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HORTICULTURAL  
MAGAZINE

SPECIAL NUMBER

THE AZALEA HANDBOOK

JOURNAL OF THE AMERICAN HORTICULTURAL SOCIETY

JANUARY, 1952

# The American Horticultural Society

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The legend under plate 17 on page 49  
should read:

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**I**NVITES to membership all persons who are interested in the development of a great national society that shall serve as an ever growing center for the dissemination of the common knowledge of the members. There is no requirement for membership other than this and no reward beyond a share in the development of the organization.

For its members the society publishes THE NATIONAL HORTICULTURAL MAGAZINE, at the present time a quarterly of increasing importance among the horticultural publications of the day and destined to fill an even larger role as the society grows. It is issued for the months of January, April, July and October and is written by and for members. Under the present organization of the society with special committees appointed for the furthering of special plant projects the members will receive advance material on narcissus, tulips, lilies, rock garden plants, conifers, nuts, and rhododendrons. Membership in the society, therefore, brings one the advantages of membership in many societies. In addition to these special projects, the usual garden subjects are covered and particular attention is paid to new or little known plants that are not commonly described elsewhere.

The American Horticultural Society invites not only personal memberships but affiliations with horticultural societies and clubs. To such it offers some special inducements in memberships. Memberships are by the calendar year.

The Annual Meeting of the Society is held in Washington, D. C. Members are invited to attend the special lectures that are given from time to time.

The annual dues are five dollars the year, payable in advance; life membership is one hundred dollars; inquiry as to affiliation should be addressed to the Secretary, 1600 Bladensburg Road, N. E., Washington 2, D. C.

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# THE AZALEA HANDBOOK

THE AMERICAN HORTICULTURAL  
SOCIETY  
1952

by

FREDERIC P. LEE, FRED O. COE, B. Y. MORRISON,  
MILO PERKINS, AND FREEMAN WEISS



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# THE EDITORS TO THE READERS

Appreciation grows with understanding. In this volume are facts or conclusions of fact, not traditional folklore, as to the azalea's way of life—its relationships, its structure, its growth factors, its living quarters, its enemies. The objective is an understanding founded on scientific data (so far as presently available) set forth in terms reasonably clear to the serious amateur. Accomplishment of such an objective is not common among popular horticultural works. In addition there are set forth cultural directions, data on the arts of hybridizing and propagation, and an extensive descriptive list of azalea species and clonal varieties of hybrid and non-hybrid origin.

The Azalea Handbook is the work of a small Editorial Board appointed by Mr. Henry E. Allanson in 1948 during his term as president of the American Horticultural Society. The Board has been assisted by an Azalea Committee composed of distinguished horticulturists, taxonomists, plant breeders, plant propagators, plant pathologists and entomologists, nurserymen, and amateur growers. For the Editorial Board Mr. Frederic P. Lee assumed primary responsibility for the chapters on Azalea Relationships, Azalea Flowers, Azalea Leaves, Azalea Growth Factors, Azalea Soil and Mulches, Azalea Plant Habit and Age, Cultural Directions for the Azalea Gardener, Azaleas for the Garden, and Satisfactory Azaleas for Regional Areas; Mr. B. Y. Morrison for the chapter on Azalea Hybridizing by the Amateur; Dr. Freeman Weiss and Dr. Ernest N. Cory of the University of Maryland for the plant disease and insect pest portions, respectively, of the chapter on Azalea Enemies; and Mr. B. Y. Morrison, Mr. Albert W. Close, and Mr. John L. Creech, jointly, for the chapter on Propagation of Azaleas.

Much of the data found here has never been in print before. At the same time use has been made of existing literature and of materials obtained by consultation and correspondence outside the committee. All this is gratefully acknowledged by the Editorial Board though a detailed citation of literature and list of acknowledgments is omitted in view of the non-technical character of the handbook.

It is believed that the handbook offers as much information about azaleas as can be usefully assembled at this time for the serious amateur gardener. The handbook is addressed to him, not the nurseryman or the horticultural or botanical scientist. Further the handbook is limited to the outdoor growing of azaleas, and does not cover the forcing of azaleas by florists or other indoor growing of azaleas.

Some philologist may point out that a serious work should at least give the origin and meaning of the name of the plants to which it is exclusively devoted. Carolus Linnaeus in 1753 chose the name of the group from the Greek "azaleos,"—meaning dry or parched or inhabiting dry situations—since one of the few species known to Linnaeus, *pontica*, was supposed to favor a dry habitat. The name is wholly inappropriate as a description of the moisture requirements of azaleas as we know them today. However, forgetting its Greek meaning, "azalea" certainly has a rhythmic cadence that makes it an attractive plant name and at the same time a lilting name suited to lovely and decidedly unparched ladies.

*January 1952.*

FREDERIC P. LEE, *Chairman*

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*The Editorial Board*



PLATE I

Mollis Hybrid, clone Mrs. Oliver Slocock

# I. AZALEA RELATIONSHIPS

No group of shrubs has greater beauty or is more varied in its beauty than the azaleas. The azalea species important to the gardener are natives of a small portion of the world — eastern United States, Korea, Japan, Formosa, and eastern China, with one outlier species each in the Caucasus-Black Sea region and our Pacific States. There is great similarity between the plant life of eastern United States and of eastern Asia and so we find the Asiatic azalea species and the varieties derived from them are adaptable to the growing conditions of large portions of our country. Around 45 species and 1100 named clones are available to gardeners in the United States. There are about 71 species and 2700 named clones altogether.

Flowers of azaleas have a remarkable color range, — white and yellow, orange, scarlet, crimson, and purple with an array of intermediate hues of differing intensities; there are vivid and sparkling shades, pastel tints, pure whites, and striped, flecked, or sectored designs as well as self-colored flowers with or without conspicuously contrasting throats or blotches. Flowers are single, semi-double, and double and, in addition, all of these may be of the hose-in-hose form with sepals like petals. Bloom is abundant, not scanty. The species and clones provide a two to four months period of heavy bloom and outside the far South the bloom on a plant tends to come in a burst.

For each region in the eastern half of the country and in the greater part of the Pacific coastal area there can be obtained suitable hardy azaleas for outdoor use. Also, compared with many other shrubs, azaleas are relatively free

of plant diseases and harmful insect pests. Among the azaleas are both evergreen and deciduous shrubs running from one or two foot dwarfs on up to plants ten feet in height, — many even taller ultimately. Some are spreading, some upright; some dense, some open. Most azaleas tolerate shade; many prefer it.

With such a range of forms, the landscape potentialities of azaleas are tremendous, especially since all azaleas fit in with the characteristics of our landscape and architecture. At the same time a collection of old plants affords excellent cut flowers. If pruning becomes desirable in order to shape plants, it may be done during the blooming period and the cut flowers used for decoration.

Azaleas require a minimum of care and are not costly to maintain. Their requirements, while different from those of most shrubs, are simple. At the same time large old azalea plants are valuable and costly today. Azaleas are longlived and the purchase and growing on of inexpensive small plants of better varieties becomes a source of pecuniary, as well as esthetic, return.

## MAJOR BOTANICAL GROUPINGS

For purposes of classification the plant population of the Earth is broken down into divisions, and each division in turn is sub-divided into classes, then orders, families, genera, and species.

One of the many genera in the heath family (*Ericaceae*) is the genus *Rhododendron*. That genus is composed of some 800 species. Most botanists classify azaleas as members of the genus *Rhododendron* and place around 71 of these 800 species in what some call

*Rhododendron* series *Azalea* and others *Rhododendron* subgenus *Anthodendron*. This series or subgenus encompasses all the true azaleas.

Plants of most of these 71 species were at one time regarded as constituting a genus of their own, the genus *Azalea*. However, botanists today have officially discontinued the use of "Azalea" and replaced it by "Rhododendron." In consequence the azaleas are now a series or subgenus within the genus *Rhododendron* and the Latinized names of the azalea species should be preceded by "Rhododendron" or "R", not "Azalea" or "A". However, most nurserymen and amateurs continue, as we do here, to use azalea, not rhododendron, as the common name for these plants.

Finally, this series or subgenus of rhododendrons which contains the azaleas, is in its turn subdivided into six subseries or sections. Five of these are important to the gardener in dealing with azaleas. Their subseries names occur throughout these pages. These five are—

1. SUBSERIES LUTEUM (Section Pentanthera)<sup>1</sup> which includes all but two of the deciduous species of the United States, as *arborescens*, *calen-*

*dulaceum*, *canescens*, *nudiflorum*, *occidentale*, *prunifolium*, *roseum*, and *viscosum*, and three, *japonicum*, *molle*, and *flavum* from other areas.

