or shortly apiculate and the base mostly rounded, but sometimes shallowly subcordate. Venation is fairly prominent, the veins below scarcely elevated, with 2 basal pairs plus 8 to 10 pairs of laterals. The texture is rigidly coriaceous, the margins entire, and the surface glabrous and dull above, without hydathodes. The petioles are stout, glabrous, 1.8 to 3.6 cm long, very light green, and slightly flattened above.

The figs, either single or geminate in leaf axils, or in clusters from short tubercles in the axils of leaf scars, have a stout, very short, peduncle, up to 0.3 cm long. They are 0.7 cm in diameter, 0.6 cm from base to apex, and oblate-spherical. The surface is slightly pubescent, and is decorated with conspicuous, greenish-white flecks which are thickly scattered. The body color is green, becoming reddish brown at maturity. For a small fig, the umbilicus is prominent, slightly protruding from the rounded apex; the bracts are green at first, later becoming pink to scarlet. The interior is white.

24. *Ficus virens* Aiton (Spotted Fig)

(Plate IX, A1-2)

This account of *Ficus virens*, described by Aiton (5), must consider other specific names, chiefly *F. lacor*, described by Francis Hamilton (353) and commonly referred to as *F. infectoria* Roxburgh. In his illustrated account, G. King (437) wrote: "The oldest name of this species is thus *F. lacor* Ham., the specific name being doubtless a corruption of the word *pakur*, which is still in Bengal the vernacu-

lar name of this tree." However, King thought it better to continue Roxburgh's name *infectoria* than "to restore the rather barbarous name *lacor* originally given it by Hamilton." On the other hand, Mary Barrett (67) stated that Roxburgh (657) gave no adequate description of the species, and that what he did give was too slight to warrant publication. She added: "Its correct title, *Ficus lacor*, has been

acknowledged for years, but has been used seldom, even by those who have recognized its validity." Lawrence (459) cited Miss Barrett's account of *F. lacor* as a good example of new and adopted botanical names. According to Francis (300), the specific name *infectoria* comes from the Latin *infector*, a dyer. (See *F. tinctoria*, species No. 16, and *F. racemosa*, species No. 82, both of which are said to enter into dyeing compounds.)

Corner (196) first classified *F. infectoria* Willd. "sensu Roxb." under *F. virens* Aiton. Later (199b), he treated *F. infectoria* Willd. "sensu auct." (non vera equals *F. tsiabala* Burm. [f.]) also under *F. virens*. He regarded the combination *F. lacor* as not well verified. Corner further stated: "This [*F. virens*] is the earliest name for the common banyan of India, which has the articulate lamina and which extends through Malaysia to Australia [*F. cunninghamii*] and to South Africa as the complex of *F. ingens* Miq." (See *F. ingens* in chapter XVI.) A sterile specimen from a plant grown at Kew, in the herbarium of the British Museum, is labeled "*F. virens* Ait." in pencil. Hence, Dr. Corner believes that there is no doubt of its validity. Aiton (5) erroneously referred it to the West Indies, believing that it represented a plant figured by Sloane. Steele (730) stated that *F. virens* was to be grown in a greenhouse, all the others in a stovehouse. *Ficus virens* was listed by P. Miller (536) as his No. 10. On the other hand, Mary Barrett maintained, in unpublished notes, that *F. virens* Ait. should become allocated to *F. laurifolia* Lam., which predated it by one year, and that it is the West Indian plant figured by Sloane. See also, *F. maxima* (species No. 53) and *F. amplissima* (species No. 37) for some related comment.

Accounts of the Spotted Fig as *F. infectoria*, with illustrations, were given by Wight (826), G. King (437), D. Brandis (103), Talbot (747), E. H. Wilson (841, 843), Koorders and Valetton (446), Francis (300), and Mowry (561); without illustrations, by Roxburgh (657, 658), Miquel (542), D. Brandis (102), Kurz

(455), F. M. Bailey (37, 42), G. Watt (815), G. King (438), J. D. Hooker (388), Talbot (746), T. Cooke (189), Duthie (247), Ridley (639), Gamble (309), C. E. Parkinson (585), Parker (584), Haines (352), C. E. C. Fischer (286), Nehrling (574), Anderson (10), Diels (231), Royal Palm Nursery (659), and Sturrock and Menninger (737). Kelsey and Dayton (434) called it the Dotted Fig. Sata (670) described and illustrated *F. stipulosa* Miq., which he stated equals *F. infectoria* Roxburgh var. *caulocarpa* King. (See the account of *F. caulocarpa* in chapter XVI.)

Ficus lacor was described, with an illustration of a leaf, by Mary Barrett (68); without illustrations, by Steudel (732), Naudin and Mueller (570), Koorders and Valetton (445), Handel-Mazzetti (356), Rehder (627), and Summerhayes (743). Under the synonym *F. lucescens*, the species was described by Blume (92), Miquel (542), Gagnepain (306), and Alston (8). The notes by Mary Barrett (67) on the synonymy of *F. lucescens* Blume should be consulted; also, Corner (199b), who classified it under the variety *elongata* of *F. racemosa*. In his account of *F. lacor*, Manjunath (497a) stated that the tree is very variable, "but in its most typical forms has a distinctive, oblong, high-shouldered leaf, with a generally rounded or truncate base, and a rounded, then abruptly acuminate, apex. The tip is noticeably slender." See also, the account by Domin (235), Marie Neal (572) thus distinguished two forms:

Side veins distinct (India east through Malaysia). *F. infectoria*
Side veins indistinct (Queensland).
F. cunninghamii

Ficus infectoria has been commonly listed as *F. cunninghamii* in Australian works, such as those of Bentham and Mueller (77), Maiden (492), and Mueller (563). Rock (649) recommended the "Java Willow" for planting in the wet forest zone of Hawaii. It has been grown in Hawaii under the name *F. cunninghamii*. (The common name Java Willow is also applied to *F. benjamina*; see spe-

cies No. 34.) Trees of *F. infectoria* are being grown in Honolulu at the Foster Garden, in parks, and along streets. According to Riedel (641), it was listed by Dr. C. F. Franceschi, Santa Barbara, California, in 1900, and a tree was planted on Eucalyptus Hill in 1910. Nehrling (575) reported that the E. N. Reasoner Nursery had sent him a fine specimen many years earlier, which he planted in the open at Gotha, Florida. Although often badly frozen, it became a large and beautiful bush. For lawn planting, Reasoner recommended cutting it back to the ground after it had become well established in order to force it to branch strongly from the base, thus making a vaselike form. Specimens are still found in parks and collections of trees in the vicinity of Miami, Florida. According to Mary Barrett (62, 67), the variety *lambertiana* is distinguished from the typical species by its usually hairy parts, except the leaves, and occasionally the figs. The blades are typically broad-ovate, but sometimes are broadest near the middle. This Australian form was described by G. King (437) and Talbot (747). Talbot also described *F. infectoria* proper and variety *wightiana*, the latter with leaves smaller, the bases narrowed, and petioles shorter. King had already described and separated four varieties, all of which were discussed by Mary Barrett (67).

Ficus virens belongs to the subgenus *Urostigma*. Grandi (336) described the fig insect, *Blastophaga coronata*, from receptacles of *F. infectoria* in Sumatra, also *B. ishiana* from Japan. Joseph (425, 426, 429) described *B. constabularis*, *Sycoscapteridea indicus*, and two other insect inhabitants of the figs in India.

Aiton (5) stated that *Ficus infectoria* [*tsjahela*] was introduced into England in 1763 by John Bush, with the common name Veiny-leaved Fig. The validity of this determination, however, is in doubt, for the name "*tsjahela*" properly belongs to another species, as shown by Mary Barrett (60). See also, the article by Robinson (647). E. H. Wilson (841) reported that *F. infectoria*, the Szechuan Banyan,

is the most striking tree in that province of China, some reaching an enormous size.

Several introductions of the Spotted Fig have been made into the United States. PIS No. 6,203 at Miami represents plants of *F. lacor* from a local source. PI No. 32,805 came from India as *F. lucescens* in 1912. Under PI No. 41,720, the same (as *F. lacor*) was introduced in 1916 from Chungking, China, where it was said to be used principally for shade along highways and in temple yards. PI No. 59,677 (as *F. lacor*) was obtained in 1924 from Lucknow, India, as seeds. Scions of *F. lucescens* Blume were received from France in 1932, and were given PI No. 101,319, but apparently no trees of this number were established. Trees of PI No. 74,592, introduced from Guam in 1927 under the name *F. philippinensis*, but growing at Miami (PIS) under the designation *F. lucescens*, are regarded as equal to *F. lacor*. PI No. 105,606 (China, 1933) is also identified as *F. lacor*. Characters of trees noted under PI No. 221,183 at Miami in May, 1958, correspond very closely to variety *typica* of *F. lacor* described by Mary Barrett (67). PI No. 103,504 represents seeds sent from India in 1933 by Walter Koelz (his number 17), and described by him as having yellow fruits up to 7.5 cm long. However, trees of this number at Miami (PIS) appear to be a form of *F. lacor*, with typical small, spotted fruits. Furthermore, trees of PI No. 123,209 in the same collection, labeled *F. rubiginosa* (India, 1937), are certainly not that species, but greatly resemble *F. lacor*.

In 1956, fig seeds were collected by Dr. John L. Creech (212) near Shikoku, Japan, and introduced under PI No. 249,537 as *F. wightiana* Wallich. Benthams (76) expressed the opinion that this might be only a variety of *F. infectoria*, and G. King (437) treated it as such. A detailed account of *F. wightiana* was given by Sata (670), with references to previous accounts. See Forbes and Hemsley (290) for localities; also, Corner (199b) under *F. virens*. All distributions of PI No. 249,537 should be identified as *F. lucescens*.

ens, according to a notice from the United States Plant Introduction Station.

Cuttings of PIS No. 6,203, received from Miami, Florida, in 1936, were rooted at Riverside, California, and a few plants became established. The cuttings failed to survive, as did one rooted plant previously received from the New York Botanical Garden. A plant from the Royal Palm Nursery, Oneco, Florida, was potted, and was later found to be heavily infested with the root-knot nematode. Other plants did become established at the UCLA Botanical Garden (since lost), at the Huntington Botanical Garden, San Marino (still growing but small), and at Balboa Park, San Diego. At the last two localities, plants are small and bushy, with the leaves more or less distorted and mottled by a leaf mosaic caused by a virus. Several botanical specimens of trees established at Santa Barbara have been collected and donated by Dr. Reid Moran.

Small trees growing in a nursery row at Riverside were severely injured in 1948 when the temperature fell to 26° F., and were again injured in 1949. They recovered, however, by sucker growth from the crown. Large trees in Florida were not injured by cold weather during the winter of 1957-58. Both in Florida and California, the new foliage from bushy, deciduous plants is very ornamental on account of the bright scarlet or bronze coloration. At Hong Kong, according to Herklots (371), the trees are deciduous, at least for a short period.

The following description of *F. virens* is made from specimens studied in Cuba, Florida, and California: The trees are generally of vigorous growth, up to 9 m high, having a broad top and drooping branches, with or without aerial roots. The trunk shows no buttresses, but has large crown roots spreading widely over the ground surface. The bark is light gray, somewhat roughened by longitudinal creases and corky lenticel scars, also by old nodal rings. Although the trees are generally described as glabrous, the young twigs and buds commonly show fine pubescence or pubescence. These twigs are at first green,

then gray, with prominent lenticels. The terminal buds are from 0.7 to 0.8 cm long, and variable in color from green to gray or tawny or even maroon. The stipules of *F. infectoria* were described by Lubbock (481) as linear, obtuse, membranous, and convolute, those of seven or more expanded leaves being visible at the same time.

The alternate, equilateral leaves, from 15 to 17 cm long and up to 7.5 cm broad, are glabrous, green, and somewhat glossy above, with entire margins, though these are sometimes more or less undulate. In shape they are elliptical to ovate, with broad, rounded, or truncate base and narrowing toward the apex, which is commonly sharply acuminate, the acumen from 0.7 to 1.1 cm or more long. Venation is prominent, with 1 pair of basal veins and 7 to 10 pairs of laterals, more or less elevated above the lower surface. The texture is membranous to thinly coriaceous (chartaceous). The petioles, slightly grooved above, are slender and glabrous, and 5 to 10 cm long.

The axillary figs are commonly geminate and almost sessile, but usually have a very short, thick peduncle. They are oblate to globular or short-turbinate, 0.7 to 1.1 cm in diameter, with a glabrous or finely puberulent surface when young. Their surface, green at first but later fading to almost white, is conspicuously decorated with scarlet dots, which accounts for the common name Spotted (or Dotted) Fig. The apex of the fruit is flat or rounded, with a small, protruding umbilicus and pink or more deeply colored scales. Internally, the long-styled flowers are succulent, with perianth pink to scarlet. (See figure 38 with description of *F. hispida*, species No. 8. Notes on the remaining kinds pictured will be found under species Nos. 33, 50, and 80.)

The ornamental value of *F. infectoria* var. *lambertiana* was thus treated by Parker (584): "This species is often planted. As a shade tree, it is one of the best in the Punjab. Though not as large as the Pipal and banyan, it gives a much denser shade, and for a garden possesses

the advantage of shedding its leaves all in a few days and producing a fresh crop almost immediately afterward. The young foliage is usually beautifully tinted."

Ficus virens Ait. var. *glabella* (Bl.) Corner extends in its native habitat from tropical forests of the eastern Himalayas to Burma and Malaya. G. King (437) regarded it as a variable species, and recognized three varieties, *affinis*, *concinna*, and *papuana*.

The leaves are much like those of *F. lacor* [*infectoria*]. In fact, Backer (34) stated that *F. infectoria* Roxburgh and *F. glabella* Blume "pass imperceptibly into each other; they show no constant points of difference, and had better be united into a collective species that should be called *F. glabella*." However, Mary Barrett (67) reported that typical specimens of *F. glabella* "differ from *F. lacor* var. *typica* mainly in their smaller leaves and in their figs, which are sessile or pedunculate, purple to black, and sometimes white or yellow dotted." Corner (196) classified this species as *F. virens* Ait. var. *glabella*, the plants having elliptic to obovate lamina, cuneate leaf base, short petiole, and more or less sessile figs on short, woody burs on the twigs behind the leaves. See accounts by Koorders (444) and Corner (199b). Pancho (582) reported *F. concinna* Miq. as being planted in parks and gardens in Manila and other large cities. The whitish midveins of leaves and the divergently spreading branches distinguish it from other species. *Kew Index* gives its proper identification as *F. glabella*.

Burkill (124) found that trees of *F. glabella* have no known economic value in the Malay Peninsula. According to Ochse (580): "The tender, light-colored, young top shoots, which at intervals cover and adorn the tree, are eaten raw as lablab [a garnish] with rice," as are the shoots of various other fig species in the East Indies. Gullfoyle (346) gave the common name as "Swamp Fig Tree," but the origin of the name is not apparent. It was offered in nursery catalogues in 1910, according to Riedel (641). It must have been cultivated in France in 1932, for scions were brought

from Paris under PI No. 101,315. Setyodiwiryo (689) listed it as being cultivated at Bogor. Douglas and Baas-Becking (239) found a tree in the same garden that was 20 m tall. The species belongs to the subgenus *Urostigma*. According to Grandi (336), *Blastophaga glabellae* was described by Hoffmeyer (379) as inhabiting *F. glabella* in Sumatra. For other accounts of this subspecies, see Miquel (544), G. King (438), Elmer (256), D. Brandis (103), Clercq (162), Koorders and Veleton (446, with illustration), Ridley (639), C. E. Parkinson (585), Haines (352), Diels (231), and Summerhayes (743).

Seeds of *F. glabella* were collected in Sumatra by Fairchild and Dorsett, and were introduced in 1926 under PI No. 67,566. Seeds from Buitenzorg, Java (now Bogor), arrived in California in 1928 under FHB No. 75,409, and several seedlings were grown. The roots of some showed root knots caused by infestation of the garden nematode. If any specimens representing these importations are now growing, their location is not known. *Ficus glabella* makes a beautiful shade tree in Sumatra, with a fine, rounded crown resembling *F. microcarpa* var. *nitida* in shape and general character. According to Holtum (384), a tree at Singapore changes its leaves three times a year, but at irregular intervals. All parts are glabrous, with thinly coriaceous, obovate or oblanceolate leaves, 5 to 10 cm long, with entire margins, a shortly apiculate apex, and acute or cuneate base. The lateral pairs of veins, not elevated, number 7 to 10.

The figs are rather crowded, mostly from the axils of fallen leaves, sessile or very shortly pedunculate, globular, 0.7 cm in diameter, purplish when mature.

Seeds labeled *Ficus concinna* were received from the Philippines in 1963, and seedlings have been grown at Riverside. Corner (196) treated *F. concinna* Miq. as a species, with the var. *subsessilis* Corner as a new variety. Later, Corner (199b) listed three varieties. G. King (437) had given the name as *F. glabella* Bl. var. *concinna*.

25. *Ficus monckii* Hassler (Monck's Fig)

(Plate II, B1-2)

Ficus monckii, designated here by the common name, Monck's Fig, was described by Hassler (360), with *F. cestriifolia* Schott as a synonym. Its native habitat is Paraguay. The species belongs to the subgenus *Urostigma*. See the account by Parodi (588), who described and illustrated a cross-section of the fruit of the variety *sanmartinianus*. De Wolf (230b) classified *F. monckii* under *F. enormis* (Mart. ex Miq.) Miq. See the note under *F. subtripplinervis* in chapter XVI.

Seeds of *F. monckii* were received at Riverside in 1947 from the Jardín Botánico, Buenos Aires, and several of the resulting seedlings are thriving and bearing fruit in various parts of southern California.

The habit is treelike, with no aerial roots. The terminal buds are 1.5 cm long, and reddish purple. The twigs are green at first, soon becoming gray, and are glabrous, with prominent, longitudinal lenticels.

The alternate, equilateral leaves are up to 15 cm long and 7.5 cm broad, oval, the apex obtuse, and the base rounded or shallowly subcordate. Venation is prominent, the veins slightly elevated below, and the

midrib yellowish green, with 1 basal pair plus 6 to 8 pairs of laterals. The texture is chartaceous to subcoriaceous, the margins are entire, and the surface is glabrous and glossy. Hydathodes (if present) are very indistinct. The petioles are about 3.1 cm long, green, glabrous, slightly flattened, and channeled above.

The figs are axillary, single or geminate, sessile or short-pedunculate, spherical to oblate-spherical, and 0.7 cm long and broad, the smooth, green surface decorated with densely scattered, light-green to reddish-brown flecks. The brown basal bracts are early deciduous. The umbilicus is small, and very slightly depressed. The interior is white.

Monck's Fig is not suitable for pot culture because of the bare trunk left by early dropping of the lower leaves. Compared with some other species, it is of doubtful value for specimen planting. The trees at Riverside are somewhat hardier than such tender subjects as Poinsettia, scarlet Bougainvillea, or Copa de Oro (*Solandra grandiflora*), but any exposed branches near a building will suffer injury when the temperature drops much below 30° F.

CHAPTER IX • Species 26 through 34

26. *Ficus insipida* Willdenow (Glaborate Fig)

(Plate IX, C1-2)

Ficus insipida, described by Willdenow (833), was thus treated by De Wolf (230): "This is, undoubtedly, the most widely distributed of the *Pharmacosyceae*, though with the exception of one doubtful record, it does not occur in the West Indies. It ranges, on the continent, from northwestern Mexico to Paraguay. In Mexico and Central America, it seems to be a component of the arid or subarid forests; but, since Standley notes that figs are left standing when forests are cleared, and since much of the accessible forest is not virgin, it seems unwise to try to guess as to the natural habitat." De Wolf gave fourteen botanical names of species as synonyms, including *F. glabrata* HBK, *F. anthelminthica* Mart., *F. radulina* S. Wats., and *F. crassiuscula* Warb. Three of these are included here, but *F. radulina* is treated separately, as species No. 83. See also, another account by De Wolf (230c). Seeds of *F. insipida* received in 1947 from Tobias Lasser, Caracas, Venezuela, germinated, but the seedlings were later lost. A letter from Señor Lasser in 1949 stated: "Maybe *Ficus insipida* is *F. macrosyce* Pittier. The seeds I sent belong to a big tree with straight, columnar trunk."

"Chilamate," as *F. crassiuscula* is called in Costa Rica, was assigned its specific name by Warburg, but was actually described by Standley (717). The species is closely related to *F. radula*, from which it is separated in a key by "long stipules and large, glabrous leaf blades, these not apiculate at the apex and with more numerous lateral veins."

See further comment under *F. maxima*, species No. 53.

Other accounts were by Standley (719, 721, 723) and by Standley and Steyermark (726). Grandi (336) described *Blastophaga astoma* as inhabiting the figs of this species in Costa Rica.

In 1936, six rooted plants were received at Riverside from Summit, Canal Zone, and were grown in pots for several years. At the time of writing, none had survived. PI No. 74,426 represents an introduction from the same source in 1927. Plants obtained from the Canal Zone by D. T. Fullaway in 1924 and assigned HSPA No. 3,136 were labeled *Ficus crassiuscula*. In 1959, trees were found growing at the Lyon Arboretum in two separate locations. I did not see any plants of *F. crassiuscula* in either Florida or Texas collections in 1958.

The "Higuerón" or "Chilamate," as *F. glabrata* and various other native figs are called in the American tropics, was described by Kunth (HBK) (450) from type specimens collected by Bonpland in Colombia. Standley (721) stated: "This is one of the handsomest of all fig trees. The trunk and limbs are nearly always free from epiphytes, which for some reason do not frequent fig trees." Standley and Steyermark (726) reported: "Trees of this species are seen in Guatemala, often along roadsides, frequently growing about habitations, from sea level to 1,400 m, but chiefly at low elevations. On Pacific plains, some huge trees rival the ceiba in size." [*Ceiba casearia*; Bombacaceae; the kapok tree.]

Standley (717) described *F. glabrata* with reference to specimens collected by various botanists, and felt there was little doubt they belonged to Kunth's species. He added: "Whether this is the same as Martius' *F. anthelminthica* is not certain, in spite of the fact that Miquel considered them identical. At any rate, the specific name used by Martius is a homonym and not available." As stated above, De Wolf classified the *F. anthelminthica* of Martius as synonymous with *F. insipida*. Dugand (244) discussed the identity of these two

species, and reported on material from different localities. Furthermore, he described two varieties, with illustrations of typical leaves, *F. glabrata* var. *obtusula* and the variety *typica*. A map of Colombia was shown, to indicate the distribution of each variety. Other accounts were given by Pittier (606), Standley (723), Hazel Munsell *et al.* (566), Yuncker (851), Miranda (547, with illustration), Pérez-Arbeláez (594), Correa (203), and Miquel (539, as *anthelminthica*). The plants are practically glabrous throughout, and the name Glabrate Fig therefore seems appropriate. The latex is one of the sources of a proteolytic enzyme known as ficin, as discussed in chapter IV. The medicinal properties of "leche de ojo" obtained from *F. anthelminthica* were reported by Clark (157). See also, the report on latex from *F. anthelminthica* by Bekkedahl and Safiotti (74a).

Seeds of *F. glabrata* were received from Honduras in 1948, and a number of seedlings were grown at Riverside. The leaves were found to be very susceptible to infestation by mites. Young plants under lath cover were not seriously injured by winter temperatures down to 24° F. However, no plants of this importation have become established. Some plants received from a nursery in south Texas in 1958 have been identified as *F. glabrata*. Seeds obtained from Tapachula, Chiapas, Mexico, in 1959 have produced seedlings, some of which are growing outdoors at Fallbrook and Riverside, California, and at Arcadia (LASCA). Fruiting trees are growing at the Lyon Arboretum, Honolulu, under HSPA No. 7,309.

The trees of *F. insipida* are large, often 30 to 40 m high, with glabrous, short-jointed twigs and papery, linear-lanceolate stipules. A tree in the Lyon Arboretum is 18 m high, with a trunk 120 cm in diameter and prominent buttresses. There are no aerial roots. The terminal buds are up to 7.5 cm long, glabrous, and green.

The glabrous leaves are alternate, equilateral (sometimes slightly inequilateral, according to De Wolf [230]), elliptical to lanceolate, broadest at the middle, 12.6 to 30.5 cm long, with gradually acute or acuminate apex and rounded or shallowly subcordate base. The lateral veins are well elevated, from 14 to 24 pairs, diverging from the midrib at an angle of 40 degrees. The veins on young plants are often tinged with pink. The texture is chartaceous to subcoriaceous. The petioles are 1.1 to 5 cm long, and glabrous.

The figs are solitary, 1.8 to 3.6 cm in diameter, subglobose, glabrous, or very sparsely scabrous. The surface is prominently decorated with large, irregular flecks of light green. Some mature fruits are tinged with red. The peduncles are up to 1.1 cm long. The umbilicus is prominent, protruding, and nipple-like. The interior is white. Standley (723) reported that the figs are larger and juicier than with most other native species, and are rather good to eat. Hazel Munsell *et al.* (566) stated, on the other hand, that the fruits are insipid and rarely used.

The Glabrate Fig deserves to be thoroughly tested in collections for use on large grounds. Young seedlings drop their lower leaves, and soon become too large for use as pot plants.

27. *Ficus subcordata* Blume

(Plate XI, B1-2; Plate XXIV, C1-3)

Miquel (542) described a fig species as *Urostigma subcordatum*, with reference to the earlier description by Blume (92) as *Ficus subcordata*. The short account by Miquel gave the species as tree-like, with leaves petiolate, rounded or subcordate base, ovate-elliptic in shape, obtuse apex, parallel venation, up to 16 cm long. The

receptacles were not described. Corner (196, 199b) classified *F. subcordata* Bl. in the section *Conosycea*, with the following three as synonyms: *F. garciniaefolia* Miq., *F. calophylloides* Elm., and *F. fairchildii* Backer. He stated: "This is an uncommon but widespread species; from Tonkin to New Hebrides, yet I can see but

slight differences in the size of leaf in the collections (35 in all), and I have compared the types." He added that the venation, cystoliths, and sunken stomata of sterile herbarium specimens of *F. subcordata* clinch its identity with *F. garciniaefolia*. Accounts follow of the three introduced species listed by Corner as synonyms.

Ficus garciniaefolia (Garcinia-leaf Fig), first described by Miquel (544) from Timor, was given its name from the resemblance of the leaves to those of *Garcinia mangostana*, the mangosteen (Guttiferae). The brief description by G. King (437) stated that the leaves resemble those of *F. elastica* in venation, but that their texture is thinner, the stipules are smaller, and the receptacles much larger than in *elastica*. See also, Corner (199b). Summerhayes (743) recorded it from New Guinea, and Setyodiwiryo (689) listed it from Bogor, where a tree 15 m tall was earlier found by Douglas and Baas-Becking (239). Seeds of this species were received at Riverside in 1948 from Buitenzorg (now Bogor), Java, and a number of seedlings were grown. Another packet of seeds was received from Java in 1959, and from the two lots, plants were distributed for trial. PI No. 260,748 represents the introduction made in 1959.

Nonfruiting plants growing at Riverside, San Marino, and Arcadia (LASCA) are treelike, with all parts glabrous, although King referred to the stipules and the basal bracts of the receptacles as "puberulous externally." The terminal buds are slender, 5 cm or more long, and green. The young twigs are tawny at first, but soon assume a deeper shade of brown. The new growth is scarlet.

The alternate, equilateral leaves are 15 cm long and 3.6 cm broad, elliptical-lanceolate, with a bluntly acuminate apex and a narrow, rounded base. Venation is not prominent. The 1 pair of basal veins and the 15 to 17 pairs of laterals are all indistinct, and hardly raised above the lower surface of the blade. The texture is membranous or thinly subcoriaceous. The margins are entire. Hydathodes are scat-

tered over the upper surface. The petioles are up to 2.5 cm long, tawny, and somewhat flattened above.

According to G. King (437), the figs are sessile, ellipsoid, 3.6 cm long, and glabrous. Young plants are tender, having suffered injury at about 25° F., even under lath shelter. Garcinia-leaf Fig trees cannot be recommended for planting until more is known about their adaptability to heat, cold, and cultural conditions.

Ficus calophylloides. This specific name apparently refers to the beautiful leaves, which are glossy and dark green on their upper surfaces. It was described by Elmer (259) from the Philippines, the range extending from Davao along the east coast northward to Tayabas and Laguna provinces.

Elmer included it in the section *Strangulatae*, the plants starting life as epiphytes which often strangle their hosts. See also, Elmer (263). According to Merrill (524), the mature trees are found in forests, both at low and medium altitudes, where they are locally known as "balete." F. X. Williams (836) described and illustrated the flowers, but did not name the species of fig insect which is responsible for pollination. This species was introduced in 1939 from the Philippines under PI No. 135,432 as a large forest tree with smooth, light-colored bark, dark-green leaves, and yellow fruits the size of small plums. Earlier introductions in 1928, 1929, and 1930 were under PI Nos. 77,657, 80,417, and 90,516. Plants grown in pots at Riverside in 1941 failed to survive a temperature of 24° F., even though protected by a lath shelter.

The following description is made from nonfruiting trees in Florida, Cuba, and California; from fruiting trees in the Lyon Arboretum, Honolulu; and from notes by Elmer (259, 263) and Merrill (524) on trees growing in the Philippines: In native trees, the trunks are erect, buttressed at or near the base to a width of 1.5 m, and the main limbs often start 12 m aboveground, per Merrill. Small trees have aerial and prop roots. The bark is gray, roughened by raised lenticels. The twigs are glabrous,

green at first, but later become gray. The terminal buds are glabrous, green, and 2.5 to 3.6 cm long. According to Elmer, the branchlets are yellowish to reddish brown, usually scurfy, with the smooth young twigs sharply angular.

The alternate, equilateral leaves are oval, up to 17 cm long and 7.5 cm broad, with a rounded or apiculate apex and a rounded to slightly decurrent base. Venation is very fine, much like that of *F. elastica*, with at least 20 pairs of parallel lateral veins that are hardly at all elevated; the midrib is greenish white below. The surface is glabrous, glossy, and dark green above, but lighter below. The texture is somewhat thick and coriaceous. The margins are entire. The petioles are up to 5 cm long, greenish white, glabrous, and shallowly channeled on the upper surface.

The figs are axillary, mostly geminate, sessile, oblong, and 1.5 cm in diameter. The surface is smooth, green, sometimes minutely sprinkled with white flecks. Basal bracts are prominent. The umbilicus is very inconspicuous, the color much like that of the body. The interior is white.

This species deserves further trials for pot plants as well as for specimen trees in parks and large grounds. However, it is too tender for general planting except in very mild climates.

Ficus fairchildii. In 1926, Dr. David Fairchild collected seeds of a species of *Ficus* growing in Java, and introduced it into the United States under PI No. 67,502 with the following description: "A tall, gray-barked tree, with fine buttresses and medium-sized leaves. This tree is used for shade at the gate of a private house." From the seeds, 200 plants were grown for distribution. In 1964, the original tree in the Fairchild Kampong, Coconut Grove (Miami), Florida, had a trunk measuring 5.7 m in circumference, with prominent buttresses, and enormous roots spreading widely over the limestone surface. The

species was described and illustrated by Backer (35) in honor of Dr. Fairchild. He stated that it came nearest to *F. elastica*, which is distinguished from *F. fairchildii* by the geminate, yellowish-green receptacles, by the unique single stipule, and by the aerial roots commonly found on older trees. Trees of the Fairchild Fig have been found at the Atkins Garden in Cuba and at various places in south Florida.

See the account by Lucita Wait (788), with an illustration of the large trunk.

The trees reach a large size, with dark-gray bark, the lenticels prominent on the branches. The green buds and young twigs are slightly pubescent, a character which again differentiates it from the glabrous *F. elastica*. According to Backer, the whole plant is glabrous, with the exception of the bracts at the bases of receptacles.

The leaves are alternate, equilateral, up to 17.2 cm long and 6.8 cm broad, elliptical, with a bluntly acuminate apex and a rounded base. The texture is subcoriaceous and more or less rubbery. Venation is indistinct, with the raised midrib flanked by about 20 pairs of laterals, which are practically parallel. The upper surface is glabrous and glossy, without hydathodes. The petioles are 6.2 cm long, slightly channeled above, yellowish green, and glabrous or slightly pubescent when young.

The geminate, axillary fruits are oblong and sessile, although Backer (35) stated that the bracts fall, "disclosing the shortly-stalked receptacle." The figs are 1.8 to 2.5 cm long and up to 1.8 cm in diameter, greenish yellow, with the glabrous surface densely decorated with slightly raised or pimply dots. According to Dr. Fairchild, in Java the figs are as large as olives and of the same shape, red to almost black when ripe. The umbilicus protrudes slightly from the apex, and on the larger figs is almost 0.4 cm across. The interior is white.

28. *Ficus macrophylla* Desfontaines ex Persoon (Moreton Bay Fig)

(Plate X, A1-2)

The Moreton Bay Fig was briefly described by Desfontaines (227) as *Ficus macrophylla*, Persoon (598), according to Mary Barrett (62, 68), published the same name with his own description and with some of Desfontaines' data, without, however, giving the latter any credit. The later account by Desfontaines (228) did credit Persoon as the author. Furthermore, Mary Barrett stated that the best description of *F. macrophylla* is that of Borzi (97) as *F. magnolioides*. (See Mary Barrett, as given above, for further notes and taxonomy; see also, under *F. magnolioides* in chapter XVI.) PI Nos. 3,448 and 3,497 represent plants obtained from Sicily in 1899 as *F. magnolioides*. Corner (196, 199b) gave *F. macrophylla* as the type species in series and subseries *Malvantherae*. The specific name is derived from the Greek *makros* (large) and *phylon* (leaf). While the leaves of this species are larger than those of other Australian figs, such as *F. rubiginosa*, they are not so large as the leaves of certain species in other countries. Bentham and Mueller (77) described it as being closely allied to *F. rubiginosa*, and especially to the variety *petiolaris* of *F. platypoda* [*obliqua*], but with much larger leaves.

A few varieties of *F. macrophylla* have been described. The variety *pubescens* of F. M. Bailey (43, 44) was classified by Corner (199b) under *F. baileyana* Domin. It differs from the type in having a brown hairiness in various parts of the tree, and the fruit ovoid or bluntly three-sided. Guilfoyle (346) listed the variety *aurea*, and called it the Golden-leaved Moreton Bay Fig. Domin (235) described a species as *F. baileyana*, but *Kew Index* ascribes this to *F. macrophylla* var. *pubescens* of F. M. Bailey. An introduction of seeds from Australia labeled *F. baileyana* was made in 1959 by the Arboretum at Arcadia (LASCA), and a number of trees have been grown. Specimens from a young tree bearing fruit at Riverside under the label

F. baileyana were identified by Dr. Corner as *F. obliqua* var. *petiolaris*, which is described with species No. 39 in this book. *Ficus columnaris* of Moore and Mueller is so closely related to *F. macrophylla* that it is described at the end of this section and accorded varietal status.

According to James (418), the Moreton Bay Fig is not a desirable tree to cultivate in any garden because of the surface roots and litter of fallen leaves. Veitch (777) also found that the chief fault of the tree as a garden specimen is its enormous spread of roots. On the other hand, Maiden (495) referred to it as a much-maligned species: "Some say it should be banished, but it is one of the best trees ever introduced to Sydney." He stated that it will grow among rocks and will stand being blown about by fierce winds. Audas (31) reported thus: "*Ficus macrophylla* is by far the most generally known of the fig trees of northern New South Wales and Queensland, and is cultivated considerably in the other states as an ornamental tree in parks and gardens, and sometimes (unsuitably) as a street tree." Francis (300) added the common name "Black Fig" on account of the darkly colored bark of trees growing in dense scrubs. He stated that the trees attain 48.5 m in height and a column diameter of over 1.8 m, with wide buttresses. Lyon (484) gave measurements reported by C. E. Pemberton as 70.6 m in height, 30.4 m to the first branch, and 17.5 m circumference of trunk 2 m above the ground. Nehrling (575) wrote of it: "An avenue in the Adelaide Botanic Garden, planted many years ago by its director, the late Robert Schomburgk, is the delight not only of the Australians, but of all the travelers, who promenade under its deep shade." See also, the illustration by Graf (324) of an avenue near Algiers.

The "Centenary Volume" (1855-1955) of Adelaide Botanic Garden gave a short description and an illustration of the Moreton Bay Fig avenue, which is approxi-

mately 110 m long. The trees were planted in the 1860's. (See figure 14 in chapter II.) Cockayne (164) reported them as growing well at Auckland, New Zealand. It was the opinion of Parker (584) that it was the most ornamental species grown in the Punjab of India, and deserved to be more widely cultivated. A fine specimen was reported by Hankin (402), growing at Tresco, Scilly Isles, thirty miles west of Land's End, England.

Trees of *Ficus macrophylla* have been widely distributed for ornamental planting. Under PI No. 3,494 (Sicily) in 1899, W. T. Swingle quoted another authority, who regarded it as one of the largest and most rapidly growing figs that had been tested in Algeria. Other PI numbers are: 7,191 from Germany and 7,418 from Italy in 1901; 8,290 from France in 1902; 33,071 from Australia in 1912; 37,140 from Brisbane in 1914; 52,865 as seeds from Honolulu in 1921; 90,710 as seeds from New South Wales in 1930, with the notation, "said to be the grandest of Australian street trees"; and 183,874 from Florida plants in 1949.

The Moreton Bay Fig is grown in Florida, but not so commonly as some other species, such as *F. altissima*. The Royal Palm Nursery (659) reported it as being hardier than most species, but stated that it had been very little used and deserved wider recognition. Nehrling (574, 575) planted two trees in 1938 at Naples, Florida, and predicted that they would be "fine for lawns and unrivaled in many respects for highways." A tree seen in 1958 at the Edison Home, Fort Myers, Florida, had a medium-sized trunk with very prominent buttresses, and surface roots extending widely in all directions.

Fine specimens, typical of the species in leaf and fruit, were found growing in and around Honolulu in 1959 at the following locations: Street trees along Paki Avenue bordering Kapiolani Park; in Beach Park next to Waialae; on the University of Hawaii campus; at Schofield Barracks; and trees along streets and in gardens.

In California, trees of the Moreton Bay Fig have reached grand proportions, ow-

ing to their early introduction and long years of growth. According to Butterfield (132), this species was listed in the master copy for the catalogue of William C. Walker, Golden Gate Nursery, San Francisco, for 1858-59. If he had realized the eventual size attained by the tree, Franceschi (298) would not have written: "An indispensable inmate of every garden is the Moreton Bay rubber tree." The much-publicized tree planted in 1877 by the Crabb family and now standing in a park adjoining the Southern Pacific depot in Santa Barbara, California, may not have the largest trunk diameter, but does show a spread of branches rivaling that of any other tree of its kind in the state. See figure 13 in chapter II for a photograph of this splendid tree. See also, the description and illustration by Van Rensselaer (774). According to a report in the *California Cultivator* of June 13, 1942, the huge, horizontal branches needed support, and were braced by a large number of steel cables. Numerous large trees of this species are found in parks and gardens, from Santa Barbara to San Diego, California. A short description and an illustration of a tree in Altadena, California, were given by Mira Saunders (674). See the illustration on the cover page of *Pacific Garden*, January, 1911; also, one by Betts (80).

According to Grandi (336), *Pleistodontes froggatti* was described by Mayr (510) from this fig species in New South Wales. (See figure 8 in chapter II.) Grandi (337) also recorded *Philotrypesis aterrima* Saunders as being an inhabitant of the fruit. Reference has already been made to the introduction of fig wasps into Hawaii to provide pollination and resultant production of fertile seed. (See under "Fig Insects" in chapter II.) An excellent and detailed account of the fig wasp in its relation to the development of fertile seed in the Moreton Bay Fig was given by Pemberton (592). See also, the earlier account by Froggatt (304), the historical account of the fig wasps' introduction into Hawaii by Muir (565), and the record by Timberlake (757a). The final resolution legally permitting the introduction of fig wasps

into Hawaii was submitted to the Board of Commissioners of Agriculture and Forestry by Executive Officer C. S. Judd, March 2, 1921.

The following accounts of *F. macrophylla*, with illustrations of tree or leaf, were given by Maiden (494), Pope (608), F. M. Bailey (43), Guilfoyle (346), Francis (300), Audas (31), Mowry (561), Mary Barrett (58, 68), Morrison (557), McMinn and Maino (490), Maino and Howard (496), and Graf (324). Others, without illustrations, were given by Miquel (539, 542), Simpson (699), Marie Neal (571, 572), Sturrock and Menninger (737), Morton and Ledin (558), and Riedel (641).

Leaves and fruit of the Moreton Bay Fig have been regarded as good supplemental food for stock in Australia. Rae (619) told about feeding leaves regularly to cattle without deleterious results, except for a slight tainted flavor of the milk. The following quotation from the article by Pemberton (592) is also applicable here: "Bearing in mind the way in which these and other native figs flourish exceedingly in the poorest soil, that cattle devour the leaves and branchlets greedily, that they will submit to persistent hacking-back to an extent which will kill most other trees, it seems a matter for consideration that these trees should always be planted for shade purposes on dairy farms, and that they should even be planted as a reserve for fodder in stony, sterile places where no grass will grow."

The following description has been made from notes taken in Florida, Hawaii, and California, in comparison with some of the accounts already cited: In Queensland, the tree normally starts in forests as an epiphyte, ultimately strangling the host tree, although some seedlings may appear on the ground or in the crevices of rocks. Natural seedlings are apparently scarce in Hawaii, although those of *F. microcarpa* grow by the thousands and become weedy. The trees gradually reach large proportions, with immense buttresses, trunks up to 8 m or more in circumference, and branches both high and spreading. (See

figures 11, 12, and 13 in chapter II.) Aerial roots (if produced) grow mainly from large, framework branches near the ground, and these may produce a few extra trunks or props. The dormant buds are 3.6 to 7.6 cm long, green or slightly rusty, and finely pubescent. The two stipules are up to 15 cm long and 1.8 cm broad at the base when shed, and rusty-pubescent outside. The young twigs are green, glabrous, and generally short-jointed, with the new growth green or slightly rusty. The older twigs are gray; the bark of the larger branches and trunk, according to Francis (300), is "gray, dark gray, or nearly black on the very large trees; rough, with small pustules, or somewhat scaly on large trees."

The alternate, equilateral leaves are 10.5 to 22.7 cm long and 7.5 to 12.6 cm broad, oblong-oval, the apex obtuse or broadly acuminate, and the base broad and rounded. Venation is not prominent below, with 1 or 2 basal pairs plus 16 to 20 pairs of laterals. The midrib is very light green, or almost white above, sometimes tinged with scarlet. On young trees, the leaves are green, but lighter below; on older trees, the under surface shows a rubiginous scurf which is conspicuous when viewed from below. The texture is coriaceous, the margins entire, and the petioles are very light green, 10.5 to 15 cm long, and slightly flattened above.

The fruits are axillary and commonly geminate; the vegetative bud between them is not in evidence until the figs drop. The thick, club-shaped peduncle, 1.1 to 1.5 cm long, is enlarged into a pad at the base of the fruit. The figs are oval to oblong-spherical in shape, 1.1 to 1.8 cm in diameter, commonly somewhat greater in length. The greenish or purple-tinted surface is prominently decorated with large, yellowish-green flecks. It is smooth, or may be very sparsely puberulent. The three basal bracts are broad and obtuse. The small, narrow umbilicus protrudes slightly from the rounded apex. The interior is white.

Ficus columnaris Moore and Mueller, the Banyan of Lord Howe Island, was thus

described by Mueller (562): "One of the most magnificent productions in the whole empire of plants. . . . The pendulous air-roots, when they touch the ground, gradually swell into columns of the same dimensions as the older ones which have already become converted into stems, so that it is not apparent which was the original trunk; there may be a hundred of the stems to the tree on which the huge dome of dark, evergreen foliage rests, but these stems are all alike, and thus it is impossible to say whence the tree comes or whither it goes." Other more or less similar accounts were given by Naudin and Mueller (570), Hemsley (364), and Maiden (493). Maiden described and illustrated *F. indica*, but a footnote stated that this should be *F. columnaris*, which strikingly resembles *F. macrophylla*. Percy S. Allen (7) stated that a single tree of *F. columnaris* may cover nearly an acre [about 40 hectare] of ground. See also, Audas (31).

PI No. 141,765 represents an introduction of *F. columnaris* from Sydney in 1941, with the notation: "It is said to bear some resemblance to *Ficus macrophylla*." Seeds

were introduced into Hawaii in 1921 by C. E. Pemberton under HSPA No. 1,773, and seedlings became established in the Lyon Arboretum. Large trees, bearing fruit, were found there in 1959. Since 1943, several fine trees have become established in southern California. The leaves of young, vigorous trees of both *F. macrophylla* and *F. columnaris* lack the rubiginous under surface characteristic of the leaves of older trees, as noted above. A tree of the latter variety in the Lyon Arboretum showed leaves larger than those on a neighboring tree of *F. macrophylla*, and very slightly, if at all, rubiginous on the lower surface. This is contrary to the statement by Mueller that the Lord Howe Island Fig tree is more like *F. macrophylla* than *F. rubiginosa*, but that leaves of *F. columnaris* are more rufous than those of either one.

According to Pemberton (592), the fruits and flowers of *F. columnaris* are almost identical to those of *F. macrophylla*. Furthermore, the same fig wasp, *Pleistodontes froggatti*, inhabits the fruits of both trees. Therefore, *F. columnaris* is considered to be a variety of *F. macrophylla*.

29. *Ficus watkinsiana* F. M. Bailey (Watkins Fig)

(Plate XI, A1-2)

The Watkins Fig, named for the botanist George Watkins by F. M. Bailey (39), is indigenous to Queensland, Australia, and occurs as a large tree from the Bellinger River northward. According to Veitch (777): "The huge roots of this species, standing out like solid slabs at the base, sufficient to hide half a dozen men, gradually curl up [strangle] the largest trees till they completely envelop and finally destroy them."

The leaves are much like those of the Moreton Bay Fig, *F. macrophylla*, but the fruits are distinguished from those of that species by the prominent nipple at the apex. Mary Barrett (63) stated that both Francis (300, with illustration) and Summerhayes (741, plate 3187) regarded *F. bellingeri* C. Moore (555) as synonymous with *F. watkinsiana*, and Guilfoyle (346) called it the Bellinger River Fig.

Ficus watkinsiana was introduced as PI No. 78,600 in 1929, and *F. bellingeri* as No. 77,996 in 1928 and No. 90,708 in 1930, all from Australia. The University of California received seeds from New South Wales in 1940, and grew a number of seedlings for distribution. Specimen trees are growing at the Atkins Garden, Cienfuegos, Cuba; at Miami (PIS); and at the following locations in California: Elysian Park and UCLA Botanical Garden, Los Angeles; Huntington Botanical Garden, San Marino; Arcadia (LASCA); and Franceschi Park, Santa Barbara.

The Watkins Fig tree was described by F. M. Bailey (43) as one of the best kinds for affording shade in Australia. In California, no trees of this species have reached the age or size of *F. macrophylla*, but the species shows promise of rivaling the latter as an ornamental. The trunk has

buttresses which are not so massive as those of *F. macrophylla*. It is not recommended, however, for planting as a street tree or near walls because of its broad base and large surface roots. At Riverside, the roots of young potted plants were badly infested by the garden nematode, as shown by the presence of root knots or galls. Young trees have shown no damage, or only superficial injury, from temperatures down to 26° F. The leaves of one tree at Elysian Park, Los Angeles, were found to be malformed by the attack of a leaf mosaic.

The branches of the Watkins Fig show some aerial roots, even in young pot plants. The twigs are light gray when young, and glabrous or puberulent, with conspicuous lenticels. The buds are slender, up to 7.5 cm long, green or tawny, with some glabrous to puberulent and others pubescent. The stipules are deciduous, of unequal length (1.8 cm broad at the base and up to 15 cm long), lanceolate, brown to light scarlet outside, and glabrous.

The leaves are alternate, equilateral (or very slightly unequal at the base), and

large—15 to 30 cm long and 7.5 to 10.5 cm broad. The blade is elliptical, narrowing toward the bluntly acute apex and the rounded or somewhat acute base. The margins are entire, the texture is coriaceous, and the surface is mostly glabrous and glossy. The color is green except for the midrib, which is often pink or scarlet in young leaves. Hydathodes marginal; sometimes lacking. Venation is indistinct, with the laterals not elevated. The midrib is flanked by 1 or 2 basal veins and 15 to 20 pairs of laterals. The petioles are 5 to 12.6 cm long, light green to tawny, becoming reddish brown, and somewhat flattened above.

The globose or oblong figs are axillary, single or geminate, on thick, angular peduncles 1.5 cm long, which are enlarged toward the apex. They are 1.8 cm in diameter and 2.5 cm long, with the apex protruding and nipple-like. The surface is very finely pubescent as seen under a hand lens, and is roughened by nipple-like protuberances. The color is green or rusty. The basal bracts are early deciduous. The interior is white.

30. *Ficus stricta* Miquel

(Plate X, C1-3)

Ficus stricta, described by Miquel *et al.* (545) under *Urostigma*, was later classified by Miquel (544) as a species of *Ficus* from Java. According to G. King (437, with illustration), it is closely allied to *F. elastica* and *F. benjamina*. The species was also figured by Koorders and Valetton (446). Graf (324) gave an illustration and a brief description of *F. stricta* (Guam), known in some Florida nurseries as *F. philippinense*.

Seeds of *F. stricta* were obtained in 1960 from Prof. Juan V. Pancho, Laguna, P.I., who wrote that several species of *Ficus*, including *F. stricta*, may be cultivated as wayside or shade trees in parks and campuses.

All of these seeds germinated well, and both seeds and seedlings have been distributed for trial. PI No. 268,135 was assigned to the introduction.

The following description is from non-fruiting plants in comparison with the account by King (437), who stated that it grows as a tall tree with all parts glabrous. Seedlings have twigs which are green at first, but soon become gray, with terminal buds 2.5 cm in length which are set at an angle, making the stems somewhat inclined. The stipules are 3.6 cm long, linear-lanceolate, greenish white, and deciduous.

The glabrous leaves are up to 17 cm long and 5 cm broad, elliptical, with the base rounded, the apex abruptly acuminate to cuspidate, and the cusp 1.1 cm long. The texture is coriaceous. The surface is smooth and somewhat glossy, with hydathodes sparsely scattered near the entire margins, as mentioned by Graf (324). Venation is indistinct, the veins flush with the lower surface, the basal ones

hardly recognizable, and the primary laterals difficult to count, but numbering at least 15 pairs. The petioles, 1.8 cm long, are brownish. According to G. King (437), the leaves are coriaceous, slightly inequilateral, petiolate, with apex acute,

base rounded, and up to 12.6 cm long. He gave the receptacles as "sessile, axillary, in pairs, globular, smooth, about 0.7 inch [1.8 cm] across, yellow when mature." Seedlings have a drooping habit, and are very tender to cold at Riverside.

31. *Ficus sundaica* Blume (*F. indica* Linné)

Ficus indica is another confused and confusing species, for which it is hard to write a lucid account. The *Kew Index*, for example, lists seven different authors and synonyms for this specific name.

From the account of G. King (437), I glean the following: "Linnaeus quoted for his *Ficus indica* so many plants—Indian, African, and American—that it is impossible to tell exactly what he considered as the type of this species. The name *indica* has, by subsequent authors, been attached for the most part to the plant described above because they believed it to be the one intended to be portrayed in Rumphius' [660 of this book] figure in *Herbarium Amboinense*, Vol. III, t. 84, a figure which Linnaeus did indeed quote under his *F. indica*." King concluded that it would be safer to abandon the specific name altogether, but added: "I quote Blume's *sundiaca* [*sic*] and *rubescens* as synonyms of this with hesitation, for, of the specimens so named at Leiden and Utrecht, a good many belong to the plant accepted as the *F. nitida* of Thunberg. Blume's own description of *sundiaca* would really cover *nitida*. The only synonym I quote with any certainty is *pellucido-punctata* Griff., for Griffith's figure and description answer well to this, and can refer to nothing else."

Corner (199b) preferred to classify *F. pellucido-punctata* as a distinct species. See Griffith (342); also, G. King (438). Hamilton (353) had already concluded that "Peralu" or *F. bengalensis* was the *F. indica* of the Greeks and Romans and the banyan tree of modern travelers. He added: "I applaud Dr. Roxburgh for rejecting the barbarous specific *bengalensis* and for restoring to the Peralu the ancient appellation of *Ficus indica*." In his com-

mentary on Joannis Loureiro's *Flora Cochinchinensis* (478a), Merrill (527) stated: "The incomplete description applies to *F. benjamina* as well as to the not closely related *F. indica*, yet I believe the latter to be the species he attempted to describe."

Mary Barrett (66) had the following to say about the history and nomenclature of this *Ficus*: "The original *F. indica* was the name which Theophrastus gave to the huge banyans seen in the Indian Punjab by the army of Alexander the Great. [See a related statement in the account of *F. bengalensis*, species No. 65.] The references cited by Linnaeus show that his *F. indica* in *Species Plantarum* is the same species. However, Linnaeus, who apparently never had seen *F. indica*, unwittingly gave the title *F. benghalensis* to a plant of the same species which he had studied at Leiden, and which has been described and illustrated under different names by other botanists. *Ficus indica* had almost disappeared from taxonomy when Miquel [544 of the present book] revived it as the title of a Philippine specimen."

On the other hand, Corner (196) reduced *F. indica* to *F. benghalensis*. For *F. indica*, as understood by King, Corner substituted *F. sundaica* Blume. He further stated: "This is, as King suggested, the same as the species for which he sought to maintain the name *F. indica* Linn. Blume's specimen is sterile, but the venation and sunken stomata leave no doubt; further, this common *Ficus* is not represented among others of his from Java." The correct spelling of the specific name is *sundaica*, not "*sundiaca*," as given by King. See the account of *F. sundaica* by Miquel (542) as *Urostigma sundaicum*. See also, under *F. korthalsii* in chapter XVI.

Accounts which confuse the glabrous *F. sundaica* [*indica*] and the pubescent *F. bengalensis* will be ignored. Vahl (773) described *F. indica* as a glabrous tree, with lanceolate leaves, acuminate at the apex, and receptacles very shortly pedunculate. Other accounts which treated it as a glabrous tree were given by Kurz (455), Merrill (519), Elmer (259, 260, 263), Koorders and Valetton (446, with illustration after that of King), Ridley (639), C. E. Parkinson (585), Corner (193), and Quisumbing (615). An early account of *F. indica*, with illustration, was given by Ursinus (771). Elmer (261) gave field notes on *F. indica* var. *gelderi* (Miq.) King. Seeds labeled *F. gelderi* were received from Prof. Juan V. Pancho, Laguna, Philippines, in 1963, and seedlings have been grown at Riverside under PI No. 294,473. Corner (199b) classified *F. gelderi* Miq. under *F. pellucido-punctata* Griff.

Biswas (85) referred to the account by Lamarck and Poiret (456), and concluded that the two American species, *F. anthelmintica* and *F. laurifolia*, are close to *F. indica* in characters. According to Gates (313), this species is a pioneer everywhere in the Philippines, and one which stands but little competition. Corner and Stearn (200) stated that it is easily distinguished from *F. bengalensis* by its pointed (not blunt) leaves. Pancho (582) reported that trees of *F. indica* are similar in habit to those of *F. benjamina*. They are very resistant to strong winds, and are planted along avenues and in parks in the Philippines. According to Grandi (336), *Eupristina masoni* Saunders was described as the insect found to be pollinating the fruit of *F. indica* in India.

In 1901, PI Nos. 7,356 from England and 8,196 from India represented introductions as *F. indica*. See also, PI Nos. 80,418 and 269,160, from the Philippines in 1929 and 1960. Plants received at Riverside from L. W. Bryan, Hilo, Hawaii, in 1928 and again in 1939, survived vacuum fumigation, but did not become established. Two other plants obtained in 1939 succumbed to frost injury at 26° F.

Seeds received from Manila in 1940 failed to germinate. Cuttings sent from Honolulu in 1960 were rooted by Edward F. Frolich, laboratory technician at UCLA, and two plants were potted. Several cuttings have been rooted from these mother plants, and a few of the young plants have been distributed for trial.

My present account is based upon specimens introduced into Hawaii in 1921 under HSPA Nos. 1,465, 1,510, and 1,777 from the Philippines, now growing in the Lyon Arboretum and Wahiawa Botanic Garden; also, young trees at Riverside and Arcadia (LASCA). These show vegetative characters similar to the description and illustration by G. King (437) of *F. indica*, except for lateral pairs of veins; and similar to specimens so labeled in the herbarium of the University of California, Berkeley.

A tree planted in the Lyon Arboretum in 1924 has multiple trunks, 12 in all, the largest 75 cm in diameter. The trunks of some trees are more or less masked by numerous aerial roots below a height of about 6 m. The bark is smooth and light gray. The twigs are slender, 0.6 cm thick, glabrous, green at first, but later turning light gray to brown. The terminal dormant buds are 3.6 cm long, sharp-pointed, green, and glabrous.

The alternate, equilateral leaves are up to 22.7 cm long and 6.2 cm broad, lanceolate or elliptical, with obtuse or abruptly acuminate apex and narrowed or somewhat decurrent base. Venation is hardly prominent, the veins not elevated below, with 1 basal pair extending upward at an acute angle plus 15 or more pairs of laterals that are difficult to count. The surface is glabrous above and below, and the margins are entire. On the leaves of some plants, hydathodes are sparsely scattered near the margins. The texture is coriaceous and somewhat brittle. The petioles are 2.5 to 5.0 cm long, often arcuate, flattened above, and hardly or very shallowly channeled. No receptacles have been found as yet on the large trees at Honolulu. According to King, the figs are crowded in pairs, sessile, from the axils of fallen

leaves, globular, smooth, yellowish red when ripe, and average about 0.8 cm in diameter.

Ficus sundaica (*indica*), as seen in Hawaii, shows characters of decidedly orna-

mental value. It is well worthy of propagation and trial for pot culture as well as for specimen trees in parks or large gardens, although it may be susceptible to frost damage in some localities.

32. *Ficus elastica* Roxburgh (India Rubber Tree)

(Plate X, B1-2)

The India Rubber Tree, described by Roxburgh (657, 658) as *Ficus elastica*, is native to forests of the eastern Himalayas, on to Assam, Burma, Malaya, and Java, where young trees are commonly epiphytic. Kurz (455) reported the habitat as upper Burma, where whole forests are said to exist in the valley of Hookhoun. The eventual production of prop roots or multiple trunks, the high buttresses of the main trunk, and the wide-spreading surface roots make it a spectacular tree in tropical countries. Tennant (752), quoting from Hood's "Poem of the Elm Tree," wrote that in Ceylon, the roots of *F. elastica* writhe over the surface in undulations,

"Like snakes in wild festoon,
In famous wrestling interlaced—
A forest Laocoön."

One common name of the species is, therefore, "Snake Tree." For example, in Ceylon, the roots along an avenue planting so covered the surface as to form a framework of which the interstices retained the materials that composed the roadway. See the illustration of buttresses and aerial roots in the *Gardener's Chronicle* (17:264, 1882). According to the illustrated account by Worthington (849), it was introduced into the Peradeniya Gardens in 1835.

No other species of *Ficus* has ever been so widely propagated and distributed for pot culture as *F. elastica*. A writer in *Garden and Forest* (2:544, 1899) stated: "It was cultivated in England as early as 1815, and whoever first thought of using it for home decoration made a happy hit." It was probably first used in this way (to any great extent, at least) in Berlin. Nehrling (575) wrote: "This species is probably familiar to more persons, even in our northern states, than the one which sup-

plies fruit for our tables, as it grows indoors both in town and country. Its hardiness, indifference to fumes of gas, to dust, to uncertain watering, and indeed to neglect, entitle it to our highest respect." Rockwell and Grayson (651) reported that *F. elastica* was seldom being used for indoor culture, but was occasionally seen in an unpretentious restaurant or shop. Mary Barrett (67) stated: "Nor is this rubber plant very frequently seen now in pots or tubs in northern climates," in contrast to earlier periods when household rooms were of more ample proportions. At present, however, the flood of potted India Rubber plants offered for sale in the United States is evidence that the species has not lost its renown as an ornamental. Furthermore, Jeffery (420) found that in England, more interest was being taken in house plants, and the India Rubber Tree was regaining a measure of its former popularity.

Pokorny (607) published the results of measurements made of eleven leaves from branches of *F. elastica* showing variations in length and breadth. G. King (437) found this species not to be very variable. However, an inspection of the plants displayed by any large modern nursery will reveal specimens that vary considerably in the length and color of terminal buds, size and color of leaves, and presence or absence of hydathodes on the upper surfaces of blades. Probably the oldest and one of the best-known varieties is *variegata*, also given in some catalogues and publications as *F. elastica* var. *aurea*, *F. elastica* *albo-variegata*, *F. elastica* var. *doescheri*, or *F. elastica* var. *aureo-marginata*. W. Watson (813) reported that the variegated form introduced into England about five years earlier had become

popular. Its leaves are light green, with irregular white or yellow blotches. Pot plants are sometimes seen. Some specimens are found growing outdoors in Florida, where Nehrling regarded it as "a most beautiful variety; a vigorous, tall grower, very dense, with a very symmetrical form." For accounts of the variety *variegata*, see N. Taylor (750) and L. H. and Ethel Z. Bailey (45); for *albo-variegata*, see P. Fischer (287). A new variety, "*tricolor*," was described and illustrated in color by Rochford (647a). He saw it at the International Show in Hamburg in April, 1963, and considered it to be "the most beautiful *Ficus* seen to date, with its fine, silver-gray and cream markings, made more attractive by the pink midrib" [hence the name "*tricolor*"]. The varieties "*schryveriana*" and "*doescheri*" were also described. The latter is sometimes called the New Orleans Rubber Plant. The variety "*schryveriana*" was described and pictured by Violet Stevenson (732a), who reported that it had been selected by a Belgian named Schriver [so spelled].

Ficus elastica "*rubra*" is listed in some nursery catalogues, but is not well defined. The name "*rubra*" was proposed by L. H. and Ethel Z. Bailey (45), with "*belgica*" as a possible synonym. It may be the form called *rubrinervis* Hort. by Sata (670). The species *F. rubra* Roth actually classifies with the variety *nitida* of *F. microcarpa*. Mathias and McClintock (504) listed "*F. elastica* '*rubra*,' Red Rubber Tree, synonym *F. rubra* Hort., not Roth." Plants of "*rubra*" appearing on the market from time to time have the following characters: Habit dwarf (i.e., growth slower than that of others); plants more bushy, tending to have lateral branches and aerial roots; terminal bud scarlet; leaves like those of "*decora*," but commonly smaller; hydathodes (if present) very prominent near margins; color of young leaves brilliant, especially below; petioles and young twigs scarlet.

The latest candidate for popularity is *Ficus elastica* var. *decora*. European correspondents report that among seedlings

grown in the late 1930's by a Belgian nurseryman, Gratien van Hecke at Ghent, one was selected for superior qualities, and was distributed under the name "*decora*." One informant believes that some plants are offered under that name that resemble one another, but do not originate from the identical group of variants. Inspection of several horticultural periodicals following 1930 fails to reveal this name. However, a nursery catalogue from Holland listed it in 1952, as well as the forms, "*F. elastica selecta* (*decora* type); also, Belgischer *decora*, a type with short, somewhat broader, leaves than *selecta*." A later catalogue showed *F. superdecora*, giving its advantages over *decora*. According to Graf (324), another is listed as "*decora schrijvereana*." Mary Noble and J. L. Merkel (578) referred to "*F. elastica* var. *craigii* or *decora*." United States Plant Patent No. 2,220 was issued on January 15, 1963, to a Belgian firm covering a variegated sport of *F. elastica decora*. The color illustration appears very similar to the variety "*tricolor*." According to Chandler (145), *F. decora* came into this country as *F. belgica*. The name "*belgica*," however, does not appear in the European catalogues I have consulted. It is used synonymously with "*decora*" by some nurseries in the United States. Others maintain that the two are different in leaf size and color. Sheehan (691) reported that this cultivar comes in many forms, and is sold under several names, such as "*F. elastica variegata*, *F. decora*, *F. belgica*, and *F. rubra*," the last two being the same. He added that the veins of *decora* are sunken, whereas the chief feature of *belgica* is the reddish coloration of the juvenile foliage and the red midrib of the mature leaves. Boutard (99) stated that *decora* has larger, more rounded, and more "perky" leaves than the original "rubber plant."

Ficus elastica has been grown for so many decades in Europe that it is only natural that nurseries in the United States should have introduced it and its varieties from time to time. From pots, the young plants have been shifted to outdoor loca-

tions, and its adaptability to soil and climatic conditions has gradually been learned. Mary Barrett (67) wrote that in Florida, where it thrives well, "It has the distinction of being one of the largest species of *Ficus*. Its great height and spreading branches, of which the lowest are supported by prop roots, and its high, sharp buttresses ending in straggling, aboveground roots, make it one of the state's plant spectacles." Magnificent trees are to be seen at Fort Myers, Coconut Grove, Perrine, and other places in the state. Zuill (854) reported that the best-known specimen in Bermuda is on Queen Street, Hamilton, in front of the library, a landmark as far back as 1870. The conclusion of Menninger (512) was that *F. elastica* as a pot plant may deserve popularity, but in the garden it throws roots 10.5 cm thick on top of the ground, to reach 30 m or more in all directions.

In California, specimens do not become quite so large or spectacular, lacking aerial roots and multiple trunks. Franceschi (298) reported that *F. elastica* is more tender than *F. macrophylla*, but does perfectly well at Santa Barbara, where a tree some twenty years old was believed at the time of writing (1895) to be the largest and finest specimen in the state. The three-part pamphlet entitled *Famous Trees*, issued by the USDA for the U. S. Forest Service in 1935, included, in part II, a specimen in Los Angeles with a trunk 6.3 m in circumference. This tree, still standing, is actually *F. macrophylla*, and not *F. elastica* as stated. India Rubber Trees with trunks 45 cm in diameter are growing on the grounds of the State Boys' School at Whittier, California. A few years ago, a tree on Painter Avenue, Whittier, reached a height of 9 m, but had to be removed because of the damage done by surface roots to the sidewalk and curb. Other good specimens are to be found in favorable locations in southern California. Literally hundreds of trees of *F. elastica* and its variety *decora* have been transplanted from pots to dooryards, but these suffer more or less serious frost damage during cold winters. Many fine trees of

this species are growing in Hawaii. According to Wilder (830), Captain Benjamin Pitman, who came from Boston and located in Hilo, planted the first tree of *F. elastica* in the Islands. The original tree, which still adorns the grounds of the Hilo Hotel, was reported in December, 1963, to be 86 years old. The front cover of *Hawaiian Planters' Record*, Vol. 26, No. 3, showed a trunk of *F. elastica* of immense size at Koloa, Kauai. Lyon (483) wrote of this species: "What better could we ask for than this magnificent tree with which to build the core of our new forests?" F. X. Williams (837) referred to his garden tree as "a grown-up version of great-grandmother's dear little household dust collector, her precious India Rubber plant."

Nehrling (575) stated that in Florida, a heavy frost often cuts rubber trees down, but that they always sprout again from the vigorous rootstock. In 1948, a young tree growing in a canyon at Santa Monica, California, suffered severe injury at a temperature of 27° F. or possibly two or three degrees lower, while another plant growing on a bank 3 m higher was undamaged. Nursery trees were found by Rhoads (634) to be affected by a *Clitocybe* root rot. According to Cynthia Westcott (819), *F. elastica* is subject to attacks by several diseases, including anthracnose, crown gall, leaf spots, and root knot caused by nematodes. Grandi (336) recorded *Blastophaga clavifera* Mayr from the figs of *F. elastica* in Java.

Common names, in addition to India Rubber Tree, are Caoutchouc Tree, Snake Tree, and Berlin Weed, the last one given because of its popularity in Germany as a house plant. According to *Time Magazine*, November 1, 1963, the emblem of New Germany is the "Gummibaum" (rubber tree), which the luxurious, centrally heated apartments use by the thousands.

Additional accounts of *F. elastica*, with illustrations, were given by Griffith (342), Blume (92), Sherman (693), Lemaire (465), Pope (608), Koorders and Valton (446), E. H. Walker (793), Ochse (580), Mowry (561), Corner (193),

Bruggeman (118), Pancho (582), and Manjunath (497a); without illustrations, by Balfour (51), Drury (243), D. Brandis (102, 103), Merrill (519), Gamble (309), Ridley (639), Holland (382), Haines (352), McMinn and Maino (490), Diels (231), Burkill (124), Quisumbing (615), and Miquel (539). Stapf (728) listed fifty-five references with illustrations of *F. elastica*, four of which are in color. See also, G. Watt (815) for a long list of references.

A peculiarity nearly unique among species of *Ficus* is the single stipule which sheathes the terminal bud of *F. elastica*. G. King (437) referred to the "single, subsistent stipule, which is colored and almost half as long as the leaf." In her description, Mary Barrett (67) also wrote of the terminal bud, covered with a single stipule. Most botanical accounts refer to "stipules" and not to "a stipule." For example, Corner (193) said that in saplings, the stipules may be very large, even 30 cm long. An excellent review of the systematic status of the species, its synonyms, and its varieties has been given by Mary Barrett (67).

Several introductions of the India Rubber Tree have been made by the USDA. The following ones have been particularly noted: PI No. 4,399 from France, and No. 4,630 from Italy, both in 1900; No. 7,222 as seeds from Germany in 1901; No. 7,417 from Italy, and No. 7,540 from France, both in 1901; and No. 92,949 from Egypt as cuttings in 1931.

The following description is made from specimen plants growing in California and Florida, in comparison with the accounts just cited and with young plants under cultivation: Trees in native forests reach 60 m in height, in Florida to 24 m, and a few in California to 15 m. The trunk is often buttressed, and surface roots extend widely in all directions. Aerial roots appear in humid climates, eventually forming multiple trunks. The bark is fairly smooth, gray on the sunny side to russet on the shaded side. Lenticel scars are prominent on the branches, spreading crosswise and forming partial circles. The

twigs are rather thick, somewhat zigzag on fruiting branches, glabrous and green at first, with prominent, corky lenticels. The terminal buds are variable, both in length and color, from short to 15 cm, and from green to tawny or reddish brown. The single stipule is lanceolate, pink to scarlet, and varies in size, but is often 15 cm or more long. The new growth is green to rosy or scarlet.

The alternate, equilateral leaves are variable, ranging from 12.6 cm long on mature trees and on fruiting twigs to 30 cm on vigorous branches. They are elliptical, with the apex rounded, then acuminate or abruptly apiculate, the acumen 1.1 to 2.5 cm long, and the base rounded. The midrib is prominent below, but the lateral veins are indistinct, hardly (if at all) raised above the surface, 25 to 30 in number, and parallel to each other, extending outward from the midrib at approximately a right angle. The texture is thick and rubbery, the margins entire, and the surface glabrous and glossy. Hydathodes are seldom, if ever, present on the leaves of typical *F. elastica*. However, they are often sparsely scattered near the margins on leaves of the varieties *decora* and *rubra*. The petioles are greenish white, 5 to 10 cm long, and slightly channeled on the upper side.

The figs are axillary, usually geminate, and often densely set toward the tips of short-jointed twigs. They are sessile, but, as Kurz (455) stated, "are borne on the cuplike bases of the fallen bracts," a sort of pseudostalk. Vigorous young trees are very slow to set fruit, but plants in containers sometimes do produce figs. These are oblong, broad at the base, may be slightly angled, and are about 1.1 cm long. The surface is glabrous and light green, prominently spotted with darker flecks. The basal bracts are prominent. The umbilicus is also prominent for such a small fig, and is tinged with scarlet. In south Florida, the small figs become sufficiently soft to attract cedar waxwings and other birds which feed upon them.

Propagation of this species by marcottage ("mossing") has almost completely

superseded propagation by cuttings. Single-leaf cuttings with a heel of wood at the base, or terminal shoots with three or four leaves attached, may be used, although marcottage gives marketable plants more rapidly and produces better-developed lower leaves. See the account by Gamble (309) on propagation and methods of planting in rubber plantations.

A valuable character of the India Rubber Tree is that under proper conditions, pot-grown plants are able to maintain their lower leaves for several years, but the maximum age of such leaves before dropping is apparently not recorded. Taplin (748) stated that trouble in rooting *F. elastica* "variegata" had been overcome by grafting it onto a normal green plant.

33. *Ficus pertusa* Linné (f.)

(Plate VI, B1-2)

According to De Wolf (230), the name *Ficus pertusa* was used by Linné (f.) (476) on a specimen from Surinam which represented the small-fruited populations of that area. He added: "This and *Ficus citrifolia* are undoubtedly the most widespread of the American species of the genus." Thirty-seven botanical names were given as synonyms, including *F. padifolia* HBK, *F. arbutifolia* Link, *F. ochroleuca* Grisebach, and *F. subtriplinervia* Martius; the last-named species is listed in chapter XVI. De Wolf also stated: "There is a very definite distinction between population on the basis of fruit size, but there is no sharp discontinuity, either in measurements or in geography." See references to *F. pertusa* by Desfontaines (227), Willdenow (834), Lemée (467), and De Wolf (230b).

According to Cook and Collins (187), *F. arbutifolia* was cultivated along the roadside at Arroyo, Puerto Rico, while *F. ochroleuca* was described by Grisebach (344) from trees indigenous to Jamaica. Later accounts were given by Warburg (803), Fawcett and Rendle (280), Howard and Proctor (398), and Rossberg (654). Seeds of *F. ochroleuca* obtained from Jamaica in 1941 produced fine seedlings, which were distributed to various nurseries in California for trial. Young plants in a nursery row at Riverside were severely injured by frost in 1946 and 1948. Small trees grew and produced fruit in a nursery at Yorba Linda, California. The leaves are somewhat longer and broader than those of *F. padifolia*, also in cultivation. According to Fawcett and

Rendle, the leaves are finely dotted with cystoliths on both sides, but California specimens of *F. ochroleuca* fail to show hydathodes on the leaf surface. Grisebach (344) stated that bracteoles close the aperture of the umbilicus, forming a convex point in the middle of the concavity.

Ficus padifolia, described by Kunth (HBK) (450) from type specimens collected by Bonpland, exhibits great variation; more, in fact, than any other Central American species, according to Standley (717), who stated: "*Ficus padifolia* is one of the most abundant and widely dispersed of the North American strangler figs. The young plant at first climbs the trunk of some tree, often a palm, by attaching its long, slender, ropelike stems to the host plant by means of aerial roots. In time, the fig develops a large trunk and crown, and surrounds and kills the host tree. With age, it forms a very broad crown, from the branches of which aerial roots descend and enter the ground, thus developing new trunks and forming a tree of the familiar banyan type of Asia and Africa. The trees at maturity are very handsome. The receptacles are edible."

The variability of this species is indicated by the large number of synonyms listed by Standley. "With a small series of specimens," he wrote, "it would be possible to differentiate several species, but with the numerous collections at hand, all the characters heretofore relied upon for differentiation break down." Further accounts were given by Standley (721, 722), Standley and Record (724-725), and Standley and Steyermark (726). Cecile

Matschat (505) included it as one of the Mexican figs which should be widely grown in the southern United States. The inner bark of the tree was used for the preparation of paper by the Aztecs and Mayans, as related by Von Hagen (784, with illustration) and Hunter (403).

Ficus padifolia was introduced from Costa Rica in 1917 under PI No. 44,116, with seeds presented by Carlos Werckle. He described the trees as very large and dense, of exceptionally beautiful color, and evergreen, although other fig species are bare of leaves for varying periods during the dry season. PI No. 92,350 represents an introduction from Chiapas, Mexico, in 1931, labeled "*Ficus* sp." There has been some question as to the identity of this later material, but specimens studied at the Atkins Garden, Cuba, in 1949 and Miami, Florida, in 1958 under PI No. 92,350 certainly do represent *F. padifolia*. PI No. 221,181 (Florida, 1935) is listed as *F. padifolia*. According to *Plant Immigrants* (130:1124), the species is called Werckle's Rubber Tree. (See *F. perforata*, species No. 41, for another application of this name.) Nehrling (574, 575) called it the Sayula Rubber Tree because it is a prominent roadside tree near Sayula, Mexico. Several local names, recorded by Standley (717) and Hernández (372), are used for the species, such as "Nacapulí" and "Camichín," but none of them seems to be applicable to introduced trees. Possibly, Central American Banyan might be a suitable appellation.

Trees of *F. padifolia* were planted in Florida by Nehrling (576) in 1919, and Starrock and Menninger (737) included it in their list. Typical specimens were found in 1958 at the Jennings Estate, at the Plant Introduction Station (PIS), and at the border of the parking lot for the picnic ground adjacent to the Fairchild Tropical Garden and Old Cutler Road, all in South Miami. My own familiarity with the tree has been increased during the course of several trips to Mexico, where I obtained botanical specimens and fertile seeds. Seedlings are growing and bearing fruit at Riverside and Arcadia (LASCA),

where the trees are deciduous for a short period in late winter. Fruiting trees were seriously injured by a temperature of 25° F. in the winter of 1962-63, but recovered rapidly during the summer.

Grandi (329) described *Blastophaga silvestri* (subgenus *Valentinella*) as the insect which inhabits the receptacles of *F. padifolia* in Costa Rica. This fig species belongs to the subgenus *Urostigma*.

The trees sometimes grow as banyans with multiple trunks, as just stated. The trunk lacks prominent buttresses. Aerial roots occur in clusters near the ground, and issue from branches 3 m or more above the ground. The gray bark is somewhat creased or furrowed, with large lenticels and leaf scars. The terminal buds are 1.1 cm or less long, slender, very acute, glabrous or very slightly puberulent, and green.

The alternate, equilateral leaves are 5 to 10 cm long and 2.5 to 3.6 cm broad, lanceolate, with the apex acuminate and the base rounded. Hydathodes (when present) are scattered thickly. Venation is not prominent, the veins hardly at all raised or only slightly elevated below, difficult to count, with 1 pair basal plus at least 9 pairs of laterals. The texture is chartaceous, the surface glabrous and glossy above, and the margins entire. The petioles are slender, up to 3.6 cm long, and channeled above.

The axillary, commonly geminate figs are borne on slender peduncles up to 0.8 cm long, these often slightly curved and glabrous or very slightly puberulent. They are variable in shape, from subglobose to obovate, oblate, or turbinate, without a neck, and are 0.7 to 1.1 cm in diameter by about 0.8 cm from base to apex. The surface markings are very prominent and unusually striking; the ground color is mahogany or chocolate-brown, decorated with large, light-green, slightly raised flecks that almost cover the upper part of the body. The apex protrudes prominently, like the mouth of a jug, with the umbilicus in the center of a depression. The interior is white. (See figure 38 with description of *F. hispida*, species No. 8.)

34. *Ficus benjamina* Linné (Weeping Fig)

(Plate XIV, A1-2; B1-2; E1-2)

The specific name of *Ficus benjamina*, given by Linné (474), leads one to the conclusion that it was bestowed in honor of an individual. However, the original spelling was *beniamina*, probably a Latinized version of "banyan" or "banian" (ultimately derived from Sanskrit), briefly discussed under *F. bengalensis*, species No. 65. Another possible derivation of the name is the supposed relation of the tree to the source of benzoin, which is sometimes known as "benjamin." Miquel (539) gave the specific name as *benjaminicum*, while Bentham and Mueller (77) gave the spelling as *benjaminea*. The common name Weeping Fig is well applied, for specimen trees usually have a graceful, weeping habit which accounts for their ornamental value. Other common names are Waringin, Willow Fig Tree, Benjamin Banyan, Java Tree, Java Willow, Weeping Laurel, and Oval-leaved Fig. ("Java Willow" has also been applied to *F. virens*, species No. 24.)

Mary Barrett (67) gave an excellent account of the systematic status of this species of *Ficus*, and distinguished four more or less distinct varieties which she separated in a key, as follows:

Figs sessile, although sometimes narrowed at the base; basal bracts present. Figs less than 15 mm in diameter, red, yellow, or purple.

Leaves ovate, subrounded at base; basal veins faint but usually visible; surfaces not, or barely, papillate. var. *benjamina*

Leaves elliptic, base broad-cuneate; basal veins indistinguishable; surfaces distinctly papillate.

"*waringiana*"

Figs 15-25 mm in diameter.

Figs yellow or orange. var. *comosa*

Figs showing a pseudostalk; no basal bracts present at maturity. var. *nuda*

These are described separately in the text that follows. Corner (196, 199b)

gave *F. benjamina* as the type species of the series *Benjamineae* Miquel, with figs sessile, rarely pedunculate or pedicellate. He listed three varieties: *benjamina*, *bracteata*, and *nuda*.

A. *Ficus benjamina* var. *benjamina*. This typical form of the Weeping Fig has a wide range of distribution, in Burma, Malaya, China, Indo-China, the Philippines, and other islands of the southwestern Pacific. It has been widely planted in other countries because of its ornamental appearance, as confirmed by the following statements. Balfour (51): "A valuable avenue tree." Elmer (256): "Presents a pleasing appearance, with its mature blood-red fruits." Maiden (494): "One of the most beautiful of all species." E. H. Wilson (844): "In beauty of architecture ranks without a peer." Royal Palm Nursery (659): "A very lovely lawn subject, and particularly beautiful when the long, drooping branches are covered with tiny red figs." Nehrling (574, 575): "Unquestionably one of the most beautiful, noble, and elegant shade trees in existence." From a gardener who sent specimens from Nassau in 1906 under PI No. 18,734: "Appears to stand the dust and heat of the street better than any tree I have seen." Lucita Wait (790): "A gracefully drooping tree, much planted in south Florida." Watkins (809): "The graceful, weeping branches of this evergreen fig cascade to meet the green turf of the terrace." See also, Mary Barrett (68). Figure 41 shows a fine specimen of this tree.

The Weeping Fig is not frost-hardy, and cannot be expected to thrive and mature into a good-sized tree except in comparatively warm locations. According to Maiden (494), the trees are tender to frost at Sydney, and Anderson (10) recommended it only for the northern rivers of Australia. Both in Florida and in California, trees of *F. benjamina* are found to be much more tender than those of *F. microcarpa*. Fine specimens are growing

in Cuba and south Florida, but few, if any, mature trees can be found outdoors in southern California. Four young trees 3.5 m high were found growing vigorously at Irvine Park, Orange County, California, in September, 1963. At Los Angeles, two trees 2.5 m high were frozen to the ground in 1948 at about 25° F. Small trees in a nursery row at Riverside failed to survive temperatures of 26° F. in 1946. However, plants for pot culture and for sheltered patios are being propagated in large numbers by some nurseries in California, and in some cases are being planted along streets. Boutard (99) stated that it is a graceful, small, narrow-leaved tree which improves with age as a house plant.

Both Merrill (519) and Elmer (263) reported that in the Philippines, trees of *F. benjamina* begin life as epiphytes and then develop as stranglers. Browne (117) stated that probably the most familiar example of a strangling fig in Borneo is *F. benjamina* or Waringin. Typical cultivated trees of this species, however, have a single trunk. Trees in Florida may have aerial roots which cling to the trunk and buttresses. Lyon (484) reported that it rarely produces prop roots in Hawaii. He

further stated that it so closely resembles some forms of *F. retusa* [*microcarpa*] that it is quite generally confused with them, but may be distinguished by its longer and more pointed leaves, produced on slender, drooping branches. Corner (193) also suggested: "Care must sometimes be taken to distinguish it from the Malayan Banyan, *F. retusa*, although the finely veined, long-tipped leaves, the absence of bunches of aerial roots, and the orange-red figs are, in most cases, characteristic." He added that some trees appear to be hybrids with *F. retusa*.

Accounts, mostly other than those already cited, were given as follows, those marked with an asterisk having illustrations: Blume (92), Roxburgh (658), Drury (243), Kurz (455), Morris (556*), G. King (437,* 438), James (418), Veitch (777), D. Brandis (103), Koorders and Valetton (446*), W. H. Brown (115, 116), Gamble (309), Ridley (639), Merrill (524), C. E. Parkinson (585), Simpson (699), Mowry (561*), Diels (231), Burkill (124), G. R. Wilson (845), Summerhayes (743), Marie Neal (571, 572), Corner (193,* 199b), Sturrock and Menninger (737*), Smiley (706), Quisum-



Fig. 41. Few species of *Ficus* can surpass the Weeping Fig, *F. benjamina*, as specimen trees in parks or large gardens. (Photo by Dr. R. A. Hamilton, Honolulu.)



Fig. 42. *Ficus benjamina* will frequently develop aerial roots and "prop" roots (multiple trunks) in southern Florida.

(Photo by A. J. Basinger)

bing (615), Holtum (385*), Desch. (226), Bruggeman (118*), and Graf (324*). Stapf (728) gave twenty-one references to authors who had illustrated *F. benjamina*, one in color. See also, the brief illustrated account in *Sunset Magazine*, September, 1961.

Grandi (328) described the fig insect *Eupristina konigsbergeri*, collected from fruits of *F. benjamina* var. *comosa* in Java, and *E. jacobsoni* from the typical *F. benjamina* in Java and Malacca. He also recorded *Philotrypesis distillatoria* as an inhabitant of these figs in Sumatra. Joseph (427, 429) described two new species, *Philotrypesis tridentata* and *Terastiozoon benjamina*, from India. In California, young plants are found to be susceptible to infestation by the root-knot nematode.

According to Aiton (5), *F. benjamina* was cultivated in England by Philip Miller in 1757. It has been introduced into the United States several times and from different countries. It was obtained from Nassau in 1906 under PI No. 18,734 and from Australia in 1915 as No. 41,438. PI No.

67,501, collected in Java in 1926 by Dr. David Fairchild, represented the form known as *F. warangiiana*, with foliage resembling that of *F. benjamina* but with trees taller and branches not so spreading. PI No. 67,701 was obtained from Sumatra in 1926, and No. 80,080 from India in 1929. PI Nos. 80,420 and 80,569, received as seeds from the Philippines in 1929, produced seedlings classified as the variety *auda*. PI No. 99,569, from the West Indies in 1932, and No. 116,747, from India in 1936, produced plants of the variety *comosa*. PI Nos. 123,210 and 124,232, both from India in 1937, as well as No. 137,968 sent from Celebes in 1940, were probably from trees of the typical *F. benjamina*. An introduction from Singapore in 1929 under Plant Quarantine No. 77,899 was also of the typical form. FHB No. 75,407 consisted of seeds from Java labeled *F. benjamina* var. *crassinervia*. Cuttings from Egypt in 1931 under PI No. 92,948 probably failed to root.

The following description of typical *F. benjamina* is made from notes taken of trees growing at the Atkins Garden, Cienfuegos, Cuba, in 1949; the Miami Plant Introduction Station (PIS) in 1949; at Honolulu in 1959 and 1960; and from pot plants in California; all in comparison with the various descriptions cited above: A tree at the Atkins Garden twenty years old had a trunk 45 cm in diameter, without buttresses, but with some aerial roots from the branches. At Miami, some trees had prominent surface roots; also, aerial roots, some of which formed multiple trunks (figure 42).

The bark is smooth and gray, somewhat roughened or warty. The drooping, glabrous branches have slender twigs which are green at first, but later become grayish brown, with prominent lenticel scars. The terminal buds are green, 0.8 cm long, slender, and sharp-pointed.

The alternate, equilateral leaves are up to 10.5 cm long and 4.3 cm broad, ovate-elliptical, with glossy, green surface. The apex is gradually (sometimes abruptly) acuminate, the acumen about 1.8 cm long, often somewhat bent or twisted. The blade

is slightly narrowed toward the rounded base, sometimes a little decurrent on the petiole. The texture is thinly coriaceous. The venation is obscure, with the midrib raised but laterals flush with the lower surface. The basal veins are indistinct, but often extend along the margins to one-third the length of the blade. The lateral veins are also indistinct or almost indeterminate, numbering some 8 to 12 pairs. The petioles are slender, up to 2.5 cm long, glabrous, and slightly channeled above.

The axillary, sessile figs are commonly geminate, globular to slightly oblong, and about 1.1 cm long and 0.8 cm in diameter. White flecks are scattered over the glabrous surface, which is green at first, but becomes bright scarlet to almost black at maturity, contrasting strongly with the color of the green leaves. At the apex, the eye is slightly depressed, with a nipple-like protuberance at the center. The interior is white.

B. *Ficus benjamina* "waringiana."

Waringin, according to Backer (34), is a collective name for several large species of *Ficus*. It is also a vernacular name applied to a fig tree found in Java and Malaya, but determined to be a form of *F. benjamina*. At Miami, trees usually have few aerial roots or secondary trunks. On the other hand, Fairchild (273) found that trees in Java spread by hanging roots, and eventually a single tree comes to look like a whole grove. Mary Barrett (67) stated: "The leaves of this form are elliptic, usually twice or more than twice as long as wide, distinctly papillate on both surfaces, with an abrupt, rather long, slender and acute acumen, sometimes bent, a more or less cuneate base, and undifferentiated basal veins."

C. *Ficus benjamina* var. *comosa* (Comose or Tufted Fig). The common name "Comose" refers to the tufted masses of dark-green foliage borne by trees of this variety. The first description by Roxburgh (656) contained certain contradictions. "For example," stated Mary Barrett (67), "the color plate shows peduncled figs, both yellow and purple, of the same size, 2.5 x 2 cm, although the text

calls them sessile, with a contracted base, deep yellow when mature, and gooseberry size."

Other accounts, with illustrations, are by J. T. Lowe (480), Wight (826), G. King (437), Koorders and Valetton (445), N. Taylor (750), McCann (487, with color plate), and Benthall (75a); without illustrations, by Sprengel (716, as *F. pendula*), Prain (610), Lyon (484), Haines (352), and Mary Barrett (67). In his account, Haines stated that there is no doubt as to Roxburgh's plant described as *F. comosa*.

The Comose Fig is indigenous to eastern India, but is also found in Assam, Burma, and probably in Malaya and the Philippines. It differs from the typical Weeping Fig in having larger fruits, 2.1 cm long and 1.8 cm in diameter, and orange-yellow. Mary Barrett (67) reported that this variety had been doubtfully mentioned for Florida, but that she did not see any trees in her travels. On the other hand, I found it growing at Miami in 1949, and made notes on the trees and the yellow fruits. According to Greenhall (341), this "Ceylon Willow" is widely planted around Port-of-Spain, Trinidad, and the orange-colored fruits are eaten by fruit bats. Trees are found along Honolulu streets, on the University of Hawaii campus, and in the Lyon Arboretum.

D. *Ficus benjamina* var. *nuda*. This variety is called *nuda* because the basal bracts of the fruit are early deciduous. It was thrice described by Miquel: as *Urostigma nudum* (539), as *U. benjaminicum* var. *nuda* (545), and as *Ficus nuda* (544). (For further synonyms and related comments, see under *F. karzii* in chapter XVI.) In venation of the leaf blade, it is similar to the typical form, but presents the following contrasts to that variety, as pointed out by Mary Barrett (67): Banyan habit; narrower leaf blades, with a longer, more slender, more abrupt acumen and a less rounded base, with 1 quite distinct pair of basal veins; and a receptacle which has ridged meshes when dry. The figs are light green when young, but become reddish brown at maturity. The

pseudostalk is a continuation of the base of the ovoid receptacle.

In addition to the four varieties described in the foregoing text, there are other forms which should be briefly treated. *Ficus haematocarpa*, described by Blume (92), has since been identified as *F. benjamina*. F. M. Bailey (41) described and illustrated *F. benjamina* var. *Le Huntii*, from New Guinea, as a tree of drooping habit, with leaves 8.5 cm long, and pyriform receptacles 1 cm long. Plants labeled *F. philippinensis* have appeared in the nursery trade during recent years. In habit of growth and in leaf and fruit characters, they appear to be very similar to some varieties of *F. benjamina*, and are certainly different from the species described from the Philippines as *F. philippinensis* Miquel, which was regarded by Corner (196, 199b) as a variety of *F. virgata* Reinwardt ex Blume. See *F. philippinensis* and *F. pinkiana* in chapter XVI.

E. "Ficus exotica." Some very decorative forms of *F. benjamina* are listed and sold under this name, as mentioned by Morton and Ledin (558). The drooping twigs have glossy leaves, distinctly undulate along the margins. This is apparently the form listed and illustrated by Graf (324) as *F. benjamina exotica*. He called it the "Thrip-proof" Java Fig, having a coquette twist of its slender leaf tips.

Trees of the *exotica* type are common on the campus of the University of Hawaii, and are readily distinguishable from those of the typical variety *benjamina* by the much smaller leaves, the slender, zigzag twigs, and the very small, green or yellowish receptacles.

F. *Ficus schlechteri*. This recent introduction is grown in Florida. It is not the East Indian species noted by Warburg (803), but is similar to *Ficus benjamina* var. *comosa*. Graf (324) listed it as "*F. philippinense schlechteri*." There is an illustration of it as *F. "schlechteri"* in *Tropical Homemaker and Gardener* for July, 1957, with the notation: "One of our most beautiful *Ficus*; new foliage is a russet red; has long, weeping branches. Is very tender. Slow-growing." Scions in-

troduced from France in 1932 as *F. schlechteri* under PI No. 101,334 did not become established, and probably represented a species different from the one considered here.

In May, 1958, I saw the original Florida tree of *F. schlechteri* at Bob Wilson's nursery in Miami; he had introduced it from the Philippines in 1950. The tree was then 5.5 m high, with large leaves on drooping branches, and only a few aerial roots close to the trunk. Contrary to the statement just quoted, the tree is a rapid grower and is easy to propagate. The figs are sessile, pyriform, 1.8 cm long, and orange-yellow, similar to those of the variety *comosa*.

An introduction from India in 1930 under PI No. 88,326 was labeled *F. kurzii* King. In his account of this species, G. King (437) gave *F. nuda* Miquel var. *macrocarpa* Kurz as a synonym. His illustration shows leaves similar to those of *F. benjamina*, and the description tallies closely with the characters of that species. D. Brandis (103) stated that *F. kurzii* is similar to *F. rhododendrifolia* Miquel. Bruggeman (118) reported that *F. kurzii* is confused with *F. benjamina*, but is distinguished by the presence of aerial roots and by short-stalked figs. These characters, however, may be found in some of the varieties described above. See also, under *F. kurzii* in chapter XVI.

As stated by Mary Barrett (67): "Trees of the Weeping Fig are desirable for lawn and street planting because of their habit and the density of their somewhat striate-leaved foliage. Their drooping branches and twigs make graceful, umbrella-like shapes on lawns or, after the removal of some of the lower parts, create tree-tunnels along streets." The trees are unquestionably beautiful, but are too broad and spreading for narrow streets. In large parks, however, and along wide highways, few trees can surpass those of *F. benjamina* for shade, form, and distinction. This was corroborated by Kuck and Tongg (449) in their statement of the Benjamin Banyan: "It is often called the most attractive of all green shade trees in Hawaii."

CHAPTER X • Species 35 through 46

35. *Ficus iteophylla* Miquel (Itea-leaved Fig)

(Plate XXXI, B1-3)

Ficus iteophylla was first described by Miquel (544) from specimens collected in Senegal, West Africa. The specific name signifies the resemblance of its leaves to those of some member of the genus *Itea* (Saxifragaceae or Iteaceae). Hutchinson (407) distinguished it from two similar species in the following key:

- Leaves oblong or oblong-elliptic, rounded at the base.
 Petiole $\frac{1}{4}$ inch [6 mm] long or less, *F. burkei*
 Petiole $\frac{3}{4}$ inch [18 mm] long or more, *F. spragueana*
 Leaves oblanceolate, attenuate to an obtuse or subacute base. . . *F. iteophylla*

Hutchinson and Dalziel (410) gave in more detail the characters which separate *F. iteophylla* from *F. spragueana*. See the account under *F. spragueana*, species No. 81. Lely (463) gave an illustrated description of *F. iteophylla* as a very well-known species from Nigeria, distinguished by its long, narrow leaves and long clusters of small figs. Broun and Massey (110) described it as an epiphyte or as a separate tree in the Sudan. According to Dalziel (221), trees of this species were introduced from Gambia into Florida, where the fruits attracted mockingbirds, cardinals, and finches, so that it was being established as aviary food.

A fig species was described and illustrated by Miquel (539) as *Urostigma dekdekana*, with *Ficus tjieia* Hochst. in parentheses. Schweinfurth (683) gave an account of *F. dekdekana* from specimens collected in Eritrea. Hutchinson (407) characterized the leaves of *F. iteophylla* as shown in his key above, and the receptacles as tomentose. In his key to species, he listed *F. dekdekana* as having leaves sharply pointed, petioles comparatively long, and receptacles glabrous or very

slightly pubescent. Eggeling, per Dale (251) described *F. dekdekana*, with *F. iteophylla* as a synonym. Other accounts of *F. dekdekana* were given by Aubréville (29, with illustration), Irvine (412), Dale and Greenway (218), and Mary Barrett (65).

Seeds were obtained at Riverside from Nigeria in 1940 under PI No. 137,932, and seedlings were distributed. PI Nos. 161,326 and 161,327 represented further introductions as *F. iteophylla* from Saint Louis, French West Africa, in 1947. However, the latter number may be properly identified as *F. natalensis* Hochstetter (species No. 40).

In its native habitat, this tree grows to a large size, more than 12 m high and up to 4.5 m in circumference, according to Lely (463), but varies considerably, from a tall, narrow tree to one with an enormous, flat-topped crown 22 m in diameter. Trees seen in Florida and Cuba in 1948 and 1949 were upright, small, with light-gray bark, and the lenticels raised and corky.

The following description is a composite one, drawn from the sources mentioned above: The young twigs are short-jointed and glabrous, or may be pubescent, with rusty hairs. The terminal buds are 1.1 cm long, green, with dry or shriveled stipules, these often persistent for several nodes.