2. SUBSERIES OBTUSUM (Section Tsutsutsi) which includes the evergreen or persistent leaved species of China, Japan, and Formosa as *indicum*, *macrosepalum*, *mucronatum*, *obtusum*, *oldhami*, *phoeniceum*, *poukhanense*, *scabrum*, and *simsi*.

3. SUBSERIES SCHLIPPENBACHI (Section Sciadorhodion) which includes such fine deciduous species from Korea, China, and Japan as *schlippenbachi*, *reticulatum*, *mariesi*, *weyrichi*, and *quinquefolium*.

4. SUBSERIES CANADENSE (Section Rhodora) which includes the deciduous species *canadense* and *vaseyi* from the United States and *pentaphyllum* and *albrechti* from Japan.

5. SUBSERIES NIPPONICUM (Section Viscidula) which is monotypic and includes only a single species, *nipponicum*, from Japan.

Each subseries (other than the monotypic subseries Nipponicum) represents azalea species which appear to be closely allied in the processes of evolution. Consequently matters of cultivation, hybridization, propagation, flower color range, and flower form, which differ between species in different subseries, generally are more similar for species within the same subseries. In chapter V the important species within

<sup>1</sup>The subdivision of the comprehensive genus *Rhododendron* into so-called "series" and "subseries" is a temporary expedient of taxonomists designed to place related forms together pending further study of this large but imperfectly-known group of plants. All the azaleas, collectively, constitute one such series, the Series Azalea, in contemporary botanical parlance. The subseries serve as guides in understanding and ascertaining relationships within the group of plants that collectively constitute the Series Azalea.

The subseries names are taken from a characteristic and usually well known species in the subseries. However, since the subseries names are merely species names in unmodified form, such subseries names are not considered as having proper botanical standing under the International Rules of Botani-

cal Nomenclature. Therefore, the equivalent sectional names shown above in parenthesis, as (Section Pentanthera), have also been included since they conform to the Rules and will be found in critical botanical treatments of azaleas. The use of the term "section" refers back to a former and more stable method of designation which may subsequently be revived after further botanical study clarifies the relationships existing between rhododendron species.



each subspecies are described from the horticultural standpoint.

SPECIES, VARIETIES, HYBRIDS,  
AND CLONES

**SPECIES.** A *species* (the term is both singular and plural) is a group of wild plants with so many characteristics in common as to indicate a high degree of relationship and common descent. These wild plants are therefore given a collective name composed of the name of the genus and a descriptive term or epithet in Latin or Latinized in form. Thus the Western Azalea is named *Rhododendron occidentale* (abbreviated *R. occidentale*). In this volume we omit the part of the name that refers to the genus since all the plants we deal with are of the one genus *Rhododendron*. The various species within any genus, such as the genus *Rhododendron*, in theory, and usually in fact, are separated from each other by reasonably distinct characteristics.

**VARIETIES AND FORMS.** The innumerable individual plants composing a species are not exact duplicates identical in all respects. A population census of the species *calendulaceum* might show several million plants growing in the wild; of the species *prunifolium*, only a few thousand. In either case each of the seed propagated individuals in the wild, as well as in gardens, that belong to or constitute the species may vary from other individuals of the species in minor characteristics not necessarily readily observable. On the other hand, groups of individuals within the species may all possess some variations that are substantially similar, readily observable, and important horticulturally. One group of individuals within the species *calendulaceum* may vary from other groups within that species in color of flower, as light yellow or orange or scarlet. Groups of individuals with-

in the species *obtusum* vary from other groups in height, as ground covers or 10 foot shrubs, in color of flowers as white or salmon, pink, crimson, or purple, or in hardiness, or in combinations of these and other characteristics. It is these more important variations in minor characteristics, usually on a geographical basis, that give rise to *varieties* ("var."). More local or sporadic variations usually are classified as *forms* ("f.").

**CLONES.** When a gardener buys a plant grown from seed or dug up in the wild he must recognize that, depending on the variability of the particular species, variety, or form, he is not certain of acquiring a plant even apparently identical with his neighbor's plant of the same species, variety, or form name. If an individual plant within a species, variety, or form is selected as being particularly desirable, it can be preserved absolutely only by being propagated vegetatively by cuttings, grafts, divisions, or layers. The original selected plant and the aggregate of the plants descended from it by vegetative (asexual) propagation constitute a *clone*. All members of a clone are identical except as influenced by environment or as rarely, but directly, changed by bud mutations (sports). Most so-called "varieties," "horticultural varieties," "named varieties" or "garden varieties" of azaleas are clones ("cl."). Examples of clones are *indicum* cl. Warai-gishi, *phoeniceum* var. *calycinum* cl. Omurasaki; *mucronatum* f. *plenum* cl. Fujimanyo. Whether a clone is potentially immortal or whether there is some overall limit to its longevity as a whole (not of individual members), is unknown. Some clones have vanished but whether from failure or inability to propagate vegetatively or from disease attacking and causing

the death of all members of the clone or for other reasons is not clear.

**HYBRID GROUPS.** The majority of azaleas grown today in gardens are *hybrids*, the result of crossings between parents of different species, varieties, or forms. The individuals grown from seed of any such cross are not identical as are the individuals composing a clone; like the individuals composing a species, each individual raised from such a cross is different in greater or less degree. Repetition of a cross, or interbreeding of the individuals derived from it, may give rise to additional variation within the group. Furthermore, as often happens, individuals of more than two species are in the background heredity as one of these hybrid groups. These poly-hybrids (abbreviated to *polybrid*) are rather common among garden azaleas. In technical parlance, such a group is called a *grex hybrida* (literally, a hybrid group). It is often convenient to give such a hybrid group a name. However, it is to be understood that any such

name refers to the hybrid group in its total variation and not to individual clones within the group, and so plants sold under any such hybrid group name may vary widely. Ghent (gandavense), Koster (kosteriana), Mortier (mortieri), Viscosepala, and Sander (sanderi) are examples of such hybrid group names. There are two ways of writing such names: Ghent Hybrids or  $\times$ Gandavense, Koster Hybrids or  $\times$ Kosteriana, and Sander Hybrids or  $\times$ Sanderi. The first method is used here because it is simpler and because it is sanctioned under the International Code of Nomenclature for Cultivated Plants.

**CLONES OF HYBRID GROUPS.** Especially desirable individuals of a hybrid group may be selected and propagated vegetatively and so give rise to a clone, as Sander Hybrid cl. Vivid, Viscosepala Hybrid cl. Daviesi, Ghent Hybrid cl. Pucelle. Thus a clone may be either hybrid or nonhybrid in origin. The great variability inherent in azaleas makes clones of especial importance.

## II. AZALEA PLANT HABIT AND AGE

### PLANT HABIT

Azaleas are primarily shrubs, although a few of the deciduous azaleas, as *pentaphyllum*, *arborescens*, *quinquefolium*, *reticulatum*, and *weyrichi*, make small trees in the wild but not usually under garden conditions. The deciduous azaleas are upright, rather than spreading, and may be from a foot or two to 10 or 15 feet tall. *Canescens* quite commonly grows to a height of 15 feet in the wild in the woods of northern Florida. The evergreen azaleas of the Obtusum Subseries include both upright and spreading shrubs, some less than a foot high, others up to 10 feet or more. These evergreen azaleas, and particularly the Kurumes, generally have the reputation of being low-growing. However, while they are still too new in this country to know their ultimate height, many clones have plants which today are around 7 to 10 feet tall and still growing. The evergreen azaleas are usually much branched and dense and twiggy but some, as *kaempferi*, tend to send up tall leaders and then fill out with age. The deciduous azaleas are usually more open or loosely branched, some having ascending and others spreading branches. Other deciduous azaleas, as *schlippenbachi* and *flavum*, are densely branched.

Among the azaleas, plants can be had of about every known habit for a shrub. There is none of a weeping form, although many upright azaleas, as they grow older, tend to overarch. Neither is there any of a columnar form and there is a suspicion that even the most upright ultimately will be almost as broad as tall or even broader than tall. A century old plant of Ghent Hybrid cl. Unique at the Sunningdale

Nurseries in England is 16 feet tall and 30 feet wide. The more spreading types, as *mucronatum*, will quickly be twice as broad as tall and plants of this species may be seen in Chestnut Hill, Philadelphia as much as 23 feet in diameter.

Azaleas are not fast growers; neither (with the exception of the very dwarf azaleas) are they slow growers. A growth of 3 to 8 inches a year is common.

### LIFE OF PLANTS

Azaleas are long-lived plants and their beauty increases with size and age. They grow old gracefully. Plants of the deciduous azaleas and others have been in the Arnold Arboretum near Boston, Massachusetts from 50 to 70 years and are still flourishing. They include such species as *arborescens*, *calendulaceum*, *roseum*, *kaempferi*, *nudiflorum*, *schlippenbachi*, *vaseyi* and *viscosum*, and many of the Ghent and Arnold Hybrids have been growing there nearly that long. Even so unsatisfactory a plant as *flavum* has lived at the Arboretum for the same period. Some of the Indian Hybrids now on display at Magnolia Gardens near Charleston, S. C., were first planted a century ago. The large Kurumes and Kaempferi Hybrids at the home of Henry F. duPont, at Winterthur, Delaware, are more than 25 years old and some of the Kurume introductions in 1917 are still living in pots in the greenhouses of John S. Ames at North Easton, Massachusetts. Even the oldest of our azaleas in cultivation are still too young for one to start the preparation of life expectancy tables, but at least any owner of a well established azalea can know it will probably outlive him and his children.

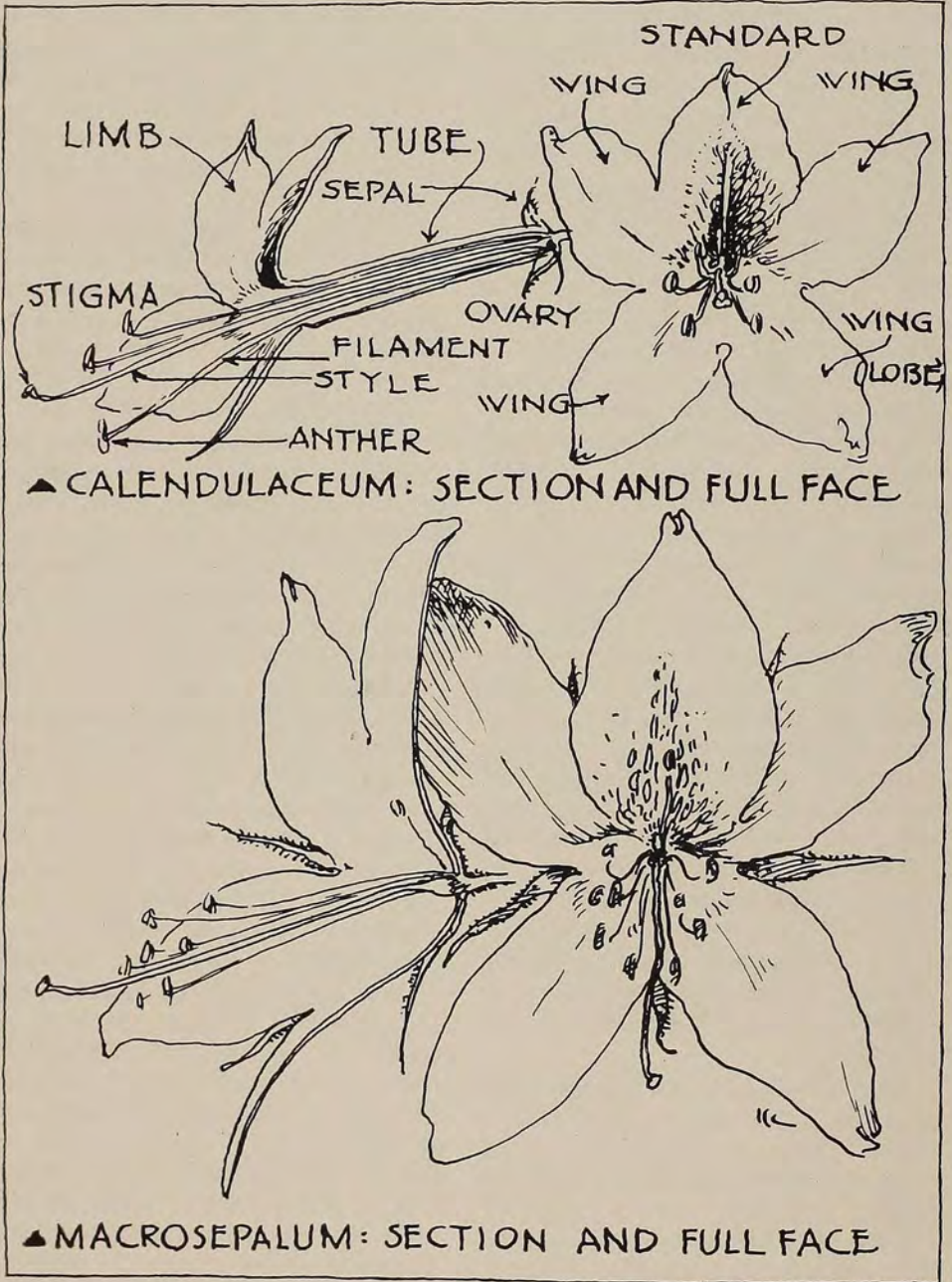


Plate 2

B. Y. Morrison

Flower Parts and Shapes

### III. AZALEA FLOWERS

#### FORM

Much of the beauty of azaleas is attributable to the wide variation in form, size, and color of their flowers. Understanding of the structure of an azalea flower is a prerequisite to identifying variations in form.

**COROLLA AND CALYX.** The typical flower has five colored petals, better called corolla lobes because they are joined or fused for some distance up from their base and then flare out. Together these corolla lobes constitute the corolla of the flower. This gives a funnel-shaped corolla composed of a tube (the lower fused portions) and limbs (the upper separated, but slightly overlapping or imbricated, flaring portions). The five limbs arrange themselves in a butterfly-like fashion. As you face the flower one limb, the standard, is at the top. Two limbs, the upper wings, are on either side and somewhat below the standard. They usually, but not always, constitute the greatest width of the flower. The two remaining limbs, the lower wings, are still further below but closer together, although occasionally they spread out and constitute the greatest width of the flower.

The ovary with its five cells (locules) surmounted by its single style rests in the center and just above the base of the corolla. The stamens with their pollen-bearing anthers arise at the juncture of the ovary and corolla and in species are usually found in multiples of five. They may extend above the corolla (i.e., are exserted) and so be a conspicuously attractive part of the flower, as in *canescens*, *viscosum*, and *flavum*. In most instances the stamens are the same length as or shorter than the corolla. Usually the stamens

of an azalea flower are unequal in length. The anther which tops the stamen, is divided into two sacs, each containing pollen. In the azalea when the pollen is ripe, it pours from an apical pore in each sac rather than being launched by the more common process of each sac opening bookwise along a longitudinal slit.

The corolla at its base is surrounded by, or appears to rest in, five green sepals (better called calyx lobes since they are likewise fused part way up) and together they constitute the calyx. The calyx lobes are commonly minute ranging from  $1/24$  to  $1/8$  of an inch long. Occasionally, as in *macrosepalum*, they become  $1/4$  inches in length and so a prominent feature of the normal flower. Plate 2 on page 12 shows line drawings of the parts of typical azalea flowers.

The flower is supported by a short, slender, green pedicel or footstalk that affixes the flower to the branch. The pedicel may run up to  $3/4$  inch in length depending on the species. In some species it is very short or practically absent so that the flower is sessile and in effect sits on the branch.

**SEMI-DOUBLE AND DOUBLE FLOWERS.** The typical flower is exemplified by the evergreen azalea most frequently used in home gardens, Kurume cl. Hi-no-degiri, and is a single flower. But semi-double and double flowers are also found. In the double flowers, all or most of the stamens are *fully* transformed to petal-like structures so that the true petals and the transformed stamens look substantially alike. This results in filling up, at least in part, the space occupied by stamens in single flowers. Each stamen is usually transformed into one petal-like structure,

but sometimes may be transformed into as many as five by multiplication of parts. The pistil may be absent or transformed. Instead of the usual five petals, double azalea flowers may run up to 30 or so petals. Gable Hybrid cl. La Premiere and Shishu, a *mucronatum* hybrid, are examples.

In the semi-double flowers all or most of the stamens are *partially* transformed to petal-like structures. The partially transformed stamens are smaller than true petals or are contorted or the anther or filament of the stamen may remain evident. Also there may be a few normal stamens or a few stamens fully transformed to petals. Among the various types of semi-double flowers are Indian Azalea cl. William Bull, Fujimanyo (a clone of *mucronatum* f. *plenum*), Rutherford Hybrid cl. Crimson Glory, Gable Hybrid cl. Louise Gable, and *indicum* cl. Warai-gishi.