The alternate, equilateral leaves, in close ranks or series on the upper few centimeters of the twigs, are broadly lanceolate to obovate, tapering from the middle toward the narrowly rounded base and the acuminate apex, and are up to 12.5 cm long and 3.6 cm broad. Venation is not very prominent, with the basal veins indistinct and the laterals (10 to 12 pairs) hardly, if at all, elevated below. The upper surface is glabrous and green, but much lighter below. There are a few large, white hydathodes near the margins on

the upper side. The margins are somewhat undulate. The petioles are slender, up to 3.1 cm long, glabrous, and narrowly channeled above.

In Cuba, the trees are deciduous for a short period in winter, the fruits appearing before or with the new crop of leaves in the axils of leaf scars of the main twigs or on short lateral branches. In a nursery in California, potted plants only 45 cm high were seen producing numerous figs in the leaf axils in December. Young trees

at Arcadia (LASCA) have also borne fruit profusely. The figs, single or geminate, are borne on slender peduncles 0.7 cm long, are slightly enlarged at the apex, and pubescent. They are spherical, up to 0.7 cm in diameter, densely silky-pubescent, this pubescence obscuring the red flecks on the surface, which is green, or reddish brown on the exposed side. The umbilicus is a bit large for such a small fig, and protrudes somewhat from the rounded apex. The interior is white.

36. *Ficus mariannensis* Merrill (Marianna Fig)

(Plate IX, D1-2)

The Marianna Fig was described by Merrill (520) as *Ficus mariannensis*, although Linné (f.) (476) had given an account of it as *Artocarpus integrifolia*. Trecul (761) stated that *Artocarpus mariannensis* was a native of tropical Asia, "now widely distributed in cultivation." Diels (232) gave the distribution of the species in Micronesia, and Corner (199b) classified it as a synonym of *F. prolixa* Forster (f.), which is treated in chapter XVI.

The insect which inhabits the receptacles of *F. mariannensis* in Guam was described by Swezey (744) by the name *Megastigma mariannensis*.

Two introductions of this species have been reported. The first one, in 1927, was made under PI No. 74,591, with the following citation: "A giant banyan fig which is epiphytic on other trees. The latex is astringent and is used to stop the flow of blood. This variety is native to Guam." The second introduction, from Guam in 1929, was given PI No. 78,575, with the statement that the plant starts as an epiphyte but eventually becomes a tall tree.

According to Merrill (520), the Marianna Fig is probably as closely related to *F. infectoria* [virens] as to any other kind, but is distinguished by its short-peduncled, somewhat larger receptacles and by having its petioles scarcely jointed. He further stated that it greatly resembles *F. carolinensis* Warb. from the island of Yap, but in that species the bracts at the base of

the receptacle are free, not connate. Trees of PI No. 78,575 (just mentioned) growing at Miami, Florida, are very similar to those of *F. lucescens*, No. 74,592, but that species has been recently classified by Corner (199b) under *F. racemosa*. (See the account of *F. virens*, species No. 24, for further details on the somewhat involved history of PI No. 74,592.) Trees of *F. mariannensis* 4.5 m high are growing at the Lyon Arboretum, Honolulu.

The following description is made from specimens studied in Florida and Hawaii in comparison with the original account by Merrill: The trees show aerial roots and sometimes multiple trunks; the bark is gray. The young twigs are slender, glabrous, or very slightly puberulent, while the older ones are gray and glabrous, with lenticular scars fairly prominent and somewhat rusty. The terminal buds are 0.7 to 1.1 cm long, green or tawny, and glabrous.

The alternate, equilateral leaves are 5.0 to 12.6 cm long and 3.6 cm broad, elliptical, with the apex gradually acuminate and the base rounded. Venation is fairly prominent, the laterals not elevated above the lower surface, and numbering from 8 to 10 pairs, with 1 pair basal. The texture is thinly chartaceous, the surface glossy and glabrous, and the margins entire. The slender petioles are up to 3.6 cm long, green, and somewhat flattened and channeled above.

The axillary fruits, often borne profusely, are single or geminate, oblate or

spherical to obovate, up to 0.8 cm in diameter, on a very short, stout peduncle or practically sessile. The surface, glabrous, with conspicuous and well-scattered white flecks, is green at first, becoming purplish black before falling. The basal bracts are prominent and flaring, connate, according to Merrill (520), with brown or dry margins. The umbilicus is flush with the sur-

face or slightly depressed, and the scales are pink or scarlet (to green on pot plants). The interior is white.

The Marianna Fig has no special merit as an ornamental tree. It closely resembles *F. virens*, the Spotted Fig, which has attracted attention for planting in large parks only. The latter is treated as species No. 24 in the present work.

37. *Ficus amplissima* J. E. Smith

(Plate XI, Cl-3)

The account of this species must also consider *Ficus tsiela*, described by Roxburgh (657, 658), who stated that Tsiela, the vernacular name applied to it by Reede (624), seemed to be the same species. He added: "Its native station is in the mountains, but it is found everywhere on the lowlands, planted with *F. indica* and *F. religiosa*, where it grows to be nearly as large, and is equally shady." It was illustrated by Wight (826), who also reported that the trees do not have pendulous branches, and are therefore far superior to the banyan or to *F. benjamina*, the aerial roots of which "are often dangerous impediments on a road."

In his illustrated account, G. King (437) believed that the misunderstanding about the synonymy of this species "appears to have originated in the confusion of Reede's Tsiela, which is an excellent representation of *F. tsiela*." Plate 70 of King is labeled *Ficus tjakela*. It has also been confused with a narrow-leaved form of *F. infectoria* [*virens*] and with *F. benjamina*. Corner (197a, 199b) classified this species as *F. amplissima*, described by J. E. Smith (707) in *Rees' Cyclopaedia*. In his description, Smith gave two earlier references: "Linnaeus, Sp. Pl. 1514, *Tsjela*; and Rheede, Hort. Malm. V. 3:85, Tab. 63." He added that the fruit of this species is copious, the size of a pea, insipid, the food of bats, on which account it is called the Bat-tree. Other references to it were given by Cleghorn (160), Beddome (73, with figure), G. King (438), G. Watt (815), J. D. Hooker (388), Talbot (746, 747, the latter with illustration),

D. Brandis (103), Gamble (309), C. E. C. Fischer (286), Worthington (849, with figure), and Corner (199b), noted above. A detailed account of *F. tsjakela* was given by Mary Barrett (60).

Butterworth (134) regarded *F. tsiela* as a grand and beautiful tree. One avenue tree in the Madura district of India had a girth of over 10 m. Contrary to other accounts, Haines (352) reported that trees of this species are often epiphytic, without aerial roots, but sometimes send down such roots like a banyan. He distinguished it from *F. ramphii* by the very short, bluntly acuminate apex of the leaf, or by the entire absence of acumination. According to Parker (584), trees of *F. tsiela* are cultivated at Lahore, but often suffer from frost. The species belongs to the subgenus *Urostigma*.

Two introductions of *F. tsiela* have been recorded. The first, as cuttings from Egypt in 1931 under PI No. 92,954, was apparently unsuccessful. The second, as seeds from India in the same year under PI No. 93,398, gave rise to seedlings for distribution. Small trees planted in 1938 are growing at the Lyon Arboretum in Honolulu, while other trees were found in Cuba and Florida in 1949, but only in collections.

As already noted, the trees of *F. tsiela* reach a large size; in Florida, some have trunks 0.9 m in diameter and are 12 m high, with multiple trunks close to the base and aerial roots on branches 6 m or more aboveground. The bark is smooth or papillate, with corky, lenticel-like scars, the color gray or with alternating, longitudinal striations of green and gray. The

terminal buds are glabrous, green, and up to 1.8 cm long.

The alternate, equilateral leaves are up to 15 cm long and 6.2 cm broad, ovate-elliptical, tapering gradually from the middle to the obtuse or acuminate apex. The base is rounded, or sometimes subacute to decurrent. Venation is fairly prominent, the veins slightly elevated below, with 1 or 2 basal pairs plus 8 to 10 laterals. The texture is subcoriaceous, the margins are entire, and the surface is glabrous. According to Haines (352), the leaves are minutely punctulate (as in *F. rumphii*), the dots appearing translucent when fresh and as minute tubercles when dry. The

petioles are up to 5 cm long, slender, light green, and slightly flattened and channeled above.

The figs are axillary, sessile, commonly geminate, and usually densely clustered on short twigs. They are oblate-spherical or short-turbinate, and 1.1 cm in diameter. The color is green at first, becoming maroon or mahogany-red on the exposed side (or purple, according to some other descriptions); the glossy, glabrous surface is densely spotted with white flecks. The umbilicus is small, slightly depressed, with pink scales. The interior is white.

At Riverside, leaves of young plants became infected with the mosaic virus.

38. *Ficus involucrata* Blume (Involucre Fig)

(Plate XI, D1-2)

Ficus involucrata was first described by Blume (92) from specimens collected in Java. The excellent account by G. King (437), with illustration, is explicit. He followed Miquel (542) by placing it in the subgenus *Urostigma*. Koorders and Veleton (446) gave another illustrated account. Rock (650) reported that the tree reaches large proportions in west Java, especially as to size of the trunk, which may be 30 m high and nearly 1.8 m in diameter (see his plate 79).

Rooted plants received at Riverside in 1939 from L. W. Bryan, Hilo, Hawaii, greatly resembled plants of *F. infectoria* [virens] in the same nursery row. They succumbed to a winter temperature of 24° F. in 1949-50. Two cuttings received from Honolulu in 1960 rooted and produced fine young trees.

The following description is made from two trees growing in the Lyon Arboretum in 1959 (probably the same as PI No. 50,396 of 1920), and from one tree growing on the University of Hawaii campus: The trees are at least 15 m tall, with a few multiple trunks; buttresses are not prominent; aerial roots occur near the base only; the bark is gray, with narrow rings. The

dormant buds are 1.8 cm long, glabrous, and green. The young twigs are also glabrous and green, but soon become gray and scurfy, with prominent lenticel scars.

The leaves are alternate, equilateral, up to 16 cm long and 6 cm broad, oval, with acute or cuspidate apex, the cusp 1.1 cm long, and rounded to a subacute or slightly decurrent base. Venation is not prominent, the veins below not elevated, the basal veins indistinct, and 8 to 10 pairs of laterals. The texture is coriaceous, margins entire, surface glabrous and glossy above. The petioles are stout, 1.8 to 5.0 cm long, glabrous, and may be somewhat arcuate.

The axillary figs are single or geminate, sessile, oblate-spherical, and 1.8 cm in diameter. According to G. King (437), the receptacles are umbonate when young. The surface is glabrous, glossy, and is decorated with white flecks scattered over the upper half of the body, which is light scarlet and attractive. The umbilicus, protruding from the apex, is 2 mm across, with brown scales, and is tightly closed. As the specific name indicates, the involucre is conspicuous, the green bracts enveloping one-half to two-thirds of the body. The interior is white.

39. *Ficus obliqua* Forster (f.)

(Plate XIII, B1-3)

Georg Forster (f.) (294) described a fig species from islands near Australia as *Ficus obliqua*, with lanceolate, glabrous leaves and geminate fruits borne on very short peduncles. It was briefly described by P. Miller (536), while Seeman (686) also gave an account of it, with an illustration in his plate 68. The species is similar to *F. prolixa* Forster (f.), treated in chapter XVI, but Summerhayes (742) differentiated the two by the fact that the receptacles of *F. obliqua* have basal bracts which are deciduous, and after falling leave a more or less circular cushion around the apex of the peduncle. The plants vary from small shrubs to large trees with a sparse development of aerial roots. Riedel (641) suggested that trees of *F. obliqua*, or of a related species, might have been planted in Santa Barbara, California, in 1938. It may be one of these trees that is still growing at 1221 East Mason Street, Santa Barbara, with a trunk almost 1 m in diameter, a 12-m spread of branches, and a height of 9 m.

Account must also be taken of a species listed as *F. platypoda*, the description of which was credited by Miquel (539, 544) to A. Cunningham (ms. in Hooker Herbarium). It is an Australian species, designated as "Native Fig" by Black (87) and as "Small-leaved Moreton Bay Fig" by Francis (300). According to Benth and Mueller (77), there are at least four varieties, which they stated might prove to be sufficiently distinct to be treated as species. F. M. Bailey (43) treated it as *F. platypoda* A. Cann., and illustrated the four varieties, with brief descriptions: var. *minor* Miq., a large tree with small fruit; var. *petiolaris* Benth., receptacles sometimes on peduncles of "4 lines" [8 mm]; var. *mollis* Benth.; and var. *subacuminata* Benth. Other short accounts were given by F. M. Bailey (42), Anderson (10), and Marie Neal (572). See also, the list by Yuncker (852). Corner (196) classified one of the above as *F. obliqua* Forst. var.

petiolaris (Benth.) Corner. He added that the leaves of the variety *petiolaris* have the smooth lower epidermis of *F. obliqua*, not the finely striate epidermis around the stomata, as in *F. platypoda*. Later, Corner (199b) listed and classified the species, with three varieties: *obliqua*, *petiolaris*, and *puberula*. See note under *F. puberula* in chapter XVI. Grandi (336) recorded *Blastophaga greenwoodi* from *F. obliqua* in Fiji.

An introduction labeled *Ficus platypoda petiolaris* was made from Brisbane in 1929 under PI No. 78,599, with this notation: "A small tree, with thick, coriaceous, ovate-cordate leaves up to 15 cm long and small fruits less than 0.7 cm long." Cuttings were obtained from Egypt in 1931 under PI No. 92,950, as *F. platypoda*. An introduction from Australia as *F. "baileyana"* has been identified by Dr. Corner as *F. obliqua* var. *petiolaris*. Summerhayes (742) stated that material of *F. eugenioides* from the type locality agreed exactly with the specimens of *F. obliqua* from the Pacific islands. See the comment on *F. platypoda* under *F. muelleri* and *F. puberula* in chapter XVI.

Trees introduced from Samoa under HSPA No. 1,525 were found in 1959 and 1960 growing in two different locations at the Lyon Arboretum, Honolulu. Specimens were identified by Dr. Corner as *F. obliqua*. HSPA No. 1,784, an introduction as seeds in 1921, also classifies with this species.

Seedling trees of PI No. 78,599 (mentioned above) have been found in both Florida and California. In Florida, the trees show trunks 45 cm in diameter, more or less buttressed, with numerous aerial roots from framework branches, and forming multiple trunks close to the main trunk. One tree in Honolulu has two major trunks, each 30 cm in diameter, as well as two or three minor trunks, with buttresses at the base only and large surface roots. Aerial roots on the trunk are few, 1.5 m

above the ground. The bark of a tree in Santa Barbara is light gray, with prominent, narrow, longitudinal creases, the edges scurfy and gradually sloughing off. The twigs are glabrous or slightly puberulent, with terminal buds green, glabrous, or puberulent, up to 3.6 cm long. The stipules are narrow, 0.7 cm broad at the base and up to 5 cm long. A large tree is growing at the Huntington Botanical Garden, San Marino, and a smaller one on the UCLA campus.

The alternate, equilateral, entire leaves are elliptical, up to 15 cm long and 6 cm broad, with the apex obtuse or bluntly acuminate and the base rounded to somewhat narrowed (but not ovate-cordate, as noted above). Hydathodes are lacking. Venation is not prominent, the veins not elevated below, with 1 pair of basal veins plus 10 to 12 pairs of laterals. The texture is subcoriaceous, the upper surface glossy and glabrous, and the lower surface gla-

brous, or puberulent on veins. The petioles are up to 5 cm long, glabrous or slightly puberulent, flattened and somewhat channeled above. The twigs, petioles, and midribs are sometimes tinged with pink.

The figs are axillary, commonly geminate, on stout, glabrous peduncles up to 0.7 cm long. They are spherical to oblong, or even obovate, up to 0.8 cm in diameter, green, glabrous, or with minute, rusty hairs, and speckled with light-colored or reddish spots which are sometimes indistinct. The umbilicus is small, and protrudes slightly from the apex. The interior is white.

Trees of *F. obliqua* var. *petiolaris* growing in Florida are very similar in vegetative characters to adjacent trees of *F. rubiginosa* var. *australis*. The two may be best distinguished by fruit characters. Apparently, both are hardy enough to withstand injury from light frosts, and have similar ornamental features.

40. *Ficus natalensis* Hochstetter (Natal Fig)

(Plate XXIV, B1-2; Plate XXXV, D1)

The identity and synonymy of *Ficus natalensis* have been treated by Mary Barrett (65), who also pointed out the distinction between it and *F. dekldekana* (Miq.) A. Richard, with which it has sometimes been confused. The species was described by Hochstetter (377) (ex Ferdinand Krauss). Miquel (539) described it as *Urostigma natalense* Krauss, but later treated it under *Ficus*. A species described and illustrated by Sim (696) as *F. natalensis* was believed by Hutchinson (408) to be *F. craterostoma*, while *F. natalensis* of Mildbraed and Burret (535) was referred to *F. burtt-davyi*. Under *F. craterostoma*, Burt-Davy (131) stated: "Probably, this is the species reported from the Transvaal by Hutchinson and by Rehmann as *F. natalensis* Hochst., which does not appear to occur with us [the Transvaal]." See the account of *F. dekldekana* under *F. iteophylla*, species No. 35.

According to Holland (382) and to Hutchinson (408), the Natal Fig is widely distributed in tropical Africa. The former

stated that the tree is a source of bark cloth in Uganda. The preparation of bark cloth from it was described by Eggeling (251), also Irvine (412). Both gave the common name as Barkcloth Tree. According to Cowles (205), the local name "Untombé" is used in Zululand, where the figs furnish food for bats and birds. See also, the account of this fig in Natal and Zululand by Henkel (366). Illustrations of *F. natalensis* as an epiphyte or strangler were given by Marloth (500), Steedman (729), and Palmer and Pitman (581b). Eggeling (251) figured a single leaf, and Sim (696) illustrated the variety *pedunculata*. In Uganda, it is grown from stakes as a live fence and as a shade tree for coffee plantations. See also, the account by Dale and Greenway (218). In Pretoria, this species makes a handsome tree, affording a dense shade, and is planted along the streets of Cape Town, according to Hutchins (405).

A species was described by Warburg (797) as *Ficus volkensii*. Hutchinson

(407) treated this as a synonym of *F. natalensis*, and Mary Barrett (65) regarded *F. volkensii* to be typical of the form having obovate leaves, rather small in size. At least three importations of seeds of the Volkens Fig have been made, all from Tanganyika, the first in 1924 as PI No. 61,796, the second in 1925 as No. 62,807, and the third in 1928 as No. 78,261. It was reported to be a shrub or small tree, with narrow, papery leaves and axillary receptacles about 1.1 cm long. Plants of No. 78,261 were received from Florida in 1944 and distributed for trial. Seedlings growing at Arcadia (LASCA) and Riverside are from seeds introduced from South Africa by Dr. Ray B. Cowles as *Ficus natalensis*. The young trees have their leaves opposite. PI No. 105,710 represented another lot received from Africa in 1934, labeled *F. natalensis*.

The following account has been made from notes on trees observed in Cuba, Florida, and California: Trees planted in Florida in 1939 were 6 m tall in 1958. The trunks branch from near the ground, without buttresses. A few aerial roots appear on the trunk and branches. The bark is roughened by longitudinal creases, with the edges raised and sloughing off. The young twigs are glabrous and green, soon becoming gray; the older ones are dark gray to almost chestnut, with the lenticel

scars elongated. The terminal buds are about 0.7 cm long, glabrous, green at the base, but often tawny or slightly pink on one side and at the very sharp-pointed tip.

The alternate or opposite, equilateral leaves are 5 to 10 cm long and up to 5 cm broad, and obovate, with a broad, rounded, or obtuse apex and narrowed, obtuse base. Except for the midrib, venation is indistinct (flush with the surface below), with 1 basal pair plus 5 to 8 laterals. The margins are entire, the surface glabrous, and the texture thinly coriaceous (chartaceous, according to some accounts). The upper surface is deep green, while the lower surface is much lighter, and inclined to be aureous. The petioles are slender, up to 5 cm long, green, and slightly flattened above.

The axillary, geminate figs, on peduncles 0.7 cm long which are rough or warty near the base of the fruit, are about 1.1 cm in diameter, globular, and light green, becoming scarlet when mature, with yellowish-white flecks over the glossy, glabrous surface. The umbilicus is small and light scarlet.

Frost injury in south Florida was rather severe on young trees of PI No. 78,261 in 1958-59, but recovery was rapid in spring and summer. The Natal Fig is well deserving of trial in subtropical climates, either as a shrub or small tree.

41. *Ficus perforata* Linné (Jacquinia-leaved Fig)

(Plate X, D1-3)

Ficus perforata, described by Linné (475), was treated by De Wolf (230) with thirteen botanical names as synonyms, including *F. americana* Aubl., *F. jacquiniaefolia* A. Richard, *F. eugeniaefolia* Hemsl., and *F. wilsoni* Warb. Regarding this complex, De Wolf stated: "This is an exceedingly variable taxon, the West Indian plants called *Ficus jacquiniaefolia* and *F. sintenisii* being, superficially, very different in appearance. There is, however, no important character by which they can be circumscribed." Little and Wadsworth (476a, plate 24) gave an account of *F. sintenisii* Warburg as known only from

Puerto Rico, but noted: "It recently has been united as a synonym of *F. perforata* L."

The West Indian species *F. jacquiniaefolia* was named and described by Richard (636) because of the resemblance of its leaves to those of a species of *Jacquinia* (Myrsinaceae). Other accounts were given by Warburg (803), Britton (107), Britton and Millspaugh (108), Rossberg (654), Acuña and Roig (3), and Graf (324, with illustration). According to Inventory No. 110, PI No. 95,691 represents seeds of *F. jacquiniaefolia* collected in 1932 at Nassau, Bahamas, and described as a small-

leaved wild fig which produces small, purple, sweetish fruits about 2.5 cm long. Plants received in California in 1934 grew vigorously at first, but were lost later on. Plants of a later introduction were once growing in a nursery row at Riverside, but did not become established. An Orange County (California) nursery had fruiting plants in containers in 1962.

Ficus eugeniaefolia of Costa Rica, described by Standley (717) as glabrous, the leaves obovate, with 8 to 12 lateral veins, and sessile receptacles about 0.8 cm in diameter. It was designated "Werekle's Rubber or Fig Tree" by both Nehrling (574) and Riedel (641). (The same common name has been applied to *F. pertusa*, species No. 33, which see.) Nehrling stated that the trees are as dense as those of *F. nitida* [*microcarpa* var.], and equally as beautiful, while Riedel said: "The leaves look like those of *Pittosporum tobira*, but twice as large and brown-purple when unfolding."

Ficus wilsoni, described by Warburg (803) from Jamaica, was regarded by him as perhaps equal to *F. americana* Swartz, the description of which agreed with that of *F. wilsoni* also collected in Jamaica. See P. Miller (536, his No. 33). *Ficus wilsoni* was distinguished from *F. populnea* by Fawcett and Rendle (280) in their key, as follows:

Leaves generally subauriculate at the cuneate base; bracts connate. . . . *F. wilsoni*
 Leaves not auriculate at base; bracts scarcely connate. *F. populnea*

(A species designated as *F. populnea* is discussed at some length under *F. citrifolia*, species No. 57.)

Rosberg (654) distinguished *F. wilsoni* from other species in his key, but in the text gave localities only. See also, the list by Howard and Proctor (398).

In 1941, seeds of *F. wilsoni* were received directly from Jamaica. They germinated, and seedlings were distributed for trial. Those in a nursery row at Riverside failed to survive a temperature of 26° F. The plants had no particular merit as ornamentals, and none were kept.

The following description of *F. jacquiniifolia* is made from notes on trees found in Florida in 1940, 1949, and 1958, and in the Lyon Arboretum in 1959 and 1960: Trees in collections are 7.6 to 9 m high, with trunks 25 to 30 cm in diameter, without buttresses but showing prominent surface roots. Aerial roots are very few, short, on the lower part of the trunk. The bark is smooth and gray, roughened by circular nodal and lenticular scars. The terminal buds are 0.8 cm long, glabrous, and green or tawny. In Florida, the twigs are numerous, slender and short, often standing upright on the upper sides of horizontal or spreading branches.

The leaves are alternate, equilateral, small, up to 5 cm long and 2.5 cm broad, with broad, rounded apex and narrowed or acute base. The shape is oval (commonly obovate), and broadest above the middle of the blade. Venation is obscure, only the midrib being elevated and prominent below, with 2 basal pairs plus 6 to 10 laterals which are indistinct but discernible against a light. The texture is subcoriaceous, the margins entire and slightly revolute, and the surface glossy above, glabrous on both sides. The petioles are short, up to 1.1 cm long, somewhat channeled above, and jointed at the blade.

The axillary figs are mostly geminate, borne on slender peduncles up to 0.7 cm long. They are globular to oblate-spherical, up to 0.7 cm in diameter (not 2.5 cm long, as just described under Inventory No. 110). The surface is green, glabrous, and marked by scattered flecks of white or lighter green. The umbilicus is small, but conspicuous for such a tiny fig, and slightly protruding. The interior is light-colored. In Florida, the flowers are apparently inhabited by a fig insect which has not been described as yet, to judge from available records. In Honolulu, no figs have been observed on the trees.

The Jacquinia-leaved Fig was recommended by N. Smiley (706) for seaside planting because it seems to be resistant to salt air or spray. It warrants trials for planting in pots and for small specimen trees.

42. *Ficus thonningii* Blume

(Plate XII, B1-2)

According to *Index Kewensis*, the species described by Blume (*Rumphia* 2:18, 1836) as *Ficus thonningii* equals *F. microcarpa* Vahl. However, most botanists treat it as *F. thonningii*, with *F. microcarpa* and various other specific names as synonyms. Miquel (539) described it as *Urostigma schimperii*, but later (540), he classified and illustrated it as *Ficus thonningii*. The typical *F. thonningii* is a West African species, but Hutchinson and Dalziel (410) stated that it extends eastward to the Red Sea, Ethiopia, Uganda, and south to Angola. Mathias and McClintock (504) listed *F. thonningiana* Miq., although Miquel (544) gave the name as *F. thonningii* Bl., under No. 125.

In Ripley's "Believe It or Not!" (*San Francisco Examiner*, August 28, 1951), there appeared an illustration with three leaves labeled "Sandpaper Plant" (*Ficus microcarpa*) of Java, having rough leaves used for polishing. The *Kew Index* lists four specific names under *F. microcarpa*, three synonyms with other species and one from tropical Africa, described by Vahl (773). Uphoff (769) gave *F. microcarpa* Vahl (syn. *F. thonningii*) as an African species which furnishes bark cloth for the native people. The leaves of *F. thonningii* are glabrous, not sandpapery. Lamarck and Poiret (456) had described Vahl's species as a fig with small fruit, indigenous to Guinea.

According to Unwin (768), *F. thonningii* is one of the commonest shade trees in West Africa, and is planted in towns "far north, in French territory." Lely (463) reported it as a common tree in Nigeria which is often seen as a strangler, completely enveloping its host. Holland (382) stated: "Welwitsch considers that these trees, together with *F. gnaphalocarpa*, belong among the most stately trees of tropical Africa, both on account of their large-leaved and widely extended heads with brick-red branches, as well as for the abundance of their peach-colored figs—

somewhat sweet and tolerably juicy—with which they are laden twice a year."

Keys for separating *F. thonningii* from related species were given by Mildbraed and Burret (535), Hutchinson (407), Hutchinson and Dalziel (410), Lebrun (460), Lebrun and Boutique (462), and Aubréville (29). The species is sometimes confused with *F. hochstetteri* A. Rich., which Jex-Blake (422) regarded as better than *F. thonningii* for cultivation. Dale and Greenway (218) stated that the tree is propagated by stakes in Uganda, therefore, "A number of forms have developed, some of which closely resemble similarly propagated forms of *F. natalensis* (from which *F. thonningii* is best distinguished by its sessile receptacles)." Other accounts of this species were given by W. J. Hooker (393), Irvine (411, 412), Cooper and Record (190), Aubréville (30, with illustration), Eggeling (251, with illustration of leaf), and F. W. Andrews (14).

Seeds were received in 1936 directly from Nairobi as *F. hochstetteri*, but the resultant seedlings distributed for trial were finally determined to be *F. thonningii*. Trees are now established at San Diego, San Marino, Arcadia, and Santa Barbara, California. This species is not hardy, even to moderate freezes, having suffered severe damage at San Marino in 1948. However, the plants recovered, and have spread by rootlike suckers into several thickets, with tops 7.5 m high.

In California, the trunks have buttresses or crown roots near the ground. Aerial roots are profuse on some trees, the lower ones taking root in the ground. The terminal buds are short, up to 1.1 cm long, somewhat concealed by the dry, parchmentlike bud scales, white hairy-pubescent at the base, and chocolate-brown. The twigs are angular and green (except for patches of light gray at the nodes), and minutely puberulent. On older branches, the bark is light gray to chocolate-brown, checked or creased lengthwise.

The alternate, equilateral leaves, up to 14 cm long and 5.5 cm broad, are elliptical, with the apex broadly obtuse and the base rounded to very slightly subcordate. Venation is somewhat obscure, with the veins not elevated below, the basal pairs indistinct, 10 to 15 pairs of laterals, and reticulations prominent. The margins are entire, the texture is coriaceous, and the surface is smooth and glabrous. The color is dark green above, but much lighter below, and somewhat aureous. The petioles are 5 cm long, and slightly flattened above.

The figs, common on some seedlings but scarce or lacking on others, are densely

crowded on twigs, single or geminate in the leaf axils, and sessile. They are oblong to oblate, up to 1.5 cm in diameter, and faintly pubescent on the green surface, which is prominently decorated with white flecks. The umbilicus is small and nipple-like, with the scales not much in evidence. The interior is white. According to Irvine (411, 412), the figs are not edible, contrary to the statement by Holland (382).

Trees of *F. thouningii* possess distinct ornamental characters for planting in warmer localities. Even when injured by frost, they recover rapidly and make good specimen plants with an ample display of dark-green foliage.

43. *Ficus aurea* Nuttall (Florida Strangling Fig)

(Plate XIV, F1-2)

The first botanical description of *Ficus aurea*, with color plate, was made by Nuttall (579), based on specimens collected from a large tree at Key West, Florida. He called it the Small-fruited Fig Tree. An earlier account of the same tree had been made by Romans (653). It is one of two species of *Ficus* that is indigenous to the mainland of the United States, the other being *F. citrifolia*. *Ficus aurea* has sessile or very short-stalked fruits, while *F. citrifolia* has fruits borne on long peduncles. Both were illustrated by Bessey (79) and by Sargent (668, 669). The common name Florida Strangling Fig is applied to *F. aurea* because the tree is commonly an epiphyte, the young plants starting from seeds deposited by birds on other trees or palms. A newspaper in St. Petersburg, Florida, dated April 7, 1958, showed a "tree-mendous oddity": a strangling fig rooted on a *Phoenix* palm. Other common names applied to it are Wild Fig, Florida Banyan, and Golden Fig. The last name apparently refers to the miniature fruit, which is yellow when mature.

This species grows abundantly on the hammocks and keys (cays) of the south Florida peninsula, and is also found in Cuba and the Bahamas. According to Sargent (667), a single large specimen located about 10 miles [16 km] west of

the mouth of the Miami River on the shore of Biscayne Bay covered nearly a quarter of an acre [about .10 hectare] of ground with its numerous secondary trunks. Nehrling (575) told of magnificent trees at Naples, Florida, where they withstood well the effects of salt spray along the beach. He also reported that the trees are very serviceable for highway planting. For other accounts and illustrations, see Britton (106), Fawcett and Rendle (280), Safford (663), Small (705), Mowry (561), Rossberg (654), Lucita Wait (789), Graf (324), and Argo (23a).

The insect which inhabits the fruits of *F. aurea* and provides for pollination of the flowers is *Secundeisena mexicana* Ashmead, as listed by Muesebeck *et al.* (564).

According to Bessey (79), the fertile seeds germinate in the light but not in the dark. However, nurserymen in Florida have long been propagating this species from seed, and fertile seeds received at Riverside germinated freely in a vermiculite medium. On the other hand, Reasoner (622b) found that cuttings provided a much quicker and simpler method of propagation than with seeds. During the rainy season, every cutting grew without the use of artificial heat. Numerous seed-

lings have been grown and distributed for trial, in both Hawaii and California. One small tree was growing at the Huntington Botanical Garden (San Marino) in 1947, but failed to survive the following winter. Others have since become established at Riverside and at Arcadia (LASCA).

The roots of *F. aurea* are reported to be resistant to attacks of the garden nematode in Florida, although galls have been found on the roots of potted plants in California. Cynthia Westcott (819) included root knot in a list of diseases affecting this fig. Others are anthracnose, crown gall, leaf spot, and rust. The foliage is sometimes attacked by a fungus, a species of *Ophiodothella*, which causes the leaves to drop prematurely. The use of seedlings as rootstocks for the Common Fig (*F. carica*) has also been investigated. Experience at Miami, Florida, showed that the two are not compatible; scions failed to make a good union or any subsequent growth.

The following description has been developed from notes taken on native trees in Florida, a tree in the Lyon Arboretum, and plants in California. It is presented after comparison with the accounts of various authors.

The tree reaches a large size in its native environment, with aerial strangling roots and the trunk somewhat buttressed. The young twigs are light green, with elongated lenticels; the older twigs are grayish brown and glabrous. In California, the terminal buds of young, vigorous specimens are up to 3 cm long and minutely puberulent.

The entire, equilateral leaves are alternate, up to 17 cm long and 4 cm or more broad, subcoriaceous in texture, and elliptical, narrowed to an obtuse or slightly acuminate apex and a rounded to subacute base. The light-green or almost white midrib, elevated below, is flanked by 1 pair of basal veins and 8 to 14 pairs of laterals, scarcely raised. The surface is glossy and deep green above, but lighter green below and glabrous, except for inconspicuous, short, rusty hairs on either side of the midrib. The petioles average 2.5 cm in length, are somewhat flattened above, but may be somewhat puberulent when young.

The figs are axillary, single or geminate, and almost or quite sessile. They are subglobose, 0.8 cm in diameter, yellow when mature, and somewhat puberulent, with fairly conspicuous white flecks scattered over the surface. The basal bracts are large and conspicuous, while the ostiole at the apex is small. The interior is faintly pink. Nuttall (579) stated that the figs "are nearly half embraced by the sheathing, bifid or trifid, one-sided involucre." From my own notes made in Florida in May, 1958, I add the following: "Body of fig with a pseudostalk which extends upward along one side of the fig like a handclasp, thus producing a lopsided fruit with apex and umbilicus on the opposite or inner side." (Figure 1, chapter I.)

Young trees under trial at Riverside produced fruit in January, 1963, at the end of two seasons' growth; also, at various times in 1964.

44. *Ficus superba* Miquel (Cedar Fig)

Ficus superba, described by Miquel (544), was included and illustrated by G. King (437) in his account of Indian and Malayan figs. He regarded it, apparently from herbarium specimens, as near to *F. infectoria* [virens] var. *geniculata*, but distinguished it from that species by its tomentose stipules and large receptacles. Koorders and Valetton (446) described and illustrated it from Java. Sata (670) listed *F. superba* Miquel as "a

doubtful and excluded species." According to Corner (193), *F. superba*, the "Sea Fig," is a magnificent tree which should be brought into cultivation. The young leaves are pink, but quickly turn to a beautiful, fresh green. He noted a specimen growing in the Cathedral Close in Singapore.

Ficus henneana was described by Miquel (544), apparently in honor of the botanist Henne. Both Maiden (495, with

illustration) and Anderson (10) called it the "Deciduous Fig," but others, such as Guilfoyle (346), gave the common name as "Cedar Fig." It is found in Queensland and northern Australia. The tree is glabrous and semideciduous but, according to Audas (31), dropping its leaves for a short period only. Other accounts were published by Bentham and Mueller (77) and Lyon (484), both without illustrations; Pemberton (592, with photo of tree only); and F. M. Bailey (42, 43, with sketch of leaves and fruit). Riedel (641) stated that the Cedar Fig was listed in some 1910 catalogues. The species belongs to the subgenus *Urostigma*. Corner (196, 199b) classified it as "*F. superba* Miq. var. *henniana* (Miq.) Corner comb. nov."

Two introductions of the variety *henniana* have been made, both from Australia; one in 1929 as PI No. 78,598, the other in 1930 as No. 90,709. C. E. Pemberton collected seeds of the Cedar Fig in Australia and sent them to Hawaii, where many seedlings were grown under HSPA No. 1,520. He recommended it highly for reforestation, and reported the trees to be of moderate size and of fine shape and appearance. Seeds received in California in 1929 germinated well, and a number of seedlings were grown for distribution, but no trees became established. The roots of some were found to be infested by the garden nematode. An introduction was made from Hong Kong in 1965 under PI No. 304,128, labeled *F. superba*. Fruiting trees have been studied and characters noted in Florida in 1940, 1949, and 1958; also in Hawaii in 1959 and 1960.

Ficus henniana is generally described as a shrub or small tree. Specimens in Florida are small, with trunks up to 30 cm in diameter; the branches produce some aerial roots, forming a few multiple trunks. A tree in the Lyon Arboretum,

Honolulu, has low, spreading buttresses, a 30-cm trunk, and aerial roots wrapped around the trunk below 1.8 m. The terminal dormant buds are short, up to 7 mm long, glabrous, and green or tawny. The twigs are green at first, later becoming brown, with prominent lenticels.

The alternate, equilateral leaves are up to 10 cm long and 5 cm broad, oval, with obtuse or bluntly acute apex and rounded or shallowly subcordate base. The entire margins become somewhat undulate or wavy on drying. The thinly coriaceous blades are glabrous, with venation hardly prominent, the midrib flanked by 1 indistinct basal pair of veins plus 9 or 10 lateral pairs. The petioles are slender, from 2.5 to 5 cm long, glabrous, and slightly channeled above.

The axillary figs, either solitary or geminate, are borne on peduncles 0.3 to 0.7 cm long. They are spherical to slightly oblate, with or without a short neck, and about 2.3 cm in diameter. The smooth, green surface is conspicuously decorated with flecks of white. The basal bracts are minute. The small umbilicus shows pink scales. The interior is white.

Ficus superba var. *henniana* is another species which hardly merits attention as an ornamental tree. However, the illustration by Pemberton (592) of a specimen growing in the Sydney Botanical Garden shows that it is adapted for planting where it is not crowded by other trees. (See *F. gracilipes* and *F. muelleri* in chapter XVI for synonymy.)

Seeds labeled *F. superba* var. *japonica*, received in September, 1964, from Dennis Hill, Hong Kong, germinated, and young trees are being grown at Riverside, Miquel (544) and G. King (437) described the receptacles as axillary, but from the axils of fallen-leaf scars.

See the key separating five varieties by Corner (199b).

45. *Ficus deltoidea* Jack (Mistletoe Fig)

(Plate XXV, C1-5)

The botanical description of this species as *Ficus diversifolia* is credited to Blume (92), who apparently gave it this specific name on account of the great variation or diversity shown by individual plants of a population. Jack (414) had earlier described it under two designations: *F. ovoidea* and *F. deltoidea*. W. J. Hooker (392) also followed Jack in describing plants under these two specific names. G. King (437) stated that he "retained Blume's name for the species in preference to either of Jack's because Blume's description recognizes the dimorphousness of the plant, and covers the two forms which Jack raised to specific rank." See also, G. King (438). However, Backer (35), also Corner and Stearn (200), maintained that *F. diversifolia* Blume should be called *F. deltoidea* Jack. Corner (196) classified *F. deltoidea* in subsection *Ficus*, series *Erythrogynaeae*. The common name "Mistletoe Fig" presumably was appended because the species often grows as an epiphyte on other plants, and the thick leaves resemble those of some mistletoes. Corner (193) called it the "Rusty-leafed Bush Fig."

An excellent account of the species, its varieties, and the pollinating insect *Blastophaga quadripes* Mayr was given by Solms-Laubach (709), and was reviewed by Hemsley (363). See Warming (807). Ridley (639) reported it to be one of the most variable plants in the genus, the leaves differing even on the same bush. Van Steenis (775) discussed and illustrated this heterophyly in *F. deltoidea*, and stated that Van der Pijl (603a) could not find any regularity in its occurrence. The following varieties have been recognized: (A) *ovoidea*, with spatulate leaves, the midrib forking near the middle of the blade; (B) *deltoidea*, with leaves obovate, the midrib forked; (C) *lutescens*, with narrow-lanceolate leaves, feather-veined, the midrib not branched; and (D) *kunsteri*, a creeping or erect epiphyte, with

obovate leaves, often retuse and broad at the apex, the midrib forked. Corner (196, 199b) stated that superficially there is a bewildering diversity in plants of *F. deltoidea*, and attention to details led him to distinguish twelve varieties. Other descriptions, with illustrations, were given by Miquel (539), F. W. B. (33), Gentil (314), and Graf (324); without illustrations, by Kunth and Bouché (452-453), Miquel (542), Burkill (124), Merrill (529), and De Witt (229a). See J. G. Watson (810) for Malayan names. Griffith (342) described and illustrated it as *F. sideroxyliifolius*.

Plants of the Mistletoe Fig have long been cultivated in pots, but according to Gentil (314), are mostly limited to conservatories of "scientific establishments." However, the writer designated as F. W. B. (33) wrote: "I often wonder that the London market growers have not seized on this manageable little plant as a relief to the acres of *Ficus elastica* now grown by them. Even the growers around Paris seem to have neglected it." Further: "The delta, situated in the fork of the principal veins or nerves at the back of the leaf, has long been a puzzle to inquiring minds." PI No. 101,313 represented cuttings obtained from Paris in 1932 as *F. diversifolia*, but apparently these did not become established.

The following description of this species was made from plants growing for long years past in the conservatory of the University of California at Berkeley, and from specimens growing outdoors at Arcadia (LASCA): The plants are bushy, spreading, glabrous, bearing fruit continuously—even on small pot specimens. The twigs are slender and more or less zigzag because the terminal bud is set at an angle. The dormant buds are slender, 1.1 cm long, and tawny. The bark of the young twigs is green, soon becoming gray, with flaked-off epidermis or with partially encircling fissures.

The foliage is dimorphous, two distinct shapes often occurring on the same twig. The blades of one form are spatulate, 2.5 to 3.6 cm long by almost the same width, with a broad, rounded apex and a narrowed base. Venation is unusual for this genus: One pair of veins extends from the base close to the margin at least half the length of the blade. The midrib branches or bifurcates about 1.1 cm from the base, with a peculiar black spot or gland ("delta") at the principal forks on the underside, as mentioned by Blume (92). The blades of the other form are elliptical, broadest at the middle, and up to 10.5 cm long, narrowing gradually to the obtuse apex and acute base. The midrib is not branched, and has 5 pairs of lateral veins. In both cases, the texture is thick and rubbery. Hydathodes are prominent, appearing as white dots scattered widely over the upper surface. The leaf color is dark green above and light yellowish green or aureous below; "pale green to

khaki," according to Corner and Stearn (200). The petioles are jointed at the base of the blade, somewhat curved, and up to 1.5 cm long.

The figs are axillary and single, although some accounts state that they are geminate on wild plants. The peduncles are slender and slightly longer than the leaf petioles. The figs are glabrous, pyriform to urceolate, with a distinct neck, and are up to 0.8 cm broad and 1.1 cm long, including the neck. Their color is green at first, becoming yellow. The umbilicus is prominent for a small fig, and is about 0.2 cm across. The interior is strawberry.

Plants of *F. deltoidea* (as *diversifolia*) have recently appeared in the retail market in Los Angeles, Honolulu, and elsewhere. Even small plants are loaded with fruits that look like little green or yellowish buttons. It is well suited for espalier treatment or for a potted specimen in protected patios.

46. *Ficus microcarpa Linné (f.) (*F. retusa* Linné; *F. nitida* Thunberg)
(Laurel Fig)**

(Plate XIV, C1-2; D1-2)

Linné (474) described a species of *Ficus* as *F. retusa*, while Thunberg (755) described one as *F. nitida*. Nearly one hundred years later, Bentham (76) expressed the opinion that *F. nitida* was a synonym of *F. retusa*, and most botanists have since accepted *nitida* as a variety. The taxonomy of this species and its variety was reviewed by Mary Barrett (66), and her account should be consulted for details. However, Corner (196, 199b) classified *F. retusa* L. as *F. microcarpa* L. (f.), with synonyms and a key to the identification of ten varieties. A specimen of *F. retusa* in the Linnaean herbarium is, according to Corner, without doubt the species known as *F. truncata* Miq. But that specific name "is a later homonym, and a new name must be found for it."

(See the account of *F. truncata* in chapter XVI.) Quite remarkably, he continued: "*Ficus microcarpa* never reached Carolus Linnaeus," although the description is credited to C. Linné the younger (476). Furthermore, *F. nitida* Thunb. is properly *F. benjamina* L., according to Corner. I agree with him that "the name change is jarring," for this is one of the most widely cultivated species of the genus.

Ficus retusa was early established in the West Indies, for Hughes (400) wrote of "Garden Mangrove" trees already 12 m tall, later identified as *F. nitida* by Maycock (508). According to Standley (720), with Donde (238) as authority, it was imported into Yucatán from Cuba about 1860. Aiton (5) reported that plants of *F. nitida* were introduced into England in

* While *microcarpa* is recognized here as the specific name having "priority" on the principle of *nomen conservanda*, the text retains *retusa* in most instances because the various authors cited or quoted have employed it.—Editor

1786 by Sir Joseph Banks from the East Indies, into which area this variety may have been imported. Aiton further stated that trees of *F. retusa* were brought into England in HMS *Providence* by Rear Admiral William Bligh. See also, P. Miller (536). It was described by Miquel (539) as *Urostigma nitidum*; Miquel (544) also listed *F. nitida* as "alpha" under *F. retusa*. A writer who signed himself only as E. C. (135) told of a dwarfed plant of *F. nitida* sent to London from China when it was 200 years old. When received, it had reached a height of only 61 cm.

Sampson (665) published a report on *F. retusa* as the "Banyan or Yung Tree" of south China, also called the "Bastard Banyan" to distinguish it from the true banyan of India. Bentham and Mueller (77) gave a good description of this species, stating that its habitat extends from Australia to the East Indies and New Caledonia, northward to the Philippines and south China. According to the illustrated account by G. King (437), the various forms found in India divide themselves into two groups: (A) the typical form, *F. retusa*, with leaves inclining to be circular, very slightly apiculate, and with slightly narrowed base; and (B) the variety *nitida*, corresponding to *F. nitida* as described by Thunberg, with ovate to rhomboid-elliptic, shortly apiculate leaves which are narrowed at the base. J. D. Hooker (388) stated that all specimens from Ceylon were referable to Thunberg's *nitida*, but were variable in the shape and dimensions of their leaves. Duthie (247) wrote that *F. retusa*, when cultivated, affords an abundance of cool shade, and should be more generally used along roadsides as well as in groves. He regarded *F. nitida* as a very handsome evergreen tree, suitable for planting in gardens if sufficient space were allowed for the development of aerial roots from the lower branches. Kurz (455) described the variety *macrocarpa* as having larger leaves, and receptacles twice the size of those in the normal form of *F. retusa*. The same variety was also included under *F. nuda*, which Kurz treated as a distinct species.

Haines (352) agreed with several other authors when he distinguished between the two forms, *F. retusa* proper having leaves with an obtuse apex, and *F. nitida* having leaves tapering at both ends. Porto and Brade (609) also described and illustrated the two as distinguished from *F. benjamina*. A variety of *F. retusa* was described by Diels (231) as *papuana*, from north-eastern New Guinea, with lateral veins forming a very wide angle at the midrib, not an acute angle as in the species. Corner (193) called *F. retusa* the Malayan Banyan, found growing wild from India to New Guinea. Trees are common in Malaya, especially in swampy ground and near the ocean, often forming impenetrable thickets which smother other vegetation. He stated that village trees are mostly relics of this original native growth, preserved and venerated by the Chinese, who make offerings to them and use the aerial roots in medicine. Sata (670, with illustrations) followed King in recognizing *F. retusa* and the variety *nitida*. He noted that it is the most popular and widely distributed of all fig species, and one which is often confused with *F. indica* [*sundaica*].

In 1953, Willard Hagen, of Arcadia, California, obtained plants labeled *F. hillii* from Australia. This species was described by F. M. Bailey (39), but it has recently been identified as a form of *F. retusa*. Accounts of *F. hillii* were given by F. M. Bailey (42; 43, with illustrations of leaf and fruit), Anderson (10), Lord (478), and Corner (196). According to Anderson, the trees may be recommended for ornamental and avenue planting as well as for shade and shelter. In California, the plants (indistinguishable from those of *F. nitida*) are vigorous growers, and are promising both for pot culture and for specimens in parks or large gardens.

Personal observations on the Laurel Fig were made during a year's sojourn at Lingnan University, Canton, China, in 1934-35. Trees on the campus were typical of *F. retusa*, having leaves with the apex blunt, and sessile figs, mostly purplish black, which either swarmed with

fig insects, predators, and messmates, or contained innumerable small, fertile seeds. A good illustrated description of this same "Small-leaved Banyan" was made by E. H. Walker (793), who stated that Fuchow, capital of Fukien Province, is called the Banyan City. See also, the list of trees by Sauer (671).

I have also seen many trees of this species in Mexico, Florida, Cuba, California, and Hawaii, as recorded in Condit (181), from which account I quote the following: "The Indian Laurel, as *Ficus retusa* is commonly designated, is probably the one species of the genus most widely planted along streets and highways throughout subtropical countries. In India, south China, the Philippines, and parts of Australia, it makes a handsome tree for avenue borders. It is a very common street tree in Algiers, where Dr. Louis Trabut observed three forms, one less subject to attacks by thrips than the other two. Towns and cities of Mexico have many magnificent specimens, often five to six feet [1.5 to 1.8 m] in trunk diameter, growing from sea level to an elevation of 5,000 feet [about 1,520 m] at Guadalajara. The main highway traversing the island of Cuba is frequently lined on both sides with trees of *F. retusa* and the more drooping specimens of *F. benjamina*. In Brazil, the Indian Laurel is a tree of beautiful shape, with dense, green foliage. There, as elsewhere, it is often pruned into fantastic shapes or kept dwarf by frequent clipping of twigs."

Authorities differ as to the development of aerial roots on trees of the two forms. Mary Barrett (66) stated: "In comparison with var. *nitida*, the typical form of *Ficus retusa* has at the most only a few air roots, and usually none which form a secondary trunk." Other references to the presence of aerial roots follow. Talbot (747): "Aerial roots very numerous, like whipcord, rarely absent." Ridley (639): "A big tree with aerial roots, quite glabrous." Lyon (484): "Several varieties in Honolulu, some producing more drop roots than others." C. E. Parkinson (585): "A large, evergreen shade tree, often stem-clasping

and with numerous aerial roots." E. H. Walker (793): "An interesting feature of this tree is the profusion of aerial roots, which often grow from the trunk and branches in great numbers, hanging down like whiskers." Standley (722): "In Costa Rica, under favorable conditions, this tree often assumes the banyan form, developing aerial roots that become new trunks." Corner (193): "Malayan Banyan, an evergreen tree much resembling *F. benjamina*, but developing numerous tassels of slender aerial roots from the branches, even from the twigs, some of them developing into pillar roots."

Banyan Drive at Hilo, Hawaii, seen in 1959 and 1963, is bordered by typical trees of *F. retusa*, producing aerial roots in profusion. Trees in Mexico are of the variety *nitida*, and seldom show prominent aerial roots except in coastal locations such as San Blas, where such roots are festooned from the main branches. Judging from these accounts and observations, aerial roots are produced by trees of both *F. retusa* and its variety *nitida*, especially under favorable conditions such as atmospheric humidity.

Other accounts were given as follows, those marked by an asterisk having illustrations: Reede (624*), as Itti-arealou), W. J. Hooker (389*), Wight (826*), Voigt (782), Champion and Bentham (144), Ettinghausen (269*), Bureau (121), Beddome (73), D. Brandis (102, 103), Kurz (455), Trimen (763), G. King (438), Kanjilal (432), Miyoshi (549*), T. Cooke (189), Pope (608*), Talbot (747*), Elmer (259), E. H. Wilson (840*), Shaw (690), Kirtikar and Basu (440*), Koorders and Valetton (446*), Troup (765), Gamble (309), Merrill (524), C. E. C. Fischer (286), Mowry (561), Anderson (10), Burkill (124), Alston (8), Diels (232), Royal Palm Nursery (659), Summerhayes (743), Holdridge (380), Foster and Foster (295), Sturrock and Menninger (737), Marie Neal (572), Morton and Ledin (558), Jane Philpott (602*), Mary Barrett (68*), Riedel (641), Graf (324*), and Pancho (582). The color illustration

by Skinner (703) labeled *F. retusa* apparently represents a tree of the variety *nitida*. See Desch (226) for an account of the Laurel Fig's value for timber.

The common name Laurel Fig seems more appropriate than Indian, Spanish, Cuban, or Portuguese Laurel. Other common names for the species are Shining-leaved Fig, Small-leaved Fig, Bastard Banyan, and Chinese Banyan. The varietal name *nitida* signifies lustrous or shining surface of leaves. *Retusa* means notched, possibly in allusion to the retuse or depressed apex of some receptacles. On the other hand, *F. retusa* is often referred to as the Blunt-leaved Fig, the apex of the blade being commonly blunt or obtuse.

The fig insect *Eupristina verticillata* was described by Waterston (808) and by Grandi (335) as inhabiting the receptacles of *F. retusa* in Borneo, Sumatra, the Philippines, and China. Another insect, *Eupristina okinawensis*, was described by Ishii (413) from *F. retusa* var. *nitida* in Okinawa. See also, Grandi (336). According to F. X. Williams (836), *F. retusa*, the Chinese Banyan, is a typical strangling fig in the Philippines; the *Grandiella* wasps (pollinators of the fruits) bite and force their paths through the ostiole. Grandi (337) mentioned *Philotrypsis emeryi* as an inhabitant of the fruit in Sumatra.

Reference has been made to the early introduction of the Laurel Fig into England, the West Indies, and Yucatán. It was introduced into Santa Barbara, California, by Franceschi (299), who stated that there were once some fine specimens in the center of Los Angeles, but that these had had to give room for buildings. Trees were probably brought into Hawaii from China, giving rise to the common name Chinese Banyan. HSPA No. 1,360 represents trees in the Lyon Arboretum. Ever since the introduction of the pollinating insect, fertile seeds have been available for planting by nurserymen in Hawaii and elsewhere.

The following PI numbers represented importations into the United States: Under No. 3,213, *F. nitida* was obtained from

Algeria in 1899. Also from Algeria, *F. nitida* was introduced in 1925 under No. 63,560, with this notation: "Cuttings of the broad-leaved type which has been found far superior as a street tree here. It is called *camellia* by Dr. Trabut and *laevigata* by Dr. Melia." No. 3,220 (Algeria, 1899), labeled *F. laevigata*, was reported to be rather like the India-rubber Tree, but "It has much smaller leaves; larger, however, than those of *F. nitida*, to which it is said to be superior as a shade tree." (See *F. citrifolia*, species No. 57, for notes on *F. laevigata*.) In 1926, seeds of *F. retusa* came from Java under No. 68,859, as "a large tropical tree with aerial roots." No. 101,332 represented scions of *F. retusa* from France in 1932, and No. 118,772, seeds of *F. nitida* from Brazil in 1936, but it is doubtful if either of the last two produced plants. No. 240,075, from Sicily in 1957 as *F. magnolioides*, has been identified as *F. retusa*. Seeds under No. 304,127, received from Hong Kong in 1965 labeled *F. microcarpa*, germinated well, and young trees are being grown at Riverside.

Troup (765) regarded this as one of the hardiest species of *Ficus*, stating: "In the abnormal frost of 1905, it remained unaffected at Lahore, where other species suffered, some badly." Parker (584), however, contradicted this account by asserting: "Young trees of *F. retusa* suffer a good deal from frost at Lahore."

In California, the absence of large trees of *F. retusa* or its variety *nitida*, such as those found in Mexico (except at San Diego, Anaheim, and a few other places), is evidence that they are not so winter-hardy as the trees of *F. rubiginosa* or *F. macrophylla*. Stoutemyer (734) reported that *F. retusa* is no longer approved for planting in the colder sections of Los Angeles County. Trees of the typical *F. retusa* are rare at Orlando, Florida, while those of the variety *nitida* are more common. The latter suffered only slight injury from frost during the winter of 1958-59, while such subjects as avocado and mango showed brown and dry foliage. At Largo, Florida, however, with the temperature

down to at least 25° F., trees of *nitida* were severely injured.

Trees of the Laurel Fig growing in Mexico, south Texas, Florida, and Cuba are almost invariably infested by a species of thrips, *Gynaikothrips ficorum* Marchal, which causes the young leaves to become curled or folded and to assume a reddish-brown coloration. Watkins (809) reported that in the Antilles, thrips infestation is of normal occurrence on the leaves of *F. retusa*. In California, the first infestation by this thrips was discovered in San Diego County in 1959, apparently a natural northward spread from locations near the Mexican border. See Harper (357) for the account, and description of the insect. A thrips-resistant form of the Laurel Fig has been introduced from Algeria, but reports of its resistance in this country are of doubtful validity. Of two trees seen in Florida in 1959, one had thrips crawling over the foliage, but no leaves were curled; the other had the leaves typically infested. The foliage of an adjacent tree of *F. benjamina* showed a light infestation. This thrips does not ordinarily attack other figs, although Dammerman (222) reported it as attacking small-leaved species of *Ficus* in the Malay Archipelago.

The thrips may be partly controlled by an insecticide such as malathion, but biological control offers a more practical method. The Laurel Thrips became established in Hawaii early in 1964, and spread like wildfire. A state entomologist, Noel Krauss, sent to the Philippines in May, found an anthocorid bug preying on the thrips, and forwarded specimens. They were mass-produced, liberated in June, and many were recovered in September. Observations made since that time have indicated a more or less effective control of the thrips. Three applications a year of a systemic insecticide were reported by R. Boardman (92a) to be effective in controlling thrips in Los Angeles County.

Holdridge (380) reported that *F. nitida* would be much more commonly planted if propagation were less difficult, that rooting of cuttings was not a certain method, and that marcottage was a better one.

However, thousands of trees are being successfully propagated from cuttings of tender wood taken from mother trees. Plants grown from seed can be expected to show some variation.

The age of large trees of the Laurel Fig cannot be determined by a count of the rings seen in a cross section of the trunk. Dutton (249), for example, counted 1,000 rings on a cut stump at Oaxaca, Mexico, but found from city records that the tree had been planted only 80 years earlier. The bark of mature trees is fairly smooth, and gray. Trees of the variety *nitida* sometimes have buttresses, but not prominent ones as in *F. macrophylla*. They have an upright, dense habit of growth, and are therefore well adapted for streets and for screen or hedge planting. (Figures 32, 33, and 34, chapter IV, show good examples when used for street or school-ground planting.) The terminal, dormant buds are 1.1 cm long and glabrous. The color may be green to tawny or purplish brown, all shades sometimes being found on a single tree.

The leaves of the variety *nitida* are alternate, equilateral, up to 7.5 cm long and 4 cm broad, and elliptical, tapering to a bluntly acuminate apex and an acute base. Venation is indistinct, only the midrib being elevated below, with 1 basal pair plus 6 to 8 pairs of laterals. The texture is coriaceous, the surface glabrous and glossy above, the margins are entire, and the color is deep green. The petioles are 0.8 cm long, and slightly channeled above.

The figs are axillary, single or geminate, sessile, obovate-spherical, up to 0.8 cm in diameter, and glabrous, with white flecks widely scattered on the green surface. The umbilicus is triangular and brown. The interior is white.

The trees of *F. retusa* are distinguishable, even at some distance, by the spreading top and by the branches being inclined to droop toward the tips. They are well adapted for specimen planting in parks and large yards, for espalier treatment, or in containers; the plants can be kept within bounds by pruning. In contrast to the variety *nitida*, the leaves are broadly ovate

or broadly elliptic, with an obtuse to rounded apex and a rounded base. The sessile figs are up to 1.5 cm in diameter, light green, with greenish or corky-brown flecks. The bracts are prominent for a small fig, three in number, flaring at the base of the fruit. The umbilicus is small and triangular.

In spite of the expense involved, hundreds of trees of *F. retusa* and its variety *nitida* are being planted along streets and in cemented sidewalk areas of several cities in southern California, as detailed and illustrated in chapter IV under "Ornamental Value." Various problems arise

in this operation, principally regulation of the size of the trees in over-all spread and trunk diameter; prevention of frost damage in the colder sections; and control of injury by pests, such as thrips, on the foliage. Another problem may arise in the future, as mentioned by Clay and Hubbard (159a), who illustrated the shallow, spreading root system of *F. retusa* in Hawaii. They stated: "Man-made structures are hardly a match for powerful, vigorous trees. Walls crumble, sidewalks buckle, paving splits, and pipes clog and crack under pressures from growing root systems."

CHAPTER XI • Species 47 through 58

47. *Ficus microcarpa* Linné (f.) var. *rigo* (Bailey) Corner

(Rigo Fig)

(Plate XIII, A1-2)

Ficus rigo was first described by F. M. Bailey (40) from specimens obtained at the Kamerunga State Nursery of New Guinea, off a tree from which rubber was being obtained in the Rigo district, hence the specific and common names. According to Bailey, the species "approaches *F. retusa*, but differs in leaf venation." Diels (231), however, treated it as *F. retusa* var. *rigo*. Corner (196) first classified it as *F. microcarpa* L. (f.) var. *latifolia* (Miq.) Corner, but later (197b), gave it as *F. microcarpa* L. (f.) var. *rigo* (Bailey) Corner. Lane-Poole (457) stated that *F. rigo* is one of the best yielders of rubber in Papua and New Guinea.

An introduction of the Rigo Fig was made under PI No. 32,325 in 1911 from British New Guinea. In 1928, seeds collected by C. E. Pemberton in Papua were forwarded to Honolulu, and seedlings were grown there. From this lot, rooted trees were forwarded by the late Dr. H. L. Lyon to Washington, D.C., and were given PI No. 94,210. In 1931, trees were received in California, both from Washington and direct from Hawaii. Nehrling (575) included this species among those grown by him in Florida. In 1960, a large tree was found at the Wahiawa Botanic Garden north of Honolulu. Young trees are growing at Arcadia (LASCA) and at Riverside.

Notes taken from established trees furnish the following description: A tree in Cuba in 1949 had a trunk 60 cm in diameter, not buttressed, but with large, spreading crown roots. In 1958, a tree was found in Florida with a 91-cm trunk, not but-

tressed, but with some multiple trunks issuing from the framework branches. The chestnut-brown bark is roughened by rings formed from nodal scars. Lenticel scars appear as rough white spots on the younger branches and corky spots on older ones. The green, glabrous buds are up to 2.7 cm long, and taper to a sharp point.

The alternate, equilateral, and glabrous leaves are broadly elliptical, with a broad-rounded or obtuse apex and a narrowed or subacute base, and are up to 15 cm long and 7.5 cm broad, with entire margins. The texture is coriaceous. The midrib is greenish white and slightly raised below, but the laterals are almost or quite flush with the surface. The 1 basal pair is distinct, but the laterals vary in number, with 6 on some blades but 10 to 12 on others. The petioles are light green, up to 3.6 cm long, and are flattened and channeled above.

The figs are axillary, commonly geminate, and sessile, with a broad, cushion-like base showing three thick, protruding bracts. According to F. M. Bailey (40), there are three persistent basal bracts which are large for the size of the figs; the latter are spherical, 0.7 cm in diameter, with white flecks that are inconspicuous on the green background. The umbilicus is small, flush with the surface, and slightly tawny. The interior is white.

The Rigo Fig has no outstanding characters to recommend it, either for specimen plantings or pot culture, in competition with such species as *F. rubiginosa* or *F. macrophylla*, both of which are somewhat hardier as well.

48. *Ficus nymphaeifolia* P. Miller (Waterlily-leaf Fig)

(Plate III, B1-2)

Linné (472) wrote of a plant growing in the garden at Leiden, and used the descriptive term "*nymphaeae folio*" but later (474) gave the spelling as *nymphaeifolia*. He said that it came from America. P. Miller (536) used the word "*nymphaeaeifolia*," and coupled it with *Ficus*, noting that the species had been brought from India to Holland.

I am indebted to some unpublished notes which Mary Barrett sent in 1949 for clarification of descriptions and of the confusion as to the original habitat of this species. Lamarek and Poiret (456) declared that it grew wild in India, and had been planted at Schoenbrunn. But Hernández (372) wrote of "Amacoatic," which Cervantes (143), as well as Sesse and Mocino (688), identified as *F. nymphaeifolia*. Miquel (539) described it under *Urostigma*, and declared that it came from South America, not from the East Indies. Kunth (HBK) (450) described it as growing at Caracas, Venezuela, and stated that there was scarcely any doubt about a plant of this species collected at Caracas by Bridenmyer being the same one cultivated in the garden at Schoenbrunn. See Steele (730), Kunth (451), Kunth and Bouché (452-453), and Pittier (606). Standley (717) said that this species was to be expected in Panama, "since it occurs in Colombia." De Wolf (230) wrote of it: "*Ficus nymphaeaeifolia* is apparently a fairly common species, from Panama to the State of Amapá in Brazil, at the mouth of the Amazon. Yet the only description of this species as a living plant that I have been able to find is in Humboldt's personal narrative of his travels in the American tropics in 1799-1804." See the account and illustration by De Wolf (230) of leaf and geminate fruits; also, that of Mary Barrett (68).

Various introductions of the Waterlily-leaf Fig have been made. Nehrling (574, 575) reported that he received the type from a reliable horticultural firm in Er-

furt, Germany, in 1890. At Gotha, Florida, trees were killed to the ground by frost in February, 1895, but new sprouts later grew from the stump. Nehrling also told of "magnificent" specimens at Coconut Grove, Buena Vista, and in the garden of C. T. Simpson at Biscayne Bay (Florida), those at the last location having come originally from the National Botanic Garden in Washington. It was once grown at the New York Botanical Garden, for cuttings were received in California in 1928, but these failed to become established. Cuttings imported from Egypt in 1931 under PI No. 93,273 were accompanied by the following notation: "A tropical American tree, with erect branches and long-petioled, broadly heart-shaped leaves 8 inches [20 cm] long, resembling those of a water lily." Seeds received at Riverside from Caracas in 1947 were assigned PI No. 161,328. One plant from this lot is growing at a nursery in Santa Monica, California.

The following description has been made from trees of PI No. 161,328 growing at Miami, Florida, and from potted plants in California: The inactive buds are 4.3 cm long, glabrous, and tawny-green to pink or scarlet. The stipules are about the same length, broadly lanceolate, and pinkish. The young twigs are stout, 0.8 cm thick, short-jointed, and rusty-green, with conspicuous lenticels; the mature twigs are roughened by scars left by fallen leaves and fruit.

The alternate, equilateral leaves of the sucker growth are 10.5 to 17.2 cm long and up to 13.5 cm broad, broadly oval, the apex rounded (acute, broadly acute, rounded, or shortly acuminate, according to De Wolf, cited above), and the base deeply cordate, the sinus mostly open. Venation is prominent, the veins well elevated below, with 3 basal plus 7 lateral pairs, the latter widely spaced. Veins on the upper surface are greenish white or tinged with pink. The texture is thinly

coriaceous, the surface is glabrous, and the color is dark green above, but glaucous or very much lighter below. The petioles are up to 11.5 cm long, glabrous, and faintly channeled above. (According to Chittenden [152, per Potter], the roundish leaves are sometimes 30.5 cm long and 20 cm wide, deeply heart-shaped at the base, mucronate at the apex, with petioles up to 20 cm long.)

The figs are in axillary pairs, sessile, or with peduncles up to 0.7 cm long, globular, up to 2.5 cm in diameter, minutely puber-

ulent or glabrous, and greenish, with purple spots.

E. J. Lowe (479) included *F. nymphaeifolia* in his list of "beautiful-leaved plants" of Britain. Nehrling (574) wrote: "Among all my plants, trees, and shrubs, this noble rubber tree is one of my special favorites. It is so distinct from all its congeners, having such beautiful, round, large, glossy leaves, as shiny as if just varnished." The trees, however, are very subject to frost injury, and for outdoor planting should be placed in sheltered positions only.

49. *Ficus avi-avi* Chapelier ex Bojer (Avi-avi Fig)

(Plate XXV, A1-2)

Ficus avi-avi is indigenous to the islands of Mauritius and Madagascar, where it grows into a medium-sized tree with fissured, gray bark. The description is generally credited to Chapelier (147) from an earlier account by Bojer (94), but a still earlier description of a sterile specimen was given by Blume (92) as *F. avi-avi*. Miquel (544) referred to it as *F. avi-avi* Blume. Avi-avi is a vernacular name applied to the tree in its native habitat. Humbert (401) published a short account of it, with an illustration of the trunk and adventitious roots from large branches. See also, the account and illustration of multiple trunks by Montagnac (554).

An introduction of the Avi-avi Fig was made by the University of California at Riverside in 1953, and a few plants were propagated and distributed for trial. The following description is made from potted plants and from small, outdoor trees growing at Riverside: The vegetative parts are glabrous. The young twigs are stout, 1 cm in diameter, and green, with prominent, corky lenticels. The older twigs are gray-brown, with scurfy or creased bark. The terminal buds are green, and up to 6 cm long. The stipules are 5 cm long, thin, and greenish white.

The large, alternate leaves are equilateral, broadest toward the cordate base,

gently sloping to the less broad, obtuse apex, the larger ones 21 cm long and 17 cm broad. The basal sinus is mostly open, and is 0.7 cm wide. Venation is prominent, green or greenish white, with 2 or 3 pairs at the base plus 6 to 8 pairs of laterals. The texture is subcoriaceous; the margins are entire. The whole upper surface is conspicuously and evenly dotted with small, white hydathodes. The petioles are up to 10.5 cm long, and somewhat flattened above.

A complete description of the fruit is not available. At Arcadia (LASCA), however, two figs were found on a small tree in March, 1961. They were in the axils of fallen leaves on pubescent peduncles 0.7 cm long, which were enlarged toward the apex. The shape was spherical, the size 0.8 cm in diameter, and the surface sparsely pubescent and somewhat pebbly, owing to raised flecks. The umbilicus protruded slightly, and was bilabiate, with each lip purplish; the basal scales were not in evidence. The long-styled flowers were white.

Young plants of *F. avi-avi* look very attractive, but their adaptability to pot culture is questionable, and their value for outdoor planting still remains to be determined. Young trees at Riverside and Arcadia (LASCA) have suffered frost damage at 26° F.

50. *Ficus soldanella* Warburg (Rock Wild-fig)

(Plate VIII, A1-2; Plate XXV, B1-2)

Ficus soldanella, described by Warburg (802), was called the Rock Wild-fig by Codd (165), whose illustrated account stated that it is a species occurring on rocky knolls throughout the Kruger National Park of South Africa, rarely exceeding 4.5 m in height, with a white trunk that is usually twisted. According to a letter received from Dr. Codd in 1959, there is an illustration of this species in *Flowering Plants of Africa*, Vol. 31, Plate 1215 (1956). Other accounts have been given by Hutchinson (407, 408), Burt-Davy (131), Henkel (366), and Palmer and Pitman (581b, with a figure of one leaf). It was figured by Sim (696) under the synonym *F. picta*; also, in the *Annual of the Tree Society of South Africa*, 1964.

In 1958, seeds of *F. soldanella* received from Pretoria were shared with correspondents in California, Hawaii, Texas, and Florida. Numerous plants are being grown in pots and in outdoor locations. Trees are thriving at Arcadia (LASCA), Riverside, and Honolulu. Small plants may show a prominent, bulbous base, such as those pictured in figure 22, chapter II.

The following description is made in comparison with the accounts cited above: The terminal buds are 2 cm or more long, green, glabrous, on stout branches.

The alternate, equilateral leaves are almost orbicular, 10.5 to 21 cm long and very nearly as broad, with a broadly or abruptly acute to obtuse apex and a deeply cordate base; the sinus is closed on some blades. Venation is prominent, with the veins well elevated below. Hydathodes

(if present) few and scattered. There are 3 basal veins, the upper ones branching and extending upward to half the length of the blade; laterals green to pink or scarlet. The 3 to 6 laterals (9-nerved, according to Henkel) are forked toward the entire to undulate margins. The texture is chartaceous to subcoriaceous. The surface is glabrous above but sparsely hairy below, especially along the veins. The color is green, with veins green, or commonly pink or scarlet. The petioles are up to 15 cm long, pink, and scarcely or not at all flattened above.

The figs are borne profusely, and are single, geminate, or in threes, in the axils of leaves or in the scars of fallen leaves. They are on short peduncles or practically sessile, globular, 0.8 to 1.1 cm in diameter, glabrous, and green to an attractive dark red on the exposed side, with flecks present but obscured by the red coloration. The umbilicus is porelike and not prominent. The interior is scarlet or strawberry. (See figure 38 with description of *F. hispida*, species No. 8. Notes on the remaining kinds pictured will be found under species Nos. 24, 33, and 80.)

Small plants of the Rock Wild-fig are attractive because of the broad leaves, which are often decorated with scarlet or pink veins and have pink petioles. However, for pot culture it has the same drawback as many other species of *Ficus*: the early dropping of the lower leaves results in a bare trunk. The species awaits further trials to determine its hardiness and adaptability to various locations.

51. *Ficus wildemanniana* Warburg

(Plate XXI, B1-2)

Plants of a species of *Ficus* called to my attention at Miami, Florida, in May, 1958, were introduced from Denmark by James Vosters as ornamentals, having characters which recommended the species for pot culture. They were listed as *F. pandurac-*

formis, under which name a fig has long been grown in Europe. E. J. Lowe (479) included it in his list of "beautiful-leaved plants" grown in Great Britain. Riedel (641) recorded "*F. panduriformis*" as being offered in Europe in 1911. Reference

to the description of *F. panduriformis* Miquel showed that the introduced plants were not the same as Miquel's species. Specimens sent to Dr. Gordon P. De Wolf in 1960 were identified by him as *F. wilde-manniana*, described by Warburg (799). He wrote: "This species, *F. lyrata*, and *F. sagittifolia* are the three large-leaved members of the complex [in the Congo]. Neither one seems to be very variable in the wild." Accounts were also given by Mildbraed and Burret (535), Wildeman (828), Hutchinson (407), Lebrun (460), and Graf (324, with illustration). See also, Srivastava (716a), and comment under *F. lyrata* (species No. 17) and *F. sagittifolia* (in chapter XVI).

Plants were propagated and distributed to the trade by Mr. Vosters. Some were donated to the University of California for trial. However, propagation of the species

in Florida on a large scale was discontinued. While specimen plants are ornamental, the species seems not to have received the favorable attention of nurserymen.

Nonfruiting plants have oblong-lanceolate leaves up to 20 cm long and 11.5 cm broad, with the apex obtusely acuminate, the base cordate, and the sinus open. The texture is coriaceous. The upper surface is green and glossy, while the lower surface is much lighter in color, more or less aureous, and glabrous. The basal veins number 2 or 3 and the laterals 6 or 7, widely spaced and well elevated. The original description gives additional characters: stipules deciduous; petioles about 2.5 cm long, glabrous; receptacles sessile, subglobular, about 3 cm in diameter, glabrous; basal bracts pubescent; the ostiole small, slightly depressed.

52. *Ficus costaricana* (Liebman) Miquel (Costa Rica Fig)

Ficus costaricana, first described under *Urostigma*, was placed in the genus *Ficus* by Miquel (544). Little if any attention was paid to this species until Standley (717) described it. In this same publication, he described *F. kellermannii* as a new species from Guatemala, and stated that it is most closely related to *F. cotinifolia*, but that the latter has dull leaf blades and conspicuous involucre which are half as long as the receptacle, or even longer. Standley and Record (724-725), distinguished two species in a key, as follows:

Stipules persistent; leaves mostly obovate or obovate-oblong. . . . *F. costaricana*
Stipules early deciduous; leaves not obovate. *F. kellermannii*

However, Standley and Steyermark (726) described *F. costaricana*, with *F. kellermannii* as a synonym, and noted that ultimately the latter might be maintained as a distinct species, but did not make it obvious on what characters it could be separated.

Other descriptions were given by Standley (718, 719, 721) and De Wolf (230, with illustration).

A packet of seeds labeled *F. kellermannii* was received in 1959 from Dr. R. A. Hamilton, of the University of Hawaii. He had obtained the seeds two years earlier from Central America, and had stored them in a refrigerator. The seeds were viable, and both seeds and seedlings were distributed for trial. One lot of these seeds was assigned PI No. 262,188.

In a letter sent in May, 1960, Dr. Hamilton stated that the Salvadoran name for this species is "Amate plano," because of the horizontal branching habit of the tree. He also related an interesting legend regarding it. The people of El Salvador harbor a superstition that one should never sleep or take shelter under an "Amate" tree at night, because at the stroke of midnight a devil emerges from its top.

Young trees in Honolulu have green, glabrous twigs with prominent lenticular scars. The terminal buds are 3 cm long, green, and glabrous. Two seedling trees growing outdoors at Riverside are similar, but vary in certain characters. The twigs are silky-pubescent, while the terminal buds are puberulent and green to reddish brown.

The leaves are alternate, equilateral, entire, subcoriaceous, oval, up to 30.5 cm long and broad, with the apex obtuse and the base rounded or very shallowly subcordate. The surface is glossy and glabrous above, with hydathodes scattered between the veins or sometimes absent. The lower surface is velvety-pubescent to almost glabrous. Venation is prominent, with the veins well elevated below, showing 2 or 3 basal pairs plus 11 to 13 laterals. The petioles are stout, less than 2.5 cm up to 6.2 cm long, green, round in cross section, and puberulent when young.

53. *Ficus maxima* P. Miller

The identity and synonymy of this species have been elucidated by De Wolf (230). He stated: "The oldest legitimate name for this species, as here defined, is *Ficus maxima* Mill. There is no specimen from Miller's herbarium in the British Museum or in the Sloane collection at the Museum. Sloane's illustration is certainly not diagnostic, but the description is good and sufficiently specific, so that I have no hesitation in designating it the nomenclatural type of Miller's name, and following Fawcett and Rendle (1914) [280 of the present book] in referring it to the plant which for a century has been known as *Ficus suffocans* Griseb."

De Wolf commented further that *Ficus maxima* seems to be relatively common, from Cuba and southern Mexico to and through the Amazon basin. See also, another account by De Wolf (230c). In the rain forest of Jamaica, the trees sometimes overtop the forest canopy, as reported by Asprey and Robbins (27); and seedlings spring up on waste land left after the removal of bauxite in western Jamaica, according to Howard and Proctor (398).

The specific names listed as synonyms for *F. maxima* number thirty, and include the following which have been introduced into cultivation: *F. laurifolia* Hort. ex Lam.; *F. radula* Willd.; *F. glaucescens* Miq.; *F. mexicana* Miq.; *F. suffocans* Griseb.; and *F. subscabrida* Warb. Each is treated separately in the text that follows.

The figs are briefly described as being sessile, 1.1 cm in diameter, with the surface smooth.

(See subdivision 58 in the "Vegetative" key, chapter V.)

Grandi (329) described *Blastophaga estherae* (subgenus *Valentinella*) as inhabiting the receptacles of *F. costaricana* in Costa Rica.

The hardiness and general adaptability of this species have not been determined. It does merit careful tests in various localities as a new member of the large family of exotic figs.

Ficus laurifolia was described by Lamarck (456) from American specimens. According to Maiden (494), trees growing in the grounds of the Garden Palace, Sydney, were well named Laurel-leaved Fig, the leaves having unusually long petioles. It was also described by Vahl (773), who referred to an earlier account by Sloane as *F. indica maxima*. *Ficus laurifolia* Kunth and Bouché (452-453) is properly identified as *F. diospyrifolia*, according to the *Kew Index*. *Ficus laurifolia*, reported by Sebire (685) as abundant in the environs of Thies, Senegal, and a fine ornamental, is apparently a different species. See also, the account of species No. 24 (*F. virens*).

Ficus radula, described by Willdenow (833), was introduced from Caracas, Venezuela, under PI No. 161,333 in 1947. Accounts of the species were given by Kunth (HBK) (450), Warburg (803), Standley (717, 719, 721, 723), Standley and Steyermark (726), Uphoff (769), and Miquel (539, with illustration). Standley reported that the specific name signifies "scraper," in allusion to the rough leaves. Plants grown in California as *F. radula* failed to survive a temperature of 24° F. in 1950. Trees seen at Homestead, Florida, in 1958 had glabrous, not scabrid, leaves.

It is very questionable, then, whether *F. radula*, as such, has become established in the United States.

Ficus glaucescens, first described by Miquel (544), is widely distributed, from Sinaloa in Mexico to Guatemala and Panama, according to Standley (717). Specimen trees were growing in the hospital grounds at Ancon, Panama, in 1911. Riedel (641) stated that trees of this species are often planted in Mexico along roads or near houses for shade.

Ficus mexicana was first placed by Miquel (542a) in the subgenus *Pharmacocoyces*, as told by De Wolf (230); Miquel (544) later put it in *Ficus*. Standley (717) stated that it is one of the strangler figs, and is very abundant on the coastal plains of Tepic and southern Sinaloa.

In his key to species, Standley separated it from *F. glabrata* [*insipida*] as follows:

Lateral veins of leaf blades 14 to 21 on each side of the midrib, the surfaces glabrous, *F. glabrata*
Lateral veins 12 to 15 on each side, the surfaces usually very scabrous.

F. mexicana

Seeds collected at Alamos, Sonora, in 1947 and again in 1951 produced seedlings which did not thrive at Arcadia (LASCA). In 1951, they suffered slight frost damage at 26° F.

Ficus suffocans was described by Grisebach (344) from Jamaican specimens. There the trees reach 30 m in height and the trunk 1.2 m in diameter, with prominent buttresses. Warburg (803) gave an account of it, and Rossberg (654) reported the species as widespread in Jamaica, Santo Domingo, Haiti [Hispaniola], and Cuba. A short description was also given by Acuña and Roig (3).

Ficus subscabrida was named by Warburg (803), apparently because of the scabrous character of the lower leaf surface. He expressed the opinion that *F. subscabrida* might be the same as *F. radula* A. Richard (not Willdenow), an opinion shared by Acuña and Roig. It was illustrated and described by Marie-Victorin and Leon (499) as a strangler.

PI No. 88,114 represents an introduction of *F. subscabrida* from Cuba in 1930,

with the following note: "A wide-spreading Cuban tree, reaching a height of 60 to 70 feet and a spread of 80 feet or more. [Approximately 18.5 to 21.5 m; 25 m.] The leaves are very similar to those of *F. elastica* in shape and thickness, but smaller. The fruit is eaten by pigs, bats, and other animals and birds." Seedlings grown in California became infested by nematodes, and were destroyed. According to HSPA Nos. 6,456 and 6,612, seeds of *F. subscabrida* (PI No. 88,114) were introduced into Hawaii in 1930, and seedlings became established in the Lyon Arboretum in two or three locations. One of these trees, planted in 1934, was seen in 1959 and again in 1960, and found to be 15 m tall, with a single trunk 27 cm in diameter, without aerial roots.

In 1949, a tree of *F. subscabrida* was found growing in the natural forest at the Atkins Garden of Harvard University in Cienfuegos, Cuba, and notes were taken of it. The following account has been made from these notes and from those made in Hawaii, in comparison with the other accounts cited: The Hawaiian tree shows thick buttresses from the base of its trunk. The young twigs are green for one or two nodes only, becoming light brown, the surface scurfy, with rough lenticel scars. The mature bark of the native tree is mottled, its gray color alternating with patches resembling lichens, appearing as if oiled or wetted. The terminal buds are 3 cm long, slender, lanceolate, glabrous, and green.

The alternate, equilateral leaves are up to 17.2 cm long and 8.6 cm broad, oval or elliptical, the apex rounded and obtuse, and the base rounded or subacute. The venation is prominent, the veins well elevated below, with 1 pair basal plus 9 to 12 pairs of laterals. The texture is coriaceous, the margins are entire and slightly revolute, the upper surface is glabrous, and the lower surface is puberulent or scabrid on the veins. The petioles are long, commonly arcuate, rusty-brown, but sharply delineated from the green coloration at the base of the blade or midrib.

No figs were found on trees studied by myself, but good herbarium specimens,

with fruit, have been furnished by Dr. J. B. Acuña, Havana. The figs are solitary and spherical, 1.1 cm or more in diameter, on a slender peduncle 1.1 cm long.

In comparison with the foregoing description, the following characters of *F. maxima* are added, as given by De Wolf (230): Leaves are 2.5 to 12 cm wide and 6 to 24 cm long, glabrous above, glabrous or puberulent beneath (although given in

the key as almost always scabrid); lateral veins 5 to 16 pairs; petioles 0.5 to 4.0 cm long; figs 1.0 to 2.5 cm in diameter, borne on a peduncle up to 2.5 cm long; umbilicus small, flat, or bracts outflexed.

Trees of *F. maxima* appear to be of slow growth in California, and are probably tender to cold. They have no special characters to recommend them for ornamental planting.

54. *Ficus hauili* Blanco (Hauili Fig)

(Plate XVIII, B1-2)

Ficus hauili, described by Blanco (88), was regarded by the late E. D. Merrill as the Philippine representative of *F. septica* Burman (f.). Merrill (516) treated the Hauili Fig as a distinct species, but stated that it had been reduced to *F. leucopleura* Blume, which is a synonym of *F. leucantatoma* Poiret. Several other accounts of *F. hauili* from 1906 to 1923 were given by Merrill. For example, in his *Flora of Manila* (519), he described the receptacles as "axillary, solitary, depressed-globose or turbinate, obscurely ridged or angled." Elmer also gave several accounts (256, 257, 263), and reported it to be the most widely distributed fig in the archipelago, frequently found growing in yards and fields as a shade tree. Corner (199b) treated *F. hauili* under *F. septica*, which see as our species No. 12.

This species was included by Elmer (263) in the section *Axillares* (A: *Glabratae*). The specific name is also one of the common names, so it seems appropriate to call it the Hauili Fig. See also, the accounts by W. H. Brown (116), Sata (670), and Quisumbing (615). Sata stated that it is very closely allied to the Formosan *F. septica* Burman (f.), from which it is distinguished by the narrower leaves, with their bases more or less gradually narrowed, and cuneate. Grandi (334) described *Ceratosolen jucundus* as inhabiting the fruits of *F. hauili* in the Philippines. See also, Wiebes (824c) for an account of this fig insect.

There seems to be no record of the establishment of this species designated as

F. hauili on the United States mainland. PI No. 3,447 represented an introduction of *F. leucantatoma* from Sicily in 1899. Two lots of seeds were received at Riverside in 1957, one from the Philippines under PI No. 237,169, the other from Formosa, but no plants were secured. However, rooted plants labeled *F. ruficaulis* were received from L. W. Bryan, Hilo, Hawaii, in 1948. A specimen sent to the late E. D. Merrill at the Arnold Arboretum, Jamaica Plain, Massachusetts, was identified by him as *F. hauili*, with this comment: "I am by no means sure that the Philippine species can be separated from the much older *Ficus leucantatoma*. I suspect that it is only a form of the latter." Sata (670) treated *F. ruficaulis* as a distinct species, belonging to the subgenus *Eumetamorphae*.

Trees of the Hauili Fig planted in the Lyon Arboretum, Honolulu, in 1928 had reached a large size by 1960, and the following description has been mainly developed from notes taken on them: One specimen has a trunk almost 1 m in diameter, and is 16.7 m high, with a crown spread of 13.6 m. No aerial roots are present, nor are the buttresses very prominent. The bark is mostly smooth, and mottled with dark to light-gray patches resembling lichens. The dormant buds are 3 cm long, slender, tapering to a sharp point, glabrous, and green; some are slightly tinged with scarlet. The twigs are short-jointed, green at first and somewhat pubescent, becoming rusty, with lenticel scars mostly near the nodes. In common with

several other species, the terminal buds project from the leaf axils at an acute angle with the twig, which therefore appears zigzag.

The leaves are alternate and equilateral (in some cases, slightly inequilateral at the base), 12.6 to 22.7 cm long and up to 8.6 cm broad, oval, with the apex bluntly acute to cuspidate and the base narrowly or broadly acute. Venation is prominent, the veins slightly elevated below, with 1 or 2 basal pairs plus 8 to 12 pairs of laterals. The texture is chartaceous, the surface glabrous and glossy, and the margins entire. Hydathodes are sparsely scattered over the upper surface. The petioles are 1.1 to 2.5 cm long, green at first, becoming rusty, with scurfy rings, and slightly flattened and channeled above.

The figs are geminate, or may be solitary, according to Quisumbing (615). They are borne in the leaf axils on pe-

duncles up to 0.7 cm long, and are globular, with a very short neck (or may be oblate, without a neck). The size is 1.5 cm in diameter, but slightly less from base to apex. The surface is prominently ribbed, glabrous, with sparsely scattered, rusty-brown flecks. The color is green at first, becoming flushed with pink or red to chocolate-brown at maturity. The umbilicus is prominent and sunken, with green scales. The interior is white.

In its native habitat, *F. hauili* was described by W. H. Brown (116) as an erect shrub or small tree, 3 to 8 m high. The much larger trees in the Lyon Arboretum appear to have more promising ornamental qualities than those of the closely related *F. septica*. The Hauili Fig is well worthy of trial, both as a pot plant and for outdoor planting on the mainland. Its frost-hardiness still remains to be determined.

55. *Ficus urbaniana* Warburg

(Plate XII, A1-2)

Ficus urbaniana was described by Warburg (803) from St. Croix and other islands of the Lesser Antilles. A brief account was given by Boldingh (95). Britton and Wilson (109) stated that the trees are occasionally planted on St. Croix. According to Standley (719): "A tree, perhaps of this species, is planted in Balboa [Canal Zone], near the Administration Building." See also, the accounts by Rossberg (654) and Standley (723). Also, Dugand (244) wrote of it as follows: "*Ficus involuta* (Liebm.) Miq., var. *urbaniana* (Warb.) Dugand, comb. nov. It extends from the Lesser Antilles and Venezuela to Peru." Little and Wadsworth (476a) classified *F. urbaniana* as a synonym of *F. obtusifolia* HBK (our species No. 78, which see), and reported it as native, as well as planted, on St. Croix. De Wolf (230) treated *F. involuta* as a synonym of *F. obtusifolia*, but omitted *F. urbaniana*.

Seeds received from Caracas, Venezuela, in 1947 were assigned PI No. 161,335. Young plants under a lath shelter at Riverside were severely injured in 1950 by a

temperature of 25° F. Outdoor plants at Miami (PIS) and at Homestead, Florida, were also found in 1958 to have been damaged by the previous winter's cold.

In their native habitat, the trees reach a medium or large size, and have thick branches. Young plants under cultivation have terminal buds about 2.5 cm long, glabrous, and green to brown. The twigs are 0.8 cm thick, glabrous, becoming gray, with somewhat shreddy bark, and prominent leaf and lenticular scars.

The alternate, equilateral leaves are up to 20 cm long and 12.6 cm broad, broadly ovate to obovate, with a rounded, bluntly obtuse apex and rounded or subacute base. Venation is prominent, the midrib flanked by 1 pair of basal veins plus 4 to 6 pairs of laterals. Tertiary veins are also prominent, with fine reticulations. The texture is subcoriaceous, the surfaces glabrous, and the margins entire. The stout petioles are 2.5 to 5 cm long, flattened and slightly channeled above.

According to the foregoing accounts, the axillary figs are either sessile or shortly

pedunculate, usually geminate, subglobose, up to 2.5 cm in diameter, finely pubescent or nearly glabrous, with a large and prominent umbilicus. The basal bracts of the receptacle are conspicuous, and about 1.1 cm broad.

Ficus urbaniana is a tropical species, and young trees have suffered severely from frost in both California and Florida. Therefore, it cannot be recommended for planting except in frost-free or protected localities.

56. *Ficus ovata* Vahl (Ovate-leaved Fig)

(Plate XII, C1-2)

Ficus ovata is a species described by Vahl (773) from Guinea, having leaves "ovato-oblongis." Therefore, it seems appropriate to call this the Ovate-leaved Fig. According to Holland (382) and Hutchinson and Dalziel (410), the trees of *F. ovata* are often epiphytic at first, and have a wide range, from Nigeria to the former Belgian Congo and east Africa. *Ficus johnstonii*, described and illustrated by Stapf (727) as a new species from Liberia, is regarded to be the same as *F. ovata*. Other accounts were given by Brunner (119), Schwabe (681, with illustration), Mildbraed and Burret (535), Hutchinson (407), Broun and Massey (110), Aubréville (29, with illustration), Dalziel (221), Lebrun and Boutique (462), F. W. Andrews (14), and Schnell (677a). In Ghana, trees are commonly planted for shade or used for fences, according to Irvine (412). Lebrun (460, 461) listed a variety as *octomelifolia* Mildbraed and Burret.

Scions of *F. ovata*, introduced from France in 1932 under PI No. 101,323, apparently failed to grow. Trees have long been growing in California at Santa Barbara, on the former Bard Estate at Hue-neme, and in the city park at Oxnard, but their source has not been determined. The species belongs to the subgenus *Bibracteatae*, section *Axillares*. Because of the large, broad leaves, the tree may be mistaken for that of *F. platyphylla*. (See *F. umbellata*, species No. 18.)

In California, the trees develop trunks up to 45.5 cm in diameter, with fairly prominent buttresses but no aerial roots. The dormant buds are up to 3.6 cm long,

glabrous, and chestnut-brown to scarlet. The stipules are lanceolate, glabrous, and scarlet on the outer side. The young twigs are green, soon becoming gray, with prominent, longitudinal lenticels. The new growth is green.

The alternate, equilateral leaves are 15 to 25 cm long and 7.5 to 10.5 cm broad, and oval, with a bluntly acute or shortly acuminate apex and a rounded or shallowly subcordate base. Venation is prominent, the veins being elevated above and especially so below, with 2 or 3 basal pairs plus 8 to 12 pairs of laterals. The surface is glabrous, the margins are entire or somewhat undulate, and the texture is thinly coriaceous. The petioles vary in length, from 5 to 12.5 cm (sometimes as long as the blade), and are slightly channeled above.

The figs somewhat resemble those of *F. involucreta* (species No. 38) in having an involucre which sheathes from half to two-thirds of the body. They are axillary, commonly geminate and sessile, spherical (or somewhat compressed laterally), and 1.8 cm in diameter. The surface is glabrous, glossy, and decorated with greenish-white flecks, which are also prominent on the involucre. The mature color is maroon or mahogany-brown. The umbilicus is depressed, with a nipple in the center, and with reddish-brown scales. The interior is white.

In Nigeria, trees of *F. ovata* form a broad crown, are easily grown from stakes, and are often planted for shade. The success of this species in California warrants further trial as an ornamental in localities other than those mentioned.

57. *Ficus citrifolia* P. Miller (Short-leaved Fig)

(Plate XXIV, D1-2)

In his *Gardener's and Botanist's Dictionary*, Philip Miller (536) described *Ficus citrifolia* under his No. 10. The type specimen is in the British Museum, and consists of a twig with two leaves and a peduncle with the remnants of a fig. De Wolf (230) stated: "There is no doubt that it represents this common lowland fig of the West Indies." He wrote further: "*Ficus citrifolia* is a species which ranges from Florida to Paraguay. Though there seems to be little direct evidence, I presume that this is frequently a species of disturbed habitats. Specimens from relatively high altitudes (600-1,700 m) in the Greater Antilles, Venezuela, and Colombia [*F. populoides*] may represent a different taxon, though present information suggests they are only ecological forms. . . . The leaf shape is generally ovate, with the base rounded and/or more or less emarginate. The leaf bases vary from round to emarginate on the same twig."

In his account of *F. citrifolia*, De Wolf listed twenty-nine botanical names as synonyms, including *F. pedunculata* Dryand, *F. populnea* Willd., *F. laevigata* Vahl, *F. lentiginosa* Vahl, *F. eximia* Schott, *F. pyriformis* Desl., *F. populoides* Warb., *F. brevifolia* Nutt., and *F. hemsleyana* Stand.

A short account of each kind is given here, with the exception of *F. populnea*, which is treated more fully at the end of this account.

Ficus pedunculata Dryand (Jonas Carlsson Dryander) was designated "Willow-leaved" by P. Miller (536) under No. 7. Grisebach (344) described it as a common tree in Jamaica, where it is called "Jamaica Cherry." Cook and Collins (187) reported that this species was originally described from St. Christopher, but is found also in other parts of the West Indies. It becomes a large tree, with oblong leaves 7.5 cm long and small, globose, red figs.

Ficus laevigata, described by Vahl (773), was reduced by Warburg (803) to *F. populnea* Willd. Accounts of it as *F. laevigata* were given by Rossberg (654), Acuña and Roig (3), Holdridge (380, with illustration), and Little and Wadsworth (476a).

Ficus lentiginosa, described by Vahl (773), was described later by Grisebach (344). It was given the local Puerto Rican name "Jaquay" by Cook and Collins (187). These authors published a fine illustration of leaf and fruits, and stated that the figs are light green, spotted dull red, and are much larger than those of *F. pedunculata*. Both species are planted along roads for shade. The description by Standley (717) was based on Mexican specimens, apparently from a tree cultivated at Acapulco. He gave *F. populnea lentiginosa* of Warburg (803) as a synonym. Britton (107) referred to *F. lentiginosa* as a native tree in Bermuda, with many aerial roots, erroneously known there as "banyan."

Ficus eximia Schott. In 1946, a packet of seeds labeled *F. eximia* var. *glabra* was received from the Jardín Botánico, Asunción, Paraguay. The seeds germinated well, and numerous plants were grown for distribution. The species was described by Schott (678), and the variety by Hassler (360), after Miquel (539), as *Urostigma glabrum*. An illustrated description of the species as *F. eximium* was given by Miquel (543). Trees are growing near Santa Ana, California.