**HOSE-IN-HOSE FLOWERS.** Further, any of these three (single, semi-double, or double) may be of the hose-in-hose form in which the sepals are fully metamorphosed or transformed into petal-like structures so that calyx and corolla look alike. Such flowers appear to have two cycles of petals, one growing within the other. Sometimes the sepals are only partially transformed to petals and are much smaller or narrower than petals or are contorted. Such flowers should not be given the hose-in-hose designation. Examples of hose-in-hose flowers are Kurume cl. Snow (hose-in-hose single), Pericat Hybrid cl. Glory (hose-in-hose semi-double), and Gable Hybrid cl. Rosebud (hose-in-hose double). Plate 3 on page 15, and plate 6 on page 20 illustrate types of flowers.

It is among the Gable, Pericat, Belgian, and Rutherford Hybrids, the newer Glenn Dale Hybrids, and the

*indicum* (macrantha) varieties that the semi-double, semi-double hose-in-hose, double, and double hose-in-hose flowers more commonly appear. Single hose-in-hose flowers are frequent among the Kurumes and many hybrid groups in the Obtusum Subseries.

**OTHER VARIATIONS.** Other types of variation in flower form occur, as frilled, ruffled, or waved edges of the corolla lobes (here called "frilled"). A few azaleas, such as those of the Canadense Subseries, have bell-shaped rather than funnel-shaped flowers. The parts of most azalea flowers (as calyx lobes, corolla lobes, stamens) occur in fives or multiples of five. Rarely they appear in fours or multiples of four or with 6, 7, or 8 corolla lobes, as usually occurs with Chugai Hybrid cl. Tamagiku. Commonly among hybrids and occasionally among the species the stamens are of varying numbers between five and ten.

Occasionally the petals do not fuse and form a tube with a flaring end but, as in *macrosepalum* f. *linearifolium*, Koromo-shikibu, probably a *macrosepalum* hybrid, and *indicum* cl. Kin-no-zai, are separated and narrow and straplike. The lovely flowers of the native *vaseyi* usually have seven stamens and the two lower wings are somewhat narrower and widely separated from the two upper limbs. A few botanists do not recognize *vaseyi* as an azalea but put it in a separate genus. *Bittia*. *Schlippenbachi* has distinctive flowers which give the effect of a large wild rose and to many it is the most beautiful of azaleas. Plate 4 on page 16 and Plate 2 on page 12 illustrate shapes of the faces of azalea flowers.

It is these variations in flower form, as well as in size, color, and blooming period, that create the differing esthetic effects and untiring charm of azaleas. They should lead the perceptive



SINGLE



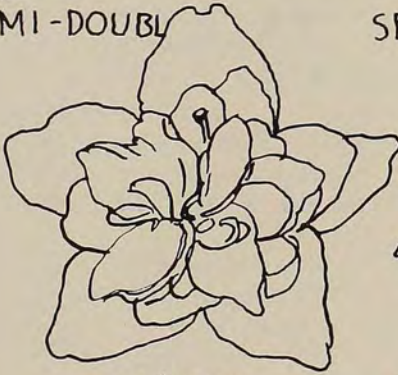
SINGLE: HOSE-IN-HOSE



SEMI-DOUBL



SEMI-DOUBLE: HOSE-IN-HOSE



DOUBLE



DOUBLE: HOSE-IN-HOSE

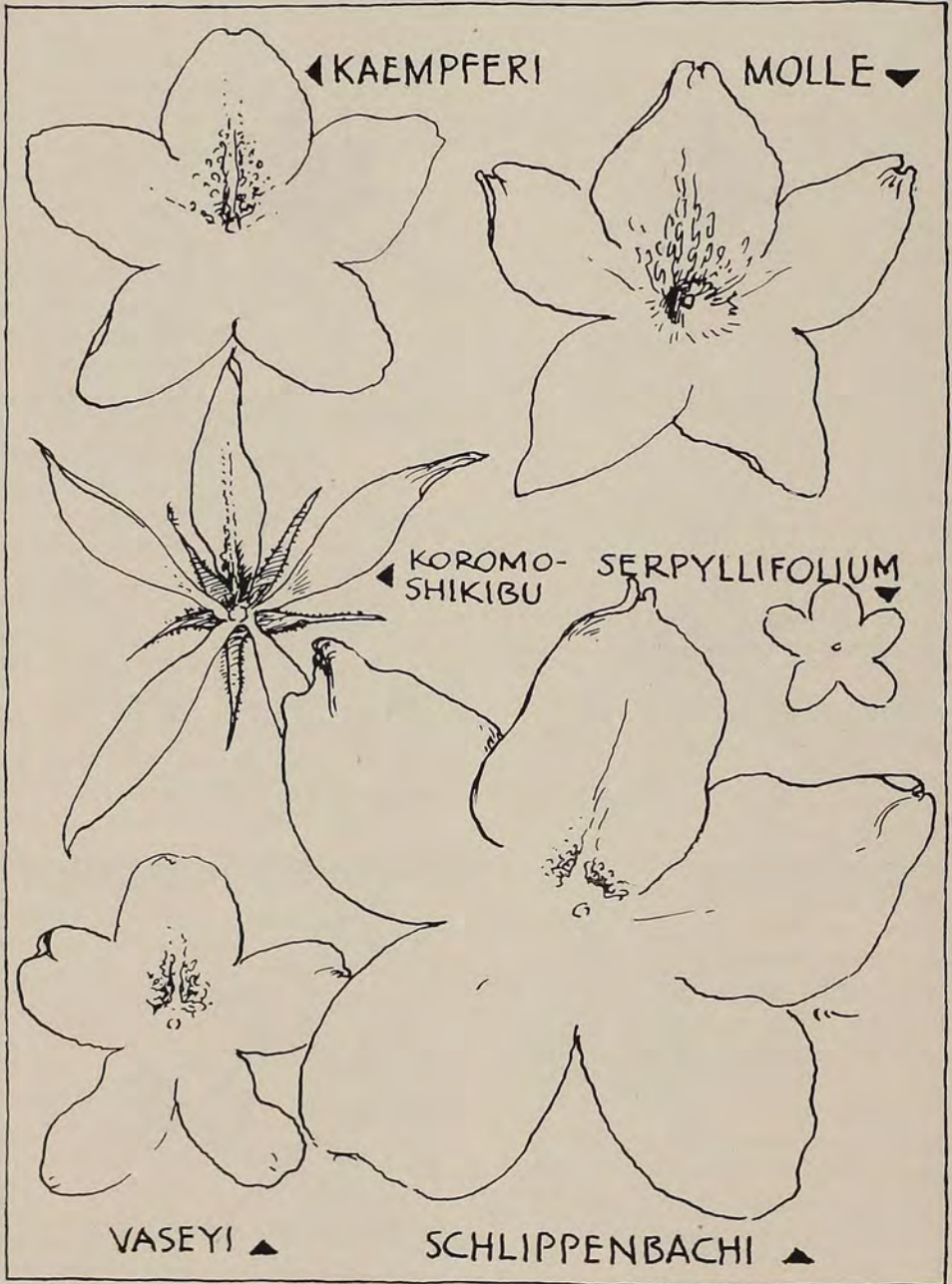


Plate 4

B. Y. Morrison

Flower Shapes



and sensitive gardener to make a wide selection of varieties.

The size of an azalea flower may be measured in two ways—the length being the distance from the base of the tube to the level of the top of the flaring limbs; the width being the distance between the tips of the two upper wings. From the tiny flowers of *canadense* and *tschonoski*, the size of the flowers ranges up to 4½ inches in width among the newer hybrids and 2½ inches in length. *Mucronatum*, *scabrum*, and *schlippenbachi* with flowers 3 inches or more wide have about the largest flowers among the species. Plate 5 on page 18 shows the varying sizes of azalea flowers.

#### CLUSTERS

From each flower bud may come a single flower or a cluster of flowers (umbel-like raceme) up to 20 or more in number.

The particular number of flowers to the cluster varies with and within the species. The more flowers to the cluster, the more rhododendron-like is the effect. Variations of season and environment affect the number of flowers per cluster. The approximate number of flowers to the cluster of some of the more important species is—

Arborescens 3-6	Occidentale 10-20
Austrinum 8-15	Phoeniceum 1-3
Calendulaceum 5-25	Poukhanense 1-3
Indicum 1-2	Roseum 5-9
Japonicum 6-12	Scabrum 2-6
Flavum 7-12	Schlippenbachi 3-6
Mucronatum 1-3	Simsi 2-6
Obtusum 1-3	Vaseyi 5-8

Some of the Ghent and Mollis Hybrids have even larger clusters, especially when making strong vegetative growth as a result of heavy pruning or fertilization.

The flower buds are at the tips of branches but a branch tip may have 2 or 3 buds instead of a single bud, thereby increasing the cluster effect. The azaleas of the Obtusum Subseries and others, even though they may have only a few flowers to the cluster, give a "blooming-all-over" effect as a result of the denseness of their branching, thus making them one of the showiest of flowering shrubs.

#### COLOR

**PIGMENTS AND COLOR RANGE.** The colors in azalea flowers are the result of three groups of chemical compounds or pigments. One group (the anthocyanins) is dissolved in the cell sap and gives the pink, red, and purple range of colors seen typically in the Obtusum Subseries of azaleas.

Also found in the cell sap is a second group of pigments (the anthoxanthins). These pigments are usually colorless but under some conditions develop into yellow or orange. In combination with the pink, red, and purple pigments they give rise to the salmon and brilliant pinks in the Obtusum Subseries. These anthoxanthin pigments will be found, for example, in some forms of the species *simsi*, *indicum*, and *kaempferi*.

The third group (the carotinoids) occurs as solid particles in the cells of the corolla and gives the yellow, orange, scarlet range of colors seen typically in the Luteum Subseries of azaleas. Some azaleas, as *calendulaceum* and *japonicum* combine all three groups of pigments. Separately or in combination these pigments provide azaleas with a wide range of colors from yellow through orange, scarlet, crimson and purple, but not blue. However, purple is a result of combinations of red and blue anthocyanins and therefore it is to be expected that on occasion indi-

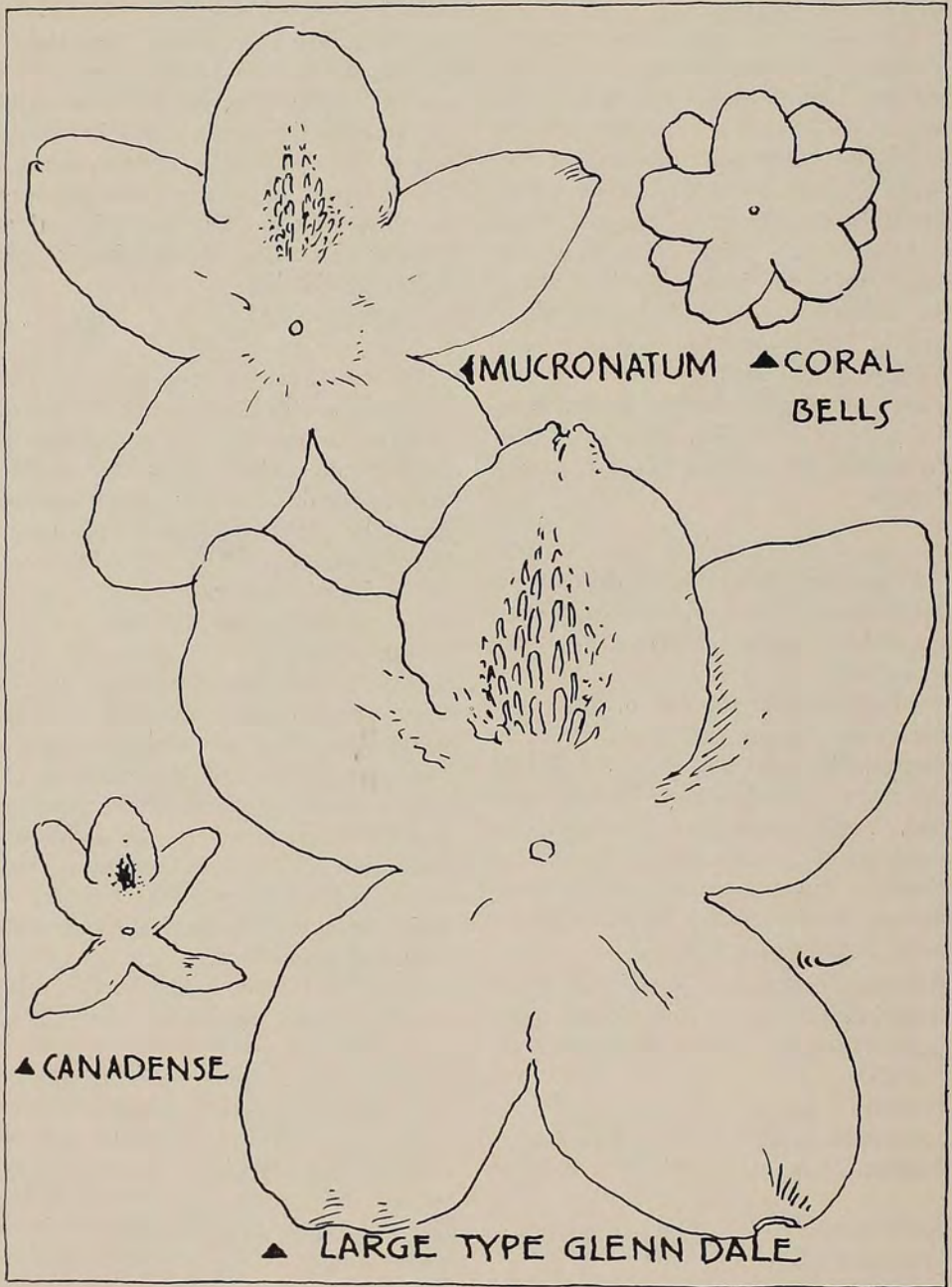


Plate 5

B. Y. Morrison

Flower Sizes

vidual plants might "throw" a blue color. Reports have been made of plants found in the wild that, while not actually "blue," have so little of the red pigment in the flowers that they have a distinctly bluish tinge. White, which is common among azalea flowers, results from a lack of these pigments and to the presence of air in the exterior cells of the corolla.

"BLOTCHES." An azalea flower is not necessarily all one color, that is, a "self." Many are bicolors with great variation in pattern. The large majority of azalea flowers accentuate their attractiveness and color effect by having a "blotch" of a different color on the standard, often extending onto the two upper wings. This blotch may be either lighter or darker than the ground color.

STRIPED FLOWERS. *Simsi* var. *vittatum* (*Vittata* Fortunei) introduced to England by Fortune from Chinese gardens around 1850 has a white flower striped, dotted, or flecked magenta, or some of the flowers may be magenta selfs. In rare years all its flowers will be magenta selfs. *Indicum* f. *variegatum* (*Matsushima*) introduced to England by McKilligan around 1833, likewise is a white flower striped or dotted. Neither is known growing wild. Both are likely ancestors of the numerous flowers that today are dotted, flecked, striped or sectored with a color different from the ground color. The striped flowers have a peppermint stick candy appearance loudly admired by partisans and condemned by opponents. White flowers may also have a colored margin, or colored flowers a white margin. The effect is that of a throat differing in color from the rest of the flower.

On the *same* plant there may be differently colored flowers. This is exemplified by *simsi* var. *vittatum* itself or Chugai Hybrid cl. How-raku which has flowers that are white with a char-

treuse blotch, white with faint dots of tyrian rose, white flecked or striped tyrian rose, half tyrian rose and half white with dots, and tyrian rose selfs. This variation in color among flowers on the same plant is characteristic of the Chugai Hybrids, common among the Indian Azaleas, and occasionally found among the Kurumes and others of the Obtusum Subseries.

A plant with striped (or dotted, flecked or sectored) flowers is not fixed except in the sense that it will continue to produce a known range of variants. These variants from the irregularly striped (or dotted, flecked, or sectored) flowers are, in order of common occurrence, (1) self-colored flowers of the color of the stripe, (2) flowers characterized both by a white ground flushed with a hue derived from the color of the stripe but usually lighter in tone and by an irregular white margin, (3). flowers with a white base and a margin of the color of the stripe, and (4) least often, white flowers. Insofar as some twenty years experience shows, cuttings taken from branches showing any one of such four variations produce plants with that particular variation and it becomes permanent. Cuttings taken from the striped (or dotted, flecked, or sectored) branches of the original plant produce plants that are equally permanent in their capacity to go on throwing all of the range of variants noted above. This has been observed in the Glenn Dale Hybrids, in the Chugai Hybrids, and occasionally in the Belgian Hybrids.

These color variations may at times arise from sectorial chimaeras or variegations as where an identical sector or wedge of each flower on a stem or on all stems of a plant has a different color from the rest of the flowers. This may be illustrated by some forms of the Kurume cl. Nani-wagata. Such chi-



Plate 6

Robert L. Taylor

*Indicum* cl. WARAI-GISHI

An example of semi-doubleness (partial petaloidy of stamens) in azaleas.

maeras probably have a genetic basis. They are not graft chimaeras or graft hybrids such as result from development of a bud and branch at the point of union of a stock and scion.