Ficus pyriformis was described by Defontaines (228). According to the *Kew Index*, this equals *F. fontanesii*. N. Taylor (750) stated that it might be *F. benjamina*, *F. fontanesii*, or *F. rubra*. The Yokohama Nursery Company once listed it in their catalogue. Riedel (641) referred to a tree labeled *F. pyriformis* (possibly *F. pyriformis*) growing at the former Bard Estate, Hueneme, California. This was an erroneous identification, as

determined by a personal visit in 1936 and by a map of the grounds which is still in my possession. (See also, the note under *F. erecta*, species No. 58.)

Ficus populoides Warburg. In 1949, I found a tree labeled *F. populoides* at the Atkins Garden, Cienfuegos, Cuba. It had apparently grown from seeds of a native tree, for the figs were insect-inhabited. Planted in 1928, this specimen had a trunk 25 cm in diameter, with no buttresses or aerial roots. According to Warburg (803), this species is related to *F. populnea*, but differs in its thick, broad, and commonly larger leaves and by having its receptacles on shorter peduncles. Two other accounts of *F. populoides* were given by Rossberg (654), with a long list of localities, and by Acuña and Roig (3), who gave *F. lentiginosa* Grisebach (not Vahl) as a synonym. PI No. 155,217 represented an introduction from Cuba in 1946.

Ficus brevifolia was described and later illustrated in color by Nuttall (579), and the common name Short-leaved Fig became attached to the species. Nehrling (574, 575) called it the Poplar-leaved Rubber Tree because the leaves are shaped much like those of some poplars. Britton (106) stated that trees of *F. brevifolia* are sometimes "parasitic" like those of *F. aurea*, but that its entire later career is usually terrestrial. Other accounts were given by Sargent (669, with illustration), Small (704), Britton and Millspaugh (108), and Mowry (561); the last three without illustrations.

Ficus hemsleyana was described by Standley (717) in honor of the botanist W. B. Hemsley. However, De Wolf (230) stated: "Standley published this name as a substitute for the epithet *verrucosa* of Liebman. Standley apparently did not see the type, for the material that he has cited which I have seen represents a form of *F. citrifolia*." *Ficus hemsleyana* King from Borneo is distinct from Standley's species considered here. The type specimens of *F. hemsleyana* were from Nicaragua, but the native habitat ranges throughout Central America to Panama.

Dugand (244) gave a brief account of this species, while Standley and Steyermark (726) reported it as growing mostly in the lowlands, but also ascending to 1,200 m in Guatemala. See also, Yuncker (851). Grandi (329) described *Blastophaga tonduzi* (in the subgenus *Valentinella*) from receptacles of the Hemsley Fig collected in Costa Rica. A natural seedling obtained from Summit, Canal Zone, in 1947 grew in a pot at Riverside for a while, but did not become established.

Ficus populnea. According to Britton and Wilson (109), *F. populnea* consists of "numerous races, differing in size of foliage and fruits and in length of peduncle." It has therefore been given various specific names. Britton and Wilson treated it as *F. laevigata* Vahl, with a list of eighteen other specific names and variety combinations. The description by Willdenow (832) as *F. populnea* apparently preceded that by Vahl (773) as *F. laevigata*. Trees of *F. populnea* are common in southern Florida, but not so numerous as those of the other indigenous species, *F. aurea*. They are also found at low elevations in Puerto Rico, Cuba, and the Lesser Antilles.

In his excellent account, *The Florida Strangling Figs*, Bessey (79) reported that both native species, *F. aurea* and *F. populnea*, may exhibit the epiphytic habit when young (the latter only rarely), and added that he had observed *F. populnea* only once as an epiphyte, upon an oak tree. The trees do develop aerial roots, especially in open places, as related and illustrated by Simpson (697-698). On one tree, some slender roots "had glued themselves to the trunk." An old native looked at the tree and, according to Simpson, dryly remarked: "They ain't no game a-goin' that critter cain't play at."

Accounts of *F. populnea* have been written by Sargent (668, with illustration); and by Miquel (539), Grisebach (344), Eggers (252), Warburg (803), and Fawcett and Rendle (280); the last five without illustrations.

The following PI numbers show introductions from various places, entered

under other specific names: No. 3,220 from Algeria in 1899 as *F. laevigata* (noted also under *F. microcarpa*, species No. 46); No. 98,849 from Martinique and No. 98,850 from the British Virgin Islands, both in 1932 as *F. laevigata*; Nos. 107,135 and 107,136 from British Guiana, both in 1934 as *F. laevigata*; and No. 221,182 from Florida in 1954 as *F. brevifolia*.

See also, the key under *F. perforata*, species No. 41; and the comment under *F. brittonii* in chapter XVI.

Both native and cultivated trees have been observed personally in Cuba, southern Florida, and Hawaii. Plants introduced into California either did not become established or were considered to be of very little ornamental value. Some were found to be infected with leaf mosaic, caused by a virus. The fig insect and accompanying mesmates or parasites which swarm out of the receptacles of *F. populnea* in Florida have apparently not been specifically identified. However, a gall midge (*Ficomysia birdi*) was described by Felt (282) from the fruits.

A comparative study of individual seedling trees of *F. populnea*, growing along the old Tamiami Trail west of Miami, was made by me in May, 1958. The trees could not be distinguished at a distance from those of *F. aurea*, which were also growing at the roadside, but were easily identified at close range by leaf and especially by fruit characters. These variations were noted: Color of terminal bud green, tawny, or maroon; leaf blade 7.5 to 11.6 cm long and 4.3 to 6.8 cm broad; apex obtuse or bluntly acute; base rounded to slightly subcordate; hydathodes lacking, or only a few scattered ones; lateral pairs of veins 5 to

8; diameter of receptacle 0.7 to 2.3 cm; length of peduncle 0.4 to 2.3 cm.

Following is a general description of trees observed in Cuba and Florida: The trees have a few aerial roots, produced from the lower branches or trunk; the twigs are glabrous, silvery gray at first, becoming dark gray; terminal buds are green to reddish brown, 1.1 cm long.

The alternate, equilateral leaves are up to 12.6 cm long and 4.8 cm broad, oval, the apex obtuse or bluntly acuminate, the base rounded, and the margins entire. The midrib is well elevated, but the 1 or 2 basal and 6 to 8 lateral pairs of veins are flush with the lower surface. The texture is thinly coriaceous, and the surface is glabrous above and below. The petioles are slender, and 3.6 to 10.5 cm long.

The axillary figs, mostly geminate, are borne on slender peduncles up to 1.5 cm long. They are 1.1 cm in diameter, scarlet when mature, spherical or turbinate, and glabrous, sometimes lacking prominent markings but more often with white or reddish-brown flecks scattered over the surface, especially on the upper half of the body. In some specimens, the white flecks are slightly raised, so that the surface is papillate. The umbilicus is prominent, protruding from the apex, nipple-like, and pink. The interior is white.

Nehrling (575) regarded *F. populnea* as a handsome, evergreen tree, more open in growth than trees of *F. aurea*, "excellent for planting along highways, and even as an avenue tree in cities." It is often grown as a shade tree in the Bahamas. However, other species of *Ficus* are much more favored for ornamental planting along streets and in parks or gardens, and apparently no plants are being propagated for sale by nurseries.

58. *Ficus erecta* Thunberg

(Plate XIII, C1-2)

The specific name of this fig leads one to the supposition that the tree is unusually erect. However, it is generally described as a bush or small tree, and the few plants growing in California are low, spreading shrubs even after many years of growth. It was described by Thunberg (755), and is generally assigned to the subgenus *Eusyce*. Corner (196, 199b) classified it in the section *Ficus*, series *Podosyceae*. Other descriptions, with illustrations, were given by G. King (437), J. D. Hooker (387, with color plate), and Sata (670); without illustrations, by Thunberg (756), Vahl (773), P. Miller (536), Hooker and Arnott (394), Miquel (540), Benthams (76), Forbes and Hemsley (290), D. Brandis (103), Clercq (162), Rehder and Wilson (628), and Steward (733). Steward stated that the Chinese name for this species, with its edible figs, means "Heavenly-fairy Fruit."

Ficus erecta, widely distributed in parts of China, Japan, and Taiwan, is variable in habit of growth and in leaf and fruit characters. Both King and Corner recognized two varieties which are distinguished in the following key:

Variety *sieboldii*. Leaves elongated, lanceolate; receptacles much constricted at the base.

Variety *beecheiana*. Young branches hispid-pilose; leaves almost tomentose on lower surface; receptacles shortly hispid, not constricted at the base.

Ficus erecta has long been established in California. In 1926, and again in 1927, seeds were received from Japan as PI No. 67.135, and many seedlings were grown, both at Berkeley and at Chico. In 1936, one small, bushy plant was found at the former Bard Estate, Hueneme, California, incorrectly labeled *F. pyriformis*. (See also, the note under *F. citrifolia*, species No. 57.) In 1940, some trees 2.5 m high were growing at the Huntington Botanical Garden, San Marino, California, but

they could hardly be called ornamental. Another plant has been growing in Hillside Park, Santa Barbara, California, for many years, but it is still bushy and only one meter tall. Seeds of *F. beecheiana* were received from Foochow, China, in 1949, but all failed to germinate. It was reported to be growing on hillsides as small trees 4.5 m or more tall, with fruits abundant throughout the year. PI No. 48,710 was listed as *F. beecheiana* from China in 1919. Both *F. erecta* and *F. beecheiana* were included by Sauer (671) in a list of plants growing on the campus of Lingnan University, Canton, and in the vicinity. See the account by Chou and Li (154) on the food value of the edible fruit; also, Dunn and Tutcher (245) for localities.

Bushes of *F. erecta* are deciduous in California, and are therefore resistant to injury by temperatures several degrees below freezing. They are precocious, producing figs even on young seedlings. The roots are susceptible to infestation by root-knot nematodes, and the foliage is also subject to leaf mosaic caused by a virus. Grandi (332) described *Blastophaga nipponica* from the receptacles of *Ficus erecta* in Japan.

Plants of this species growing in California apparently belong to the variety *beecheiana*, as illustrated and described by King. The gray-barked stems, several from the ground, have buds 1.1 cm long, glabrous, and green to somewhat reddish. The stipules are lanceolate, reddish brown, and slightly pubescent along the margins.

The alternate, equilateral leaves, 5 to 17 cm long and up to 7.5 cm broad, are lanceolate, with the apex gradually tapering to an acute tip and the base rounded or slightly subcordate. Venation is fairly prominent, especially below, with 1 basal pair plus 6 to 8 pairs of laterals. The margins are entire, the texture thin or membranous, and the surface smooth to somewhat scabrid above (when young,

pubescent on the veins below). Hydathodes are densely scattered over the upper surface. The blades are green, but often show reddish coloration on the veins below. The petioles are slender, up to 2.5 cm long, and slightly pubescent.

The figs, axillary and solitary on slender peduncles 1.1 cm long, are spherical or somewhat urn-shaped, up to 0.8 cm in diameter, with a short, thick neck. The surface is very sparsely pubescent on young fruits to almost glabrous when ma-

ture, with prominent, white flecks on the green to reddish-brown (or even scarlet) background. The umbilicus is prominent, usually protruding, and is bordered with reddish-brown scales with light, scarios margins. The interior is white.

The deciduous shrubs or small trees of *F. erecta* are of no value for ornamental planting. Sata (670) regarded *F. beecheyana* as having no outstanding merit for garden use, although plants are often seen in yards at Taipei, Taiwan.

59. *Ficus rubiginosa* Desfontaines ex Ventenat (Rusty-leaved Fig)

(Plate XV, C1-2; D1-2)

The Rusty-leaved Fig, a native of Australia, was named *Ficus rubiginosa* by Desfontaines (227), but without an adequate description. A year later, Ventenat (778) described the species in detail, with a good illustration, and cited Desfontaines as author of the specific name. Later, Desfontaines (228) credited Ventenat as the author. The taxonomy of this species and of some synonyms has been well covered by Mary Barrett (62). *Ficus ferruginea* Hort., as reported by W. J. Hooker (390), equals *F. rubiginosa*. Corner (199b) treated it as *F. ferruginea* Desf. Riedel (641) stated that a species was offered in European catalogues in 1911 as *F. ferruginea*. Willdenow (833, 834), who cited *F. rubiginosa* as a synonym of *F. ferruginea*, gave New Holland as its habitat, but his description was probably made from plants growing in the Berlin Botanic Garden. According to Aiton (5), *F. australis* was introduced into England in 1789 by Sir Joseph Banks under the common name Botany Bay Fig. In Florida, it was regarded by Simpson (699) as a fine species which sends out numerous aerial roots and has its leaves covered with a rusty pubescence. A short account, with illustration, was published by Bonstedt (96). See also, Moore (555). However, Corner and Stearn (200) gave it as *F. australis* Hort. non Willd., and stated: "Under this illegitimate name, there is cultivated a fig with glabrous young growth and glabrous, rotund, or broadly ovate leaf blades, up to about 3.5 inches [9 cm] long and 2.5 inches [6.4 cm] broad. Origin uncertain." The account of *F. rubiginosa* by W. J. Hooker (390) gave *F. australis* as a synonym. Corner (199b) also listed *F. australis* Willd. under *F. rubiginosa*.

A variegated form, *F. rubiginosa* "variegata," has long been grown, but in a

small way only, mostly as a pot plant. Proof that this form is only a bud sport or variant is afforded by the fact that plants of "variegata" frequently show whole branches with green leaves typical of *F. rubiginosa*. Sargeant (666) gave an account of this variant in Australasia as "*F. australis* variegata." See also, P. Fischer (287). A variety designated as *glabrescens* was described and illustrated by F. M. Bailey (43) as having leaves smaller than those of the species and nearly or quite glabrous.

Three more or less distinct types of *F. rubiginosa* are commonly found growing in California and as isolated specimens elsewhere. The first, *F. rubiginosa* var. *rubiginosa*, has a dense head of branches with pubescence on the twigs and a prominent, rubiginous scurf (which is easily rubbed off) on the lower surfaces of the leaves. The second, which I designate as the variety *pubescens*, shows a very conspicuous pubescence on the twigs and leaves, the latter having a decided purplish hue while immature. The third, *F. australis* Hort., lacks the conspicuous pubescence of the other two. Some California nurseries have been marketing trees for many years labeled *F. microphylla*. The trees now bordering the main or Hilgard Avenue entrance to the UCLA campus were originally purchased from a local nursery under this name, but have proved to be typical specimens of *F. rubiginosa*. (*Ficus microphylla* is briefly treated in chapter XVI under "Additional Species," with some further data.)

Illustrations of *F. rubiginosa* were given in color by Ventenat (778) and W. J. Hooker (390). However, Hooker's is of doubtful validity because the leaves and fruit shown are more typical of *F. macrophylla* than of *F. rubiginosa*. Guilfoyle (346), Maiden (495), Lyon (484),

Mowry (561), Audas (31), McMinn and Maino (490), Jane Philpott (602), and Graf (324), all gave black-and-white illustrations, either of tree or leaf. Other accounts, in addition to those already cited, were published by Smith (707), Bentham and Mueller (77), Maiden (492), Mueller (563), James (418), Veitch (777), F. M. Bailey (42), Lyon (485), Francis (300), Anderson (10), Royal Palm Nursery (659), Nehrling (574, 575), Marie Neal (572), Parodi (588), and Corner (199b).

According to Grandi (336), the fig insect *Pleistodontes imperialis* was described by S. S. Saunders (675) as an inhabitant of the receptacles of *F. rubiginosa* in New South Wales. See also, Froggatt (304) and Wiebes (824d) for accounts of this insect. It was introduced into Hawaii in 1920, and soon became established in the fruits of local trees; fertile seeds have been produced in large quantities ever since. See Timberlake (757a), and chapter II of the present work under "Fig Insects." Fortunately, however, seedlings are much less common on walls or trees than are those of *F. microcarpa* or its variety *nitida*, and are consequently less likely to become weeds.

The following introductions have been made and assigned PI numbers: No. 1,298 from Sydney in 1898; No. 3,455 from Sicily in 1899; Nos. 15,693 and 33,104 from Sydney in 1905 and 1911; No. 37,141 from Brisbane in 1914; No. 90,711 from New South Wales in 1930; and No. 101,333 as scions from France in 1932. Some earlier importations were evidently made, for Riedel (641) stated that plants were exhibited in San Francisco in 1870, and in 1900 were offered for sale by Dr. C. F. Franceschi at Santa Barbara, California. See also, Butterfield (133). Nehrling (575) reported having seen a specimen 4.5 m high in a conservatory in Chicago in 1893, from which he obtained a plant for his place at Gotha, Florida. Unfortunately, this small plant was killed by frost in 1895. Common names other than Rusty-leaved Fig are Rusty, Port Jackson, Small-leaved, and Botany Bay Fig.



Fig. 43. Plants of *Ficus rubiginosa* grow into fine specimens, as shown by this tree on the grounds of the Veterans Administration Center at West Los Angeles. The tree shown is the variety *pubescens*.

(Photo by Dennis Kucera.)

Seedlings of the introductions just mentioned have been widely distributed, and mature trees with fruit are commonly found in California, Hawaii, Texas, and Florida. The following extracts from various accounts show characters of interest to gardeners. James (418): "A most useful tree for shade purposes; of compact habit; can be clipped to any shape." W. T. Swingle, with PI No. 3,455: "It produces splendid masses of evergreen foliage, and in spite of its irregular manner of growth, should be tested in the South and in Arizona and California." Lyon (484): "An Australian fig of promise, and possibly more serviceable than *F. macrophylla*, thriving in the driest situations in Australia." Anderson (10): "A handsome species, distinguished by the rusty-hairy surface on the underside of leaves." Royal Palm Nursery (659): "A rather compact tree, of medium size, quite useful as a trimmed subject or as a large shrub." Nehrling (575): "One of the hardiest of all the rubber trees, and one of the best for street and highway planting." The resinous exudation from the trees of this species was described at length by both Maiden (492) and Mueller (563).

It is apparent, from the foregoing accounts of the different types or forms found in cultivation, that this species is a variable one. An especially variable character is the presence or absence of aerial roots. Bentham and Mueller (77)

stated that trees in New South Wales "are of considerable size, with spreading branches, throwing out woody roots which descend to the ground, forming pillars as in the Indian Banyan tree." Seldom do cultivated trees show multiple trunks. They do commonly have aerial roots, but these vary considerably in abundance and development. An exceptional case is a tree in Balboa Park, San Diego, California, adjacent to the roque (croquet) court, from the branches of which hang innumerable aerial roots, their tips usually drying out before they reach the ground.

Because of its comparative hardiness, dense habit of growth, evergreen foliage, and ability to withstand periods of drought, the Rusty-leaved Fig is worthy of more widespread planting as an ornamental (figure 43). The use of one or more types on the campuses of the University of Hawaii, Honolulu, and of UCLA, Los Angeles, is a good demonstration of its value for landscaping (figures 44, 45). These trees can be planted on grounds of limited area, and kept within bounds by more or less severe pruning.

The following description is made from trees and specimens studied in various places in comparison with the accounts cited above: The trees reach a large size; two in south Florida have trunks 75 cm in diameter and are up to 12 m high, with aerial roots clasp[ing] the lower parts of



Fig. 45. *Ficus rubiginosa* is an outstanding subject for street planting, as indicated by this specimen growing at the University of California, Los Angeles.

(Photo by Dennis Kucera.)

the trunk. Buttresses are sometimes present, but not conspicuous. The bark is dark gray, fairly smooth, but somewhat roughened by narrow, broken rings of a lighter gray than the bark itself; also, by longitudinal creases. The young twigs are scurfy-pubescent, short-jointed, and often angular or somewhat flattened. The terminal dormant buds are 2.5 to 5 cm long, densely rusty-pubescent, colored reddish brown. The stipules are up to 12.6 cm long, one longer than the other, lanceolate, scurrious on margins, glabrous within, but pubescent on the outer side.

The alternate, equilateral leaves are 7.5 to 17.2 cm long and up to 6.2 cm broad, oval, with the apex bluntly obtuse and the base broad and rounded. Venation is indistinct in some leaves but fairly prominent in others, the veins below very slightly elevated or almost flush with the surface, with 1 or 2 basal pairs plus 8 to 12 laterals. The texture is coriaceous, the margins entire, the surface prominently rubiginous above and below when young, the upper surface becoming more or less smooth and glabrous with age. The petioles are up to 4.3 cm long, sparsely pubescent at first,



Fig. 44. Several specimens of *Ficus rubiginosa* are found on the campus of the University of Hawaii. The compact habit of growth is highly attractive.

(Photo by Dr. R. A. Hamilton.)

rusty at maturity, slightly flattened above but hardly at all grooved.

The trees commonly bear the axillary, geminate fruits profusely, those on different trees varying considerably in size, shape, and surface characters. The peduncles are 0.2 to 0.8 cm long, angular, thick, and clublike, enlarged or swollen toward the apex, and densely pubescent. Sizes vary from 1.1 to 1.5 cm in diameter, shapes from globular to oblate-spherical

or slightly oblong, and color from green or rusty to yellowish. The surface also varies, from rusty-pubescent or scurfy to almost smooth, with prominent, greenish or white flecks loosely scattered, these often somewhat raised or pebbly. The bracts are very early deciduous. The umbilicus is small, flush with the apex or very slightly protruding and nipple-like, with indistinct, reddish-brown scales. The interior is white.

60. *Ficus archeri* Standley (Archer Fig)

(Plate XXXI, C1-2)

The Archer Fig, *Ficus archeri*, was described by Standley (723) from specimens collected in Colombia, with this notation: "Leaves are distinctive in shape and venation, and remarkable for their thick texture and lustrous surface." Two years earlier, in 1935, the species was introduced into the United States from Colombia under PI No. 111,595, and trees became established in both Florida and Cuba. Plants have grown in California since 1937, and distributed to various localities for trial. Three of four young trees in a nursery row at Riverside were killed during the winter of 1949-50 by temperatures down to 24° F. The fourth tree, protected by cornstalks, survived, but its branch tips were badly frozen.

The following description has been made from trees studied in Florida, Cuba, and California, in comparison with the original account by Standley: The trees show no aerial roots. The thick branches, with short internodes, have gray, puberulent bark. The terminal buds are lanceolate, up to 3.1 cm long, glabrous or slightly puberulent, and green to pinkish.

The leaves are alternate, equilateral, and up to 15 cm long and 6.2 cm broad. The shape is oblong-elliptical to obovate, with a rounded or bluntly acuminate apex and

a rounded base. Both surfaces are glabrous, except on veins below. The upper surface is glossy and green, while the lower one is a paler green. The margins are entire. The texture is thick and rubbery. Venation is fairly prominent, with the midrib well elevated but the laterals flush with the surface below. One pair of veins is basal; there are 7 to 12 pairs of laterals, ascending at a broad angle toward the margin. The petioles are up to 3.6 cm long, green, and puberulent when young.

The figs are axillary, commonly geminate, and sessile, and are borne profusely, even on small potted plants. They are about 1.1 cm in diameter, globose, glabrous, and green, with a few scattered brown flecks. The basal bracts are prominent, forming a thickened pad at the base of the fruit. The umbilicus is prominent, with dark-brown scales. The interior is scarlet or pink.

Ficus archeri makes a good showing as a potted plant for patios or near windows indoors. It has distinct possibilities as a specimen tree, in common with *F. watkinsiana* and *F. rubiginosa* (species Nos. 29 and 59). The 1957 edition of the *Catalogue Guide of Eden Park Conservatory, Cincinnati*, listed "*F. elastica archeri*," the Archer Fig, of unknown origin.

61. *Ficus ribes* Reinwardt ex Blume (Gooseberry or Currant Fig)

(Plate XV, B1-3)

Blume (92) described this species as *Ficus ribes* (Herb. Rwdt.). Miquel (539) described and illustrated *Covellia microcarpa* as a new species, but in later accounts (542, 544) he classified it as a synonym of *F. ribes* in the subgenus *Covellia*. Elmer (263) placed it in his section 3—*Tuberculatae* (*T. longifrutescens*), without description.

Corner (197, 199b) classified this species in the subgenus *Ficus*, subsection *Sycocarpus* Miq., series *Longituberculatae* Sata. In his illustrated account, G. King (437) reported it as indigenous to Java, Sumatra, Singapore, New Guinea, and the Philippines. Other accounts, with illustrations, were given by Engler (265, flowers only), Raciborski (617), Koorders (443), Koorders and Valetton (446), Kirtikar and Basu (440), and De Witt (229a); without illustrations, by Kurz (455), G. King (438), Merrill (517, 524), D. Brandis (103), Clercq (162), and Sata (670). Solms-Laubach (709) described this dioecious species in comparison with *F. carica*. Wettstein (821) figured the mode of its fruiting as an example of cauliflory, with the clusters of receptacles resembling those of currants. The common name Gooseberry or Currant Fig therefore seems appropriate. See J. G. Watson (810) for Malayan names.

As related by Grandi (336), *Ceratosolen crassitarsus* was described by Mayr (509) as an inhabitant of the receptacles of *F. ribes* in Java and Singapore. Grandi (337) mentioned *Philotrypesis minuta* Mayr as also inhabiting the figs in Java. See the account by Wiebes (824c) of *Ceratosolen crassitarsus* Mayr and of *C. gracilis* sp. nov. as inhabiting the fruits of this species in Java and the Philippines.

Two introductions of *F. ribes* are recorded, one in 1920 via Honolulu as PI No. 50,397, another in 1928 from Manila as No. 77,659. However, no plants were found growing in Cuba or Florida when I visited those areas in 1949 and 1958.

The plants may be propagated readily by cuttings. Small plants at Arcadia (LASCA) and at Riverside have suffered severe frost damage. According to Setyodiwiryo (689), it is being grown at Bogor.

Fruiting trees were found in the Lyon Arboretum, Honolulu, in 1959 and 1960, and the following notes are based on those specimens: The small trees have a shrubby habit of growth, with a thicket of sprouts from the base and from fruiting branches which grow along the ground, take root, and produce leaves. There are no aerial roots. The slender terminal buds are 0.8 to 1.5 cm long, glabrous, green or pinkish, and somewhat flattened or angular. The twigs are green for a few nodes only, becoming rusty-brown and scurfy, the epidermis cracking in rings.

The alternate leaves are slightly inequilateral, 6.2 to 13.7 cm long and up to 5 cm broad, lanceolate, often somewhat falcate, as G. King (437) reported, with one side more rounded than the other. The apex is sharply acuminate, the base subacute, and the margin subentire to slightly undulate or broadly crenate. Venation is prominent, the veins fairly well elevated below, the basal pair very short and indistinct, the laterals from 9 to 12 pairs. The texture is chartaceous, the upper surface glabrous, the lower surface slightly pubescent on veins, with hydathodes widely sprinkled between the veins above. The petioles are 0.7 to 1.1 cm long, arcuate, silky-pubescent when young, but soon becoming rusty and scurfy.

The figs are borne profusely, and are single, geminate, or often in clusters of 3 to 6 on long, forked branches from the base of the trunk or from the larger limbs. The slender peduncles are up to 0.8 cm long, scurfy or pubescent, somewhat angular or flattened, and slightly swollen at the apex. The shape is turbinate to subglobose, with or without a short neck, and the size small, 0.7 cm or less in diameter. The green surface is short-pubescent, often

strongly ribbed at the apex, as King stated, and decorated with sparsely scattered, slightly raised, rusty flecks. The basal bracts are very short, green, and triangular. The umbilicus is prominent for such a small fig, and flush with the

surface; the scales are green. The interior is white.

Plants of *F. ribes* have little value as ornamentals, but should be added to collections in warm locations because of their cauliflorous and prolific fruiting habit.

62. *Ficus petiolaris* HBK (Petiolate Fig)

(Plate XV, A1-2)

Kunth (HBK) (450) described *Ficus petiolaris* as having "*foliis longissime petiolatis*." It therefore seems appropriate to apply the common name Petiolate Fig to the species. Miquel (539) described it as *Urostigma petiolare* and S. Watson (812) as *Ficus jaliscana*, the latter from specimens collected near Guadalajara by Pringle. According to Standley (717): "Trees of *F. petiolaris* are abundant all along the western coast of Mexico, growing on dry slopes, often on the face of cliffs. It is perhaps the most distinct of all the Mexican species, being strongly marked by the tufts of long, white hairs on the lower surface of the leaves, as well as by the leaf outline." Possibly the northernmost locality is that given by Shreve (694): Cañón Higuera, west of Moctezuma, Sonora.

As mentioned in chapter IV under "Paper and Cloth," *F. petiolaris* is one of the Mexican species utilized for paper making. Accounts of such use were given by Von Hagen (784), Christensen (154a), and Hunter (403). According to Riedel (641), the trees also yield a commercial rubber gum (Texcalama), which is very elastic and adhesive, and is used by Mexican surgeons for treating bones, hernia, etc. Uphoff (769) also mentioned this property, and added that the aerial roots may provide cables for suspension bridges. See the short illustrated description by Graf (324).

At least two introductions of the Petiolate Fig have been made by horticulturists in Florida. Dr. Henry Nehrling grew it from seed, and praised it highly. Mulford Foster had a tree growing on his place at Orlando, but transferred it to Miami, where it was seen growing vigorously in

1958 on the grounds of the Jennings Estate on the Old Cutler Road.

During the course of various trips to Mexico from 1947 to 1960, I have found trees of *F. petiolaris* growing on rocky cliffs, on dry slopes, and in deep, river-bottom soils from Sonora to Chiapas. Seeds collected in Mexico in 1947 for distribution were given PI Nos. 161,330 and 161,331.

Some seedlings have been found growing in Florida, south Texas, California, and Hawaii.

The trees naturally vary in size from small to large, according to the terrain in which they grow. The habit is generally upright, with a single trunk, or with many suckers or sprouts from the base. The bark is greenish yellow and scurfy or scaly. Buttresses are not present, or are hardly noticeable, and aerial roots are not produced. The terminal buds are 1.8 to 3.6 cm long, glabrous, and green or pinkish. The thin stipules are broad at the base, tapering to a sharp point, and 2.5 to 5 cm long. The twigs are green to gray, glabrous, with longitudinal lenticels.

The alternate, equilateral leaves are orbicular, or practically so, 5 to 15 cm wide and almost the same in length; the apex is rounded and abruptly short-apiculate, and the base is cordate; the sinus is deep and narrow, with the lobes sometimes overlapping. Venation is prominent, with 2 to 4 pairs of veins at the apex of the petiole plus 5 or 6 laterals, the veins often pink or scarlet, especially above. The texture is chartaceous, the margins are entire and commonly undulate, and the surface is glabrous, except for tufts of white hairs in the axils of the basal veins below, and sometimes above. The petioles are slender,

7.5 to 10.5 cm long, glabrous on some plants but silky-pubescent when young on others, becoming glabrous at maturity; they are pink on the upper surface.

The figs are axillary and geminate, on peduncles which vary considerably on individual trees, from 0.7 cm long and stout to 2.5 cm or more and slender. The shape is globular, obovate, or somewhat oblate; the surface is green and slightly pubescent, with prominent pink or white flecks; the size is 0.7 to 1.1 cm in diameter; umbilicus nipple-like; interior white.

63. *Ficus sycomorus* Linné (Sycamore)

(Plate XXXII, A1-3)

The name Sycamore is derived from two Greek words, "sykon," fig, and "moron," mulberry, hence the species is sometimes called the Mulberry Fig. It is also known as Pharaoh's Fig. Its original habitat was probably the Arabian peninsula, but in ancient times it spread to Egypt and neighboring countries; also, north into Palestine and Syria. The Sycamore was one of the sacred trees of Arabia and Egypt, and is figured on the walls of a temple at Karnak as dedicated to Hathor, the cow-headed goddess of love and social merriment, approximately equivalent to the Greek Aphrodite. See E. and J. Lehner (462a).

The Bible alludes to the Sycamore several times. The prophet Amos gave his occupation as a dresser of Sycamore trees and Zacchaeus climbed into one to watch the crowd pass by.

The tree bears an edible fruit in leafless clusters issuing from the trunk and larger branches. According to Aaronsohn (1), the quantity yielded by each tree is simply incredible. In arid regions, the figs, which are tolerably rich in sugar, are an excellent food, not only for livestock but for human beings as well. Aaronsohn added that the fruit is inferior, but is greedily eaten by the Bedouins. According to Grandi (336), the fruits are inhabited by a wasp, *Sycophaga sycomori* (*crassipes*) Linné, whose presence is essential to the natural development of the fig itself. Also,

The lower leaves borne by seedlings of *F. petiolaris* are early deciduous, which makes them unsuitable for pot culture, although small specimens with scarlet-veined leaves are very attractive. They resemble superficially the South African *F. soldanella*. Young plants are known to be susceptible to frost injury, but the hardiness of older trees has not been determined.

Young potted plants sometimes develop bulbous bases, as shown in figure 22, chapter II.

Ceratosolen arabicus was described by Mayr (510) from the figs in Yemen and Eritrea. In order to render them edible, "dressers" (in Egypt, but not in Israel) treat the young figs with a special material which causes them to mature in four or five days. This maturity may be caused by the release of hormones which stimulate parthenocarpic development of the syconium. See Henslow (370); also, under *F. auriculata*, species No. 104.

The wood of the Sycamore is hard and durable, and has been used since ancient times for well sweeps (shadoofs), coffins, and many other purposes. In the Bulak Museum, Cairo, there is a statue carved from Sycamore wood which is recognized as one of the most ancient wood carvings in existence; it is estimated to be at least 5,000 years old.

In Egypt and some other countries, the Sycamore is a successful and widely planted tree. Brown and Walsingham (114) stated: "Nothing is more picturesque than an avenue of Sycamores, and as a shade tree in rural districts it is unsurpassed; but the great spread of its branches makes it objectionable in situations where it is in close proximity to cultivated land." It can hardly be recommended generally as an ornamental or useful tree, but should be a good specimen tree for botanical gardens, parks, and large estates in warm localities. According to Schroeder (679), the oldest Sycamore



Fig. 46. This fine example of *Ficus sycamorus* is thriving and bearing figs in considerable quantities at Arcadia (LASCA). (Photo by Dennis Kucera.)

tree in Europe at the time of writing (1935) was in the Parque Santelmo near the Alcázar in Seville.

The species was described by Linné (473) as *Ficus sycamorus*, and as *Sycamorus antiquorum* Gasp. by Miquel (539, 541). For accounts of it, with illustrations, see the following: J. Parkinson (586), Joannis Loureiro (478a), Henslow (369), Blomfield (90), Fiori (284, 285), Engler and Prude (267), Mary Barrett (64), Codd (165), F. W. Andrews (14), Palmer and Pitman (581b, leaves only), Graf (324), and De Witt (229a); without illustrations, by Raffeneau-Delile (621), Tristram (764), Schweinfurth (683), Dowling (240), Goldmann (322), C. Henry (367), Muschler (568), Hutchinson (407, 408), Tihamer (757), Burt-Davy (131), Henkel (366), Lebrun (460), Lebrun and Boutique (462), and Dale and Greenway (218). See also, the list of references, with illustration, in Stapf's *Index Londinensis* (728). A bulletin on *F. sycamorus* was published in Israel by Carmin (139), with special emphasis on insect pests.

The following introductions have been made by the United States Department of Agriculture: PI No. 7,011 from Algeria in 1901; No. 13,138, labeled "Africa," in 1905; while the next sequence came from Egypt, as No. 25,094 in 1909; No. 37,729 in 1914; Nos. 39,827, 39,857, 39,858, 40,984, and 40,985 in 1915; and No. 44,708

in 1917. The final two listed are PI No. 100,469 from Palestine in 1932 and No. 206,504 from Israel in 1953. Cuttings of the Sycamore, sent to the late G. P. Rixford, San Francisco, in 1914 and distributed by him in California, failed to take root. Trees have become established in Florida and California, either from cuttings or as nursery plants. Nehrling (575) reported that many fine specimens could be seen in Miami, Florida, and vicinity in 1910. Several large trees have long been growing and bearing profusely at the Plant Introduction Station (PIS), Miami. Fairchild (274) told of a Sycamore which grew so fast that it became the real shade of the Station. The profuse fruit crop borne by the tree constitutes one serious objection to it as an ornamental, for the dropped fruits, if not removed, accumulate around the trunk in a fermenting mound. One tree 6 m tall was situated by the gate leading into the service yard of Lincoln Park Conservatory, Los Angeles, for several years before 1950. The tree had to be removed, but plants propagated from it were distributed. One tree is growing and bearing fruit at Arcadia (LASCA) in a section partly devoted to Bible plants (figure 46; also, figure 4, page 10).

The tree of *F. sycamorus* is subject to injury by light frosts, and is therefore not found in the hill country of Israel. The divine wrath against the Ephraimites is thus expressed in Psalms 78:47: "He destroyed their vines with hail, and their sycamore trees with frost." The tree just mentioned, growing at Lincoln Park, Los Angeles, was frozen back severely at least twice, but suckers from the trunk renewed the top. Successful growth of this species can be obtained only in the warmest and most frost-free locations; however, the trees will recover if not too seriously injured.

The Sycamore is generally regarded as an evergreen tree, but may be deciduous for a short period. Burt-Davy (131) called it a deciduous tree. According to Blomfield (90), the trees are evergreen in their native habitats, "Nubia and Abyssinia" (more recently, northeastern Sudan

and Ethiopia), but are often leafless for a month or two in Egypt in February and March. In Florida, the trees do not defoliate completely in the spring, but do have their foliage greatly reduced.

In its natural habitats, the species is very drought-resistant, grows to a considerable size, and reaches a venerable old age. In Yemen, seedling trees grow spontaneously, but in Egypt and Palestine, the tree is reproduced by cuttings of well-matured wood. Two methods are used: One is to plant pieces of branches 7.5 to 15 cm long in the ground, leaving only the tip exposed. Another way is to propagate cuttings in a nursery and transplant them at the end of one season to the desired location. Experience at Riverside has shown that herbaceous cuttings of the Sycamore taken from potted plants do not root so readily as those from other species of *Ficus*.

At Miami (PIS), Sycamore trees have trunks up to 75 cm in diameter, with buttresses fairly large and prominent. The bark is tawny-yellow, the outer bark flaking off in large scales. There are no aerial roots. The latex is white at the first exudation, but soon becomes yellow with exposure, and stains yellow. The twigs are brown, with prominent lenticels. Their surface is glabrous, or nearly so, except at the nodes, which are usually prominently tufted with a ring of white, silky hairs. The green terminal buds are plump, 1.1 cm long, 0.6 cm thick at the base, and silky-pubescent.

The leaves are alternate, equilateral, and broadly ovate, up to 15 cm long and 13.5

cm broad, with a blunt, rounded apex and a cordate base. The basal sinus is mostly open, but is sometimes nearly closed. Venation is prominent, the midrib flanked by 1 conspicuous pair of basal veins and 2 minor pairs, the former ones up to three-fourths the length of the blade. There are 3 to 5 lateral pairs. The texture is subcoriaceous and somewhat harsh, and the surface is deep green above, but lighter below. The blade is glabrous and rather glossy above but slightly pubescent below, especially on the veins. The margins are entire and more or less undulate. The petioles, up to 5.6 cm long, are sparsely silky-pubescent, and brown, but abruptly changing to green at the midrib. The leaves shrivel rapidly when detached.

The fruits are borne on framework limbs and trunk in dense, branched, leafless clusters, singly or in pairs, on slender peduncles which are up to 2.3 cm long and often prominently curved, with white pubescence. The figs are spherical or slightly oblate, up to 2.5 cm long and broad, without prominent markings, the surface covered with a white, velvety tomentum. The three basal bracts are prominent, triangular, and broadly flaring. The umbilicus is greenish, with scales slightly protruding. The interior is white.

At least five varieties of the Sycamore are recognized in Israel: Balami, Bouti, Gazi, Esali, and Ibrahimi. The Balami is considered the best for fresh fruit, and is also dried for later consumption.

See the account of *F. mallotocarpa*, species No. 94, for brief comment on its similarity to *F. sycomorus*.

64. *Ficus cotinifolia* HBK (Cotinus-leaved Fig)

(Plate XVI, B1-2)

The Mexican species, *Ficus cotinifolia*, subgenus *Urostigma*, was first described by Kunth (HBK) (450) from specimens collected by Bonpland near Acapulco. A good account of the species and its systematic status was given by Standley (717), who stated that it ranges nearly throughout all Mexico, and naturally exhibits great variation. Standley (720), also

Standley and Steyermark (726), reported that the leaves and branches are much used in Yucatán as fodder for horses and mules, and that the latex may become an adulterant for chicle. The inner bark of this and certain other species has been used for paper making since ancient times. See the accounts by Von Hagen (784) and Christensen (154a). According to Gentry

(316), the "Nacapuli" is one of the most common figs of Sonora, and the small, dry figs are occasionally eaten, especially by children. The resemblance of the leaves to those of certain species of *Cotinus* (Anacardiaceae) accounts for the name.

Trees of *F. cotinifolia* are growing in California and Florida from seeds collected at Álamos and at Guadalajara, Mexico, in 1947. One lot of seeds was assigned PI No. 159,445, and a second lot No. 161,325. A tree numbered PIS 8,512 at Miami, Florida, appears to be of this species. An earlier Mexican introduction was made under PI No. 20,869 in 1907. California plants have been found to be typical of the species in vegetative characters.

In Mexico, *F. cotinifolia* often starts life as an epiphyte and later becomes a strangler, as illustrated by Gentry (316). He further stated that the tree is deciduous or partly so in the dry season, even when adjacent to running water. The trunks of trees near Álamos sometimes show prominent buttresses. The branches produce aerial roots, which may become attached to the ground and form multiple trunks. The young twigs are densely pubescent, becoming glabrous and gray to rusty with age. The terminal buds are 0.7 to 1.1 cm long, and are densely pubescent with white, silky hairs. The stipules are up to 1.3 cm long, acute, and sericeous outside.

The alternate, equilateral leaves, varying from small to 15 or 17 cm long and 8.5 to 15 cm broad, are short-oval to rounded-oblong, or often almost orbicular. The apex is rounded and obtuse, and the

base is rounded or subcordate to cordate, with a narrow sinus. Venation is prominent, especially below, with 1 to 3 basals and 5 to 7 laterals, these ascending at an angle of 45 degrees. The texture is subcoriaceous, the margins are entire, and the surface is almost glabrous, somewhat scabrous above but villous below, or with only scattered white hairs along the veins. The petioles are 2.5 to 5 cm long, light green to rusty-scurfy, and slightly (or not at all) channeled above.

The axillary, sessile, and mostly geminate figs are enclosed for one-half to two-thirds of their length by large, conspicuous involucre. The size is 0.5 to 1.1 cm in diameter, the shape is globose or slightly oblate, and the surface is sparsely puberulent when young to glabrate at maturity, green, with numerous reddish-brown flecks. The umbilicus is small, hardly prominent, and closed by truncate, brown scales.

In California, trees of this species are deciduous for a long period in winter, or for a short one even in summer, and are not promising as ornamentals. One specimen at Riverside bore fruit profusely in midwinter when less than a year old. A tree at Weslaco, Texas, was regarded in 1958 as being distinctly ornamental at certain periods of the year, but was frozen to the ground in the winter of 1962-63. Young trees in California are very slow in growth, and have also suffered severely from frost. Young potted plants may develop bulbous bases, as shown in figure 22, chapter II.

65. *Ficus benghalensis* Linné (Banyan Fig)

(Plate XVI, A1-2; C1-2)

The common name of this species, designated *Ficus benghalensis* by Linné (473), was given to it by the British in allusion to the banyans, or banians, traders of India who used the space under the spreading branches of the tree for a market place. The spelling "*benghalensis*" used by Linné was regarded as an orthographic error by Mary Barrett (59), but was maintained by Corner (196). See also, the his-

torical account by Mary Barrett (63). The trees are especially noted for their abundance of aerial roots, which come into contact with the ground and form props or multiple trunks. John Evelyn (270) gave a picturesque description of the method by which "it propagates itself into a vast forest (if not hindered) by shooting up, and then letting a kind of gummy string to fall and drivel [*sic*] from its

branches, which takes root in the ground again, and in this process spreads a vast circuit." Drury (243) also told about these branches, which increase from year to year, "forming a vast assemblage of pillarlike stems," and quoted the following lines from Milton, but without credit:

"Branching so broad and long that in the ground
The bending twigs take root, and daughters
grow

About the mother tree, a pillared shade,
High over-arched with echoing walks between."

The banyan habit is not restricted to *F. bengalensis*, for many other species of *Ficus* also have prop roots, including *F. elastica*, *F. pertusa*, and *F. altissima*.

For the confusion which has existed between *F. bengalensis* and *F. indica*, see the account of the latter (which I treat in this book as *F. sundaica*, species No. 31). Nehrling (574) had both kinds in his garden in Florida, and regarded them as distinct species. *Ficus bengalensis* may also be confused with *F. altissima*, as I have observed in some Florida gardens. For differentiation of the two species, see G. King (437) and Mary Barrett (59). Corner (196, 199b) reduced *F. indica* to *F. benghalensis*, and classified it in the section *Conosycca*, series *Indicae*. For *F. indica* as given by King, Corner has substituted *F. sundaica* Blume.

Banyan trees are found growing "wild" over an extensive area of India and neighboring countries, but whether such trees are indigenous is not readily determined. According to Yule and Burnell (850), it is a sacred tree, and native workers object to cutting it, even though it is an "obnoxious epiphyte" in some forests. (For some interesting details regarding this veneration of "sacred trees," see the account of *F. religiosa*, species No. 20.) Yule and Burnell also stated that the wood is generally of little value, but is durable under water and is therefore used for well curbs. The prop roots are used for tent poles and yokes. The bark yields a coarse fiber which is used for rope-making. The broad leaves are used as plates; they are also commonly cut for use as fodder for elephants. Milton, in his *Paradise Lost*,

referred to these leaves as the ones which furnished aprons for Adam and Eve in the Garden of Eden. For various uses, see Talbot (746, 747).

Van Steenis (775), on the authority of De Witt (229a), thus referred to the army of Alexander the Great in the Punjab of India in 330 B.C.: "They came across the Banyan Tree, and their notes enabled Theophrastus to write his excellent account of the great tree which sheltered an army under its boughs." According to a writer in *The Field*, June 5, 1948: "The oldest tree in the world is at the confluence of the Ganges and the Jumna at Pryag. It is called Akshaya Bata, or the banyan tree, and it is 5,000 years old." (On authority of the Nepalese Ambassador.) See also, Gamble (309) for references to large banyan trees and their value, and Corner (199a) for the record of an immense tree in the Andhra Valley. The Northwestern Life Insurance Company figures a banyan tree on its stationery, and states: "We grow like the Banyan Tree, which is our official emblem, ever renewed by the fresh strength of new roots."

Ficus bengalensis was introduced into England in 1690 by the Earl of Portland, and was cultivated in the Royal Garden at Hampton Court in 1692. See Steele (730) and Aiton (5). Banyan trees grow luxuriantly in south Florida, but are not so common as trees of the False Banyan or Lofty Fig, *F. altissima*. According to the Federal Writers' Project (281), a large banyan tree at Dania, Florida, was so attractive to a tourist that he offered \$2,000,000 for it with the proviso that it be transplanted to his place in the North and that it would survive the winter! The few trees found in southern California seldom reach a large size. They grow vigorously for a few years, but are badly injured by severe frosty weather. However, one tree on the grounds of the State School for Boys at Whittier has thrived, and displays a trunk 45 cm in diameter and a top 9 m high. Other trees are found in Elysian Park, Los Angeles; in City Park, Redondo; and younger ones at various other localities, including Arcadia (LASCA).

Numerous trees of the Banyan Fig have been planted in Hawaii, the oldest at Lahaina, Maui, in 1873. Wilder (830) stated that Albert Jaeger planted the two large trees on Beretania Street, corner of Punahou. Several trees are growing in Ala Moana Park, some with aerial roots drooping profusely from the large branches. A plaque has been placed on one tree at Waikiki bearing the following lines, written by Robert Louis Stevenson when Princess Kaiulani was absent in Europe:

"Her islands here in southern sun
Shall mourn their Kaiulani gone,
And I, in her dear banyan shade,
Look vainly for my little maid."

The Banyan Fig tree is resistant to drought but not to frost, as just mentioned. Troup (765) stated that severe frosts damage the leaves, but recovery is rapid, as was learned after the abnormally cold season of 1905 in northern India. Reference is made in chapter IV, under "Pests and Diseases," to infestation by scale insects with the resulting growth of a black fungus on banyan trees in Hawaii. In California, the roots of some plants have become infested with nematodes which cause root knot. Occasional trees show a leaf mosaic similar to that found on the Common Fig.

Grandi (337) mentioned *Philotrypesis transiens* Walker as an inhabitant of the receptacles in India, and *Eupristina masoni* Saunders as the pollinating insect. Joseph (425, 427) also described *Philotrypesis travancoricus* and *Indothymus crenulatus* from the fruits. In addition, *Terastiozoon keralensis* Jos. has been listed in connection with *F. bengalensis*.

Several introductions of *F. bengalensis* have been made, under the following PI numbers: No. 26,173 from India as seeds in 1909, No. 39,113 from India in 1914, No. 98,394 from Cairo as cuttings in 1932, No. 101,311 from Paris as scions in 1932, and No. 116,511 from India as seeds in 1936. Cuttings were received at Riverside from Balboa Park, San Diego, California, in 1928, and three plants from the New York Botanical Garden in 1930, but no plants became established.

Accounts of the Banyan Fig are numerous. G. Watt (815) published a long list of references to it, and told about the uses of the tree for paper, medicine, fodder, and wood. See Stapf (728) for a list of illustrations. The following accounts may be cited: with illustrations, J. Forbes (292), G. King (437), Pope (608), Koorders and Valetton (446), Bose (98), Corner (193), McCann (487, in color), Cowen (204, in color), Lucita Wait (790), Worthington (849), Graf (324), Manjunath (497a), and De Witt (229a); accounts without illustrations, by Joannis Loureiro (478a), Desfontaines (227), Miquel (539), Ventenat (778), D. Brandis (102), G. King (438), Hole (381), Duthie (247), H. Collett (167), C. E. C. Fischer (286), and Lewis (469). See an account of the chemical examination of the fruit by Reinherz (629).

The following description is based on notes taken in Florida in 1949 and 1958 and in Hawaii in 1959 and 1960 after comparison with the accounts of others: The tree has surface roots and buttressed trunk, the smooth, light-gray bark becoming furrowed and scaly. Aerial roots are numerous, forming many multiple or secondary trunks in warm, humid climates (figure 47). The twigs are 1.1 cm thick, pubescent, and gray, becoming somewhat scurfy with age. The terminal buds are plump, 3.1 cm long, attenuate, pubescent, and reddish brown. The new foliage is an attractive bronze.

The alternate, entire leaves are equilateral, 15 to 25 cm long and 12 to 17 cm broad, ovate, with the apex blunt or very obtusely acuminate and the base rounded, truncate, or subcordate. Venation is prominent below, the midrib flanked by 2 or 3 pairs of basal veins plus 5 to 7 pairs of laterals. The texture is stiff and leathery. The lower surface of the blade is usually velvety-pubescent to the touch (or almost glabrous), the pubescence visible to the naked eye on veins only. The upper surface is green, dull or somewhat glossy, and commonly puberulent. The petioles are up to 7.5 cm long, pubescent, and slightly flattened above.



Fig. 47. This true Banyan, *Ficus bengalensis*, is an attractive feature on the grounds of the Edison Home at Fort Myers. (Photo by A. J. Basinger.)

The figs are axillary, geminate, sessile, oblate-spherical, 1.3 cm in diameter, and scarlet, with indistinct white flecks scattered over the pubescent surface. The three basal bracts are conspicuous and yellowish. The umbilicus is prominent, with the center depressed. The interior is strawberry.

Ficus bengalensis var. *krishnae*. De Candolle (137, 138) described *F. krishnae* as a new species, growing in a botanical garden at Calcutta. The leaves were peculiarly cup-shaped at the base. This abnormal form is known botanically as a hypoascidium, such as that found in pitcher plants. Worsdell (848) illustrated a single leaf, and called it an ascidium in which "all the leaves on the tree, without exception, have basal pockets, the inner surface of which is morphologically the lower." According to Masters (503), a specimen of this "fig-leaf ascidioform," sent by Dr. David Prain from Calcutta, was once exhibited at a meeting of the Royal Horticultural Society in London. Cuttings taken from trees of *F. krishnae*

produce plants identical with the mother tree, as is normal with most plants. However, seedlings from such a tree are about 10 per cent like *F. krishnae* and 90 per cent like *F. bengalensis*. Furthermore, Biswas (84, 86) described a tree of *F. krishnae* growing at Calcutta which developed a bud mutation on one branch, some leaves being of the typical *F. bengalensis* form, while others showed the cup-shaped peculiarity of *F. krishnae*. A tree of *F. bengalensis* at Miami, Florida, has been found to produce bud sports with characters similar to those of *F. krishnae*. The latter is therefore regarded as a horticultural variety of the Banyan Fig.

Seeds of the Krishna Fig were introduced from India in 1937, and grown as PI No. 123,211 at Miami (PIS). Trees propagated from this introduction are growing at various places in Florida, among them Laurel, Naples, Fairchild Tropical Garden (Miami), and Homestead. See Prain (611) and Penzig (593) for further accounts and illustrations of *F. krishnae*.

66. *Ficus bussei* Warburg (Busse's Fig)

(Plate XXVII, C1-2)

Ficus bussei is an African species, found growing along the coast of Zanzibar and in Tanganyika (now both included in Tanzania). A photograph taken by W. K. O. Busse, the German botanist after whom the species was named by Warburg (803), shows a magnificent shade tree, surpassing in breadth the height of 15 m. According to Mildbraed and Burret (535), this species belongs to the subgenus *Bibracteatae*, section *Platyphyllae*. A variety, *longipetiolata*, was described as having a broader crown than trees of typical *F. bussei*. Lebrun and Boutique (462) gave a good description of Busse's Fig, and included it in the key to species, having the base of the blade cordate and the lobes connivent, "with receptacles from 2 to 2.7 cm in diameter and peduncles from 1 to 1.5 cm in length." It was described also by Peter (599), and by Dale and Greenway (218) from Kenya.

Busse's Fig was introduced into the United States in 1924 from Amani, Tanganyika, under PI No. 62,806. It became established at Miami (PIS), where notes were taken in 1940 and 1949. A small tree was found growing at the Atkins Garden in Cuba, but in neither place were trees in fruit. In 1938, rooted plants were received in California from Florida, established in pots, and were distributed later for trial.

The following description has been made from trees growing in Florida and Cuba, and from potted plants in California, in comparison with the botanical accounts just cited: The trees are small, with no aerial roots. The twigs are stout, 0.8

cm thick, with very short internodes. The young bark is very pubescent, with silky white hairs in rings at the nodes or on the edges of large leaf scars. According to Mildbraed and Burret (535), the branches are pubescent, but Lebrun and Boutique (462) gave them as puberulent to glabrous. The lenticels are prominent. At the Atkins Garden, the lower bud of a twig takes precedence over the terminal bud, growing outward and upward, thus forming a series of arching branches. The terminal buds are practically glabrous, green, 0.8 cm long and 0.7 cm broad at the base, narrowing to the acute apex.

The leaves are alternate, equilateral, and are bunched near the ends of the twigs. The blades are 12.6 to 21.3 cm long and 7.5 to 12.6 cm broad, oval-elliptic, with the apex obtuse, the base cordate, the sinus closed, and the basal lobes slightly overlapping. The margins are entire and somewhat revolute. The surface is pubescent both above and below, especially on the veins. Venation is prominent, with the midrib flanked by 2 or 3 pairs of basal veins plus 8 to 10 laterals, all well elevated. Tertiary veins are distinct, with numerous areoles. The blades are rough on the upper surface, and coriaceous in texture. The petioles are stout, 2.5 to 5 cm long, densely pubescent, and slightly grooved above.

According to the accounts available, the axillary receptacles are subglobular and whitish-pubescent, 1.8 to 2.5 cm in diameter, with the bilabiate ostiole lacking external bracts. The peduncles are about 1.1 cm long.

67. *Ficus sonderi* Miquel (Sonder's Fig)

(Plate XXXIV, B1-2)

According to Codd (164), *Ficus sonderi* was named by Miquel (544) in honor of Prof. O. W. Sonder, who worked extensively on the botany of South African plants. Sonder (710) gave an account of

it as *Sycomorus hirsuta*. It is found on rocky knolls, and grows into a fine, spreading, deciduous tree, up to 9 m in height. A good description of it was given by Hutchinson (408), with a list of ref-

ferences and synonyms. Some of these accounts were written by Miss L. S. Gibbs (318), Sim (696), Hutchinson (407), Burtt-Davy (131), Henkel (366), Lebrun (460), Lebrun and Boutique (462), Eggeling (251), Pardy (583), Dale and Greenway (218), and F. White (823). According to Eggeling, *F. sonderi* is very closely allied to *F. glumosa* Delile, but it is best distinguished by spreading hairs on the lower sides of the leaves and on other parts. Both Hutchinson and Burtt-Davy referred to a statement that the plants contain an abundant white latex which falls upon the dense, dark-green foliage, staining it white and rendering the trees recognizable at some distance. Lebrun and Boutique classified it in the subgenus *Bibracteatae*, section *Axillares*.

Seeds received in 1958 from Dr. L. E. W. Codd, Pretoria, produced seedlings for distribution. Young plants sometimes develop conspicuous, bulblike bases, as shown in figure 22, chapter II, for two other species. The green, dormant buds are plump, 2.5 cm long, and silky-hairy, especially at the base. The stipules are persistent for a few nodes, lanceolate, and brown and papery when dry. The young

twigs are densely silky-white hairy, the hairs persisting on the older twigs.

The alternate, equilateral leaves are up to 17 cm long and 8.6 cm broad, oval, with a bluntly obtuse apex and a cordate base. The sinus is narrow, but not quite closed. Venation is prominent, with 2 or 3 basal pairs plus 4 or 5 laterals, all well elevated. The margins are entire and fringed with hairs. The texture is subcoriaceous. The upper surface displays silky-white hairs when young, but later becomes smooth; the lower surface is silky-hairy along the veins. Hydathodes are present, many with a silky hair protruding. The petioles are up to 3.6 cm long, densely silky-hairy, and light green. See the illustration of a single leaf by Codd (165), as well as our plate XXXIV.

To sum up the data in the foregoing accounts, the figs, crowded in the leaf axils at the ends of young branchlets, are geminate, sessile, subglobose, villous, and 1.1 cm in diameter.

Ficus sonderi is one of the exotic species which has not been tested sufficiently to evaluate its hardiness and adaptability to cultural conditions. To judge from its habitat, it should be drought-resistant.

68. *Ficus vogelii* Miquel (Vogel's Fig)

(Plate XXVII, A1-2)

Ficus vogelii was described and pictured by Miquel (539) under *Urostigma*, but he later (544) included it in the genus *Ficus*. The specific name honors C. J. Vogel, a coffee planter and collector in the East Indies. This is an African species, widely distributed from Senegal in upper Guinea to the Belgian Congo, as recorded by Hutchinson (407). Unwin (768) stated that this is one of the most common fig trees in Nigeria, and is usually found along roads in native villages. Fairchild (273) reported that in Gambia it was the most conspicuous tree in the gardens, the branches being covered with small, red figs. According to Irvine (411), it is a common shade tree in Gold Coast villages, where it is used for fence posts, as it grows rapidly from cuttings. Trees of *F.*

vogelii have long been the source of the product known as "Lagos rubber." (See chapter IV, under "Latex.") Other references to this species, with illustrations, were made by Stapf (727) and Engler and Drude (267); without illustrations, by W. J. Hooker (393, under *Urostigma*), Sebire (685), Warburg (798, 803), Mildbraed and Burret (535), Wildeman (828), Holland (382), Hutchinson and Dalziel (410), Lebrun (460), Lebrun and Boutique (462), R. O. Williams (838), Corner and Stearn (200), Irvine (412), and Dale and Greenway (218). See also, the account, with a figure of leaf, by Mary Barrett (65), who called it the West African Rubber Tree.

Grandi (326) described the fig insect *Allotriocoon heterandromorphum* from

the receptacles of *F. vogelii* in Senegal. Grandi (337) also recorded the species *Philotrypesis selenetica* as inhabiting the figs in French Guinea.

Vogel's Fig has long been grown in North America. In 1928, cuttings were received in California from the New York Botanical Garden, but no plants were propagated from them. PI No. 70,946 represents an introduction of seeds from Gambia in 1927, with this notation: "A beautiful shade tree, with large, oblong-elliptic leaves which are mostly gathered at the ends of twigs. The small fruits are attractively grouped on the branches, and produce many viable seeds." Other introductions were PI Nos. 80,413 from Africa in 1929, and 240,505 from Italy in 1957. Seedlings from these introductions have been distributed and trees established in several localities. Fruiting trees have been studied and specimens collected at the Atkins Garden in Cuba, at various places in Florida, at Santa Barbara, California, and at Honolulu, Hawaii. The road at the main entrance to the Plant Introduction Station (PIS), Miami, is bordered by several fine specimen trees of this species.

Ficus vogelii is similar to *F. nekbudu* in many respects. The two were separated by Hutchinson (407) in a key, as follows:

Basal bracts of the receptacle silky-pubescent, *F. vogelii*
 Basal bracts densely villous, the receptacles woolly-pilose, *F. nekbudu*

Under cultivation, the trees vary in trunk size, production of aerial roots, and in fruiting habits. At Miami, some have numerous aerial roots, even from branches 6 m aboveground, these forming multiple trunks. At Honolulu, one tree has a trunk 76 cm in diameter, with aerial roots on the lower part of the trunk only. The bark is rough, with lenticular excrescences. The terminal buds are small, 1.1 cm or less

long, tawny or brown, and slightly pubescent. The twigs are stout, short-jointed, and gray, with prominent lenticels, and have a conspicuous fringe of white, silky hairs at the base of the terminal bud or at the first node.

The alternate, equilateral leaves are oval, up to 25 cm long and 12.5 cm broad, with the apex rounded or slightly obtuse and the base rounded or subcordate. The margins are entire. Venation is prominent, the veins well elevated below, with 1 basal pair plus 4 to 6 laterals, these widely spaced, about 3.6 cm apart. The texture is coriaceous. The surface is glabrous above and below, except for a few white hairs along the veins. The petioles are stout, up to 15 cm long, and chocolate-brown, the color changing abruptly to green at the base of the midrib; the upper surface is very slightly flattened, and is channeled.

The sessile, neckless figs are densely clustered, not only in the leaf axils several centimeters from the tips of the twigs, but also from old leaf scars or nodes a considerable distance back, on branches 7.5 cm thick, or even on framework branches from short tubercles in clusters of 3 to 7 fruits. The shape is subglobular to oblong or short-pyriform, the diameter 1.1 cm, and the surface densely puberulent, with a few brown flecks on the orange-yellow background. The umbilicus is fairly prominent. The interior is of a neutral shade (not colored).

The trees of *F. vogelii* are so similar in general appearance to those of *F. nekbudu* (species No. 86) that the two may be considered as interchangeable for ornamental planting. Both seem to be equally hardy. Neither grows to be a large tree, and the size can be regulated by pruning. The young plants make good pot specimens which can be transplanted later to any desired location.

69. *Ficus stuhlmannii* Warburg (Stuhlmann's Wild Fig)

This species, described by Warburg (797), was designated Stuhlmann's Wild Fig, with illustration of a leaf, by Codd (165), who commented: "The species is named after Dr. Franz Stuhlmann, German botanical explorer in east and central Africa toward the end of the nineteenth century, and is found from Tanganyika and the Belgian Congo southward to Zululand." According to Burt-Davy (131), *F. howardiana*, described and illustrated by Sim (696), is a synonym. Other accounts were given by Engler (266, with illustration), Mildbraed and Burret (535), Hutchinson (407, 408), Henkel (366), Lebrun (460), Lebrun and Boutique (462), and Dale and Greenway (218). Seeds were received from Pretoria in 1947 under PI No. 161,334, and were distributed for trial from Riverside. Seedlings grown under glass in California have been found to be unusually susceptible to mite infestation. Trees at Arcadia (LASCA) were slow-growing, being only 1 m high after five years of growth, and had produced no fruit at the time of writing.

In their native habitat, the trees become about 9 m high, and are deciduous for a short time in spring. According to Codd (165), this species usually grows as a strangler, but also appears to be capable of developing as a separate tree without any obvious aerial roots. The terminal buds are 1.8 cm long, silky-pubescent, and

tawny to light scarlet. The young twigs are also pubescent, and green or tawny, becoming gray, with shreddy bark. The stipules are lanceolate and somewhat persistent; but are deciduous, according to Henkel (366) and Hutchinson (407, 408).

The alternate, equilateral leaves are up to 11.5 cm long and 5 cm broad, and are oblong-ovate, with an obtuse apex and a shallowly cordate base. Venation is prominent below, with the midrib flanked by 2 pairs of basals plus 3 to 5 laterals. Tertiary veins or reticulations are unusually prominent. The texture is thinly subcoriaceous, the margins are entire, and the surface is softly pubescent above and below. Mildbraed and Burret (535) stated that *F. stuhlmannii* is related to *F. glumosa* Delile, but is characterized especially by the prominent reticulations of the blade, the pubescence of both surfaces, and the dense, white hairs standing straight outward from the epidermis. The petioles are 2.5 cm long, and pubescent. (Refer to *F. petersii* in chapter XVI for a distinguishing leaf character.)

The receptacles are reported to be axillary, solitary or geminate, sessile, globose, 1.1 cm in diameter, and densely tomentose.

Under cultivation, Stuhlmann's Wild Fig is of very slow growth, and has no particular characters which recommend it for further trial.

70. *Ficus lapathifolia* (Liebman) Miquel

(Plate XXVII, B1-3)

Type specimens of this species collected near Veracruz, Mexico, were described by Liebman (471) as *Urostigma lapathifolium*. Miquel (544) described it as *Ficus lapathifolia*. He had previously called it *Urostigma guatemalanum* which, according to Standley (717), "was cultivated at Berlin from material collected in Guatemala by Warszewicz." The species ranges from Tampico, Veracruz, Chiapas, and

Yucatán in Mexico to Guatemala and Costa Rica. According to Lundell (481a), the trees are very common in Petén, Guatemala, covering ruins, and are responsible for much destruction of monuments and buildings.

Other descriptions and accounts of *F. lapathifolia* were given by Standley (720), Paul H. Allen (6), and Graf (324, with illustration).

Grandi (329) described *Blastophaga (Julianella) aguilari* from receptacles of this species in Costa Rica. P. H. Timberlake, in a letter dated December 18, 1957, stated that this insect belongs to the genus *Juliana*, the three members of which are distinct from species of *Blastophaga* and similar to *Eupristina* of the Old World.

Fruiting specimens of *F. lapathifolia* were collected in Chiapas, Mexico, in 1952, and placed in the herbarium at Riverside. Fertile seeds found in the fruits in 1956 were planted, and fine seedlings were thus obtained for distribution. The following description is made from herbarium material and from young seedling trees growing at Arcadia (LASCA), in comparison with the accounts cited: The trees probably always start as epiphytes, and eventually reach a large size, up to 22.8 m in height, with prominent buttresses at the base of the trunk, as described and illustrated by Paul H. Allen (6). The young twigs are clothed with prominent gray hairs, which persist on the older branches. The pinkish stipules are densely puberulent, about 3.6 cm long, and lanceolate. The terminal buds, at least 2.5 cm long, are green or reddish brown, but the new growth is uniformly green.

The alternate, equilateral leaves are 10.5 to 25 cm long and up to 10.5 cm broad, and are elliptical to broadly oblong, with the apex rounded or obtuse (often somewhat apiculate) and the base rounded or shallowly subcordate. The upper surface is copiously pubescent at first, becoming glabrate with age, while the lower surface is velvety-pubescent or covered with matted white hairs. Hydathodes (when present) are prominent and scattered thickly between the veins on the upper surface. The margins are entire; the texture, somewhat coriaceous. Venation is prominent, with 2 or 3 basal pairs plus 9 to 12 laterals, all well elevated above the lower surface. The petioles are stout, 2.5 to 7.5 cm long, and slightly flattened above. They are densely puberulent on the younger leaves.

The figs are axillary, commonly geminate, globular, 1.1 to 1.8 cm in diameter, and densely white-sericeous on the surface, which is prominently decorated with reddish-brown spots. The peduncles are stout, about 0.7 cm long, and puberulent. The umbilicus protrudes slightly from the rounded apex. The bracts at the bases of the receptacles are fairly prominent, and flaring.

71. *Ficus drupacea* Thunberg (Brown-woolly Fig)

The list published by Setyodiwiryo (689) of plants cultivated in the Hortus Botanicus Bogoriensis [Bogor Botanic Gardens] of Indonesia included a species of *Ficus* under the specific name *pilosa*. A packet of seeds received at Riverside in 1959 from Bogor under PI No. 260,747 was labeled *F. drupacea*. Corner (196) stated that examination of Thunberg's type (*F. drupacea*) had shown it to be the well-known *F. pilosa* from Java, described by Reinwardt ex Blume (92). Later, however, Corner (199b) classified this species as *F. drupacea* Thunberg, with a key to five varieties. The original and brief description as *F. drupacea* by Thunberg (755) gave the leaves as obovate, cuspidate, and glabrous, and the fruits as ovate, rugose, and sessile. P. Mil-

ler (536) gave a short account of it under his No. 53. See also, Smith (707).

The account of *F. pilosa* by Kurz (455) stated that all its younger parts are covered with a villous-woolly, rusty or golden-colored tomentum, but when fully grown, the parts are glabrous. G. King (437) described and illustrated the species, and commented: "It comes very near *F. mysorensis* Heyne, and I greatly doubt whether it should be kept separate. My own opinion is that further observation in the field will prove this and *mysorensis* to be but forms of one plant. The variety *chrysocoma* runs exactly parallel to the variety *pubescens* of *F. mysorensis*." A similar opinion was expressed by D. Brandis (103), who regarded *F. pilosa* as closely allied to *F. mysorensis* and

probably not specifically distinct. Corner (199b) classified *F. mysorensis* and three of its varieties under *F. drupacea*. F. M. Bailey (43) referred to it simply as a deciduous tree in Queensland. Other accounts of *F. pilosa* were given by Miquel (544), Bentham and Mueller (77), Koorders and Valetton (446, with illustration), and Ridley (639). See also, the comment under *F. mysorensis* (species No. 72, immediately following).

The common name Brown-woolly Fig was assigned by Corner (193) to *F. pilosa*, which he described as "a big tree like *F. indica*, with the buds, twigs, leaf-stalks, and undersides of the leaves brown-woolly hairy." He gave the distribution as India to Australia, common in Malaya, and frequent at Penang. Summerhayes (743) stated that it is common on the granite coast of Papua, the tree some 20 m high, with the leaves glossy above, the midrib white, and the receptacles small and beaked. According to Merrill (524), *F. pilosa* Naves (not Reinwardt) equals *F. payapa*.

The seeds from Bogor germinated well, producing seedlings much like those of *F. mysorensis* var. *pubescens*. Young outdoor plants growing at Riverside show the following characters: The young twigs are tawny, densely pubescent, gradually becoming gray-brown and smooth, with prominent lenticel scars. The terminal buds are scarlet, 2.5 cm long, and silky-

pubescent; the stipules are deciduous and pubescent. Concerning pubescence, Bentham and Mueller (77) reported that the adult foliage and fruits, and even the young leaves, are usually glabrous, the stipules alone on the terminal buds being covered with ferruginous hairs sufficient to justify the name *pilosa*, with very rarely the petioles and principal veins of the leaves also being hairy. G. King (437) found the young leaves to be covered with a short, flocculent tomentum which is early deciduous.

The leaves are equilateral, slightly obovate to elliptical, and up to 22.7 cm long and 7.5 cm wide, with the apex gradually acute and the base subcordate. Venation is quite prominent, with 1 basal pair of veins plus 12 to 14 laterals. The surface is puberulent when young and hairy along the margins, but glossy and glabrous when mature. Hydathodes are very few, and are sparsely scattered along the margins of some leaves. The texture is subcoriaceous. The stout petioles are 0.4 cm in thickness, 1.8 to 2.5 cm long, very slightly if at all flattened, pubescent when young, puberulent when mature, and light scarlet.

The figs are reported to be axillary, sessile, geminate, oblong, 1.8 cm long, orange-red, and smooth.

Young plants of *F. drupacea* show good ornamental characters, and are very well worthy of trial in comparison with *F. mysorensis* var. *pubescens*.

CHAPTER XIII • Species 72 through 83

72. *Ficus mysorensis* Heyne (Mysore Fig)

(Plate XVIII, A1-3; A4)

The Mysore Fig, described and illustrated by Benjamin Heyne in Roth's *Novae Plantarum* (655) as *Ficus mysorensis*, gets its name from the state of Mysore in southern India, where one variety of the species is indigenous. Two varieties are recognized: *F. mysorensis* var. *pubescens* and *F. mysorensis* var. *subrepanda*. The variety *pubescens* is found in peninsular India and Ceylon, up to 760 m elevation. The variety *subrepanda* is not found in southern India, but grows at the base of the eastern Himalayas and in the Burmese hills at elevations of 305 to 610 m. According to Gamble (309), the large, evergreen trees of this species are good to shade coffee plantations. Corner (196) stated that he could not distinguish *F. mysorensis* Heyne from the large and varied complex of *F. drupacea* Thunberg, but the latter is treated separately under species No. 71, just preceding the present account. Other accounts, with illustrations, were given by G. King (437), Talbot (747), Miquel (539), Worthington (849), and Graf (324); without illustrations, by Kurz (455), G. King (438), J. D. Hooker (388), D. Brandis (103), Clercq (162), C. E. C. Fischer (286), Alston (8, as *F. cotoneaeifolia*), and Corner (199b).

Several new species of insects have been described quite recently by Joseph (426, 427, 428, 429) as inhabiting the fruits of *F. mysorensis* in India: *Arachonia plumosa*, *Ceratosolen mysorensis*, *Eupristina belgaumensis*, *Parakoebelea thalakvadiensis*, *Philotrypes longispinus*, *Sycobia mathewi*, *Sycobiella claviscapa*, and *Sycoscapta triformis*.

The Mysore Fig has been introduced into the United States at various times. PI No. 58,587 represents seeds received in January, 1924, from the Botanic Garden, Bangalore, India. It may have been

a seedling of this introduction grown at Golden Gate Park, San Francisco, from which the University of California obtained a plant in June, 1930. Good growth was secured, and cuttings were rooted from it. PI Nos. 39,114, 39,643, 39,666, 43,292, 47,685, 49,635, 68,336, and 80,082, all except the last one labeled *Ficus hookeri*, received from India between 1914 and 1929, can probably be identified as *F. mysorensis*. (See also, the account of *F. hookeri* in chapter XVI, "Additional Species.") PI No. 114,950 represented seeds received from Bangalore, India, in 1936. Seeds of PI No. 116,838, listed in the Inventory as *Ficus* sp., were received in 1937 from Miami (PIS) under the label *F. mysorensis*, and seedlings were grown at Riverside for distribution. The two varieties mentioned above are being grown both in Florida and California.

Still another introduction was made from Egypt in 1931 under PI No. 92,952.

The success of outdoor trees of *F. mysorensis* has stimulated interest in this species as an ornamental, and trees are commonly being offered for sale by nurseries. It looks promising as a young plant in pots, but how it will withstand the dry air of buildings has not been well determined. Some trees of the variety *pubescens* grown outdoors show a drooping habit of growth in spite of frequent pruning. Trees of the variety *subrepanda* have grown upright at Miami, Florida, and at Santa Barbara and Los Angeles, California, and are distinctly ornamental in appearance. Well-established specimens of *subrepanda* seem to be able to withstand four or five degrees of frost without serious injury. The 1957 Catalogue Guide of Eden Park Conservatory, City of Cincinnati, listed *F. mysorensis* as a large tree with orange-red fruit.

The following description of typical *F. mysorensis* has been developed from observations and notes made at various times and places since 1930, in comparison with accounts by the authors cited: Aerial roots are not abundant on native trees, and are not seen on cultivated specimens. The twigs are stout, 0.8 cm thick, and are chocolate-brown and puberulent when young. Corky lenticels are very prominent on the new growth, gradually fading with age. The terminal buds are 2.5 to 3 cm long and 0.7 cm in diameter at the base, tapering uniformly to the acute apex, densely silky-pubescent to puberulent or even glabrous, and green to tawny, or somewhat rusty in the variety *pubescens*. The two stipules are conical, acute at the apex, and rusty-pubescent on the exterior surface. The new growth is green.

The leaves are alternate, equilateral, oval or broadly elliptical, and are up to 30 cm long and 15 cm broad. The apex is abruptly acuminate, with the acumen often 1.1 cm long; the base is rounded to slightly cordate or subcordate. The margins are entire. Venation is prominent, appearing as narrow, white lines above, with the veins below well elevated and spaced 0.8 to 2.5 cm apart. The midrib is flanked by 3 or 4 pairs of basal veins plus 12 to 14 laterals. The texture is coriaceous or subcoriaceous. The surface characters vary: The young leaves are lightly tomentose or puberulent, especially below, while the older ones are glabrous and glossy above and glabrous or slightly puberulent

along the veins below. The petioles are 5 cm long, puberulent or practically glabrous, dull or yellowish green, and slightly flattened or shallowly channeled on the upper surface.

The axillary fruits, up to 4.3 cm long and 2.5 cm in diameter, are commonly geminate, sessile, lacking a neck, ovoid, with a broad, rounded base, and circular in cross section or sometimes compressed laterally. They are somewhat puberulent when young but glabrous at maturity, and are roughened by conspicuous, raised, white or reddish flecks. The mature fruits are orange-yellow to scarlet or purplish black. The rather prominent umbilicus is a darker orange than the body. The basal bracts are 3 in number, and conspicuous. A lengthwise section shows a yellowish meat or rind 0.8 cm thick, with both staminate and white pistillate flowers lining the cavity. The fruits become somewhat pulpy at full maturity, and are eaten by birds.

According to Lucita Wait (790), the bright-yellow figs of this species "are rather hard and firm, with a pitted skin such as the citrus fruits have; when cut and defoliated, the twigs and fruit will last for days, with or without water," thus adding greatly to tropical fruit or flower arrangements. The variety *pubescens* has smaller leaves than the variety *subrepanda*, with a smaller number of lateral veins. The tomentum is very dense and prominent, especially on young parts, and rusty-brown.

73. *Ficus afzelii* G. Don ex Loudon (Loquat-leaved Fig)

(Plate XX, A1-2)

Ficus afzelii is a species indigenous to tropical Africa, from the Gold Coast to Nigeria, the former Belgian Congo, and southeast to Mozambique. The specific name *F. eriobotryoides* has been more widely used in literature than has *F. afzelii*, and the common name Loquat-leaved Fig is very appropriate because the leaves resemble those of the loquat.

The systematic status of this species was clarified by Mary Barrett (65), who

showed that the combination *Ficus afzelii* G. Don (237) has priority over *F. eriobotryoides* Kunth and Bouché (452-453). The specific name *afzelii* refers to "Adam Afzelius, who had collected in Sierra Leone from 1792 on." The common name Old Calabar Fig has also been ascribed to it.

In its native habitat, the tree starts as an epiphyte and eventually reaches a height of 9 m or more, with leaves crowded

at the ends of yellow-shaggy branchlets. The sessile receptacles are densely hairy, yellow, and 2.5 cm or more in diameter. On the Gold Coast, where the trees are sometimes cultivated in gardens, the figs are reported to be edible.

Accounts of this species, either as *F. afzelii* or *F. eriobotryoides*, have been given by Mildbraed and Burret (535), Hutchinson (407), Hutchinson and Dalziel (410), Irvine (411, 412), Lebrun (460), Lebrun and Boutique (462), Daveau (224), Holland (382), Aubréville (29, with a good illustration of clustered fruit), and Schnell (677a, with a figure of the fruit). According to Hutchinson and Dalziel, the variety *ballei* A. Chevalier differs from the type by the leaves being permanently and rather densely golden-pubescent on the lower surface. A species described and figured by Warburg and Wildeman (804) as *F. monbuttensis* was given as a variety of *F. eriobotryoides* by Lebrun and Boutique. Hutchinson and Dalziel placed the species in the subgenus *Bibracteatae*, section *Axillares*, while Mildbraed and Burret assigned it to the section *Cynthistipulae*.

Ficus afzelii has been grown in Florida and Cuba for many years. PIS No. 8,508, also PI Nos. 93,271 and 96,395 (the last two as cuttings from Egypt in 1931 and 1932), were labeled *F. eriobotryoides*.

Nehrling (575) stated that he obtained a specimen of *F. afzelii* from a friend at a conservatory in Chicago. He found this "rubber tree" to be a vigorous grower, quite hardy, and of ornamental appearance, with large, narrow leaves. Cuttings were received at Riverside from the New York Botanical Garden in 1928 and from the Missouri Botanical Garden in 1941, but no plants developed from either lot. One plant of PIS No. 8,508 (just mentioned) was obtained from Florida in 1941, and was grown in a pot at Riverside for several years.

The following descriptive notes have been made from trees found growing in the open ground in Florida in 1940, 1949, and 1958; Cuba in 1949; Hawaii in 1959 and 1960; and from potted plants in Cali-

fornia: The trees show neither buttresses nor aerial roots. The older bark is gray, roughened by longitudinal cracks. The twigs are thick, 1.8 cm in diameter, and scurfy to rusty or villous-pubescent, with prominent leaf scars. The terminal dormant buds are remarkably short for such a robust twig (less than 1.1 cm long), smooth, and reddish purple. The stipules are up to 2.5 cm long, sometimes persisting for a few nodes. They are brilliant scarlet when the buds are opening.

The alternate leaves are large, 30 cm long on mature plants to 63 cm long on young, vigorous branches, and 10.5 to 18.5 cm broad. The blades are obovate-lanceolate, usually broadest above the middle. The apex is abruptly obtuse, with a very short acumen; the lower part of the blade is somewhat narrowed to a rounded or subcordate base. The margins are entire, and somewhat revolute on fresh leaves. Venation is prominent below, with the midrib flanked by 2 or 3 basal veins plus 12 to 16 laterals extending toward the margin at an acute angle. The blade is subcoriaceous in texture, glabrous and more or less glossy above, with silky-white hairs below, especially on the midrib and lateral veins. The newly expanded leaves are maroon, while the upper surface of the mature leaves is green, with the lower surface considerably lighter. Hydathodes are either absent, or are sparsely scattered over the upper epidermis. The petioles are stout, variable in length, from very short to 15 cm, flattened and somewhat grooved above, rusty-brown and densely pubescent, abruptly changing to green at the base of the midrib.

The axillary, sessile figs are borne mostly in pairs in dense clusters below the leaves at the apex of the previous flush of growth. Because of this crowded condition, the figs are angular. They are oblong to globose or oblate, and 2.5 to 4.3 cm in diameter. The yellowish surface is densely covered with silky-white hairs that conceal any markings. The umbilicus is small for such a large fruit, very slightly protruding from the apex, with small, green scales. The interior is brown to scarlet.

74. *Ficus acanthocarpa* Léveillé

(Plate XXXIII, C1-2)

The record book of the Hawaiian Sugar Planters' Association shows that their introduction No. 1,686 represented seeds obtained from China, with the labels *F. amanticarpa* and *F. amanthocarpa*. Neither specific name appears in *Index Kewensis*, and it is assumed that the above names were misspellings of *F. acanthocarpa*, a species described by Léveillé (468). Its distribution is given as central to south China and the island of Hainan. A note in the record book states, "*F. amanticarpa* equals *F. retusa*." However, trees found in the Lyon Arboretum in 1959 are clearly distinct from the latter species [*F. microcarpa*, species No. 46 of the present work], both in leaf and fruit.

Three different shipments of two rooted plants each were received at Riverside from L. W. Bryan, Hilo, in 1939 and 1940, but most of the plants failed to survive the fumigation treatment given them. The one plant that did become established was killed by the winter cold of 1946 at a temperature of about 25° F.

There are two separate plantings of *F. "amanthocarpa"* in the Lyon Arboretum. Trees in SA 11, Row 12, Nos. 1 and 2 have characters which hardly correspond with those in the original description. A tree in S 9, Row 8, No. 3 differs from the foregoing ones in the green buds, obovate leaves with bluntly obtuse apex, in its fruiting habit, and especially in the presence of stinging hairs on the surface of the fruit. This last character may be the one mentioned by Léveillé as "peduncles prickly, the divided bracteoles spiny."

Trees of this species were once growing at the Kohala Mountain Arboretum of Hawaii, but they were not found by L. W. Bryan and myself in March, 1965.

The following brief description is a composite of characters of the trees just discussed: The trees reach a large size, with a trunk 1 m in diameter and smooth bark, without aerial roots. The pubescent buds are 1.1 cm long, green to rusty-brown, terminating short-jointed, pubescent twigs with prominent lenticels.

The leaves are alternate, equilateral, oval to obovate, up to 15 cm long and 6.2 cm broad, with acuminate or obtuse apex and rounded or broadly acute base. Venation is prominent, the veins well elevated below, with 1 basal pair plus 8 to 12 laterals. The texture is coriaceous, the margins entire, and the surface glabrous above to silky-pubescent along the veins below. The petioles are also pubescent.

The trees in the Lyon Arboretum are very fruitful, and are decorated with short bearing branches from the framework to the small limbs, the fruiting spurs single or branched, seldom over 10.5 cm long. The figs are geminate, or often found as two pairs placed opposite at the end of a spur, thus showing four figs in a sort of whorl. They are oblong in shape, up to 2.5 cm long and 0.8 cm in diameter, scarlet, with conspicuous white markings. The surface is prominently sericeous, the appressed hairs causing a stinging sensation. The umbilicus is broad, practically covering the entire apex, with scarlet scales. The interior is white.

75. *Ficus payapa* Blanco (Payapa Fig)

(Plate XXVIII, C1-4)

Ficus payapa was described by Blanco (88) as a Philippine species. Later on, Miquel (544) described another from Celebes as *F. forstenii*. Merrill (524) regarded the two as synonymous. Accounts of the species as *F. payapa* were published

by Merrill (516), W. H. Brown (116), Sata (670), Quisumbing (615), and Pancho (582); as *F. forstenii*, by G. King (437, with illustration), Elmer (257), and W. H. Brown (115); and as *F. drupacea*, by Corner (199b).

The local Tagalog term "Payapa" applied by Blanco seems appropriate as a common name for this species. It belongs to the subgenus *Urostigma*. The fig insect which inhabits the receptacles in the Philippines was described by Grandi (334) as *Eupristina bakeri*.

Seeds of *F. forstenii*, received in Hawaii from the Philippines in 1921, were assigned HSPA No. 1,458. A tree of HSPA No. 7,341 growing in the Lyon Arboretum is also identified as *F. forstenii*. Furthermore, labeled specimens of both *F. payapa* and *F. forstenii* in the Arboretum are regarded as identical. PI No. 90,801 represents an introduction of seeds from the Philippines in 1930, with the following notes by P. J. Wester: "A tree, with smooth, oblanceolate, subcoriaceous leaves 5 to 8 inches [13 to 20 cm] long, and axillary pairs of nearly globular fruits 1 inch [2.5 cm] in diameter." Seedlings of this number were grown in California from 1931 to 1938, but have since been lost. PI No. 137,966, introduced as seeds in 1940 from Celebes, may be identified as *F. payapa*. Notes were made of this species at the Atkins Garden in Cuba in 1949, at Miami (PIS) in 1949 and 1958, and at Honolulu in 1959 and 1960.

The tree just listed as HSPA No. 7,341 and planted in 1935 had, in 1960, a top 18 m high, a spread of 27 m, and a main trunk 1.6 m in diameter, with several multiple trunks and some aerial roots below 2.5 m. In 1958, two trees of PI No. 90,801, planted at Miami in 1940, had trunks 60 cm in diameter, with fairly prominent buttresses, aerial roots from horizontal branches, a height of 9.1 m, and a spread of 12 m. The bark on the larger branches is gray, with narrow, encircling rings; on the smaller branches it is roughened by corky lenticels. The terminal buds are green, 1.1 to 1.5 cm long, and densely pubescent. The young twigs

are green, and densely pubescent with rusty hairs; the older ones are gray and glabrous, but roughened by corky lenticels which are especially prominent near the nodes.

The alternate, equilateral leaves, up to 25 cm long and 12.5 cm broad, are oval, elliptical, or sometimes obovate, with the apex bluntly acute or "narrowly and rather abruptly apiculate" (as reported by King), and the base rounded or narrowed to subcordate. Venation is prominent, the veins well elevated below, with 1 basal pair plus 6 to 10 laterals. The midrib is almost white above. The texture is coriaceous, the margins are entire, and the lower surface has a scurf or pubescence which is easily rubbed off when young, but becomes glabrous or sparsely pubescent on the veins. The petioles are up to 5 cm long, finely puberulent, and round or slightly flattened in cross section.

The young fruit buds are prominent on the twigs, projecting from the leaf axils like ears, each 0.7 cm long. The figs, axillary and commonly geminate, are sessile, oblong, 2.5 cm long and 1.8 cm in diameter. The glabrous, orange-yellow surface shows conspicuous, greenish-white flecks, which are slightly raised or pimply. The umbilicus is small, with scales much the same color as the body or tinged with pink. The bracts are short, and concealed at the base of the fruit. The interior is white.

Ficus payapa is a majestic tree, such as the specimen seen near one corner of George Hall on the University of Hawaii campus. The orange-yellow fruits add to its attractiveness. However, young trees in California and older ones in south Florida have suffered frost injury. The species warrants further trial in warm locations where space is available for the trees to spread naturally. It should also be tested as a pot plant.

76. *Ficus dusenii* Warburg (Dusén's Fig)

Ficus dusenii, of the subgenus *Urostigma*, was described by Warburg (797) from specimen No. 417 collected by Per Karl Hjalmar Dusén in the Cameroun of tropical Africa. According to Abbé A. Walker (792), the latex of the "Dusén Fig" is used as birdlime for catching birds in Gabon, west Africa.

Scions of this species were introduced as PI No. 101,314 in 1932 from Paris, France, with the following description: "A tree up to 40 feet [12.5 m] high, native to tropical Africa. The entire, obovate to elliptic leaves are 2 to 9 inches [5 to 23 cm] long, and the globose or ovoid fruits are borne in sessile, axillary pairs. Possibly a form of *F. thonningii*" [spelled *thollingii*]. Hutchinson (407) classified it as a synonym of *F. thonningii* Blume.

The following account is from notes taken in 1940, 1949, and 1958 of nonfruiting trees growing in Cuba, Florida, and California under PI No. 101,314, in comparison with the description by Warburg: The tree is upright, without buttressed trunk; the green terminal buds, up to 1.1

cm long, are puberulent or pubescent, especially on the margins of stipules. The twigs are pubescent when young.

The alternate, equilateral leaves are oblong-elliptical, 8.6 to 15 cm long and 3.6 to 7.5 cm broad, with obtuse or bluntly acuminate apex and rounded to subcordate base. The margin is entire, the surface green and glabrous above and somewhat lighter below, with or without slight pubescence along the veins. In texture, the blades are membranous to subcoriaceous. Venation is prominent on the lower surface, the veins only slightly elevated, with 2 or 3 basal pairs plus 7 to 10 laterals. The petioles, 1.8 to 5 cm long, are light green, glabrous or slightly pubescent, and narrowly channeled above.

According to Warburg (797), the axillary, sessile figs are commonly geminate, globular to pyriform, glabrous, yellow when mature, and 1.8 cm in diameter, with puberulent basal bracts.

Dusén's Fig has no particular characters to warrant extensive trials as an ornamental tree.

77. *Ficus salicifolia* Vahl (Willow-leaf Fig)

(Plate XXXV, B1-2)

The Willow-leaf Fig was described and illustrated by Vahl (772, 773) as *Ficus salicifolia*, with *F. indica* Forskal as a synonym. P. Miller (536) treated it under his No. 42. As stated in the account of *F. pretoriae* Burt-Davy (species No. 23), the latter has been confused by some botanists with *F. salicifolia* Vahl. The distribution of *F. salicifolia* was given by Blatter (89) as tropical Africa and Arabia; by Schwarz (682) as the eastern part of tropical Africa, from Ethiopia to the Transvaal; by Lebrun and Boutique (462) as Erythrea [Eritrea], Ethiopia, the Sudan, Algeria, and Arabia; by F. W. Andrews (14, with illustration) as central Sudan, usually on hillsides; and by Guest *et al.* (345) along the Red Sea coast, especially in hot valleys of the Yemen,

where *F. salicifolia* and *F. populifolia* Vahl, along with leguminous trees, form patches of forest. (See the accounts of *F. cordata*, *F. populifolia*, *F. teloukat*, and *F. vasta*, all in chapter XVI.)

The Willow-leaf Fig was separated from a related species by Lebrun and Boutique (462) as follows:

Blade oval or oblong-lanceolate; secondary veins 8 to 13 pairs; petioles 2 to 6 cm long. *F. salicifolia*
Blade elliptical or oblong-lanceolate; secondary veins 7 to 10 pairs; petioles 1.2 to 2.8 cm long. *F. zenkeri*

Ficus salicifolia belongs to the subgenus *Urostigma*. According to Grandi (336), *Blastophaga socotrensis* was described by Mayr (509) from *F. salicifolia*, as well as

another insect inhabitant, *Crossogaster triformis*, both from Socotra.

Accounts of this species other than those just cited have been given as follows: Roemer and Schultes (632), Miquel (539), J. G. Baker (50), Schweinfurth (683), Mildbraed and Burret (535), Hutchinson (407), Broun and Massey (110), Aubréville (30), and Tackholm (745); the two last with illustrations.

PI No. 97,932 represents an introduction of *F. salicifolia* from British Guiana in 1932. Inventory No. 110 stated: "It is a remarkable form of *Ficus*, with long, linear to lanceolate leaves and small fruits not over a quarter of an inch [7 mm] through. The fruits are covered with chocolate spots, making them very attractive. The tree climbs and twines about itself, much as *Ficus aurea* climbs over its host tree." Seeds of this introduction received in California failed to germinate. An introduction from Cuba in 1946 was given PI No. 155,218. Trees were seen in Cuba and Florida in 1949 and 1958.

The following description is made from notes taken on these trees, in comparison with accounts by others: The trees are upright, 4.5 m tall, much branched from near the base (sometimes somewhat climbing and entirely glabrous, according to Vahl), without buttresses, but with some aerial roots near the ground. The twigs are slender, pubescent, with silvery-gray bark, showing narrow, longitudinal cracks when mature. The tiny terminal buds are 0.8 cm long, sharp-pointed, slightly puberulent, and green or tawny.

The alternate, equilateral leaves are linear-lanceolate, often somewhat curved or falcate, up to 11.6 cm long and 1.8 cm broad (15 by 5 cm, according to Vahl), with the base rounded or very slightly subcordate and the apex gradually prolonged to an obtuse or acute point. Venation is indistinct, the lateral pairs flush with the lower surface and numbering at least 20 pairs (10 or 12 showing in the figure by Andrews). The texture is chartaceous, the margins entire, and the surface glabrous and glossy above (conspicuously warty below, according to Andrews). The petioles are slender, 1.1 cm long, somewhat pubescent when young, and tawny or brownish in color.

According to F. W. Andrews (14), the figs are "usually crowded, axillary, usually in pairs, globose, 0.7 cm in diameter; peduncle to 0.3 cm long, rather slender, densely tomentose."

Rooted cuttings of PI No. 97,932 received in 1964 from Miami (PIS) have developed into bushy plants at Riverside, bearing fruit in January, 1965. They show characters much like those noted above, but the leaves are not warty below. The tiny figs are conspicuously ornamented with chocolate-brown spots. The umbilicus is also colored. The interior is white.

Considerable frost injury was suffered by the one tree at Miami (PIS) during the winter of 1957-58. This species displays little if any value as an ornamental in comparison with *F. celebensis* (our species No. 22), which also has narrow leaves.

78. *Ficus obtusifolia* HBK (Bonpland Fig)

(Plate XXI, A1-3)

Ficus obtusifolia was reported by De Wolf (230) as a widespread species, ranging from central Mexico to northern Guatemala, thence along the Pacific Coast through Costa Rica and Colombia to northern Peru, from near sea level to 1,800 m. He added: "The name *F. obtusifolia* was first used by Roxburgh in the *Hortus Bengalensis* in 1814. It was here a *nomen nudum*, not validly published, so that it

does not invalidate the publication of *F. obtusifolia* HBK in 1817. Roxburgh's name was not validly published until 1832." See Little and Wadsworth (476a); also, the comment under *F. urbaniana*, species No. 55.

Ficus bonplandiana, given by De Wolf as a synonym, was named by Miquel (544) in honor of the botanist A. J. A. Bonpland, who collected the type speci-

mens at Acapulco, Mexico. However, the first description was by Liebman (471) under *Urostigma*. Seeds of the Bonpland Fig were collected in Mexico by Mulford Foster, and seedlings were grown at Orlando, Florida. I collected seeds in 1947 from a tree growing at Mazatlán, and in 1960 from another tree at San Blas. Numerous seedlings have since been distributed from Riverside for trial. PI No. 161,324 represents a packet of seeds sent from the tree at Mazatlán. Standley (717) stated that the description of *Urostigma involutum* Liebman strongly suggested *F. bonplandiana*, and De Wolf (230) included it as a synonym. Under PI No. 81,492, cuttings of *Ficus involuta* were introduced from the Canal Zone in 1929.