Where the dominant flowers are white striped, dotted (sanded), flecked (flaked), or sectored a color, the plant is likely also to produce occasional branches with self-colored flowers of that color. Branches with these self-colored flowers may be pruned out if a more uniform plant with only the striped, dotted, flecked, or sectored flowers is desired.

When accuracy is important in defining hues including their tints, shades, and greyed hues, comparison with a standard color chart, such as the Horticultural Colour Chart issued by the Royal Horticultural Society of Great Britain or the older Ridgway's Color Standards and Nomenclature, and use of the chart's color terms, are necessary.

#### FRAGRANCE

Acuity in sense of smell varies greatly among individuals and increases the difficulty of any attempt to describe odors in words. In general, fragrance among wild azaleas is not common. It is found most extensively among azaleas of the Luteum Subseries. *Arborescens*, *viscosum*, *atlanticum*, and *serrulatum* may have a strong, and at times rather heavy, fragrance, particularly after rain or during damp weather. To some the fragrance of *arborescens* is like heliotrope, that of *viscosum* and *serrulatum* like clove, and that of *atlanticum* like some roses. *Roseum* has a pervasive clove fragrance. An especial delight of *alabamense* is its pleasant and distinctive jasmine scent. *Canescens*, *oblongifolium*, and *nudiflorum* may have a mild, musky sweet fragrance to none at all. *Occidentale*

and *flavum* have a strong sweet fragrance.

In the Obtusum Subseries *micronatum*, *phoeniceum*, and *macrosepalum* have a delicate scent, with *macrosepalum*'s red clover fragrance being perhaps the most pronounced in the subseries.

#### BLOOMING PERIOD

FORMATION OF FLOWER BUDS. Long days and short nights promote azalea shoot or stem growth. Azalea stems usually have a growing period in the spring. When the growing period for an azalea stem is over, buds form at the end of the stem. The buds are vegetative in that they contain rudimentary stems and leaves. But in the Obtusum and Schlippenbachi Subseries the terminal buds are also potentially flower buds and under appropriate conditions of nutrition, moisture, and warm summer temperature they will also contain rudimentary flowers. Azalea buds in those subseries are therefore "mixed,"—combining both rudimentary stems, leaves, and flowers. In the Canadense and Luteum Subseries the floral and leaf buds are separate.

Formation of the earliest stages of flower parts (flower primordia) within the buds following spring growth is initiated in late June or July and is completed by the end of July or early August for most azaleas in this country, and earlier farther south. Unlike many plants, relative length of day and night has little effect on the azalea's initiation of flower buds. The buds follow a period of stem growth provided temperatures are above 65°F. Once initiated the buds will develop and grow at lower temperatures until dormancy occurs. Moisture is of importance at bud initiation time. *Schlippenbachi* exemplifies an azalea that will

not set or develop buds if the summer is dry and the moisture supply low. San Francisco (as contrasted with Berkeley across the Bay) exemplifies an area that is too cool in summer to produce good bud formation and stem growth in case of most azaleas.

**DORMANCY.** Sometime after bud initiation and during the period of bud development, the budded branch becomes dormant if the temperature is low enough. Processes that ready the bud for opening are accelerated during this chilling period. Without a chilling period the blooming is scattered and erratic, and continues over a longer period. With a suitable chilling period, the plant breaks into bloom all at once after a subsequent period of higher temperatures and the blooming period is shorter. Apparently a chilling period of around 4 to 8 weeks at temperatures below 50°F. and above freezing is required. While azaleas bloom in the tropics, they make a better display in temperate climates that have cooler temperatures part of the year.

**RECURRENT GROWTH PERIODS.** As already mentioned, azalea stems have a growing period in the spring. Following this are formed the flower buds that open and bloom the next blooming period which in most areas would be the succeeding spring. However, in the South, some or all of the crop of flower buds may open and bloom earlier perhaps induced by rain after a dry period. This is immediately followed by a second period of growth and the formation at its conclusion of a second crop of flower buds. In the far South these processes may repeat themselves a third time before cold weather.

**TIME OF BLOOMING.** In Medellin, Colombia, lat. 6°N., azaleas (Belgian Hybrids) bloom the year around and grow new shoots, form and develop buds, and flower continually. How-

ever, the bloom is scattered or dribbles along—no particular show at any one time.

In central Florida *simsi* var. *vitatum* will start blooming in September and continue through the winter until April. Duc de Rohan and Hexe will start blooming in November or December and continue into March, and also will have scattered bloom the rest of the year. Other Indian azaleas bloom from mid-February to mid-March. The forms of *indicum* (*macrantha*) bloom from late April well into the summer although some, as Warai-gishi, will have a second heavy blooming period in the fall. Some plants of *serrulatum* will flower once in July or August while others may remain in more or less continuous bloom from July to early November.

The San Francisco area has bloom from mid-September through May starting with some of the Belgian and Glenn Dale Hybrids and *mucronatum* forms and ending with Chugai Hybrids, *viscosum*, and *kaempferi*.

Washington, D. C. and Seattle, Washington, have a blooming period that extends from mid-April through most of June, or into the middle of July if the late blooming deciduous azaleas, as *occidentale* and *viscosum*, are taken into account. *Prunifolium* and *serrulatum* will be even later.

In a general way, the farther north, the shorter the blooming period for a plant, but the more concentrated the bloom and the greater the display while in bloom. The farther South, the longer the blooming period for a plant, but the more dribbling or scattered the bloom and the less the display at any one time while in bloom. Species vary in these tendencies. *Indicum* itself and many plants derived from it seem particularly inclined to scattered bloom both before and after the normal time.

*Simsi* itself shows no indication of irregularities in flowering, but the variety *vittatum* is easily stimulated into irregular and repeated flowerings, and derivatives from *vittatum* are also irregular in the same fashion. On the other hand, *simsi* and its derivatives

can be induced to flower completely and out of season by the simplest of forcing devices, heat and water after cool and dryness. *Phoeniceum* and its derivative *Formosa* do not scatter their bloom even when grown as far South as the Gulf States.



Plate 6a

*Speciosum* (Oconee Azalea) 2/3×

Lilian A. Guernsey

## IV. AZALEA LEAVES

The variation among azalea leaves in degree of evergreenness, size, shape, color, arrangement, and hairiness is not only an esthetic feature, but also helpful in identifying species and ascertaining the parentage of hybrids.

### SIZE

The species *tschonoski* has minute leaves  $1/5$  to  $4/5$  inches long and  $1/6$  to  $2/5$  inches wide, and *serpyllifolium*,  $1/4$  to  $1/2$  inches long. At the opposite extreme leaves of the little known or cultivated species *nipponicum* run up to 7 inches long and 3 inches wide. Both *molle* and *prunifolium* also have long leaves, sometimes 5 to 6 inches in length. More commonly azalea leaves are 1 to 2 inches long in the evergreen species and 3 to 4 inches long in the deciduous species.

### EVERGREENNESS

The evergreenness of many azaleas is of a kind unusual among flowering shrubs. It should not be thought of in terms of the evergreenness of a hemlock or boxwood. It results from the fact that azaleas in the Obtusum Subseries have dimorphic leaves, that is, two different sets of leaves of different forms. The leaves that unfold in the spring (spring leaves) are usually larger and thinner and are deciduous, falling off as cold weather comes on. The leaves that unfold in the summer (summer leaves) are smaller and thicker, persist into the winter, and in most instances are evergreen through the following spring. There are, however, some more or less deciduous species in the Obtusum Subseries, as *poukhanense* and *kaempferi*. Their summer leaves may persist into the winter in warmer areas, but in colder

areas their leaves are almost wholly deciduous. On the other hand, none of the azaleas in the Luteum, Schlippenbachi, and Canadense Subseries have dimorphic leaves and all their leaves are deciduous.

### SHAPE

Leaves of azaleas may be almost round or oblong but shapes as lanceolate or oblanceolate, ovate or obovate, are commonest. One variety, *macrosepalum* f. *linearifolium*, has extremely narrow leaves from  $1\frac{1}{2}$  to 3 inches long but only  $1/12$  to  $1/4$  inches wide.

### COLOR

Leaves vary from the dark green of the summer leaves of azaleas in the Obtusum Subseries through the paler greens of the deciduous species. Chugai Hybrid cl. Keisetsu has variegated leaves. Some deciduous species show fall coloring in their leaves from pure yellow through crimson to vinous purple. Many evergreen clones show bright green, green flecked with bronze or rust, bronze, red, or dark red leaves all through the late fall and winter and for garden decoration are worthy of cultivation for their fall foliage alone.