The following description of the Bonpland Fig is made from trees growing in Mexico and from young fruiting trees in southern California: In its native habitat, the tree has the banyan habit, with multiple trunks resulting from the numerous aerial roots produced through the rough, gray bark of the larger branches. According to Standley (717), a tree at Acapulco had a trunk 1.8 m in diameter and a crown 19 m broad. It is one of the strangler figs. On cultivated trees, the terminal buds are 2.5 cm or more long, glabrous or faintly pubescent, and green or tinged with scarlet on one side. The young twigs are green at first, soon becoming gray. Prominent lenticels are found on the older, somewhat scurfy, bark. The new growth is green. Large fruit buds with their sheathing bracts are conspicuous in some leaf axils. The stipules are dry.

The alternate, equilateral leaves are 15 to 25 cm long and 7.5 to 12.5 cm broad, obovate, distinctly broadest above the middle, gradually narrowing toward the rounded or acute base. The apex is broad and obtuse, hence the specific name. Venation is prominent, with 1 pair basal plus 8 to 10 laterals, these curved and about 1.8 cm apart. The surface is glabrous above and below, green, but somewhat lighter below. The petioles are thick and short, 1.8 to 3.6 cm long, and well channeled above.

The figs are axillary, geminate, oblong to spherical, up to 1.8 cm in diameter, and are borne on very stout peduncles 0.3 cm or less long. The basal bracts of the involucre are prominent, half enclosing the receptacle when young. The surface is green, with conspicuous white flecks, and puberulent. The umbilicus is 0.3 cm across, protruding, with broad, rounded scales. The interior is white.

In 1957, a letter was received from Mulford Foster, Orlando, Florida, in which he stated that his one specimen of *F. bonplandiana* was quite susceptible to frost injury; moreover, no one seemed to be interested in the species, "as there are so many more attractive and hardier species available." The tree had reached a height of 9 m by 1958, but the cold of the preceding winter, at a low of 24° F., had killed the top back to the trunk. Young trees growing at Orange, San Marino, and Arcadia, California, are upright in habit of growth, fairly ornamental, and have so far not suffered damage from frost, contrary to the above statement.

79. *Ficus geniculata* Kurz

Ficus geniculata, described by Kurz (454, 455) from tropical Asia, included two varieties: *geniculata* proper, with receptacles sessile; and *abnormalis*, with receptacles on very short, pubescent peduncles. It was further described and illustrated by G. King (437). According to King, the species is closely allied to *F. infectoria*, "with which," he wrote, "I at one time thought of uniting it; but I

am now convinced that it is a separable species. Its leaves are always more rotund than those of *infectoria*, its petioles longer, and its male flowers have a gamophyllous perianth." The leaf blades are also distinctly jointed to the petiole, while those of *F. infectoria* [*virens*] are only indistinctly jointed. See also, G. King (438). It was described by D. Brandis (103) and Haines (352). Setyodiwiryo (689) listed

it as being cultivated at Bogor. The species belongs to the subgenus *Urostigma*.

Seeds of this species were received from Buitenzorg [Bogor], Java, in 1948, and a number of seedlings were grown for distribution. Small trees are growing at San Marino, California, and at Arcadia (LASCA). From these, the following notes on vegetative characters have been obtained, in comparison with King's description: The plants are upright, with thick terminal buds, 1.1 to 1.8 cm long, which are white or light gray to tawny, and densely cottony-pubescent. The outer bud scales are dry and brittle. The young twigs are short-jointed, green, and glabrous; older ones are gray, with prominent, corky lenticels.

The large, alternate, equilateral leaves, crowded near the ends of twigs, are 15 to 23 cm long and 10.5 cm or more broad, elliptical, with abruptly cuspidate apex (the cusp up to 1.1 cm long); and broad,

rounded, or slightly subcordate base. Venation is prominent above and below, but the veins are flush with, or only slightly elevated above, the lower surface. The midrib is flanked by 1 or 2 basal pairs and 6 to 9 laterals, these extending upward at a 45-degree angle (nearly at a right angle, according to King). The texture is chartaceous. The surface is glabrous, with hydathodes lacking or sparsely scattered near the entire margins. Some young trees show leaves with irregular blotches, apparently caused by a mosaic virus. The slender petioles are 5 to 12.5 cm long, light green, slightly flattened and channeled above, and jointed at the base of the blade. According to King, the petioles separate from the blades when dry.

King described the figs as crowded on the twigs in groups of two to four in the axils of fallen leaves, sessile or shortly pedunculate, depressed-globular, 0.7 cm in diameter, and reddish with light dots.

80. *Ficus burkei* Miquel (Burke's Fig)

(Plate XXVI, B1-3)

Burke's Fig was described by Miquel (539) as *Urostigma burkei*, but later (544) he listed it as *Ficus burkei*. It is closely related to *F. petersii* Warburg, listed in chapter XVI, but was distinguished from that species by Hutchinson (408) and by Burt-Davy (131) thus:

Receptacles sessile, tomentose. *F. petersii*
Receptacles pedunculate, woolly-
tomentose or pubescent. *F. burkei*

Other accounts were given by Mildbraed and Burret (535), Hutchinson (407), Steedman (729), Henkel (366), and F. White (823). It is a species indigenous to tropical South Africa, occurring in dry, open forests below 1,310 m elevation, according to Burt-Davy.

Seeds received from Dr. L. E. W. Codd, Pretoria, in 1958 produced fine seedlings, some of which have been distributed for trial. Slides of root-tip material showed a chromosome complement of 52, double that found in most fig species. Native trees of *F. burkei* are up to 18 m high, and

produce numerous aerial roots from the branches, which are short-pubescent or tomentose when young. On cultivated plants, the young twigs are puberulent, but soon become glabrous. The chaffy stipules are sometimes persistent for several nodes. The terminal buds are 0.8 cm long, hirsute, and tinged with pink.

The alternate, equilateral, and glabrous leaves are up to 12.5 cm long and 3.6 cm broad, elliptical or somewhat obovate, with rounded or slightly obtuse apex, the blade gradually narrowing to the rounded base. Venation is hardly prominent, not raised below, with 1 indistinct basal pair plus 8 to 10 laterals. The margin is entire and undulate, the texture is subcoriaceous, and the surface has hydathodes few and scattered near the margins (or none); the color is dark green above, but lighter and somewhat aureous below. The petioles are up to 2.5 cm long, glabrous, and slightly flattened above.

One tree of Burke's Fig has borne fruit profusely in a nursery row at Riverside

since 1962. The figs are mostly geminate, borne in the axils of green leaves or in the axils of leaf scars. They are globose, 0.7 cm long and broad, on hirsute peduncles 0.5 cm long which are enlarged at the base of the fruit. (See figure 38 with description of *F. hispida*, species No. 8.

Notes on the remaining kinds pictured will be found under species Nos. 24, 33, and 50.) The surface is practically glabrous, green, with scattered greenish-white flecks. The ostiole is small and inconspicuous, porelike, and very slightly protruding. The interior is white.

81. *Ficus spragueana* Mildbraed and Burret (Sprague's Fig)

Mildbraed and Burret (535) published a brief description of a Nigerian fig as *Ficus spragueana*, the specific name being given in honor of Thomas A. Sprague, taxonomist at Kew. Hutchinson (407) placed it in the subgenus *Bibracteatae* (with ostiole porelike and none of the bracts visible from outside), section *Axillares*, and subsection *Caducae* (the stipules deciduous). Hutchinson and Dalziel (410) described it as "a tree, 30 to 40 feet [9.5 to 12.5 m] high, with shortly tomentose branchlets and comparatively small leaves; figs small, greenish, softly tomentose, sweet and juicy when ripe." Fairchild (273) reported finding a tree of *F. spragueana* at Georgetown, Gambia, "literally loaded down with fruits the size of a pea and of honey sweetness."

Seeds collected by Dr. David Fairchild from the above tree in 1927 were introduced under PI No. 70,947. One seedling of this lot, received in California in 1931, reached a height of 1 m in 1937, but many leaves became curled or misshapen, apparently caused by a virus. The trees growing at Los Angeles and San Marino, California, fruited profusely in 1944, but have since been lost. Large bearing trees were found at Miami (PIS) in 1940 and 1958 and at the Atkins Garden in Cuba in 1949.

The following description has been compiled from notes made on the above trees and from botanical specimens on hand: In Cuba, trees twenty years old have trunks about 40 cm in diameter, with no buttresses but with a few aerial roots, and light-gray bark that is somewhat flaky or scurfy. The young twigs bear conspicuous, elongated lenticels. The terminal buds are up to 0.3 cm long, and pubescent.

The leaves are alternate, equilateral, up to 12.5 cm long and 5 cm broad, and ovate or oblanceolate, with an obtuse or slightly acuminate apex and a rounded or narrowed base. Venation is hardly prominent, except for the midrib, which is flanked by 1 basal pair of veins and 7 to 9 laterals, which are obscure below but show above as finely penciled lines. The texture is coriaceous, the margins are entire, and the surface is glabrous. The petioles average 2.5 cm long, and are slightly channeled above.

The figs, axillary, densely clustered, and mostly geminate on short-jointed twigs, are spherical, 0.7 cm in diameter, on peduncles 0.6 cm long, and rusty-pubescent. The surface is covered with a dense, white, silky pubescence. The umbilicus is small, and flush with the apex. The interior is white.

Sprague's Fig, like *F. iteophylla*, to which it is closely related, is precocious in the production of fruit. Hutchinson and Dalziel (410) separated the two in a key:

- Leaves rounded at the base, oblong or oblong-elliptic, shortly acuminate, 5 to 7 cm long, 2.5 to 4 cm broad; lateral nerves, 9 to 13 pairs; receptacles about 8 mm diameter, softly tomentose. *F. spragueana*
 Leaves narrowed at the base, oblanceolate, 4 to 10 cm long, 1.5 to 3 cm broad; lateral nerves, 6 to 10 pairs; receptacles 8 to 12 mm diameter, tomentose. *F. iteophylla*

It seems that these two species are very likely to be confused when under cultivation, and the identity of specimens may have to be properly evaluated. See the account of *F. iteophylla*, species No. 35.

82. *Ficus racemosa* Linné (Cluster Fig)

(Plate XXVIII, A1-2)

Mary Barrett (61) compared the characters of *Ficus racemosa* described by Linné (473) and *F. glomerata* described by Roxburgh (656), and showed why the two are synonymous, with *F. racemosa* having the priority.* The latter was earlier described and illustrated by Reede (624) under the name Atty-alou. See also, the commentary by Hamilton (353). The variability of the species is indicated by the fact that Mary Barrett recognized four varietal combinations. Two of these, *F. glomerata* var. *elongata* and var. *mollis*, had been described and illustrated earlier by G. King (437). The latter variety is much more pubescent than the former. This species is aptly designated the Cluster Fig, for prominent clusters or bunches of fruits grow from tubercles on the trunk and main branches. Drury (243) added the common names Red-wooded Fig and Country Fig. According to the *Key Index*, *F. vesca* F.v.M. equals *F. glomerata*. (See *F. semicostata* in chapter XVI.) Corner (197) stated that *F. glomerata* Roxburgh belongs to the subgenus *Sycomorus*, and gave *F. acidula* King, *F. lanceolata* B. Ham., and *F. henrici* King as equaling *F. racemosa* L. var. *elongata* King. See also, Corner (199b) for a key classifying four varieties; and the note under *F. saemourpa* in chapter XVI regarding resemblance to *F. lanceolata*.

According to Riedel (641), *F. lanceolata* was listed in European catalogues in 1911. It was described by Roxburgh (658) as a native of Chittagong, whence it was sent to the Calcutta Botanic Garden in 1798. It produced fruit there more or less the year around, in fascicles on the trunk and branches. (See figure 2 in chapter II.)

The Cluster Fig is widely distributed, from India and Ceylon to Burma, the Malay Peninsula, and Australia. Accord-

ing to Talbot (746), it is one of the best shade trees in the Mysore coffee plantations. Notes on the habitats of the Cluster Fig and chemical examination of the fruit were given by Reinherz (629). Gamble (309) described it as a very common tree in India, particularly noticeable because it is deciduous in the middle of the rainy season in August. Troup (765), on the other hand, stated that the trees appear to shed their leaves at different times, in some localities early in the cold season, the new leaves appearing in December. According to Naik (569), *F. glomerata* enjoys some popularity as an avenue tree in south India, where it yields edible figs in great abundance. The fruits can be dehydrated to yield a useful powder which, when malted and roasted, gives a good breakfast food. A few other authors have agreed that the fruits are edible, but Cowen (204) said, "They are always full of crawling insects."

In 1935, Grandi (336) described *Ceratosten fusciceps* Mayr as the pollinating insect for *F. glomerata*. Joseph (424) described the same fig insect, as well as another inhabitant of the fruit, *Lipothymus glomeratus*, a new species. Joseph (425) compared *Sycophagella agrimensis* with *Sycophaga brevitarsus*, these two occurring together in the figs. Still another new species, *Parakoebelia stratheni*, was described by Joseph (429) in 1957. See also, Wiebes (824c).

G. Watt (815) gave a list of references to the literature on *F. glomerata*, as well as uses of the plant for gum, dye, medicine, edible fruit, fodder, and wood. The following accounts may be cited: With illustrations, by Wight (826), F.M. Bailey (43), Talbot (747), Koorders and Valetton (446), Ochse (580), Mowry (561), Corner (193), McCann (487, in color), Benthall (75a), Condit (180), and

* While the species *glomerata* is frequently mentioned in the present account, this is done merely for the sake of quoting the various cited authors accurately.

Graf (324); without illustrations, by Steele (730), Willdenow (834), Roxburgh (658), Balfour (51), D. Brandis (102, 103), Kurz (455), Clercq (162), Duthie (247), Gamble (309), Osmaston (581), Corner (191), and Lewis (469).

One of the main points of consideration for this species in the United States has been its utility as a nematode-resistant stock for the Common Fig. The roots of *F. racemosa* show no galls or knots, characteristic of infestation by the garden nematode. Plants of PI No. 52,406 have been tested for stock purposes in Florida. The results have not been satisfactory, mainly because of injury to the stock by cold, as stated by Christie (155). At Riverside, one tree has been growing on a warm hillside for several years. Three varieties of the Common Fig grafted on its branches have borne fruit, while bunches of the Cluster Fig developed on the trunk below. (Figure 48 shows the tree with scions of the Common Fig developed; the clustered, cauliflorous fruits of *F. racemosa* are well shown in figure 2, chapter II.) See the accounts of this species as a rootstock by Condit (176, 182).

Several introductions of *F. racemosa* have been made into the United States. Nehrling (575) gave an account of his experiences with it at Gotha, Florida, in 1888. He also stated that Reasoner Brothers, Oneco, had distributed it over the state many years earlier. The following PI numbers represent introductions, mostly as seeds: No. 6,857 in 1901 as plants from Florida; No. 12,111 in 1904 from France; No. 52,290 in 1920 from India; No. 52,406 in 1921 from Queensland via Honolulu; No. 52,496 in 1921 from Siam; No. 93,397 in 1931 from India; No. 137,964 in 1940 from Java; and No. 163,290 in 1949 from India. Plants of No. 52,406 were received from Miami (PIS) in 1927, and were grown at Riverside. Seeds obtained from Java in 1948 of a variety labeled *F. oblongata* germinated well, and several seedlings became established. Trees have been located at San Diego, Los Angeles, Santa Barbara, Arcadia (LASCA), San Marino, and Yorba Linda.



Fig. 48. Three kinds of Common Fig, *Ficus carica*, grafted onto a nematode-resistant *F. racemosa* rootstock, were thriving and bearing fruit after several years of growth at Riverside.

(Photo by Dennis Kucera.)

The catalogue of Peter Riedel, Santa Barbara, for 1911 offered trees for sale at 50 cents for the 24-inch [61-cm] size. At the Atkins Garden in Cuba, a tree planted in 1916 had by 1949 a trunk 2 m in diameter, with prominent buttresses. Specimen trees are growing at various places in southern Florida, as are several in the Lyon Arboretum, Honolulu, and in other collections in Hawaii. HSPA Nos. 1,342, 1,455, 1,657, 1,891, 6,062, 6,248, and 6,574 represent introductions of seeds from various sources between 1920 and 1932.

According to Gamble (309), trees of *F. racemosa* are not hardy in north India, having suffered severely from frost in 1905. In Florida, the critical temperature for the tops of the Cluster Fig is about 28° F. However, trees used as rootstocks for the Common Fig can be protected from trunk injury by banking dirt above

and around the bud union. (See related information in chapter IV, at the end of the section headed "Propagation." Figure 28, illustrating such a union, appears in the adjacent text.) Several trees up to 4.8 m in height were growing in 1946 on the Yuma mesa in Arizona, but the tops were frozen back to stubs in 1948. In California, also, young trees have been found to be very susceptible to frost damage. One tree growing on a hillside at Riverside reached a height of 4.5 m, with a trunk 20 cm in diameter. During the winter of 1936-37, this tree was severely injured by frost, and the trunk developed sour sap which flowed down and bathed the roots over a long period. A few weeks later, however, a single sprout appeared which completely renewed the top within a moderate period.

A note by Hayes (361) told of the pollination of fruits borne by trees of the native fig, *F. palmata*, by insects emerging from figs of *F. glomerata*. Fertile seeds were secured and planted; leaves of the seedlings resembled those of *F. palmata*. This experiment in cross-pollination deserves more study and further trials to establish its practicability.

Trees of *F. racemosa* reach a large size in their natural habitat. Osmaston (581) stated that he had measured a tree which was 12 m in girth around the buttresses at 2 m from the ground. Both Gamble (309) and Maiden (492) described wood characters. In Burma, according to Corner (193), this "Red River Fig" is a medium-sized or tall tree, up to 25 m high, with a moderately spreading, rather open crown. The trunk becomes buttressed at the base, with the bark rather rough and coarsely scaly when old.

Trees in the Lyon Arboretum, Honolulu, have very prominent, thin buttresses extending out 3 m or more from the trunk. Similar trees are growing in Ala Moana Park, Honolulu. Aerial roots are not present, although Nehrling (575) referred to "short, wiry air-roots" on a tree at Fort Myers, Florida. The twigs are rusty-brown and puberulent when young, but soon become glabrous. The terminal buds are

up to 1.1 cm long, green to slightly pink, and pubescent. The stipules are lanceolate, early deciduous, or may be persistent for several nodes. The new growth is green.

The leaves are alternate, equilateral, up to 20 cm long and 8.4 cm broad, and elliptical-ovate, with an acuminate apex and a rounded base. The texture is subcoriaceous to chartaceous. The margins are entire or slightly undulate, and the surface is glossy and glabrous, or very sparsely pubescent, especially on the veinlets below when young. Hydathodes are sparsely scattered over the upper surface. Venation is prominent, with veins well elevated below, the midrib often slightly curved, and flanked by 1 pair of basals plus 7 to 10 pairs of laterals. The color is green, with a distinctive, silvery sheen on the upper surface. The petioles are up to 10.5 cm long, jointed at the base of the blade, and chocolate-brown, this color extending as a triangular patch into the upper surface of the midrib.

The figs are borne in leafless, much-branched clusters from the trunk and larger limbs, with individual fruits on lateral spurs or twigs. The peduncles are up to 1.8 cm long, and somewhat enlarged or swollen at the apex or junction with the base of the fig. The figs are spherical to short-pyriform, with neck short and thick (or absent), and are up to 3.5 cm in diameter. The color is green at first, turning scarlet at full maturity, and attractive in appearance. White flecks are densely scattered over the finely puberulent surface. The umbilicus is prominent, flush with the surface or slightly depressed, and scarlet. The outer scales are thick, while the inner ones are thinner and scarlet. The interior is strawberry.

The ornamental value of Cluster Fig trees was thus evaluated by Nehrling (575): "Of all the fig trees I know, this is the least ornamental, and consequently the least desirable, though in a large collection it forms a unique object. For variety's sake and for its unique appearance when in fruit, it would be well suited for highway planting, as it seems to grow well in the driest soils." More recent experi-

ence, however, in Dade County, Florida, hardly bears out this statement as to the suitability of the tree for highway planting, but in parks its clusters of figs always

attract attention. Parker (584) stated that these trees are occasionally planted in gardens and along roadsides of India, but are "never ornamental."

83. *Ficus radulina* S. Watson

Ficus radulina was first described by S. Watson (812) from specimens collected by Dr. Edward Palmer in 1885 near Batopilas, Chihuahua, Mexico, on the eastern side of the Sierra Madre. It is also found at Álamos, Sonora, on the western slope of the Sierra. A tall tree, described and illustrated by Gentry (316) from Arroyo San Bernardo, had a trunk 1 m or more in diameter, rising 6 to 7 m before branching. According to Standley (717), the species is very well marked by the densely pubescent young branches. He gave the native names as "Nacapuli," "Higuera," and "Salate," but some of these may also be applied to certain other species, such as *F. pertusa* and *F. cotinifolia*, species Nos. 33 and 64. (The Spanish word *higuera* means simply "fig tree," and thus may be locally applied to any or all species.) The fruit is said to be edible. Except for the densely sericeous twigs, this species corresponds closely with *F. insipida* (species No. 26), to which it was united by De Wolf (230).

Seeds collected at Álamos, Mexico, in 1947, assigned PI No. 159,446, produced some good seedlings at Riverside. Another collection of seeds, made in 1955 at Mazatlán by Paul Kovach, was donated to the Arcadia Arboretum (LASCA). PI No. 240,711 represented seeds sent in 1957 by Howard S. Gentry from trees at San Bernardo, but the seedlings from this introduction lacked the dense pubescence characteristic of the species. Young plants have become established in Orange County, California; at Arcadia (LASCA); and at Riverside.

The following description has been made from the above plants and from notes taken in Mexico: A native tree in a

stream bed at Álamos has a trunk 1 m in diameter, with prominent buttresses and gray bark. The dormant buds are 7.5 cm long, green, and glabrous. The young twigs are densely sericeous with short, white hairs, this pubescence persisting for several nodes into older wood. The new growth is green.

The alternate, equilateral leaves are 10.5 to 17 cm long and up to 8.2 cm broad, and elliptical, with a rounded base and the blade tapering gradually to an acuminate apex. Venation is prominent, with the veins well elevated, 2 pairs basal (5-nerved at the base, according to Standley) plus 12 to 15 laterals extending at a broad angle from the midrib. The texture is subcoriaceous. The margins are entire. The surface is glabrous above, but is minutely puberulent or scaberulous (minutely scabrous) to glabrate (slightly glabrous) below. Hydathodes (if any) are uniformly scattered over the upper surface on cultivated plants. The petioles are up to 5 cm long, pubescent, and very slightly channeled above.

This is one of the Mexican figs in which the receptacles are solitary in the leaf axils. The peduncles are stout, 0.7 cm long, and puberulent at first, soon becoming glabrous. The globose fruits have a short neck, are 2 cm in diameter, and puberulent on the surface when young. They are decorated with large, prominent, greenish-white flecks. The umbilicus is nipple-like, with greenish scales. The interior is strawberry.

Young plants of *F. radulina* are probably tender to frost. The species is on trial, but has not been sufficiently tested under cultivation to warrant anything more than an experimental planting.

CHAPTER XIV • Species 84 through 96

84. *Ficus palauanense* Merrill (Palawan Fig)

(Plate XXVIII, B1-2)

The Palawan Fig was described by Merrill (515) as *Ficus palauanense*. Later accounts gave the spelling as *F. palauanense* or *palauanensis*. Corner (196, 199b) reduced it to *F. forstenii* Miq., which is treated in this work under *F. payapa* Blanco, species No. 75. *Ficus palauanense* is a Philippine species, well distributed in Tayabas, Davao, and Palawan provinces. See the accounts by Elmer (258, 259, 261), Merrill (524, 525), and Sata (670). According to W. H. Brown (116), trees of this species are found throughout the islands in forests at low altitudes. He also reported that bast from its bark is stronger than that of any other species tested by A. E. W. King (436) for ropes. Pancho (582) stated that the Palawan Fig is cultivated in parks and gardens of the Philippines, where the wide-spreading branches provide an excellent shade. The same is true in Hawaii, where two trees on the campus of the University of Hawaii are especially ornamental, with their dark-green leaves and scarlet fruits. Others are at Schofield Barracks, along the border of the municipal golf course, and at the Wahiawa Botanic Garden.

Ficus palauanense belongs to the subgenus *Urostigma*.

Three different shipments of rooted plants were sent to California in 1939, 1940, and 1948 by L. W. Bryan, Hilo, Hawaii, but none of the plants survived the fumigation treatment given them. Attempts by Edward F. Frolich, laboratory technician at UCLA, to root cuttings finally succeeded in 1961, but unfortunately no plants became established.

The following description is made from trees in the Lyon Arboretum (thirteen in all) and on the University of Hawaii campus: The trees have prominent aerial roots which form multiple trunks in the

Arboretum but not on the campus. The bark is gray and smooth, except for warty lenticel scars and concentric rings or creases. The terminal buds are 2.5 cm long and 0.7 cm thick at the base, tapering gradually from the middle to a sharp point. The color is green; the surface is densely sericeous. The young twigs are green, glabrous, and short-jointed, becoming gray, with prominent lenticels. The stipules, prominent as the buds expand, are triangular, chocolate-brown, and pubescent on the outside; they are 5.7 cm long and 2.5 cm broad at the base.

The alternate, equilateral leaves are 15 to 22 cm long and up to 8.5 cm broad, elliptical-oval, with an abruptly cuspidate apex, the cusp 1.1 cm long, a rounded or broadly acute base, and entire margins. Venation is prominent, the veins well elevated below, with 1 basal pair, extending upward at an acute angle to about half the length of the blade, plus 6 to 8 laterals. The texture is coriaceous and brittle. The surface is green, glabrous throughout, glossy above, and lacks hydathodes. The petioles are stout, 2.5 to 3.2 cm long, slightly flattened, and shallowly channeled above.

The figs are axillary, geminate or single, sessile, spherical to oblong, and up to 2.3 cm long and 1.5 cm in diameter. Their smooth, glossy surface is green at first, but becomes bright scarlet at maturity, and is prominently decorated with very small, dark-red flecks. The rounded apex shows a prominent umbilicus, with conspicuous, straw-colored scales; it is almost, or quite, 0.7 cm across. The interior is white.

The Palawan Fig tree is a worthy competitor of *F. altissima*, so commonly grown in Florida. It deserves extensive trials on the mainland to determine its ornamental value under local climatic conditions.

85. *Ficus trigonata* Linné

In his description of *Ficus* species, De Wolf (230) gave an account of *Ficus trigonata* L., with thirteen botanical names as synonyms. These included *F. crassinervia* Desf. ex Willd., *F. mammilifera* Warb., *F. combsii* Warb., and *F. mitrophora* Warb. De Wolf stated: "*Ficus trigonata* is apparently one of the common figs of the Greater Antilles. While there is considerable vegetative variation within the species, there seems to be no discernible geographical restriction of the variation and, consequently, there seems to be little justification in recognizing a distinct species on each island. Besides this, it seems to be fairly common in Central America." Accounts of the four species follow.

Ficus crassinervia, described by Willdenow (833), is indigenous to Puerto Rico and other islands of the West Indies. A native tree of this species was found at the brow of a hill near the sugar mill at Soledad, Cienfuegos, Cuba, in 1949. The tree is somewhat buttressed at the base, with aerial roots from framework branches wrapped around the trunk. The terminal buds are 0.7 cm or less long, green, and puberulent.

The alternate leaves are equilateral, broadly elliptical, and up to 20 cm long and 10.5 cm broad, with truncate to rounded or slightly subcordate base and broad, rounded apex. Venation is fairly prominent, with the midrib flanked by 1 basal pair and 8 to 10 lateral veins. The blades are glabrous above to slightly puberulent on the veins below. The texture is coriaceous. The margins are entire, and somewhat revolute.

The axillary, sessile receptacles (usually geminate) are subglobose and less than 1.1 cm in diameter, with a velvety surface. See accounts by Grisebach (344), Britton and Wilson (109), Rossberg (654), Acuña and Roig (3), and Lemée (467). The species was listed by Desfontaines (228) on his page 246 as "*Ficus crassinervia* Willd. Sp. Am. m. Cald.," but was not described by him on his page 413.

Ficus mammilifera was described by Warburg (803) and placed in the subgenus *Urostigma*. Seeds received from Jamaica in 1941 germinated well, and a number of seedlings were distributed for trial. Those grown at Riverside succumbed to frost in 1948, and apparently all others have been lost. The species showed good possibilities for pot culture, having glabrous, glossy leaves up to 20 cm long. According to Fawcett and Rendle (280), in Jamaica the tree reaches a height of 12 m, with parchmentlike leaves showing white dots on the upper surface. The figs are mostly on short peduncles, and are about 1.1 cm in diameter, with the umbilicus closed by blackish scales. A variety *hirsuta* has puberulous stipules and smaller figs with hirsute bracts.

Ficus combsii, also described by Warburg (803), has been grown by the New York Botanical Garden and the Atkins Garden, Cienfuegos, Cuba. Herbarium specimens, collected in Cuba in 1946 by J. T. Roig and J. B. Acuña and in 1949 by myself, seem to be authentic, although Warburg gave the stipules and leaves as glabrous. According to Starrock and Menninger (737), *F. combsii* is a strong-growing, spreading tree which is "very hardy" and requires "lots of head room." Acuña and Roig (3) described it briefly, with the related *F. crassinervia* Combs (not Willdenow) in parentheses. An introduction from Cuba in 1946 was given PI No. 155,214. Grandi (338) described *Blasitophaga (Julianella) bruneri* as the fig insect inhabiting the fruits in Cuba.

Cuban trees are of medium size, with silvery-gray bark that is very shallowly creased by lenticel scars. The trunk is not buttressed, and the branches do not show aerial roots. The gray twigs are 0.7 cm thick, rather short-jointed, and pubescent when young. The terminal buds are 0.7 cm or more long, brown, and pubescent.

The alternate, equilateral leaves, borne mostly near the tips of twigs, are up to 18 cm long and 10.5 cm broad, elliptical,

with broad, obtuse apex and subcordate base. The sinus is closed. Venation is prominent, with the midrib flanked by 2 pairs of basal veins plus 9 to 11 lateral pairs well elevated above the surface. The texture is subcoriaceous, the margins entire and somewhat revolute, and the surface lightly pubescent above but densely so below. The petioles average 2.8 cm in length, and are densely pubescent, green, and slightly flattened or channeled above.

The sessile, axillary figs, borne singly or in pairs, are spherical or slightly oblate, and 1.5 to 2.3 cm in diameter. The surface is pubescent, and is decorated with prominent light spots. The umbilicus is darker colored than the tawny-yellow body.

Ficus mitrophora was described by Warburg (803) from specimens collected in Haiti. In his key, he separated five new species with sessile receptacles, as follows:

- a. Bracts of receptacle 1 to 3 mm long.
 Apex of leaves subacute; receptacles puberulent *F. membranacea*
 Apex of leaves rounded; receptacles sub-velvety *F. combsii*
- b. Bracts of receptacle 4 to 6 mm long.
 Apex of leaves subacute; receptacles silky-puberulent *F. harrisii*
 Apex of leaves rounded or obtuse.
 Receptacles velvety . . . *F. mitrophora*
 Receptacles glabrous *F. hartii*

Warburg further observed that *F. mitrophora* is related to *F. combsii* of Cuba, but differs from it in having the petioles hardly at all pruinose, stipules and twigs pubescent when young, receptacles more tomentose, and basal bracts generally pubescent. It was listed and briefly described by Barker and Dardeau (54) as "Figuier rouge" (red fig tree) or Common Fig of Haiti. This and several other species from the West Indies were listed but only briefly described by Rossberg (654).

A fig has long been grown at Miami, under PIS No. 8,503, as *F. mitrophora*. Plants of PI No. 81,493 were received from Summit, Canal Zone, in 1929, and became established in California. They were badly injured by frost in 1937 and 1948, but one plant is growing at the

Huntington Botanical Garden, San Marino. Cuttings of PI No. 183,875, rooted at my request from a fallen tree in the Cuban Experiment Station, Havana, in 1949, apparently belong to another species, probably *F. umbellata* Vahl (our species No 18.) Another lot from the Canal Zone in 1929 was given PI No. 221,184. Rooted plants received in 1936 from the Canal Zone, labeled "*F. macrophora*," are identified as *F. mitrophora*.

Through the courtesy of Dr. J. R. Millar, of the Chicago Natural History Museum, an examination was made in 1958 of herbarium specimens labeled *F. mitrophora* collected in the West Indies by various botanists. These naturally showed some variation in the shape and size of leaves, but in general corresponded closely with Warburg's description and with my own notes, taken in Florida and California. The résumé follows: The tree becomes 5 to 20 m tall, according to Warburg, and has dense foliage. The young twigs, 1.1 cm thick and densely pubescent with white, silky hairs, have tawny terminal buds 1.1 cm long, broad at the base but soon narrowing to a sharp apex, practically glabrous except at the base, which is densely hairy. The mature twigs are rusty-gray, with lenticel and leaf scars prominent.

The large, alternate, equilateral leaves are bunched toward the tips of the short twigs. They are up to 30 cm long and 12.5 cm broad, with rounded base and rounded or very bluntly obtuse apex. Venation is prominent, the veins well elevated below, with 1 or 2 basal pairs plus 6 to 9 pairs of laterals widely spaced. The texture is coriaceous. The margins are entire. The surface is glossy above and glabrous throughout. The petioles are 5 cm long, channeled, and jointed at the blade.

The axillary, commonly geminate, figs are oblong to spherical, often somewhat flattened or compressed, and 2 cm in diameter. The green surface is silky-pubescent and papillate, with raised light flecks. The basal bracts are prominent, broad, and densely silky-hairy. The small umbilicus is porelike, slightly sunken, and lacks surface scales. The stigmas are scarlet.

86. *Ficus nekbuda* Warburg (Zulu Fig)

(Plate XVII, A1-2)

Ficus nekbuda was described and illustrated by Warburg (799), the specific name being the one used for the tree by natives of Zululand. Sim (696) described and illustrated a fig from Portuguese East Africa as *F. utilis*. Hutchinson (407, 408) compared the type specimens of the latter with those of *F. nekbuda* from the Congo, and regarded the two as identical. Baileys' *Hortus* (45) and Mary Barrett (68) both treated *F. utilis* as a synonym of *F. nekbuda*. The account by Mary Barrett (65) of the latter and the characters which differentiate it from *F. vogelii* may be consulted for further details. See species No. 68 for the present account of *F. vogelii*.

Other reports were given by Wildeman (827), O. W. Barrett (69), Lebrun (460), Lebrun and Boutique (462), and Henkel (366). Lebrun and Boutique placed the species in the subgenus *Bibracteatae*, section *Axillares*. See also, Graf (324, with illustration).

This species is widely distributed, from the former Belgian Congo and East Africa to Natal and Zululand. The bark of Zulu Fig trees may be peeled from the trunk and made into a saronglike cloth garment. Sim (696) stated that the preference for "M'Chopes" cloth is apparently owing to "the local knowledge of the art of coppicing, and the suitable stems produced thereby." Hutchinson (cited above) reported that the tree was grown in the Royal Botanic Gardens (Kew) and at the Serres Coloniales, Brussels, in 1913. See chapter IV under "Paper and Cloth" for several other species having similar useful qualities.

PI No. 29,359 represents an introduction of *F. utilis* from East Africa in 1909, with this note by O. W. Barrett: "A medium-sized tree of the open bush from Zululand to Somaliland; prefers sandy soil. Almost evergreen except in long droughts. Roots well from cuttings. Fruits worthless." Scions brought from France in 1932 under PI No. 101,342 failed to grow.

Trees of this species have long been growing and bearing fruit in California at Montebello and at Balboa Park, San Diego. Specimens were also seen at Weslaco and Brownsville, Texas, and at Bradenton, Fort Myers, Naples, and Miami, Florida, in 1958.

The following description is partially based on notes made of these trees, in comparison with the accounts just cited: According to the original description by Warburg (799), the Zulu Fig reaches 20 m in height, with an immense trunk throwing enormous branches in all directions. It grows at first as a strangler. Cultivated trees are small, the largest in California having a trunk 61 cm in diameter. Some aerial roots are usually present near the base. The terminal buds, 1.1 cm long, are glabrous, and rusty or dark brown. The stipules are 2.5 cm long, and 1.5 cm broad at the silky-pubescent base. The young twigs are at least 1.1 cm in diameter, and are densely covered or felted with white, silky hairs that are later deciduous.

The alternate, equilateral leaves are large, 25 to 30 cm long and 15 cm broad, elliptical or broadly oval, with a bluntly obtuse apex and a rounded or slightly subcordate base. Venation is prominent, with veins well elevated below; 1 to 3 basal pairs plus 5 to 7 laterals spaced 2.5 to 3.6 cm apart. The texture is coriaceous. The surface is glabrous above to sparsely pubescent along the veins below. The margins are entire. The petioles are stout, up to 10.5 cm long, somewhat flattened above, and rusty-scuffy on the surface, with a sharp line of demarcation between the apex and the greenish midrib.

The axillary figs are sessile, and are often angular because of being densely clustered toward the tip of the branch or on short lateral twigs. They are 2 cm in diameter and length, and grayish white, caused by a coating of dense, silky pubescence. The basal bracts are prominent, flaring, pubescent, and 0.8 cm long. The

umbilicus is small, sunken, and more or less concealed by pubescence. The interior is scarlet, or it may be white.

Nehrling (574, 575) had trees of *F. utilis* growing at Naples, Florida, and reported the species to be a very strong grower, assuming a fine form, broad and dense, thus predicating its adaptability for avenue and highway planting. Specimen trees grown in pots at a Los Angeles nursery in 1943 reached 2.5 m in height, but the leaves tended to sunburn or to become discolored. At temperatures of 25

to 27° F., trees 2.5 m tall with a trunk diameter of 8 cm were severely injured in 1948. In California, a tree at Huntington Botanical Garden, San Marino, has been severely damaged by frost three different times, twice to the ground level, and has therefore been removed. Both at San Diego and at Montebello, trees have thrived and borne fruit freely without suffering from frost. Therefore, *F. nekkudu* is a species which may have promise in some localities as an ornamental, but may be damaged by occasional freezes.

87. *Ficus malunensis* Warburg (Maluna Fig)

(Plate XXXI, A1-2)

Ficus malunensis was described by Warburg (800) from specimens collected at Malunu, Province of Isabela, Luzon. P.I. Elmer (258) gave a good botanical account of it, and stated that its nearest ally is *F. longipedunculata* Elmer (a synonym of *F. chrysolepis* Miquel), from which it can be easily distinguished by "its shorter, pubescent peduncles, bracts, and receptacles." According to F. X. Williams (836), the Maluna Fig is not of the strangling or banyan type, but evidently exists as an independent tree. This species was regarded by Sata (670) as "not clearly distinguishable from the Malayan form currently referred to as *Ficus callosa* Willd." Botanical specimens sent to the Philippines in 1959 were also identified by botanists as *F. callosa*, but the latter is here treated separately, as species No. 88 immediately following the present account.

Mature trees were found in 1959 in the Lyon Arboretum, Honolulu (HSPA No. 1,965, and probably also No. 1,486), and at the Wahiawa Botanic Garden. It is said to be very difficult to grow from cuttings, in contrast to *F. carica* and others.

The following description is made from material collected at Honolulu, in comparison with Elmer's account. He reported it as "a round-topped and widely spreading tree, 15 m high, with moderately hard wood; bark thick, yellowish gray or mottled." Some trees at Honolulu are over 9 m high, with a spread of 12 m, and a trunk

diameter of 66 cm. Aerial roots are lacking. The terminal buds are about 1.1 cm long, gray, with closely appressed silky hairs. The stout, short-jointed twigs, 0.7 cm thick, are gray-green, with prominent, corky lenticels, soon becoming dark gray and considerably roughened.

The alternate, equilateral leaves are up to 32.5 cm long and 20 cm broad, oval to broadly ovate, often broadest below the middle, with the apex broadly obtuse or rounded and the base rounded to truncate, or sometimes shallowly subcordate. Venation is prominent, the veins well elevated below, with 2 or 3 short basal pairs plus 8 or 9 pairs of laterals. The texture is coriaceous and somewhat brittle, the margins are entire, and the surface is glabrous above and below. The petioles are stout, up to 8.5 cm long, glabrous except at the very base, with lenticel-like, rusty excrescences scattered over the surface, and are ordinarily but slightly or not entirely channeled.

The figs, single or geminate, axillary or commonly crowded near the tips of short twigs, are borne on prominent, slender peduncles, which are generally curved, pubescent, and up to 2.5 cm long. The shape is pyriform, with a prominent, slender neck about as long as, or slightly longer than, the peduncle; the size is up to 4.5 cm long, including the neck, and the globular body is about 2.5 cm in diameter. The green surface, pubescent with

short, white hairs, is remarkably free of colored flecks, although sometimes blotched with patches of lighter green. The rather prominent bracts at the base of the neck are dry and brown at the apex but almost white on the margins. The umbilicus is practically flush, or with green, pubescent scales slightly protruding. The interior has a thick, white meat, with pink

flowers lining a cavity that is unusually small for such a large fig.

Ficus malauensis is one of the species which, if once introduced into Florida as Riedel (641) stated, has not become established in the continental United States. The tree certainly does have ornamental characters, and is well worthy of trial in parks and large gardens.

88. *Ficus callosa* Willdenow (Callose-leaved Fig)

(Plate XVII, B1-3)

Ficus callosa, described by Willdenow (832), is a species widely distributed in tropical Asia, including Ceylon, the evergreen forests of India, the forests of Burma, as well as the Andaman Islands, Java, and other parts of the East Indies. G. King (437) placed the species in the subgenus *Urostigma*, while Elmer (263) included it, without description, in his list of Philippine figs under section 5—*Axillares* (A: *Glabratae*).

In 1932, it was introduced from Ceylon under PI No. 95,582, with the following description: "A large tree, native to south-eastern Asia, with hoary, warted branchlets and rigid, leathery, elliptical leaves 5 to 8 inches [13 to 20 cm] long. The yellow, pubescent fruits, 1 inch [2.5 cm] in diameter, are slightly pear-shaped, and are borne singly in the axils of leaves." The original Latin description referred to the leaves as "*callosa*," meaning hard and thick in texture, which accounts for the specific name. Worthington (849, with illustration) called it the Shiny-leaved Fig.

Descriptions and accounts of this species were given by Vahl (773), Kurz (455), G. King (437,* 438), D. Brandis (103), Clercq (162), Talbot (746, 747*), Koorders (444), Koorders and Valetton (446*), Gamble (309), C. E. Parkinson (585*), C. E. C. Fischer (286), and Lewis (469); those marked with an asterisk show illustrations. Senanayaki (687) referred to the use of *F. cremata* [*callosa*] as wood in Ceylon, but added that except for very temporary packing materials, it is unsuitable as a timber. Trees of this species were recorded by Setyodiwiryo (689) as grow-

ing at Bogor, Indonesia; and in the Peradeniya Gardens, Ceylon, by Parsons (590). (See comment under *F. portuensis* in chapter XVI.)

The tree of *F. callosa* has been variously described by some of the authors just cited, as follows: By both Kurz and Brandis, as an evergreen forest tree, but bearing at an early age, even as a shrub; by Gamble, as a large tree with soft wood, white or grayish brown in color; by Parkinson, as a large, deciduous tree with light-gray, smooth bark; and by Talbot, as a very large, evergreen tree with pearly juice, no aerial roots, and warted branchlets.

The following description is made from a tree at Miami (PIS), bearing PI No. 95,582, as noted above: The tree has no aerial roots. The trunk, 30 cm in diameter, has slight buttresses, a few surface roots, and gray bark. The twigs are slightly pubescent, about 0.6 cm in diameter, and dark chocolate-brown. The terminal buds are 0.7 cm long, slightly pubescent, and tawny.

The alternate, equilateral leaves are 20 cm or more long (15.0 to 27.5 cm, according to Brandis) and 9.5 cm broad, oblong to elliptical, with a rounded base and an obtuse or obscurely apiculate apex. The texture is coriaceous. The surface is glossy and deep green above, but lighter below; both surfaces are glabrous except for the larger veins below, which, according to some accounts, are slightly scabrid or rough to the touch. The margins are entire and slightly revolute. Venation is prominent, with the light-green midrib flanked

by 1 pair of basals and 10 to 12 laterals, each curving toward the margin, some spaced 2 cm apart. The petioles are glabrous, 2.5 to 5.0 cm long, 0.3 cm thick, and slightly channeled above.

The figs are axillary, usually solitary (occasionally in pairs, as described by Brandis), 2 cm in diameter, globular to obovate or slightly oblate, sometimes with

a neck which is 0.6 cm long and abruptly joined to the body, and borne on a slender peduncle 0.8 cm long and enlarged at the apex. The color is green and the surface pubescent, without prominent flecks. The umbilicus is small, less than 0.2 cm across, flush with the broad, rounded apex, and the scales are greenish white. The interior is white.

39. *Ficus altissima* Blume (Lofty Fig)

(Plate XVII, Cl-2)

The specific name *Ficus altissima* given by Blume (92) signifies "lofty" or "very lofty," hence the common name. Some descriptions refer to it as a tall tree, others as a large, spreading tree with few aerial roots. It is sometimes known as the False Banyan because the aerial or prop roots are much less numerous than those of the "true banyan," *F. bengalensis*. (See chapter II, under "Trees.") The common name Council Tree is also applied to it because in Java, councils were once held in the shade of its branches. The species is indigenous to the Asiatic tropics, from the Himalayas in India to Burma and Malaya.

Several accounts of *F. altissima* may be cited as follows, an asterisk marking those with illustrations: Miquel (542, under *Urostigma*), Kurz (455), J. D. Hooker (388), G. King (437, * 438), Dussawillez (246*), Råde (618), D. Brandis (103), Clercq (162), C. E. Parkinson (585), Mowry (561*), Burkill (124), Merrill (513), Mary Barrett (59, * 68*), Clement *et al.* (161*), and Graf (324). G. Watt (815) gave a good account, with a list of references to literature; also, Worthington (849) published a short description, with illustration, as *F. fergusonii* King. See J. G. Watson (810) for Malayan names.

As pointed out under *F. bengalensis* (species No. 65), *F. altissima* and *F. bengalensis* may be confused as to identity. The keys for identification in chapter V separate the two species on the basis of leaf blades and the pubescence of various parts. Mary Barrett (59, 68) reported them to be similar in habit of growth and in the shape of the leaf blades. See also,

differentiation of the two in a key by G. King (438).

Ficus altissima is commonly used in Florida as a highway tree, especially in the vicinity of Miami. There the top is not "lofty," but broad and spreading. The largest tree of this species growing in North America is at Punta Gorda, Florida, where it was planted about 1913 by Marian A. McAdow (486), a former owner of Banyan Acres, according to her account. In 1949, the trunk (or supporting trunks) measured 19.5 m in circumference and the crown 40 m in diameter. It was probably this tree that led Mary Barrett (68) to state that *F. altissima* was one of the first ornamental figs to be introduced into southern Florida. Magnificent specimens of the Lofty Fig are growing at Miami, mostly along streets. Lucita Wait (790) reported that many trees of this species were propagated as cuttings from plants furnished by the E. N. Reasoner Nursery at Oneco. Because of variation in the trees, she advocated taking stock "from one which is known to have good foliage and nice, bright-red fruits."

In 1929, the Royal Palm Nursery presented plants of the Lofty Fig to the United States Department of Agriculture, which gave it PI No. 82,398. The Department had already introduced it from India in 1919 with PI No. 47,843; also, as cuttings from Egypt in 1931 under PI No. 93,272.

Several large trees of *F. altissima* are growing in the Lyon Arboretum and in the vicinity of Honolulu. The multiple trunk of one such tree was shown in a

photograph by the late H. L. Lyon (485) in 1929; a similar photograph by A. J. Basinger appears in chapter II, as figure 19. The scarlet fruits are conspicuous because they lie beside and on the trail.

According to Tucker (766), *F. altissima* was grown at Santa Barbara, California, by Dr. C. F. Franceschi, but the date of its first introduction has not been determined. Specimens collected at the former Bard Estate, Hueneme, California, in 1940 and again in 1947, may have been propagated from a tree of Franceschi's introduction. No large specimens of the Lofty Fig are found in California, as there are of several other species of *Ficus*. The University of California received young trees from Florida and from Hawaii in 1928, and grew them as potted plants in the greenhouse for several years. One of these plants became infected with a virus which caused leaf mosaic. Another plant of the same lot was transferred to the Huntington Botanical Garden at San Marino, where it also developed mosaic on the foliage. (See figure 36 in the text of chapter IV, referred to under "Pests and Diseases.") At the UCLA Botanical Garden, one tree of *F. altissima* grew vigorously, and produced bright-red fruits profusely from 1937 to 1941, but had to be removed to make way for roads. A tree was once established at Arcadia (LASCA), and young trees are growing at Riverside.

This species has attracted the attention of nurserymen for distribution in pots. The large, glossy leaves and the scarlet fruits, borne profusely in the leaf axils, make this a distinctly ornamental conservatory or house plant. Its tolerance of the dry air in heated rooms is not known.

The cold-hardiness of *F. altissima* has not been definitely ascertained. In ordinary seasons, the trees apparently thrive outdoors in the lower Rio Grande Valley of Texas and in southern Florida. However, the species is not so resistant to winter cold as *F. macrophylla* or *F. rubiginosa*. It certainly is worthy of more extensive trial in various thermal belts.

The following description is adapted from notes made on trees growing in Florida, Hawaii, and California: Trees in southern Florida have broad tops, with some aerial roots and a few multiple trunks. The twigs are up to 0.7 cm thick, pubescent, with elongated lenticels. The bark is green or light silvery-gray. The terminal buds are plump, prominent, 3.6 cm long, up to 0.8 cm thick at the base, puberulent on the surface and on the margins of stipules, and tawny or reddish brown.

The entire, glabrous leaves are alternate, equilateral, oval, up to 25 cm long and 15 cm broad, with a rounded or bluntly acuminate apex and a broad, rounded base. Venation is prominent, the midrib flanked at the base by 2 pairs of veins, 1 pair much larger than the other, forming, as Mary Barrett (68) stated, a conspicuous angle or "V." There are 5 to 9 pairs of laterals. The texture is coriaceous to subcoriaceous. The surface is green and glossy above, but lighter-colored below. The petioles are up to 11.5 cm long and 0.7 cm broad, somewhat flattened, hardly (or indistinctly) channeled above, green or pink, and puberulent.

The figs are axillary, sessile, and mostly geminate. They are spherical, up to 1.5 cm in diameter, pubescent at first, becoming smooth and glabrous, commonly scarlet, and almost devoid of exterior markings. The basal bracts are prominent, and yellowish to pink. The umbilicus is fairly prominent, scarcely 0.4 cm across, with the scales almost concealed or sunken in a porelike depression. The interior is white.

Nehrling (575) reported that trees of *F. altissima* are rapid growers, and are "a marvel of beauty when large," therefore invaluable as shade trees for highways in southern Florida. However, like those of *F. bengalensis*, the trees eventually reach a large size, and individual specimens vary considerably in vigor and habit of growth. The popularity of this species as a street or highway tree has consequently waned in recent years.

90. *Ficus goldmanii* Standley (Goldman Fig)

(Plate XX, B1-2)

This species was named by Standley (717) in honor of E. A. Goldman (321), who collected the type specimens at Álamos, Sonora, Mexico, in 1899. Its range extends from Sonora throughout Mexico to Central America. Paul H. Allen (6) reported it to be a very common tree in Costa Rica, where it is used for living fence posts and for shade. Personal observations have been made of trees at Álamos, Mazatlán, Guadalajara, and Oaxaca, some with immense trunks and wide spread of branches. A large tree was observed at the Federal Experiment Station, Honolulu, in 1934. Specimens of leaves and fruit of this tree, received in 1948 from E. Y. Hosaka, confirmed the identification as *F. goldmanii*. Unfortunately, this fine, ornamental tree had to be removed. The species belongs to the subgenus *Urostigma*. Standley and Steyermark (726) gave the common names "Amate" and "Matapolo," but both are also used for various other fig species; "Amate" is applied to *F. costaricensis* (species No. 52), for example.

Seeds were collected in 1947 from trees at Álamos, Mexico, and seedlings were grown at Riverside for distribution. A tree seen at Álamos had a trunk 1.25 m in diameter, with fairly prominent buttresses but lacking aerial roots. On the other hand, Paul H. Allen (6) stated that mature trees have banyanlike trunks and roots pendant from the branches. Gentry (316) described it as attaining immense proportions: 10 m high, 30 m broad, with

a trunk 2 to 3 m in diameter. His illustration shows such a tree with a top spread of 30.5 m.

The terminal, dormant buds are 2.5 cm long, green to tawny, and slightly pubescent. The young twigs are fairly stout, up to 0.7 cm thick, pubescent, and green, soon becoming light chocolate-brown.

The alternate, equilateral leaves are oblong-elliptic, up to 25 cm long and 10.5 cm broad, with a rounded or slightly acute apex and subcordate base. The prominent midrib is flanked by 2 or 3 pairs of veins at the base plus 9 to 12 laterals extending at a broad angle toward the entire margins. The young plants show leaves with a velvety puberulence above and below, but mature trees have coriaceous, brittle leaves, glossy and glabrous above, with puberulence on the lower veins only. The petioles are up to 5 cm long, shallowly channeled above, and glabrous or very slightly puberulent.

The axillary figs are single or geminate, spherical to oblate-spherical, often somewhat oblique, and up to 2.5 cm in diameter. The densely puberulent body is green, with prominent, white flecks scattered over the surface. The umbilicus protrudes from the apex, with a distinct rim 0.3 cm across. The puberulent peduncles are from 1.1 to 2.5 cm long, and slightly enlarged toward the apex. The interior is strawberry-red.

In California, the young trees have a tall or spindly habit of growth, and so can hardly be recommended as ornamental.

91. *Ficus palmata* Forskal

Ficus palmata was described by Petrus Forskal (293).

Considered by several botanists as the Indian representative of the Common Fig, it ranges in habitat from northern India and Afghanistan to Arabia, Egypt, and Ethiopia. The systematic botany of *F. carica*, *F. palmata*, *F. pseudo-carica* Mi-

quel, and of several other related forms was recounted by Condit (174a) in 1947, so it will be treated only briefly here. G. King (437), in studying the floral characters of four so-called species, found no differences in the flowers, and therefore stated: "I have a strong suspicion that all may be but forms of *F. carica* Linn." See

Parsa (589), Manjunath (497a), Miquel (539), and Corner (199b).

Trabut (760) grew the three species named above, and succeeded in crossing them one with another. One such hybrid of *palmata* × *carica* was introduced from Algeria in 1917 under PI No. 45,235, somewhat preceding Traub's publication date (1922). These three have also been grown in California for several decades. The receptacles have very similar staminate and pistillate flowers, are inhabited by the same species of *Blastophaga* (*B. penses* Linné), and many seedlings have been grown as hybrids. Introductions from Eritrea in 1911 as PI No. 31,469 and from Italy in 1915 as No. 39,828 are both classified as *F. pseudo-carica*. In 1941, there were received, through the USDA, twenty-seven packets of fig seeds, each collected in Iran from a separate wild fig tree, and forwarded under PI Nos. 141,121 through 141,147. Seeds of PI Nos. 269,491 and 269,492 were collected in West Pakistan in 1960 by Howard Anderson, and forwarded directly to the University of California. Seedlings of each lot were grown, and were tentatively determined as belonging to the species *F. palmata*. The leaf forms of these seedlings varied widely, from entirely nonlobed to 3-, 5-, or 7-lobed blades, and even to those with lacinate or very much dissected blades. The fruits also showed great diversity in size, color, shape, and quality. Most of them were small, very seedy, and acidic in flavor. All were nonparthenocarpic, i.e., they required caprification, the stimulus of pollination of flowers and resulting fecundation, to insure setting and maturity of the figs. No hybrids producing good, edible fruits were secured from crosses of *F. palmata* × *F. carica* or from reciprocal crosses. One character found in

some receptacles, but not found in those of *F. carica*, is the red color of the stigmas of both short- and long-styled flowers.

Kirtikar and Basu (440) treated *F. palmata* Forskal, with *F. carica* Linné as a synonym. According to Naik (569): "The species that goes in Bangalore by the name of *Ficus palmata* is also one which may need its specific status to be looked into and re-examined." The matter has become somewhat more complicated by the fact that Joseph (428) described a new species of *Blastophaga* (*B. vaidi*) from the receptacles of *F. palmata* at Dehra Dun, India. Joseph (427, 429) also described *Philotrypesis palmata* and *Sycoscapteridea forstenii* as inhabitants of the fruits. As Naik suggested, the *F. palmata*-*F. pseudo-carica* complex needs to be thoroughly studied, and the specific status of each to be determined; this might result in the consolidation of the three species and their near relatives into one.

The trees of *F. palmata* and *F. pseudo-carica* have practically no ornamental or economic value, at least in the United States. The species occur as shrubs or small trees, although Gamble (309) stated that native Indian trees of the former reach 3 m in girth. The fruits are edible, but are very inferior in quality to those of *F. carica*. The Brawley caprifig, described by Condit (178), is a cross of the Kadota variety with pollen of *F. pseudo-carica*. Except for its small size, it is a good variety of caprifig. Gamble believed that it would be worth the attempt to improve *F. palmata* by cultivation, but did not suggest any definite procedures. While our attempts to improve it in California by hybridization were disappointing, there are still good prospects of developing varieties of economic value by successive crosses of the three related species.

92. *Ficus pseudopalma* Blanco (Palm-like Fig)

(Plate XXII, A1-2)

Ficus pseudopalma, described by Blanco (88), is another one of the aberrant and strikingly distinct species of the genus. In its native habitat, the Philippine Islands, it is an unbranched shrub or tree, seldom over 7.5 m high, with the long leaves crowded near the summit. Gates (313) reported it as a dominant species in swampy areas at Los Baños, P.I. An illustrated account of a specimen growing at Forest Station, Los Baños, was given by F. X. Williams (835, 836). He stated: "I found but three species of pleasantly edible Philippine figs; the best of these, the tolerably large seed figs of *Ficus pseudopalma* Blanco, are sweet and juicy, with a pleasant flavor of their own, even the rather thick rind being palatable." The species is noted for its very large insect inhabitant, the female *Ceratosolen bakeri* Grandi (335), pollinator of the flowers, being over 3 mm in length.

The Palm-like Fig was introduced in 1912 as PI No. 33,182, and in 1917 as No. 44,470, both from the Philippines. The University of California received rooted plants from Hawaii in 1928, in 1939, and again in 1941. A Los Angeles nursery obtained fertile seeds via Hawaii in 1952 and grew about 200 seedlings, most of which were later discarded as not suitable for pots or ornamental specimens in the vicinity. However, a California nursery did list it in its 1958-59 catalogue, with the comment: "The silhouette of this bizarre plant suggests the rosette of bird's-nest ferns at the end of naked limbs; most unfiglike."

Nehrling (575) reported that this species thrives well in southern Florida, where it makes a fine lawn plant. A specimen at Fort Myers was 3.8 m in height at that time (1942). Another fine specimen has long been growing in a yard at the corner of South Bayshore Drive and Seventeenth Street, Coconut Grove, apparently the only one of its kind in the vicinity. Plants propagated from suckers

of this small tree have been distributed. Several specimens are growing in Hawaii, one of the oldest being located beside the Central Union Church in Honolulu. (See figure 9 in chapter II, referred to under "Shrubs." The illustrations show representative habits of growth.) Another tree at the Kamehameha School had the tall stem cut back, the resulting side shoots producing an especially ornamental effect. According to Pancho (582, with illustration), it is cultivated in the Philippines for ornament and for its culinary value, the tender shoots being prepared for salad. For other accounts, with illustrations, see Sata (670), Marie Neal (572), and Graf (324); without illustrations, see Merrill (514, 516, 519), Elmer (257, 258, 262), and Galloway (307). Corner (196, 199b) gave *F. pseudopalma* as the type species of the series *Pseudopalmeae*, subsection *Ficus*.

The following descriptive notes were made from plants growing in Florida, Hawaii, and California: The slender trunks, up to 6 m tall, are only a few centimeters in diameter. The inactive terminal bud is 3.6 cm long, loose or somewhat open, green, and glabrous. The stipules are persistent for several nodes, and are smooth and lanceolate before shriveling. The twigs are green and glabrous, with the bark becoming gray with age. The new growth is green.

The leaves are alternate, equilateral, up to 1 m long and about 15 cm broad, obovate, gradually narrowing from the middle toward the base, with the apex somewhat mucronate. Venation is prominent above and below, with a coarse midrib and up to 27 pairs of lateral veins. The texture is subcoriaceous, the upper surface somewhat glossy, with hydathodes present. The upper margin is prominently and coarsely dentate, while that near the base is almost entire. The petioles are stout and short.

The axillary fruits, borne on very short peduncles, are urn-shaped and broadened

toward the apex, 3.6 cm long and 2.3 cm broad. The surface is ribbed lengthwise and densely pebbled by raised white flecks. The basal bracts are prominent and dark. The surface is dark brown at the base, shading to greenish purple on the body. The pistillate flowers are pink or strawberry. The umbilicus is large, crowning the protruding apex with purplish scales; the center is sunken.

93. *Ficus nota* Merrill (Tibig)

(Plate XIX, A1-3)

Ficus nota was described by Merrill (515) with reference to the earlier description by Blanco (88) as *F. aspera nota*. According to Elmer (256, 257, 258, 259, 263), it is a common species in the Philippines, and is successfully grown in gardens. Merrill (519) also stated that it is endemic, and not uncommon in yards. The local name Tibig applied to the species is the accepted or adopted official common name for *F. nota* only, according to Director Eugenio de la Cruz, Laguna, in a letter dated April 12, 1960. He further stated: "This small tree is comparatively abundant along the banks of fresh-water streams, or in the forests at low and medium altitudes, practically throughout the Philippines. If ever it is found growing in thickets and in settlements, it may be because the achenes or seeds are easily carried by water currents." They adhere also to clothing or to the body of a carabao, and when dry they fall off and then germinate in any kind of soil, but preferably in shady places or ones associated with high humidity. The species belongs to the subgenus *Covellia*. Other accounts were given by Merrill (524), Wester (820), Fairchild (275; 276, with illustration of fruits), Sata (670), and Pancho (582).

Two fig insects were described and illustrated by C. F. Baker (46) as inhabiting the receptacles of *F. nota*. These are *Blasitophaga nota*, classified in the genus *Ceratosolen* by Grandi (336), and *Sycophaga nota*. In addition, Baker found four mesemites, guests, or parasites as inhabitants of the same receptacle. Grandi (337) re-

ported *Philotrypesis similis* Baker as one of the symbionts. F. X. Williams (836) figured the fruits, flowers, and fig insects, the last ovipositing in the gall-flowers of *F. nota*. He also found that the fruits are subject to the attacks of small flies that deposit their eggs within the fleshy part, feed freely therein as larvae, but leave and pupate in the soil. See also, the account of *Ceratosolen notus* by Wiebes (824c).

At least four introductions of seeds have been made of *F. nota*: PI No. 50,697 in 1920 from Java; and No. 61,010 in 1924, No. 95,370 in 1931, and No. 134,993 in 1939; the last three from the Philippines. Notes by Wester (820) on No. 61,010 stated: "The tree is upright and of medium size. The fruits are produced in short racemes from the ground up and on the stout branches, and are about one and one-half inch [4 cm] in diameter, fleshy and juicy, very sweet for a wild fruit, with the characteristic flavor of the cultivated fig." F. X. Williams (835), on the other hand, found the fruits to be "quite unpalatable." The Tibig has been introduced into California, both as seeds and as plants. As Wester reported, it is very tender to frost, and the roots are also susceptible to attacks by nematodes. A plant received from Hilo, Hawaii, in 1939 as *F. mindoroensis* Merrill has been identified as *F. nota*. The tree is still small at the time of writing, but is growing vigorously at Arcadia (LASCA). An introduction of *F. mindoroensis* was made from the Philippines in 1942 under PI No. 144,039. (See *F. mindoroensis* in Index.)

Fruiting trees of *F. nota* have been observed and notes made at Laurel and Miami, Florida, as well as of nonfruiting plants in California, as follows: A tree at the south end of the municipal golf course at Honolulu was tentatively identified to be this species in 1960. Native trees are erect, up to 9 m high, or shrubby with crooked stems. In Florida, the trees are low and spreading, with trunks branching near the ground, probably because of having suffered occasional frost injury. No aerial roots were observed. The twigs are hollow when young, about 0.7 cm thick, and densely silky-pubescent. Older twigs are chocolate-brown, with leaf scars large and prominent. The terminal buds are 2.5 cm long, 0.7 cm thick at the base, pubescent, somewhat flattened or angular, and green to tawny.

The alternate leaves are large, up to 25 cm long and 15 cm broad, ovate, the apex bluntly acute or acuminate, and the margins coarsely serrate to almost entire. The blades are variable as to the base, which is sometimes obovate and narrowed to cordate with narrow sinus, the lobes often overlapping and sometimes asymmetrical. Some blades are distinctly narrowed from the middle or above toward the rounded base. The texture is chartaceous. Hydathodes are present, and densely scattered over the surface, which is pubescent only

on veins above but silky-pubescent below. Dr. Eugenio de la Cruz, Laguna, P.I., writes that the leaves are rough, but too thin and pliable to withstand scrubbing floors, unlike those of the Sandpaper Fig, *F. coronata*, or the Fragrant-leaf Fig, *F. odorata*. Venation is prominent, with 3 to 5 pairs of basal veins and 7 to 9 laterals flanking the midrib, these well elevated, widely spaced, and branched toward the margin. The petioles are up to 5 cm long, stout, silky-pubescent, rusty-scurfy, and reddish to chocolate-brown, abruptly changing to green at the base of the midrib.

This species is cauliflorous, with the figs borne mostly in fascicles from the stem and branches, as illustrated by Wester (820), on pubescent peduncles up to 1.1 cm long. The sterile figs are 3.5 cm in diameter, globular to oblate-spherical, with the surface pubescent but glossy, and decorated with prominent, white flecks which are thickly scattered, the larger ones with a corky spot in the center. The figs are green when young, but change to scarlet before dropping. The umbilicus is large and somewhat depressed. The interior is strawberry.

Ficus nota is interesting from a botanical standpoint because of its cauliflorous habit. The trees are not particularly ornamental, and are too tender to frost to be recommended for wide planting.

94. *Ficus mallotocarpa* Warburg

(Plate XXIX, A1-4; Plate XXX, B1)

Ficus mallotocarpa (occasionally misspelled *mallatocarpa*) was described by Warburg (797) from specimens collected in east Africa at 1,400 m elevation. He reported that it may be readily distinguished from *F. vallis-choudae* and *F. capensis* by the soft-hairy fruits, which are more like those of *F. gnaphalocarpa*. However, the fruits of both *F. capensis* and *F. mallotocarpa* are densely tomentose, as pointed out by Lebrun and Boutique (462). These authors separated the two species in a key, for which see the next page.

Mildbraed and Burret (535) treated this species as a variety of *F. capensis*.

Other accounts were given by Engler (266, with illustration), Hutchinson (407), Battiscombe (71), Hutchinson and Dalziel (410), Burt-Davy (131), and Lebrun (460). Dale (217) stated that *F. sycomorua* is closely allied to *F. mallotocarpa*, and that the two are likely to be confused. On the other hand, Frank White (823) reported that *F. mallotocarpa* had theretofore been separated from *F. capensis* because of the villous-tomentose fruits, a character so variable that "no useful purpose is served by keeping them apart."

Trees of *F. mallotocarpa* found growing at the Atkins Garden in Cuba in 1949 fur-

nished notes and herbarium specimens. Accession No. 5,639 (HSPA) represents an introduction of seeds into Hawaii from Nairobi, Africa, in 1930; the offspring are thriving in the Lyon Arboretum at Honolulu. Specimens now growing in California were propagated from rooted plants forwarded by L. W. Bryan, Hilo, Hawaii, in 1939. The first lot failed to survive the fumigation treatment given, but one plant of the second lot did survive, and plants were propagated from it for distribution. One specimen at Arcadia (LASCA) has grown vigorously into a tree, with branches low and spreading, 7.6 m broad and 4.5 m in height. An introduction in 1942 by the University of California was given PI No. 144,038.

The key given by Lebrun and Boutique (462), referred to on the preceding page, follows:

Leaf blades suborbicular to broadly elliptic, rounded or obtuse at apex, entire or slightly undulate; leaf or stipular scars marked by a fringe of hairs. *F. capensis*

Leaf blades oval to oblong, sometimes obovate, acuminate at apex and largely toothed; scars without a fringe of hairs. *F. mallotocarpa*

According to Hutchinson (407), native trees of this species are 3 to 9 m tall, or even more, with the habit of an alder, and the sap watery-viscid rather than milky. The young branches of plants in Cuba and California are hollow or devoid of pith. Such branches are glabrous or somewhat pubescent, especially at the nodes, but not fringed; green at first, but soon becoming brown. The terminal dormant buds are up to 2.5 cm long, silky-pubescent, and green.

The alternate leaves are equilateral (often a little unequal-sided at the base, according to Hutchinson), up to 22.7 cm long and 10.5 cm broad, ovate, with the apex abruptly apiculate or bluntly acuminate and the base rounded or shallowly subcordate. Venation is prominent, with veins well elevated below, the midrib often pink or scarlet, flanked by 1 or 2 basal pairs plus 5 to 7 laterals. The texture is chartaceous, and the surface glabrous or slightly pubescent above, glabrous or silky-pubescent below, especially along veins. Hydathodes are present, and well scattered on the surface between veins. The margins are coarsely crenate. The petioles are 6.2 cm long, silky-pubescent only when young, and slightly channeled above.

As Hutchinson stated, the figs are on crowded panicles or on fruiting branches which are leafy at the tip, on the lower part of the trunk or large limbs, or sometimes in the axils of the leaves. The peduncles are 1.1 cm long, and densely pubescent or scurfy. The figs are up to 3.1 cm broad and 1.5 to 3.6 cm long, including the prominent neck, oblate to pyriform, and silky-pubescent on the green or slightly violet surface, which is decorated with densely scattered white flecks or faint stripes. The basal bracts are medium-sized and flaring. The umbilicus is prominent, 0.3 cm across, in the center of a depression, with scarlet scales. The interior shows a rather small cavity, bordered with white flowers. Battiscombe (71) described the fruits as bright red when ripe, and 3.6 to 5 cm in diameter.

Ficus mallotocarpa is a tropical species, probably tender to frost and not to be recommended for ornamental planting until its value is determined.

95. *Ficus ampelas* Burman (f.) (Ampelos or Wiry Fig)

(Plate XXXIII, D1-3)

Ficus ampelas, described by Burman (f.) (128), is distinct from *F. ampelas* Koenig ex Roxburgh, which was classified by Corner (199b) under the subspecies *parasitica* of *F. tinctoria*. According to the illustrated account by G. King

(437), the species is widely distributed in the Malay Archipelago, but is apparently absent from the Peninsula. Merrill (524) reported that trees are common in the Philippines, "in thickets and forests at low and medium altitudes." Elmer (263)

stated: "It is quite an ornamental plant, and should be planted in our parks." Other accounts were given by H. O. Forbes (291), Vahl (773), Miquel (539, 542, 544), Merrill (517), Elmer (257, 260, 262), Koorders and Valetton (446), and Sata (670). According to Setyodiwiryo (689), it has been cultivated in the Bogor Botanical Garden. Corner (196) classified it in the series *Scabrae* of Miquel. He stated: "There are two sheets in Herbarium Delessert [Geneva] named, in Burman's hand, *F. ampelas*. One, which I will call A, is the usual interpretation as given by Miquel, King, and Valetton. The other, which I will call B, is *F. montana* Burm. (equals *F. quercifolia* Roxb.)." Corner (197a) described a new variety as *hispidula*. Later, Corner (199b) classified *F. ampelas* in the section *Sycidium*, series *Scabrae*, with four varieties. (See the note under *F. kingiana*, in chapter XVI, for a synonym.)

In a letter dated February 12, 1960, Dr. Eugenio de la Cruz, Laguna, P.I., wrote: "This tree has fine and very flexible branchlets or twigs, like a piece of a vine, hence a wiry fig, which might be the right interpretation of that specific name or epithet, *ampelos* [sic]. In fact, its branchlets, when fresh, are generally used for tying purposes."

PI Nos. 67,560 and 67,700 represent introductions of seeds of *F. ampelas* from Sumatra in 1926, with the notation: "A large tree, with good-sized leaves and small, yellowish-red to deep-red fruits." PI No. 68,856 was listed from Java in 1926. No. 137,962, from the Philippines in 1940, has also been identified as *F. ampelas*. Seeds received by the University

of California from the Philippines in 1957 and assigned PI No. 237,168 failed to germinate. The species has apparently not become established on the mainland, but is worthy of further attempts at introduction.

Grandi (336, 337) recorded *Philotrypesis jacobsoni* and *Blastophaga sumatrana* as inhabitants of the fruits of *F. ampelas* in Sumatra.

The following description is made from the various accounts just cited and from trees of HSPA No. 1,551 growing in the Lyon Arboretum, Honolulu: *Ficus ampelas* grows as a shrub or tree of various sizes, often epiphytal and scandent, according to King (437), the trunk not buttressed, and the main branches widely spreading and more or less drooping at the tips.

The alternate leaves are variable in shape and size on the same plant, usually inequilateral, shortly petiolate, ovate-elliptic or lanceolate to oblanceolate, 6.2 to 10.5 cm long, the margins subentire, serrate or crenate, the apex acute to cuspidate and the base rounded to subacute. Lateral pairs of veins, numbering 4 to 6, are rather prominent and elevated on the lower surface. Both surfaces are more or less scabrid when young, but become glabrous and glossy at maturity.

The figs are axillary, solitary or geminate, or may be in fascicles in the axils of fallen leaves. They are globose, up to 0.7 cm in diameter, and densely covered with small, harsh papillae and hispid hairs. The peduncles are short and hispid. The umbilicus has its center depressed. Figs colored green or light yellow to red may all be found on the same plant.

96. *Ficus urceolaris* Welwitsch ex Hiern (Urnshaped Fig)

(Plate XXII, B1-4)

Ficus urceolaris, first described by Hiern (376) from notes on herbarium material collected by Dr. F. Welwitsch, owes its specific name to the urceolate or urn-shaped receptacles borne by the plant. It is indigenous to tropical Africa, growing as a shrub or small tree up to 5 m tall.

Accounts of it were given by Mildbraed and Burret (535), Hutchinson (407), Hutchinson and Dalziel (410), Broun and Massey (110), Eggeling (251, with figure of leaf), Lebrun (460), Lebrun and Boutique (462), F. W. Andrews (14), and Dale and Greenway (218). Both Eggeling

and Andrews gave *F. storthophylla* Warb. as a synonym, but that was treated as a distinct species by Hutchinson, who stated that his account of *F. urceolaris* was made partly from living plants in the Brussels Botanic Garden. De Wolf (230a) wrote of *F. asperifolia* Miquel: "As I understand this species, it includes at least part of *F. urceolaris*." He treated *F. storthophylla* as a distinct species, illustrating its leaves.

PI No. 76,424 represents an introduction of seeds in 1928 from a shrub growing at the edge of the "bush" near Bunia, Uganda. Seedlings of this introduction were found growing at Miami (PIS) in 1940 and 1958. These were found to be susceptible to frost damage when unprotected. A small, bushy plant was received in California in 1942, and others have been propagated from it. A plant at Arcadia (LASCA), several years old, is only 1 m high, but is fruitful at practically all seasons. Identification of it has been confirmed by Dr. De Wolf.

The following account is given from notes on the above plant and another at Miami: The twigs are slender, chocolate-brown, and densely pubescent or hispid, with the brown terminal buds 0.8 cm long and sparsely pubescent.

The alternate leaves are slightly inequilateral (according to Hutchinson, the midrib divides the blade into two very

unequal halves), elliptical to somewhat obovate, 10.2 to 20.4 cm long and up to 10.2 cm broad, with the base acute and the apex cuspidate, the narrow cusp 1.1 cm or more long. Venation is prominent, with 1 pair of veins near the base plus 6 or 7 laterals. The texture is chartaceous. Hydathodes are well scattered over the surface, which is rough and scabrous above and below. The margins are irregularly and coarsely serrate. The petioles are 0.7 cm long, curved upward, and hispid-pubescent.

The axillary receptacles, single or geminate, are urceolate, 0.8 cm in diameter, with a neck which may readily be mistaken for a true peduncle. The surface is studded with short, harsh hairs which are white at the base, and is roughened by a few misplaced scales. The color is green or purplish, changing to yellow as the fruit matures. The umbilicus is prominent and broad, with loose, pink scales more or less open to the interior. The ovaries and styles of the flowers are succulent, and light green to white; the stigmas are light violet.

The Urnshaped Fig is an interesting dwarf plant, with its early and frequent production of small fruits. However, it can hardly be rated as a popular candidate for ornamental planting except for possible use in pots.

CHAPTER XV • Species 97 through 108

97. *Ficus odorata* Merrill (Fragrant-leaf Fig)

(Plate XIX, B1-3)

Blanco (88) described a Philippine species as *Ficus hispida odorata*, but Merrill (515) classified it simply as *F. odorata*. Other reports were made by Merrill (516, 517, 519, 524), Elmer (257, 258), W. H. Brown (116, with a good illustration), Sata (670), and Pancho (582). The species is widely distributed in the Philippines, and is occasionally cultivated. Elmer stated: "The fact that it is quite common in the town of Luchan and that it serves an economic purpose leads me to believe that it has been introduced. Just before festive times, its foliage is extensively collected for cleaning [scouring] purposes." Several accounts mention the fragrance of its leaves, especially when they are dried. It seems appropriate, therefore, to call it the Fragrant-leaf Fig.

Seeds of *F. odorata* have been introduced several times from the Philippines and elsewhere. PI No. 50,698 was received from Java in 1920; No. 80,421 in 1929, and No. 95,371 in 1931; the last two from the Philippines. From the last-named lot there were grown seedlings, and these were distributed for trial. Seeds received directly in California in 1934 and again in 1940 failed to germinate. Another packet received in 1960 showed very minute seeds, but these germinated and produced good seedlings. Plants of No. 95,371 are growing at Miami (PIS), where notes were taken in 1949 and in 1958. This species was also noted at the Atkins Garden in Cuba in 1949.

Cultivated trees of the Fragrant-leaf Fig are small, up to 4.5 m high and spreading to 6 m, the trunk 20 cm in diameter, with neither buttresses nor aerial roots. The bark is light gray, mottled with patches of silvery-gray resembling lichens. The twigs are green, very pubescent even

on mature, brownish wood, with their terminal buds short, green, and pubescent.

The alternate leaves are up to 25 cm long, with an acuminate apex. At the base, the blades are very inequilateral, with one lobe broad and rounded and the other narrow, these either overlapping or narrowly separated. Venation is prominent, with 1 basal vein from the narrow lobe and 3 from the broad lobe, plus 5 to 7 laterals. Tertiary veins are also prominent, with fine reticulations between. The margins are obscurely dentate to finely serrate. Each hair of the pubescent or scabrid surface appears to come from a hydathode, but no white dots show clearly. The petioles are thick, 0.8 cm long, and usually somewhat curved.

The axillary figs, mostly single but occasionally geminate, are on pubescent peduncles 0.7 cm long. They are spherical to oblate, 1.5 cm in diameter, and densely villous-pubescent, with numerous scarlet flecks on the green or reddish-purple surface. Misplaced scales are found prominently on both peduncle and body. The umbilicus is conspicuous, with numerous protruding, light-green scales tipped with scarlet. The interior is strawberry.

Ficus odorata is related to *F. ulmifolia*, but was separated from it by Merrill (519) in the following key:

Leaves very strongly obliquely cordate,
fragrant on drying; receptacles
densely hirsute, *F. odorata*
Leaves not obliquely cordate; receptacles
glabrous or somewhat hispid.

F. ulmifolia

This species is of doubtful ornamental value, either for pots or for specimen trees. However, it is worthy of inclusion in collections for its botanical interest.

98. *Ficus coronata* Spin (Sandpaper Fig)

(Plate XXXIII, A1-3; B1-2)

There are several species of *Ficus* which may be designated as Sandpaper Fig because of the scabrid leaf surface, and the systematic status of some of them will be discussed. *Ficus stephanocarpa*, described by Warburg (801), is an Australian species which Mary Barrett (62) stated has been incorrectly called *F. aspera* Forst. and *F. scabra* Forst. On the other hand, Corner (196) classified *F. coronata* Spin in the subsection *Sycidium*, series *Scabrae* Miq., *F. scabra* Hort., and *F. aspera* Hort., not verified. He added: "I have examined the type of *F. coronata* Spin, which is well preserved in the Turin [Torino] Herbarium, and it is exactly the species known as *F. stephanocarpa* Warb. It appears to have been one of the early species introduced to cultivation in European hot-houses." The citation to Spin (713) appears in bibliographies, both by Pritzel and by Alfred Rehder for Bradley. See Pritzel (612a) and Rehder (626a) for these bibliographical references.

The Australian *F. stephanocarpa* Warb., *F. stenocarpa* Mueller, *F. aspera* Hort. or *F. M. Bailey*, and *F. scabra* Forst. are all treated here as the same species. On the other hand, Corner (199b) classified *F. stenocarpa* under *F. fraseri* Miq. The African species *F. exasperata* Vahl and the Philippine *F. ulmifolia* Lam., both confused with *F. stephanocarpa* in botanical gardens, are treated in the present work as distinct; the first in chapter XVI, "Additional Species," and the second as species No. 15.

Two species listed here are very similar in leaf characters, but are distinguishable mainly by the receptacles, those of *F. stephanocarpa* being densely white-hairy, with upright scarlet scales at the apex, and those of *F. stenocarpa* smooth or somewhat scabrid, with the apex green or pink. Bentham and Mueller (77) described both *F. stenocarpa* and *F. aspera* (our species No. 11), separating them in a key as shown in the next column.

Receptacles unisexual, the males oblong-cylindrical, the females ovoid or globose. Leaves opposite or alternate.

F. stenocarpa

Receptacles androgynous, ovoid or globose. Leaves all alternate, pubescent or villous underneath. Receptacles villous, the orifice broad, with exserted bracts. *F. aspera*

According to C. T. White (822), trees of *F. stenocarpa* in rain forests of New Caledonia grow up to 7 m high, but probably much larger. See also, F. M. Bailey (42). Grandi (327) first described *Blastophaga ghigi* from the receptacles of *F. stenocarpa* in New South Wales.

Ficus aspera was cultivated in the Brisbane Botanic Garden, according to F. M. Bailey (37). Seeman (686, plate 65) stated: "The Vitian [Fijian] name of the plant signifies the fig tree on the leaves of which food is served or wrapped." Other references to *F. aspera* have been made by Miquel (540, 544), Guilfoyle (346, with illustration), Guillaumin (347), Parodi (588), Yuncker (853), and Parham (583a, with illustration). The common name "Tongue-leaved Fig Tree" was given to this species by Guilfoyle.

Ficus scabra was illustrated in color by Seeman (686, plate 64). It is not the species of Sim (696), which occurs in east Africa. In a letter dated July 4, 1963, Dr. E. J. H. Corner stated that *F. scabra* Jacquin is not *F. scabra* Forst., but is *F. hispida* L. (f.), and as it is a later homonym it cannot be used for *F. hispida*. Maiden (491) stated that both George Bentham and Ferdinand von Mueller looked upon *F. aspera* and *F. scabra* merely as varieties of the same species, differing only in opinion as to which name should stand. Audas (31) reported the common names of *F. scabra* as Tongue-leaved, Rough-leaved, or Sandpaper Fig Tree. Yuncker (853) gave a brief description of it. In

1928, a tree was located in the City Park at Santa Ana, California, and cuttings from it were rooted. This tree, labeled "*Ficus scabra*, Elmleaf Fig," is still growing in the same park, its trunk 44 cm in diameter at the base, with clusters of figs sheathing the framework branches.

Trees of *F. stephanocarpa* were described by Francis (300) as bushy, up to 15 m high, with alternate leaves that are very harsh to the touch, accounting for the name Sandpaper Fig. Anderson (10) distinguished this species from *F. stenocarpa*, and stated that it occurs mainly along streams, hence the name Creek Fig. In the 1921 *Forestry Notebook* of the late H. L. Lyon (copy in the HSPA Library, Honolulu), there is a description of both staminate and pistillate trees of *F. stephanocarpa*. It was introduced into Hawaii under HSPA No. 1,522. Trees found growing in the Lyon Arboretum in 1959 and 1960 differ in some respects from those seen elsewhere, but are properly referred to this species.

Seeds of both *F. stenocarpa* and *F. stephanocarpa* were received in 1948 from Queensland, and seedlings of both have become well established in several California localities. Characters distinguishing the two are noted in the foregoing text. A tree found growing at Miami under PIS No. 1,487 was identified as *F. stephanocarpa*. This species may be described as follows: The tree is small, without aerial roots. The terminal buds are 0.7 cm long, densely pubescent, and green. The young twigs are scabrid and white-pubescent over a purplish epidermis, the older ones with brown, scabrid bark roughened by warty lenticels.

The leaves are alternate or often opposite, equilateral or somewhat inequilateral

at the base, oval or elliptical to slightly oblanceolate, with the apex acuminate to abruptly cuspidate, the cusp 1.1 cm long, and the base rounded to shallowly subcordate. Venation is prominent, the veins well elevated below, with 2 or 3 basal pairs plus 5 to 8 pairs of laterals. The texture is chartaceous; the margins are serrate. Hydathodes are tiny, and scattered over the whole upper surface, which is rough-hispid, while the lower surface is pubescent on veins. The petioles are 1.1 cm long, pubescent, and commonly arcuate.

The figs are axillary, or sometimes (as in the Lyon Arboretum) borne on warty tubercles from the larger branches. The peduncles are variable, commonly 0.7 cm long, often merging with the neck and hardly distinguishable from it, and are densely pubescent, with flaring bracts. The figs are 1.1 cm in diameter and 1.5 cm long, and are urn-shaped to globular or pyriform. The surface is densely white-sericeous, with or without small, reddish flecks on the green background. Misplaced bracts are commonly found on the sides of the fruit. The umbilicus is very prominent, with the pubescent scales lanceolate, upright, and scarlet. The interior is pink to scarlet.

The flowering habit of *F. stephanocarpa* is similar to that of the Common Fig (*F. carica*), the long-styled pistillate flowers being found only in receptacles borne on one tree, and the short-styled pistillate flowers and the staminate ones both being in receptacles borne on a separate tree. This fact suggests the possibility of hybridization between the two species. *Ficus stephanocarpa* is interesting because of its sandpapery leaves and its small, hispid fruits tipped with scarlet scales. It is of doubtful value as an ornamental.

99. *Ficus hirta* Vahl (Hairy Fig)

(Plate XXXV, A1-3)

The Hairy Fig, described by Vahl (773), has received critical attention by Mary Barrett (67). She found that specimens labeled *Ficus hirta* Vahl in the Herbarium of the New York Botanical Gar-

den could be roughly classified into four groups. The third group, with "leaves unlobed or lobed, ovate, elliptic, or obovate," agreed best with Vahl's description; this group was designated as "*F. hirta* Vahl

var. *typica*, M. F. Barrett var. nov." Various synonyms were given, as well as four varieties. A comparison was made of this species with *F. fulva*, with the comment: "*F. hirta* is much more variable than *F. fulva*." Corner (196, 199b) classified *F. hirta* in the subseries *Trichosyceae* of the section *Ficus*, and classified eight varieties in a key. Other accounts of *F. hirta* have been given as follows, an asterisk indicating the use of illustrations: Blume (92), Roxburgh (658), Wight (826*), Miquel (539, 542*), Champion and Benthams (144), Benthams (76), Drury (242), Kurz (455), Solms-Laubach (709*), G. King (437,* 438), Schneider (677*), D. Brandis (103), Rehder (627), Craib (206), Koorders and Valetton (446*), Backer and Van Slooten (36*), Ochse (580*), and Corner (193).

PI Nos. 68,858 and 86,673 represent introductions of the Hairy Fig as seeds from Java in 1926 and from India in 1930. The latter is thus described in Inventory 102: "A shrub or small tree, with leaves 5 to 12 inches [13 to 30 cm] long, varying from ovate to lanceolate and entire or three-lobed to five-lobed. Native to southeastern Asia." Seeds received in California in 1928 germinated, but the seedlings failed to become established. In 1962, seeds received from Hong Kong produced seedlings which fruited profusely in pots in 1964. According to Grandi (336), *Blastophaga javana* was described by Mayr (509) from the fruits of *F. hirta* in Java.

Ochse (580) stated: "Notwithstanding their hairiness and roughness, the very young shoots are often eaten raw, as lab-lab [garnish], with rice. The ripe, yellow or red receptacles have a sweet taste, and are relished by the natives, especially by the children." According to Setyodiwiryo (689), *F. hirta* is being cultivated at Bogor, Indonesia.

The following description is made from various published accounts: The plants are usually low shrubs, with twigs and buds hairy-bristly but hardly irritant. The leaves are alternate, equilateral, very variable, unlobed and lobed on same or on different branches or trees, 10 to 25 cm long and up to 15 cm broad, with margins usually serrate. Venation is prominent, with 1 pair of basal veins plus 4 to 10 laterals forking near the margin. The blades are bristly or tomentose on both surfaces, becoming almost bare when mature except on veins below. The petioles are hairy, and up to 7.5 cm long.

The figs, axillary and usually geminate, are either sessile or shortly pedunculate, 0.7 to 2.5 cm in diameter, yellow-hairy or bristly on the surface, and yellowish or red when ripe. In shape, the figs are dimorphous, globose when the flowers inside are female (the seed figs), or ovoid when both short-styled pistillate flowers and staminate flowers are present. The interior is pink. (See figure 39, showing a potted plant with a few figs, with the account of *F. dryepondiana*, species No. 13.)

Ficus hirta is sometimes confused with *F. fulva*, described here as species No. 102. An example of this confusion is the article by Treub (762) on female flowers and embryology. According to Backer (35), *F. fulva* Reinwardt ex Blume is the species for which Treub described apogamy under the incorrect name *F. hirta*. The authenticity of labeled specimens should therefore be carefully evaluated before listing them in collections.

The Hairy Fig has no special characters to recommend it for ornamental planting. Both it and *F. fulva* may possibly provide subjects for experiments in cross-pollination with the Common Fig, *F. carica*. It is probably very susceptible to frost injury.

100. *Ficus gnaphalocarpa* Steudel ex Miquel

(Plate XXIX, B1-3)

The specific name of *Ficus gnaphalocarpa* is derived from two Greek words, "gnaphalion," down-covered, and "karpos," fruit, signifying that the surface of the receptacles is "très tomenteux," very tomentose, as stated by A. Richard (635). He mentioned an earlier reference by Steudel (732) (apparently to specimen No. 874 in section 2 of Pl. Schimp., Abyssinia). Miquel (539) described it as *Sycomorus gnaphalocarpa*. It belongs to the subgenus *Sycomorus*. Other descriptions, without illustrations, were given by Mildbraed and Burret (535), Hutchinson (407), Hutchinson and Dalziel (410), Dalziel (221), Unwin (768), Holland (382), Broun and Massey (110), Lebrun (460), Lebrun and Boutique (462), F. W. Andrews (14), Irvine (412), and Dale and Greenway (218); with illustrations, by Miquel (541), Hiern (376, as *F. trachyphylla*), Dinter (233), Lely (463), Eggeling (251), and Aubréville (30). See *F. trachyphylla* in chapter XVI.

This African species grows as a large tree in Ethiopia, the Sudan, Angola, Southwest Africa, and in the Cape Verde Islands. According to Lely, the tree demands a moist site, preferably on the bank of a stream; though giving a deep shade, it is not planted in towns for that purpose. Holland reported that the trees of this species yield a latex which, when boiled and cooled, results in a product somewhat like gutta percha that is exported by a local company in northern Nigeria. The peach-colored figs are tolerably juicy, somewhat sweet, and "may be used by colonists for the extraction of a spirit tasting like a superior gin." See also, the account by Irvine (412) regarding medicinal and other uses.

The chief interest in *F. gnaphalocarpa* in the United States is its possible use as a nematode-resistant stock for the Common Fig. Both Dalziel (221) and Holland (382) noted its use as a stock in Senegal. However, interest in Florida and Cali-

fornia has not been keen. Experience has shown that the trees are somewhat tender to frost; as Christie (155) pointed out, cuttings do not root readily, and success in budding or grafting is still problematical.

PI No. 139,454 represents an introduction of this species from Portuguese West Africa in 1940. Seeds of this number and of another lot received in 1948 from Senegal germinated freely in California, and a number of plants were grown for distribution. Two fine trees growing at Riverside were killed back to the ground during the winter of 1949 at about 25° F. A tree at Laurel, Florida, lost its leaves during the winter of 1957-58, but showed very few signs of injury during the following spring and summer. Large specimens were found in several localities in Florida in 1958. An especially fine tree growing in a front yard at 7707 Ponce de Leon, S.W., Miami, showed many moldy fruits on the ground on May 25, but none on the tree. Trees at Arcadia (LASCA) have produced fruits since 1961. These trees, 9 to 12 m tall, took but small injury during the winter of 1962-63 at a temperature of 25° F.

In Florida, trees have trunks at least 45 cm in diameter, not buttressed, with gray to chocolate-brown bark and branches without aerial roots. According to Lely (463), the bark of older trees "is very distinctive, gray-green, fairly smooth, with gray scales here and there about the bole and light-green patches where these have fallen." The terminal buds are plump, 1.1 cm long, light green, and densely silky-pubescent. The stipules, commonly persistent for several nodes, are lanceolate, with long, silky hairs at the base and along the midvein. The young twigs are green, with a silky-white pubescence, becoming tawny to gray. The pubescence is more or less persistent.

The leaves are alternate, equilateral, up to 15 cm long and 10 cm broad, short-

ovate to almost circular in outline, with a broadly rounded apex, a cordate base, and a narrow (sometimes broad) sinus. The margins are subentire to coarsely and irregularly serrate, especially along the upper half of the blade. Venation is prominent, with 3 or 4 basals and 5 pairs of laterals, all well elevated below. Long, white hairs are on the veins, above and below. The texture is rough, brittle, and subcoriaceous. Hydathodes are well scattered over the upper surface, each with a very short bristle, making the blade scabrous to the touch. The petioles are stout, up to 3.6 cm long, and silky-white pubescent when young, becoming scurfy.

This is one of the species in which figs are commonly solitary in the leaf axils or,

according to Lely, "borne directly behind the leaves in short clusters any time from December to March." Dale and Greenway (218) stated that the leaves dry up with extraordinary rapidity when picked, and that the figs are solitary or paired. The figs are globose or short-pyriform, often with a short neck, on peduncles up to 2 cm long, densely tomentose, and are 2.5 cm in diameter. At maturity, they are light green to purplish, with dense, white hairs. The bracts are variable, at the apex of the peduncle next to the body of the fruit, and flaring; or sometimes on the body as misplaced scales. The umbilicus is prominent, 0.8 cm across; the opening is star-shaped, with scarlet scales. The interior is white.

101. *Ficus minahassae* Miquel (Minahassa Fig)

(Plate XXIII, A1-4)

The Minahassa Fig was first described by Teysmann and De Vriese (753) as *Boscheria minahassae*. The description by Miquel (544) as *Ficus minahassae* placed it in the subgenus *Covellia*, and stated that the trees are widely dispersed in the whole province of Minahassa, Celebes. Hickson (375) gave a long account of the Minahassas, a legend of the introduction of rice based on the leaf of a tree called "Puti Weren" (the species in question). In his illustrated account of the Minahassa Fig, G. King (437) stated: "This is another of the numerous magnificent things collected during one of his journeys in the Malay Archipelago by the late indefatigable Mr. Teysmann. It has apparently been collected by no one else." His statement was quoted by Sata (670), with illustrations. According to Merrill (515), this very striking and characteristic species "was first described by Blanco, his name *Ficus glomerata* being, however, previously taken by that of Roxburgh's species." It is known only from Celebes and the Philippines, where it is widely distributed in the islands, the trees growing especially on river banks in the forests. Other reports were made by Elmer (257, 258, 259, 263), Clercq (162), Merrill (514, 524), W. H.

Brown (115, 116), Quisumbing (615), and Corner (199b).

The insect which inhabits the receptacles of this fig in the Philippines was described by Grandi (334) as *Ceratosolen pygmaeus*. This specific name is very well chosen, for it would take a pygmy of an insect to enter the orifice and oviposit in the pistillate flowers of such a small fig. See also, Wiebes (824c).

At least three importations of seeds have been made from the Philippines under PI Nos. 80,419 in 1929, 95,369 in 1931, and 134,992 in 1939. Seeds from the Philippines were obtained at Riverside in 1934, 1940, and 1958. Some of the tiny seeds germinated, especially those of the 1958 introduction, and plants were distributed for trial.

The following description is based on notes taken of bearing trees observed at the Atkins Garden, Cienfuegos, Cuba, in 1949; at Miami, Florida, in 1949 and 1958; and seedlings in California: Trees under cultivation have silvery-gray bark that is somewhat scurfy, a trunk without buttresses, and branches showing no aerial roots. The terminal buds are prominent, 4.5 cm long, pubescent with long, silky hairs, and colored brown to reddish



Fig. 49. The tiny figs of *Ficus minahassae* are borne in masses on ropelike, leafless branches that may be 3 meters long. This fine specimen was observed in the Atkins Garden at Cienfuegos, Cuba. (Photo by L. J. Condit.)

brown. The stipules are somewhat persistent for 3 or 4 nodes, or even cling to bare twigs. Elmer (257) stated that the bracts often remain long after the leaves have fallen. The young twigs are short-jointed and very pubescent, the hairs sharp and needlelike, giving a stinging sensation when touched, each hair from a dark reddish-brown, prominent papilla.