### ARRANGEMENT

Azalea leaves fundamentally are arranged in a spiral. They are never opposite or in pairs. However, spirals are sometimes so condensed and the leaves therefore so crowded at the tips of the branch that the leaves appear to be in star-like whorls. In certain species leaf arrangement becomes one of the attractions. Azaleas in the Schlippenbachi Subseries and *pentaphyllum* in the Canadense Subseries have star-like "whorls" of leaves at the branch



tips. Many species, as *kaempferi*, also crowd their leaves at the end of the branches but without the appearance of "whorls." The evergreen species usually have leaves well distributed along the branches as well as crowded at their tips. These leaves along the branches are lost in the late fall but the summer leaves at the tips of the branches are retained.

#### HAIRINESS

The particular covering (indumentum) of azalea leaves, when present, consists of hairs which may be straight or sometimes curly but which are always unbranched and usually more or less closely appressed to the surface of the leaf. The hairs themselves are visible to the naked eye but not their flattened or laminated, rather than cylindrical, shape. The hairs may be of uniform size for a given species or, as in *canescens*, may occur as a dense, felty pubescence of very numerous, whitish, and relatively short hairs interspersed with occasional longer, thicker, and more bristle-like hairs, (setae) imparting a strigose character to the leaf surface. These bristle-like setae are usually sharp pointed but in some species, as in *atlanticum* and *alabamense*, they may be gland tipped (glandular setae) so that the leaves are sticky as they first unfold. Under the microscope these bulbous glands vary interestingly (within a species) from straw yellow in color through pink to deep red. Occasionally small insects are trapped upon these sticky glands. The hair may vary from yellow through gray-brown to reddish in color, although in young leaves, particularly of *mucronatum* and its allies and in *canescens*, *roseum*, and some others in the Luteum Subseries, the hairs may be nearly white.

The hair of azalea leaves is sparse compared with that of the leaves of

many other species in the genus *Rhododendron*. Some azalea leaves are glabrous (bald and smooth) at maturity. Some have hair on only the underside of the leaves. *Oldhami* is among the most hairy azalea species and has rather conspicuous reddish brown hairs on both sides of the leaves. *Mucronatum* leaves are clothed on both sides and *macrosepalum* leaves on the underside, with less conspicuous gray to reddish hairs.

Leaf hairs, in general, are thought to aid in regulating the water supply of the plant through restricting loss by transpiration when supply from the roots is short. For this purpose, however, the scanty strigose azalea hairs are among the least efficient forms of indumentum found in the genus *Rhododendron*. Their function, if any, is one chiefly of conjecture. They may in fact be a relic or subsidiary appendage with no special function at all so far as the well-being of the plant is concerned in this day and age.

#### GLAUDESCENCE

Leaves of some species, such as *canadense*, have a gray, waxy covering (bloom) on their undersides. Such leaves are glaucescent like the skin of some plums from which the bloom can be wiped off. In other species, as *viscosum* and *atlanticum*, only some of the individual plants making up the species have leaf glaucescence; others do not. Since these individual plants that have glaucescence occur quite haphazardly throughout the population, leaf glaucescence is clearly not a segregating character. As such it can scarcely serve as a basis for such varietal status as has been accorded it in botanical texts.

Glaucescence may possibly, like hairs, aid in prevention of water loss though probably not to any significant extent or more species would be ex-

pected to possess this character. Without a pocket lens, glaucescence and fine white hairiness can be easily confused for both may give a similar gray appearance to the leaf underside.

#### ODOR

The leaves of many azaleas have, for a short period when opening in the

spring, an unpleasant musky odor, usually noticeable, however, only in the still confined air of a warm place, as a greenhouse. Plants with a *molle* or *japonicum* heredity in whole or in part have leaves that are noticeably odoriferous in hot mid-summer weather. The leaves of some azaleas, as *arborescens*, possess, when dried, a persistent vanilla (coumarin)-like fragrance.

#### SOME BOOKS ON AZALEAS

CLEMENT GRAY BOWERS, RHODODENDRONS AND AZALEAS, The Macmillan Co., 1936, 526 pp. on both azaleas and rhododendrons.

H. HAROLD HUME, AZALEAS, KINDS AND CULTURE, The Macmillan Co., 1948, 189 pp., 48 ills.

H. SCHEERLINCK AND OTHERS, TUINBOUW ENCYCLOPEDIË, VOL. I. DE AZALEA INDICA L., De Sikkel, Antwerp, Belgium, 1938, 527 pp. In Flemish. Belgian Hybrid azaleas.

J. B. STEVENSON, EDITOR, THE SPECIES OF RHODODENDRONS, 2D ED., 1947, The Royal Horticultural Society, London, England, 81 pp. on azalea species included.

E. H. WILSON AND ALFRED REHDER, A MONOGRAPH OF AZALEAS, The Arnold Arboretum, 1921, 206 pp. Azalea species.

Occasional articles and notes on azaleas appear in the National Horticultural Magazine, The American Horticultural Society; The Journal of the Royal Horticultural Society and the Rhododendron Yearbook of that Society; The Quarterly Bulletin of the American Rhododendron Society; and the Arboretum Bulletin of the University of Washington Arboretum Foundation.

#### INDEX

An index of species, varieties, forms, and clones listed in the Azalea Handbook will be a part of the index for Volume 31 (1952) appearing in the October 1952 issue of the National Horticultural Magazine.



Plate 7

John L. Creech

*Atlanticum* (Atlantic Azalea)

An azalea with a stoloniferous root system susceptible of propagation by division. *Atlanticum* is almost unique among azaleas in this characteristic.

## V. AZALEAS FOR THE GARDEN

This is neither a census report on the azalea population of the world nor a news story on the finalists in a worldwide azalea beauty contest. It is more nearly an azalea Who's Who based on the reported experience of plant explorers, taxonomists, hybridists, and horticulturists. Here are described only azaleas that are of horticultural importance and available to the gardener in this country, although in a few instances he will have to be both patient and insistent in locating sources of supply and occasionally have to import from abroad.

The arrangement of the chapter is, first, the azalea species, varieties, and forms and, second, the hybrid groups of azaleas. For each hybrid group some representative clones are listed. The descriptions, among other items, usually cover the habit of the plant, its relative order of blooming, and the flower type, size, and color.

*Habit:* The height for fully matured plants in semi-shade is designated as low (up to 3 ft.), medium (3 to 5 ft.), or tall (over 5 ft.).

The terms upright (erect and taller than broad), spreading (erect and broader than tall), and dense (compact and twiggy) are used to describe other habit characteristics, bearing in mind that with age many upright plants tend to fill out and spread and many upright and spreading plants tend to overarch. Plants on the West Coast are generally lower growing than in the East and plants grown in the shade are generally taller than those grown in the sun.

*Blooming period:* The calendar blooming period varies, of course, from area to area with latitude and climate; from year to year with earliness or lateness of the season; from plant to

plant with exposure and other cultural conditions and length of time established. The order of bloom is set forth in five categories: early, early midseason, late midseason, late, and very late. Emphatically the designations are useful for order, not date, of bloom. Moreover, the same plants may even vary a little in order of bloom from season to season and plants of the same clone may even vary (sometimes strikingly) in order of bloom from region to region.

*Flowers:* Type of flower is specified as single, semi-double, or double, and also, if hose-in-hose, that fact is stated. Size is expressed by width in inches, but this characteristic as well as color, will vary somewhat with growing conditions and from season to season. Where the data are available, colors are designated both by the common names as yellow, orange yellow, yellowish orange, orange, reddish orange, orange red (scarlet), red (crimson), violet red (pink), reddish violet (purple), and violet without respect to the tone of the hue (light to dark scale) and whether whitened or greyed, and also by the more precise Royal Horticultural Society Colour Chart (HCC) or Robert Ridgway Color Standards and Color Nomenclature (RCS) names. Where such data are not available the color designation and terminology are those of the introducer or a grower. While likely to be more poetical, such a color designation and terminology unfortunately afford no exact basis for comparison.

A majority of azalea flowers heighten their color effect and attractiveness with a blotch of somewhat darker or occasionally lighter color and this is frequently mentioned where the blotch is conspicuous.

The recorded color of an azalea flower is not absolute, even for a given clone, since the intensity of pigmentation may vary from year to year at the same site due to climatic or environmental factors. Altitude, temperature, light, and soil chemistry may also be involved. The effect of an abnormal summer may leave its mark in the flower color of the subsequent spring, due perhaps to carbohydrate concentration within the plant. Deciduous azaleas growing at high altitudes (4,000 ft.) in the Blue Ridge Mountains, where strong light but cool air prevails, will develop a stronger color than when transferred to a lower altitude and less intense light.