The alternate, equilateral leaves are up to 20 cm long and 12.5 cm broad, ovate, the apex rounded or acuminate, and the base cordate with lobes meeting or slightly overlapping. The margins are finely serrate and set with silky hairs. Venation is prominent below, the midrib flanked by 1 prominent and 1 to 3 indistinct basal pairs plus 7 to 9 laterals, certain veins being forked once or even twice before reaching the margin. The texture is membranous, and the surface has prominent, bristly, white hairs above and below. Hydathodes are thickly scattered. The petioles are 2.5 to 7 cm long, brownish, and pubescent as on the young twigs.

The figs are borne profusely, in sessile or pedunculate masses or capitula produced on long, ropelike, leafless branches springing from the trunk or framework of the tree 1 m or more aboveground, each commonly branching from near the base (figure 49). Each capitulum may be 2.5 cm or more in diameter. Elmer (256) reported that the fruiting branches are often 3 m long, and so dense as to conceal the trunk. The individual receptacles are small (0.3 cm in diameter), sessile, and red, with a prominent umbilicus. The seeds are very small. The interior is scarlet.

Ficus minahassae has very little ornamental value. It is obnoxious to gardeners because of the stinging hairs. The trees are frost-tender, those in southern Florida having been severely injured in the winter of 1958-59. It is of particular interest in botanical collections because, as noted with PI No. 134,992, it is one of the most strikingly curious of figs, with its red fruits borne on pendulous branches sometimes 3 m long.

102. *Ficus fulva* Reinwardt ex Blume (Stinging Fig)

(Plate XXIII, B1-2)

Ficus fulva was described by Reinwardt ex Blume (92) from specimens collected in Malaya. According to Corner (193), the common name Stinging Fig alludes to the unpleasant bristles, which sting slightly. Their sharp points may enter the flesh and cause a rash. Corner reported it as a species common in Malaya, from Malacca northward, especially at the edges of forests and near passes in the mountains.

Mary Barrett (67) published a systematic account of *F. fulva* Reinwardt ex Blume and of *F. hirta* Vahl, two species which "resemble each other in their possession of both unlobed and palmately 3- or 5-lobed leaves, and in a general roughness or hairiness of the external surface." Most other accounts agree that the leaves of *F. fulva* may be lobed or unlobed on the same tree, but Corner definitely stated that sapling leaves are not lobed. This species is sometimes identified as *F. dumosa*, but Miss Barrett said that the only character of *F. dumosa* which has not been reported also for *F. fulva* is the number of sepals (4) in the male flowers. *Ficus fulva* is the species for which Treub (762) described apogamy under the erroneous name of *F. hirta*, as explained in our account of the latter (species No. 99). Corner (196) classified *F. dumosa* as *F. hirta* Vahl var. *dumosa* King. He stated: "*Ficus dumosa* differs merely in being thinly hispid-villous, and in having, for the most part, palmately lobed leaves, few being simple. . . . The Indochina records are *F. hirta* v. *imberbis* Gagnep." Corner (199b) treated *F. fulva* and its synonyms, giving two varieties. (See also, comment under *F. chrysoarpa* in chapter XVI.)

Other accounts of *F. fulva* may be cited: Vriese (785, with illustration), Miquel (542), G. King (437, with illustration; 438), D. Brandis (103), Koorders and Valeton (446, with illustration), Ridley (639), Burkill (124), and Skene (702). See J. G. Watson (810) for Malayan

names. The species belongs to the subgenus *Eusyce* of Miquel, to which the Common Fig (*F. carica*) also belongs. This suggests the possibility of hybridizing the two species. Grandi (326) described *Blastophaga inopinata* from *F. fulva* in Java and Sumatra. Grandi (337) also recorded *Philotrypesis ornata* as inhabiting the figs.

PI No. 73,995 is listed as *F. fulva* Reinwardt, and described in Inventory No. 94 as a small, tropical tree with dense foliage and yellow-red fruits 2 cm in diameter, from Buitenzorg [Bogor], Java, in 1927. A year earlier, it had been introduced from Sumatra under PI No. 67,696. Plants of No. 73,995 have long been established in Florida (PIS), but apparently this species has not been grown elsewhere to any extent. One small tree received from Florida in 1941 grew well and even bore fruit in the university greenhouse at Riverside. However, when left in a lath-house during the winter of 1949-50, it failed to survive a temperature of 24° F.

The following description is made from notes taken in Florida in 1940 and 1958, and from the small trees in California, in comparison with the accounts of others: In their native habitat, the trees reach 9 to 18 m in height, with spreading branches destitute of aerial roots. After long years of growth, a tree in Florida is bushy and small, and is completely deciduous for a short period each spring. The young twigs are short-jointed, brown, and rusty-pubescent; the older ones are rough-corky, with prominent lenticels below the large leaf scars and nodes. The terminal dormant buds are stubby or short, up to 2 cm long, and silky-pubescent, scarlet on the lower half to whitish at the tip. G. King (437) reported that *F. fulva* has a single stipule, but this has not been confirmed by observations of cultivated trees.

The alternate, equilateral leaves are almost spherical (orbicular) in outline, non-lobed or shallowly 3- to 5-lobed, up to 25

cm long and about as broad. The apex is shortly acute or apiculate, and the base is cordate, with the sinus mostly broad and opened. Venation (more or less palmate in lobed blades) is prominent, especially below, with 1 basal pair extending upward to at least half the length of the blade, plus 5 laterals. The texture is velvety and subcoriaceous; the margins are serrate. The upper surface is pubescent or slightly hispid, while the lower surface is covered with dense, silky-white hairs. The petioles are stout, up to 9 cm long, pubescent, and round in cross-section.

The figs are axillary, commonly geminate, sessile, spherical to short-turbinate, and 2 cm in diameter. Light flecks on the

tawny-brown surface are concealed by a dense pubescence consisting of white, silky hairs. The three basal bracts are prominent, pubescent, and light scarlet. The umbilicus is fairly prominent, with the scales protruding and more or less upright. The interior is scarlet.

The short-styled pistillate flowers and the mass of staminate flowers near the ostiole definitely class this Florida tree as one of the caprifig type. Trees bearing fruits with long-styled pistillate flowers would be especially suitable for cross-pollination experiments. This species is not a promising candidate for ornamental planting, and should be planted (if at all) in warm localities only.

103. *Ficus grossularioides* Burman (f.) (White-leafed Fig)

Ficus grossularioides was described by Burman (f.) (128), but most accounts of this species are found under the designation *Ficus alba* Reinwardt ex Blume (92). Backer (35) noted that the three species, *F. alba*, *F. leucoptera* Miq., and *F. tricolor* Miq., should be united, and named *F. grossularioides* Burm. Corner (196) first followed this classification, and placed *F. grossularioides* in the subgenus *Ficus* and subsection *Eriosycea* [usually spelled *Eriosycaeae*]. Later, Corner (199b) gave *F. tricolor* specific rank, with *F. leucoptera* as a synonym.

According to the illustrated account by Corner (193): "*F. alba*, the White-leafed Fig, is one of the easiest wild plants to recognize, because there is no other with latex and white undersides to the leaves except the Sau, and that has stiff blades. Also, it is one of the few trees which have a different leaf-form in the sapling stage from the adult." Another illustrated report was that of Ochse (580), who stated that the trees are spread all over Java, from 500 m above sea level to high in the mountains on forest margins and in thin forests. Ridley (639) stated that the trees are very common in secondary growth and edges of woods at Singapore. Other accounts of *F. alba* were given by G. King (437, with illustration), Clercq (162),

Koorders and Valetton (446), Burkill (124), and Gilliland (319).

Packets of seeds received directly from Singapore in 1929 and 1931 were labeled *F. alba*. Seedlings grown from them succumbed to a winter temperature of 26° F. at Riverside. PI No. 49,533 is listed as *F. alba* from Malaya in 1920, and No. 67,567 represents seeds collected in Sumatra in 1926. Another introduction was made from the Straits Settlements in 1931 under PI No. 95,089. Seedlings were grown, but comparison with specimens in the National Herbarium at Washington, D.C., showed that they belonged to some species other than *F. alba*. In 1955, Dr. F. W. Went introduced seeds labeled *F. alba* from Java. Seedlings were grown at Arcadia (LASCA), but none have survived.

Ficus grossularioides (*alba*) grows as an evergreen shrub or small tree, up to 9 m high. The leaves of adult twigs are equilateral, small, acuminate, 5 to 15 cm long, elliptical, with serrate margins; the leaves on vigorous young twigs are 20 to 34 cm long, varying from cordate to 3-, 5-, or 7-lobed. The texture is chartaceous. The blades are green above and white-tomentose below, hence the common name. The petioles are 2.5 to 10 cm long.

The figs are borne in pairs, mostly on twigs just below the leaves, sessile, globose,

up to 1.1 cm in diameter, orange at maturity, becoming dark red before dropping. The interior is strawberry.

Apparently, no plants of the White-leaved Fig are currently under cultivation

in the United States. The species has no special characters to recommend it for ornamental planting, and young trees are probably susceptible to damage by light frosts.

104. *Ficus auriculata* Loureiro (Roxburgh Fig)

(Plate XXVI, A1-3)

The specific name *auriculata* apparently refers to the scales which almost completely cover the ostiole, as explained by Merrill (527), and as given in the original description by Joannis Loureiro (478a), "*fructu auriculata*." Corner (197, 199b) gave *Ficus auriculata* as the correct designation for the species, and placed it in the subgenus *Ficus*, section *Neomorpha*. It was treated by Roxburgh (658) as *F. macrophylla*, a name properly assigned to an Australian fig described under our species No. 28. On the other hand, Mary Barrett (67) published a detailed account of its taxonomy and the reason for giving *F. roxburghii* Wallich (795, as No. 4,508 in his Catalogue) priority for the specific name. The common name Roxburgh Fig is retained as the one most frequently found in literature. It grows as a spreading tree or shrub, from the lower Himalayas and the Punjab in India eastward to Burma. In their native habitat, the plants are classed as evergreen, but some of those established in the United States are deciduous for short periods in winter.

Plants of the Roxburgh Fig are cauliflorous, the fruits being borne in clusters from tubercles on the large branches, on the lower part of the trunk, or from the crown roots. (See figure 6 in chapter II, mentioned in the text under "Cauliflory.") Fairchild (273) described and illustrated a full-grown tree in the Canary Islands with its trunk literally covered with large, flattened, hollow figs, 7.5 cm in diameter; a rather exceptional size, as my own description indicates. He further reported that these figs may be stimulated into partial maturity and pulpiness by treatment of the eye with oil or with a hormone spray, a process sometimes used with the Common Fig as well as the Sycomore

(See related comment under *F. sycomorus*, species No. 63.) Bois (93) reported *F. roxburghii* to be the only indigenous species cultivated for its fruits in Indo-China, the large figs being consumed by the Annamites [Vietnamese]. Naik (569), however, stated that the large, brick-red fruits are of poor quality.

In its native home, fruits of the Roxburgh Fig are inhabited by the fig insect *Ceratostenes emarginatus*, as described by Mayr (510), and by *C. effractarius* of Grandi (335). These insects ensure pollination of the flowers, development of fertile seeds, and complete maturity of the figs. Such fruits are edible, and are sometimes offered for sale in markets at Simla and elsewhere. Joseph (429) described *Sycoryctes roxburghii* as a new species of insect inhabiting the fruit. Introduction of pollinating insects into Florida received serious consideration many years ago, but for various reasons the project was abandoned. (See chapter II, under "Fig Insects.")

Further accounts of *F. roxburghii* or *F. auriculata* may be cited as follows: With illustrations, by Bureau (121, 122), G. King (437), Cunningham (216, in color), Fairchild (272, 277), Benthall (75a), Graf (324), and Manjunath (497a); without illustrations, by Balfour (51), Kurz (455), G. King (439), Veitch (777), G. Watt (815), D. Brandis (103), Bamber (53), Troup (765), H. Collett (167), Gamble (309), Parker (584), Osmaston (581), and Burkill (124). Stapf (728) gave a list of nine references, with illustrations. See also, a brief illustrated account in *Sunset Magazine*, September, 1961.

The ornamental value of the Roxburgh Fig has long been recognized. Veitch de-



Fig. 50. Some trees of *Ficus auriculata* are cauliflorous, bearing figs on tubercles which develop on the larger limbs. This is a peculiarity shared by other species.

(Photo by Dennis Kucera.)

pictured it at Delhi as a great bush, 18 m across, and very striking because of its large leaves, 30 cm long and 25 cm broad. Vilmorin (781) gave an account of an avenue several hundred meters long planted to trees of this species in the Garden of Hamma near Algiers. Troup stated that it is cultivated for ornament and for the sake of its edible fruits. Plants in both Florida and California have attracted much favorable attention because of the large, tropical-looking leaves, and especially the beautiful coloration displayed by the newly expanded foliage. The rich maroon or mahogany color of the new leaves shows vividly in color photography, but black-and-white illustrations of course utterly fail to convey an idea of it.

The Roxburgh Fig is found in the Himalayas at elevations up to 1,520 m, and has therefore been considered to be fairly hardy. However, Troup (765) reported that it is not very frost-hardy, and that plants were badly damaged at Lahore in 1905. In both Florida and California, outdoor plants have suffered severe injury from frost, but suckers from the base soon renewed the top. One plant at Riverside

was not injured in 1946 by a temperature down to 26° F., but in January, 1963, leaves and twigs of another plant were injured at the same minimum temperature. Trees should not be damaged by several degrees of frost if the leaves have dropped and the wood has become somewhat dormant. Riedel (641) reported the Roxburgh Fig to be the most impressive of a collection at the UCLA Botanical Garden, where it was briefly deciduous.

At least seven introductions have been made under PI numbers: 32,752 in 1912 and 76,755 in 1928, both from Calcutta; 77,050 from Germany in 1928; 77,952 from Tenerife, Canary Islands, in 1928; also, 86,675 in 1930, 135,788 in 1940, and 156,109 in 1946, the three last from India. Seeds offered for sale by a California nursery were obtained in 1961, and produced seedlings at Riverside; some seeds of this lot were assigned PI No. 274,239. Two distinct forms are represented by the various plants grown. The first is tree-like, with large, green leaves, and bears figs on the trunk and large branches (figure 50). The second is shrubby in habit, with ornamental foliage, and is also cauliflorous.

The following description is made from notes taken at Miami (PIS) and of plants in California collections: One noteworthy character is the absence of solid pith, i.e., the young twigs are hollow, as mentioned by D. Brandis (103). The juvenile twigs are often 1.5 cm thick, green at first, but soon becoming gray. The leaf scars are conspicuous, the lenticels large and russet. The terminal dormant buds are thick and bulging at the base, up to 1.1 cm in diameter and 2.5 cm or more long, pubescent, and purplish brown or both brown and green on the same plant.

The leaves are alternate, equilateral, ovate, and up to 40 cm long and 34 cm broad, or even larger. The base is broadly cordate, with sinus open or sometimes narrowed and almost closed. The apex is sometimes rounded and obtuse, but more often acute or acuminate. The margin is broadly crenate to almost entire. Hydathodes are usually prominent and scattered

over the upper surface of the blade between the large veins. The surface is glabrous above, but pubescent on the veins below. Venation is conspicuous, the midrib flanked by 3 pairs of basal veins, the upper and most prominent pair curving upward and extending to one-half or more the length of the blade. Lateral pairs number 5 or 6, and are well elevated; tertiary veins are prominent, with the areoles large. The petioles are up to 22.5 cm long, very slightly or not at all channeled above, green or tawny, and glabrous.

Unbranched fruiting spurs are on the main branches, with the fruits fascicled at the apex of the spur. Figs are also borne on bushy plants in dense clusters from leafless branches at the base of the trunk. (See the earlier reference to figure 6 in chapter II.) The neck is prominent and thick, often ribbed. The peduncles are stout, 2.5 cm or more long, 0.4 cm thick at the base, gradually increasing in thickness toward the apex, densely pubescent, and green or brown. The three basal bracts are large, flaring, and green to straw-colored. The figs are large, up to 6.2 cm

in diameter and over 5 cm from base to apex, pyriform to oblate, with the apex "the shape of a Dutch turnip," according to Anon. (20). The surface is marked with conspicuous white or rusty flecks which are often slightly elongated and widely scattered. Pubescence is prominent, composed of silky-white hairs. The color is green at the base, shading to reddish brown at the apex. The umbilicus is large, depressed, with the mass of scales 1.1 cm across. The pistillate flowers are scarlet.

An account by Cunningham (215) of the fertilization of flowers of *F. roxburghii* is quoted in chapter II, under "Parthenogenesis," together with some interesting related comment.

Anon. (22) (probably B. Y. Morrison) stated that *F. roxburghii* had not been given much publicity because its cuttings were difficult to root and stock plants were scarce. Fairchild (273) also reported that this species is difficult to propagate, and recommended layering as the best way to secure new plants. However, plants may be grown from cuttings placed in a mist-propagating frame, or by marcottage.

105. *Ficus oligodon* Miquel (Apple Fig)

(Plate XXXII, B1-4)

In his Catalogue, Wallich (795) listed his No. 4547 as *Ficus pomifera*. The species described by Miquel (544) as *F. oligodon* was classified by Corner (197, 199b) as the type of subgenus *Ficus*, section *Sycocarpus*, subsection *Pomiferae*, with *F. pomifera* Wallich ex King as a synonym. A detailed description, with illustration, of *F. pomifera* by G. King (437; 438, without illustration) gave the distribution as Sikkim to Malaya at elevations of 245 to 915 m. According to Gamble (309), *F. pomifera* resembles *F. roxburghii*, but differs in the fruit. He reported the fruit to be edible, one of the best of the edible wild species, although Corner declared the fruit to be edible but tasteless. Both G. King (437) and Ridley (639) placed this species in the subgenus *Neomorphe*.

The account of *F. pomifera* by Corner (191) stated that it is allied with certain

species of *Covellia*, "rather than with other Malayan species of *Neomorphe* which, as defined by King, is unnatural." He added that the species appears to grow in secondary jungle, and in the absence of fruit might be mistaken for the common *F. variegata*, "but the resemblance between the two is largely superficial; *F. pomifera* should easily be distinguished by the white bark, absence of large buttresses, firmer, coarsely dentate leaves with a rounded, cuneate base, and the much larger receptacles." Corner (197b) reported that the fig insects of *F. oligodon* agree with those of *F. auriculata*. (See chapter II, under "Fig Insects.") He further added: "*Ficus oligodon* has very much the same distribution on the Asiatic mainland as *F. auriculata*, but *F. oligodon* extends down into the Malay Peninsula as far as the south of Selangor and Pahang" [prov-

inoc). The specific name *pomifera* signifies "pome- or apple-bearing," hence the common name Apple Fig assigned to it by Corner (193). Other accounts were given by D. Brandis (103) and C. E. C. Fischer (286).

In 1946, a species labeled *Ficus roxburghii* was received by the Huntington Botanical Garden, San Marino, California, from Washington, D.C., and was given accession number 13,163. Two trees were growing until the middle 1960's, when one was removed. The remaining tree, identified as *F. oligodon*, has thrived and produced figs from tubercles on the larger branches.

PI No. 133,194 is classified as *F. oligodon*. This was collected in 1939 by Charles Knowlton, Patiala State, India, and I listed it as a spreading tree, probably evergreen, with inedible figs, green and red, and long-stalked. Small trees of PI No. 269,489, from seeds collected in West Pakistan by Howard Anderson in 1960, are growing and bearing fruit at Riverside. They are identical with those at San Marino, and may also be labeled *F. oligodon*.

The following description is from specimens of the trees just referred to: The bark is smooth, gray, very much like that of the Common Fig (*F. carica*). The terminal buds are up to 3.6 cm long, green, puberulent, and sharp-pointed. The twigs are pubescent, green at first, becoming light gray, with prominent lenticel and leaf scars.

The leaves are alternate, equilateral, up to 20 cm broad and 22.7 cm long (therefore more or less circular or orbicular in outline), the apex rounded, the base shallowly cordate, with sinus narrow (sometimes closed), not rounded or subcuneate as described by King. The margins are remotely or coarsely crenate from base to apex. Venation is prominent, with 3 basal veins, the uppermost pair extending at an acute angle to three-fourths the length of the blade, plus 4 laterals. Both surfaces are practically glabrous, but the veins below are faintly pubescent. Hydathodes are scattered over the upper surface of the blade. The color is dark green above, but much lighter below. The petioles are 4.5 to 7.5 cm long, round in cross section, and glabrous.

The figs, borne singly or in small clusters from tubercles on the trunk and larger branches, are pyriform, up to 3.6 cm long and 3.1 cm in diameter, with a prominent neck and a thick peduncle which is often 2.5 cm long. The green, densely pubescent surface is thickly decorated with small, light-green flecks. The irregular bracts are closely appressed to the base of the neck, and an occasional misplaced scale is found on the body of the fruit. The umbilicus is prominent, 0.7 cm in diameter, somewhat depressed, with green scales. The interior is pink. The staminate flowers are massed at the apex of the syconium, thus resembling the caprifigs of *F. carica*.

106. *Ficus variegata* Blume (Red Stem-fig)

(Plate XXX, A1-3)

Ficus variegata, described by Blume (92), apparently was given the specific name because of its red fruits (*rubro-variegatis*), which show white streaks and dots when ripe. Corner (193) called it the Common Red Stem-fig, and reported that trunks of the trees are plastered with fruits. He wrote: "A more prolific organism can hardly be imagined, and it may be taken as an emblem of tropical luxuriance." According to G. King (437), the species is rather variable as to size and

pubescence of leaves. The trees are occasionally cultivated for their fruit, which even in its wild condition is edible. Ochse (580, with illustration) also reported: "The young fruits are eaten with *sambal* [curry sauce], and the ripe ones have a sweet taste." It is perhaps the commonest large fig tree in Malaya, found up to 915 m elevation, and is very widely distributed, from Assam to the Philippines and from Hong Kong to Java, according to Corner (191). Later on, Corner (199b)

classified the species as *Ficus variegata* Blume, with synonyms (such as *F. integrifolia* Elmer) and a key to identification of five varieties. He included it in the subgenus *Ficus*, section *Neomorpha*, subseries *Variegatae*. According to Roxburgh (658), *F. racemifera*, which equals *F. variegata*, was introduced into the Calcutta Botanic Garden from Sumatra by Dr. Charles Campbell. See also, comment under *F. cordifolia* and *F. chretoides* in chapter XVI.

The following additional accounts may be cited: Miquel (542, 544), G. King (438), Merrill (515, 524), D. Brandis (103), Koorders and Valetton (446, with two illustrations), Rock (650), C. E. Parkinson (585), Corner (193, with illustrations of fruit and flowers), Diels (231), Elmer (259, 263), Summerhayes (743), Quisumbing (615), and Holtum (385). Pancho (582) included it in his account of cultivated trees, and stated that the wide-spreading branches with broad leaves afford an excellent shade. See Desch (226) for its timber value.

According to Grandi (336), *Ceratosolen striatus* was described by Mayr (510) from the figs of *F. variegata* in Java. Holtum described caprification by the same fig insect. Wiebes (824c) gave an account of the insect as *C. appendiculatus* Mayr.

Several introductions of *F. variegata* have been made into Hawaii and given HSPA numbers. One shipment of seeds forwarded to Washington from Hawaii in 1920 received PI No. 50,398. Another from Straits Settlements in 1937 (HSPA No. 8,315) was given PI No. 122,987. PI No. 67,558 represents a collection of seeds made by Fairehild and Dorsett in Sumatra in 1926. A packet of seeds of No. 122,987 was received in California, and these provided a number of seedlings. Trees were found and studies made of this species at Miami (PIS) in 1940 (but not in 1958), and in the Lyon Arboretum, Honolulu, in 1959 and 1960. According to Corner (199b), *F. polysyce* Ridley, also growing in the Lyon Arboretum, comprises "many figs indeed," including *F. variegata*. See Ridley (640) regarding the

fruits of *F. polysyce* being eaten by bats. Setyodiwiryo (689) reported that trees are growing at Bogor, Indonesia.

Account should also be taken of *F. chlorocarpa* Benth., which was listed by Maximowicz (507) and by Merrill (526) as being found in gardens of south China. Dunn and Tutcher (245) stated that trees are common along watercourses at Hong Kong. Sauer (671) reported it to be growing at Canton.

Seeds labeled *F. chlorocarpa*, received from Hong Kong in 1962, produced seedlings which are properly classified as *F. variegata* Blume var. *chlorocarpa* Benth., as given by Corner (199b).

The trees of *F. variegata* reach a large size in their native habitat, lacking aerial roots but having prominent buttresses. Twenty-year-old trees in the Lyon Arboretum have trunks 1 m in diameter. The young twigs are hollow, short-jointed, glabrous, green at first, but soon becoming russet. The terminal buds are up to 2.5 cm long, glabrous or hairy-pubescent, green or slightly tinged with pink, especially near the tip. The silky-pubescent stipules are semideciduous or persistent for several nodes.

The alternate, equilateral leaves are oval to ovate, 25 cm long and 12.5 cm broad, with the apex bluntly obtuse to acuminate and the base rounded to truncate or subcordate. Venation is prominent, the veins well elevated below, with 2 basal pairs of veins, the upper ascending at an acute angle to almost the middle of the blade, plus 5 to 8 lateral veins, these widely spaced. The texture is chartaceous, the margins are subentire to shallowly and remotely crenate or dentate, and the surface is glabrous above and silky-pubescent below along the veins of young leaves. Hydathodes (usually present) are sparsely scattered. The petioles are 3.6 to 10.2 cm long, hardly at all flattened or channeled, rusty, but abruptly changing color at the point of insertion with the blade.

The figs are borne in dense clusters on woody branches that are leafless, or leafy at tips, and grow from warty tubercles on the trunk and larger limbs. Their shape

is spherical to pyriform, 2 to 3.5 cm in diameter, velvety-pubescent to glabrous, and light green, but ripening to rose-red, with longitudinal stripes or variegations on the surface of fruits from some trees; or the surface prominently roughened with small, pimply flecks on fruits from other trees. The peduncles are up to 5 cm long, and

pendulous or flexible in some specimens. The flowers inside are white.

The Red Stem-fig is of doubtful value as an ornamental. The trees are curious and interesting because of their copious production of fruits on the trunk and branches. They are probably tender, having suffered severe damage at 26° F.

107. *Ficus cocculifolia* Baker (Adabo)

(Plate XXXI, D1-2)

J. G. Baker (49) described two new species of *Ficus* from Madagascar, one as *F. sakalavarum* and the other as *F. cocculifolia*. About a year later, Baron (56) stated that the two were very similar in outward appearance, but that *F. sakalavarum* had fruit much smaller than that of *F. cocculifolia* and not so abundant. A popular account of *F. sakalavarum* was given by Perrier (595) who, contrary to the above, found that large trees are very common on the plains of the western region. In his account of food plants, Bois (93) quoted from the article by Perrier, and stated that *F. sakalavarum* is especially interesting. The species was also briefly treated by Uphoff (769). "Adabo" is the vernacular name of this fig in Madagascar. A good illustrated account was given by Montagnac (554).

Perrier (596, 597) later gave the nomenclature as *F. cocculifolia* subsp. *sakalavarum*, and separated it from other species in his key, as follows: "Internal surface of receptacle and base of flowers without bristles; leaves always rounded at the apex; figs always on special, leafless, short twigs, these thick and never axillary or in large clusters at base of trunk." An illustration shows typical leaves and a leafless, fruiting branch. The subspecies differs in having the fruiting branches very short, bearing two or three fruits; peduncles short and thick; figs large, puberulent when young, finally glabrous, yellow at maturity, inedible, and said by some natives to be poisonous.

Seeds of the subspecies were obtained from Madagascar in 1953, and seedlings were distributed for trial. At Arcadia

(LASCA), the plants have developed into fine specimens, 7.6 to 9.1 m tall. The terminal buds are 2 cm long, silky-pubescent, and green or somewhat tawny at the tip. The stipules are also pubescent, with hairy margins. The young twigs are decidedly dark-colored and pubescent; the older ones are brown.

Seeds of the typical species were obtained directly from Madagascar in 1960. Seeds of "Adabo," a native type, were also received; PI No. 264,684 shows the record of introduction. Two lots of seeds were received through the United States Embassy, Malagasy Republic, and the USDA in December, 1963, labeled thus: PI Nos. 293,676 and 293,677, the latter as *sakalavarum*.

The alternate, equilateral leaves are oval, 16 cm long and 10 cm wide, with a broadly rounded apex and shallowly cordate base. Venation is prominent, the veins well elevated below, with 1 basal pair plus 4 to 6 laterals. In cultivated trees, the axils of the lower veins often show peculiar cracks, colored brown to scarlet. The texture is thinly chartaceous, and slightly harsh above, and the margins are crenate, but almost entire or somewhat undulate toward the apex. White hairs are found along the veins on both surfaces. The hydathodes are tiny and inconspicuous, scattered over the upper face of the blade. The petioles are 2.5 cm long, and white-pubescent to dark on the lower side.

No fruits have been found on the large trees at Arcadia (LASCA), but at least two seedling trees at Riverside have borne sparingly. The figs are axillary, sessile, or very shortly pedunculate, oblate, and 4.5

cm in diameter. The surface is practically glabrous, and green, with darker green stripes. The umbilicus is prominent, 0.5 cm across. The interior is white, with a mass of staminate flowers near the orifice.

Ficus cocculifolia is reported to be used in Madagascar as a rootstock for the Common Fig (*F. carica*). The affinity is said to be good with some varieties, but not with others. (For further details on the use of this rootstock, see chapter IV, at the end of the section headed "Propagation." Figure 28, illustrating such a union, appears in the adjacent text.)

Trees of the subspecies *sakalararum* growing at Arcadia (LASCA) resemble those of *Alnus rhombifolia* Nutt., the White Alder of California. They have attracted the attention of some horticulturists by their upright habit of growth and ornamental appearance. Perrier (595) remarked that the Adabo does not deserve the contempt in which it is often held. The tree is useful as a forage plant, and might be more fruitful if it were improved by selection. It is also the source of a substance used for the manufacture of alcohol. Its growth is rapid.

108. *Ficus capensis* Thunberg (Cape Fig)

(Plate XXXIV, A1-6)

During the course of his explorations in western Africa, David Fairchild (273) stopped under a wild fig tree to rest, and found the fallen fruit to be edible but not very sweet. He gave Dalziel (221) as authority for referring the species to that "great hodgepodge" called *Ficus capensis* Thunberg (755), trees of which are widely scattered from the Cape to the Gold Coast and the Sudan. According to Holland (382), the Cape Fig tree is plentiful but not cultivated in Nigeria; the fruits, used as food in the raw state, are said to have an agreeable flavor that is almost equal to that of the Common Fig (*F. carica*). Burt-Davy (131), however, stated that the figs usually contain insects, and are not worth eating. Lebrun (460) described three varieties in addition to "*F. capensis typica*." Recently, Reynolds (633a) published an account of the "Man of the Woods," the chimpanzee of central Africa, whose primary food consists of wild figs. An illustration is given of a profusely fruiting tree of *Ficus* (misspelled "*Fiscus*") *capensis*, with a female chimpanzee gorging herself on the figs.

The following references to literature on the Cape Fig may be cited: With illustrations, by Miquel (539, as *Sycomorus capensis*), Anon. (21), Sim (696), Marloth (500, in color), Aubréville (29), Eggeling (251), Codd (165), Pardy (583), Olive Coates Palgrave (163, in

color), Irvine (412), Palmer and Pitman (581b), and Schnell (677a); without illustrations, by P. Miller (536), Warburg (797), Schweinfurth (683), Hutchinson (407, 408), Lebrun and Boutique (462), Aubréville (30), Dale and Greenway (218), F. White (823), and Miquel (541).

Ficus capensis was introduced into the United States as PI No. 56,533 from France in 1923, and as No. 70,945 from seeds collected by Fairchild in Gambia in 1927. PI No. 73,935 also represents material from Africa in 1927. Another introduction was made in 1933 from Angola under PI No. 103,913, labeled "Ukuyu, wild fig." See PI No. 161,323 for a record of seeds obtained by the University of California in 1947 from Saint-Louis, Senegal. Seeds were received directly from South Africa in March, 1947, and again in May, 1948, from which seedlings were grown at Riverside. An introduction was made from Ethiopia in 1951 under PI No. 194,930. At least two California nurseries have also secured fertile seeds, and have grown numerous seedlings which were found later to have no ornamental value for the commercial market. The Cape Fig has not been regarded as an ornamental tree in countries where it is native.

Like their northern neighbor, *F. sycomorus* (species No. 63), the trees of *F. capensis* are cauliflorous, bearing fruit in large clusters from the trunk and frame-

work branches, but are distinguishable from the Sycamore by the larger leaves and less puberulent fruits. Both belong to the subgenus *Sycomorus*. See the account of *F. mallotocarpa* (species No. 94) for the characters which distinguish it from *F. capensis*.

Specimen trees showing characteristic fruiting clusters have been studied at the following locations: Miami (PIS) and Hollywood, Florida; the Atkins Garden, Cienfuegos, Cuba; San Marino, Los Angeles, and Arcadia (LASCA), California; and the Lyon Arboretum, Honolulu. The trees of *F. capensis* are tropical in origin, and cannot be expected to thrive where temperatures fall much below freezing. In California, outdoor trees have been severely injured by temperatures falling to 25° F. Cumings (214) reported a rust, *Crossospora fici*, on the trees in Uganda. This rust had been collected earlier in Luzon on *F. variegata* (species No. 106).

In Florida, the trees have attained a height of 7.5 m and a trunk diameter of 60 cm. Neither buttresses nor aerial roots are developed. The terminal dormant buds are 2 cm long, somewhat angular or flattened, and brown and pubescent at the base. The twigs are gray-brown and pubescent when young.

The leaves are alternate, equilateral, up to 22.7 cm long and 12.6 cm broad, oval, with an obtuse or acuminate apex and a rounded or subcordate base. The venation

is prominent, with 1 or 2 basal veins plus 4 or 5 laterals. The margins are coarsely crenate. The surface is glabrous above and below, or sparsely pubescent on the midrib. The texture is thinly coriaceous. The upper surface of the blade is usually dotted with hydathodes. The petioles are slender, up to 10.2 cm long, sparsely hairy when very young, later showing rings of shreddy epidermis, and are only slightly flattened above.

The figs, borne profusely on leafless, much-branched stalks growing from the trunk and larger branches, are up to 2.5 cm long and 2 cm in diameter, spherical or pyriform, with or without a short neck, and puberulent on the green surface, which is thickly dotted with flecks of white. The peduncle is 1.1 cm long, and commonly swollen or enlarged toward the body of the fig. The umbilicus is small but prominent, in the center of a depression, with pink scales. The interior is pink or white.

Trees seen in the Lyon Arboretum, Honolulu, in 1959 and 1960 are 9 to 12 m tall, and lack aerial roots. The fruiting branches, dangling from the framework limbs, are up to 2.5 m long, the tips of some taking root in the ground, thus forming new plants. (See figure 5 in chapter II, mentioned under "Cauliflory.") Two trees at Arcadia (LASCA) bear fruit profusely; one with green figs, the other with purple ones. (See also, figure 7.)

CHAPTER XVI

ADDITIONAL SPECIES (ARRANGED ALPHABETICALLY)

Ficus acamptophylla Miquel was listed by Setyodiwiryo (689) as being cultivated at Bogor, Indonesia, in the Botanic Gardens. Burkill and Henderson (126) reported it to be a climbing epiphyte or a tree. See Corner (196, 199b).

Ficus acuminata. *Kew Index* classified *F. acuminata* B. Ham., No. 4,478 in the Wallich Catalogue (795), as *F. parietalis*. Corner (199b) did not include it as a synonym of *F. parietalis* Blume, but gave *F. acuminata* Roxburgh as a synonym of *F. subulata* Blume, also *F. acuminata* Wallich as a synonym of *F. heteropleura* Blume. Chittenden (152, per Potter) treated it as equal to *F. parietalis*. W. J. Hooker (391) described and illustrated it as being grown in the Glasgow Botanical Garden under the botanical name *F. cerasiformis* and the common name Sharp-pointed Fig. See *F. parietalis* later in this chapter; also, *F. rostrata*.

Ficus adenosperma Miquel was listed by Setyodiwiryo (689) as being cultivated at Bogor. According to Summerhayes (740), the trees form dense thickets in river beds in New Guinea. Corner (195, 199b) classified this species in a new section, *Adenosperma*, of the subgenus *Ficus*, with four varieties.

Ficus agapetoides Diels is now being grown in the greenhouse of the University Botanic Garden, Cambridge.

Ficus aggregata Vahl was introduced from France in 1932 under PI No. 101,309 as an Indian climber with oval, obtuse, glabrous leaves, 7.5 cm long and punctate above, with clusters of sessile, globose fruits. No plants became established. Corner (199b) gave this specific name as a synonym of *F. microcarpa*.

Ficus albipila (Miquel) King is, according to Corner (196), the most widely distributed species of the subgenus *Pharmacococca*. A synonym, *F. colossea*, was described by Mueller (562) as an Aus-

tralian tree becoming more than 30 m high, with immense buttresses and a spreading head, therefore called "Abbey Tree" by colonists. Hemsley (362) also called it "the Australian Abbey Tree, which gives grateful shade with its ample, woolly leaves." Two illustrations were given by Maiden (495) of these giant fig trees southeast of Cairns, Queensland. However, a recent letter from S. L. Everist, Government Botanist at Brisbane, stated that these trees are not *F. colossea* at all, but *F. virens*. He added that trees of *F. albipila* [*colossea*] have thin buttresses, spreading up to 4.5 m high, and leaves 15 to 20 cm long, cordate at the base, tapering to the long, drip-tip apex, and conspicuously hairy underneath. (See the note under *F. cordifolia* in the present chapter.)

Ficus allutacea Blume, according to G. King (437), is a scandent shrub, cultivated in the Buitenzorg (Bogor) Botanic Gardens, Java.

Ficus amasonica Miquel was listed by E. J. Lowe (479) among a number of "beautiful-leaved plants."

Ficus americana Aublet. J. Burman (127) gave the following for this species: "Pluk, Phyt. Tab. 178, fig. 1." Lemée (467) treated it under *F. pertusa* Linné (f.), but De Wolf (230) classified *F. americana* Aublet as a synonym of *F. perforata* Linné.

Ficus angustifolia Blume was introduced in 1935 from Venezuela under PI No. 110,929 as a woody vine up to 6 m long, a native of the Moluccas. No plants became established. According to the *Kew Index*, *F. angustifolia* Blume equals *F. cuspidata* Reinwardt, but Corner (199b) classified Blume's species under *F. obscura* Blume. Kelsey and Dayton (434) called it the Slimleaf Fig. *Ficus angustifolia* Roxburgh (not Blume) is treated later in this chapter under *F. nervosa*.

Ficus annulata var. *valida* Blume. This species, or its variety, was cultivated in the Buitenzorg (Bogor) Botanic Gardens, Java, from which seeds were introduced in 1928 under FHB No. 75,419. The seeds failed to germinate. Burkill and Henderson (126) listed *F. annulata* as an epiphyte, or a tree up to 15 m tall. See J. G. Watson (810) for Malayan names, and Corner (199b) for synonymy.

Ficus antaoensis Hayata was thus treated by Sata (670): "The receptacles of this species are very handsome in color (scarlet to orange-red), and therefore, with its large leaves, it is a very valuable ornamental." See also, the account by Li (470). Corner (199b) treated it as a synonym of *F. ruficaulis* Merrill.

Ficus ardisioides Warburg is cultivated at Bogor, according to Setyodiwiryo (689).

Ficus arnottiana Warburg was reported to be growing in the Royal Botanical Gardens at Peradeniya, Ceylon, by Parsons (590). See Haines (352) and Osaston (581) for descriptions, and Worthington (849) for a brief account with an illustration. Joseph (426) identified *Blastophaga arnottiana* as an inhabitant of these figs in India. Corner (199b) listed *F. arnottiana* Miquel, with two varieties.

Ficus asperima Roxburgh is appropriately called the Scabrous-leaf Fig for, like various other members of the genus, it has leaves so rough and scabrous that they have actually been used in some countries for scouring wood and metal. According to Alston (8), an appropriate name used in Ceylon is Furniture-leaf Fig. The rough leaf surface is caused by the presence of short, hispid hairs. Introductions of seeds labeled *F. asperima* have been made at various times and from different localities. In 1928, the University of California received seeds under FHB No. 75,399 through Washington, D.C., and grew a number of seedling plants from them. PI No. 123,528 represents seeds received in 1937 from Madras, India. (See the account of *F. tinctoria*, species No. 16, for a note on this importa-

tion.) Specimens collected from plants growing at Miami (PIS) in 1940 and at the Atkins Garden in Cuba in 1949 have been identified as *F. gibbosa* (Blume) Corner [*F. tinctoria* Forster (f.), subsp.], not *F. asperima* Roxburgh. Comparison of this material with a single herbarium specimen of *F. asperima* at the New York Botanical Garden corroborated this identification. Specimens of the Scabrous-leaf Fig formerly established at several places in California have disappeared, and their actual authenticity is in question. This species was described by Roxburgh (657, 658). Other descriptions, with illustrations, were given by Wight (826), G. King (437), Talbot (747), Kirtikar and Basu (440, after King), Alston (8), and Worthington (849); without illustrations, by Miquel (539), Dalzell and Gibson (220), Drury (242), Balfour (51), Beddome (73), G. Watt (815), Talbot (746), D. Brandis (103), Gamble (309), and Haines (352). Corner (199b) classified it under *F. exasperata*, which see in this chapter. According to Grandi (327), *Blastophaga gestroi* inhabits the figs of *F. asperima* in Ceylon and India. Grandi (337) also recorded *Philotrypesis quadrisetosa* as an inhabitant of the figs in Ceylon. This *Ficus* species occurs as a shrub or small tree up to 912 m elevation in the hill ranges of central and south India and in Ceylon. Balfour wrote: "The trunk is remarkably short but very thick, and is sometimes so completely covered with small, very leafy, branches as to be entirely hidden." There are no aerial roots. The young branches are rough, with stiff hairs. G. Watt stated that the young branches are said to be jointed and hollow (lacking pith). The leaves are reported to be alternate, petiolate, oval or elliptic, and 7.5 to 12.5 cm long, with the margins slightly serrate. The apex is obtusely pointed and the base is rounded or subacute. The lower surface is hispid, while the upper surface is strongly scabrous. There are 3 rather prominent veins at the base and 4 or 5 pairs of laterals on each side of the midrib. The figs are pedunculate, hispid, globose, 1.1 to 2.5 cm

in diameter, and slightly depressed at the apex, with a somewhat prominent umbilicus and erect scales.

Ficus aurata Miquel is being grown in the greenhouse of the University Botanic Garden at Cambridge. Corner (199b) listed synonyms and five varieties.

Ficus bambusaefolia was described and illustrated from Fiji by Seeman (686). Degener (225) reported it to be a dwarf shrub, covering the ground, creeping along aggressively, and putting forth many shoots 30 to 60 cm long. See also, the account by Parham (583a).

Ficus baroni Baker was introduced from Madagascar via France in 1932 under PI No. 101,310, but did not become established. See Perrier (596).

Ficus barteri, described by Sprague (715), was sent to Kew Gardens from Nigeria, where it had first been collected by a Mr. Barter, hence the specific name. One author stated: "It is distinguished from all the other species of *Ficus* by its very long, narrow, acute leaves." A tree in the palm house at Kew once produced orange-colored figs. Later accounts were given by Stapf (727), Hutchinson (407), Holland (382), Lebrun (460, 461), N. Taylor (750), Aubréville (29, with illustration), and Chittenden (152, per Potter). It grows as a shrub, or as a small tree about 7.6 m high. Holland wrote: "The tree produces rubber, but is probably of more value for decorative purposes, for which the long, narrow, acute leaves, by comparison with those of larger foliage, eminently fit it." Irvine (412) described the figs as axillary, usually paired, orange-yellow, 2.5 cm in diameter, and edible.

Ficus battieri is not listed in the *Kew Index*. Graf (324) gave an illustration and brief description of it as a Central American fig; a small tree, with short internodes and linear, coriaceous leaves up to 25 cm long. The photograph used as an illustration was taken at the nursery of Dutrie at Ghent, Belgium.

Ficus bennettii Seeman. Bennett's Fig was grown in the Brisbane Botanic Garden, according to F. M. Bailey (37). Corner (199b) gave this as a synonym of *F.*

habrophylla G. Bennett, as he also did in the case of *F. edulis* Bureau, which see in this chapter.

Ficus binnendijkii Miquel was listed by Setyodiwiryo (689) as being grown at Bogor. See J. G. Watson (810) for Malayan names.

Ficus botryocarpa Miquel. Seeds received at Riverside from the Philippines in 1960 failed to germinate. PI No. 268,134 was assigned to it. See Corner (199b) for classification and synonymy; see also, the accounts of *F. conora* and *F. mindoroensis* in this chapter.

Ficus brachypoda. According to Egeling (251), trees of *F. brachypoda* Hutchinson are cultivated in Uganda for the production of poles. However, *Kew Index* lists a species of the same name by Miquel as being equal to *F. eugenioides*. See Dale and Greenway (218) for a description of *F. brachypoda*; also, Wiebes (824b) for an account of *Agave paradoxum modestum* (nov. subsp.) as an inhabitant of the fruit.

Ficus brasiliensis Link. According to F. M. Bailey (37), this Brazilian fig is cultivated in the Brisbane Botanic Garden.

Ficus brassii Robert Brown. According to Chittenden (152, per Preston), *F. brassii* was introduced into England from Sierra Leone in 1824. Corner and Stearn (200) gave it as a synonym of *F. capensis* Thunberg (species No. 108), but added that the name might be applied to other species in gardens. Chittenden (152, per Potter) reported it as a greenhouse or bedding plant, with stems and leaves rusty-hairy, the leaves somewhat fiddle-shaped and deep green. This brief account refers to a species different from that described by Summerhayes (740) from New Guinea as *F. brassii*. He stated that *F. irregularis* [celebensis] Miquel has similar leaves, but differs in its much smaller, long-stalked receptacles. Corner (199b) treated *F. brassii* Summerhayes under *F. pachystemon* Warburg. (See *F. celebensis*, species No. 22.)

Ficus brittonii Boldingh. This West Indian species, described by Boldingh (95), resembles *F. populnea* Willdenow,

but is separated from it by characters of the leaf base. (See *F. populnea* under *F. citrifolia*, species No. 57.) *Ficus brittonii* has a leaf with distinctly narrowed base, while in *F. populnea* the base is broad, not narrowed. De Wolf (230) treated the latter as a synonym of *F. citrifolia* P. Miller. According to the original description, *F. brittonii* is a tree, with oblong leaves 10 cm long and 3.6 cm broad, the petioles 2.3 cm long. The axillary fruits are less than 0.7 cm in diameter, with a short peduncle. This species, once grown by the New York Botanical Garden under its accession No. 37,394, was collected in Curaçao, W.I., in 1913 by N. L. Britton and John A. Shafer. (The former's name appears in "Literature Cited" of this book; the latter was custodian of the N. Y. Botanical Garden's museum.) Cuttings received at Riverside in 1928 failed to root.

Ficus buxifolia was first described by Wildeman (827) from some specimens collected in the Congo. Graf (324) gave a brief, illustrated description of it as a fast-growing tree with small, orbiculate leaves, the broad apex shallowly lobed. The photograph was taken at Stoffregen-Dortmund, Germany.

Ficus camarinensis, first described by Merrill (521, 524), was collected in Luzon (Camarines Province), P.I., hence both the specific and common names. Corner (199b) classified it under *F. cordatula* Merrill, a tree of which is growing on the campus of the University of Hawaii at Honolulu. The Camarine Fig was introduced into Hawaii from the Philippines as seeds under HSPA Nos. 1,714, 1,768, 1,819, 1,829, and 1,849. In 1939, two rooted plants were received by the University of California, Riverside, from L. W. Bryan, Hilo, Hawaii, and established in pots. One plant, moved to an outdoor nursery, failed to survive a winter temperature of 26° F. in 1946. Seeds of this species were received in 1963 from Prof. Juan V. Pancho, Laguna, P.I., and seedlings are being grown at Riverside. PI No. 294,469 was assigned to this acquisition. Seedling plants have leaves with crenate margins, and are identical with

plants of *F. nota*. According to Merrill, the Camarine Fig grows as a tall tree, quite glabrous except for the bud scales, which are appressed-hirsute. Its alliance is apparently with *F. forstenii* Miquel. (See the account of *F. payapa*, species No. 75, wherein *F. forstenii* is treated.) The alternate leaves are subcoriaceous, oblong-elliptic, up to 22.5 cm long and 11.3 cm broad, entire, with rounded base and acutely acuminate apex, the acumens up to 2 cm long, and the veins numbering 10 to 12 pairs. The solitary, sessile figs are ellipsoid in shape, smooth or somewhat warty, and 3.3 cm long. The apex is rounded and the umbilicus is distinct. Nonfruiting potted plants have terminal buds 2.5 cm long, the surface densely villous, and the color green or slightly pink. The leaves are alternate, symmetrical, up to 15 cm long and 7.5 cm broad, oblong-oval, with an apiculate apex and a subcordate base, and 10 pairs of lateral veins. The surface is velvety-pubescent above and below. According to F. X. Williams (835), the receptacles of *F. camarinensis* are scented somewhat like plums or prunes. Their flavor, however, is far inferior to this fragrance, and he found them not to be pleasantly edible. He added: "Besides possessing an inferior flavor, the interior contains a mixture of true seeds, chaff, gall seeds, male flowers, and dead insects." The identity of a tree growing in the Lyon Arboretum, Honolulu, is in question and needs clarification.

Ficus canonii (Bull) N. E. Brown. Van Houtte (395) gave a short illustrated account of a plant exhibited at Cologne labeled "*Artocarpus* (?) *canonii*." It was regarded as very decorative because of its purplish-crimson leaves with incised margins, as shown in his illustration. During the ensuing several years, it was grown at the Kew Gardens and was found, after producing fruit, to be a species of *Ficus*. N. E. Brown (112) accordingly published a description of it as having been cultivated at Kew, although it came originally from the Society Islands. Parsons (590) recorded it as growing at Peradeniya, Ceylon. In 1909, seeds of *F.*

canoni were introduced from England into Florida under PI No. 26,174, along with others, "in the hope of finding a suitable stock for the Common Fig." An introduction of scions was made from Paris in 1932 under PI No. 101,312, but apparently no plants were secured from either of these two lots. PI No. 262,355 represents an introduction from the Netherlands in 1959 by Dr. Frederick G. Meyer, and plants are being grown at the Longwood Gardens in Philadelphia. One plant propagated there was sent to Riverside in 1961, followed by some rooted cuttings in 1965. Corner (199b) classified *F. canoni* under *F. aspera* Forster (f.). (See the account of *F. aspera*, our species No. 11.) According to Brown's account, the young leaves are more or less pinnatifid, while older ones have an entire or sinuate-dentate margin. Plants in pots at Riverside have leaves ovate or ovate-oblong in outline, with a very acuminate or cuspidate apex and a cordate base, the auricles often overlapping. In color, the leaves are dark bronzy-red above and vinous-purple beneath. On these pot-grown plants, the figs are globose, 1.1 cm in diameter, densely pubescent, scarlet when mature, with a stalk 0.5 cm long. See also, the reports of Chittenden (152, per Potter), Encke (264), and Graf (324); the last with an illustration.

Ficus capreifolia Delile. In 1964, seeds of this species were received from Dr. L. E. W. Codd, Pretoria. They were collected by Mr. H. Mockford at Pafuri, northern Transvaal, with the note: "It is an odd species, growing on river banks and forming numerous reedlike stems up to 10 feet [3 m] long." (According to *Kew Index*, *F. capreifolia* Delile equals *F. antithetophylla* Steudel ex Richard, of Ethiopia, but De Wolf [230a] treated it as a distinct species.) The seeds sent by Dr. Codd germinated freely, and seedlings are being grown for trial. A portion of this shipment of seeds has been given PI No. 300,984. Miquel (539) gave an illustration of this species. Young plants show the following characters: Twigs green, densely hirsute; terminal buds 0.7

cm long, pubescent, reddish brown; leaves mostly alternate but some opposite, lanceolate, up to 12.5 cm long and 3 cm broad, with apex obtuse and base rounded; venation prominent, elevated below, with 10 to 12 laterals; texture chartaceous; surface hispid; margins entire to finely serrate; petioles hirsute, 1 cm long.

Ficus carnosa Hort. According to N. Taylor (750), this fig was advertised in 1895 for indoor culture.

Ficus casearia Mueller ex Benth. F. M. Bailey (37) reported this species as growing at Brisbane, while Benth. (77) gave a good account of it from Queensland in general. Corner (199b) classified it as a synonym of *F. septica* Burman (f.), our species No. 12.

Ficus cassidyana Elmer was received from the Philippines in 1929 as PI No. 81,473, but the seeds failed to germinate. This species, described by Elmer (257) as well as Merrill (524), is a tree, 7.6 m tall, with spreading branches and grayish-white bark. The leaves are heart-shaped, scabrous, and brown. The figs are brown, hairy, and 7.5 cm in diameter.

Ficus caudatifolia. An introduction labeled *F. caudatifolia* Warburg was made from the Philippines in 1940 under PI No. 137,962, with the following note by Dr. David Fairchild: "A small tree that branches low down, and has leaves that are very hispid like *F. hispida* L. (f.), but its fruits are distinctly pear-shaped and turn a pretty red when they ripen. They are one and one-half inches [4 cm] long, on longish pedicels. I have never seen *Ficus* fruits like this before. They are as rough as sandpaper, and have many brown spots on them." According to Elmer (263), *F. caudatifolia* Warburg belongs to the section *Axillares*, in which the fruits are axillary or sometimes along the twigs, but are never borne upon tubercles. Other accounts were given by Elmer (258, 259), Merrill (518, 524), and Sata (670). Corner (199b) classified this species under *F. heteropleura* Blume. Trees grown from Dr. Fairchild's introduction (PI No. 137,962), seen at Miami (PIS) in 1949 and again in 1958, have leaves that are

hispid-pubescent, and very small fruits, borne singly or in pairs from warty tubercles. Furthermore, a tree in the Lyon Arboretum labeled *F. caudatifolia* (probably *F. nota*) also bears fruit from spurs on the trunk or on twigs that are leafy at the tip and that may take root in the ground. These cauliflorous trees can hardly be of the species described by Warburg and classified by Elmer, or noted by Fairchild. PI No. 137,962 has now been correctly determined as *F. ampelas* Burman (f.), as noted in the account of that species (our No. 95). An earlier introduction, PI No. 134,990, was made from the Philippines in 1939 as *F. caudatifolia*. Seeds were again received from the Philippines in 1963, and seedlings are being grown at Riverside. Their identity still remains to be determined at the time of writing.

Ficus caulocarpa, described by Miquel (539) first under *Urostigma*, but later by him (544) under *Ficus*, has been treated by Corner (199b), with *F. stipulosa* Miquel as a synonym. G. King (437) classified the latter as *F. infectoria* [virens] var. *caulocarpa*. Merrill (518) regarded *F. stipulosa* as the Philippine form, and gave *F. caulobotrya* Miquel as a synonym. Quisumbing (615) treated both *F. caulocarpa* and *F. caulobotrya* under *F. stipulosa*, with a description of its characters and uses. See also, Li (470). However, Corner (196) referred to specimens of *F. caulobotrya* Miquel as a mixture of leaves, "clearly a *mixtum compositum* of mounting the material, and the name can be dismissed." (See a similar comment under *F. wendlandii* in the present chapter.) Pancho (582) illustrated leaves, fruits, and flowers of *F. stipulosa*, and wrote: "The presence of numerous crowded receptacles on the branchlets easily distinguishes this from other species. It grows to about 20 m, and is cultivated for shade." Seeds labeled *F. caulocarpa* were received from the Philippines in 1963. These germinated and produced seedlings which are not of this species, but are closely identical with those of *F. nota*. Some of these seeds, sent to Washington,

D.C., were assigned PI No. 294,470. Over thirty years ago, L. W. Bryan, Chief Forester, state of Hawaii (now retired), collected seeds from a tree at Baguio, Philippines. Some seedlings from this collection were planted about 8 miles [13 kilometers] below Volcano House, along the main highway to Hilo. Specimens collected in March, 1965, show the following characters: Trees small, spreading; leaves lanceolate, entire, base subacute, apex bluntly acuminate, veins 6 or 7 pairs; the fruits from tubercles in leaf axils of short, terminal twigs, the peduncles up to 1 cm long, and the umbilicus large. This introduction is classified as *F. caulocarpa*. (See note under *F. virens*, species No. 24.)

Ficus cavroni Carrière was grown in a hothouse in Paris, and was briefly described by Carrière (142) as coming from Brazil. Preston and Potter, in Chittenden's Dictionary (152), both reported it as a shrub, with wedge-shaped leaves 45 cm long, rusty on the lower surface.

Ficus chauxieri Hort. Maiden (494) described *F. chauxieri* as "a handsome, broad-leaved species which does well in places, even in exposed situations." He did not ascertain its botanical origin, and believed it to be related to *F. bengalensis*. Much later confusion might have been avoided if he had been more explicit as to the meaning of "broad-leaved," and if his illustration of the tree had shown leaves more sharply defined. Corner and Stearn (200) listed *F. chauxieri*, with the statement: "Possibly a form of *F. bengalensis*." On the other hand, Kelsey and Dayton (434) listed *F. chauxieri* as a horticultural variety of *F. elastica*. This is probably on the authority of N. Taylor (750), but his statement reads: "In Europe, this is said to be second only to *F. elastica*." It was not, however, designated as a variety of that species. Barnhart (55) stated: "There seems to be some confusion in the minds of nurserymen as to the correct name of this subject [*F. chauxieri*]. The crowning glory of the plant is its bright-red fruits, borne in pairs without stems, in the axils of the

petioles. They are three-fourths of an inch [2 cm] in diameter, with a rough surface." Nehrling (574, 575) reported it as a noble species from New Caledonia, "ranking in Germany next to the common rubber tree as a pot plant." Thompson (754) published an account of this species, with a line drawing which showed a large, bushy plant in an outdoor border. The broad leaves, 25 to 30 cm long, had gently undulating margins, and were conspicuously marked with yellowish-green midrib and veins. In Chittenden's Dictionary (152), it was described as an erect plant, with leaves oval, obtuse, broader than in *F. elastica*, dark green, margins waved, and veins pale yellow. The 1910 catalogue of the Franceschi Nursery, Santa Barbara, California, listed *F. chauvieri* as a very fast-growing and ornamental plant. Riedel (641) told of specimens once growing in Los Angeles; at the old Bard Estate, Hueneme; and in Pasadena. A recent communication from a nursery firm in England stated: "To the best of our knowledge and belief, this variety is not now grown in Europe as a pot plant, and we do not know of a botanical garden with a specimen." It was grown by the New York Botanical Garden in 1900, but has since been lost. If we accept the account of Barnhart (55) as authentic, a plant with "bright-red fruits 2 cm in diameter" cannot be identified as a variety of *F. elastica*. Furthermore, that species seldom produces fruits on pot plants, and when produced by well-established trees, the figs are found to be green, small, and oblong in shape. This leads to the conclusion that *F. chauvieri* Hort. is a form of *F. bengalensis*, as classified by Corner (199b), and as surmised by Corner and Stearn (200).

Ficus chlamydodora was described by Warburg (797) and illustrated by Engler (266). According to PI Nos. 61,490 and 63,770, seeds of it were obtained from Africa in 1924 and 1925, respectively, with the following description: "A stately tree, grown largely for shade in parts of tropical Africa because of the handsome foliage and brick-red

branches." Apparently, no seedlings were grown from these introductions.

Ficus chrysocharpa Reinwardt. In 1929, 1931, and 1940, seeds of this species were received from the Singapore Botanic Garden, those in 1931 under PI No. 95,090. It was described as "a yellow-hairy shrub, 1.2 m high, with oblanceolate, serrulate leaves 7.5 cm long. The oblong to globose fruits, borne in axillary pairs, are 1.1 cm in diameter and covered with golden-yellow hairs, becoming red when mature." The seeds all germinated freely, but the resulting plants were weak and chlorotic, and failed to survive. See the accounts by Blume (92), G. King (437), and D. Brandis (103). Corner (199b) classified *F. chrysocharpa* Reinwardt under *F. fulva* Reinwardt ex Blume, for which see species No. 102.

Ficus clavata Wallich. This, the Clavate Fig, was described by Wallich (795) as No. 4,495 in his Catalogue. The specific name apparently refers to the fruits, which are club-shaped or clavate. In 1936, seeds were received of PI No. 114,745, labeled *Ficus clavata*, and collected in Szechuan Province, China. It was described as a shrub, almost 2 m high, with membranous, oblong-lanceolate leaves 12.6 cm long, a native of India and the Federated Malay States. The seeds germinated freely, but the seedlings showed two more or less distinct types of plants; one with narrow or elongated leaves, the other with broad leaves having serrate margins. These plants were grown for several years and some were distributed in California for trial. Notes were taken of the above PI number growing at Miami (PIS) in 1940 and at the Atkins Garden in Cuba in 1949. No specimens were found in the Florida collection in 1958. Nonfruiting specimens of plants grown in California, compared with material in the U. S. National Herbarium, show them not to be identical with *F. clavata*. Furthermore, the specimens studied do not conform with the descriptions of *F. clavata* by G. King (437), D. Brandis (103), H. Collett (167), or Gamble (309). It must be concluded that seedlings grown under PI No.

114,745 are not properly identified as *F. clavata* Wallich, which in turn has been classified by Corner (199b) under *F. subincisa* J. E. Smith.

Ficus clementis Merrill. Seeds of this species were received from the Philippines in 1963, and seedlings are being grown at Riverside. PI No. 294,471 was assigned to some of the seeds sent to the USDA. Their seedlings, however, do not conform with descriptions of *F. clementis* by Merrill (518) and Elmer (259). Corner (199b) treated this species as a variety of *F. crassiramea* Miquel.

Ficus clusioides Miquel. Seeds of this species were received in 1963 from Prof. Juan V. Pancho, Laguna, P.I., and seedlings are being grown at Riverside. PI No. 294,472 was assigned to some of the seeds sent to Washington, D.C. It was described by Miquel (544); other accounts were given by G. King (437), Merrill (513, 524), and Elmer (261). *Ficus clusioides* has been classified by Corner (199b) as a synonym of *F. callophylla* Blume.

Ficus collina, not listed in the *Kew Index*, and with authorship of the name not stated, was included by E. J. Lowe (479) among the "beautiful-leaved plants" cultivated in England.

Ficus conora King. Three introductions of this species have been made: PI No. 77,658 from Manila in 1928, and Nos. 80,047 and 81,491 from Summit, Canal Zone, both in 1929. The same description was given for all three numbers, apparently an adaptation from the illustrated account by G. King (437): "A tree, native to New Guinea, with softly pubescent branchlets, lanceolate, entire leaves 7 inches [18 cm] long, pubescent beneath, and turbinate fruits an inch [2.5 cm] in diameter, borne on long, flexuose, leafless branches arising at the base of the trunk." The figs are often either partially or entirely covered by the soil. (See the comment on this geocarpic peculiarity under "Cauliflory" in chapter II.) Other reports have been given by Elmer (261, as *F. conora*; 262, as *F. subalbida-ramea*), Merrill (515, 522, 524), Sata (670), Summer-

hayes (743), and Pancho (582). Corner (199b) treated it as a synonym of *F. botryocarpa* Miquel, mentioned earlier in the present chapter. See also, the note under *F. mindoroensis* in this chapter. According to Pancho, these trees are occasionally cultivated in the Philippines, and the bark, when cut, exudes abundant water which may be collected for drinking purposes. Merrill (522) reported that Blume erroneously reduced *F. conora* to *F. ribes* Reinwardt ex Blume, an allied species (our No. 61) with smaller leaves and very much smaller receptacles. No trees have been found in collections on the mainland or in Hawaii. Standley (719) recorded it as being cultivated in the Canal Zone.

Ficus consociata Blume was growing at Bogor, Java, in 1957, according to Setyodiwiryo (689). See J. G. Watson (810) for Malayan names and Corner (199b) for classification.

Ficus cooperi Hort. ex Regel was called the Cooper Fig by Kelsey and Dayton (434). According to Hovey (396), the red-veined *F. cooperi* from Australia is "another greenhouse plant," desirable in its way. A brief description of it was given by Seeman (686) from plants growing in the Sydney Botanical Garden. N. Taylor (750) reported it as listed in catalogues from 1895 to 1911 as a native of tropical America, but that the specific name had not been found in botanical literature dealing with that area. See a similar report by Riedel (641). Corner (199b) classified it under *F. granatum* Forster (f.).

Ficus copiosa Steudel. Seeds received in 1967 from S. L. Everist, Government Botanist, Brisbane, Queensland, were presented to the Botanical Garden at Riverside. They germinated freely, and seedlings were growing well at the time of writing. This species was treated by Corner (199b), with synonyms and two varieties. (See the note under *F. polycarpa* in the present chapter.) One synonym is *F. magnifolia* F.v.M., the Large-leaved Fig. The account by Benthham and Mueller (77), copied verbatim by F. M. Bailey (42), separated *F. copiosa* from *F. chret-*

ioides F.v.M. (using the synonym *magnifolia* for the former) in a key which appears in the present chapter under *F. ehretioides*. *Ficus magnifolia* [*copiosa*] was listed by Audas (32) as the "Great Fig," with leaves 60 cm long. According to Corner (199b), *F. copiosa* Steudel belongs in the section *Sycidium*, series *Copiosae*.

Ficus cordata was described and illustrated by Thunberg (755) as a species with leaves subcordate, ovate, obtuse, and glabrous, with the fruits axillary, sessile, globose, the size of a pea. It was briefly described by P. Miller (536) under his No. 48. See also, Willdenow (834). According to Marloth (500), this species, commonly called Melkboom (Milk Tree) in Afrikaans, is one of the most widely distributed South African trees. It has been confused with two other species, *F. salicifolia* Vahl and *F. pretoriae* Burtt-Davy (our species Nos. 77 and 23, which see). Wager (787) identified the Wonderboom as *F. cordata*, but the Division of Botany at Pretoria has stated in a letter that Wager's identification was incorrect. *Ficus cordata*, closely allied to *F. ingens* Miquel (listed later in the present chapter), and confused with it in literature, occurs in the western part of South Africa, while the latter is found in the eastern part and extends into tropical Africa. See also, the accounts by Hutchinson (408) and Henkel (366). *Ficus cordata*, once grown by the New York Botanical Garden, had its accession No. 2,971, and came from the Buffalo Botanical Garden in 1900. Accession No. 3,264, obtained from Fairmount Park, Philadelphia, at about the same time, was also identified as *F. cordata*. A third accession was No. 14,767, from the Jardin des Plantes, Paris. Although it was listed and briefly described by Riedel (641), it has apparently not appeared under cultivation in California. According to various accounts, the trees produce numerous aerial roots from the branches; these roots are tomentose when young. The leaves are elliptical, rounded or subcordate at the base and acuminate at the apex, up to 10 cm long and 5 cm broad, rigidly

coriaceous, and glabrous. The figs are sessile or shortly pedunculate, mostly geminate, slightly depressed-globose, 0.8 cm in diameter, spotted, and minutely puberulent.

Ficus cordifolia Blume once grew at Peradeniya, Ceylon, according to Parsons (590). Douglas and Baas-Becking (239) found and illustrated a specimen 15 m tall in the Buitenzorg (Bogor) Botanic Gardens. It was reported by Setyodiwiryo (689) to be still there in 1957. According to Corner (196), *F. cordifolia* Blume, as understood by Koorders and Valetton (446), is equal to *F. albipila* (Miquel) King, which see earlier in the present chapter. Later, Corner (199b) classified it under *F. variegata* Blume (our species No. 106). On the other hand, *F. cordifolia* Roxburgh equals *F. rumphii* Blume (our species No. 21), according to the *Kew Index* and Corner (199b). Seeds so labeled were received from India in 1948, but failed to germinate. See the account by Dymock (250). This is a "strangler," according to D. Brandis (102).

Ficus coriacea, described by Dryand (Jonas Carlsson Dryander) in Aiton's *Hortus Kewensis* (5), was illustrated in color by W. J. Hooker (389) and labeled with the common name Coriaceous-leaved Fig. It had long been cultivated in the Liverpool Botanic Garden, but its country of origin was not known. Steele (730) listed it as coming from the East Indies.

Ficus cuspidata Reinwardt was reported by Setyodiwiryo (689) as growing at Bogor. According to the *Kew Index*, *F. cuspidata* Desfontaines equals *F. benjamina* L., while *F. cuspidata* Zoll. equals *F. rostrata* Lamarck. The latter is treated under *F. hederacea* Roxburgh, species No. 3. Corner (199b) listed *F. cuspidata* as a subspecies of *F. sinuata* Thunberg. (See also, the brief comment under *F. angustifolia* Blume earlier in this chapter.) Corner (199b) listed *F. cuspidato-caudata* Hayata under *F. benjamina*; this form was regarded by Sata (670) as an ally of *F. retusa* [*microcarpa*] in its garden value. It is often used as a shade tree along roadsides in Taiwan, having multiple trunks

like the banyan tree of India. See the account by Li (470). Grandi (336) listed *Blastophaga valentinae* as an inhabitant of these figs in Java. See *F. rostrata* and *F. formosana*, both listed in this chapter, for further notes on synonymy; *F. benjamina*, mentioned twice above, is described as species No. 34.

Ficus cyathistipula Warburg and *F. cyathistipuloides* Wildeman were once grown at the Missouri Botanical Garden in St. Louis, but were lost when new conservatories were constructed. *Ficus cyathistipula*, indigenous to tropical Africa and the island of "Sansibar," was described and pictured by Warburg (797), as well as by Engler (266). Graf (324) gave a short, illustrated account of plants grown at the Palmengarten in Frankfurt, as well as in Switzerland. *F. cyathistipuloides*, found in the Belgian Congo, was described by Wildeman (828). The two were placed in the subgenus *Bibracteatae*, section *Axillares*, by Lebrun and Boutique (462), and distinguished in their key as follows:

- Stipules persistent to subsistent;
blade from 6.5 to 27.5 cm long and
2.5 to 8.5 cm broad; secondary veins
5 pairs; receptacles from 1.5 to 3.5
cm in diameter; peduncles from 1.2
to 2.0 cm in length. . . . *F. cyathistipula*
Stipules deciduous; blades from 6.5 to
13.0 cm long and 1.2 to 4.0 cm
broad; secondary veins 8 to 10 pairs;
receptacles from 3.5 to 4.5 cm in
diameter; peduncles from 0.8 to 0.9
cm in length. . . . *F. cyathistipuloides*

Lebrun and Boutique gave a detailed description and citations to other accounts, including the following: Hutchinson (407), Lebrun (460), Aubréville (29, with illustration), and F. White (823).

Ficus dealbata Hort., cultivated in France in 1869, equals *Coussapoa dealbata*, according to the *Kew Index*. Parsons (590) reported it as growing at Peradeniya, Ceylon.

Ficus doliaria Martius. A packet of seeds labeled *F. doliaria* was received from Campinas, Brazil, in 1948. The seeds germinated freely, the seedlings grew well,

and a number were distributed for trial. This species, of the subgenus *Urostigma*, was described by Martius (501) from material collected near São Paulo. According to Miquel (539, 543), it grows wild in various parts of Brazil. Correa (202) gave an illustrated account of its habit of growth. Also, according to Christy (156) and Correa (201), the latex produces an alkaloid, known as doliarine, which possesses medicinal properties. To judge by the vegetative characters of young plants, this species has a distinctive value as an ornamental potted specimen. The plants are treelike, with gray bark and densely pubescent, rusty-brown terminal buds 2.5 cm long. The stipules are deciduous and pubescent, and the young twigs are conspicuously clothed with rusty-brown hairs. The leaves are alternate, equilateral, up to 30 cm long and 15 cm broad, the apex rounded or shortly apiculate, the base subcordate to cordate, and the sinus narrow or practically closed. Venation is prominent, especially below; the midrib is flanked by 2 or 3 basal pairs of short veins and 6 to 10 pairs of laterals; all are well elevated. The leaves are thick and subcoriaceous, with entire to undulate margins. The upper surface of mature leaves is glossy and glabrous, or pubescent on the veins and along the margins; the lower surface is densely pubescent, especially on the veins. Hydathodes are sometimes present. The petioles are 2.5 to 7.5 cm long, and densely rusty-pubescent. No fruits were available for description. At Riverside, one plant became infected with the virus causing leaf mosaic, and was discarded. Another plant is growing at Arcadia (LASCA).

Ficus dubia Wallich (the Cherry Fig). This Malayan fig was reported by Corner (193) to be one of the most beautiful of the genus. The tree resembles that of *F. benjamina* Linné, but has larger leaves and bears pear-shaped figs that are orange to dark crimson. See J. G. Watson (810) for Malayan names.

Ficus edolfeltii King is a species from New Guinea, cultivated in Indonesia, according to Setyodiviryo (689). Douglas

and Baas-Becking (239) found a tree 18 m tall in the Bogor Botanic Gardens. Corner (197a) described and pictured a new variety as *bougainvillei*. See also, Corner (199b).

Ficus edulis was described by Bureau (121) from New Caledonia. An illustration and brief account of *F. "edule"* were given by Graf (324) as a shrub, bearing small, yellowish figs in dense clusters on the lower trunk. The photograph was taken at the nursery of Louis van Houtte, Ghent, Belgium. Corner (199b) classified *F. edulis* Bureau and *F. bennettii* Seeman as synonyms of *F. habrophylla* G. Bennett. See the brief account of *F. bennettii* in this chapter.

Ficus euveldiana Hort. André (13) reported that this species was used for pot culture in France. According to N. Taylor (750) and Riedel (641), it was offered in nursery catalogues in 1911 as having large, broad leaves with colored veins. The specific name is not listed in the *Kew Index*.

Ficus ehretioides, the Ehretia-like Fig, was named because of its resemblance to some species of *Ehretia*, a genus of tropical trees and shrubs of the family Boraginaceae (or Ehretiaceae). It was described by Mueller ex Bentham (see Bentham and Mueller [77]) from specimens collected at Rockingham Bay, Queensland. It was distinguished from *F. magnifolia* F.v.M. by Bentham; also, by F. M. Bailey (42) in the following key, both species having leaves large (15 to 45 cm long) and glabrous:

Leaves obovate-oblong or elliptical.

Stipules narrow, rigid. . . *F. magnifolia*

Leaves cordate-ovate. Stipules membranous. *F. ehretioides*

However, Corner (199b) classified *F. magnifolia* F.v.M. to equal *F. copiosa* Steudel, and *F. ehretioides* under *F. variegata* Blume. See under *F. copiosa*, earlier in the present chapter; also, under *F. variegata* (species No. 106). According to Bailey, *F. ehretioides* is known in Australia as "Magura." The trees grow to a height of 21 m, with heart-shaped leaves

and globular, edible fruits 2.5 cm in diameter, borne in clusters on the trunk and larger branches. An illustration of a typical leaf and a cluster of fruits was published by F. M. Bailey (43). Riedel (641) recommended it as a garden and avenue tree for California and Florida. Since it belongs to the same section and subgenus as the Common Fig (*F. carica*), this species should be of interest for experimentation in the possible production of an interspecific hybrid. In 1922, seeds collected by C. E. Pemberton in Queensland and sent to Hawaii were given HSPA No. 1,893. From this lot, some seeds forwarded to Washington, D.C., received PI No. 54,891. One plant received in California from Summit, Canal Zone, in 1936 failed to become established. Furthermore, a rooted plant sent from Hawaii in 1940 did not survive the customary vacuum fumigation. No plants labeled *F. ehretioides* were found in Cuba or Florida, and apparently the species is not represented in mainland collections; neither were any trees located in Hawaii during visits in 1959 and 1960.

Ficus exasperata Vahl. Two species have been described under this name. One, by Roxburgh (658), was classified by Corner (196, 199b) as *F. ampelas* Burman (f.) var. *soronensis* (King) Corner, in section *Sycidium*, series *Exasperatae*. According to Roxburgh, this was introduced into the Calcutta Botanic Garden in 1798 from the East Indies. The other species, described by Vahl (773) and indigenous to tropical Africa, is the one considered here. A good account of *F. exasperata* Vahl was given by Lebrun and Boutique (462), who cited additional references as follows: Mildbraed and Burret (535), Chevalier (150), Peter (599), and Lebrun (460). See also, accounts with illustrations by Miquel (540), Wight (826), Hutchinson and Dalziel (410), Aubréville (29), F. W. Andrews (14), and De Wolf (230a); without illustrations, by Hutchinson (407), Dale and Greenway (218), F. White (823), and Schnell (677a). Warburg (800) described and illustrated it as *F. punctifera*. Under this specific name,

an introduction was made from France in 1932 under PI No. 101,328. Hutchinson (407), as well as Schwarz (682), regarded *F. exasperata* as a synonym of, or confused with, *F. serrata* Forskal; while Corner (199b) treated the latter as a synonym. According to Holland (382), Eggeling (251), R. O. Williams (838), and Irvine (412), the rough, scabrid leaves are used like sandpaper. Aubréville (30) gave this as an example of a fig plant which overruns the ground of abandoned farms in the Sudan. The species is of doubtful ornamental value. Although it was listed by Riedel (641), there are apparently no plants yet established in the United States. See note at *F. asperima*. The following short description is after that of Lebrun and Boutique (462): The tree, up to 21 m high, has scabrous, pubescent leaves, elliptical to ovate, up to 11 cm long and 5.7 cm broad, with acuminate apex, rounded or cuneate base, and entire to finely denticulate margins. The midrib is flanked by 3 to 5 pairs of elevated veins. The figs are solitary or geminate, pedunculate, globular, pea-size, scabrous on the surface, and dark violet at maturity.

Ficus excelsa Vahl. According to Roxburgh (658), this was introduced from the Moluccas into the Calcutta Botanic Garden. Drury (243) cited a report by Reece (presumably 624 in our bibliography) that one tree in India was 15 m in circumference and was reported to be 2,000 years old. Corner (199b) listed it as a synonym of *F. tinctoria* subsp. *parasitica*, which is treated under species No. 16.

Ficus exsculpta Hort. (Bull). An anonymous writer (18) reported that "a Mr. Bull of Preston" was growing a plant under the provisional name *Artocarpus exsculpta*. The illustration showed leaves much like those of some ferns. The "species" was later found to belong to the genus *Ficus*. Simpson (700) stated that *F. exsculpta* "goes the limit, for its beautiful leaves are strongly pinnatifid." Corner (199b) classified it as a variety of *F. aspera*, which is treated as species No. 11 in this work; however, the latter is not

described there as having "pinnatifid" leaves. No record has been located to show that this fig is now being cultivated.

Ficus falcata, described by Thunberg (755), equals *F. punctata* of the same author, according to Corner (199b); see the account of the latter in the present chapter. Philip Miller (536) gave a short report under his No. 49. *Ficus falcata* was included in a list given by E. J. Lowe (479) of "beautiful-leaved plants" grown in Great Britain. According to Nehrling (574), any list should include this species: "Leaves about an inch [2.5 cm] in length differ in shape from the others, being peculiarly curved," hence the specific name (sickle-shaped). Preston, also Potter, in *Chittenden's Dictionary* (152), described *F. falcata* as "a dainty, evergreen creeper, good for covering walls of greenhouses, stumps, or stems of palms." Riedel (641) gave much the same account as N. Taylor (750) when he stated that it had been an occasional inhabitant of greenhouses in earlier years. It is a creeping and rooting plant from Malaya, similar to *F. pumila* (species No. 4), with leaves tessellated and colored underneath.

Ficus fistulosa, described by Blume (92), was so named because of the fistulous (hollow) stems, "*ramis fistulosis*." G. King (437) also described this species, giving the synonyms *F. sub-opposita* Miquel and *F. diphylla* Wallich. As King's two plates show, the plants are very variable in leaf forms and fruit characters, some figs being borne in the leaf axils, others on tubercles produced from either small or large branches. Corner (191, 193) gave a good account of *F. fistulosa*, with illustrations of the receptacles. He stated that this Yellow Stem-fig is very common in Malaya, "but is an ugly plant, whose unwanted saplings abound in hedges. But it is useful for botany classes because the fruits can be gathered at all times of the year and the ripe gall figs teem with insects." It also occurs in India and south China. This species was also described by Kurz (455, with illustration), D. Brandis (103), Koorders (444), Koorders and Valetton (446, with illustration),

Ridley (639), Burkill and Henderson (126), Merrill (525), Oehse (580, with illustration), and Burkill (124). Corner (199b) treated it, giving synonyms and four varieties. (See *F. harlandi*, later in this chapter.) It was listed by Parsons (590) as being cultivated at Peradeniya, Ceylon, and by Setyodiwiryo (689) as being grown at Bogor. According to Burkill, it is the "*Ficus miquelii*" of the story of the magic golden flowers told in the *Journal of the Royal Asiatic Society, Straits Branch* (32:215, 1899). See Wiebes (824c) for an account of *Ceratosolen constrictus* as an insect inhabitant of the fruits. Seeds labeled *F. fistulosa*, received in 1964 from Dennis Hill, Hong Kong, germinated, but none survived.

Ficus formosana was described by Maximowicz (507) from Chinese specimens. Other accounts were given by G. King (437), Sata (670), Forbes and Hemsley (290), and Li (470). Sata gave a list of references, a detailed description of the species, and stated that the plants are widely distributed in Taiwan and south China, occurring in two distinct forms. King reported that Maximowicz believed the species comes near *F. cuspidata* Reinwardt, *F. rostrata* Lamarck, and *F. caudata* Wallich, an opinion with which King "quite agreed." (See the accounts of the first two species in the present chapter.) Seeds labeled *F. formosana* were received from Hong Kong in 1962 and planted at Riverside. The seedlings show leaf and fruit characters approximating those described and illustrated by G. King (437) for *F. formosana* var. *pandurata* Hance. However, Corner (199b) treated *F. pandurata* as a distinct species. (See under *F. lyrata*, species No. 17.) The slender, reddish-brown twigs of cultivated plants bear leaves up to 10 cm long, obovate to spatulate; the figs are axillary, solitary, turbinate, 0.7 cm long, reddish brown, with a broad, conspicuous umbilicus and scarlet interior.

Ficus foveolata was described by Wallich (795) under his No. 4,493. According to G. King (437, with illustration), the plant is a creeping or climbing

shrub, rooting from the branches, and is the most widely distributed scandent *Ficus* in India, ranging from the subtropics to elevations where there is snow in winter. It is extremely variable, and King classified it into the following two groups, based on the fruits:

Receptacles globular, small (three varieties).

Receptacles ovoid, obovoid, or subglobular, large (two varieties).

The figs were reported to be solitary, sessile to shortly pedunculate, more or less umbonate, and 2.5 to 3.6 cm long. According to D. Brandis (103), this species is commonly cultivated on walls in India. It is similar in habit to *F. scandens* [*hederacea*], our species No. 3, from which it was separated by Parker (584) by the size of its fruit and the length of the peduncles. Osmaston (581) gave the following key:

Lateral nerves 4 or 5 pairs. . . *F. scandens*

Lateral nerves 6 to 10 pairs. . . *F. foveolata*

Other accounts were given by Prain (610), Duthie (247), H. Collett (167), Troup (765), Gamble (309), Rehder and Wilson (628), Sata (670, with illustration), and Li (470). Corner (199b) listed it as a synonym of *F. sarmentosa*, which see later in this chapter. In 1956, seeds of *F. foveolata* var. *arisanensis* Hayata received from Taiwan produced no seedlings. Grandi (336) reported *Blastophaga collida* as inhabiting the figs in Taiwan.

Ficus geocarpa Teysmann, known as the Common Earth Fig in Malaya, is a small, evergreen tree with fruiting runners up to 9 m long, these arising from the trunk up to a height of 1.2 m. See Corner (193, 199b). The figs are globular, up to 2.5 cm in diameter, and densely hairy. This species was listed by Setyodiwiryo (689) as being cultivated at Bogor.

Ficus gillettii was described and illustrated by Warburg (799) from specimens collected in the Congo. Among the characters given were leaves oblong, apex acuminate, base subacute, 10 to 12 cm long and 3 to 5 cm broad; receptacles subglobose, 1.5 cm in diameter, on peduncles

1.5 to 2 cm long, and dark brown. Riedel (641) recorded this species as having been offered in European catalogues in 1910. Graf (324) photographed it at the Cologne Botanical Garden, and briefly described it from Malaysia as cauliflorous, similar to *F. glomerata* Roxburgh [*racemosa*], our species No. 82. This indicates a species different from the one described by Warburg.

Ficus glaberrima Blume was described and illustrated by G. King (437), with references to earlier accounts and to synonyms. He concluded that it came very near *F. nervosa* Heyne ex Roth and *F. pubinervis* Blume, and that the three might be united specifically. However, Corner (199b) treated all three as distinct species. (See the brief accounts of both species later in the present chapter; also, that of *F. kingiana*.) The habitat of *F. glaberrima* extends from the base of the Himalayas to Burma and Java. D. Brandis (103) described it as a large tree, or at times a large, epiphytic shrub; Gamble (309), as an evergreen tree in sub-Himalayan tracts from the Jumna River eastward; Haines (352), as a small tree (tall in the Himalayas), with rather scanty latex; Osmaston (581), as a glabrous tree, with a trunk up to 1.4 m in diameter, and 12 m high. See also, the account by Merrill (529). PI No. 101,316 represents an introduction from Paris in 1932 of scions of *F. glaberrima*, "an East Indian tree, with oblong, acuminate leaves 3 to 6 inches [7.5 to 15 cm] long, and small, pea-sized fruits." No record has been found of any plants of this species being cultivated in the United States.

Ficus globosa Blume was described and pictured by G. King (437) as a large climber, the younger branches having a deciduous, brown scurf but ultimately becoming glabrous. The typical form occurs in south Burma and in Malaysia, PI No. 88,325 represents an introduction of seeds of *F. globosa* from Singapore in 1930, but apparently no seedlings became established. See the accounts by Corner (196, 199b) on taxonomy; also, J. G. Watson (810) for Malayan names.

Ficus gracilipes. PI No. 78,597 of 1929 represented an Australian species described by F. M. Bailey (39) under this name. Other accounts were given by Bailey (42, 43), the latter with a sketch of leaves and fruit. He stated, "Perhaps it is only a variety of *F. hennecana*," and Corner (199b) treated it as such. (See the account of *F. superba* Miquel var. *hennecana* under species No. 44 for a more complete discussion of this relationship; also, *F. muelleri* in the present chapter.) Guilfoyle (346) called it the Slender Fig Tree. It was described in Inventory No. 98 thus: "A small, semideciduous tree with a drooping habit, coriaceous, deep-green, elliptical leaves 3 to 5 inches [7.5 to 12.5 cm] long, and globular, deep-purple fruits an inch [2.5 cm] in diameter that are suitable for preserving."

Ficus habrophylla G. Bennett. See *F. bennettii* and *F. edulis* in this chapter.

Ficus harlandi Bentham was listed by Maiden (495) as an exotic for dry districts in New South Wales. It was described by Bentham (76), and separated in a key from other cauliflorous species. See also, Maximowicz (507). According to Sata (670), *F. harlandi* is occasionally planted in gardens of Taiwan, having receptacles both in the leaf axils and on short branchlets from tubercles. See Dunn and Tutcher (245) for localities; also, Li (470). Corner (199b) treated it as a synonym of *F. fistulosa* Blume, which see earlier in the present chapter.

Ficus hesperidiformis King. Dr. Corner writes that this species is being grown in the greenhouse of the Cambridge University Botanic Garden.

Ficus heteromorpha Hemsley, received from China in 1936, was given PI No. 114,746, with an account in the Inventory: "A small shrub of the *Sycidium* section, with exceedingly variable leaves. Native to central China." See the notes by Rehder (627), and the classification by Corner (199b) as a variety of *F. sarmen-tosa* B. Ham. ex J. E. Smith; see the latter farther on in the present chapter. Apparently, no plants have become established as a result of this introduction.

Ficus heterophylla Linné (f.). PI No. 101,317 was obtained as scions from Paris in 1932, labeled *F. heterophylla*, with these notes: "A creeping shrub, native to tropical India and Ceylon. The leaves, 1 to 3 inches [2.5 to 7.5 cm] long, vary from lanceolate and entire to broadly cordate, with repand, toothed, or deeply lobed margins; and the solitary, axillary fruits vary from globose to long-pyriform." The species, first described by Linné (f.) (476), has been treated in many other later accounts, only a few of which are listed here: Steele (730), Vahl (773), Roxburgh (658), Miquel (539, 542), Wight (826, with illustration), D. Brandis (102, 103), Kurz (455), Clarke and Stapf (158), Prain (610), Merrill (516), Duthie (247), Talbot (746, 747), Haines (352), and Corner (199b). See also, Stapf (728) for references to illustrations. Grandi (337) listed *Philotrypesis ficicola* Ashmead as an inhabitant of the figs in the Philippines. G. King (437, 438) described *F. heterophylla* as a polymorphous shrub with many forms or varieties, *F. scabrella* Roxburgh (listed later in this chapter) and *F. repens* Willdenow representing the two most prevalent forms. King's descriptions and illustrations of *F. heterophylla* and of *F. pumila* are sufficient to separate them into two species, in spite of the fact that he referred to *F. repens* as a "prevalent form." (See the comment under *F. pumila*, our species No. 4.) Apparently, there are no representatives of this species in cultivation in the United States. *Ficus heterophylla*, described by Rock (648) as very common in Hawaii, is apparently the same as *F. pumila*.

Ficus heteropoda Miquel was listed by Setyodiwiryo (689) as being cultivated at Bogor. PI No. 139,365, growing at Miami (PIS), and accession No. 8,706 in the Lyon Arboretum in Honolulu have both been identified as *F. heteropoda* Miquel. The species came originally from the Moluccas in 1940. The twigs are hollow when young. The leaves are opposite, broad, with dentate margins. The figs, borne in clusters from tubercles, are 1.1 cm in diameter, with a slender neck re-

sembling a peduncle. Seeds labeled *F. heteropoda* were recently received from Dr. A. J. Koestermans, Bogor, Indonesia, but no seedlings were secured. (See figure 3, chapter II.)

Ficus hookeri was described by Miquel (544), apparently in honor of the collector, "Hooker fil. et Thompson (*Ficus* n. 210)." It was described later by G. King (437, with illustration; 438) and D. Brandis (103). Brief accounts were given by L. H. and Ethel Z. Bailey (45), Nehrling (575), Riedel (641), and Corner (199b, as *F. hookeriana*). Various introductions of this species have been made by seeds, all from Bengal Province, India. PI Nos. 47,685 (1919), 49,635 (1920), 68,336 (1926), 80,082 (1929), and 86,674 (1930) have all been assigned to it. Inventory No. 62 gave the following for No. 49,635: "An entirely glabrous tree, with thinly coriaceous, oval leaves up to 11 inches [28 cm] in length, and axillary, depressed, obovate fruits growing in pairs, up to an inch [2.5 cm] in diameter when ripe. This fig is not common; it ascends to 6,000 feet [1,834 m] in the Sikkim Himalayas and Khasa Hills, India." (Adapted from King.) Plants of PI No. 80,082, received in California in 1931 and again in 1933, thrived in the UCLA Botanical Garden, reaching a height of 1.5 m by 1935. In 1949, fruiting trees of PI No. 68,336 were studied at the Atkins Garden, Cuba, and at Miami (PIS). None were found at the latter station in 1958. Some discrepancies were noted after comparison of cultivated material with descriptions of native plants in India. In fact, they were so similar to plants of *F. mysorensis* Heyne var. *subrepanda* that the two were regarded to be identical. Mary Barrett (68) arrived at the same conclusion after studying the two in Florida. Therefore, it appears that the seed introductions from India as *F. hookeri* did not properly represent the glabrous species described from that country, or they can be regarded as synonymous with the relatively nonpubescent species *F. mysorensis* var. *subrepanda*. (See the account of *F. mysorensis*, No. 72, with other PI numbers.)

Ficus imperialis has not been found listed in *Index Kewensis*. According to Riedel (641), plants under this specific name were offered in European catalogues in 1911.

Ficus ingens Miquel, No. 1,771 of Schimper's collection of herbarium specimens from Ethiopia was named *F. schimperiana* by Hochstetter (377). Miquel (539) cited the latter name for his species *Urostigma ingens*, later changed by him (544) to *F. ingens*. Mildbraed and Burret (535) referred *F. schimperiana* Hochstetter to *F. lutea*. Burt-Davy (131) described *F. ingens* as a deciduous shrub or tree, up to 9 m high in the Transvaal, the spring foliage assuming brilliant colors like those of the *Brachystegia* forests of south-central Africa. (Leguminosae, allied to *Cassia* and *Caesalpinia*.) Burt-Davy gave as synonyms *F. caffra* Miquel and *F. lutea* Auth., but not of Vahl. (See under *F. lutea* later in this chapter.) Other accounts as *F. ingens*, with illustrations, were given by Aubréville (29), Eggeling (251), Lebrun and Boutique (462), Codd (165), F. White (823), and in the *Annual of the Tree Society of South Africa*, 1964; without illustrations, by Hutchinson (407, 408), Hutchinson and Dalziel (410), Broun and Massey (110), Lebrun (460), Sima Eliovson (255), Irvine (412), Dale and Greenway (218), and Palmer and Pitman (581b). (See the account of *F. cordata* in this chapter for a comparative note; also, *F. virens*, species No. 24.) Seeds obtained from Pretoria in 1928 produced plants which eventually bore fruit at both Los Angeles and San Marino, California. They were found to be susceptible to nematode infestation which caused root knot, and to a virus which resulted in leaf mosaic. The branches of *F. ingens* are densely hairy, according to Burt-Davy (131); but glabrous or puberulent, according to Lebrun and Boutique (462), with the leaves entire and up to 15 cm long. A tree growing at the Huntington Botanical Garden, San Marino, has the terminal buds short and densely villous, but the twigs and leaves glabrous, the latter oblong, with the apex obtuse and

the base rounded or shallowly subcordate, and veins 8 to 10 pairs. The figs are borne in the leaf axils. The species, if properly identified here, has no special characters to recommend it as an ornamental.

Ficus irisana Elmer. Seeds of this species were received from the Philippines in 1963, and seedlings are being grown at Riverside. The plants do not conform with descriptions of *F. irisana* by Elmer (256), and may be classified as *F. cumingii* Miquel (our species No. 10), which has leaves alternate or opposite on the same plant. Corner (199b) classified *F. irisana* and its synonyms in the section *Sycidium*.

Ficus sp. "kalapat." Kalapat is not a specific botanical name, but a local one applied to at least two figs native to the Philippines, according to Merrill (524). Seeds collected by P. J. Wester were introduced into the United States in 1918 under PI No. 46,736. Inventory No. 57 stated that the Kalapat grows as a small tree which is used for live fence posts in Mindanao. "The fruits, which are bright red and of about the size of small cherries, are produced in great profusion in the axils of the leaves, and remain on the tree a long time, making this a very handsome ornamental." Nehrling (575) expressed the opinion: "Undoubtedly, this is a most desirable plant for our gardens." At this time, it has no specific name.

Ficus kalliocarpa Miquel (544, with illustration) was introduced from Sumatra in 1926 under PI No. 67,559, with the following notation: "A climbing fig which covered a tall forest tree with its growth, as does *Ficus repens*. It bears orange fruits one and one-half inches [4 cm] in diameter which are mottled with lighter yellow. From a distance, this is a striking species, and is quite a splendid covering for stone fences." Nehrling (574) apparently had it growing at Naples, Florida, for he called it Dorsett's Climbing Fig, with "leaves long, rather narrow, deep green, and leathery."

Ficus kawuri, indigenous to northern Nigeria and the Cameroons, was described by Hutchinson (406), Holland (382), Lely (463, with illustration), and Hutchin-

son and Dalziel (410). According to Lely, the trees grow to vast dimensions, forming a sunproof shade with their dense crowns. Holland stated that the trees yield a white latex which is collected for processing as rubber.

Ficus kerkhovenii Koorders and Valetton. According to Setyodiwiryo (689), this species is being grown at Bogor. See Corner (199b).

Ficus kingiana Hemsley was reported by Sata (670, with illustration) to be frequently cultivated in both private and public gardens of Taiwan. He added that the leaves are slender, the branches pendulous, and the small receptacles orange-red when mature. See also, Forbes and Hemsley (290) and Li (470). Rehder (627) listed *F. kingiana* Léveillé from eastern Asia. According to Corner (199b), *F. kingiana* Hemsley is synonymous with *F. ampelas* (our species No. 95), while *F. kingiana* Léveillé equals *F. glaberrima* Blume, treated earlier in this chapter. The original description by Hemsley (365) included an illustration of the leaves and fruits.

Ficus kirkii Hutchinson was growing in the Migombani Gardens, Zanzibar, according to R. O. Williams (838). The tree was said to be much branched, 6 m high, with thick, leathery leaves 17 cm long, intensely veiny beneath, and the axillary fruits large and warty. According to Dale and Greenway (218), the tree is found up to 760 m elevation in Kenya; the figs are solitary.

Ficus korthalsii, indigenous to Borneo, was described by Miquel (544) with the notation that it was similar to *F. elastica* in leaf. G. King (437) published a good description and illustration of it, as well as of the variety *beccariana*. He reported that the description by Miquel was based on a single specimen in the herbarium at Leiden. King further believed the affinity of the species to be closer to *F. indica* than to *F. elastica* [presumably referring to *F. sundaica*; *F. indica* has more than one synonym]. Setyodiwiryo (689) stated that it is cultivated at Bogor. Corner (196, 199b) classified *F. korthalsii*

Miquel under *F. sundaica* Blume var. *beccariana* King. See *F. sundaica*, species No. 31. PI Nos. 68,857 and 94,296 represent introductions of seeds of this fig from Borneo in 1926 and Java in 1931, with this citation: "The leaves are rigid and leathery, up to 20 cm long, and the ellipsoid fruits are nearly 2.5 cm in length." Apparently, no seedlings were obtained.

Ficus kurzii was described and illustrated by G. King (437), with *F. nuda* Miquel var. *macrocarpa* Kurz as a synonym. The latter was described from two specimens collected in the Philippines, and was regarded by King as identical with *F. benjamina* (our species No. 34, which see). See Forbes and Hemsley (290) for localities. D. Brandis (103) stated that this species is similar to *F. rhododendrifolia* Miquel, which Corner (199b) classified as a variety of *F. maclellandi* King. According to Bruggeman (118), *F. kurzii* is confused with *F. benjamina*, but "distinguished by having aerial roots on the branches and by its short-stalked receptacles." He noted it as "a splendid tree for large squares." Seeds of *F. kurzii* were introduced from Lucknow, India, in 1930 under PI No. 88,326, with the following note: "A tree, with thinly coriaceous, ovate-elliptic leaves 4 inches [10 cm] long, and globose, dark-purple fruits half an inch [1.3 cm] in diameter." No trees have been found growing in collections.

Ficus laccifera was listed by F. M. Bailey (37) as growing in the Brisbane Botanic Garden. Two species of *Ficus* bear this name. According to Corner (199b), *F. laccifera* Roxburgh equals *F. altissima* Blume (our species No. 89), while *F. laccifera* Blanco equals *F. septica* Burman (f.) (our species No. 12). See the accounts by Kurz (455), Merrill (516), Maximowicz (507), and Parsa (589). PI No. 98,396 represents an introduction of Roxburgh's species as cuttings from Egypt in 1932, with this note: "A tropical tree, with oval or cordate, shining-green leaves up to 7 inches [18 cm] long and smooth, oval fruits the size of a gooseberry. Native of Silhet, India." Apparently, the cuttings failed to take root.

Ficus leopoldi Van Houtte ex Miquel (544) was listed by E. J. Lowe (479) as one of the "beautiful-leaved plants" being grown in England when he carried on this interesting study a century ago.

Ficus lepicarpa of Java and Sumatra was named by Blume (92), and was described and illustrated by G. King (437) and Oehse (580). It is a small tree, without buttresses. The leaves, entire and up to 25 cm long, are often subopposite, sometimes inequilateral at the base, and obovate-oblong. The sessile, axillary receptacles are coarsely pubescent and white-warty on the surface. See the classification by Corner (199b), naming four varieties.

Ficus leucotricha Miquel owes its specific name to the spreading, white hairs on the branches and petioles. It was described by Bentham and Mueller (77) and by F. M. Bailey (42, 43; the latter with illustration), from Queensland. According to Riedel (641), trees of this species were offered in European catalogues in 1911. Corner (199b) gave a key for the identification of three varieties.

Ficus luciana Hort. According to *Index Londinensis*, *F. luciana* of Emile Rodigas was illustrated in "Semaine Hort., 1900, page 449." N. Taylor (750) stated that *F. "lucianii"* Hort., with large leaves, was introduced in 1900 but was otherwise unknown.

Ficus lucida Dryand, the Shining-leaved Fig of the East Indies, was described by Dryand (Jonas Carlsson Dryander) in Aiton's *Hortus Kewensis* (5). It was introduced into England in 1772 by William Malcolm, and was listed by Steele (730). P. Miller (536) copied the original description as "leaves ovate, cordate, quite entire, smooth, blunt, three-nerved at the base, branches upright." It was included in the list of "beautiful-leaved plants" by E. J. Lowe (479). N. Taylor (750) stated that it was advertised in 1893 for indoor culture. A tree grown in 1949 at the Atkins Garden, Cuba, as *F. lucida* was apparently mislabeled. PI No. 155, 215, likewise labeled *F. lucida*, came from Cuba in 1946.

Ficus luschnathiana Miquel. According to Hoehne *et al.* (378), this species was being grown in the Botanic Garden [Jardim Botânico] at São Paulo, Brazil, where trees were common and in fruit practically throughout the year.

Ficus lutea Vahl. According to Burtt-Davy (131), *F. lutea* Auth. is a synonym of *F. ingens* Miquel, but the *F. lutea* of Vahl (773) is a distinct African species. Accounts of *F. lutea* were given by Miquel (539), Steedman (729), and Schwarz (682). Miss L. S. Gibbs (318) stated that *F. lutea* Vahl becomes a large tree, and that its roots flatten over rocks to a breadth of over a meter. Scions were introduced from France in 1932 under PI No. 101, 321, but failed to establish the species in the United States. See *F. ingens* earlier in this chapter.

Ficus maculata Linné was reported by P. Miller (536) to have "leaves oblong, acuminate, serrate." N. Taylor (750) questioned the identity of the plant that was catalogued by Franceschi, and stated: "The true *maculata* is a serrate-leaved fig from Santo Domingo" [not from Cochín China]. Riedel (641) reported that it was listed by Franceschi in 1909.

Ficus magnolioides Borzi (97). During the course of his travels in Spain and Portugal, Dr. F. G. Meyer (533) visited the Jardim Botânico at Coimbra. There he found a tree of *F. magnolioides* that was 18 m high and broad, the largest (though not the tallest) tree in the garden. In a letter dated September 15, 1961, Dr. Meyer stated that trees of this species make the largest specimens of any fig that is hardy in the Mediterranean region. Large trees growing in Sicily, on the French Riviera, and in Portugal resemble those of the Moreton Bay Fig, *F. macrophylla* Desfontaines ex Persoon, to which Corner (199b) assigned the species of Borzi. (See *F. macrophylla*, species No. 28.)

Ficus manilensis, described by Warburg (800) from specimens collected in the vicinity of Manila, P.I., may properly be called the Manila Fig. It has received very little attention botanically, except for

accounts by Elmer (258, 259, 263). In one of his 1906 accounts, he referred to it as *F. rudis* Miquel var. *arborea*. In 1939 and again in 1948, plants were received at Riverside from L. W. Bryan, Hilo, Hawaii, but they failed to survive the customary fumigation treatment. Records of the Hawaiian Sugar Planters' Association show that this species was introduced from the Philippines by F. X. Williams in 1921 under HSPA Nos. 1,716 and 1,814. The specific name, however, does not appear on the list of fig trees now being grown in the Lyon Arboretum, Honolulu, and trees once grown at Hilo have been lost. According to Elmer, it belongs to the section *Axillares* (A: *Glabratae*), having axillary figs and glabrous foliage. It grows in wet, stony ground, or in ravines, as an erect or shrublike tree up to 6 m high, with subchartaceous leaves crowded near the tips of the twigs. The figs, clustered on short excrescences along the branchlets and below the foliage, are 1.1 cm in diameter, on slender peduncles, and yellowish green when ripe. Merrill (524) stated that *F. manilensis* is endemic to the Philippines, unless it is referable to the closely allied *F. rudis* Miquel of Celebes. Corner (199b) classified it as a synonym of *F. gul* Laut.

Ficus melinocarpa Blume is being grown at Bogor, according to Setyodiwiryo (689). See Corner (199b) for synonyms and varieties.

Ficus membranacea. (Plate XIII, D1-2.) This species, described by Warburg (803), is a tree or shrub native to Cuba. In 1949, Dr. Julian C. Crane, of the University of California at Davis, obtained seeds from Havana, and in the same year I collected botanical specimens as well as seeds from a tree in the natural forest at the Atkins Garden, Cienfuegos. Seedlings grown from both these introductions have since been lost. Those growing at Riverside failed to survive a low temperature of 24° F. PI No. 155,216, labeled *F. membranacea*, came from Cuba in 1946. At Cienfuegos, the large trees had some aerial roots, densely pubescent terminal buds, glabrous leaves up to 20 cm

long, and sessile figs in small clusters close to the tips of the twigs. The individual figs are spherical or slightly oblate, 1.1 cm in diameter, finely pubescent, with prominent bracts sheathing almost the entire basal half of the body. See the account by Acuña and Roig (3). See also, the key in the account of *F. trigonata*, species No. 85.

Ficus microphylla Hort. A species long grown, and still offered for sale by some California nurseries as *F. microphylla*, is properly identified as a form of *F. rubiginosa* (our species No. 59). The species *F. microphylla* Desfontaines, reported by Sebire (685) to have young leaves good for cattle fodder, is apparently not in cultivation. *Ficus microphylla* was described by L. H. and Ethel Z. Bailey (45) as a Brazilian species. Mathias and McClintock (504) listed *F. microphylla* Salzmann as "Little-leaf fig" and "Little-leaf rubber tree."

Ficus mindoroensis was described by Merrill (517) as a Philippine species, "evidently related to *F. conora* King, but very distinct." HSPA No. 1,881 represented an introduction into Hawaii of this species in 1922, with the following notation by F. X. Williams: "A small, independent tree, like *F. nota*." Two plants sent from Hilo to Riverside in 1939 survived fumigation treatment, but were grown first in pots and later in a nursery row, where they suffered severe damage at about 26° F. and were discarded. A specimen now growing at Arcadia (LASCA) seems to be properly identified as *F. nota* Merrill. Corner (199b) classified *F. mindoroensis* as a variety of *F. botryocarpa* Miquel, which see in this chapter. See also, *F. conora* King in the present chapter, as well as *F. nota* (species No. 93).

Ficus muelleri Miquel. In his account of *F. henneana* Miquel, Anderson (10) stated that it is closely allied to, and perhaps inseparable from, *F. muelleri*, which is commonly found in the Illawarra district of New South Wales and northward. *Ficus muelleri*, first described by Miquel (539) under *Urostigma*, was later placed

by him (544) in *Ficus* proper. It was illustrated by F. M. Bailey (43), and later was described as well as figured by Bailey (44). According to Riedel (641), this species was offered for sale in nursery catalogues of 1908. Corner (199b) treated it under *F. platypoda*, which is dealt with under *F. obliqua* (species No. 39), and noted under *F. puberula* in the present chapter, in which see also, *F. gracilipes*. For comment on *F. henneana*, see *F. superba* (species No. 44).

Ficus murrayana Hort. was given in the *Kew Index* as a synonym of *F. princeps*, described by Kunth and Bouché (452-453) and Miquel (543). An introduction of plants labeled *F. murrayana* was made by Dr. F. G. Meyer, who wrote in 1961 that the material introduced from Italy in 1957, labeled "*F. murrayana*," as PI No. 240,619, was not *F. princeps*. That species has entire leaves, while the introduced plant has leaves with crenate margins. Nonfruiting plants at Arcadia (LASCA) have green, glabrous twigs, leaves equilateral, 15 by 7.5 cm, coarsely crenate, the base rounded to shallowly subcordate and the apex acuminate, the surface glabrous, and 5 or 6 lateral veins. The identity of these plants will have to be determined later, if and when they bear fruit. (See the brief account of *F. princeps* later in the present chapter.)

Ficus nemoralis. (Plate IX, E1-3.) This Himalayan species was described by Wallich (795). Other descriptions were given by G. King (437, with illustration), D. Brandis (103), N. Taylor (750), Bamber (53), H. Collett (167), and Osaston (581). According to King, this species is a variable one, as may be expected from its wide distribution. He described and illustrated four varieties, and stated that it forms a connecting link between the subgenera *Eusyce* and *Urostigma* because of the arrangement of the flowers all in one receptacle. Brandis stated that it is a small, glabrous tree, often planted near villages for cattle fodder. Corner (196, 199b) classified it as a variety of *F. neriiifolia*, described by J. E. Smith (707). (See comment under

F. celebensis Corner, species No. 22.) Riedel's catalogue of 1911 offered this "very graceful Indian tree at \$1.00 for 3- to 4-foot specimens." [About 90 to 120 cm.] Riedel (641) also reported it as being listed by Franceschi in 1901, and that trees were once planted on Eucalyptus Hill in Santa Barbara, California. PI No. 47,686 is listed as *F. nemoralis* from India in 1919. Seeds offered for sale by a California nursery firm in 1961 were obtained, and planted at Riverside. One lot of these seeds was assigned PI No. 274,238. The young plants show twigs green, glabrous, with green or pinkish buds, and stipules 2.5 cm long, lanceolate, and tardily deciduous. The alternate, equilateral, elliptical leaves are up to 22.5 cm long and 7.5 cm broad, with the apex gradually acuminate and the base rounded or shallowly subcordate, the margins entire and sometimes undulate, the texture chartaceous, and the surface glabrous. The veins are well elevated below, with 1 basal pair and 8 to 10 laterals. Tiny hydathodes are well scattered over the upper surface. The trees in a hillside nursery row at Riverside suffered only slight injury from frost at a temperature of 26° F.

Ficus neobritannica is being grown in the greenhouse of the Cambridge University Botanic Garden. It was described and illustrated by Corner (197a) in 1961.

Ficus nervosa Heyne ex Roth (655). The taxonomy of this species has been treated by Corner (199b), with synonyms, one of which is *F. angustifolia* Roxburgh. It was also treated by G. King (437, with illustration), D. Brandis (103), Benthham (76), Kurz (455), Miquel (539), J. D. Hooker (388), Li (470), Worthington (849, with illustration), and Wight (826, under *F. angustifolia*, with illustration). F. X. Williams (836) described it as "a monoecious, independent tree" like that of *F. malunuensis* (our species No. 87). *Ficus nervosa* is widely distributed in tropical forests, from southern India to the Malay Archipelago, growing as a large, evergreen tree without aerial roots, the leaves and branches mostly glabrous, but the receptacles puber-

ulent, from 0.7 to nearly 2.5 cm in diameter. Parsons (590) listed it as growing at Peradeniya, and Setyodiwiryo (689) as cultivated at Bogor. Seeds received in 1964, from both Hong Kong and the Philippines, failed to germinate. Note that *F. angustifolia* Blume (not Roxburgh) is treated earlier in this chapter. (See also, under *F. glaberrima*.)

Ficus neumannii Celsius. The habitat of this species is in question, although Kunth and Bouché (452-453) gave an account of it. Chittenden (152, per Potter) described the tree as glabrous, with nearly straight branches, and with oblong, entire leaves 1.1 cm long, acute at the apex and rounded or cordate at the base. It was grown as a hothouse plant. Setyodiwiryo (689) recorded it as cultivated at Bogor.

Ficus oblongata, according to the *Key Index*, was described by J. H. F. Link (Enum. Hort. Berol. 2:449. Africa Austr.). It was illustrated and briefly described by Graf (324) as a large, evergreen tree with leaves 25 cm long, wavy along the margins. The photograph was taken at the nursery of Louis van Houtte, Ghent, Belgium.

Ficus obtusa Hasskarl. According to Setyodiwiryo (689), this species is being grown at Bogor. Corner (199b) treated it as a variety of *F. trichocarpa* Blume.

Ficus oleracea Corner (196) is being grown in the greenhouse of the Cambridge University Botanic Garden.

Ficus palmeri was described by S. Watson (811) from specimens collected by Dr. Edward Palmer in 1887 on San Pedro Mártir Island in the Gulf of California, a small island which is not located on many maps; it lies between Guaymas and Hermosillo, south of Tiburón Island. According to Standley (718), it was this species which was described by Clavigero (159), who stated that its figs are smaller and less juicy than those of the common cultivated kind. He said: "Nevertheless, the Californians esteem it so highly that when they hear of an "Anaba" with ripe fruit, they go to hunt for it and gather a supply of the fruit, even though it may be

four or five leagues distant." Brandegec (101) found *F. palmeri* growing in Baja California Sur, from San Ignacio south to Cape San Lucas, especially among rocks and upon the faces of cliffs, and added: "The small figs are edible, but I think that no one eats many, and certainly would not eat any without a good appetite." Loye Miller (535a) gave an interesting description of the trees near Cape San Lucas: "I was fascinated by the wild fig trees. These trees were spreading, green-leaved, and white-barked. And what a peculiar habit of root system they had! They seemed to prefer to start on top of a great rock pile, whence they would have to reach long roots out and down to reach the ground. How one ever lived long enough on the bare rock to produce those long, cablelike roots before it could get enough soil food to produce roots that would reach far enough to get food to grow roots! Well, I'm still wondering. But the ultimate effect was extremely picturesque." Other accounts were given by Vasey and Rose (776), Goldman (321), Standley (717), Nelson (577), Karsten and Schenck (433, with illustration), and Wiggins (825). Dr. Gustav Eisen (253) found insects emerging from the receptacles in March and again in September in Baja California. These may have been the insects which Ashmead (26) classified as *Eiseniella mexicana*. The Palmer Fig belongs to the subgenus *Urostigma*. Standley (718) reported that it is a variable species in several respects, but especially in leaf form and pubescence. Jacobsen (415) included and pictured it in his account of succulent plants, though it can hardly be regarded as any more succulent than some other species of *Ficus*, especially *F. deltoidea* Jack (species No. 45). Seeds of the Palmer Fig, collected in 1948 by Robert Peters near La Paz, Baja California Sur, at an elevation of 610 m, were donated to the University of California at Riverside. Planted at Arcadia (LASCA), the seedlings grew very slowly, suffered from frost, and were discarded. The trees grow naturally in the clefts of rocks, and are very drought-

resistant. Small specimens show the following characters: Terminal buds up to 3.6 cm long, glabrous, and green; twigs sparsely pubescent; leaves alternate, equilateral, 17 cm long and 13.5 cm broad, with acute apex and cordate base; venation prominent, with 7 pairs of laterals; surface glabrous above and almost so below, but with a few scattered hairs on the basal veins; margins entire, slightly revolute; petioles 5 m long, sparsely pubescent. The figs are reported to be globose, geminate on stout peduncles, and 1.1 cm in diameter. PI No. 198,181 represented an introduction of seeds from Mexico in 1951. Still another lot of seeds, collected in 1966 by Ralph LaRue near La Paz, has produced several seedlings.

Ficus papuana Corner (197) is being grown in the greenhouse at the Cambridge University Botanic Garden.

Ficus paracamptophylla Cor. (196) is also being grown at Cambridge.

Ficus parietalis, first described by Blume (92), was treated later by Miquel (544). W. J. Hooker (391) described it, with a colored illustration, as *F. acuminata*, the Sharp-pointed Fig, because of the acuminate apex of the leaves, and said that it was cultivated in the Glasgow Botanical Garden. (See the account of *F. acuminata* earlier in the present chapter for further details, in addition to those presented here.) G. King (437) described it in detail, with outline drawings of leaves and fruits, and placed it in the subgenus *Paleomorpha*, as did Ridley (639). King stated that a plant like the one figured by Hooker under No. 3,282 as *F. acuminata* and *F. cerasiformis* could still be seen in cultivation under the latter name at the Utrecht Botanic Garden. See also, G. King (438). Marie Neal (572) gave a short account of *F. parietalis* growing in Honolulu, and gave it the common name Small Indian Fig. A tree which had grown for over thirty-five years at the Governor's residence on Washington Place in Honolulu had to be removed, and apparently no plants were propagated from it. Graf (324) gave a brief illustrated account of a plant grown at the Ghent

Botanical Garden. Various introductions of this species have been made. In 1928, cuttings, and in 1930, a rooted plant, both labeled *F. parietalis*, were received at Riverside from the New York Botanical Garden, but all of the cuttings failed. Seeds were introduced from Sumatra in 1926 under PI Nos. 67,561 and 67,702, and scions came from France in 1932 under No. 101,325. There are no records showing that any plants are now growing in the United States; however, Dr. Corner writes that some are being grown in the greenhouse at Cambridge University Botanic Garden. The description of *F. parietalis* under PI No. 67,561 as "a handsome climbing fig" was apparently in error, for other accounts gave it as an epiphytic shrub or a small to good-sized tree. Furthermore, the receptacles were variously described as being 1 to 2 cm in diameter, a size which would barely justify the common name Small Indian Fig. Two other introductions were made from Java in 1927 under PI Nos. 72,716 and 73,996, labeled *F. parietalis*. King described it as a shrub or small tree, always recognizable by its strongly transverse-veined leaves and hispid-tomentose receptacles, which are axillary, pedunculate, globose or ovoid, yellow or orange, and 1 cm in diameter. Chittenden (152, per Potter) listed it as a "stove plant," with large, leathery leaves and bright-orange fruits. Setyodiwiryo (689) included it among the species growing at Bogor. See also, J. G. Watson (810) for Malayan names, and Corner (199b) for synonyms.

Ficus petersii, described by Warburg (797) and named in honor of Wilhelm Peters of Berlin, is an African species, growing as a strangler and often becoming a forest weed. Codd (165) described and pictured it, giving the leaves as quite smooth, a character which distinguishes this species from the other common strangling fig, *F. stuhlmannii* (species No. 69). Other accounts were given by Mildbraed and Burret (535), Hutchinson (407, 408), Burt-Davy (131), Henkel (366), and F. White (823). Seeds received at Riverside from Pretoria in 1947 under PI

No. 161,329 failed to germinate. (See the key under *F. burkei*, species No. 80, together with further comment.)

Ficus philippinensis was described by Miquel (539) as a new species from the Philippines. Its identity and synonymy have been clarified by Corner (196, 199b), who classified it as *F. virgata* Reinwardt ex Blume var. *philippinensis* (Miquel) Corner. See related comment near the end of the account of *F. benjamina* (species No. 34). *Ficus decaisneana*, described as a new species by Miquel (542), was also given by Corner (199b) as a synonym of *F. virgata*. Merrill (520) treated *F. philippinensis* as follows: "A species described from the Philippines, but which, rightly or wrongly, has been reduced to the Malayan *F. decaisnei* Steudel. The same species has more recently been described as *F. confusa* by Mr. Elmer. The Guam specimens are sterile, but agree very closely with our Philippine material." However, *F. confusa*, described by Elmer (256, 257) as a new species, was classified by Corner (199b) under *F. subulata* Blume, which see in the present chapter. Sata (670) distinguished three forms of *F. philippinensis*: *obovata* Sata, *magnifica* Elmer, and *setibracteata* Elmer. Summerhayes (743) described specimens from Papua and New Guinea. PI No. 78,576, introduced from Guam in 1929 as seeds, was described in Inventory No. 98 as "*Ficus philippinensis* Miquel: A climbing, woody, epiphytic, strangling fig, native to the Philippine Islands, which sends down aerial roots and eventually kills the host plant. It has triangular branches; oval-oblong, leathery, long-pointed leaves; and axillary fruits." Plants more recently found in commercial nurseries and reported by Mary Barrett (68) are identified as *F. benjamina* var. *philippinensis*, for which see again the account of species No. 34. Seeds labeled *F. philippinensis* Bonard ex Hering were received at Riverside from Prof. Juan V. Pancho, Laguna, P.I. The seedlings show a bushy habit of growth, with leaves opposite or alternate and coarsely serrate, and very small, axillary

fruits. These characters point to their identification as *F. cumingii* (species No. 10), which see.

Ficus pinkiana F.v.M. According to F. M. Bailey (37), *F. pinkiana* was growing in the Brisbane Botanic Garden under the common name W. Hill's Giant Fig. It was listed and illustrated (but not described) by F. M. Bailey (43). Corner (199b) treated it as a synonym of *F. virgata* Reinwardt ex Blume, in common with *F. philippinensis*, which see just preceding this note.

Ficus pleurocarpa F.v.M. was also grown at the Brisbane Botanic Garden, where it was commonly known as the Ribbed Fig of Johnstone River. See F. M. Bailey (37, 43), the latter with an illustration and the notation: "The fruit is prominently ribbed in a dry but not in a fresh state."

Ficus polita was described by Vahl (773) from specimens collected in Guinea. Other accounts were given by Hutchinson (407, 408), Hutchinson and Dalziel (410), Holland (382), Lebrun (460), Aubréville (29, with illustration), Eggeling (251), F. W. Andrews (14), Irvine (412), and Schnell (677b). Aubréville (30) gave the synonymy as follows: *F. syringifolia*, *F. niamniamensis*, *F. syringoides*, and *F. stenosphon*; all described by Warburg. It is widely distributed in tropical Africa, and is regarded as one of the best shade trees. Vahl described the plant as glabrous throughout, but Hutchinson reported the branchlets as being minutely puberulent when young. The purplish receptacles are numerous, borne on thick, woody stems from the old wood, and are at least 3.6 cm in diameter. Irvine reported them to be edible. A new species of mite, *Amblyseius sundi*, was described by Pritchard and Baker (612) from *F. polita* in central Africa.

Ficus polycarpa was described by Roxburgh (658), who stated that it was brought to the Calcutta Botanic Garden in 1798 from the Moluccas. According to Corner (199b), it is synonymous with *F. copiosa* Steudel, which see earlier in the present chapter.

Ficus populifolia, the Poplarleaf Fig, described and pictured by Vahl (772), is widely distributed, from the northern part of tropical Africa to the Red Sea coast and into Arabia. P. Miller (536) gave a brief account of it under his No. 40. Others were given by Desfontaines (227), Schweinfurth (683), Engler and Drude (267, with illustration), Hutchinson (407), Hutchinson and Dalziel (410), Blatter (89), Holland (382), Schwarz (682), Aubréville (30), and F. W. Andrews (14, with illustration). R. O. Williams (838) recorded it from Prison Island, Zanzibar, as possibly being under cultivation. No other records have been found of this species being grown as an exotic. The trees reach 18 m in height, with pendulous branchlets and smooth bark. The leaves are broadly ovate, long-acuminate at the apex and widely cordate at the base, up to 15 cm long and 10 cm broad, on slender petioles. The receptacles are axillary, geminate, globose, 0.8 cm in diameter, and glabrous or puberulent, on peduncles up to 2 cm long. It would seem that this species is worthy of introduction for trial, in comparison with *F. kerstingii* and *F. religiosa* (species Nos. 19 and 20). See also, the account of *F. vasta* in the present chapter and that of *F. salicifolia* (species No. 77).

Ficus portuana Regel was described in Chittenden (152, per Potter) as a small tree or shrub, with glabrous, oblong leaves up to 20 cm long, with two lateral lobes. Standley (717) stated that the *Index Kewensis* gave its distribution as "Mexico." However, the original illustrated description by Regel (625) stated that it was brought from the Philippines in 1861 by "Herr Oorte" as a decorative plant. On the other hand, Prof. Juan V. Pancho, Laguna, P.I., wrote, dated November 2, 1960: "I believe that this species has not been reported from the Philippines." Corner (199b) classified Regel's species under *F. callosa* Willdenow (species No. 88), which occurs in the Asian area.

Ficus praestans Corner (197) is being grown in the greenhouse of the Cambridge University Botanic Garden.

Ficus preussii, described by Warburg (797) as a species from Cameroun in Africa, was introduced from the Netherlands in 1959 by Dr. F. G. Meyer under PI No. 262,356. Plants were received at Riverside in 1961 from the Longwood Gardens near Philadelphia. The terminal buds are purplish brown, 2 cm long, with brown, more or less persistent, stipules. The leaves are oblanceolate, up to 25 cm long and 7.5 cm broad, with the apex broadly acuminate, the base rounded or acute, and the surface glabrous and dull. The veins are well elevated below, with 2 pairs basal and 6 laterals widely spaced. See Lebrun (460).

Ficus princeps Kunth and Bouché (452-453). The identity of cultivated plants labeled *F. princeps* is in doubt. According to Riedel (641), a fig under this name was listed by Dr. C. F. Franceschi at Santa Barbara in 1900. Riedel's 1911 catalogue reported it as a Brazilian tree with splendidly veined leaves. N. Taylor (750) referred to the statement by Franceschi that the tree grows 18 m high, having magnificent foliage that is bronze and copper-colored when young. L. H. and E. Z. Bailey (45) seem to have followed the original description by Kunth and Bouché. Miquel (543) also gave an account of it. See *F. murrayana* Hort. earlier in the present chapter.

Ficus procera was described by Reinwardt ex Blume (92) from specimens collected in Java. PI No. 3,456, obtained from Sicily in 1899, was listed as *F. procera*. The variety *crassiramea* was introduced from Java in 1931 under PI No. 94,297, with the following notation: "A large tree, with coriaceous, narrowly elliptic to ovate leaves having thickened and slightly recurved edges. The sessile, globular fruits, one-half inch [1.3 cm] in diameter, are subtended by three fleshy bracts as long as the fruit." Both species and variety were described and pictured by G. King (437) and by Koorders and Valetton (446). However, Corner (199b) classified it as *F. procera* Blume var. *crassiramea* (Miquel) King, under *F. crassiramea* Miquel. According to Setyodiwiryo

(689), trees are found at Bogor. Grandi (336) named *Waterstoniella jacobsoni* as an inhabitant of figs of the variety in Java and Borneo. Fertile seeds received at Riverside in 1931 produced plants of the variety, but those distributed for trial failed to survive cold winters. The typical species has not been reintroduced for trial, and the variety has no special merit to recommend it for ornamental planting purposes.

Ficus prolixa, described by Forster (f.) (294) from the Society Islands, is one of several species which have been introduced into the United States, apparently without becoming established. It was also described by P. Miller (536) under his No. 31. See the account by Guillaumin (347) and the list by Yuncker (852). According to Riedel (641), a species under this name was offered by the Franceschi Nursery at Santa Barbara in 1909. An introduction of scions was made from France in 1932 under PI No. 101,327, with this notation: "A tropical tree, with oblong-lanceolate, acuminate leaves, punctulate beneath, and fruits borne in pairs." S. Parkinson (587) and Uphoff (769) discussed the use of the bark for making tapa cloth in Tahiti. (See under "Economic Utility" in chapter IV for related information.) Merrill (530) referred to the species as *F. prolixa* (Solander ex), and stated: "Forster certainly knew of Solander's use of the specific name, yet his very short diagnosis is followed by 'F.'" Cheeseman (148) called *F. prolixa* "the banyan of the European settlers," adding that trees were not common, but were scattered irregularly over the lower parts of Rarotonga. Wilder (829, 831) also regarded the tree as a banyan, stating that specimens sometimes covered half an acre [0.20 hectare] of ground. In the latter publication, he found that the species comprised a large part of the native silva of Makatea Island, where it is considered by the natives as sacred, and is commonly cultivated near dwellings. According to Summerhayes (742), this species forms huge trees of the banyan type, with abundant aerial roots,

glabrous leaves with the base somewhat rounded, and sessile or subsessile receptacles. Corner (195) stated: "*Ficus prolixa* is the Polynesian banyan, not found in any part of Malaysia, or the Solomon Islands or Australia." Later (199b), he listed it, with synonyms and two varieties, *prolixa* and *subcordata* Corner. See comment under *F. mariannensis* (species No. 36) and *F. obliqua* (species No. 39). This species is probably too tender for culture except in frost-free climates. Its eventual large size would necessarily relegate it to large parks or estates.

Ficus proscendens Hort. was included by E. J. Lowe (479) in his account of "beautiful-leaved plants" of Great Britain. This specific name, however, is not found in the *Kew Index*.

Ficus pseudo-acamptophylla, described by Koorders and Valetton (445), was introduced from Java in 1931 under PI No. 94,298 as a large tree, with rufous-scurfy branchlets, obovate-oblong coriaceous leaves 7.5 to 15 cm long, and slightly flattened, globose fruits 0.7 cm in diameter. According to Setyodiwiryo (689), trees are growing at Bogor. Corner (199b) classified it under *F. sumatrana* Miquel.

Ficus puberula is an Australian species, described and pictured by Miquel (544) as *Urostigma puberulum*. According to Riedel (641), it was offered in Australian catalogues in 1908. Corner (196, 199b) classified it as *F. subpuberula* Corner, with the statement: "This little-known species may be a variety of *F. platypoda*." See *F. obliqua* (species No. 39) and *F. muelleri* (earlier in this chapter) for discussions on the somewhat complex synonymy involved.

Ficus pubinervis, first described by Blume (92) from Java, is another species being grown at Bogor, according to Setyodiwiryo (689). G. King (437) stated that it grows in Java at elevations up to 1,200 m, with the young parts more or less pubescent. Corner (199b) treated it, with synonyms and four varieties. See comment under *F. glaberrima* in the present chapter.

Ficus punctata Thunberg. The *Index Kewensis* gave three citations for *F. punctata*: One by Heyne as *infectoria*; another by Lamarck as *aggregata*; and a third by Thunberg as the one P. Miller (536) included under his No. 50. According to Chevalier (150), this species and *F. vogelii* Miquel (species No. 68) are domesticated in certain villages of Gabon, Africa, as a source of fiber for bark cloth. For more on this subject, see under "Economic Utility" in chapter IV. See also, an earlier account by Chevalier (149); also, J. G. Watson (810) for Malayan names. Corner (199b) classified *F. punctata* Thunberg, with four synonyms different from those given above, one being *F. jalcata*, treated earlier in the present chapter.

Ficus purpurascens (Blume) Corner is being grown at Bogor, according to Setyodiwiryo (689). Corner (199b) classified it as a variety of *F. montana* (species No. 7).

Ficus pyrifolia. Corner (199b) classified this species as follows: *F. pyrifolia* Burman (f.) is *Pyrus pyrifolia* Nakai; *F. pyrifolia* (Miquel) Boerl. equals *F. sundaica* [species No. 31]; and *F. pyrifolia* Salisbury (664) equals *F. benjamina* [species No. 34]. Identifications listed in the *Kew Index* may also be consulted. De Wolf (230) gave *F. pyrifolia* Desfontaines as a synonym of *F. citrifolia* P. Miller (species No. 57), which see. According to N. Taylor (750), plants of *F. pyrifolia* were once advertised by the Yokohama Nursery Company, which also offered *F. erecta* Thunberg (species No. 58). An introduction labeled *F. pyrifolia* came from Japan in 1917 under PI No. 44,576. Riedel (641) referred to a tree, possibly of this species, growing at the former Bard Estate, Hueneme, California. (See species Nos. 57 and 58, just mentioned.) See Perrier (596), as well as Salisbury (664) noted above.

Ficus pyrifolia Hooker. PI No. 101,329 represents an introduction of plants from France in 1932, with this notation: "A shrub, with pubescent branchlets, native to tropical India and China.

The linear-lanceolate to oblong-lanceolate leaves are 2 to 4 inches [5 to 10 cm] long, and the axillary, solitary, pear-shaped fruits are less than an inch [2.5 cm] long." Plants of this introduction, found at the Atkins Garden in Cuba in 1949, and grown in pots at Riverside, were cauliflorous, with the receptacles borne on tubercles from the trunk and not in the leaf axils, as pictured and described by G. King (437). This leads one to the conclusion that the specimens introduced under the aforesaid PI number were not properly identified, and that the *F. pyrifolia* of Hooker has not yet been grown in this country. It was included in the list by Sauer (671) of plants growing at Canton. See Miquel (539), with an illustration of *F. pyrifolia*; also, Corner (199b).

Ficus racemigera was described by Bureau (121) from New Caledonia. PI No. 101,331 represented an introduction of scions from France in 1932, with this citation: "A small tree, about 30 feet [9.5 m] high; the membranous, elliptic, entire leaves are 3 to 8 inches [7.5 to 20 cm] long; and the small, orange fruits are in long racemes." The fruits are edible, for Peters (600) stated that they are small but sweet, with the carotene content good, but with vitamins present in small amounts only. See Corner (199b) for synonyms.

Ficus recurva, described by Blume (92), was introduced from Java in 1931 under PI No. 94,299 with this notation: "Shrub, epiphytic or climbing over rocks; young shoots are villous; the elliptic to lanceolate, thinly coriaceous leaves are 3 to 4 inches [7.5 to 10 cm] long, and the small, orange-yellow figs are in pairs in the axils of leaves." G. King (437), who gave a list of references to earlier accounts, stated that the species is widely distributed and correspondingly variable in the Malay Peninsula and Archipelago up to 456 m elevation. He illustrated a typical fruit-bearing plant, and described two varieties, *ribesoides* and *urnigera*. Corner (199b) treated *F. urnigera* (Miquel) Corner as a distinct species, and gave a list of six varieties. See also, Mer-

rill (524). J. G. Watson (810) published a list of Malayan names. According to Foxworthy (297), the leaves of *F. recurva* are used as a remedy for colic. Elmer (261) reported this Javan species as also occurring in the Province of Palawan, Philippines, in fertile, humid forests up to 228 m altitude. Burkill (124) told of certain medicinal properties of the roots. Trees are found at Bogor, according to Setyodiwiryo (689).

***Ficus rostrata*.** This somewhat involved specific name is treated or noted in the present work under several headings: *F. radicans* (species No. 2), *F. hederacea* (species No. 3); and in this chapter, under *F. cuspidata*, *F. formosana*, and (indirectly) under *F. acuminata*. *Ficus rostrata* of Blanco was given by Merrill (517) as a species from the Philippines. Corner (199b) treated *F. rostrata* var. *radicans* Hort. under *F. sagittata* Vahl; *F. rostrata* Lamarek under *F. sinuata* Thunberg; and *F. rostrata* var. *urophylla* Wallich under *F. heteropleura* Blume. Three rooted cuttings labeled *F. rostrata* (PI No. 275,919) were received at Riverside in 1963 from the Longwood Gardens near Philadelphia, having originated in Belgium in 1961. These thrived, and produced fruit in 1964. Specimens were submitted to Dr. Corner, who identified them as *F. hederacea* Roxburgh (equals *F. scandens* Roxburgh of south China).

***Ficus rugosa*.** According to N. Taylor (750), *F. rugosa* is a trade name for some fig as yet undetermined. The true *F. rugosa* of Don (237) is perhaps a tropical African species, but was not specifically characterized by Don, and its status is uncertain. The *F. rugosa* described by Miquel (540) apparently refers to the account by Gasparrini (311) of a caprifig, *Caprificus rugosa*.

***Ficus saemocarpa*,** described by Miquel (544) from India, was introduced (also from India) in 1913 under PI No. 36,020, with this notation: "An evergreen shrub, with glossy, deep-green leaves. Considered to be of value as an ornamental." Seedlings were once grown by Nehrling

(574, 575) in Florida, but the species has not since been reported as being under cultivation. According to G. King (437), whose illustrated account was closely followed by D. Brandis (103), it is a low, spreading shrub, with the young branches and petioles densely but deciduously hirsute, leaves opposite and crowded, and receptacles solitary, pedunculate, or on short, leafless branches from the old wood, and 2.5 cm in diameter. King added: "It is found nowhere except in the beds of streams, and is in all likelihood a form of *hispida* modified with reference to such situations." Haines (352) stated that the shrubs of *F. saemocarpa* somewhat resemble *F. lanceolata* B. Ham., and may be more common in Bihar Province than is supposed. He separated it from *F. hispida* (our species No. 8) as follows:

Small tree. Branches hispid. Leaves ovate-oblong or obovate. . . . *F. hispida*
Low, spreading shrub in river beds.

Branchlets hirsute. Leaves lanceolate or oblanceolate. *F. saemocarpa*

Corner (196, 199b) classified *F. saemocarpa* Miquel under *F. squamosa* Roxburgh.

Ficus sagittifolia Warburg has apparently not been introduced into cultivation. It is closely related, in habitat and botanical characters, to *F. lyrata* Warburg, and is therefore worthy of consideration as an ornamental. See the accounts by Hutchinson (407), Hutchinson and Dalziel (410), Aubréville (29, with illustration of leaf), and Irvine (412). It grows in Africa as an epiphyte on the Oil Palm (*Elaeis guineensis*), with stout, glabrous branchlets and long, rather narrow (6.0 to 7.5 cm), fiddle-shaped leaves. See notes under *F. lyrata* (species No. 17) and *F. wildemanni* (species No. 51).

Ficus sansibarica was described by Warburg (797) from the Island of "Sansibar." Both Hutchinson (408) and Burt-Davy (131) gave accounts of it. R. O. Williams (838) stated that it is a tree, with large, spreading main branches, on which are borne numerous clusters of glabrous figs 4.5 cm in diameter. He men-

tioned a number of trees on the waterfront in the Jubilee Gardens, Zanzibar. Riedel (641) listed it from southeast Africa, but no record of its introduction has been found.

***Ficus sarmentosa*.** This species was classified by Corner (197) as *F. sarmentosa* B. Ham. ex J. E. Smith. He further stated: "The types of *F. sarmentosa* and *F. cabur* are preserved in the herbarium of the Linnean Society of London, and are unquestionably this species." The original account by Smith (707) was based on specimens gathered in 1802 by Dr. Francis Buchanan (Lord Hamilton) in the woods of upper Nepal. They were taken from a trailing plant branching out at the top of the supporting tree. The variability of this species is indicated by the fact that Corner (199b) listed eight varieties, with a key for their identification as well as authority and synonymy for each one. See references to *F. sarmentosa* under *F. foveolata*, *F. heteromorpha*, and *F. wrightii* in the present chapter; also, under *F. pumila* (species No. 4). PI No. 235,261 represents an introduction from Japan in 1958 by Dr. John L. Creech, whose USDA publication is given as (212) in our bibliography. He forwarded the material as *F. pumila*. However, specimens sent to Dr. Corner were identified by him as *F. sarmentosa*. The juvenile leaves or bathyphylls (Corner [192]) are small and star-shaped. Plants are being grown at the Longwood Gardens near Philadelphia, at UCLA Botanical Garden, at Arcadia (LASCA), and at Riverside. The young plants greatly resemble the variety *minima* of *F. pumila* except for the star-shaped leaves. They cling tightly to supports by means of holdfasts on the undersides of twigs. They apparently require a humid atmosphere in order to become well established.

***Ficus saussureana*,** according to the *Kew Index*, was described by De Candolle (Mem. Soc. Phys. Genève 9:65, 1941. Austral. America). It was illustrated and briefly described by Graf (324) as a Brazilian species, with stems and lower leaf surfaces cinnamon-brown, and the obovate leaves up to 30 cm long, with

rough surface. The photograph for the illustration was taken in 1939 in the nursery of Louis van Houtte at Ghent, Belgium. The title of Daveau (224) also indicates that his paper discusses this species.

***Ficus scabrella*,** described by Roxburgh (657), is ascribed by the *Kew Index* and by Corner (199b) to *F. heterophylla*, mentioned earlier in the present chapter. See G. King (437). Kurz (455) reported this species as an evergreen, prostrate or ascending shrub, with oblong leaves 5.0 to 7.5 cm long, repand-toothed, and rough-pubescent on both surfaces; the receptacles the size of a cherry or small prune, crimson, covered with white, lenticel-like spots. Riedel (641) listed it as "a beautiful climber from India."

Ficus semicostata was described and pictured by F. M. Bailey (44) from trees planted by him in the Brisbane Botanic Garden under the name *F. vesca* F.v.M. The original trees were probably brought from the Musgrave River district in 1873. The specific name alludes to the prominent ribs on the lower half of the fruit. This is a cluster fig which Corner (199b) assigned to *F. racemosa* (species No. 82).

Ficus serpyllifolia Blume is being grown at Bogor, according to Setyodiwiryo (689). A variety of the same name was given under *F. pumila* by Encke (264). Corner (199b) stated, under *F. serpyllifolia* Blume: "This species is like the creeping, bathyphyll state of an apocynaceous climber." See Corner (192) for the terms "bathyphyll" and "acrophyll," referred to in chapter II under the head "Climbers."

Ficus stenophylla Hemsley was introduced from China as seeds in 1931 under PI No. 99,171. Infertile seeds and a small botanical specimen were received from Foochow, China, at Riverside in 1948. No seedlings have been grown from either introduction. See the list by Rehder and Wilson (628); also, the key to three varieties by Corner (199b).

Ficus stupenda was described by Miquel (544) as *Urostigma giganteum*, but was treated as a distinct species with two varieties by Corner (199b). The species

was figured by Koorders and Valeton (446). It is being grown at Bogor, according to Setyodiwiryo (689).

Ficus subgelderi Corner. This species was described by Corner (196), with *F. rigida* Miquel as a new variety. Seeds labeled *F. rigida* were received in 1931 from Java under PI No. 94,300, and seedlings were grown. These seedlings did not thrive, and were discarded after trial at Riverside. Other seeds, received directly from Java in 1940, failed to germinate. See related comment under *F. tinctoria* (species No. 16). Ridley (639) gave a description under *F. rigida*. According to Corner (199b), it is widely distributed in Malaysia.

Ficus subtriplinervis is a Brazilian species, described by Martius (501). It was classified by De Wolf (230) under *F. pertusa* (species No. 33), which see. According to Riedel (641), plants were offered by the Franceschi Nursery at Santa Barbara in 1900. PI No. 101,335 represents an introduction of scions from France in 1932, with this notation: "A forest tree, with a dense crown of obtuse, papery leaves, prominently three-veined at the base, and axillary, globular fruits." Other introductions had been made earlier, from Argentina under PI Nos. 33,963 and 42,537 in 1912 and 1916, and from Uruguay under PI No. 48,672 in 1919. A tree growing on the University of Hawaii campus labeled *F. subtriplinervis* has been identified by Dr. Gordon P. De Wolf as *F. enormis* (Martius ex Miquel) Miquel, which, he said, "is probably the commonest fig in southern Brazil." See the note under *F. monckii* (species No. 25).

Ficus subulata, described by Blume (92), is a truly dioecious species which extends from the Philippines to Burma, according to G. King (437, with illustration). He reported it to be a semiscandent or straggling shrub, presenting little variation, and readily recognized by the long, subulate or awl-shaped stipules. Contrary to the statement by King, Corner (199b) listed nine synonyms and two varieties for the species. See under *F. acuminata* and *F. philippinensis* in the present chapter for

further comment on the same topic. Other accounts were given by Kurz (455), Dunn and Tutchter (245), Koorders and Valeton (446, with illustration), Merrill (524), and Summerhayes (740, 743). See J. G. Watson (810) for Malayan names. An introduction of seeds was made from Sumatra in 1926 under PI No. 67,562. These were reported to be from a handsome, climbing, large-leaved plant, bearing small, orange-colored fruits 1.1 cm in diameter, but failed to produce offspring. According to Setyodiwiryo (689), the species was growing at Bogor in 1957. Dr. Corner reports that plants are being grown in the greenhouse at the Cambridge University Botanic Garden. Seeds labeled *F. subulata* were received from Prof. Juan V. Pancho, Laguna, P.I., in 1963, and were assigned PI No. 294,474. Germination was poor, but one seedling survived, and is being grown at Riverside. This plant does not conform with the description and illustration by King, and its identity has not been established.

Ficus suringarii Witte. The original description of this species, credited by the *Index Kewensis* to H. Witte (in *Oudemans Neerland's Plantentuin*, 1865, with illustration), has not been consulted. According to Lemaire (466), it was discovered on the Island of Amboina (Moluccas) by J. E. Teysmann, who sent a live plant to the Jardin Académique at Leiden. The specific description by Witte then followed. Other descriptions were published by Carrière (140) and an anonymous writer (16, with illustration), the latter being made from a plant grown by Gronewegen and Company at Amsterdam. Corner (199b) classified *F. suringarii* Carrière under *F. nodosa* Teysmann. Riedel (641) listed it as an erect tree from Amboina, "a valuable ornamental." The species apparently failed to attract attention following its introduction in 1866. The plants had large leaves, pubescent beneath, with purplish-red veins.

Ficus teloukat, the Tuareg name for the tree in north Africa, was described and pictured by Battandier and Trabut (70). They referred to a report by De Bary, who

found the species growing along with the oleander (*Nerium oleander*). It was reported to be a large tree, with smooth, leathery, entire, oblong-ovate leaves 10 cm long, and small, fleshy, globose, pinkish fruits scarcely 1.1 cm in diameter. Aubréville (30) classified *F. teloukat* as a synonym of *F. salicifolia* (species No. 77, which see). Seeds introduced from France in 1932 under PI No. 101,336 apparently failed to produce plants.

Ficus terasonensis Hayata. According to Sata (670), this Formosan species may be better than *F. pumila* (species No. 4) for covering walls. The large, orange-red figs are eaten by children. It is closely related to the Common Fig (*F. carica*), and may be useful for hybridization. Corner (199b) listed this species as a variety of *F. aurantiaca* (species No. 5, which see).

Ficus tholloni Hort. PI No. 101,337 listed this as an importation of scions from France in 1932. As Riedel (641) stated, the place of the original publication of the name and habitat of the species is not apparent in literature.

Ficus tilineifolia was described by J. G. Baker (49). Scions introduced from France in 1932 were assigned PI No. 101,338, with this notation: "A shrub, with stout, brown branchlets and cordate-triangular, entire leaves that are scabrous above and 4 to 5 inches [10 to 12.5 cm] long. The leathery fruits are 1 inch [2.5 cm] in diameter. Native to Madagascar." Good descriptions of it were given by Perrier (596, 597).

Ficus toxicaria Linné (474) was treated by P. Miller (536) under his No. 17. G. King (437) gave a good description, with a list of references and synonyms, and an illustration. The species was also illustrated by Miquel (542) and by Koorders and Valetton (446). J. G. Watson (810) listed Malayan names, while Corner (199b) treated it as a synonym of *F. padana* Burman (f.). According to Uphoff (769), the plant is a source of wax for batik work in Java. PI No. 67,557 was given in 1926 to an introduction of *F. toxicaria* from the Sibolangit Botanic Gar-

den, Sumatra, with this notation: "A handsome species of fig tree which bears enormous quantities of nonpoisonous though not edible fruits; an excellent shade tree." King described it as a small, spreading tree, with large, membranous leaves 17 to 30 cm long; and with the receptacles short-pedunculate, depressed-globose, densely tomentose, purplish, and 5 cm in diameter.

Ficus trachyphylla. According to the *Kew Index*, this species was described by Fenzl in 1844, but Warburg (797) credited an earlier description to Kotschy. It is widely distributed in tropical Africa, and so could not be the species introduced under PI No. 101,339 from France in 1932, which proved to be the same as *F. hispida* (species No. 8), a species indigenous to Asia. It was described by Miquel (539, 541) as *Sycomorus trachyphylla*. See the note under *F. gnaphalocarpa* (species No. 100).

Ficus tremula Warburg (797), an African species, was treated by R. O. Williams (838) as a small, much-branched tree, with thin, oblong leaves, the petioles threadlike; and with fruits 2.5 cm in diameter, produced in clusters on the main trunk only. It was figured by Engler (266) and described by Hutchinson (407).

Ficus triangularis, described by Warburg (797), was treated later by R. O. Williams (839). PI No. 101,340 represented an introduction of scions from France in 1932, with this note: "A tropical African tree, closely related to *F. jurcata* Warburg, with small, triangular, leathery leaves 5 cm long, the margins revolute; and with small, green, brown-spotted fruits 0.7 cm in diameter." According to the *Index Londinensis*, the species was illustrated by an anonymous author (21) and by Engler and Drude (267). The latter included it in their figure 31 under *F. leprieurii* Miquel.

Ficus trimeni was described by G. King (437) in honor of Henry Trimen, who included the species in his *Notes on the Flora of Ceylon* (763). King wrote: "This species approaches *tsiela* Roxburgh [*amplissima* Smith] and *retusa* Linné

[*microcarpa* Linné (f.)] var. *nitida*, but differs from both by its more numerous straight primary nerves, much more spreading habit, and fewer aerial roots." Scions were introduced from France in 1932 under PI No. 101,341, with this note, taken from King: "A gigantic tree of tropical Asia, with elliptic, entire leaves 7.5 to 12.6 cm long, and with warty, globose fruits less than 1.1 cm in diameter, borne in sessile, axillary pairs."

Ficus truncata was described by Miquel (544) from Java. G. King (437) characterized it as a small tree, with the young leaves powdery-puberulent, later becoming glabrous, coriaceous, short-petiolate, and obovate, with the apex broad to even truncate, up to 11 cm long. The axillary receptacles are crowded, sessile, reddish yellow, and 0.7 cm in diameter. Seeds received at Riverside from Java in 1928 were sterile, and no plants were secured. This species is being grown at Bogor, according to Setyodiwiryo (689). Corner (199b) treated it under *F. retusa* Linné. See the brief comment under *F. microcarpa* Linné (f.) (our description No. 46).

Ficus tuerckheimii Standley. Several years ago, an unidentified fig tree was received from a Texas nursery and planted at Riverside, where it flourished, producing fruit in 1964. Specimens sent to Dr. Gordon P. De Wolf were identified by him as *F. tuerckheimii*, so named by Standley (717) in honor of Herr von Tuerckheim, who collected it in Guatemala in 1907. Lundell (481a) reported it as a large tree, found in flatland forests in central Petén, Guatemala. Material taken from the single tree at Riverside corresponds with Standley's original description. The vegetative parts are glabrous. The terminal buds are 3 cm long. The leaves are about 16 cm long and 8.5 cm broad, cordate at the base and broadly obtuse at the apex, with petioles 7 cm long. Venation is prominent, the veins elevated below, with 2 or 3 pairs basal plus 8 laterals. The receptacles are geminate, sessile, and 0.9 cm in diameter, with the involucre bilobate and united at the base.

Ficus variolosa Lindley is still being grown in the greenhouse of the Cambridge University Botanic Garden. Seeds received from Dennis Hill, Hong Kong, germinated, and four seedlings were being grown at Riverside at the time of writing. These show leaf forms as stated in a letter from Hill: one with typical, one with obovate, and two with linear-lanceolate leaves. Both petiole and midrib vary in color from reddish brown to green. The glabrous leaves have the base rounded, the apex bluntly acuminate, hydathodes well scattered, and the margins entire. The veins are not elevated below. There are 10 to 15 laterals. Accounts of the species were given by G. King (437, with illustration), Sata (670), and Corner (199b).

Ficus vasculosa is No. 4,482 of the Wallich Catalogue (795). Miquel (540, 542) and Miquel *et al.* (545) described it in accounts of *Ficus* species. According to G. King (437), it is a tree, with all parts glabrous. The leaves are elliptical or ovate-oblong, narrowed to the acute or cuneate base, and 7.5 cm long. The receptacles are axillary, globular, minutely tuberculate, pale yellow, and 1.1 cm in diameter. Other treatments of this species were by Kurz (455), G. King (438), D. Brandis (103), Koorders and Valetton (446, with illustration), Ridley (639), Burkill (124), Li (470), and Corner (199b). Sata (670) stated that it is being grown in Taiwan for shade and ornament. According to Douglas and Baas-Becking (239), a tree of *F. vasculosa* 20 m tall was found growing in the Buitenzorg (Bogor) Botanic Gardens, and Setyodiwiryo (689) listed it as still being there in 1957. See J. G. Watson (810) for Malayan names; also, Desch (226) for its value as a timber tree. According to Wiebes (824d), the insect recorded earlier from *F. vasculosa* as a species of *Pleistodontes* appears to be a *Blastophaga*.

Ficus vasta Forskal (293) is recorded by the *Kew Index* as equal to *F. populifolia* Vahl, which see earlier in the present chapter. However, it was treated as a distinct species by Schweinfurth (683), Fiori (284), Mildbraed and Burret (535),

Hutchinson (407), Blatter (89), and Dale and Greenway (218). In his key to *Ficus* of the Anglo-Egyptian Sudan, F. W. Andrews (14) separated the two species as follows:

Leaves rather long-tailed at the apex.

F. populifolia

Leaves rounded or obtusely pointed or shortly and obtusely acuminate at the apex; peduncle under 0.7 cm long.

F. vasta

According to Fiori, this species grows at elevations up to 2,200 m in Eritrea, much greater than does *F. sycomorus*; therefore, the trees are probably hardier than those of the latter. The records of *F. vasta* by Riedel (641) in his 1911 catalogue, and by Dr. C. F. Franceschi in 1909 as a tree from the West Indies are questionable for, as stated by Andrews and others, the species is African. PI No. 92,955 was listed as *F. vasta* from Egypt in 1931.

Ficus venusta. According to Acuña and Roig (3), this species was described by Kunth and Bouché (452-453) from plants grown in the Berlin Botanic Garden. The seeds originally came from Cuba.

Ficus verticillaris Corner is being grown in the greenhouse of the Cambridge University Botanic Garden. It was treated by Corner (199b), with a key to two varieties.

Ficus wendlandii [sic] was described by N. Taylor (750) as having leaves 25 to 30 cm long and 20 to 25 cm wide, dark green with light-green veins, but with its habitat and fruit unknown. Riedel (641) evidently drew his information from the same source as did Taylor. Corner (199b), referring to a specimen in the Berlin Herbarium presumably prepared by Karl Moritz Schumann, the former curator, labeled "*F. weinlandii* K. Schum.," stated: "This consists of the leafless twigs with small figs of *F. caulocarpa* Miquel and the leafy twig of a species of the section *Sycocarpus*." See the account of *F. caulocarpa* earlier in this chapter; a similar somewhat fantastic episode is related there. Another appears on page 22.

Ficus wrightii, described by Benthham (76) from Hong Kong, was classified by Corner (199b) under *Ficus sarmentosa*, which see in the present chapter, with several cross-references. N. Taylor (750) described it as a creeping or climbing fig, with wedge-shaped, three-nerved leaves 7.5 to 10 cm long, not cultivated in America outside of special collections. Riedel (641) gave similar information. See Maximowicz (507).

Ficus xylosyca Diels, a species from New Guinea, is being grown in the greenhouse of the Cambridge University Botanic Garden. See the account by Corner (199b).

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GLOSSARY OF BOTANICAL TERMS

- Achene; Akene.** A dry, indehiscent, one-seeded fruit.
- Acrophyll.** See chapter II, under "Climbers," with reference to Corner (192).
- Acumen.** A prolonged apex, usually narrowed.
- Acuminate.** Taper-pointed; gradually tapering.
- Acute.** Sharp-pointed.
- Adventitious.** Out of the proper or usual place.
- Alternate.** Only one at a place, as leaves.
- Anastomosing.** Veins forming a network.
- Androgynous.** Both male and female flowers in the same cluster.
- Annulus.** A ring, or ringlike structure.
- Apiculate.** Ending in a short-pointed tip.
- Apogamy; Apomixis.** Seed production without fertilisation of the flower.
- Arcuate.** Moderately curved.
- Areole.** Area with distinct boundary.
- Asperous.** Rough to the touch.
- Attenuate.** Gradually narrowed or drawn out.
- Aureous.** Golden.
- Auricled; Auriculate.** With earlike lobes.
- Axil.** Angle of leaf or fruit with stem.
- Axillary.** Occurring in an axil.
- Bathyphyll.** See chapter II, under "Climbers," with reference to Corner (192).
- Bilabiate.** Two-lipped.
- Blade.** Expanded part of a leaf.
- Bract.** Reduced leaf or scale.
- Calyptriform.** Shaped like a calyptra or cap.
- Caprifaction.** Transfer of pollen by fig insect.
- Capitule; Capitulum.** A dense, globular cluster or head.
- Caudate.** With a slender, tail-like appendage.
- Cauliflorous.** Flowers or fruits on a trunk or stem.
- Cauline.** Of or belonging to a stem.
- Chartaceous.** Papery.
- Ciliate.** Bordered by hairs.
- Convolute.** Rolled up lengthwise.
- Cordate.** Heart-shaped at base.
- Coriaceous.** Leathery.
- Crenate.** With rounded or blunt teeth.
- Cuneate.** Wedge-shaped.
- Cuspidate.** Apex with cusp or sharp point.
- Cytology.** Science of cells.
- Deciduous.** Falling when mature.
- Decurrent.** Prolonged down the stem or petiole below insertion.
- Dentate.** Toothed sharply.
- Denticulate.** Finely toothed; serrulate.
- Dichogamy.** Maturation of pistils and stamens at different periods; protogyny.
- Dimorphism.** Having two unlike forms, usually in the case of leaves; heterophylly.
- Diocious.** With male and female flowers on different plants.
- Diploid.** Having two sets of chromosomes.
- Elliptic; Elliptical.** Length more than twice the width, the margins rounded.
- Emarginate.** Notched at apex.
- Endemic.** Native; local.
- Endosperm.** Storage tissue surrounding embryo in a seed or achene.
- Entire.** Margin not indented.
- Epiphyte.** A plant growing on, but not nourished by, another plant.
- Episperm.** The hard, external coating of a seed; the testa.
- Equilateral.** Equal-sided.
- Falcate.** Sickle-shaped.
- Fascicle.** A close bundle or cluster.
- Fimbriate.** Fringed.
- Floccid.** Soft; weak; limp.
- Floccose; Flocculent.** Tufted with long, soft hairs.
- Fugacious.** Soon falling off or perishing.
- Fulvous.** Tawny.
- Fuscous.** Deep gray-brown.
- Gamophyllous.** Formed of united leaves.
- Geminate.** Twins; side by side.
- Geocarpic.** Fruits borne below the soil surface.
- Gibbous.** Swollen on one side.
- Glabrate; Glabrescent.** Slightly glabrous.
- Glabrous.** Bald; not hairy.
- Glaucous.** Surface with a bloom; sea-green.
- Hastate.** Base with a pair of lobes.
- Hilum.** Scar at place of attachment of seed.
- Hirsute.** Hairy, with long, firm hairs.
- Hispid.** With stiff or rigid hairs.
- Hydathodes.** Small pits or spots on the upper leaf surface.
- Hypogynous.** Flower parts inserted under the pistil or along the margin.
- Inequilateral.** Not symmetrical or equilateral.
- Indehiscent.** Not opening.
- Internode.** Portion of stem between joints.
- Involucere.** A whorl or set of bracts around a bud or flower.
- Laciniate.** Deeply cut or incised into narrow segments.
- Lamina.** Blade or expanded part of leaf.
- Lanceolate.** Much longer than broad.
- Latex.** Milky juice.
- Lenticels.** Corky spots on twigs.
- Liana.** Woody climber.
- Linear.** Very narrow.
- Lobe.** A division of an organ such as a leaf; generally rounded.
- Lyrate.** Lyre-shaped, upper part broad.
- Marcottage.** Propagation by wrapping moss around branches still attached to plant.
- Membranous.** Thin and soft.
- Mesophyll.** Middle soft cells of a leaf.
- Metamorphosis.** A passing from one form or shape into another.
- Micropyle.** Closed orifice of a seed.
- Monoecious.** With male and female flowers separated on same plant.
- Mucronate.** Tipped abruptly with a sharp point.

- Node. Joint or place on stem for attachment of leaves or buds.
- Ob-. Prefix signifying lower side up.
- Obcordate. Inverted heart-shaped.
- Oblancoolate. Inversely lanceolate.
- Oblate. Flattened at base or apex, or both.
- Oblique. Slanting.
- Oblong. Two or three times longer than broad and with more or less parallel margins.
- Obovate. Inversely ovate.
- Obtuse. Blunt or rounded.
- Ostiole. Apical orifice connecting cavity of receptacle with exterior.
- Oval. Broadly elliptic.
- Ovate; Ovoid. Egg-shaped.
- Panicle. An open and branched cluster.
- Palmate. Veins of leaf radiating from apex of petiole.
- Papillate. With papillae or minute protuberances.
- Parthenocarp. Development of mature fruits without stimulus of pollination or fertilization of flowers.
- Parthenogenesis. Producing fertile seed without fertilization of flower.
- Pedicel. Stalk of single flower or one in a cluster.
- Peduncle. Flower or fruit stalk.
- Perianth. The outer envelope of a flower; the floral leaves collectively.
- Persistent. Tardily or not at all deciduous.
- Petiole. Leaf stalk.
- Pilose. Hairy, with soft, slender hairs.
- Pinnate. Feather-veined, as of a leaf.
- Pinnatifid. Pinnately cleft.
- Pistil. Female organ of a flower.
- Pistillode. A rudimentary pistil.
- Poriform. Open, porelike.
- Polymorphy. Of several or various forms.
- Proterandrous. Condition when anther sheds pollen before stigma is receptive.
- Proterogynous. Condition when stigma is receptive before anther sheds pollen.
- Pseudo-. Greek for false.
- Puberulent. Minutely pubescent or downy.
- Pubescent. Hairy or downy, usually with soft hairs.
- Punctate. Surface dotted or pointed.
- Punctulate. Minutely punctate.
- Receptacle. Flower-bearing organ.
- Reniform. Kidney-shaped.
- Repand. With slightly uneven or undulating margin.
- Reticulate. Netted.
- Retuse. Broadly or shallowly notched.
- Revolvate. Rolled backward from margin.
- Rhomboid. Quadrangular, but with lateral angles oblique.
- Rubiginous. Rusty.
- Rugose. Wrinkled.
- Saccate. Bearing a pouch or saclike body.
- Sagittate. Shaped like an arrowhead.
- Scaberulous. Minutely scabrous.
- Scabrid. Slightly scabrous.
- Scabrous. Rough to the touch; sandpapery.
- Scandent. Climbing or trailing.
- Scarious. Thin and membranous.
- Sclereid. A sclerotic cell (hardened).
- Scurf. Small, loose, or powdery scales on a stem or leaf.
- Sericeous. Silky.
- Serrate. Saw-toothed.
- Serrulate. Finely serrate; denticulate.
- Sessile. Leaf without petiole; fruit without stalk.
- Setose. Bristly.
- Sinus. A bay, recess, or indentation.
- Sinuate. Margin alternately bowed inward and outward.
- Spatulate. Rounded above and contracted below to a narrow base.
- Stamen. Male organ of a flower.
- Stigma. Apex of pistil or style.
- Stipules. Scalelike bracts which enclose the embryonic leaf in bud and expand as the bud opens.
- Stomata. Breathing pores.
- Sub-. Prefix meaning somewhat; nearly.
- Subulate. Awl-like.
- Syconium. Botanical name of fig receptacle.
- Symbiotic. Two organisms living together in a mutually beneficial relationship.
- Symmetrical. Equilateral; same on both sides.
- Terete. Round; cylindrical and tapering in cross-section.
- Taxon. A classified biological unit.
- Taxonomy. Systematic study of individuals; classification.
- Tessellated. Surface with checkered patterns.
- Testa. The hard, external coating of a seed; the epispem.
- Tomentose. Covered with soft, woolly hairs, as in a tomentum.
- Truncate. Cut off squarely.
- Tuberculate. Bearing excrescences, pimples, or warty growths.
- Tufted. Closely bunched, as hairs on a stem or leaf.
- Turbinate. Top-shaped.
- Umbilicus. Visible part of ostiole at apex of fig receptacle.
- Umboate. Bearing a boss or protuberance, which is commonly surmounted by a spine or projection.
- Undulate. Wavy-margined.
- Urceolate. Urn-shaped; globular, with an apex like an urn or pitcher.
- Villous. Shaggy, with long, soft hairs.
- Viscid. Sticky.

PLATES

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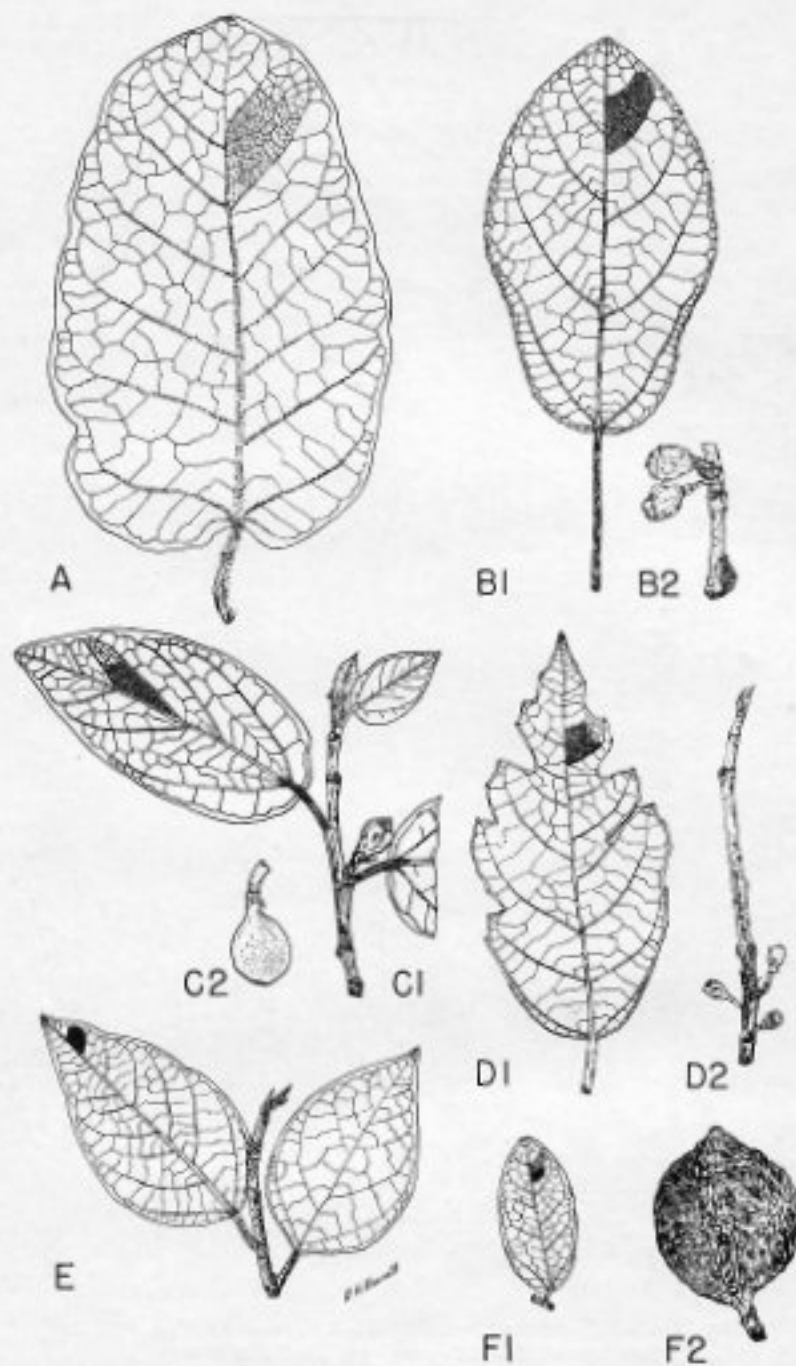


Plate I. A, *F. villosa*; B1-2, *F. tikoua*; C1-2, *F. pumila* var. *minima*; D1-2, *F. montana*; E, *F. hederacea*; F1-2, *F. aurantiaca* var. *parvifolia*.

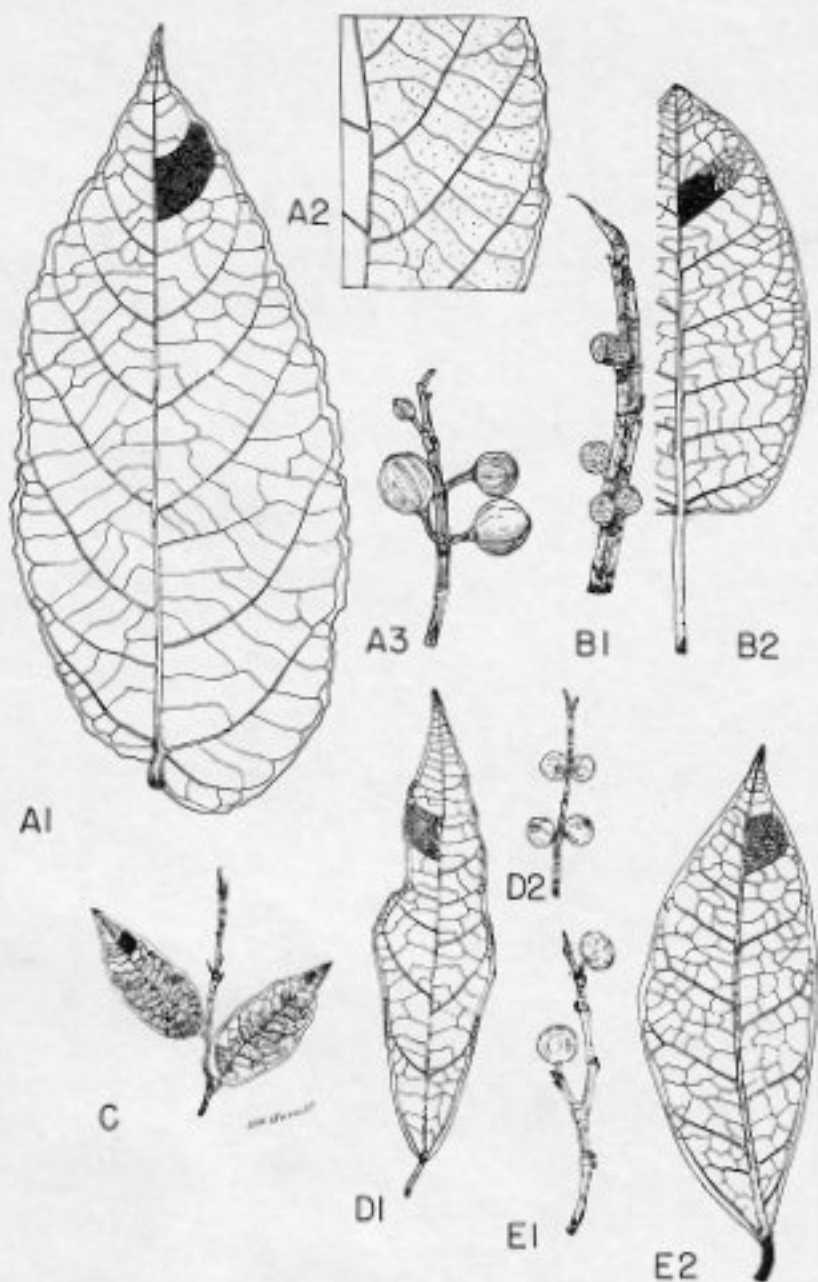


Plate II. A1-3, *F. aspera* "parcelli"; B1-2, *F. monchii*; C, *F. radicans* "variegata"; D1-2, *F. cumingii*; E1-2, *F. tinctoria*.

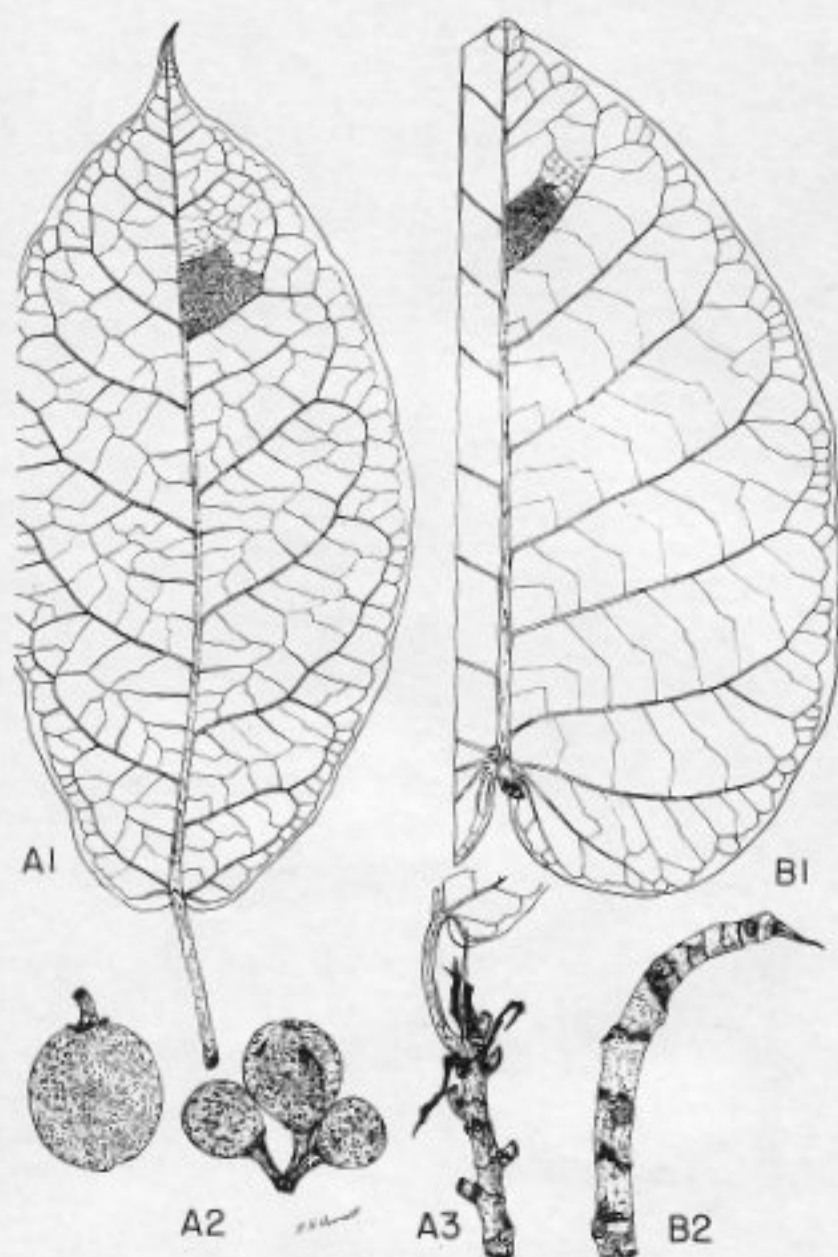


Plate III. A1-3, *F. dryepondtiana*; B1-2, *F. nymphaeifolia*.

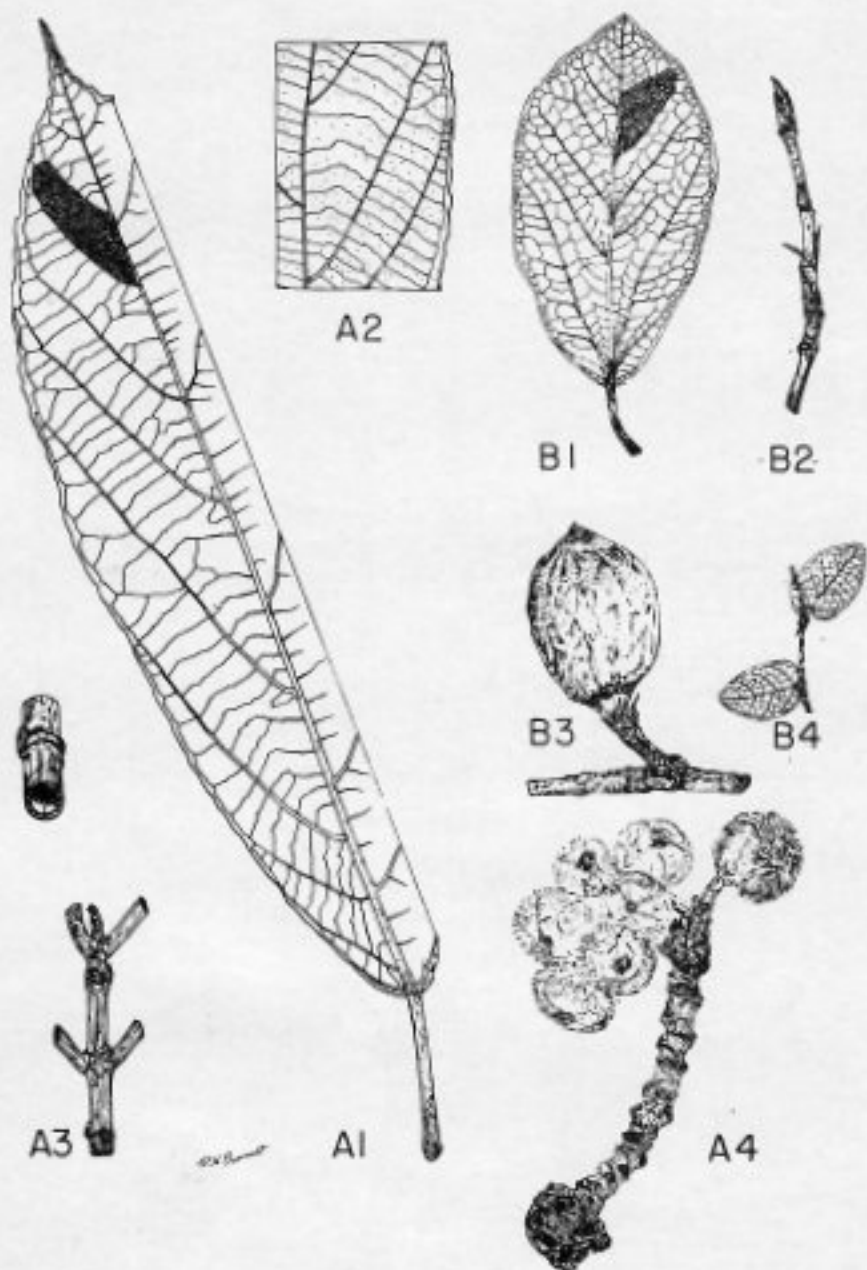


Plate IV. A1-4, *F. hispida*; B1-4, *F. pumila*.

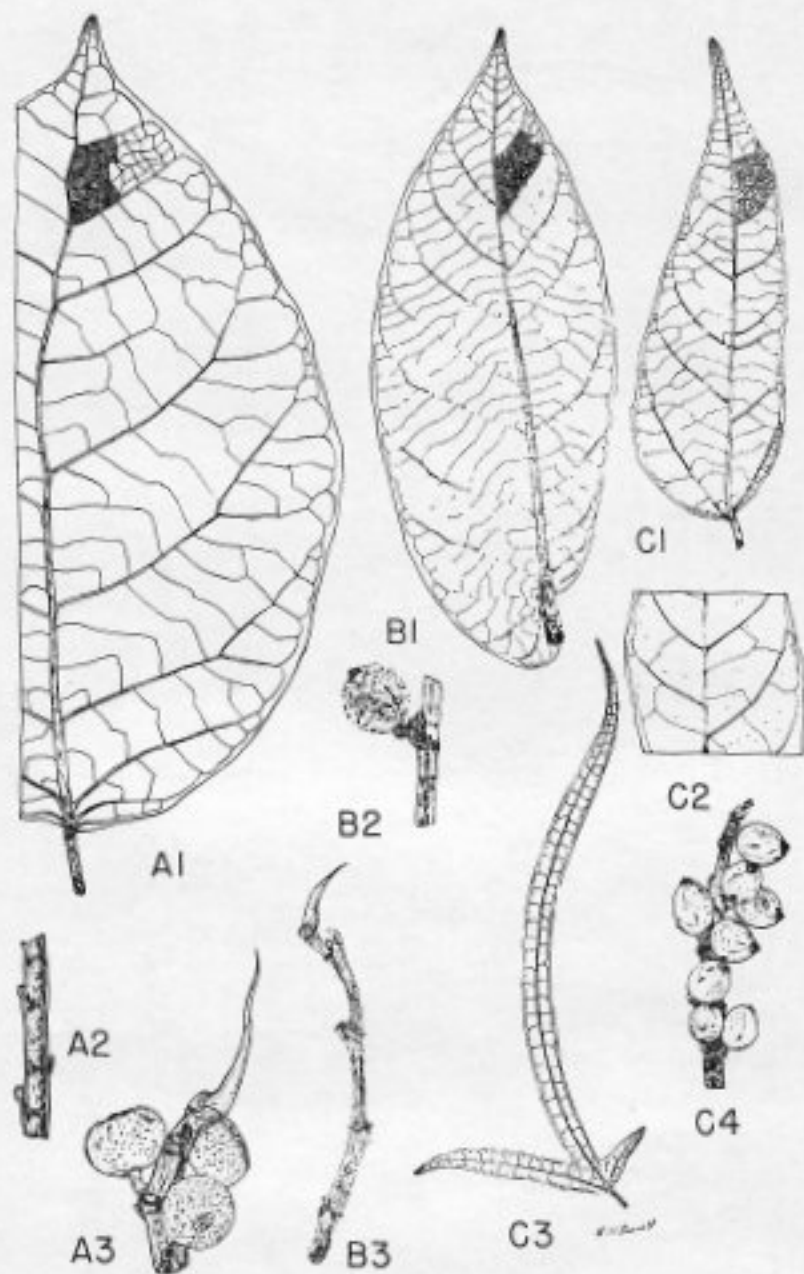


Plate V. A1-5, *F. septica*; B1-3, *F. semicordata*; C1-4, *F. ulmifolia*.

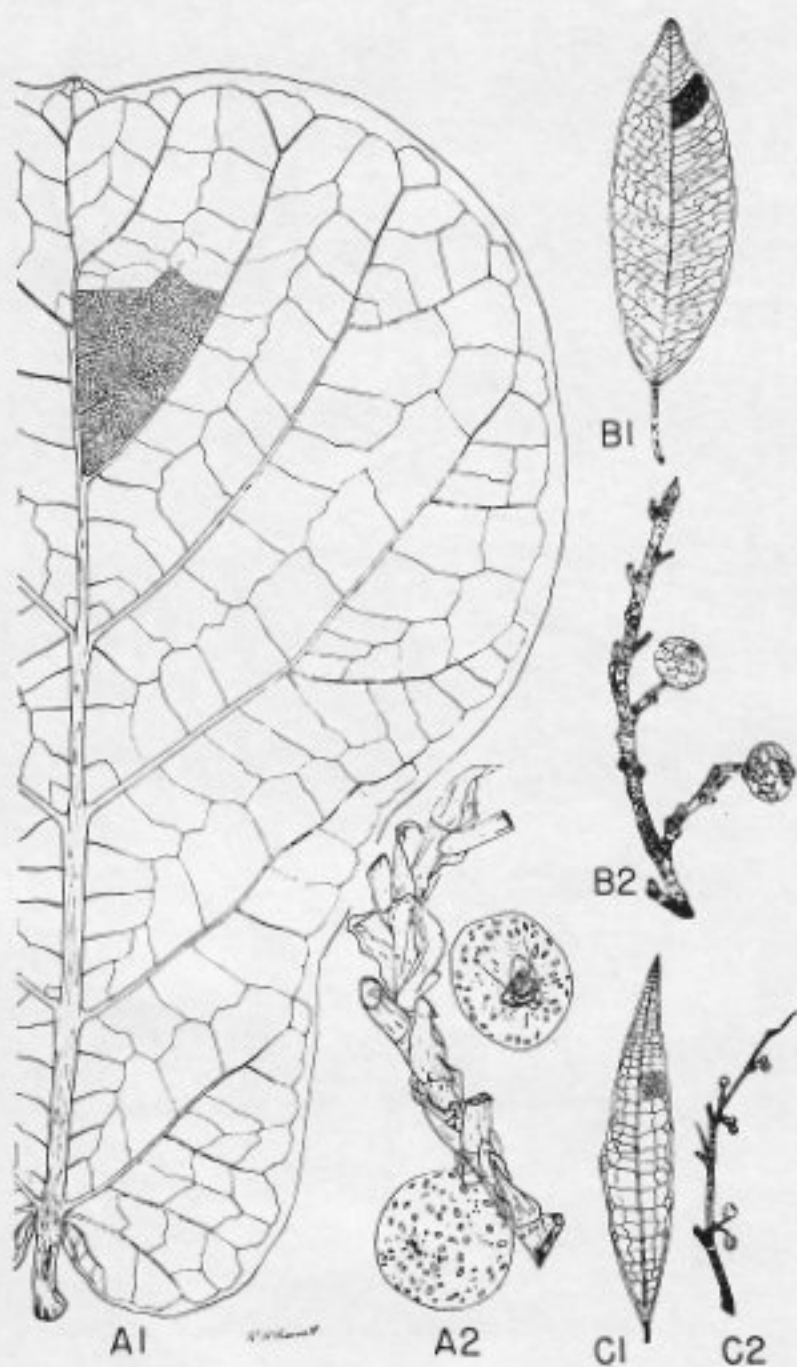


Plate VI. A1-2, *F. lyrata*; B1-2, *F. pertusa*; C1-2, *F. celebensis*.

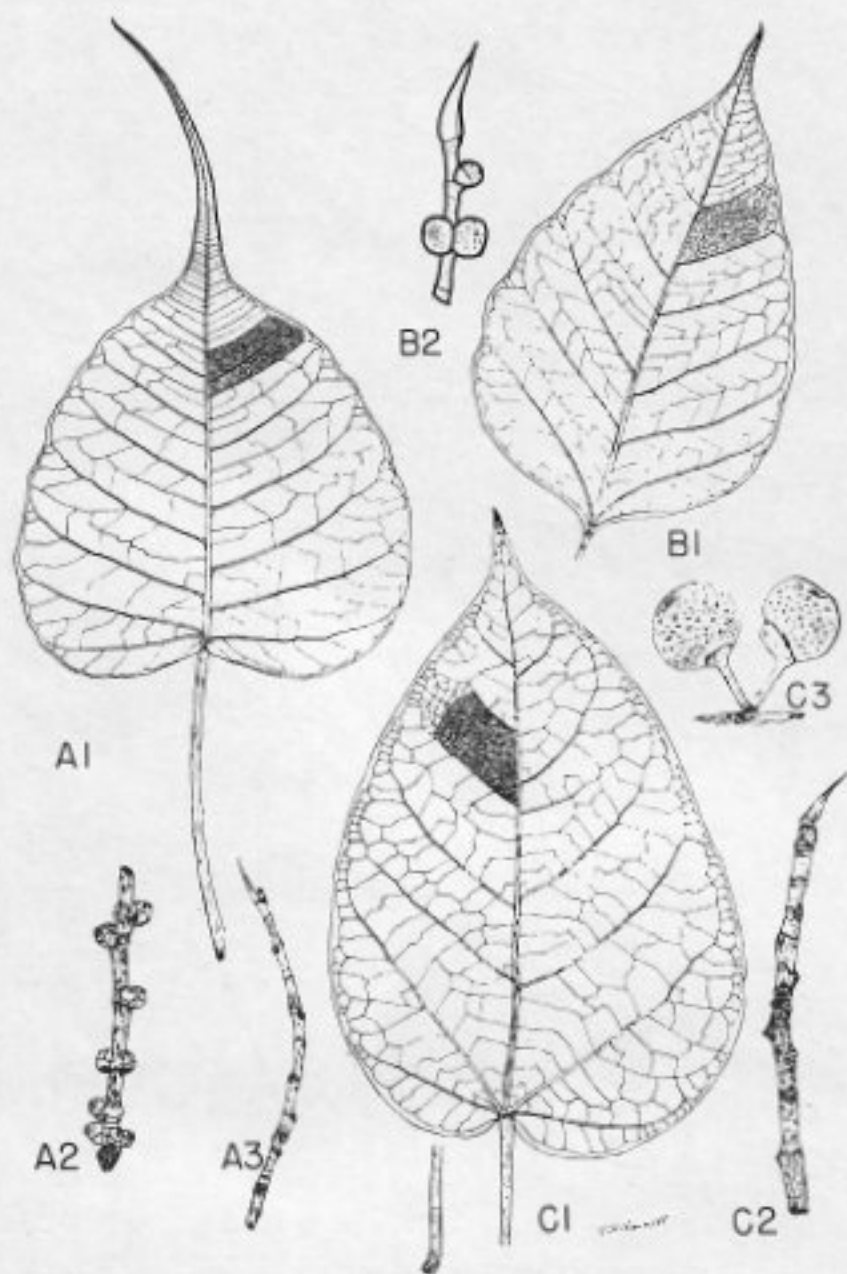


Plate VII. A1-3, *F. religiosa*; B1-2, *F. rumphii*; C1-3, *F. herstingii*.

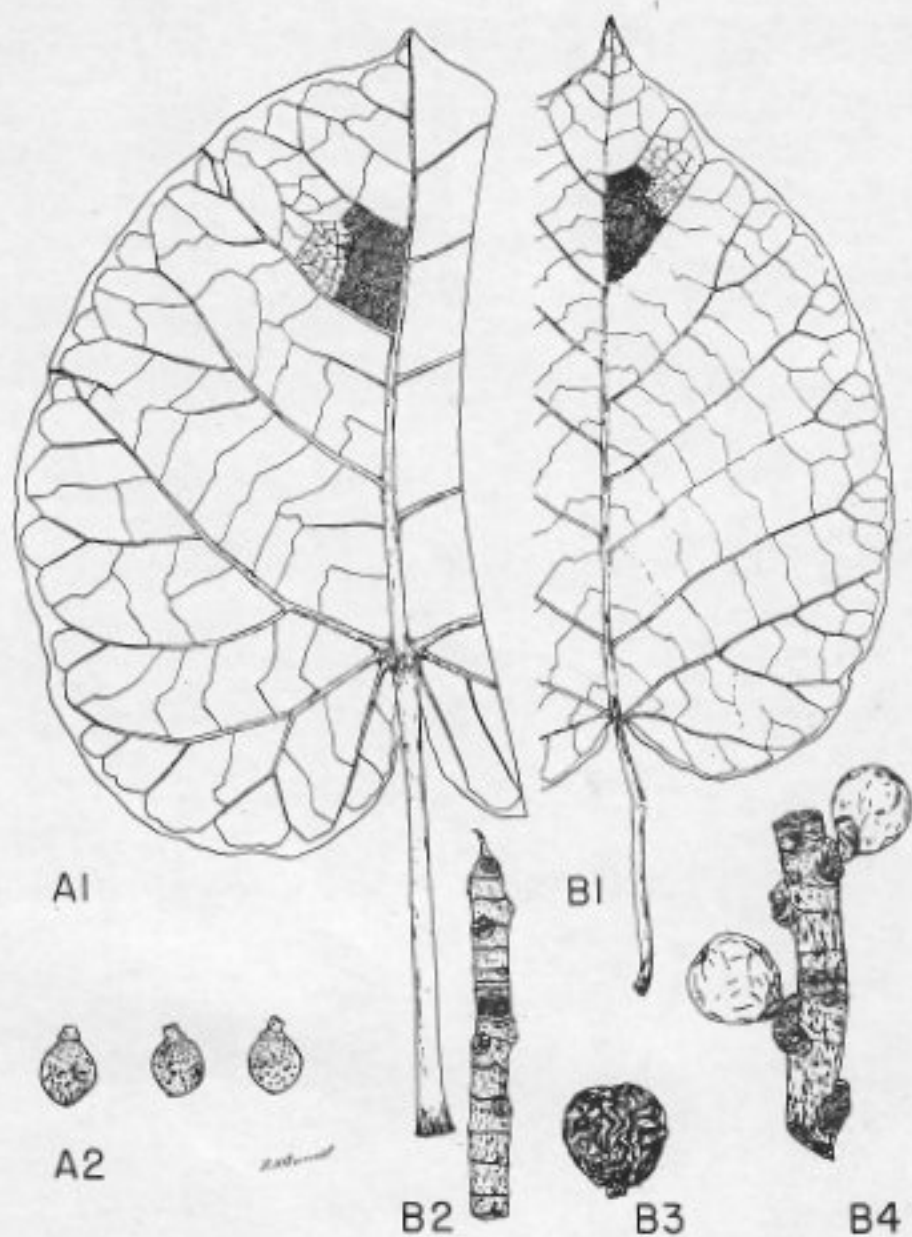


Plate VIII. A1-2, *F. soldanella*; B1-4, *F. umbellata*.

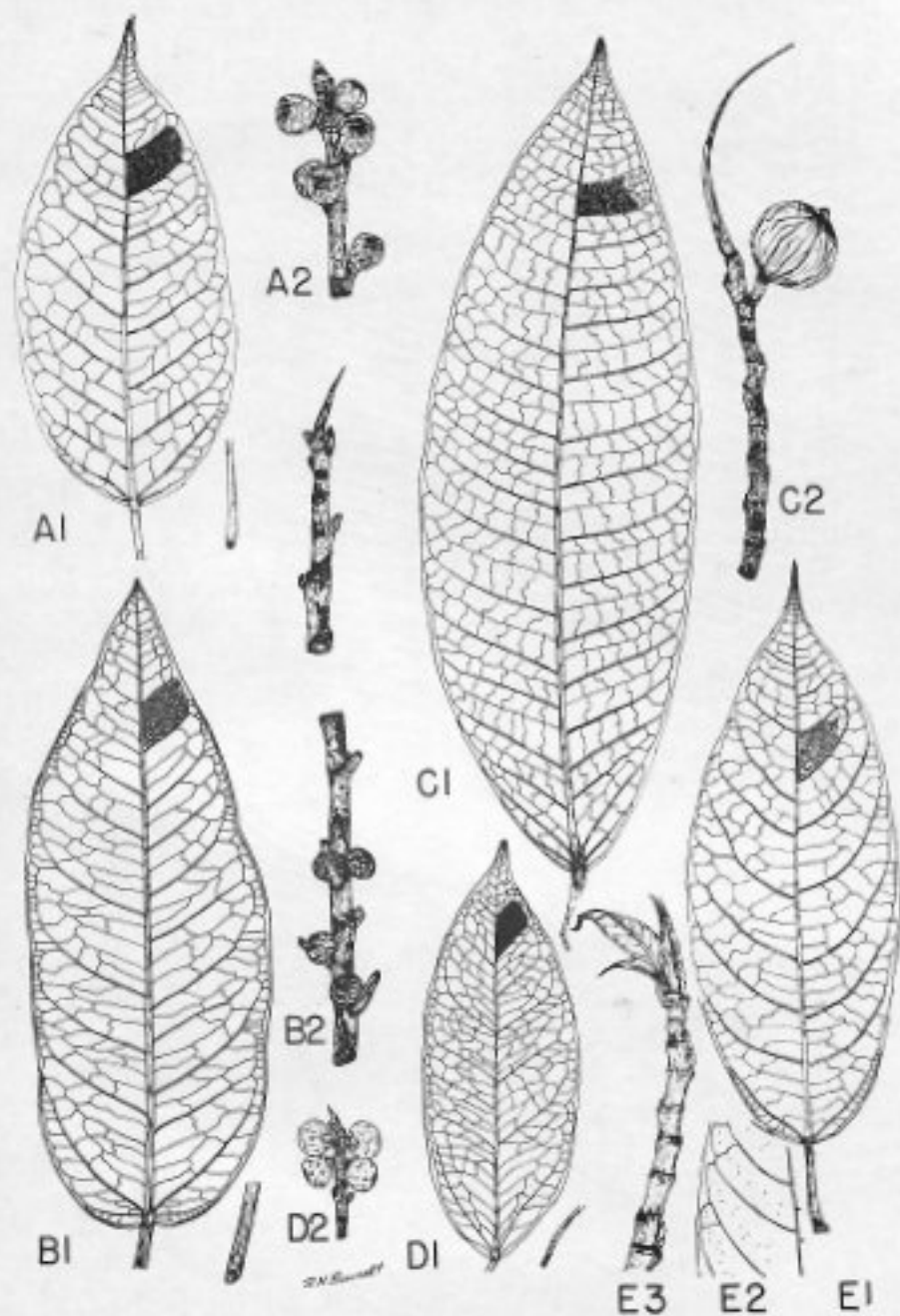


Plate IX. A1-2, *F. virens*; B1-2, *F. pretoriae*; C1-2, *F. insipida*;
 D1-2, *F. mariannensis*; E1-3, *F. neriifolia* var. *memoralis*.

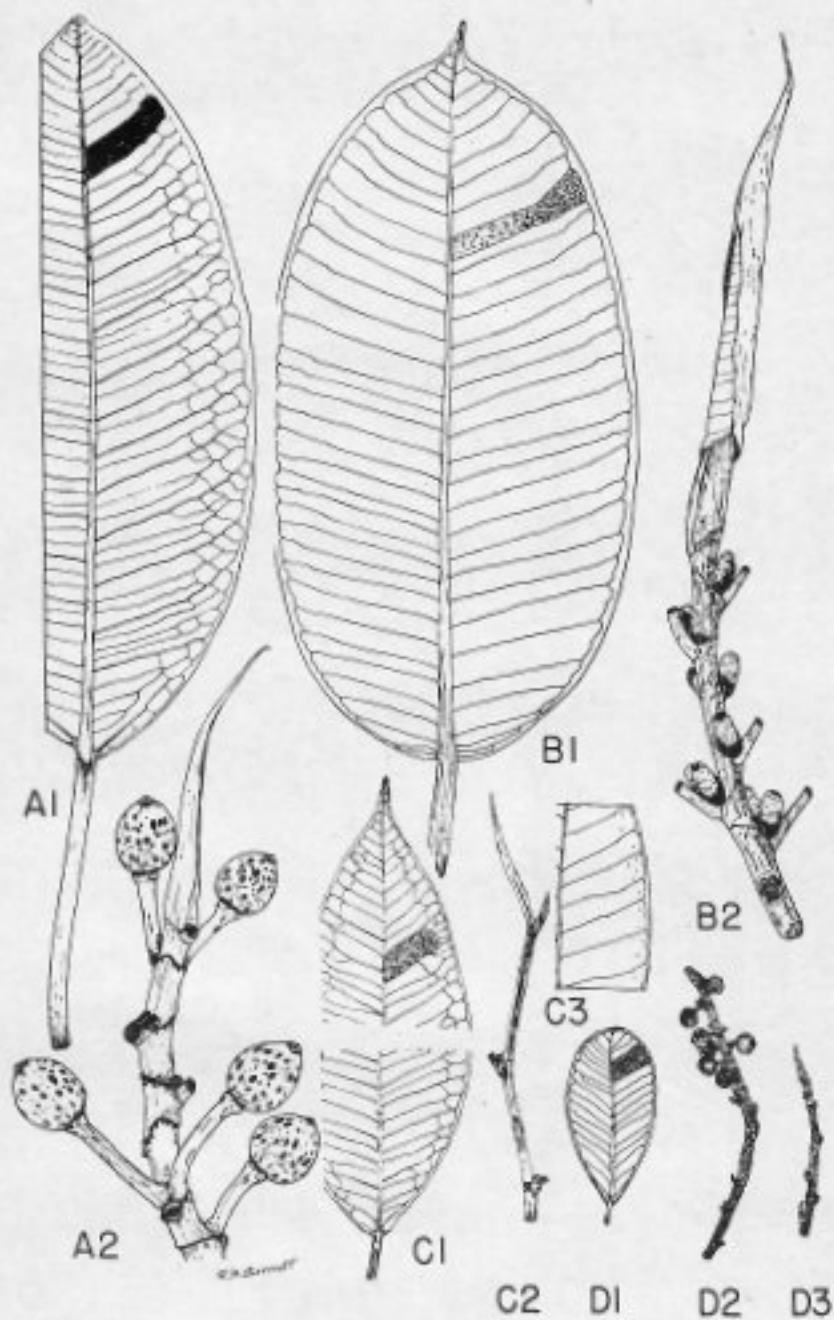


Plate X. A1-2, *F. macrophylla*; B1-2, *F. elastica*; C1-3, *F. stricta*; D1-3, *F. perforata*.

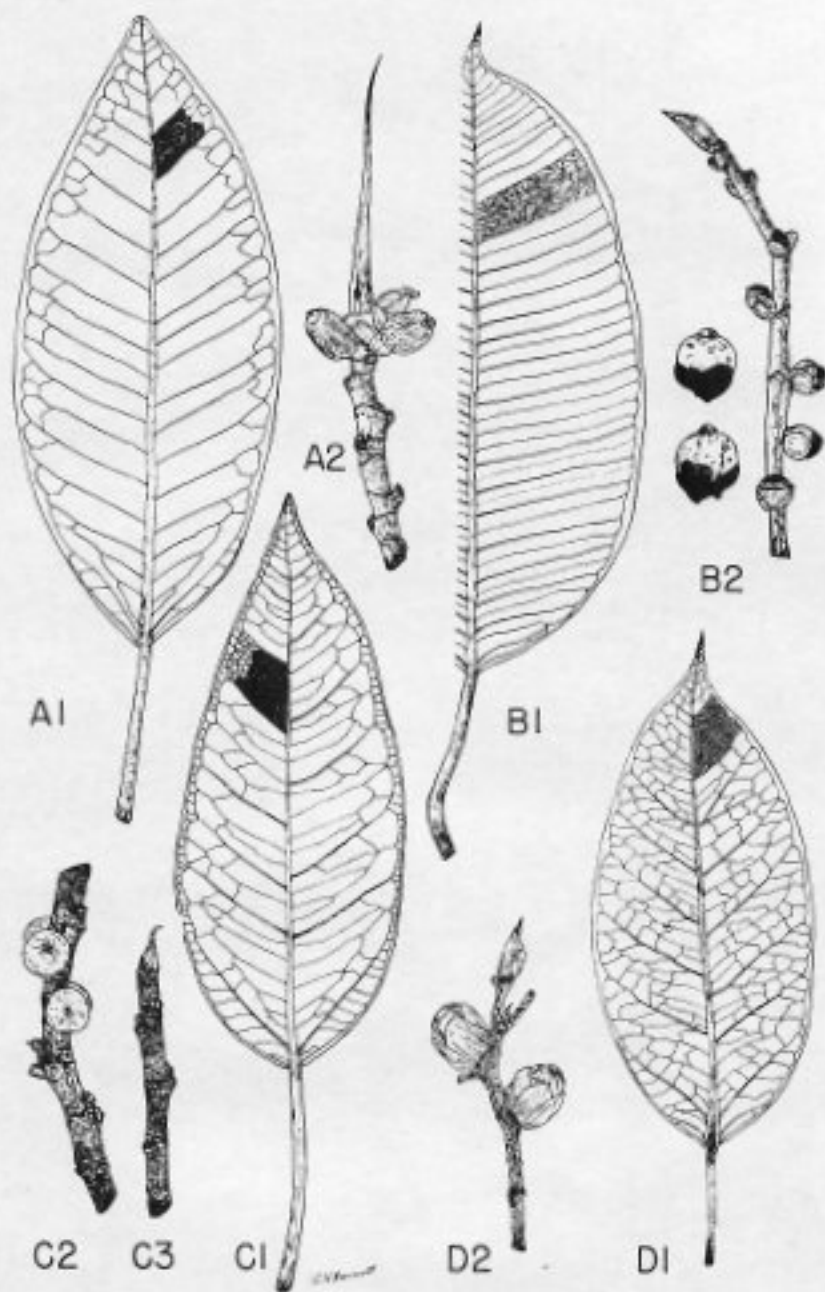


Plate XI. A1-2, *F. watkinsiana*; B1-2, *F. subcordata*; C1-3, *F. amplissima*;
D1-2, *F. involucreta*.

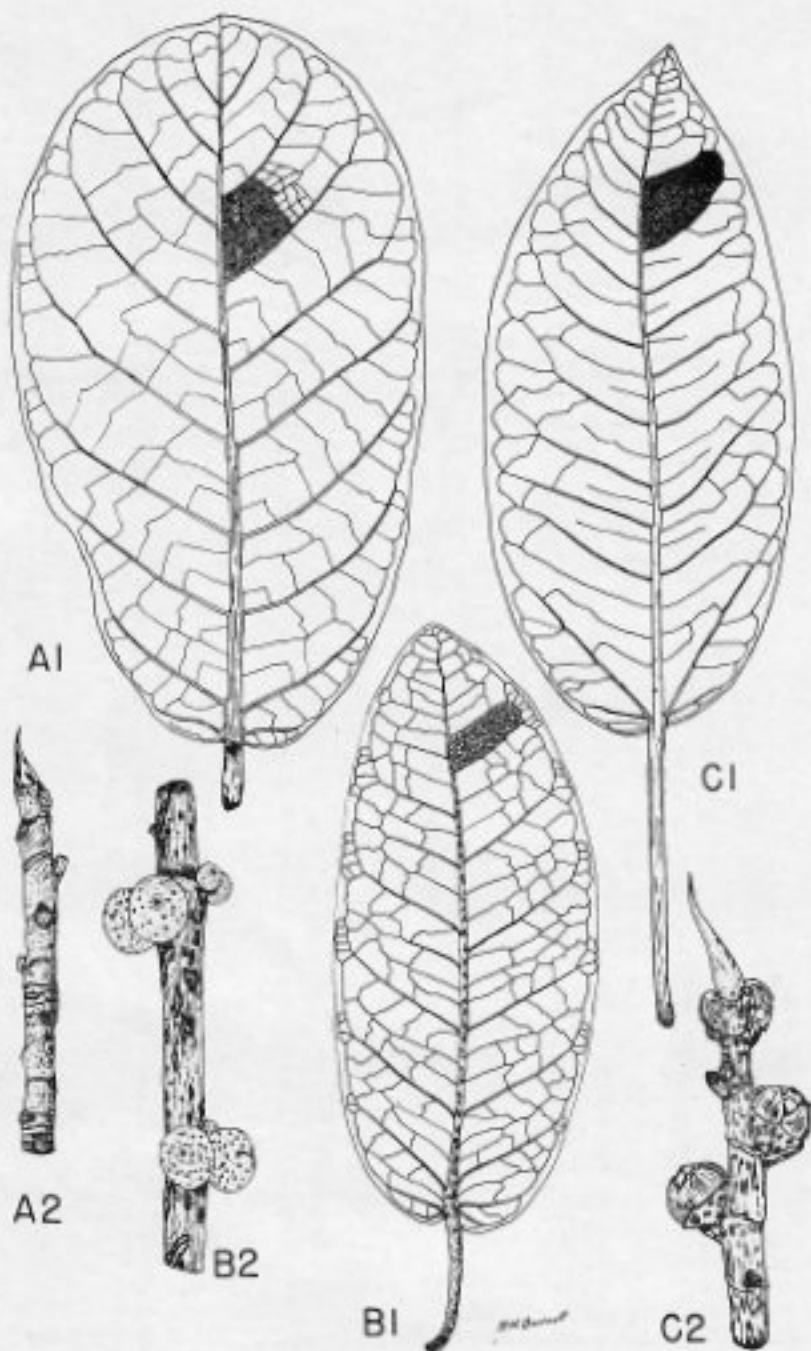


Plate XII. A1-2, *F. urbaniana*; B1-2, *F. thonningii*; C1-2, *F. ovata*.

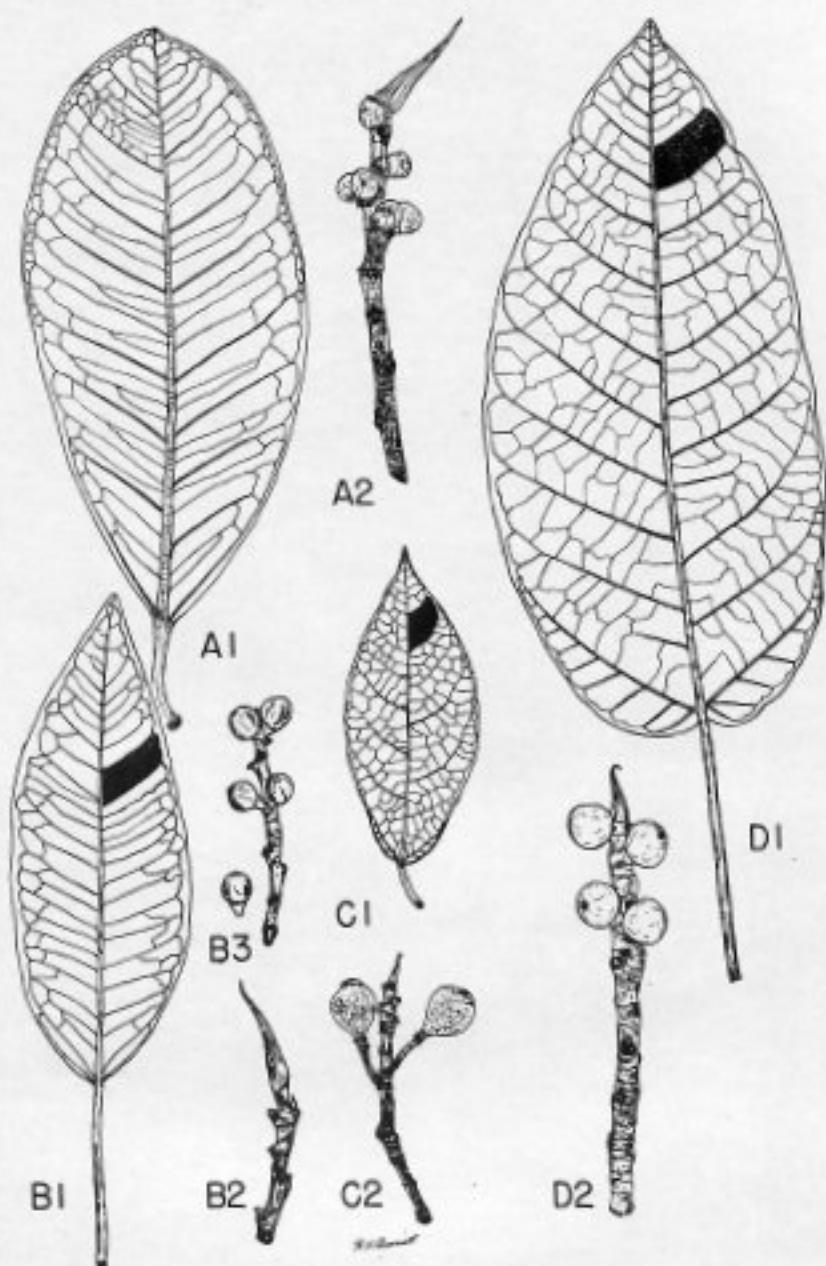


Plate XIII. A1-2, *F. microcarpa* var. *rigo*; B1-3, *F. obliqua* var. *petiolaris*;
 C1-2, *F. erecta*; D1-2, *F. membranacea*.

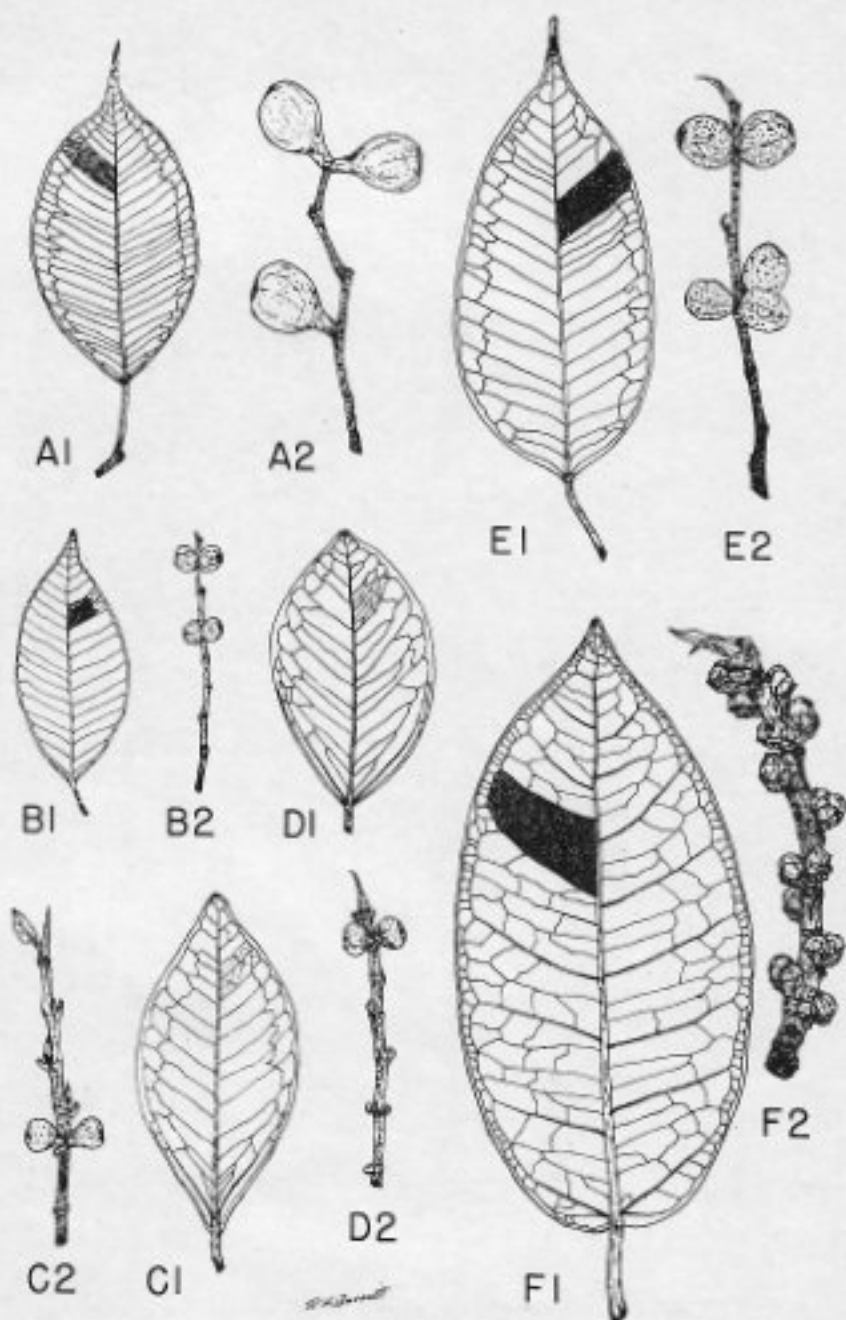


Plate XIV. A1-2, *F. benjamina* var. *comosa*; B1-2, *F. benjamina* "exotica"; C1-2, *F. microcarpa* var. *nitida*; D1-2, *F. microcarpa*; E1-2, *F. benjamina* var. *benjamina*; F1-2, *F. aurea*.

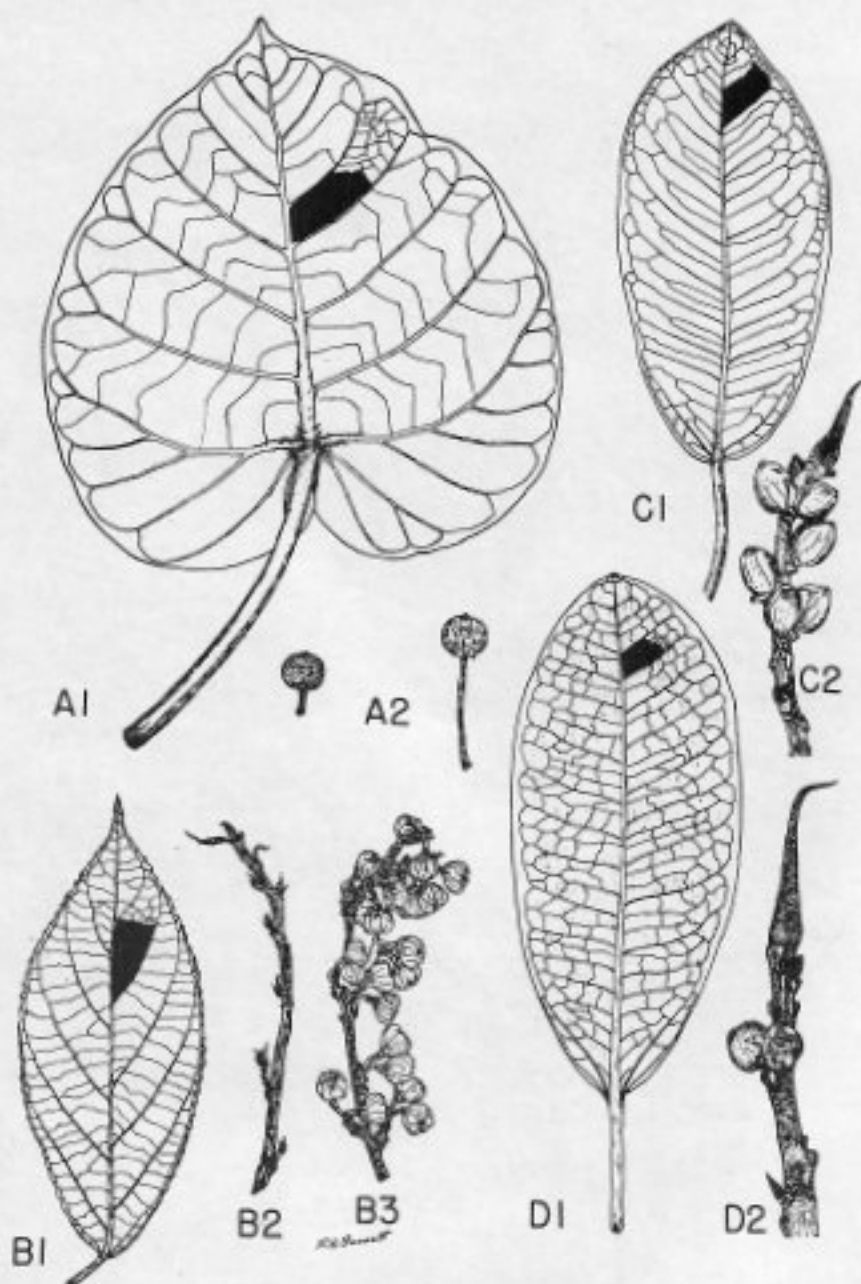


Plate XV. A1-2, *F. petiolaris*; B1-3, *F. ribes*; C1-2, *F. rubiginosa* var. *australis*; D1-2, *F. rubiginosa* var. *pubescens*.

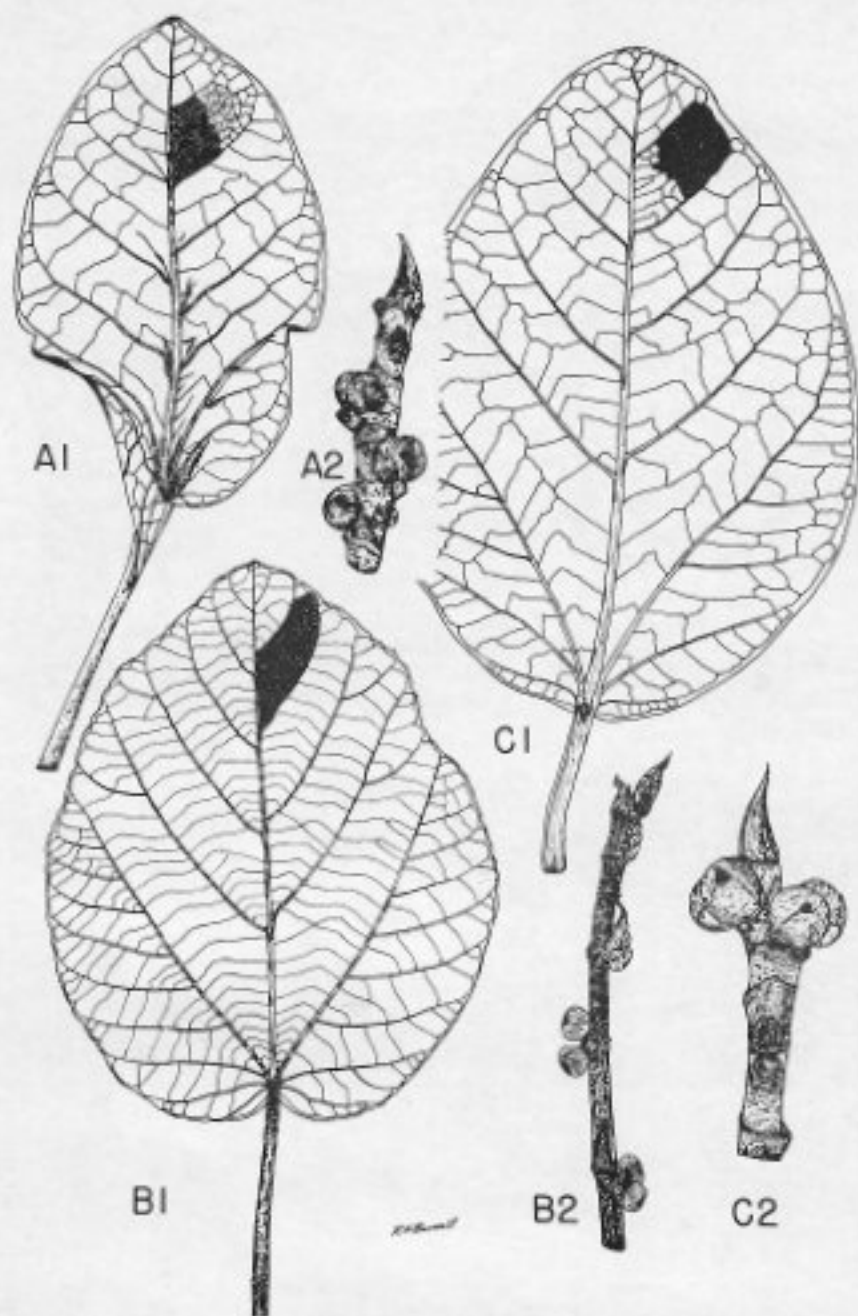


Plate XVI. A1-2, *F. bengalensis* var. *krishnae*; B1-2, *F. cotinifolia*;
C1-2, *F. bengalensis*.

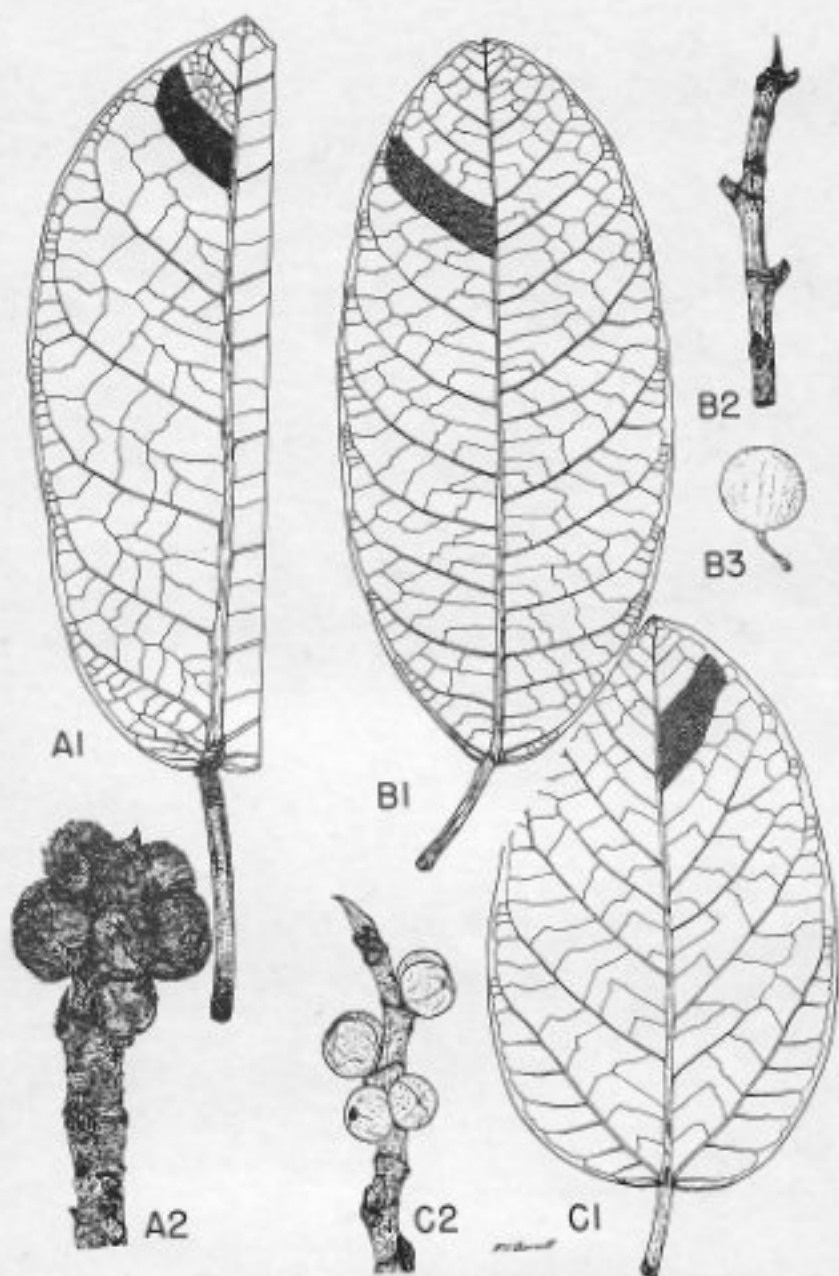


Plate XVII. A1-2, *F. nekbudu*; B1-3, *F. collosa*; C1-2, *F. altissima*.

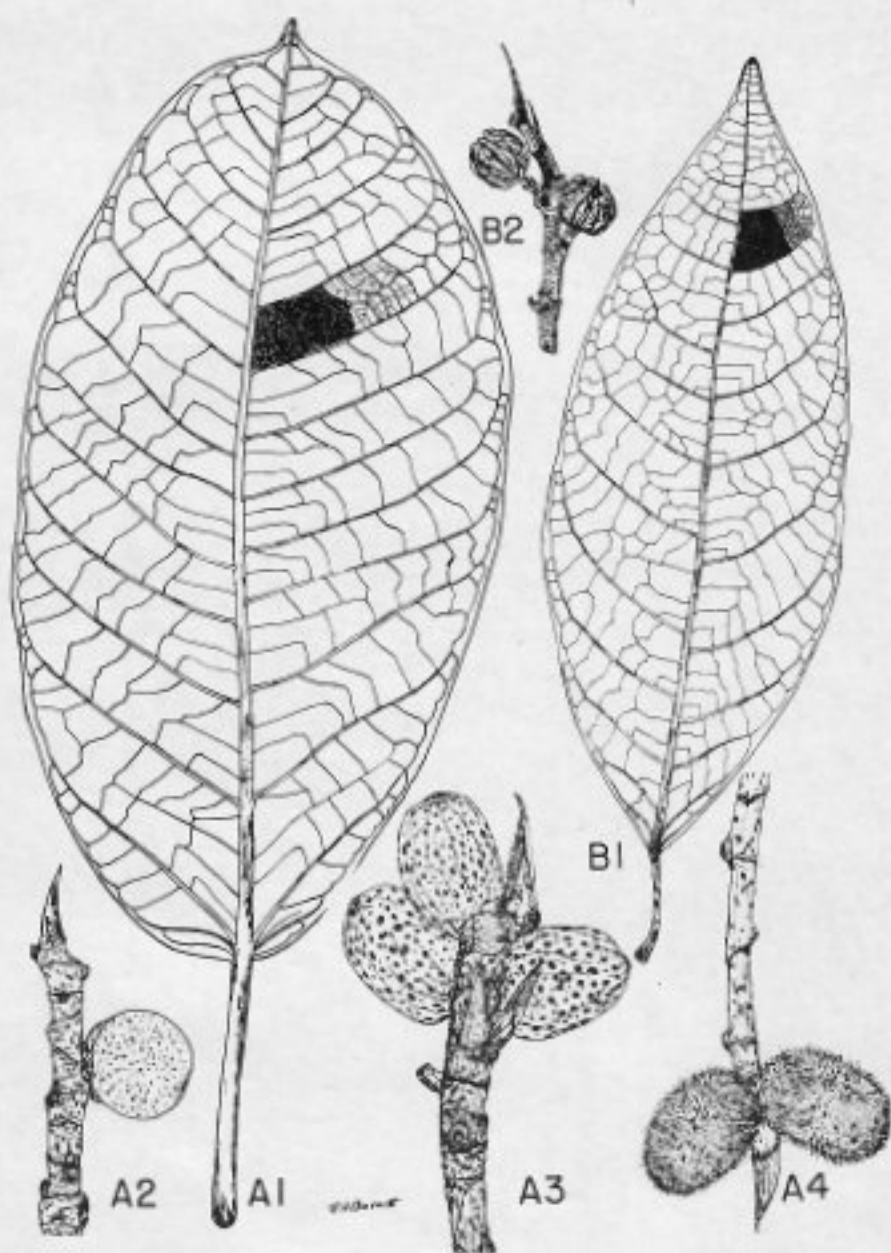


Plate XVIII. A1-3, *F. mysorensis* var. *subrepanda*; A4, *F. mysorensis* var. *pubescens*; B1-2, *F. hassili*.

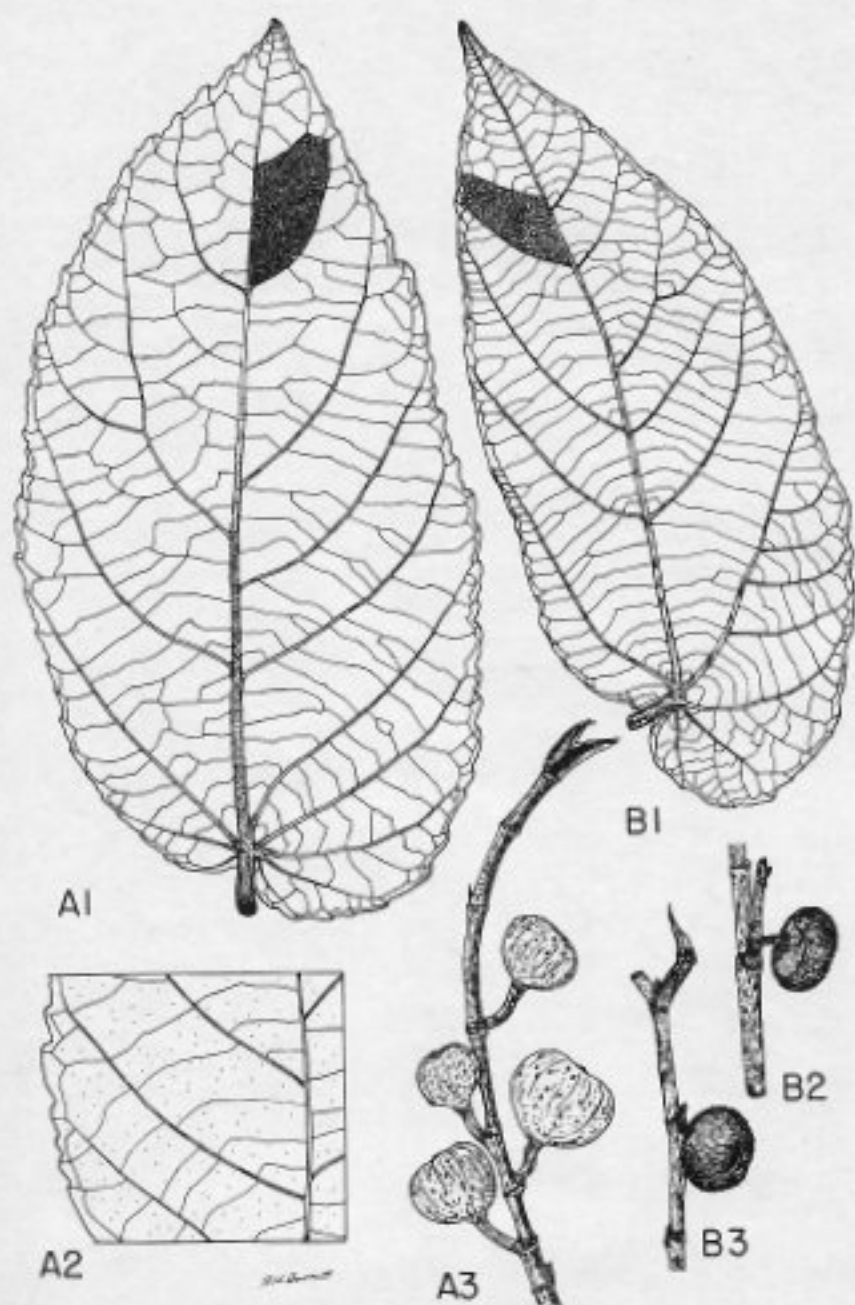


Plate XIX. A1-3, *F. nota*; B1-3, *F. odorata*.

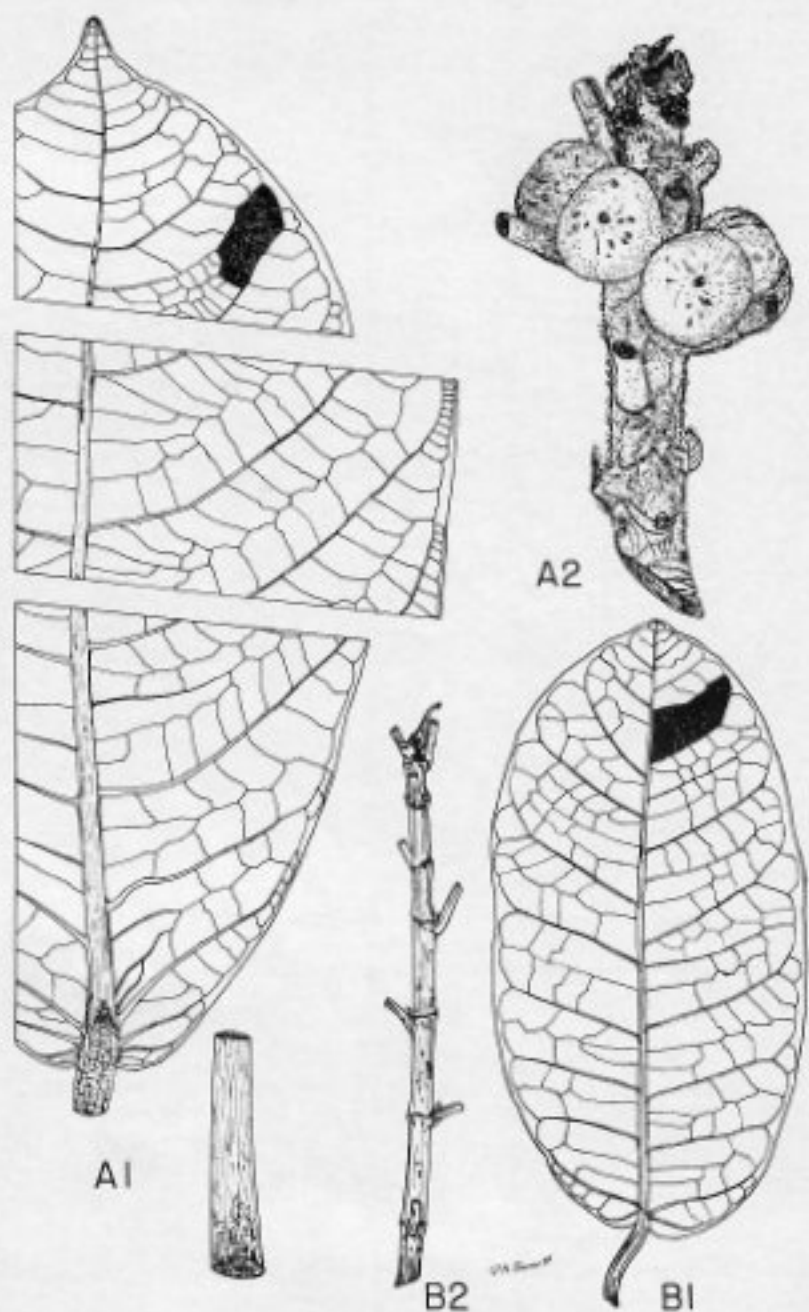


Plate XX. A1-2, *F. afzelii* (leaf blade, 55 cm long; petiole, 15 cm);
B1-2, *F. goldmani*.

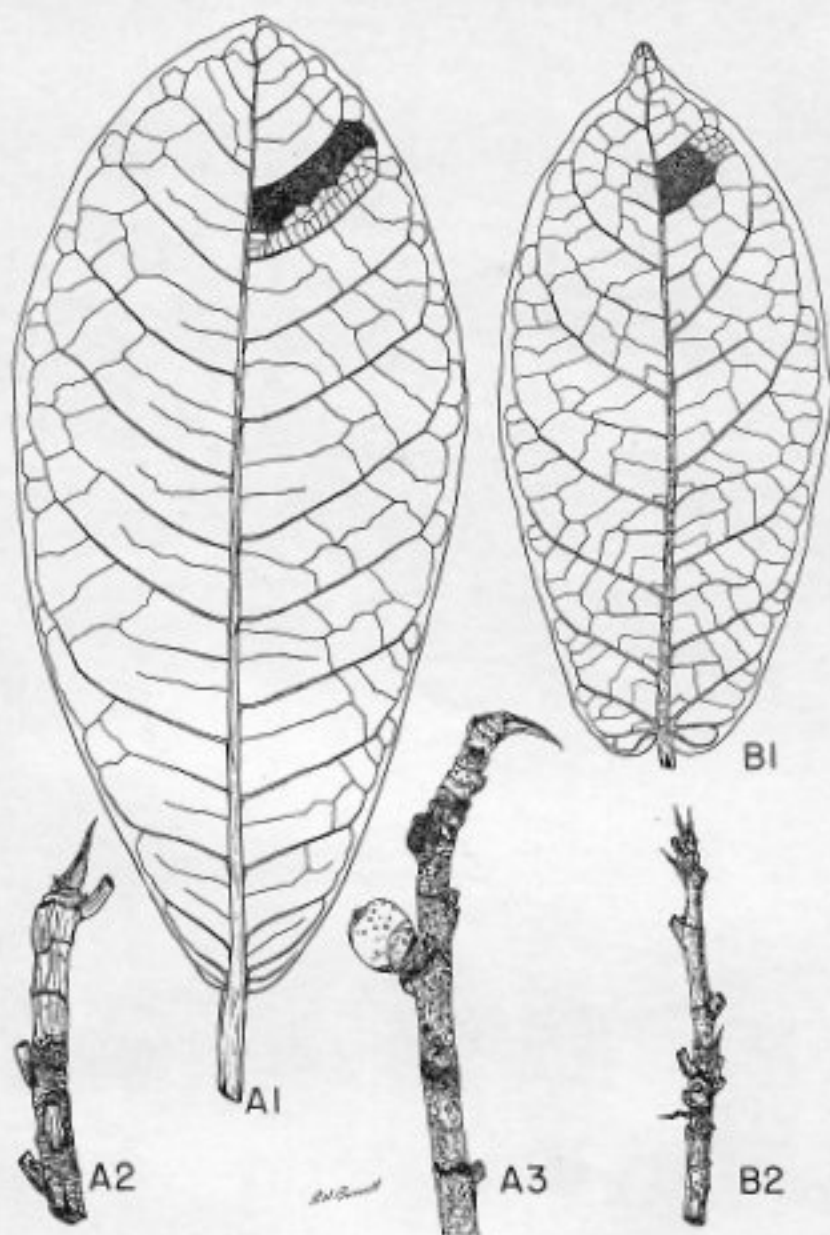


Plate XXI. A1-3, *F. obtusifolia*; B1-2, *F. wildemanniana*.

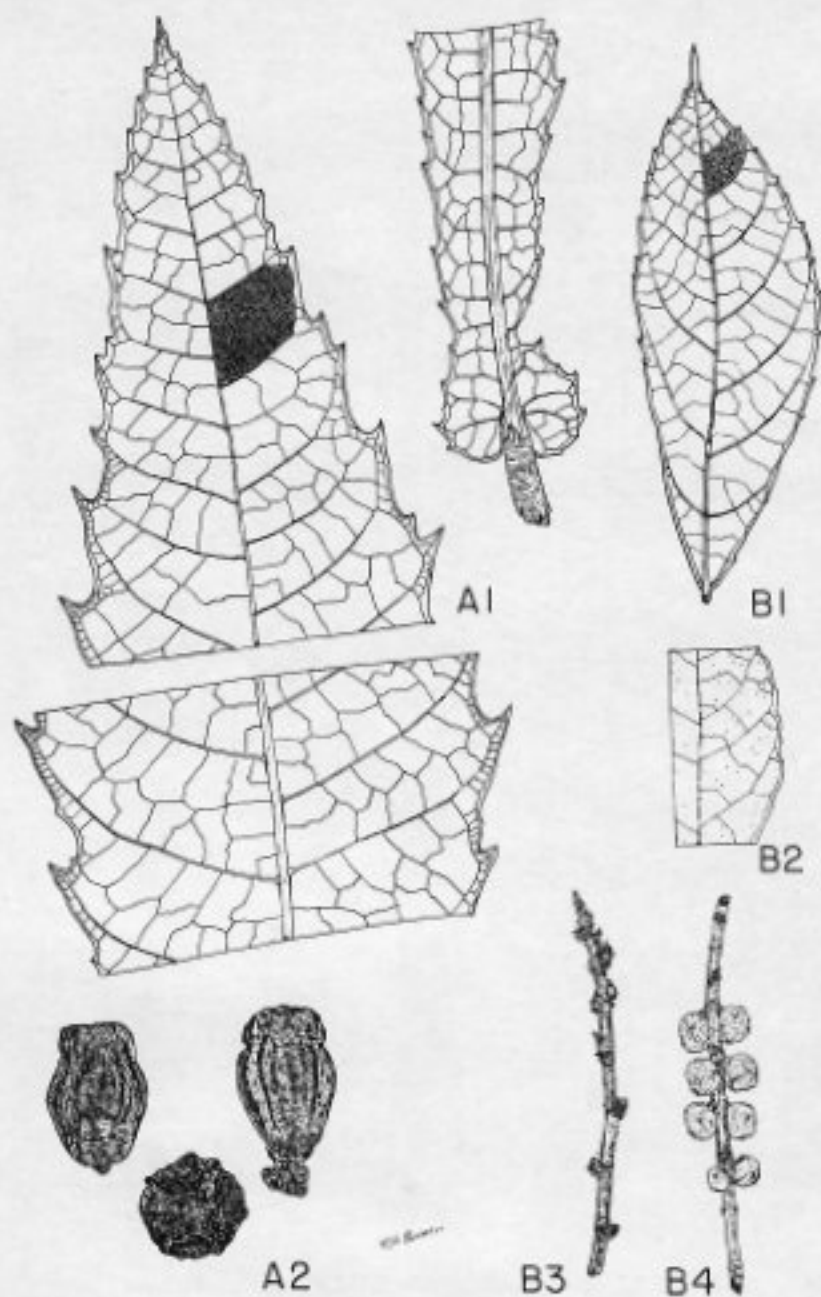


Plate XXII. A1-2, *F. pseudopalma* (leaf blade, 66 cm long); B1-4, *F. urceolaris*.

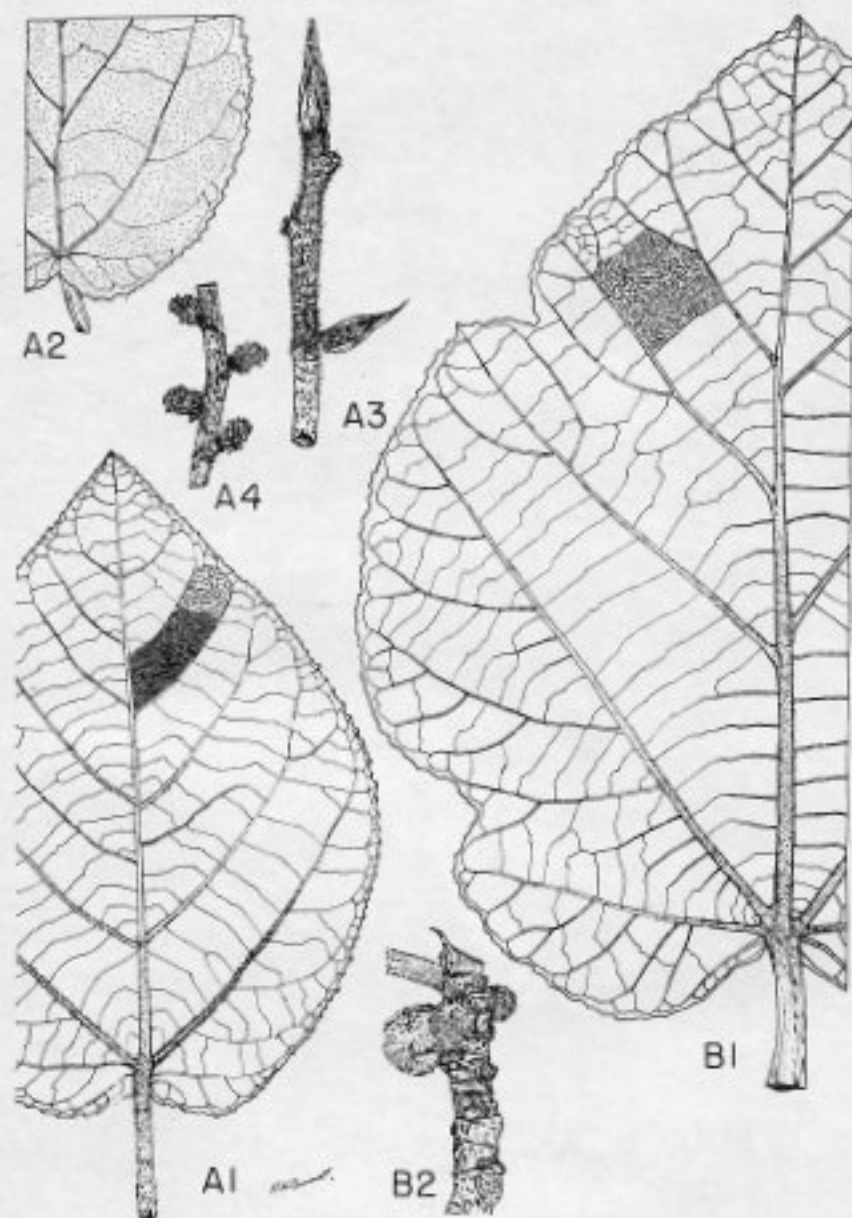


Plate XXIII. A1-4, *F. minahassae*; B1-2, *F. fulva*.

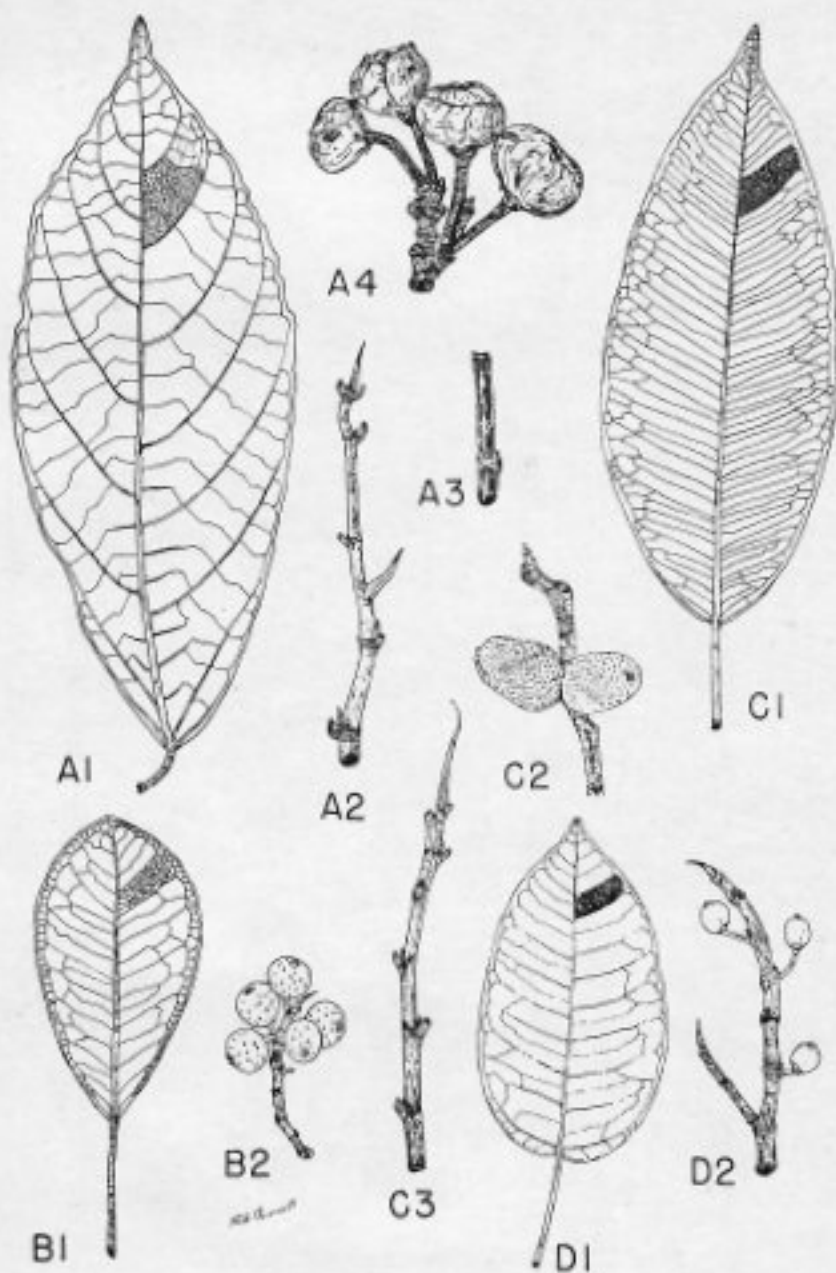


Plate XXIV. A1-4, *F. congesta*; B1-2, *F. natalensis (volkensis)*;
C1-3, *F. subcordata*; D1-2, *F. citrifolia*.

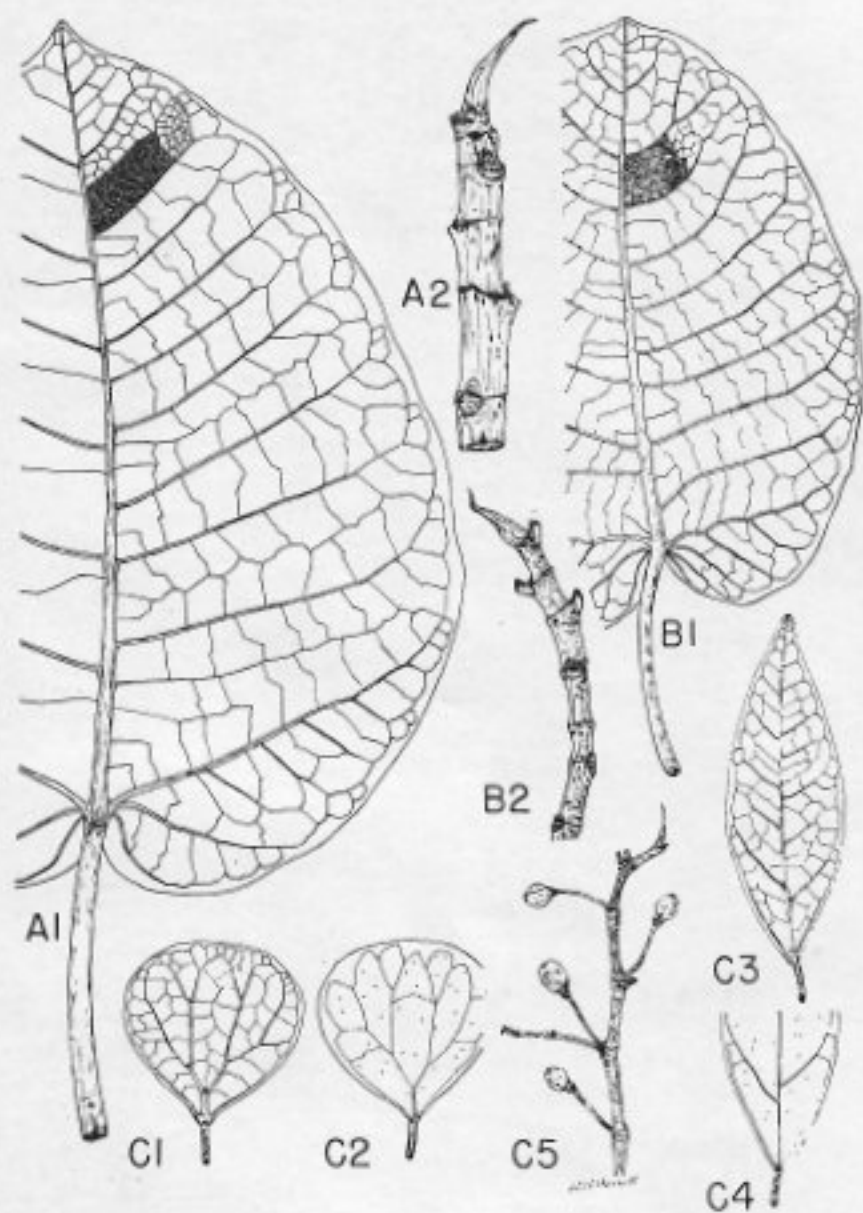


Plate XXV. A1-2, *F. avi-avi*; B1-2, *F. soldanella*; C1-5, *F. deltoidea*.

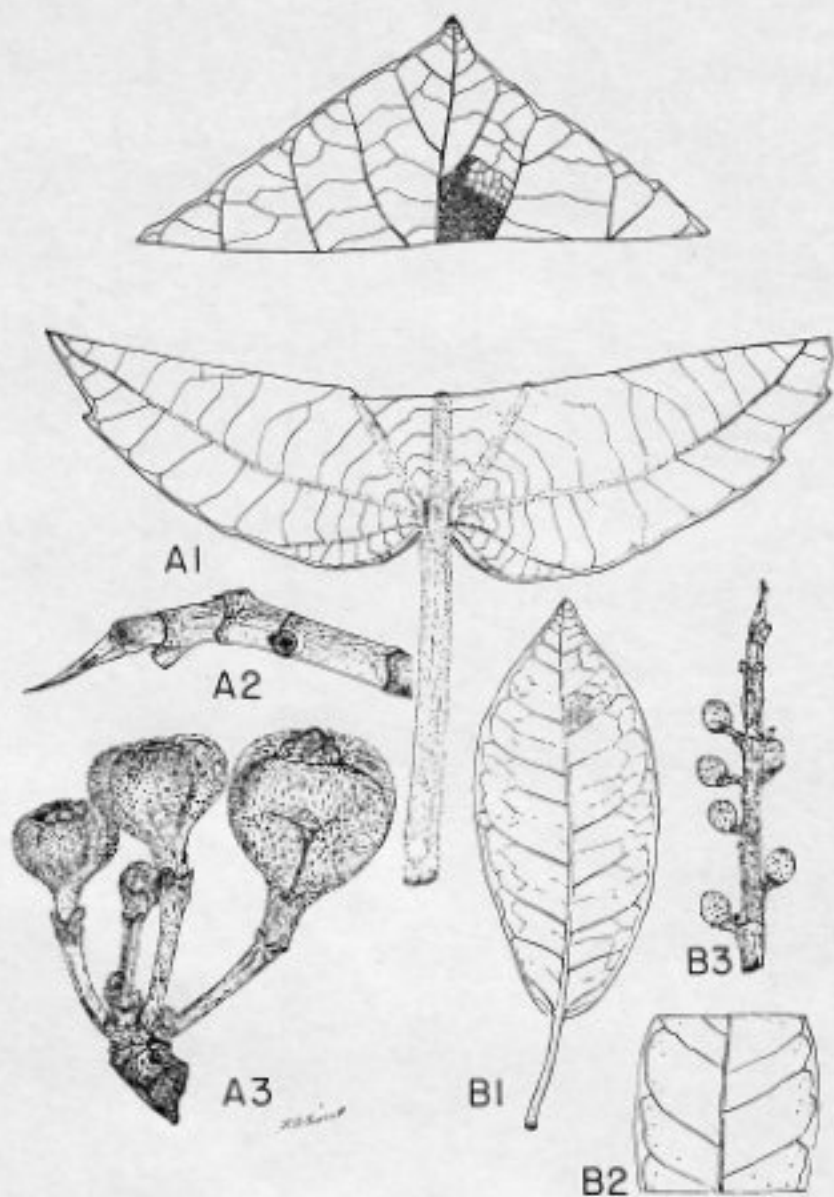


Plate XXVI. A1-3, *F. auriculata* (leaf blade, 33 cm long by 30.5 cm broad);
B1-3, *F. burkei*.

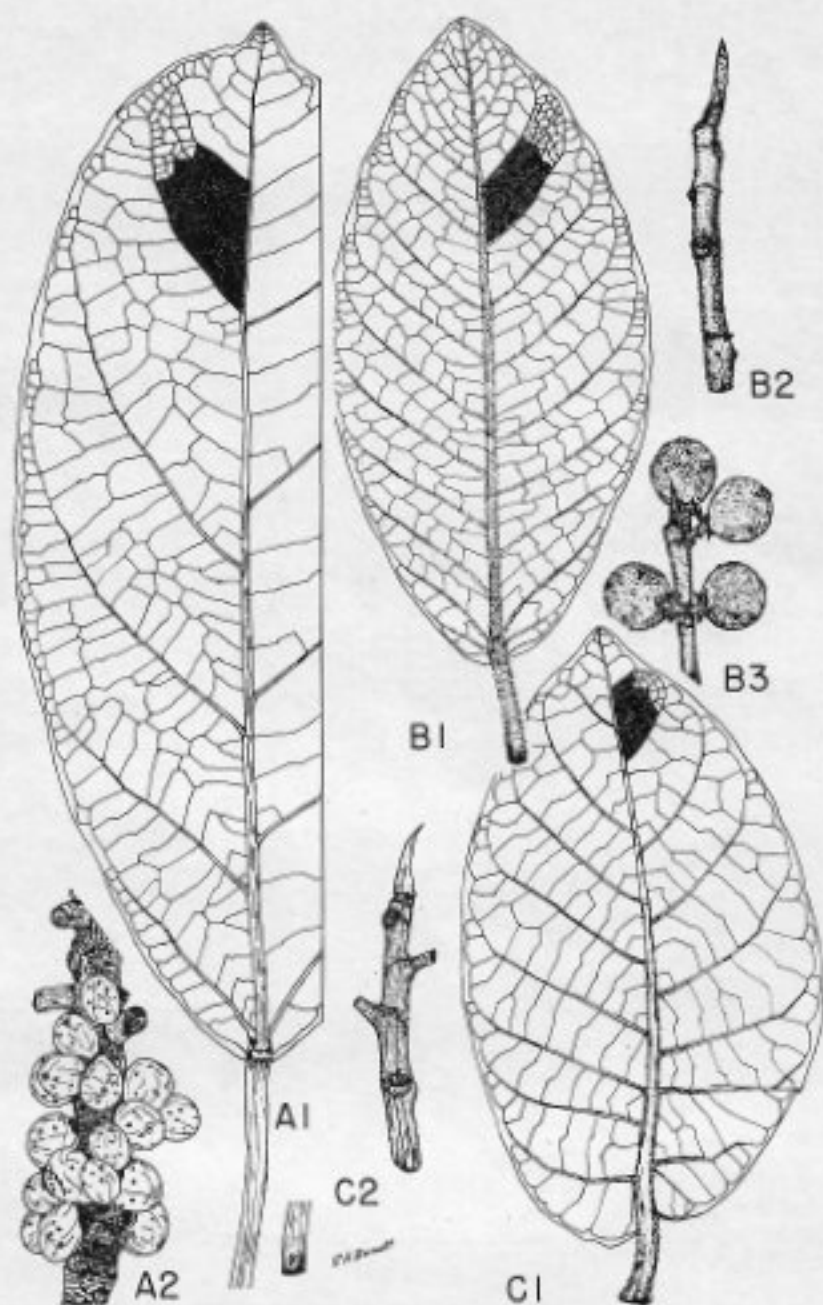


Plate XXVII. A1-2, *F. vogelii*; B1-3, *F. lopathifolia*; C1-2, *F. bussei*.

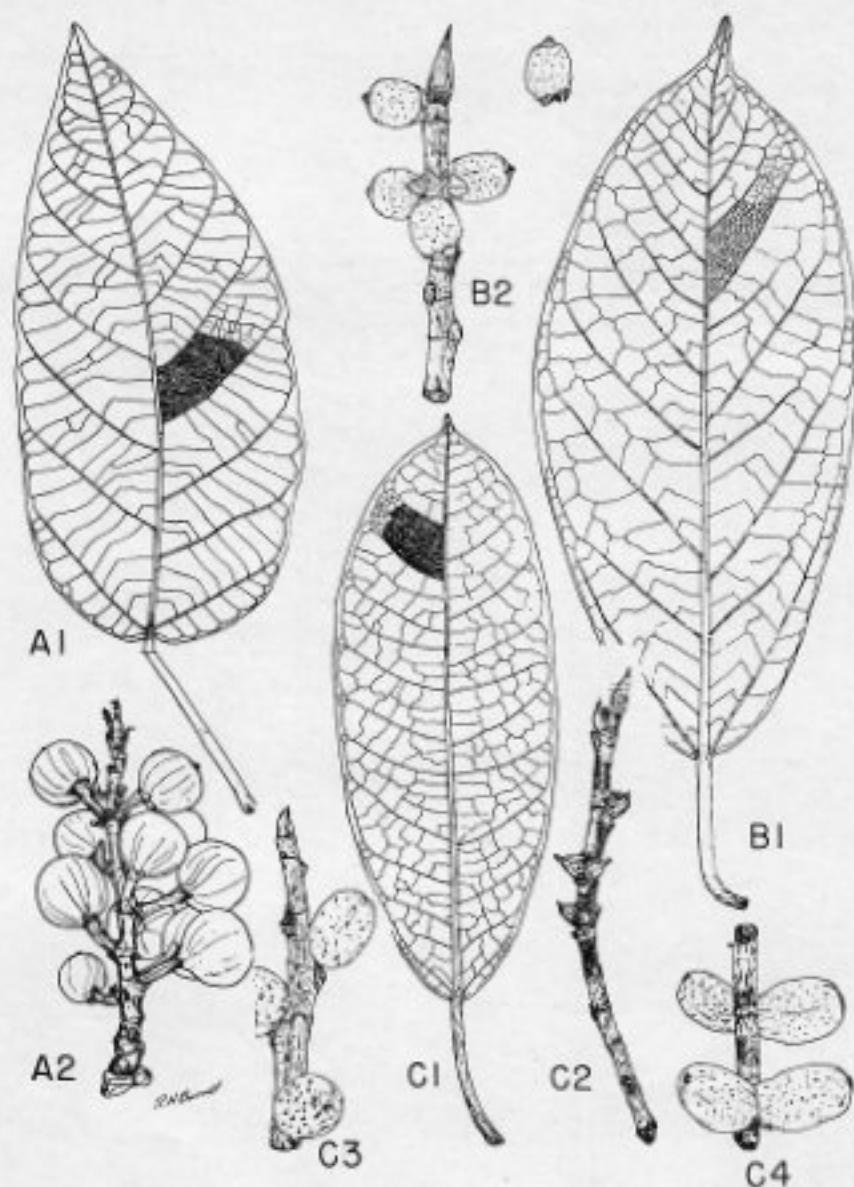


Plate XXVIII. A1-2, *F. racemosa*; B1-2, *F. palauanense*; C1-4, *F. payapa*.

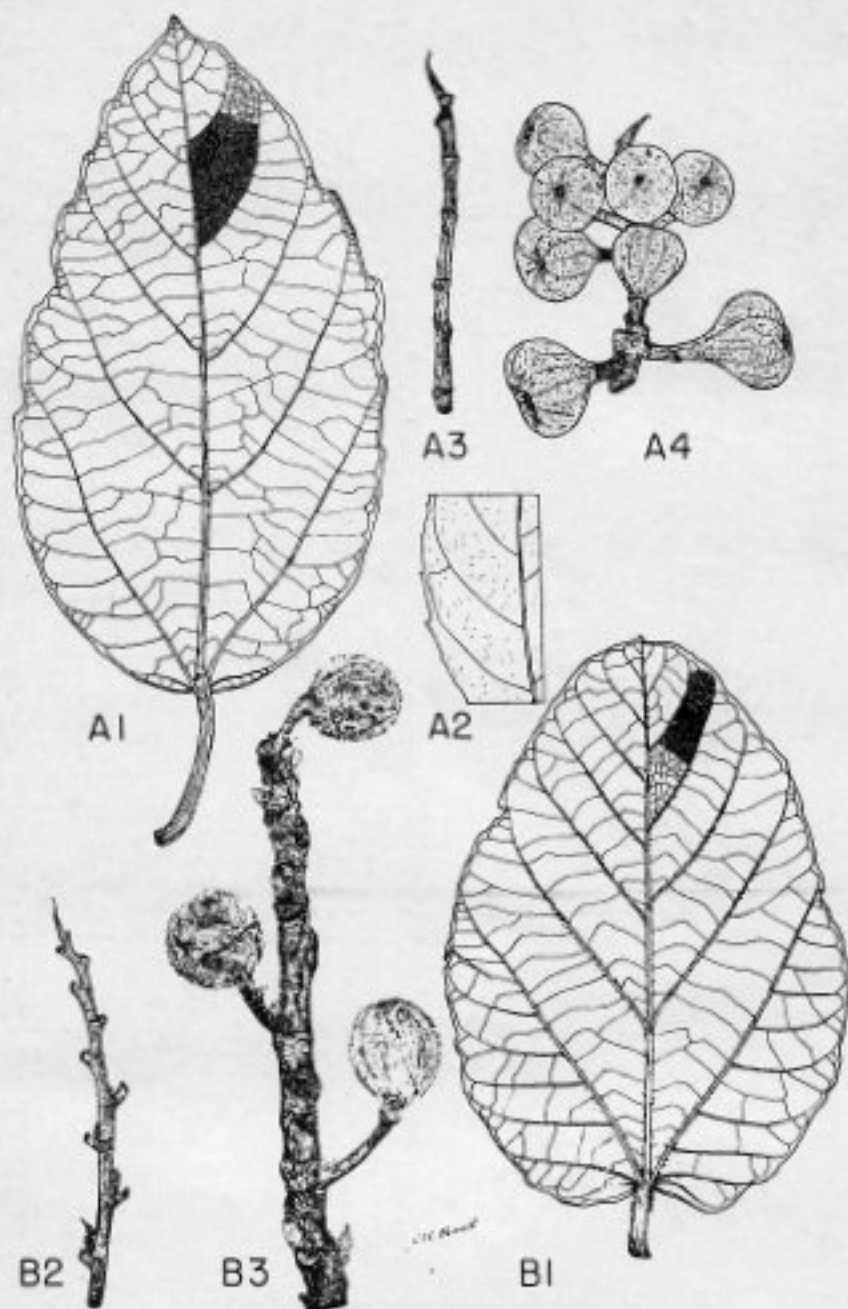


Plate XXIX. A1-4, *F. mallotocarpa*; B1-3, *F. gnaphalocarpa*.

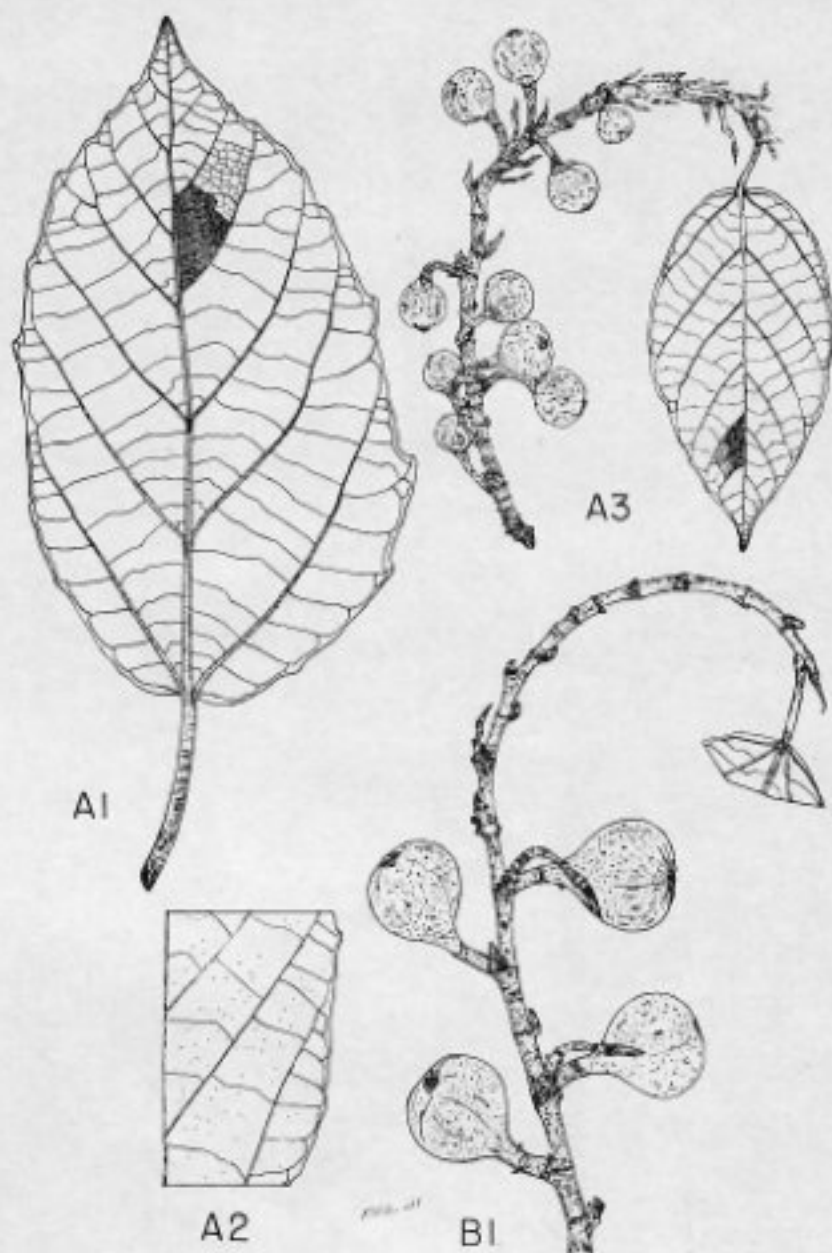


Plate XXX. A1-3, *F. variegata*; B1, *F. mallotocarpa*.

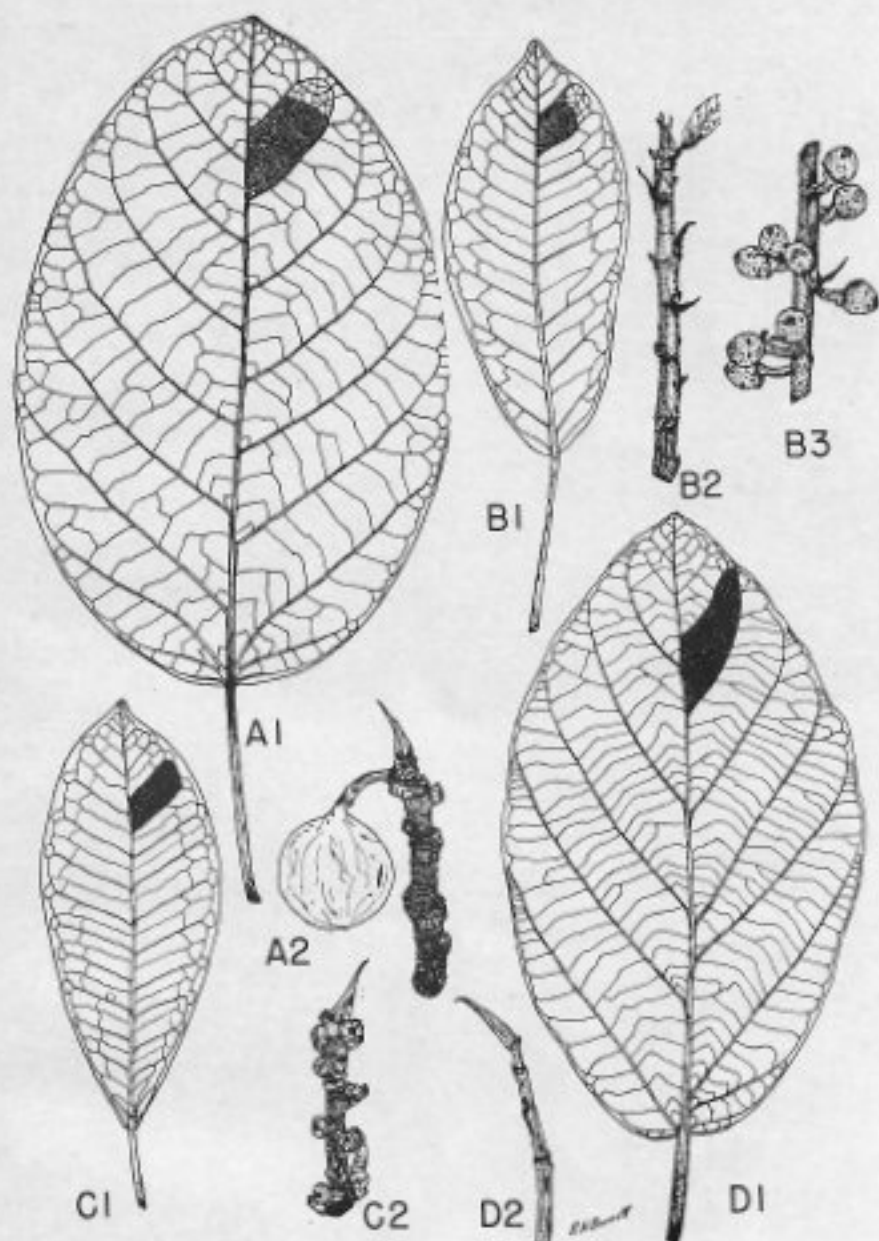


Plate XXXI. A1-2, *F. malunensis*; B1-3, *F. iteophylla*; C1-2, *F. archeri*;
D1-2; *F. coccuifolia* subsp. *sakalavarum*.

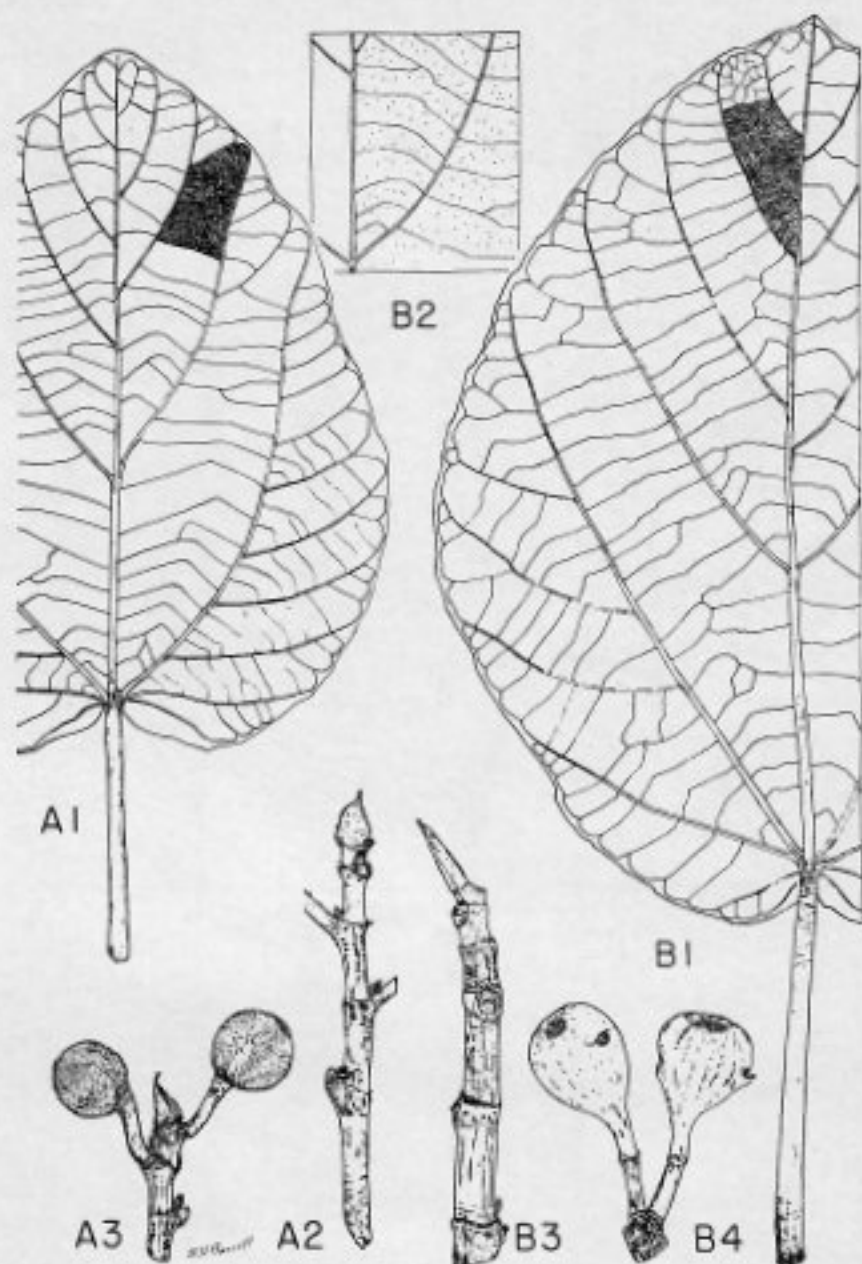


Plate XXXII. A1-3, *F. sycamorus*; B1-4, *F. oligodon*.

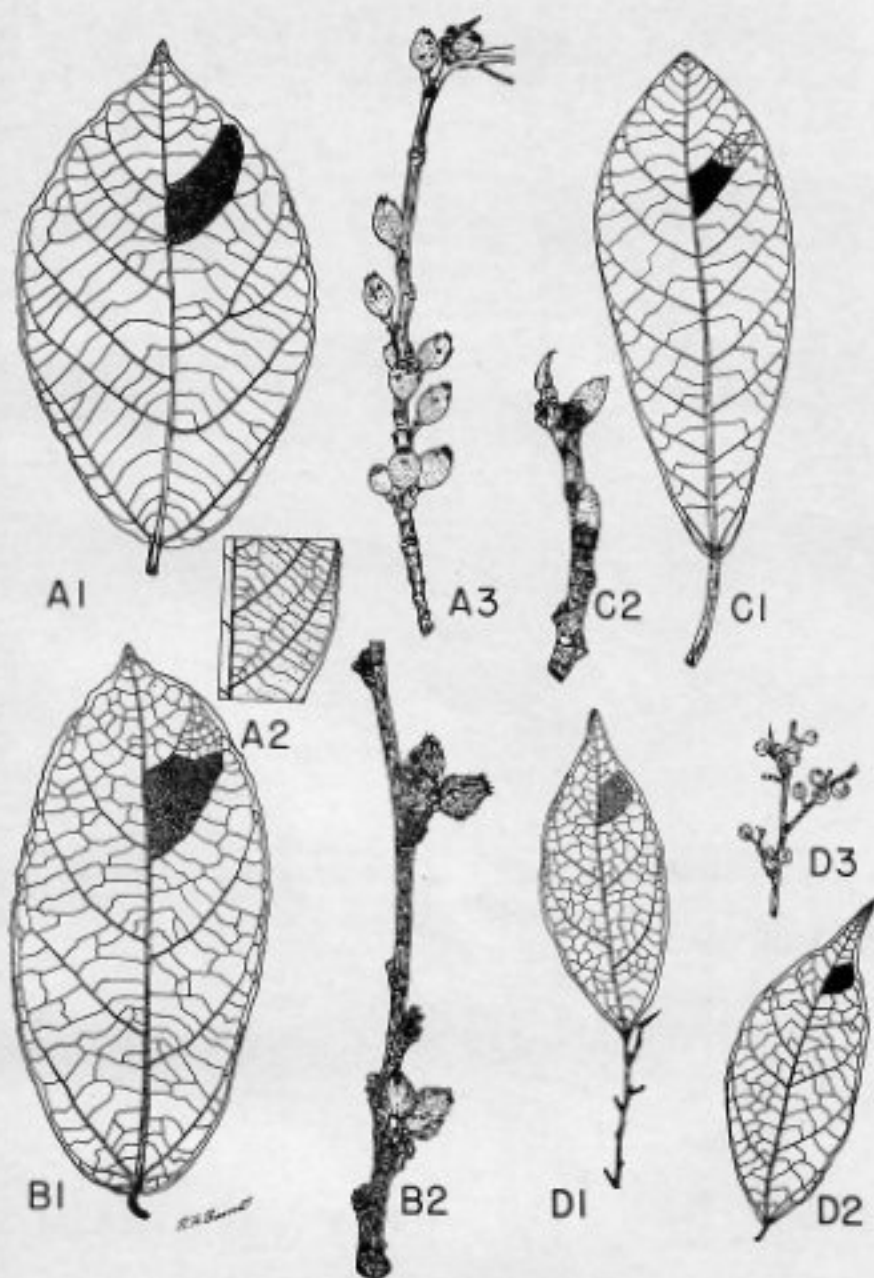


Plate XXXIII. A1-3, *F. coronata* subsp. *stenocarpa*; B1-2, *F. coronata* subsp. *stephanocarpa*; C1-2, *F. acanthocarpa*; D1-3, *F. ampelas*.

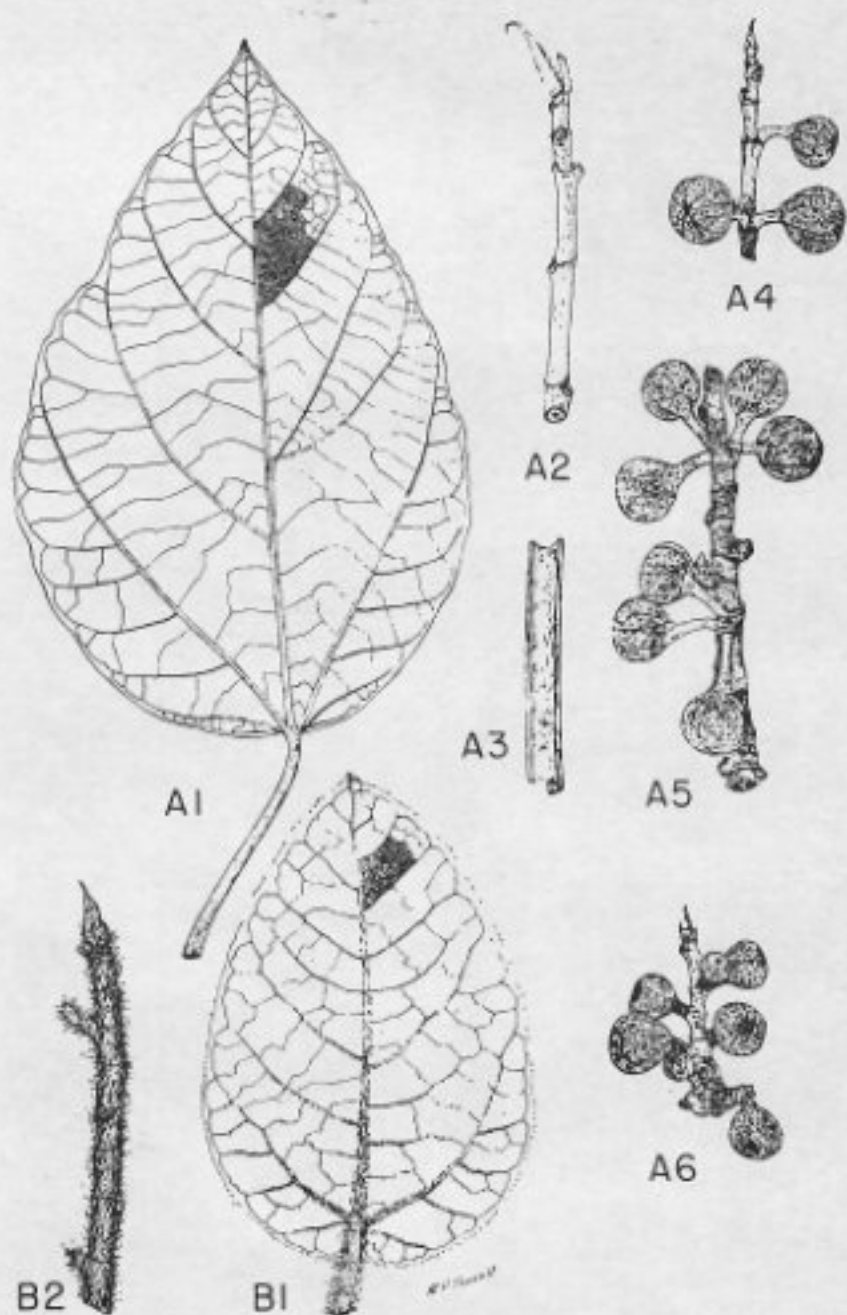


Plate XXXIV. A1-6, *F. capensis*; B1-2, *F. sonderi*.



Plate XXXV. A1-3, *F. hirta*; B1-2, *F. salicifolia*; C1, *F. cumingii*; D1, *F. natalensis*.

INDEX OF SPECIES, VARIETIES, AND SYNONYMS

Note: Since the names listed fall under the genus *Ficus*, the "F." representing that genus is omitted throughout. The specific names are listed alphabetically, uncapitalized. The 108 major descriptions are not arranged alphabetically, but often according to their close relationships. However, each of these has a consecutive species number. In using this index, the species number will serve as a guide for locating the principal description in the text; certain species have numerous page references because they are mentioned throughout the book. Practically every occurrence of a species, variety, or synonym is listed here, whether it is casual or important, including the keys in chapter V, but not the plate section.

- abnormalis* Kurz, var. of *geniculata* Kurz, 193
acampthophylla Miquel, 233
acanthocarpa Léveillé (sp. No. 74), 6, 61, 67, 189
acidula King equals *racemosa* Linné var. *elongata* King, 196
acuminata Roxburgh equals *subulata* Blume, 233, 254, 259, 261
acuminata Wallich equals *heterophylla* Blume. (The synonymy is involved; see the references just preceding.)
adenosperma Miquel, 233
affinis King, var. of *tirens* Aiton, 109
afzelii G. Don ex London (sp. No. 73), 6, 20, 26, 27, 29, 61, 69, 98, 187
agapetoides Diels, 233
aggregata Lamarck, 258
aggregata Vahl equals *microcarpa* Linné (f.), 233
alba Reinwardt ex Blume equals *grossularioides* Burman (f.), 30, 224
albipila (Miquel) King, 233, 241
albo-variegata Hort., var. of *elastica* Roxburgh, 122, 123
allutacea Blume, 233
altissima Blume (sp. No. 89), 5, 22, 23, 28, 30, 36, 40, 47, 48, 49, 61, 64, 69, 116, 177, 200, 205, 249
"amanthocarpa" and *"amanticarpa,"* see under *acanthocarpa*, 189
amazonica Miquel, 233
americana Aublet equals *perforata* Linné, 139, 233
americana Swartz, see under *perforata*, 140
ampelas Burman (f.) (sp. No. 95), 49, 65, 71, 79, 213, 238, 243, 249
ampelas Koenig ex Roxburgh equals *tictoria* Forster (f.) subsp. *parasitica* Willdenow, 213
amplissima J. E. Smith (sp. No. 37), 27, 33, 39, 49, 57, 69, 106, 135, 262
anastomozans (Wallich ex Kurz) Corner, var. of *tictoria* Forster (f.), 93
angustifolia Blume equals *obscura* Blume, 35, 233, 241, 253
angustifolia Roxburgh equals *neriosa* Heyne ex Roth, 233, 241, 252
annulata Blume, 234
antiochiensis Hayata equals *ruficanalis* Merrill, 234
anselmiantha Martius equals *insipida* Willdenow, 111, 112. See also, under *sundaica* Blume, 121.
antithetophylla Steudel ex Richard, see under *capreifolia* Delile, 237
apiocarpa Miquel, 8, 25, 34
apoensis Elmer, 15
aquatica Koenig, 75
"arbor conciliorum" Rumphius equals *rumphii* Blume, 102
arbores Elmer, var. of *radix* Miquel, 251
arbutifolia Link equals *perusa* Linné (f.), 126
arbutifolia Miquel equals *keratingii* Warburg, 98
archeri Standley (sp. No. 60), 27, 60, 68, 170
ardisioides Warburg, 234
arisanensis Hayata, var. of *foveolata* Wallich, 245
arnottiana Miquel, 234
arnottiana Warburg, 234
aspera Forster (f.) (sp. No. 11), 2, 15, 29, 34, 36, 54, 64, 70, 85, 217, 237, 244
aspera F. M. Bailey or Hort. probably equals *coronata* Spin, 217
aspera nota Blanco equals *nota* Merrill, 211
asperifolia Miquel, 49, 50, 215
asperissima Roxburgh equals *exasperata* Vahl, 29, 49, 50, 93, 234, 244
atrox Hartweg, 48
aurantiaca Griffith var. *parvifolia* Corner (sp. No. 5), 5, 8, 24, 25, 29, 53, 67, 77, 262
aurata Miquel, 235
aurea Guilfoyle, var. of *macrophylla* Desfontaines ex Persoon, 115
aurea Hort., var. of *elastica* Roxburgh, 122
aurea Nuttall (sp. No. 43), 6, 14, 15, 20, 21, 49, 57, 62, 68, 69, 142, 163, 164, 192
aureo-marginata Hort., var. of *elastica* Roxburgh, 122
auriculata Loureiro (sp. No. 104), 3, 5, 6, 10, 11, 12, 14, 15, 16, 26, 29, 32, 34, 36, 38, 44, 45, 54, 64, 66, 67, 173, 225, 227
australis F. M. Bailey, var. of *hederacea* Roxburgh, 74
australis Willdenow and Hort., var. of *rubiginosa* Desfontaines ex Ventenat, 58, 60, 138, 167
au-oui Chapeller ex Bojer (sp. No. 49), 31, 39, 58, 71, 154
awkeotsang Makino, var. of *pumila* Linné, 49, 76
baileyana Domin equals *macrophylla* Desfontaines ex Persoon var. *pubescens* F. M. Bailey, 115. See also, under *obliqua* Forster (f.), 137.
bailei A. Chevalier, var. of *afzelii* G. Don ex London, 188
bakeri Elmer, 8
bambusaefolia Seeman, 15, 235
barbata Wallich equals *villosa* Blume, 72
baroni Baker, 235

- barteri* Sprague, 235
battieri (author not stated), 235
beccariana King, var. of *sundaica* Blume (see under *korthalsii* Miquel), 120, 249
beecheana King, var. of *erecta* Thunberg, 165, 166
belgica Hort., subvar. of *elastica* Roxburgh var. *decora* Hort., 123
bellingeri C. Moore equals *watkinsiana* F. M. Bailey, 118
bengalensis Linné (sp. No. 65), 5, 6, 20, 22, 23, 28, 30, 34, 40, 43, 45, 49, 60, 61, 63, 70, 120, 121, 128, 176, 206, 207, 238, 239
benjamina Linné (sp. No. 34), 5, 6, 19, 22, 26 through 29, 36, 37, 40, 42, 43, 46 through 49, 51, 56, 57, 68, 69, 106, 119, 120, 121, 128, 135, 146, 147, 148, 162, 241, 242, 249, 255, 258
bennetti Seeman equals *habrophylla* G. Bennett, 235, 243, 246
bineradjiki Miquel, 235
blepharostoma Warburg equals *ulmifolia* Lamorek, 91
bonatii Léveillé equals *nikoua* Bureau, 78
bonplandiana Miquel equals *obtusifolia* HBK., 192, 193
botryocarpa Miquel, 235, 240, 251
bougainvillei Corner, var. of *edelfeltii* King, 243
brachypoda Hutchinson, 43, 235
brachypoda Miquel equals *eugenioides* Mueller, 235
bracteata Corner, var. of *benjamina* Linné, 128
bracteata Wallich ex Miquel (per King), 28
brasiliensis Link, 235
brazili Robert Brown, 103, 235
brazili Summerhayes equals *pachystemon* Warburg, 103, 235
brevifolia Nuttall equals *citrifolia* P. Miller, 162, 163, 164
brittonii Boldingh, 164, 235
burkei Miquel (sp. No. 80), 62, 71, 82, 133, 194, 255
burkhillii Ridley, 7
burz-dzeyi Hutchinson equals *natalensis* Mildbraed and Burret (not Hochstetter), 138
bussei Warburg (sp. No. 66), 30, 61, 180
buxifolia Wildeman, 236
cabur B. Ham. equals *sarmentosa* B. Ham. ex J. E. Smith, 260
caffra Miquel equals *ingens* Miquel, 248
callicarpa Miquel equals *aurantiaca* Griffith, 8, 24, 25, 77
calophylla Blume, 240
callosa Willdenow (sp. No. 88), 63, 68, 204, 205, 256
calophylloides Elmer equals *subcordata* Blume, 33, 112, 113
camarinensis Merrill equals *cordatata* Merrill, 236
camellia Traubt equals *microcarpa* Linné (f.) var. *nitida* Thunberg, 149
canoni (Bull.) N. E. Brown equals *aspera* Forster (f.), 34, 86, 236
capensis Thunberg (sp. No. 108), 9, 10, 11, 44, 66, 67, 212, 231, 235
caprifolia Delile, 237
carica Linné. The Common Fig. Mentioned throughout, but not described, except in the key on page 64.
carvosa Hort., 237
carolinensis Warburg, 134
carri Corner, 8, 12, 34
casearia Mueller ex Benthum equals *septica* Burman (l.), 88, 237
cassidyana Elmer, 237
catalpaefolia Miquel equals *kerstingii* Warburg, 98
cautaipi Elmer, 34
caudata Wallich, 245
caudatifolia Warburg equals *heteropleura* Blume, 237
cauliflora Corner, var. of *septica* Burman (l.), 87
caulobotrya Miquel, 238. (Possibly a "phony" specimen. See also, pages 22 and 264.)
caulocarpa King, var. of *infectaria* Roxburgh (= *virens* Aiton), 106, 238
caulocarpa Miquel, 19, 26, 33, 106, 238, 264
cavroni Carrière, 238
celebensis Corner (sp. No. 22), 55, 65, 68, 70, 103, 192, 235, 252
cerasiformis Desfontaines equals *parietalis* Blume and/or *acuminata* B. Ham., 233, 254
cestrifolia Schott equals *monckii* Hassler, 110
chartacea Wallich, 48
chamieri Hort., possibly a form of *bengalensis* Linné, 238
chlamydocarpa Warburg, 239
chlorocarpa Benthum, var. of *variegata* Blume, 229
chrysoarpa Reinwardt equals *fulva* Reinwardt ex Blume, 223, 239
chrysocoma (a variety), see under *drupacea* Thunberg, 184
chrysolepis Miquel, 204
citrifolia P. Miller (sp. No. 57), 14, 31, 49, 59, 70, 126, 140, 142, 149, 162, 165, 236, 258
"clarkeana" King (a "phony" specimen), 22. See others on pages 238 and 264.
clavata Wallich equals *subcincta* J. E. Smith, 239
clementis Merrill, var. of *crassiramea* Miquel, 240
clausoides Miquel equals *calophylla* Blume, 240
cochilifolia Baker (sp. No. 107), 36, 39, 49, 66, 230
collina (author not stated), 240
colaxea Mueller equals *albipila* (Miquel) King, 233
columnaris Moore and Mueller, var. of *macrophylla* Desfontaines ex Persoon, 56, 58, 115, 117, 118
combii Warburg equals *trigonata* Linné, 201, 202
comosa Roxburgh, var. of *benjamina* Linné, 5, 27, 57, 68, 128, 130, 131, 132
conciusa Miquel, var. of *virens* Aiton (given by Corner as a species), 109
confusa Elmer equals *subulata* Blume, 255
congesta Léveillé and Vaniot, 83
congesta Roxburgh (sp. No. 9), 29, 34, 54, 64, 67, 83

- conglomerata* Roxburgh, var. of *semicordata* B. Ham., 12, 89
- conora* King equals *botryocarpa* Miquel, 235, 240, 251
- consociata* Blume, 47, 48, 240
- cooperi* Hort. ex Regel equals *granatum* Forster (f.), 240
- copiosa* Steudel, 240, 243, 255
- cordata* Thunberg, 191, 241, 248
- cordatula* Merrill, 236
- cordifolia* Blume equals *variegata* Blume, 229, 233, 241
- cordifolia* Roxburgh equals *rumphii* Blume, 22, 102, 241
- coriaces* Dryand, 241
- coronata* Spin. (sp. No. 98), 6, 7, 29, 36, 48, 49, 54, 65, 70, 85, 212, 217
- costaricensis* (Liebman) Miquel (sp. No. 52), 40, 58, 156, 200
- costulifolia* HBK. (sp. No. 64), 6, 15, 20, 25, 27, 28, 32, 44, 45, 47, 60, 62, 68, 156, 175, 199
- cotonnefolia* Vahl, see under *mysorensis*, 186
- cragii* Noble and Merkel, var. of *elastica* Roxburgh, 123
- crassinervis* (author not stated), var. of *benjamina* Linné, 130
- crassinervis* Combs (not Willdenow) equals *combsii* Warburg [*trigonata* Linné], 201
- crassinervis* Desfontaines ex Willdenow equals *trigonata* Linné, 201
- crassiramea* (Miquel) King, var. of *procera* Reinwardt ex Blume, 240, 256
- crassiuscula* Warburg equals *luspida* Willdenow, 32, 111
- craterostoma* (author not stated), see under *natalensis*, 138
- cremata* (author not stated) equals *callosa* Willdenow, 205
- cumingii* Miquel (sp. No. 10), 15, 26, 29, 30, 54, 70, 71, 84, 91, 104, 240, 255
- cunea* or *cunia* B. Ham. equals *semicordata* B. Ham., 7, 10, 34, 44, 48, 49, 89, 90, 91
- cunia* B. Ham. (a fossil species), 89
- cunninghamii* Miquel equals *virens* Alton, 106
- cuspidata* Reinwardt equals *sinuata* Thunberg, 233, 241, 243, 259. (See by other authors, 241.)
- cuspidato-caudata* Hayata equals *benjamina* Linné, 241
- cuspidifera* King, var. of *tinctoria* Forster (f.), 93
- cyathistipula* Warburg, 242
- cyathistipuloides* Wildeman, 242
- cydoniaefolia* (author not stated) equals *parietalis* Blume, 19
- daemona* Vahl equals *hispida* Linné (f.), 12, 81
- damiit* Gagnepain equals *rumphii* Blume, 43
- dealbata* Hort., 242
- decussata* Miquel equals *virgata* Reinwardt ex Blume, 255
- decussata* Steudel possibly equals *virgata* Reinwardt ex Blume (see under *philippinensis*), 255
- decora* Hort., var. of *elastica* Roxburgh, iv, 3, 31, 37, 38, 39, 56, 123, 124, 125
- deladekana* (Miquel) A. Richard equals *iteo-phylla* Miquel, 133. See also, *natalensis*, 138.
- deltoides* Jack (sp. No. 45), 2, 13, 15, 34, 57, 58, 70, 145, 253
- dens-echini* Corner, 26
- denticulata* Vahl equals *montana* Burman (f.), 80
- denticulata* Willdenow, 75
- diformis* Lamarck equals *ulmifolia* Lamarck, 91
- diospyrifolia* (per *Kew Index*), 157
- diphylla* Wallich equals *fastuosa* Blume, 244
- discifera* Warburg, 97
- diversifolia* Blume equals *deltoides* Jack, 34, 145, 146
- doescheri* Hort., var. of *elastica* Roxburgh, 122, 123
- doliaria* Martins, 27, 30, 37, 46, 49, 242
- drupacea* Thunberg (sp. No. 71), 61, 184, 186, 189
- dryepondiana* Gentil (sp. No. 13), 34, 54, 65, 88, 219
- dubia* Wallich, 5, 39, 242
- dumosa* King, var. of *hirta* Vahl, 223
- dusenii* Warburg (sp. No. 76), 47, 62, 191
- eburnea* Hort. equals *septica* Burman (f.), 87
- edelfeldii* King, 48, 242
- edulis* Bureau equals *lobrophylla* G. Bennett, 235, 243, 246
- ectrelidiata* Hort., 243
- ekretoides* Mueller ex Bentham equals *variegata* Blume, 229, 240, 241, 243
- elastica* Roxburgh (sp. No. 32), iv, 3, 6, 12, 15, 19, 20, 23, 24, 25, 27, 28, 31, 32, 34 through 40, 45, 46, 49, 54, 55, 56, 60, 112, 114, 119, 122, 145, 158, 170, 177, 238, 239, 249
- ellipsoidea* Chien and Cheng, var. of *pumila* Linné, 75
- elliptica* HBK., 77
- elliptica* Miquel (invalidated) equals *aurantiaca* Griffith var. *parvifolia* Corner, 77
- elongata* King, var. of *racemosa* Linné, 106, 196
- enormis* (Martius ex Miquel) Miquel, 110, 261
- erecta* Thunberg (sp. No. 58), 19, 36, 49, 59, 68, 163, 165, 258
- eriotryoides* Kunth and Bouché equals *afzelii* G. Don ex London, 187, 188
- eugeniaefolia* Hemsley equals *perforata* Linné, 139, 140
- eugenioides* Mueller possibly equals *obliqua* Forster (f.), 137, 235
- exasperata* Roxburgh equals *ampelas* Burman (f.) var. *arvensis* (King) Corner, 243
- exasperata* Vahl, 31, 49, 50, 217, 234, 243
- excelsa* Vahl equals *tinctoria* Forster (f.) subsp. *parasitica* Willdenow, 93, 244
- eximia* Schott equals *citrifolia* P. Miller, 162
- exotica* Graff, var. of *benjamina* Linné, 56, 132
- exsculpta* Hort. (Bull.), var. of *aspera* Forster (f.), 244
- fairchildii* Backer equals *subcordata* Blume, 112, 114
- falcata* Thunberg equals *punctata* Thunberg, 244, 258
- fergusoni* King equals *altissima* Blume, 206

- ferruginea* Desfontaines equals *rubiginosa* Desfontaines ex Ventenat, 167
fastuosa Blume, 3, 26, 28, 83, 244, 246
fontanesii Steudel, 162
formosana Maximowicz, 95, 242, 245, 259
forstenii Miquel equals *payapa* Blanco, 27, 189, 190, 200, 236
foveolata Wallich equals *sarmentosa* B. Ham. ex J. E. Smith, 245, 260
fraseri Miquel, 217
fulva Reinwardt ex Blume (sp. No. 102), 1, 20, 28, 29, 33, 66, 69, 219, 223, 239
furcata Warburg, 262
garciniaefolia Miquel equals *subcordata* Blume, 49, 112, 113
gelderii Miquel equals *pellucido-punctata* Griffith, 121
geniculata Kurz (sp. No. 79), 33, 62, 193. Also given by King as a variety of *virens* Aiton, 143.
geocarpa Teysmann, 10, 15, 245
gibbosa (Blume) Corner, subsp. of *tinctoria* Forster (f.), 44, 92, 93, 94, 234
giganteum (under *Urostigma*) Miquel equals *stupenda* Corner, 260
gillettii Warburg, 245
glabella (Blume) Corner, var. of *virens* Aiton, 20, 109
glaberrima (author not stated), var. of *glauca* Delile, 48
glaberrima Blume, 246, 249, 253, 257
glabra Miquel, var. of *eximia* Schott [*citrifolia* P. Miller], 162
glabrata HBK equals *insipida* Willdenow, 15, 39, 45, 111, 112, 158
glaucescens Miquel equals *maxima* P. Miller, 157, 158
globosa Blume, 246
glomerata Blanco equals *minahassae* Miquel, 221
glomerata Roxburgh equals *racemosa* Linné, 19, 25, 34, 40, 44, 45, 49, 50, 196, 246
glauca Delile, 45, 48, 181, 183
gnaphalocarpa Steudel ex Miquel (sp. No. 100), 9, 26, 27, 28, 39, 45, 47, 49, 53, 65, 68, 141, 212, 220, 262
goldmanii Standley (sp. No. 90), 15, 40, 64, 70, 208
gracilipes F. M. Bailey equals *superba* Miquel var. *hennesea* (Miquel) Corner, 144, 246, 252
granatum Forster (f.), 240
grosularioides Burmann (f.) (sp. No. 103), 15, 30, 66, 69, 224
guatemalanum (under *Urostigma*) Miquel equals *lappathifolia* (Liebman) Miquel, 183
gul Laut., 251
habrophylla G. Bennett, 44, 235, 243, 246
haematocarpa Blume equals *benjamina* Linné, 132
harlandi Bentham equals *fastuosa* Blume, 245, 246
harrisi Warburg, 202
hartii Warburg, 202
hausii Blanco (sp. No. 54), 59, 68, 70, 86, 87, 159
hederacea Roxburgh (sp. No. 3), 53, 67, 73, 74, 241, 245, 259
hemsleyana King, 163
hemsleyana Standley equals *citrifolia* P. Miller, 162, 163
hennesea (Miquel) Corner, var. of *superba* Miquel, 19, 27, 49, 58, 143, 144, 246, 251, 252
henrici King equals *racemosa* Linné var. *elongata* King, 196
hesperidifolia King, 246
heteromorpha Hemsley, var. of *sarmentosa* B. Ham. ex J. E. Smith, 246, 260
heterophylla Linné (f.), 2, 30, 75, 79, 247, 260
heterophylla Rock probably equals *pumila* Linné, 247
heteropleura Blume, 34, 233, 237, 259
heteropoda Miquel, 9, 247
hillii F. M. Bailey equals *microcarpa* Linné (f.), 147
hirtata (author not stated), var. of *trigonata* Linné, 201
hirtata (as *Sycomorus hirtata* Sonder) equals *sonderi* Miquel, 180
hirta Vahl (sp. No. 99), 2, 30, 45, 65, 66, 69, 88, 89, 218, 223
hispidula Linné (f.) (sp. No. 8), 3, 7, 9 through 12, 26, 29, 34, 36, 37, 48, 54, 64, 67, 75, 81, 90, 108, 127, 155, 195, 217, 237, 259, 262
hispidula odorata Blanco equals *odorata* Merrill, 216
hispidula Corner, var. of *ampelas* Burman (f.), 214
hochstetteri A. Richard, 21, 50, 141
hookeri Miquel equals *hookeriana* Corner, 6, 106, 247
hookeriana Corner, 247
howardiana Sim equals *stuhmannii* Warburg, 183
humilis Rafinesque equals *montana* Burman (f.), 79, 80
imberbis Gagnepain, var. of *hirta* Vahl, 223
imperialis (author not stated), 248
inconstans Miquel equals *montana* Burman (f.), 79, 80
indica Forskal equals *salicifolia* Vahl, 191
indica Linné equals *sundaica* Blume, 22, 26, 36, 120, 121, 122, 135, 147, 177, 185, 249
indica Maiden equals *columnaris* Moore and Mueller, var. of *macrophylla* Desfontaines ex Persoon, 118
infectoria Heyne, 258
infectoria Roxburgh equals *virens* Aiton, 23, 27, 28, 33, 43, 45, 48, 105 through 109, 134, 135, 136, 143, 193, 238, 258
ingens Miquel, 34, 106, 241, 248, 250
insipida Willdenow (sp. No. 26), 15, 32, 38, 39, 46, 56, 58, 68, 111, 158, 199
integrifolia Elmer equals *variegata* Blume, 229
involuta Blume (sp. No. 38), 6, 57, 69, 136, 161
involuta (Liebman) Miquel equals *obtusifolia* HBK, 160, 193
irisana Elmer, 248
irregularis Miquel equals *celebensis* Corner, 103, 104, 235
irregularis Steudel probably equals *tinctoria* Forster (f.), 103

- iteophylla* Miquel (sp. No. 35), 26, 57, 62, 71, 133, 138, 195
- jacquiniaefolia* A. Richard equals *perforata* Linné, 49, 139, 140
- jalicana* S. Watson equals *petiolaris* HBK., 172
- japonica* Miquel, var. of *superba* Miquel, 144
- javanica* Reinwardt, 31
- johnstonii* Stapf equals *ovata* Vahl, 161
- "kulapat," a Philippine native name for at least two species with no scientific names assigned as yet, 248
- kulicarpa* Miquel, 248
- kuzeiri* Hutchinson, 248
- kellermannii* Standley, 156
- kerkhouenii* Koorders and Valetou, 249
- keratingii* Warburg (sp. No. 19), 5, 32, 34, 49, 55, 70, 97, 98, 256
- kingiana* Hemsley equals *ampelas* Burman (f.), 214, 249
- kingiana* Léveillé equals *glaberrima* Blume, 246, 249
- kirilii* Hutchinson, 249
- konishii* Hayata, var. of *variegata* Blume, 44
- korthalsii* Miquel equals *sundaica* Blume var. *beccariana* King, 120, 249
- krisnae* De Candolle, var. of *bengalensis* Linné, 179
- kuatleri* King, var. of *deltoides* Jack, 145
- kurzii* King, 131, 132, 249
- laccifera* Blanco equals *septica* Burman (f.), 249
- laccifera* Roxburgh equals *atlasica* Blume, 249
- lactor* F. Hamilton equals *virens* Aiton, 20, 32, 33, 105, 106, 107, 109
- laevigata* Vahl equals *citrifolia* P. Miller, 23, 31, 149, 162, 163, 164
- lambertiana* Miquel, var. of *virens* Aiton, 107, 108
- lanceolata* B. Ham. equals *racemosa* Linné var. *elongata* King, 196, 259
- lappathifolia* (Liehman) Miquel (sp. No. 70), 18, 61, 183
- latifolia* (Miquel) Corner equals *microcarpa* Linné (f.) var. *rigo* (Bailey) Corner, 152
- laurifolia* Hort. ex Lamarck equals *maxima* P. Miller, 106, 121, 157
- laurifolia* Kunth and Bouché equals *diospyrifolia* (per *Kew Index*), 157
- laurifolia* Sebero, 157
- Le Huntii* F. M. Bailey, var. of *benjamina* Linné, 132
- lentiginosa* Grisebach (relates to the following species), 163
- lentiginosa* Vahl equals *citrifolia* P. Miller, 162
- leopoldii* Van Houtte ex Miquel, 250
- lepicaarpa* Blume, 250
- leprieurii* Miquel, 22, 262
- leucostictoma* Poiré possibly equals *septica* Burman (f.) or *Amii* Blanco, 28, 86, 87, 159
- leucopleura* Blume, see under *hamii* Blanco, 159
- leucoptera* Miquel equals *tricolor* (Miquel) Corner, 224
- leucotricha* Miquel, 250
- longipedunculata* Elmer equals *chrysolepis* Miquel, 204
- longipetiolata* Mildbraed and Burret, var. of *bussei* Warburg, 180
- lucbanensis* Elmer, var. of *fatalosa* Blume, 3
- lucescens* Blume equals *racemosa* Linné var. *elongata* King (per Corner), 49, 106, 107, 134
- luciana* Hort. and Emile Rodigas, 250
- lucida* Dryand, 250
- luschthiana* Miquel, 250
- lutea* Auth. (not Vahl) equals *ingens* Miquel, 248, 250
- lutea* Vahl, 248, 250
- lutescens* Desfontaines, var. of *deltoides* Jack, 145
- lyrata* Warburg (sp. No. 17), 20, 28, 29, 38, 54, 94, 156, 245, 259
- maclellandi* King, 249
- macrocarpa* Kurz, var. of *nada* Miquel, equals *kurzii* King, 132, 147, 249
- macrophylla* Desfontaines ex Persoon (sp. No. 28), 3, 5, 6, 8, 12 through 15, 17, 18, 27, 30, 31, 36, 37, 40, 42 through 45, 56, 58, 59, 70, 115, 118, 119, 124, 149, 150, 152, 167, 168, 207, 225, 250
- macrozyce* Pittier, 111
- maculata* Linné, 250
- magnifica* Elmer, form of *philippinensis* Miquel, 255
- magnifolia* F. M. equals *copiosa* Steudel, 240, 241, 243
- magnolioides* Borzi equals *macrophylla* Desfontaines ex Persoon, 115, 149, 250
- mallotocarpa* Warburg (sp. No. 94), 26, 54, 64, 66, 67, 175, 212, 232
- malunensis* Warburg (sp. No. 87), 5, 29, 37, 63, 70, 204, 252
- mamillifera* Warburg equals *trigonata* Linné, 201
- manilensis* Warburg equals *guf* Laut., 250, 251
- marianensis* Merrill (sp. No. 36), 57, 70, 134, 257
- maxima* P. Miller (sp. No. 53), 2, 21, 32, 59, 106, 111, 157
- megacarpa* Merrill equals *aurantiaca* Griffith var. *parvifolia* Corner, 5, 8, 25, 77
- melinocarpa* Blume, 251
- membranacea* Warburg, 202, 251
- mexicana* Miquel equals *maxima* P. Miller, 21, 32, 157, 158
- microcarpa* Linné (f.) (sp. No. 46), iv, 3, 5, 6, 13, 14, 15, 22, 23, 27, 28, 30, 31, 36, 37, 40 through 44, 49, 50, 58, 68, 109, 117, 123, 128, 129, 140, 146, 152, 164, 168, 189, 233, 241, 263
- microcarpa* Vahl equals *thoningii* Blume, 141
- microphylla* Hort. equals *rubiginosa* Desfontaines ex Ventenat, 167, 251
- microphylla* Hort. and Desfontaines, 251
- microphylla* Salmann, 251
- minahasae* Miquel (sp. No. 101), 9, 27, 28, 31, 34, 37, 65, 67, 221
- mindoroensis* Merrill, var. of *botryocarpa* Miquel, 211, 235, 240, 251
- minima* (author not stated), var. of *pumila* Linné, 29, 53, 75, 76, 78, 260
- minor* Miquel, var. of *obliqua* Forster (f.), 137

- miquelii* (author not stated), see under *fiatula*
 Blume, 20, 245
mississippiensis (a fossil species), 4
nitrophora Warburg equals *trigonata* Linné, 201,
 202
nittuensis Warburg, var. of *afzelii* G. Don ex
 Loudon, 98
mollis Benthams, var. of *obliqua* Forster (f.), 137
mollis King, var. of *racemosa* Linné, 196
moshattensis Warburg, var. of *afzelii* G. Don ex
 Loudon, 188
monckii Hassler (sp. No. 25), 5, 27, 55, 59, 68,
 110, 261
montana Burman (f.) (sp. No. 7), 6, 13, 24, 30,
 34, 49, 53, 67, 79, 214, 258
mucosa Welwitsch, 18, 43
maelleri Miquel equals *platypoda* A. Cunningham
 [*obliqua* Forster (f.)], 137, 144, 246, 251, 257
murrayana Haert. probably equals *princeps* Kunth
 and Bouché, 252, 256
myrtifolia (a fossil species), 4
mysorensis Heyne (sp. No. 72), 5, 12, 30, 32, 50,
 61, 63, 69, 184, 185, 186, 247
natalensis Hochstetter (sp. No. 40), 34, 47, 48,
 57, 133, 138, 141
natalensis Mildbraed and Burret equals *burtt-*
dayi Hutchinson, 138
namtarum J. G. Baker, 43
nekudu Warburg (sp. No. 86), 6, 26, 29, 34, 48,
 63, 69, 182, 203
nemorafis Wallich, var. of *nerifolia* J. E. Smith,
 103, 252
neobritannica Corner, 252
nerifolia J. E. Smith, 103, 252
nerosa Heyne ex Roth, 233, 246, 252
neumanni Celsius, 253
niamniensis Warburg equals *polita* Vahl, 255
nigrescens King equals *sthoua* Bureau, 5, 78
nitida Thunberg, var. of *microcarpa* Linné (f.),
 iv, 27, 29, 31, 41, 42, 58, 68, 109, 120, 123, 140,
 146 through 151, 168, 263
nodosa Treysmann, 261
nota Merrill (sp. No. 93), 3, 13, 26, 35, 38, 44, 64,
 67, 83, 211, 236, 238, 251
nuda Miquel, var. of *benjamina* Linné, 6, 128,
 130, 131, 132, 147, 249
nymphifolia P. Miller (sp. No. 48), 34, 58, 153
obliqua Forster (f.) (sp. No. 39), 27, 36, 57, 58,
 62, 70, 115, 137, 252, 257
oblongata Link, 197, 253
obovata Sata, form of *philippinensis* Miquel, 255
obscura Blume, 35, 233
obtusa Hasskarl, var. of *trichocarpa* Blume, 253
obtusifolia HBK (sp. No. 78), 21, 27, 37, 59, 62,
 71, 160, 192
obtusula Dugand, var. of *glabrata* HBK [*insipida*
 Willdenow], 112
ochroleuca Grisebach equals *pertusa* Linné (f.),
 126
octomelifolia Mildbraed and Burret, var. of *evata*
 Vahl, 161
odorata Merrill (sp. No. 97), 6, 26, 29, 49, 65, 68,
 91, 212, 216
oleracea Corner, 253
oligodon Miquel (sp. No. 105), 3, 26, 39, 66, 67,
 227
oppositifolia Roxburgh equals *hispida* Linné (f.),
 29, 81, 82
otariophylla Diels equals *subulata* Blume, 30
ovata Vahl (sp. No. 56), 6, 27, 59, 69, 97, 161
ovoides Jack, var. of *deltoides* Jack, 145
pachystemon Warburg, 235
padana Burman (f.), 262
padifolia HBK equals *pertusa* Linné (f.), 15, 21,
 23, 39, 44, 45, 47, 126, 127
palamanense Merrill (sp. No. 84), 5, 33, 34, 48,
 63, 69, 200
palmeta Forskal (sp. No. 91), 4, 6, 11, 19, 33, 36,
 39, 44, 64, 198, 208
palmeri S. Watson, 15, 26, 36, 44, 253
"panachée" Hort., var. of *pumila* Linné, 75
panduraciformis Miquel, 155, 156
pandarata (Hance) Corner, 94, 95, 245
pandarata (Hort.) Sanders equals *uilemanniana*
 Warburg, 95
panduriformis Hort., 155
papuana Corner, 254
papuana Diels, var. of *microcarpa* Linné (f.), 147
papuana King, var. of *sirens* Aiton, 109
paracamptophylla Corner, 254
parasitica Willdenow, subsp. of *tinctoria* Forster
 (f.) (with refs. to other authors), 22, 93, 213,
 244
parcelli Veitch equals *aspera* Forster (f.), 34, 54,
 64, 70, 85, 86
parietalis Blume, 19, 233, 254
parvifolia Corner, var. of *aurantiaca* Griffith, see
 under *aurantiaca*
patens Ridley, 7
payapa Blanco (sp. No. 75), 61, 63, 69, 185, 189,
 200, 236
pedunculata Dryand equals *citrifolia* P. Miller,
 162
pedunculata Sim, var. of *natalensis* Hochstetter,
 138
pellucido-punctata Griffith, see under *sandaica*
 Blume, 120, 121
pendula Sprengel equals *benjamina* Linné var.
comosa Roxburgh, 131
perforata Linné (sp. No. 41), 29, 34, 36, 49, 57,
 58, 70, 127, 139, 164, 233
pertusa Linné (f.) (sp. No. 33), 6, 7, 15, 20, 21,
 23, 27, 28, 36, 39, 40, 44, 45, 47, 56, 70, 82, 126,
 140, 177, 199, 233, 261
petersii Warburg, 183, 194, 254
petiolaris Benthams, var. of *obliqua* Forster (f.),
 27, 36, 58, 62, 115, 137, 138
petiolaris HBK (sp. No. 62), 5, 15, 20, 25, 26, 30,
 32, 34, 36, 47, 58, 60, 71, 172
philippinense Hort. equals *stricta* Miquel, 119
philippinensis Bonard ex Hering probably equals
cumingii Miquel, 85, 107, 255
philippinensis Hort. probably equals *benjamina*
 Linné, 132, 255
philippinensis (Miquel) Corner, var. of *virgata*
 Reinwardt ex Blume, 132, 255, 261. See also,
 note under *sirens*, page 107.

- picata* Sim equals *soldanella* Warburg, 155
pilosa Naves equals *payapa* Blanco, 185
pilosa Reinwardt ex Blume equals *drapacea* Thunberg, 184, 185
pinkiana F.v.M. equals *virgata* Reinwardt ex Blume, 132, 255
platyphylla Delile equals *umbellata* Vahl, 44, 47, 48, 97, 161
platypoda A. Cunningham probably equals *obliqua* Forster (L.), 115, 137, 252, 257
pleurocarpa F.v.M., 255
polita Vahl, 39, 44, 97, 255
polycarpa Roxburgh equals *copiosa* Steudl., 240, 255
polystyce Ridley equals *variegata* Blume, 20, 229
pomifera Wallich ex King equals *oligodon* Miquel, 26, 227, 228
populifolia Vahl, 48, 191, 256, 263, 264
populosa Willdenow equals *citrifolia* P. Miller, 140, 162, 163, 164, 235, 236
populoides Warburg equals *citrifolia* P. Miller, 162, 163
portiana Regel equals *callosa* Willdenow, 205, 256
praestans Corner, 256
pretorica Burt-Davy (sp. No. 23), 27, 32, 45, 55, 57, 70, 104, 191, 241
preussii Warburg, 256
princeps Kunth and Bouché, 252, 256
pringlei S. Watson, 15
procera Reinwardt ex Blume, 256
prolixa Forster (L.), 48, 134, 137, 257
proscendens Hort., 257
pseudo-acamptophylla Koorders and Valetton equals *sumatrans* Miquel, 257
pseudo-caricea Miquel, 4, 19, 33, 64, 200, 209
pseudopalma Blanco (sp. No. 92), 2, 15, 16, 29, 31, 33, 44, 45, 49, 64, 70, 210
puberula Miquel equals *subpuberula* Corner, 252, 257. See also, comment under *obliqua*, page 137.
pubescens (author not stated), var. of *mysorensis* Heyne, 30, 61, 184 through 187
pubescens F. M. Bailey, var. of *macrophylla* Desfontaines ex Persoon, equals *baileyana* Domin, 115
pubescens Condit, var. of *rubiginosa* Desfontaines ex Ventenat, 60, 167
pubinervis Blume, 246, 257
pumila Hooker equals *hispida* Linné (L.), 75
pumila Linné (sp. No. 4), 1, 2, 4, 6, 24, 25, 28, 29, 34, 37, 49, 53, 67, 73, 75, 78, 244, 247, 260, 262
punctata Thunberg, 8, 33, 244, 258
punctifera Warburg probably equals *exasperata* Vahl, 243, 244
purpurascens (Blume) Corner, var. of *montana* Burman (L.), 34, 80, 258
pyrifolia Burman (L.) equals *Pyrus pyrifolia* Nakai, 258
pyrifolia Desfontaines equals *citrifolia* P. Miller, 162, 258
pyrifolia (Miquel) Boerl. equals *sundaica* Blume, 258
pyrifolia Salisbury equals *benjamina* Linné, 258
pyrifolia Hooker, 15, 162, 165, 258
quercifolia Roxburgh equals *montana* Burman (L.), 30, 49, 79, 80, 214
quinbungi (a fossil species), 4
racemifera (author not stated) equals *viriegata* Blume, 229
racemigera Bureau, 258
racemosa Linné (sp. No. 82), 9, 15, 18, 19, 22, 26, 28, 34, 39, 40, 44, 45, 49, 50, 62, 63, 68, 106, 134, 196, 246, 260
radicans Desfontaines (sp. No. 2), 28, 34, 53, 73, 74, 259
radula A. Richard, 158
radula Willdenow equals *maxima* P. Miller, 111, 157
radulina S. Watson (sp. No. 83), 6, 15, 63, 64, 68, 111, 199
ramentacea Roxburgh equals *radicans* Desfontaines, 28, 73
rapiformis Roxburgh equals *septica* Burman (L.), 87
recurva Blume, 258
religiosa Linné (sp. No. 20), 2, 15, 19, 20, 22, 30, 31, 33, 34, 36, 39, 40, 43, 45, 48, 50, 55, 69, 99, 102, 103, 135, 177, 256
repens Hort. equals *pumila* Linné, 75
repens Willdenow equals *pumila* Linné (see text on page 75 for involved synonymy), 29, 75, 76, 247, 248
retusa Linné equals *microcarpa* Linné (L.). See under *microcarpa*.
rhododendrifolia Miquel, var. of *macleanii* King, 132, 249
ribes Reinwardt ex Blume (sp. No. 61), 5, 9, 15, 26, 60, 66, 67, 90, 171, 240
ribesoides King, var. of *recurva* Blume, 258
rigida Miquel, var. of *subgelderi* Corner, 93, 94, 261
rigo (Bailey) Corner, var. of *microcarpa* Linné (L.) (description No. 47), 27, 36, 58, 68, 152
rostrata Blanco, 233, 259
rostrata Lamarek, 73, 74, 233, 241, 242, 245, 259
roxburghii Wallich equals *auriculata* Loureiro, 10, 11, 12, 26, 32, 34, 44, 225, 227, 238
rubescens Blume probably equals *sundaica* Blume, 120
rubiginosa Desfontaines ex Ventenat (sp. No. 59), 3, 14, 15, 22, 23, 27, 31, 34, 36, 37, 49, 54, 58, 60, 70, 107, 115, 118, 138, 149, 152, 167, 170, 207, 251
rubra Hort., var. of *elastica* Roxburgh, 123, 125
rubra Roth equals *microcarpa* Linné (L.) var. *nitida* Thunberg, 123, 162
rubrinervis Hort., var. of *elastica* Roxburgh, 123
radix Miquel, 251
rugicaulis Merrill, 159, 234
rugosa of G. Don et al., 259
rumphii Blume (sp. No. 21), 19, 22 (as synonym *cordifolia*), 43, 45, 55, 69, 102, 135, 136, 241
saemocarpa Miquel equals *squamosa* Roxburgh, 81, 196, 259
sagittata Vahl, 73, 259
sagittifolia Warburg, 95, 156, 259

- sakalawarum* (Baker) Perrier, subsp. of *coccinifolia* Baker, 66, 230, 231
salicifolia Corner, var. of *septica* Burman (f.), 87
salicifolia Vahl (sp. No. 77), 26, 31, 62, 104, 191, 241, 256, 262
salamonensis Reehinger, 26, 29
samaritanicus Parodi, var. of *monckii* Hassler, 110
sansibarica Warburg, 259
sarmentosa B. Ham. ex J. E. Smith, 53, 75, 245, 246, 260, 264
satterthwaitei Elmer equals *congesta* Roxburgh, 34, 83, 84
sauasarensis De Candolle, 260
scabra Forster probably equals *coronata* Spin, 49, 85, 217, 218
scabra Hort. equals *coronata* Spin, 217
scabra Jacquin equals *hispida* Linné (f.), 81, 217
scabra Sim, 217
scabrella Roxburgh equals *heterophylla* Linné (f.), 247, 260
scandens Roxburgh equals *hederacea* Roxburgh (see page 74 for other authors), 74, 245, 259
schimperii Miquel equals *thoenigii* Blume, 141
schimperiana Hochstetter probably equals *ingens* Miquel, 248
schlechteri Auth., var. of *benjamina* Linné, 37, 47, 57, 68, 132
schryveriana or *schryveriana* Hort., var. of *elastica* Roxburgh, 123
selecta Hort., var. of *elastica* Roxburgh, 123
semicordata B. Ham. (sp. No. 14), 2, 7, 10, 12, 26, 29, 34, 44, 48, 49, 60, 65, 68, 89
semicostata F. M. Bailey equals *racemosa* Linné, 196, 260
septica Burman (f.) (sp. No. 12), 3, 6, 28, 31, 34, 54, 56, 70, 86, 159, 160, 237, 249
serpyllifolia Blume, 260
serpyllifolia Encke, var. of *pumila* Linné, 76, 260
servata Forskal equals *exasperata* Vahl, 244
setibracteata Elmer, form of *philippinensis* Miquel, 255
sideroxylofolius Griffith equals *deltoides* Jack, 145
sieboldii King, var. of *erecta* Thunberg, 165
sintenisii Warburg equals *perforata* Linné, 139
sinuata Thunberg, 241, 259
sinoana Miquel equals *almifolia* Lamarek, 91
soldanella Warburg (sp. No. 50), 32, 33, 34, 58, 60, 70, 82, 98, 155, 173
sonderi Miquel (sp. No. 67), 36, 61, 180
soronensis (King) Corner, var. of *ampelas* Burman (f.), 243
spragueana Mildbraed and Barret (sp. No. 81), 62, 71, 133, 195
squamosa Roxburgh, 259
stenocarpa F.v.M. probably equals *coronata* Spin, 48, 65, 217, 218
stenophylla Hemsley, 260
stenosiphon Warburg equals *polita* Vahl, 255
stephanocarpa Warburg probably equals *coronata* Spin, 65, 217, 218
stipulata Thunberg equals *pumila* Linné, 75
stipulosa Miquel equals *camlocarpa* Miquel, 19, 106, 238
strophophylla Warburg, 215
stricta Miquel (sp. No. 30), 49, 56, 119
stuhlmanni Warburg (sp. No. 69), 27, 61, 183, 254
stupenda Miquel, 260
subcuminata Benthams, var. of *obliqua* Forster (f.), 137
subalbida-ramis Elmer equals *conora* King, 240
subcordata Blume (sp. No. 27), 5, 32, 33, 34, 49, 56, 69, 112
subcordata Corner, var. of *prolixa* Forster (f.), 257
subgelderii Corner, 93, 94, 261
subincisa J. E. Smith, 15, 240
sub-opposita Miquel equals *fastuosa* Blume, 244
subpuberula Corner, 257
subrepanda (author not stated), var. of *mysorensis* Heyne, 61, 63, 186, 187, 247
subcabrida Warburg equals *maxima* P. Miller, 157, 158
subsessilis Corner, var. of *concinna* Miquel, 109
subtriplicinervis Martius equals *perforata* Linné (f.), 110, 126, 261
subulata Blume, 30, 233, 255, 261
sufocaus Grisebach equals *maxima* P. Miller, 157, 158
sumatrana Miquel, 257
sundaica Blume (sp. No. 31), 22, 26, 36, 37, 56, 120, 147, 177, 249, 258
superba Miquel (sp. No. 44), 19, 27, 39, 49, 58, 70, 143, 246, 252
superdecora Hort., var. of *elastica* Roxburgh, 123
suringuili (Witte) Carrière equals *nodosa* Teymann, 261
swinhoei (King) Corner, subsp. of *tinctoria* Forster (f.), 92
sycomorus Linné (sp. No. 63), 9, 10, 12, 26, 27, 28, 32, 36 through 39, 44, 45, 50, 60, 67, 173, 212, 225, 231, 264
syringifolia Warburg equals *polita* Vahl, 255
syringoides Warburg equals *polita* Vahl, 255
tamraensis Merrill, 5
teloukat Battandier and Trabut probably equals *salicifolia* Vahl, 191, 261
terasonensis Hayata, var. of *aurantiaca* Griffith, 78, 262
tholloni Hort., 262
thoenigii Blume (sp. No. 42), 34, 50, 57, 62, 69, 141, 191
tiliosa Bureau (sp. No. 6), iv, 5, 24, 53, 67, 78
tilioefolia J. G. Baker, 262
tinctoria Forster (f.) (sp. No. 16), 2, 5, 6, 7, 22, 27, 29, 36, 44, 45, 55, 58, 60, 66, 68, 69, 92, 100, 105, 213, 234, 244, 261
tokela King equals *amplicissima* J. E. Smith, 135
tiela Hochstetter, 133
tomentosa Roxburgh, 29
toxicaria Linné equals *padana* Burman (f.), 262
trachyphylla. (Author in doubt: Fenzl or Kotschy. May equal *gnaphalocarpa* Stendel ex Miquel.) 81, 220, 262
tremula Warburg, 262
triangularis Warburg, 262
trichocarpa Blume, 253

- tricolor* (Miquel) Corner, 224
tricolor Roxburgh, var. of *elastica* Roxburgh, 123
trigonata Linné (sp. No. 85), 61, 63, 69, 201, 251
trimenii King, 262
truncata Miquel, 146, 263
tsiela Roxburgh equals *amplissima* J. E. Smith, 33, 39, 135, 262
tsjehela Burman (f.) equals *amplissima* J. E. Smith, 106, 107, 135
tuberculata King, var. of *tinctoria* Forster (f.) subsp. *gibbosa* (Blume) Corner, 93
tuerckheimii Standley, 263
ulmifolia Lamarck (sp. No. 15), 6, 29, 30, 31, 44, 60, 65, 69, 71, 84, 85, 91, 216, 217
umbellata Vahl (sp. No. 18), 9, 20, 26, 44, 47, 48, 55, 65, 69, 97, 161, 202
urbaniana Warburg (sp. No. 55), 59, 160, 192
urceolaria Welwitsch ex Hiern (sp. No. 96), 15, 31, 65, 214
urnigera (Miquel) Corner, 258
urophylla Wallich, var. of *rostrata* Lamarck, equals *heteropleura* Blume, 34, 259
utilis Sim equals *nekuda* Warburg, 203, 204
valida Blume, var. of *annulata* Blume, 234
vallis-chaudae Delile, 44, 212
variegata Blume (sp. No. 106), 10, 18, 19, 20, 26, 28, 38, 44, 45, 47, 48, 64, 66, 227, 238, 232, 241, 243
variegata Hort., var. of *elastica* Roxburgh, 54, 122, 123, 126
variegata Hort., var. of *radicans* Desfontaines, 53, 73
variegata Hort., var. of *rubiginosa* Desfontaines ex Ventenat, 34, 54, 167
variolosa Lindley, 263
vaseulosa (Wallich or Miquel), 263
vasta Forskål, 44, 191, 256, 263
venenata Possida-Ar., 48
venosa Willdenow equals *septica* Burman (f.), 86, 87
venusta Kunth and Bouché, 264
serrucosa Liebman equals *citrifolia* P. Miller, 163
verticillaris Corner, 264
vesca F.v.M. equals *racemosa* Linné, 196, 260
villosa Blume (sp. No. 1), 2, 31, 53, 67, 72
sirens Aiton (sp. No. 24), 6, 20, 23, 27, 28, 32, 33, 34, 36, 38, 43, 45, 48, 49, 55, 62, 70, 74, 82, 105, 128, 134, 135, 136, 143, 157, 193, 233, 238, 240
virgata Reinwardt ex Blume, 30, 132, 255
viridicarpa Corner, 10, 18
vogelii Miquel (sp. No. 68), 5, 27, 29, 33, 34, 47, 61, 65, 69, 181, 203, 258
volhensis Warburg equals *natalensis* Hochstetter, 57, 138, 139
voeringiana Auth., form of *benjamina* Linné, 22, 29, 128, 130, 131
watkinsiana F. M. Bailey (sp. No. 29), 27, 34, 43, 49, 56, 58, 62, 71, 118, 170
wendlandii N. Taylor; *swainlandii* K. Schumann, 238, 264. (Possibly a "phony" specimen. See also, page 22.)
wightiana Wallich, var. of *sirens* Aiton, 38, 107
wildemanni Warburg (sp. No. 51), 58, 95, 155, 259
wilsoni Warburg equals *perforata* Linné, 139, 140
wrightii Benthham equals *sarmentosa* B. Ham. ex J. E. Smith, 260, 264
xylophylla Wallich, 27
xylosycia Diels, 264
zenkeri Warburg, 191

INDEX OF GENERIC SUBDIVISIONS

Note: These terms, comprising subgenera, sections, subsections, series, and subseries, are employed in many places in this work, and are sometimes seemingly inconsistent because the various authors cited have not always been in agreement regarding usage. They are given in the text just as the authors have used them.

- Adenosperma* Corner, 233
Auriculatae Corner, 3
Axillares Corner, 91, 95, 98, 159, 161, 181, 188, 195, 203, 205, 237, 242, 251
Benjaminiae Miquel, 128
Bibracteatae Miquel, 88, 95, 97, 98, 161, 180, 181, 188, 195, 203, 242
Caducae Hutchinson, 98, 195
Caulocarphae Mildbraed and Burret, 97
Congestae Corner, 83
Conosyceae (Miquel) Corner, 112, 177
Copiosae Corner, 79, 241
Covellii (Gasparrini) Miquel, 15, 21, 83, 87, 171, 211, 221, 227
Cyathistipulae Mildbraed and Burret, 188
Eriocyceae (Miquel) Corner, 224
Erythrogynae Corner, 145
Eumetamorphae Sata, 159
Eusyce Miquel, 1, 2, 21, 75, 79, 165, 223, 252
Exasperatae Corner, 243
Fasciculatae Mildbraed and Burret, 88
Fibrosifillae Corner, 35
Ficus Linné (when cited as a subdivision), 2, 75, 81, 83, 145, 165, 171, 210, 219, 225, 227, 229, 233
Glabratae Elmer, 159, 205, 251
Indicae Corner, 177
Leucogynae Corner, 35, 102
Longituberculatae Sata, 171
Malsantherae Corner, 115
Neomorphae King, 9, 21, 225, 227, 229
Nonglabratae Elmer, 91
Paleomorphae (King) Corner, 254
Pharmacosyceae Miquel, 2, 111, 158, 233, 274
Plagiostigmaticae Corner, 2
Platyphyllae Mildbraed and Burret, 180
Podosyceae (Miquel) Corner, 165
Pomiferae Corner, 227
Prostratae Corner, 89
Pseudopalmeae Corner, 210
Ramentaceae Corner, 2
Rhizocladus Endlicher, 2, 75
Scabrae Miquel, 214, 217
Strangulares Elmer, 113
Sycidium Miquel, 2, 7, 35, 79, 84, 87, 89, 214, 217, 241, 243, 246, 248
Sycocarpus Miquel, 1, 3, 81, 83, 171, 227, 264
Sycomoruz (Gasparrini) Miquel, 174, 180, 196, 220, 231, 232, 262
Synoeciae Miquel, 1, 5, 7, 8, 19, 24, 25, 33, 45, 52
Trichosyceae (Miquel) Corner, 219
Tuberculatae Elmer, 171
Tuberculifasciculatae Sata, 83
Urostigma (Gasparrini) Miquel, 1, 2, 20, 35, 102, 105, 107, 109, 110, 112, 119, 120, 127, 131, 133, 135, 136, 138, 141, 144, 147, 153, 156, 162, 172, 175, 181, 183, 190, 191, 193, 194, 200, 201, 205, 206, 208, 238, 242, 248, 251, 252, 253, 257, 260
Variegatae Corner, 229

INDEX OF FIG INSECTS

Note: In the case of insects, the generic name is omitted except as a heading over a given group of species; in naming the hosts, which are all species of *Ficus*, the genus is omitted at all times.

- Agaox*
paradoxum var. *modestum* Wiebes *brachypoda* Hutchinson, 235
videntatum Joseph See Joseph (430)
- Alfonsiella*
longiscapa Joseph See Joseph (430)
- Allotriozoon*
heterandromorphum Grandi *vogelii* Miquel, 181
- Arachonia*
plumosa Joseph *mysorensis* Heyne, 186
- Blastophaga*
agulari Grandi (*Julianella*) *lapathifolia* (Liebman) Miquel, 184
arnottiana Joseph *arnottiana* Warburg, 234
articulata Joseph See Joseph (430)
estoma Grandi *insipida* Willdenow, 111
brasiliensis (author not stated) 13
brouni Ashmead *ubnifolia* Lamarek, 91
bruneri Grandi (*Julianella*) *trigonata* [Cobbold] Linné, 201
callida Grandi *foveolata* Wallich, 245
clavigera Mayr *elastica* Roxburgh, 124
constabularis Joseph *sirens* Aiton, 107
contubernalis Grandi *aurantiaca* Griffith, 77
coronata Grandi *sirens* Aiton, 107
estherae Grandi (*Valentinella*) *costaricana* (Liebman) Miquel, 157
gestroi Grandi *asperrima* Roxburgh, 234
ghigii Grandi *stenocarpa* F.v.M., 217
glabellae Hoffmeyer *sirens* Aiton var. *glabella* (Blume)
 Corner, 109
greenwoodi Grandi *obliqua* Forster (L.), 137
inopinata Grandi *fulva* Reinwardt, 223
ishiana Grandi *sirens* Aiton, 107
javana Mayr *hirta* Vahl, 219
nipponica Grandi *erecta* Thunberg, 165
nota Baker (*Ceratosolen* Grandi) *nota* Merrill, 13, 211
pectinata Joseph See Joseph (430)
peneis Linné *carica* Linné, *palmata* Forskål, and
pseudo-carica Miquel, 4, 14, 209
quadriceps Mayr *religiosa* Linné, 100
quadripes Mayr *deltoides* Jack, 145
silvestri Grandi (*Valentinella*) *peruviana* Linné (L.), 127
socotrensia Mayr *salicifolia* Vahl, 191
sumatrana Grandi *ampelas* Burman (L.), 214
tentacularis Grandi *montana* Burman (L.), 80
tondani Grandi (*Valentinella*) *citrifolia* P. Miller var. *hemaleyana*
 Standley, 163
vaidi Joseph *palmata* Forskål, 209
valentinae Grandi *cuspidata* Reinwardt, 242
 species; may be a *Pleistodonte* *vasculosa* (Wallich or Miquel), 263
 species; collected by Henry Bird (B3) in Florida *aurea* Nutt. or *citrifolia* Miller, 14
 in general (no species or host given) vl, 2, 13, 81
- Ceratosolen*
appendiculatus Mayr *variegata* Blume, 229
arabicus Mayr *sycomorvus* Linné, 173
bakeri Grandi *pseudopalma* Blanco, 210
constrictus Wiebes *fastosa* Blume, 245
crassitarsus Mayr *ribes* Reinwardt ex Blume, 171
effractarius Grandi *auriculata* Loureiro, 225
emarginatus Mayr *auriculata* Loureiro, 225

- Ceratostolen* (continued)
- fusciceps* Mayr *racemosa* Linné, 196
- gracilis* Wiebes (sp. nov.) *ribes* Reinwardt ex Blume, 171
- gracelyi* Grandi *semicordata* B. Ham., 90
- lacundus* Grandi *lauli* Blanco, 159
- longicornis* Joseph See Joseph (430)
- marchali* Mayr *hispida* Linné (f.), 81
- mysorensis* Joseph *mysorensis* Heyne, 186
- notus* (Baker) Grandi (*Blastophaga*) *nota* Merrill, 211
- pygmaeus* Grandi *minahassae* Miquel, 221
- striatus* Mayr *variegata* Blume, 229
- in general (no species or host given) 13
- Crossogaster*
- triformis* Mayr *salicifolia* Vahl, 192
- Eiseniella*
- mexicana* Ashmead *palmeri* S. Watson, 253
- Eukoebelea*
- cunia* Joseph *semicordata* B. Ham., 90
- Eupristina*
- baberi* Grandi *paysa* Blanco, 190
- belgaumensis* Joseph *mysorensis* Heyne, 186
- jacobsoni* Grandi *benjamina* Linné, 130
- konigsbergeri* Grandi *benjamina* Linné var. *comosa* Roxburgh, 130
- masoni* Saunders *sundaica* Blume and *bengalensis* Linné, 121, 178
- okinawensis* Ishii *microcarpa* Linné (f.) var. *nitida* Thunberg, 149
- sundersi* Grandi *religiosa* Linné, 100
- verticillata* Waterston *microcarpa* Linné (f.), 14, 149
- in general (no species or host given) 184
- Grandiella* sp. (author not stated) *microcarpa* Linné (f.), 149
- Indothymus*
- crenulatus* Joseph *bengalensis* Linné, 178
- Julianella* (Juliana)
- agillari* Grandi (*Blastophaga*) *lapathifolia* (Lielman) Miquel, 184
- bruneri* Grandi (*Blastophaga*) *trigonata* [combisii] Linné, 201
- Lipothymus*
- glomeratus* Joseph *racemosa* Linné, 196
- Megastigma*
- marianensis* Swaye *marianensis* Merrill, 134
- Paragaon*
- perplexum* Joseph See Joseph (430)
- Parakoebelea*
- stratheni* Joseph *racemosa* Linné, 196
- thalakvadiensis* Joseph *mysorensis* Heyne, 186
- Philotrypesis*
- aterrima* Saunders *macrophylla* Desfontaines ex Persoon, 116
- distillatoria* Grandi *benjamina* Linné, 130
- emeryi* Grandi *microcarpa* Linné (f.), 149
- ficicola* Ashmead *heterophylla* Linné (f.), 247
- jacobsoni* Grandi *ampelas* Burman (f.), 214
- longispinus* Joseph *mysorensis* Heyne, 186
- minuta* Mayr *ribes* Reinwardt ex Blume, 171
- ornata* Grandi *fulva* Reinwardt, 223
- palmata* Joseph *palmata* Ferskal, 209
- pilosa* Mayr *hispida* Linné (f.), 81
- quadrisetosa* Grandi *asperissima* Roxburgh, 234
- selenetica* Grandi *vogelii* Miquel, 182
- similis* Baker *nota* Merrill, 211
- transiens* Walker *bengalensis* Linné, 178
- transcoricus* Joseph *bengalensis* Linné, 178
- tridentata* Joseph *benjamina* Linné, 130

<i>Pleistodontes</i>	
<i>froggatti</i> Mayr	<i>macrophylla</i> Desfontaines ex Persoon, 14, 116, 118
<i>imperialis</i> Saunders	<i>rubiginosa</i> Desfontaines ex Ventenat, 14, 168
species; may be a <i>Blastophaga</i>	<i>vasculosa</i> (Wallich or Miquel), 263
in general (no species or host given)	13
<i>Secundeisenia</i>	
<i>mexicana</i> Ashmead	<i>aurea</i> Nuttall, 142
in general (no species or host given)	13
<i>Sycobia</i>	
<i>mathewi</i> Joseph	<i>mysorensis</i> Heyne, 186
<i>Sycobiella</i>	
<i>claviscapa</i> Joseph	<i>mysorensis</i> Heyne, 186
<i>Sycophaga</i>	
<i>brevitarsus</i> Grandi	<i>racemosa</i> Linné, 196
<i>nota</i> Baker	<i>nota</i> Merrill, 211
<i>sycomori</i> (<i>crassipes</i>) Linné	<i>sycomorus</i> Linné, 173
<i>Sycophagella</i>	
<i>agraensis</i> Joseph	<i>racemosa</i> Linné, 196
<i>Sycoryctes</i>	
<i>roxburghii</i> Joseph	<i>auriculata</i> Loureiro, 225
<i>trifemmensis</i> Joseph	<i>semicordata</i> B. Ham., 90
<i>Sycoscaptera</i>	
<i>triformis</i> Joseph	<i>mysorensis</i> Heyne, 186
<i>Sycoscapteridea</i>	
<i>forstenii</i> Joseph	<i>palmata</i> Forskal, 209
<i>indicus</i> Joseph	<i>ovirens</i> Aiton, 107
<i>Terastiozoon</i>	
<i>benjamina</i> Joseph	<i>benjamina</i> Linné, 130
<i>keralensis</i> Joseph	<i>bengalensis</i> Linné, 178
<i>Valentinella</i> (subgenus)	
<i>estherae</i> Grandi (<i>Blastophaga</i>)	<i>costaricana</i> (Liebman) Miquel, 157
<i>silvestri</i> Grandi (<i>Blastophaga</i>)	<i>pertusa</i> Linné (L.), 127
<i>tonduzi</i> Grandi (<i>Blastophaga</i>)	<i>citrifolia</i> P. Miller var. <i>hemsleyana</i> Standley, 163
<i>Waterstoniella</i>	
<i>jacobsoni</i> Grandi	<i>procera</i> Reinwardt ex Blume var. <i>crassiramea</i> (Miquel) King, 257

GENERAL INDEX

Note: Many characters of various species will be found described under their respective accounts. To avoid an excessive number of page references, this fact is noted in certain appropriate places, where the pages given apply, for the most part, to the generalities involved. For descriptions and notes of any given species, refer to the preceding Index of Species, Varieties, and Synonyms.

- Abbey Tree, 233
 Abstracting journals, 46
 Acanthaceae, 35
Aceria ficus (fig mite), 50
 Achenes (akenes), 7, 8
 Acrophyll, 25, 29, 91, 92, 260
 Acuña, Dr. J. B., 159, 201
 Adabo, 230, 231
 Adelaide Botanic Garden, 17, 115
 Adriatic Fig, 8
 Aerial roots, 18, 20 through 25, 48; see species descriptions.
 Abelius, Adam, 187
 Agricultural Substation No. 15, Weslaco, Texas, vi
 Ala Moana Park, Honolulu, 42, 178, 198
 Alcohol, sources of, 220, 231
 Alder, 213, 231
 Alexander the Great, 120, 177
Alnus rhombifolia, 231
 Aluminum, 36
 Amacotic, 153
 Amate, 156, 208
 Amate plano, 156
 Amat paper, 47
Amblyseius sundi (mite), 255
American Florist, 86, 95
Ampelopsis, 24
 Ampeloid Fig, 213
 Anaba, 253
 Anacardiaceae, 176
 Anderson, Don, vi
 Anderson, Howard, 209, 228
 Angkor Wat, Cambodia, 22
Annual of the Tree Society of South Africa, 155, 248
 Annulus, 7
 Anthelmintic (vermifuge), 46
 Anthoroid bugs for biological control, 150
 Anthracnose, 124, 143
Aphelenchus olesistus (nematode), 76
 Aphrodite, 173
 Apocynaceae, 48, 260
 Apogamy, 10, 219, 223
 Apple Fig, 227
Arbor conciliatorum (*Ficus rumphii*), 102
 Arcadia (LASCA), see LASCA
 Archer Fig, 170
Armillaria mellea (root-rot fungus), 50
 Arnold Arboretum, Harvard University, Jamaica Plain, Massachusetts, vi, 159
Artocarpus canosus, 236
Artocarpus exculpta, 244
Artocarpus integrifolia, 134
Artocarpus mariannensis, 134
 Ascidioform, 179
 Ascidium; hypoaecidium, 179
 Atkins Garden of Harvard University, Cienfuegos, Cuba, iv, 78, 95, 114, 118, 127, 130, 158, 163, 180, 182, 190, 197, 201, 212, 216, 221, 232, 234, 239, 247, 250, 251, 258
 Atty-alou, 196
 Australian Abbey Tree, 233
 Avi-avi Fig, 154
 Avocado, iv, 149
 Aw-keot-sang, 76
 Axillary fruits, 9, 13; see species descriptions.
 Bagging, to exclude wasps, 12
 Baker, C. F., 91
 Balata, 47
 Balboa Park, San Diego, 42, 91, 100, 169, 178, 203
 Balete, 113
 Bangalore Botanic Garden, 106
 Banjo Fig, 95
 Banks, Sir Joseph, 75, 147, 167
 Banyan (in general), 15, 17, 19, 20, 22, 23, 24, 50; see species descriptions.
 Banyan Acres, 206
 Banyan City, 148
 Banyan Fig, 176
 Baptist and Sons, Sydney, 86
 Bard Estate, Hermosa, California, 161, 162, 165, 207, 239, 258
 Bark cloth, 47, 92, 138, 141, 203, 257, 258
 Barkcloth Tree, 48, 138
 Bark, uses of, 26, 81, 177, 200, 203, 240; see species descriptions.
 Barrett, Mary F., vii, 2, 106, 115, 153; also, cited throughout.
 Barrett, Otis W., 203
Barringtonia, 10
 Barter (botanical collector), 235
 Basinger, A. J., vii, 207
 Bastard Banyan, 147, 149
 Bathyphyll, 25, 29, 85, 91, 92, 260
 Batik, 47, 262
 Bats, fruit-eating, 22, 131, 135, 138, 158, 229
 Bat-tree, 135
 Bauxite; bauxitic soils, 157
 Bay Front Park, Miami, 42
 Beach Park, Waialae, 116
 "Believe It or Not!" (Ripley), 141
 Bellinger River Fig, 118
 Benjamin Banyan, 120, 132
 Bennett's Fig, 235
 Bentham, George, 217
 Benzoin (benjamin), 128
 Berlin Botanic Garden, 167, 264
 Berlin Herbarium, 264
 Berlin Weed, 124

- Bible, plants and references, 78, 173, 174, 177
 "Big Leaf" (fig), 75
 Bignoniaceae, 50
 Biological control of insect pests, 150
 Birdlime, 47, 191
 Birds, 12, 14, 22, 44, 45, 47, 125, 133, 138, 142, 158, 187, 191
 Black Fig, 115
 Blanco, F. M., 221
 Bligh, Rear Admiral William, 147
 Blume, C. L., 141
 Blunt-leaved Fig, 149
 Bogor Botanic Gardens; Bogor; Buitenzorg, 72, 82, 103, 109, 113, 171, 184, 185, 194, 205, 214, 219, 233, 234, 235, 240, 241, 243, 245, 247, 249, 251, 253, 254, 257 through 261, 263
 Bombacaceae, 111
 Bonpland, A. J. A., 111, 175, 192
 Bonpland Fig, 192
 Bookbinding (material), 48
 Boraginaceae, 92, 243
Boscheria minabassae, 221
 Botany Bay Fig, 167, 168
 Bo Tree, 99
 Bougainville Island, 29
Bougainvillea, 110
Brachystegia, 248
 Bracts; involucre, 6; see species descriptions.
 Brawley caprifig, 209
 Breadfruit, 4
 Breakfast food, figs used for, 196
 Bridenmyer (botanical collector), 153
 Brisbane Botanic Garden, 86, 217, 235, 249, 255, 260
 Bristly-leaved Fig, 81
 British Museum, 106, 157, 162
 Britton, N. L., 236
 Broadleaf Fig, 97
 Bronx Park Botanical Gardens, 80
 Brooklyn Entomological Society, 13
 Brown-woolly Fig, 184
 Brussels Botanic Garden, 88, 215
 Bryan, L. W., vi, 84, 121, 136, 159, 189, 200, 213, 236, 238, 251
 Buchanan, Dr. Francis (Lord Hamilton); B. Ham., 89, 106, 260
 Buddha; Buddhists, 22, 99
 Budding, 39; see species descriptions.
 Bud mutation, 179
 Buds, 27; see species descriptions.
 Buffalo Botanical Garden, 241
 Bulak Museum, Cairo, 173
 Bulbous bases, 25, 155, 173, 176, 181
 Bull, William, 73, 87
 Burke's Fig, 194
 Burnett, Richard H., vii
 Bush, John, 107
 Busse's Fig, 180
 Busse, W. K. O., 180
 Butana, 48
 Buttresses, 15, 17, 18, 19, 40; see species descriptions.
Caesalpinia, 248
 Calcutta Botanic Garden, 12, 17, 20, 81, 83, 87, 89, 90, 103, 196, 229, 243, 244
California Cultivator, 116
Calimyrna Fig, 8
 Callose-leaved Fig, 205
 Camarine Fig, 236
 Cambridge Botanic Garden (Massachusetts), 75
 Cambridge University Botanic Garden (England), 75, 233, 235, 246, 253, 254, 256, 261, 263, 264
 Camichin, 127
 Campbell, Dr. Charles, 229
 Caoutchouc Tree, 124
 Cape Fig, 231
 Caprifigation; caprifigs, 2, 3, 8, 12, 14, 209, 224, 228, 259
Caprificus, 3, 259
 Carabao, as seed carrier, 211
 Carob, 9
 Carotene, 258
 Cassia, 248
Catalpa, 93
 Cauliflory, 9; see species descriptions.
 Caum, E. L., 3
 Cedar Fig, 143
 Cedar Waxwing, 125
Ceiba casearia (kapok tree), 111
 Celebes Fig, 103
 Central American Banyan, 127
Ceratania siliqua, 9
 Ceylon Willow, 131
Chemical Abstracts, 46
 Chemical properties, 100, 178, 196
 Cherry Fig, 5, 39, 242
 Chicago Natural History Museum, 202
 Chiclé, 175
 Chilamate, 111
 Chimpanzee, 231
 Chinese Banyan, 13, 23, 149
Chittenden's Dictionary, 244
 Chromosomes, 3, 37, 194
 City parks: Oxnard, 161; Redondo, 177; Santa Ana, 218
 Citrus, 11, 38
 Clavate Fig, 239
 Climatology, 36
 Climbers; Lianas ("Cleavers"), 24; see species descriptions.
 Climbing Fig, 37, 75
Clitocybe (root-rot fungus), 124
 Clown Fig, 86
Clusia, 22
 Clusiaceae, 22
 Cluster Fig, 196
 Codd, Dr. L. E. W., vi, 104, 155, 181, 194, 237
 Coffee plantations, shade for, 40, 99, 138, 186, 196
 Cologne Botanical Garden, 246
 Colonial Garden, Nogent, France, 95
 Color of figs, exterior and interior, 5, 12; see species descriptions.
 Color of leaves, 34; see species descriptions.
 Common Earth Fig, 245
 Common Fig (mentioned throughout)

- Common Fig of Haiti, 202
 Common Fig, 131
 Compatibility in rootstocks, 39, 143, 231
 Composite (floral structure), 5
 Congested Fig, 83
 Creeper Fig, 240
 Copa de Oro (vine), 110
 Coppicing, 203
 Cord, fiber used for, 22, 48, 100, 172, 177, 200, 214
Cordia, 92
 Coriaceous-leaved Fig, 241
 Cornell, Ralph D., 18
 Corner, Dr. E. J. H., v, vi, 1, 4, 12, 22, 29, 73, 74, 78, 93, 103, 106, 115, 137, 165, 217, 223, 254, 260, 261; also, cited throughout.
 Costa Rica Fig, 156
Cotinus, 176
 Cotinus-leaved Fig, 175
 Council Tree, 206
 Country Fig, 196
Coussapou decalbata, 242
 Cowles, Dr. Ray B., 139
 Crab family, Santa Barbara, 116
 "Craig" variety of *Ficus lyrata*, 95
 Crane, Dr. Julian C., 251
 Creech, Dr. John L., 75, 107, 260
 Creek Fig, 218
 Creepers, 15, 80, 90, 145, 235, 244, 245, 247
 Crops, 12
Crossospora fici (rust fungus), 232
 Crown gall, 124, 143
 Cruz, Eugenio de la, vi, 211, 212, 214
 Cuban Experiment Station, Havana, 202
 Cuban Laurel, 149
 Cuming Fig, 84
 Cunningham, A., 137
 Currant Fig, 171
Cuscuta, 20
 Cuttings, for propagation, 37, 38, 39, 80, 80, 89, 103, 108, 121, 126, 130, 135, 142, 149, 150, 153, 171, 174, 175, 178, 179, 181, 186, 188, 192, 200, 203, 204, 206, 211, 218, 220, 227, 236, 237, 249, 254, 259
Cystoliths, 2, 35, 113, 126
Dactylopius adonidum (scale insect), 50
 Dade County Nursery, Miami, 103
 De Candolle, Casimir (the grandson), 260
 Deciduous Fig, 19, 144
 Deciduous trees, 19, 27, 98, 101, 109, 127, 134, 144, 165, 174, 176, 180, 183, 185, 196, 223, 225, 226, 248
 Delessert Herbarium, Geneva, 214
 Delta (botanical structure), 145, 146
 Devil's Fig, 81
 De Wolf, Dr. Gordon P., vi, 156, 215, 261, 263
 Dichogamy, 2, 302 (defined)
 Dimorphism (polymorphism), 25, 30, 76, 78, 85, 91, 95, 145, 146, 214, 219, 223, 244, 246, 247, 248, 263, 302 (defined)
 Dismore, John E., 37
 Diptera, 14
 Diseases, of plants or humans, 49, 50. (See also, Fungus; Medicinal properties; Mosaic; Nematodes; Pests.)
 Dodder, 20
 Dolinarine (alkaloid), 46, 242
 Dorsett (see Fairchild)
 Dorsett's Climbing Fig, 248
 Dotted Fig, 106, 108
 Drip-tip leaves, 30, 100, 233
 Drought, resistance to, 36, 168, 172, 173, 175, 178, 181, 246
 Dryand (Jonas Carlsson Dryander), 241, 250
 Dreypondt, Dr. Gustave, 88
 Dreypondt Fig, 88
 Dusén, Per Karl Hjalmar, 191
 Dusén's Fig, 191
 Dutrie (nursery), Ghent, Belgium, 235
 Dye Fig, 92
 Dye, sources of, 47, 92, 100, 106, 196
 Earth Fig, Common, 245
 East India Company Gardens, Calcutta, 46
 Economic utility, 43 through 50
 Eden Park Conservatory, Cincinnati, 170, 196
 Edibility, 44; see species descriptions.
 Edison Home, Fort Myers, 116
Ehretia, 243
 Ehretiaceae, 243
 Ehretia-like Fig, 243
 Elmleaf Fig, 91, 218
 Elysian Park, Los Angeles, 118, 119, 177
 Embryos; embryology, 7, 8, 10, 11, 101, 219
 Enderud, Julius, vi
 Endosperm, 11
 Enzymes, 46, 112
 Epiphytes, 15, 30; see species descriptions.
 Espallering, 146, 150
Eucalyptus, 42
 Eucalyptus Hill, Santa Barbara, 82, 107, 252. (See also, Franceschi.)
 Euphorbiaceae, 46
 Everglades National Park, Florida, 21
 Evergreen trees, 19, 127, 164, 168, 174, 186, 225, 245, 246, 252
 Evergreen-vine Fig, 37, 75
 Everist, S. L., vi, 233, 240
 Fairchild, Dr. David, 12, 103, 109, 114, 130, 231, 237, 238
 Fairchild expeditions, 91, 93, 109, 114, 229
 Fairchild Fig, 114
 Fairchild Kampong, Coconut Grove, 114
 Fairchild Tropical Garden, Miami, iv, vi, 42, 80, 104, 127, 179
Fairchild Tropical Garden Bulletin, 103
 Fairmount Park, Philadelphia, 241
 False Banyan, 23, 177, 206
Famous Trees, 124
 Federal Experiment Station, Honolulu, 208
 Federal Horticultural Board (FHB), 109, 130, 234
 Fence posts, living, 37, 40, 138, 141, 161, 181, 208, 248
 Fensl (botanist), 262
 Fiber (see Cord)
 Ficin, 46, 112
Ficinia caribae (leaf mosaic), 49
Ficomyia birdi (gall midge), 164
 Fiddleleaf Fig, 94

- Fiddle-leaved Rubber Plant, 95
 Fig mite, 50
Figueira purgante, 46
Figuier rouge, 202
 Floral characters, 1
Floral Magazine, 86
Flora des Serres, 86
 Florida Banyan, 142
 Florida Strangling Fig, 15, 21, 142
Flowering Plants of Africa, 155
 Flowers (see Long-styled; Neuter; Pistillate; Short-styled; Staminate)
 Fodder for livestock, 45, 81, 99, 100, 117, 173, 175, 177, 178, 196, 231 (forage), 251, 252
 Folklore, 50, 99, 156, 221
 Forrest, Kathryn, vi
 Fossil species, 4, 30, 89
 Foster Garden, Honolulu, 19, 42, 78, 102, 107
 Foster, Mulford, 172, 193
 Fox, Virginia, vi
 Fragrant-leaf Fig, 212, 216
 Franceschi, Dr. C. F. (*Eucalyptus* Hill, Santa Barbara), 76, 80, 82, 86, 100, 107, 149, 168, 207, 239, 250, 252, 256, 257, 261, 264
 Franceschi Park, Santa Barbara, 118
 Frollich, Edward F., 121, 200
 Front (see Hardiness)
 Fullaway, D. T., 111
 Fulton, Harry, vii
 Fumigation, vacuum (survival under), 121, 189, 200, 213, 243, 251
 Fungus, 50, 124, 143, 178, 232
 Furniture-leaf Fig, 234
 Gall figs; trees, 1, 8, 45, 103, 244
 Gall flowers, 1, 2, 81, 211
 Gall midges; wasps, 13, 164
 Garcinia-leaf Fig, 113
Garcinia mangostana, 113
Garden and Forest, 122
Gardener's Chronicle, 73, 86, 122
Gardening, 95
Garden Magazine, 95
 Garden Mangrove, 146
 Garden Palace, Sydney, 157
 Gaskins, Dr. M. H., vi
 Gautama (Buddha), 99
 Gentry, Howard S., 199
 Geocarpic habit of growth, 6, 9, 79, 90, 240, 245
 Ghent Botanical Garden, 254
 Gillett, Dr. George, vi
 Glabrate Fig, 111
 Glasgow Botanical Garden, 233, 254
 Godang wax, 47
 Gold dust, precipitation, 49
 Golden Fig, 142
 Golden Gate Nursery, San Francisco (William C. Walker), 116
 Golden Gate Park, San Francisco, 186
 Golden-leaved Moreton Bay Fig, 115
 Goldman Fig, 208
 Gooseberry Fig, 90, 171
 Grafting (rootstocks, scions, etc.), 39, 80, 95, 98, 143, 161, 191, 197, 220, 250, 258, 262, 263. (See also, Rootstocks.)
 Great Fig, 241
 Groff, G. W., 81
 Gronewegen and Company (nursery), Amsterdam, 261
 Ground or wall covers, 24, 76, 78, 79, 80, 248
 Guava, 38
 "Guests" (insects), 13, 211
 Gum (resin), 100, 168, 172, 191, 196. (See also, Birdlime; Latex; Rubber.)
 Gummibaum, 124
Gutta percha (see Rubber)
 Guttiferae, 22, 113
 Gyedua, 97
Cynalkothrips ficorum, 50, 150
 Habits of growth, 15 through 25
 Hagen, Willard, 147
 Hairy Fig, 218
 Halawa-Nullii Arboretum, vi
 Hamilton, Dr. R. A., vi, 76, 82, 156
 Hama, Garden of (Algiers), 226
 Hardiness, 36, 37, 39; see species descriptions.
 Hathor (Egyptian deity), 173
 Hauli Fig, 159
Hawaiian Planters' Record, 124
 Hawaiian Sugar Planters' Association (HSPA), 84, 90, 93, 111, 112, 118, 121, 137, 144, 149, 158, 189, 190, 197, 213, 214, 218, 229, 236, 243, 251
 Heavenly-fairy Fruit, 165
 Hemsley Fig, 163
 Hemsley, W. B., 163
 Henne (botanist), 143
Herald (Miami), 41
Heterodera fici (nematode), 49
 Heterophylly (see Dimorphisms)
Hevea brasiliensis (rubber tree of commerce), 46
 Heyne, Benjamin, 186
 Higuera, 199
 Higuera, 111
 Hill, Dennis, vi, 144, 149, 245, 263
 Hillside Park, Santa Barbara, 42, 165
 Holly, 74, 94
 Homoptera, 93
 Hooker Herbarium, 137
 Hormones (sprays, etc.), 12, 173, 225
Hortus Bengalensis, 192
 Hosaka, E. Y., 208
 "Hug-me-tight" vine, 75
 Humboldt, Baron Alexander von, 153
 Humped Fig, 92
 Huntington Botanical Garden, San Marino, 82, 91, 108, 118, 138, 143, 165, 194, 197, 202, 204, 207, 228, 232, 248
 Hybrids; hybridization, 3, 4, 24, 77, 129, 198, 209, 218, 219, 223, 224, 243, 262
 Hydathodes, 31, 126; see species descriptions.
 Hymenoptera, 14
 Hypoascidium, 179
Ilex, 94
Index Kewensis (sometimes given as "Kew Index"), 4, 73, 75, 81, 85, 89, 93, 109, 115, 120, 141, 157, 162, 189, 196, 233, 235, 237, 240 through 243, 248, 252, 253, 256, 257, 258, 260 through 263
Index Londinensis, 75, 92, 174, 250, 262

- Indian Laurel, 41, 148, 149
 India Rubber Tree (or plant), iv, 8, 23, 34, 49, 122 through 126, 149
 Inguilines (insects), 13
 Insecticides, 150
 Insects (beneficial or harmful), 1, 2, 3, 5, 8, 9, 11 through 15, 45, 49, 50, 85, 93, 100, 116, 117, 148, 163, 164, 174, 196, 211. (See the Index of Fig Insects, preceding; also, in species descriptions.)
 International Horticultural Exhibition, St. Petersburg, 87
 International Show, Hamburg, 123
 Inventories (USDA), 81, 93, 139, 140, 186, 192, 223, 246, 247, 248, 255
 Involucre Fig, 136
 Involucres, 6; see species descriptions.
Itea, 133
 Itaceae, 133
 Itea-leaved Fig, 133
 Iti-arealou, 148
 Ivory Fig, 87
 Ivy, 73
 Jaboticaba, 9
Jacquinia, 139
Jacquinia-leaved Fig, 139
 Jaeger, Albert, 178
 Jamaica Cherry, 162
 Jaques, 162
 Jardim Botânico, Coimbra, 250; São Paulo, 250
 Jardin Académique, Leiden, 261
 Jardin Botánico, Asunción, 162; Buenos Aires, 110
 Jardin des Plantes, Paris, 241
 Java Tree, 128
 Java Willow, 106, 128
 Jennings Estate, Miami, 127, 172
 Jerusalem Department of Agriculture, 12
Journal of the Royal Asiatic Society, 245
 Jubilee Gardens, Zanzibar, 260
 Judd, C. S., 117
 Kadota Fig, 30, 209
 Kaiulani, Princess, 178
 Kalaput, 248
 Kamchameha School, Honolulu, 86, 87, 210
 Kamerunga State Nursery, New Guinea, 152
 Kano Rubber Tree, 97
 Kapiolani Park, Honolulu, 116
 Kapok (tree), 111
 Kaufman, Helen, vi
Kew Bulletin, 8
 Kew Gardens, 88, 93, 106, 195, 203, 235, 236
Kew Index (see *Index Kewensis*)
 Keys for identification:
 Major (classified) keys, chapter V, 51 through 71. (Introduction, 51; Vegetative characters, 53; Characters of fruit, 67.)
 Miscellaneous text keys, 93, 102, 104, 106, 128, 133, 140, 156, 158, 165, 182, 191, 194, 195, 202, 213, 216, 217, 242, 243, 245, 259, 264
 Kidney bean, 7
 Kiem, Stanley, vi
Kigelia, 50
 King, George, 2, 120, 165; also, cited throughout.
 Knowlton, Charles, 228
 Koeh, Walter, 107
 Kohala Mountain Arboretum, Hawaii, 189
 Kostermans, Dr. A. J., 247
 Kotschy (botanist), 262
 Kovach, Paul, 199
 Krauss, Ferdinand, 138
 Krauss, Noel, 150
 Krishna Fig, 179
 Kruger National Park, South Africa, 155
 Kucera, Dennis, vii
 Lablab (fig leaves eaten as a garnish), 45, 80, 109, 219
 Lac, 90
 Lagos rubber, 47, 181
 Lacoña, 122
 Large-leaved Fig, 240
 LaRue, Ralph, 254
 LASCA equals Los Angeles State and County Arboreta, Arcadia; usually given as "Arcadia (LASCA)," iii, vi, vii, 37, 97, 100, 105, 112, 113, 115, 118, 121, 127, 134, 139, 143, 145, 152, 154, 155, 158, 171, 174, 177, 183, 184, 194, 197, 199, 207, 211, 213, 215, 220, 224, 230, 231, 232, 242, 251, 252, 253, 260
 Lasser, Tobias, 111
 Latex, iv, 28, 46, 47, 48, 75, 87, 112, 134, 175, 181, 191, 205, 213, 220, 224, 242, 246, 249. (See also, Birdlime; Gum; Rubber.)
 Laurel Fig, iv, 146
 Laurel-leaved Fig, 157
 Laurel Thrips, 150
 Leaf-spot (fungus), 124, 143
 Leaves, characters of, 19, 20, 29 through 35; see species descriptions.
 Leche de higuera, 46
 Leche de ojo, 112
 Leguminosae, 9, 248
 Leiden Herbarium, 249
 Lenticels, 26, 27; see species descriptions.
 Lepidoptera, 93
 Lianas, 24, 25, 45, 78; see species descriptions.
 Lichenlike appearance of bark markings, 26, 158, 159, 216
 Lincoln Park Conservatory, Los Angeles, 174
 Lindsay, Dr. George E., vii
 Lingnan University, Canton, China, 81, 147, 165
 Link, J. H. F., 253
 Linnaean Herbarium, 146
 Linnaean Society of London, 260
Liquidambar, 34
 Liqueur, sources of (see Alcohol)
 Lithocysts, 35
 Little-leaf fig, 251
 Little-leaf rubber tree, 251
 Liverpool Botanic Garden, 241
 Lofty Fig, 177, 206
 Loincloths, 48
 Lokesvara ("future Buddha" at Angkor Wat), 22
 Long-styled flowers, 1, 12, 13, 108, 154, 209, 218, 224
 Longwood Gardens, Kennett Square, Pennsylvania, vii, 74, 237, 256, 259, 260
 Loomis, Harold, 38

- Loquat, iv, 187
 Loquat-leaved Fig, 187
 Lord Howe Island Banyan, 117
 Ludemann, F. (Pacific Nursery, San Francisco), 76
 Lychee, 38
 Lyon Arboretum, Honolulu, iv, vi, 3, 18, 19, 82, 84, 86, 90, 93, 97, 111, 112, 113, 118, 121, 131, 134 through 137, 140, 143, 144, 149, 158, 159, 160, 171, 189, 190, 197, 198, 200, 204, 206, 207, 213, 214, 218, 229, 232, 238, 247, 251
 Lyon, Dr. H. L., 78, 90, 152, 207, 218
 Lyon's Forestry Notebook, 218
 Lyrate-leaved Fig, 95
 Magara, 243
 Mahenda, Dr. B. C., vi
 Malathion, 150
 Malayan Banyan, 129, 147, 148
 Malcolm, William, 250
 Maluna Fig, 204
 Mango, 149
 Mangosteen, 113
 Manila Fig, 250
 Maple, 34
 Marcotage ("mossing"), iv, 38, 98, 125, 126, 150, 227
 Marianna Fig, 134
 Martius, Karl F. P. von, 111
 Matapolo, 208
 Mathias, Dr. Mildred, vii
 Maxwell, Norman, vi
 M'Chopes cloth, 203
 McClintock, Dr. Elizabeth, vii
 Medicinal properties, 45, 46, 81, 87, 100, 134, 147, 172, 178, 196, 220, 242, 259
 Melia, Dr. (botanist), 149
 Melkhoom, 241
 Merrill, E. D., 87, 159; also, cited throughout.
 Mesemates (insects), 13, 148, 164, 211
 Meyer, Dr. Frederick G., 237, 250, 252, 256
 Migombani Gardens, Zanzibar, 249
 Milk Tree, 81, 241
 Millar, Dr. J. R., 202
 Miller, Philip, 100, 130, 157
 Milton, John, 177
 Minahassa Fig, 221
 Miquel, F. A. W., 2, 46, 111; also, cited throughout.
 Mirror News (Los Angeles), 41
 Miscellaneous uses and properties, 48, 49
 Missouri Botanical Garden, St. Louis, 72, 80, 188, 242
 Mistletoe, 20, 145
 Mistletoe Fig, 15, 145
 Mines, 50, 112, 183, 255
 Mockford, H., 237
 Moffat (botanist), 18
 Monck's Fig, 110
 Monkeys, 22
 Montagnac, P. R., 39
 Moraceae, 31, 35
 Moran, Dr. Reid, 108
 Moreton Bay Fig, 13, 15, 17, 45, 115, 118, 250
 Morrison, B. Y., 14, 227
 Morton, Julia F., vii
 Mosaic Fig, 85
 Mosaic virus, 49, 50, 100, 119, 136, 164, 165, 178, 194, 195, 207, 242, 248
 Mueller, Ferdinand von, 217; also, frequently cited.
 Mukherjee, Dr. S. K., vi, 17
 Mulberry, 4, 48
 Mulberry Fig, 173
 Munich Herbarium, 34
 Mutuba, 48
 Myrciaria ovaliflora, 9
 Myrsinaceae, 139
 Myrtaceae, 9, 10
 Mysore Fig, 186
 Nacapali, 127, 176, 199
 Natal Fig, 138
 National Botanic Garden, Washington, D.C., 153
 National Geographic, 22, 48
 National Herbarium, Washington, D.C., 224, 239
 Native Fig, 137
 Nature, 104
 Nectaries (wax glands), 34
 Nehrling, Dr. Henry, 172; also, frequently cited.
 Nematodes, 39, 49, 76, 85, 108, 109, 119, 124, 130, 143, 144, 158, 165, 178, 198, 211, 220, 248
 Nets, fishing, 48
 Neuter flowers, 1
 New Orleans Rubber Plant, 123
 New York Botanical Garden, 108, 153, 178, 182, 188, 201, 218, 234, 236, 239, 241, 254
 Number of *Ficus* species, 4
 Nyedua, 97
 Oakleaf Fig, 79
 Oil Palm (*Elaeis guineensis*), 259
 Old Calabar Fig, 187
 Oleander (*Nerium oleander*), 262
 Olinda Beetle (Fuller Rose Beetle), 100
 Ophiostoma (leaf-drop fungus), 143
 Opium, 49, 87
 Opposite-leaf Fig, 81
 Orange, Navel, 11
 Orchids, 20
 Ornamental value, 39 through 43; see species descriptions.
 Ostiole; orifice, 2, 5, 8, 13, 51, 149, 180, 221; see species descriptions.
 Oval-leaved Fig, 128
 Ovate-leaved Fig, 161
 Pacific Garden, 116
 Pacific Nursery, San Francisco (F. Ludemann), 76
 Pakur, 105
 Palawan Fig, 200
 Palermo (Sicily) Botanic Garden, 80
 Palmengarten, Frankfurt, 242
 Palmer, Dr. Edward, 199, 253
 Palmer Fig, 253
 Palmer Nursery, Osprey, Florida, 76
 Palm-like Fig, 210
 Pancho, Prof. Juan V., vi, 119, 121, 236, 240, 255, 256, 261
Pantomorus godmani (Olinda Beetle), 100
 Papaya, 46

- Paper, made from bark, 47, 127, 172, 175, 178
Paradise Lost, 177
 Parasites, 13, 20, 164, 211
 Parcell (botanical collector), 86
 Parque Santelmo, Seville, 174
 Parsons, T. H., 99
 Parthenocarpy, 11, 173
 Parthenogenesis, 10, 81, 227
 Payapa Fig, 189
 Pectin, 49
 Poduncles, 5, 9; see species descriptions.
 Peepul (Fipal), 36, 99, 108
 Pemberton, C. E., 81, 115, 118, 144, 152, 243
 Pepsin; papain, 46
 Peradeniya Gardens (see Royal)
 Perala, 120
 Pessimism, iv, 11
 Pests, 49, 50, 100, 112, 174, 178, 183, 255. (See also, Diseases; Mites; Nematodes.)
 Peters, Robert, 253
 Peters, Wilhelm, 254
 Petiolate Fig, 172
 Petioles (see Leaves; also, species descriptions).
 Phallic significance, 50
 Pharaoh's Fig, 173
Phaseolus, 7
Phoenix (palm), 142
 "Phony" identifications, 22, 230, 264
 Phyllotaxy, 29
 Pinillate flowers, 1, 2, 6, 51, 85, 187, 202, 209, 211, 218, 219, 221, 224, 227
 Pith (of twigs), 26, 82, 87, 91, 213, 226, 234; see species descriptions.
 Pitman, Captain Benjamin, 124
Pittosporum tobira, 140
Plant Immigrants, 127
 Plant Introduction numbers, USDA (given as "PI Nos." in text; very numerous).
 Plant Introduction Station, USDA, Miami (PIS), iv, vi, 85, 91, 93, 97, 100, 105, 107, 108, 118, 127, 130, 160, 174, 179, 180, 182, 186, 188, 190, 192, 197, 202, 205, 215, 216, 218, 223, 226, 229, 232, 234, 237, 239, 247
 Plant patents, United States, 123
 Plant quarantine, United States, 130
 Poinsettia, 110
 Poisonous plants, 48, 49, 83, 230
 Pollen; pollination, 8, 10 through 15, 100, 142, 149, 198, 209, 225; see species descriptions.
 Polymorphism (see Dimorphism)
 Popenoe, Dr. John, vi
 Poplarleaf Fig, 256
 Poplar-leaved Fig, 100
 Poplar-leaved Rubber Tree, 163
 Pops, 97
Populus tremuloides (Quaking Aspen), 33, 100
 Port Jackson Fig, 168
 Portland, Earl of, 177
 Portuguese Laurel, 149
 Potter, Colin, 78
 Prais, Dr. David, 179
 Predators, 13, 148
 Pringle (botanical collector), 172
 Propagation, 37, 125, 126, 132, 143, 175, 227. (See Cuttings; Marcottage; also, various comments in species descriptions.)
 Prop roots, 20 through 24; see species descriptions, especially re banyans.
 Pruning (see Topiary art)
 Pubescence, 27, 28; see species descriptions.
 Pati Weren, 221
Pyrus pyrifolia, 258
 Quaking Aspen, 33, 100
Radopholus similis (nematode), 49
 Rain forests, 18, 30. (See also, Drip-tip leaves.)
 Reasoner, E. N.; Reasoner Brothers (nursery), Oneco, Florida, 107, 108, 197, 206. See also, Royal Palm Nursery, both in text and Literature Cited as (659).
 Red River Fig, 198
 Red Rubber Tree, 123
 Red Stem-fig, 228
 Red-wooded Fig, 196
Rees' Cyclopedia, 135
 Rehnman (botanist), 138
 "Religious tree," 99
 Resin (see Gum)
 Retting of leaves, 100, 101
Revue Horticole Belgique, 88
 Ribbed Fig, 255
 Riedel, Peter (nursery), 197, 252, 256; also, frequently cited.
 Rigo Fig, 152
 Ripley's "Believe It or Not!", 141
 Riverside equals University of California, Riverside, q.v.
 Rixford, G. P., 174
 Rock Wild-fig, 155
 Rodigas, Emile, 250
 Roig, J. T., 201
 Root knot; root-knot nematode, 49, 85, 108, 109, 119, 124, 130, 143, 165, 178, 198, 248
 Root rot; root-rot fungus, 50, 124
 Roots (in general), 19 through 25; see species descriptions.
 Rootstocks, 39, 81, 85, 124, 143, 197, 231, 237
 Rope (see Cord)
 Rough-leaved Fig, 81, 217
 Rough Rubber Tree, 81
 Roxburgh Fig, 15, 225
 Roxburgh, William, 89, 120, 192, 221; also, cited throughout.
 Royal Botanic Gardens, Kew (see Kew Gardens)
 Royal Botanical Gardens, Peradeniya, Ceylon, 122, 205, 234, 236, 241, 242, 245, 253
 Royal Garden, Hampton Court, 177
 Royal Horticultural Society, 87; *Proceedings*, 73
 Royal Palm Nursery (see Reasoner)
 Rubber, 46, 47, 126, 152, 172, 181, 220, 235, 249. (See also, Birdlime; Gum; Latex.)
 Rubber plant; tree (term employed casually), 38, 42, 95, 122, 124, 154, 168, 188, 239
Ramphía (publication), 141
 Ramphius Fig, 102
 Rust (disease), 143, 232
 Rasty Fig, 168

- Rusty-leaved Bush Fig, 145
 Rusty-leaved Fig, 167
 Sacred trees, 22, 23, 50, 95, 99, 147, 173, 177, 257
 Sakyamuni (Buddha), 99
 Salate, 199
 Salt spray, resistance to, 36, 140, 142
 Sambal (curry sauce), 228
 Sanders and Sons (nursery), St. Albans and
 Bruges, 95
 Sandpaper Fig, 45, 212, 217
 Sandpaper leaves or fruits, 31, 49, 82, 92, 141,
 157, 212, 216, 218, 234, 237 (fruits), 244
 San Francisco Examiner, 141
 Sango, 48
 Satterthwaite Fig, 84
 Satterthwaite, G. W., 83
 Sau, 224
 Saxifragaceae, 133
 Sayula Rubber Tree, 127
 Sealrout-leaf Fig, 234
 Scale insects, 50, 90, 178
 Scandent Fig, 74
 Schimper (botanist), 248
 Schoenbrunn (royal palace, Vienna), 153
 Schomburgk, Robert, 17, 115
 Schumann, Karl Moritz, 264
 Schwarten, Lazella, vi
 Schwarz, A., 91
 Science News Letter, 46
 Scora, Dr. R. W., vii
 Sea Fig, 143
 Seed figs, 5, 8, 12, 45, 97, 210, 219
 Seeds; seedlings, 2, 3, 5 through 8, 10, 11, 12, 14,
 22, 24, 25, 38; see species descriptions.
 Seibert, Dr. R. J., vii
 Serres Coloniales, Brussels, 203
 Shade trees, 17, 39 through 42. (See also, Coffee
 plantations and species descriptions.)
 Shafer, John A., 236
 Shaggy Fig, 72
 Shapes and sizes of figs, 5; see species descrip-
 tions.
 Sharp-pointed Fig, 233, 254
 Sharamith, Helen, vi
 Shearing (see Topiary art)
 Shining-leaved Fig, 149
 Shiny-leaved Fig, 205
 Shipley, Oliver M., vii
 Short-leaved Fig, 163
 Short-styled flowers, 1, 2, 12, 209, 218, 219, 224
 Shrubs (habit of growth), 15; see species descrip-
 tions.
 Sibolangit Botanic Garden, Sumatra, 262
 Silkworms, 48
 Simonson, Dr. I. M., 78
 Simpson, C. T., 153
 Singapore Botanic Garden, 103, 239
 Slender Fig Tree, 246
 Slimleaf Fig, 233
 Sloane (botanist and author), 106, 157
 Small-fruited Fig Tree, 142
 Small Indian Fig, 254
 Small-leaved Banyan (or Fig), 148, 149, 168
 Small-leaved Moreton Bay Fig, 137
 Smyrna-type figs, 12, 14
 Snake Tree, 21, 122, 124
 Solandra grandiflora, 110
 Sonder, Prof. O. W., 180
 Sonder's Fig, 180
 Sooty mold, 50
 Sour sap (disease), 198
 Spanish Laurel, 149
 Spanish moss, 20
 Spotted Fig, 6, 105, 135
 Sprague's Fig, 195
 Sprague, Thomas A., 195
 Staminate flowers, 1, 2, 51, 85, 187, 209, 218, 219,
 224, 228
 State School for Boys, Whittier, California, 124,
 177
 Stevenson, Robert Louis, 178
 Stewart, Dr. William S., iii, vi
 Stiff-haired Fig, 81
 Stinging Fig, 223
 Stinging hairs, 27, 189, 222, 223
 Stipules, 27, 28; see species descriptions.
 Stoutemeyer, Dr. Vernon, vii
 Stranglers, 15, 19, 20, 126 (typical), 141, 183, 193,
 203, 241, 254, 255; see species descriptions for
 any not listed here.
 Street trees, 39 through 43; see species descrip-
 tions.
 Strophanthus poison, 48
 Stuhlmann, Dr. Franz, 183
 Stuhlmann's Wild Fig, 183
 Subtropical Experiment Station, Homestead,
 Florida, 104
 Sunset Magazine, 41, 79, 86, 130, 225
 Surface characters of fruits, 5, 6; see species
 descriptions.
 Swamp Fig Tree, 109
 Swingle, W. T., 116, 168
 Sycamore, 12, 173, 225, 232
 Sycamore, five named varieties in Israel, 175
 Syconium, 1, 2, 4 through 6, 13; see species de-
 scriptions.
 Sydney Botanical Garden, 22, 144, 240
 Szechuan Banyan, 107
 Tanning material, 100
 Tapa cloth, 48, 257
 Texcaluma, 172
 Teysmann, J. E., 103, 221, 261
 The Field, 177
 Theophrastus, 120, 177
 "Thrip-proof" Java Fig, 132
 Thrips, 41, 50, 132, 148, 150, 151
 Tibig, 211
 Tikas (leaves mixed with opium), 49
 Tillandsia, 20
 Timber (see Wood)
 Timberlake, P. H., 184
 Time Magazine, 99, 124
 Tongue-leaved Fig Tree, 217
 Topiary art (shearing; pruning), 40, 42, 43, 140,
 168, 182
 Trabut, Dr. Louis, 148, 149
 Transvaal Fauna and Flora, 104
 Traps, fiber used for, 48

- Trees (habit of growth), 15 through 19; see species descriptions.
- Tree Society of S. Africa, Annual of the*, 155, 248
- Tropical Homemaker and Gardener*, 132
- Tsela, 135
- Tubercles, 9, 10; see species descriptions.
- Tuerckhelm, von (botanical collector), 263
- Tufted Fig, 131
- Turin (Torino) Herbarium, 217
- Twigs, 26, 27; see species descriptions.
- UCLA (University of California, Los Angeles; botanical garden or campus), vii, 82, 91, 100, 118, 138, 167, 200, 207, 226, 247, 260
- Ukuyu, 231
- Umbilicus, 5, 7; see species descriptions.
- University Botanical Garden, Riverside, 240
- University of California, Riverside. (Mentioned throughout, but not indexed. The author's "workshop" was located there.)
- Utombé, 130
- "Upside-down tree," 22
- Urnshaped Fig, 214
- Urticaceae, 35
- USDA (United States Department of Agriculture), vi, vii, 125, 206, 240, 260. Also, the numerous PI (Plant Introduction) numbers cited fall under USDA.
- U. S. National Herbarium, 239
- Utrecht Botanic Garden, 254
- Van Hecke, Gratien (nursery), Ghent, Belgium, 123
- Van Houtte, Louis (nursery), La Platte (Ghent), Belgium, 88, 243, 253, 260
- Variiegated leaves, 15, 34, 73, 75, 85, 90, 123
- Vavra Estate, Los Angeles, 82
- Veiny-leaved Fig, 107
- Venation, 32, 33; see species descriptions.
- Vermifuge (anthelmintic), 46
- Villosa Fig, 72
- Virus (see Mosaic)
- Vitamins, 258
- Vogel, C. J., 181
- Vogel's Fig, 181
- Volkens Fig, 139
- Vosters, James, 155
- Wahiawa Botanic Garden, near Honolulu, 84, 121, 152, 200, 204
- Waipahu Fig, iv, 24, 78
- Walker, William C. (Golden Gate Nursery, San Francisco), 116
- Waringin, 22, 29, 128, 129, 130, 131
- Warszewicz, Joseph (botanist and collector), 183
- Water, tree is source of, 240
- Waterlily-leaf Fig, 152
- Watkins Fig, 118
- Watkins, George, 118
- Waved-leaf Fig Tree, 87
- Wavy-leaf Fig, 86
- Wax glands (nectaries), 34
- Wedgeloaf Fig, 89
- Weedy figs, 14, 15, 22, 43, 117, 168, 244, 254
- Weeping Fig, 128
- Weeping Laurel, 128
- Welwitsch, Dr. F., 141, 214
- Went, Dr. F. W., 224
- Werkle, Carlos, 127
- Werkle's Rubber Tree (or Fig Tree), 127, 140
- West African Rubber Tree, 181
- Wester, P. J., 190, 248
- W. Hill's Giant Fig, 255
- White-leaved Fig, 224
- Wild Fig, 142
- Williams, F. X., 251
- Willow Fig Tree, 128
- Willow-leaf Fig, 191
- Willow-leaved Fig, 162
- Wilson, Bob (nursery), Miami, 132
- Wind damage, resistance to, 36, 115, 121
- Winters, Dr. Harold F., vi
- Wiry Fig, 213
- Witte, H., 261
- Wonderboom, 104, 241
- Wood, utility of, 43, 44, 100, 149, 173, 177, 178, 196, 198, 205, 229, 235, 263
- Yellow Stem-fig, 244
- Yokohama Nursery Company, 162, 258
- Yang Tree, 147
- Zulu Fig, 203