Occasionally the terms "tender," "hardy," and "very hardy" are used. They serve to divide azaleas into three categories giving a rough approximation of relative ability to withstand low temperatures. However, this subject of hardiness and suitability of azaleas for various regions is dealt with primarily in chapter VI.

*Name:* In some instances it will be seen that different introducers of new clones have given the same name to different plants in different groups, e.g., Pericat Hybrid cl. Glory and Bobbink and Atkins Hybrid cl. Glory, or Glenn Dale Hybrid cl. Bopeep and Mayo Hybrid cl. Bopeep, or Sander Hybrid cl. Ruby, Kurume cl. Hinode-no-taka to which E. H. Wilson, keeper of the

Arnold Arboretum, gave also the alternate name of Ruby, and the plant known as Ward's Ruby. In other instances it will be seen that the same plant has been given different names as Indian Azalea cl. Elegans Superba (Pride of Mobile) or the species *flavum* (*luteum*, *ponticum*). In this volume the alternate name appears in parenthesis. As exemplified above E. H. Wilson gave substitute English names to the Kurumes he brought over from Japan, a confusing practice, as well as one "illegitimate" under the International Code of Nomenclature for Cultivated Plants. Such English names are not translations. They likewise appear in parenthesis, e.g., Kurume cl. Suetsumu (Flame).

A "PI" number after, or in lieu of, a name indicates that the plant was one introduced by the Division of Plant Exploration and Introduction, United States Department of Agriculture, and the number is the identifying plant introduction number appearing in the "Plant Inventory" pamphlets published by that Division.

In a few instances there is given in brackets after a clone with a Japanese name, a free translation of that name in the hope of better fixing the plant in the gardener's mind. This translation is *not* an alternate name. The translations are contributed by Mr. and Mrs. Vincent Canzoneri of Bethesda, Maryland.

## SPECIES, VARIETIES, AND FORMS

### LUTEUM SUBSERIES

The species in the Luteum Subseries come principally from the east coast of the United States, with one from the west coast, two from eastern Asia (China and Japan), and one from the Caucasus-Eastern European region. The leaves are deciduous and the plants

upright but open rather than dense. The flowers have longer tubes than most azaleas, exerted stamens (except in *japonicum*), and a wide color range—yellow, orange, red, pink, rose and white. They account for the only yellows and oranges among azaleas.

Identities and relationships within

this subseries, especially among the eastern North American members, have been much confused because of the lack of adequate basic information concerning the chromosome relationships—even the actual distribution in the wild—of the plants involved. Henry T. Skinner, curator of the Morris Arboretum, Chestnut Hill, Philadelphia, Pennsylvania, is engaged in extensive field and herbarium studies of plants within this subseries. On the basis of these current investigations the classification for plants in the Luteum Subseries set forth below and the explanatory data in connection therewith have been worked out, and the existing range and descriptive data revised, by two members of the Azalea Committee of the American Horticultural Society, Skinner and Wendell H. Camp, curator of experimental botany and horticulture, The Academy of Natural Sciences of Philadelphia.

#### **Austrinum - Prunifolium Alliance:**

These are the native azaleas of the yellow-orange-red color range. The parental types of this alliance must have included an *austrinum*-like early flowering, highly glandular, yellow plant and a *prunifolium*-like late flowering, relatively non-glandular, red plant, both diploids, i.e., possessing the usual 26 chromosomes. From two such parental types all members of the alliance could readily have been derived, including one or more orange flowered mixtures of similar plants (complexes) that are polyploids with 52 chromosomes. Such complexes are conspicuous in the mountain regions. As generally recognized, *calendulaceum* includes these polyploid complexes—at least in part. *Calendulaceum* is therefore to be regarded as an important but nonetheless a derived rather than a basic member of the alliance.

**AUSTRINUM** (Florida A.): Woods and streamsides of northern Florida and the Georgia-Alabama coastal plain to southeast Mississippi; upright, medium to tall; first of the alliance to bloom, late midseason, before *calendulaceum*; flowers 1" to 1¼" in cream yellow, through golden yellow to shades of orange (e.g. maize yellow, HCC 607/2; Indian yellow, HCC 6/2; carrot red, HCC 612/3; apricot, HCC 609/2); usually with petal reverse striped in orange-red to purplish (e.g. mandarin red, HCC 17/2) with tube of the same color. The more occasional pure yellow limb and tube may suggest the original type before the pale or reddish tones were derived by interbreeding with *canescens*. Flowers occasionally semi-double; hardy.

**FLAVUM** (Pontic, luteum) (Pontic A.); This species is found in the Caucasus-Black Sea region and north to Lithuania. It is included in this otherwise American alliance because it has many of the characters of the basic elements of *austrinum* and may indeed be more closely related to this species than has hitherto been supposed. *Flavum* is upright, tall; late midseason; flowers single, 1½", yellow (e.g. chrome yellow, HCC 605) with darker blotch, fragrant. It rarely grows satisfactorily along the eastern seaboard over the years, possibly because the hot weather is too long continued and intense. It may also be more subject to stem borer than other species. *Flavum* is fully interfertile with the other diploid members of the alliance. It is from the synonym for *flavum*, namely *luteum*, that the subseries obtains its name. *Flavum* is shown in Plate 42 on page 139.

**CALENDULACEUM** (Flame A.): Open hillside woods, Pennsylvania to Ohio and Georgia above the fall line. It is upright, tall; late; flowers with gradually dilated tube, single, rarely frilled, 1½" to 2½", with a remarkable range of fine colors, yellowish orange, orange, reddish orange and orange red (e.g. cadmium orange, HCC 8, to spanish orange, HCC 010/1 at tips, with orange blotch; marigold orange, HCC 11; saturn red, HCC 13; fire red, HCC 15/1, and scarlet, HCC 19); very hardy. Blooms about time leaves appear. Probable a derived intermediate of the yellow-red alliance. The orange-red to red phases of this species are usually from higher elevations and later flowering. They may represent a genetically distinct population perhaps intermediate with *cumberlandense*. See Plate 2 on page 12 for a sketch of *calendulaceum*.

**SPECIOSUM** (Oconee A.): Open woods and wooded slopes in piedmont regions of Georgia and South Carolina; medium height, blooms between *austrinum* and *calendulaceum*; flowers 1¼" to 1¾"; color orange (e.g. indian orange, HCC 713/1; marigold orange, HCC 11; saturn red, HCC 13) to some excellent reds (e.g. jasper red, HCC 018; scarlet, HCC 19/1) on the Georgia bank of the Savannah River; with or without an orange blotch; intergrades with *canescens* are often a striking pink. This relatively non-glandular species represents the earliest flowering phase of the red end of this alliance. *Speciosum* is shown in Plate 6a on page 23.

The validity of the name *R. flammeum* (Michx.) Sargent, as applied by Rehder (Jour. Arnold Arb. 26:73, 1945), is open to question; the more familiar name *speciosum* is here retained pending further study of the whole problem.

Material described under *fastigifolium*, with smaller red flowers and orange-yellow blotch, probably falls within the *speciosum-canescens* complex. Of the thirteen plants of *fastigifolium* originally discovered and transplanted only a few are apparently still in cultivation.

**CUMBERLANDENSE** (Cumberland A.): Open woods at higher elevations of Cumberland Plateau from Kentucky, south across Tennessee to the mountains of northern Georgia and Alabama. Height usually 2 to 4 ft., but may attain 9 ft. at maturity; blooms two to four weeks after *calendulaceum*; flowers 1¼" to 1¾"; colors usually orange to reddish orange, orange red and red (e.g. apricot, HCC 609/2; burnt orange, HCC 014; saturn red, HCC 13; mandarin red, HCC 17/1; jasper red, HCC 018; vermilion red, HCC 18); tubes glandular to non-glandular, leaves often small, deep green above and more or less glaucous beneath. Occasional hybrids with *arborescens* occur in clear yellows and pinks.

*Bakeri* as described from the mountains of north Georgia, is essentially similar and evidently represents the somewhat yellower end of the same complex. While including orange reds and oranges the colors of *bakeri* also vary to salmons, salmon apricots and clear straw yellows.

The name Camp's Red A. has been used for a particular selection of plants from the Black Mountain in Kentucky. Ultimately they may be determined not to be true *cumberlandense*. Some seed collected in the

wild as being Camp's Red has been found to produce plants with flowers of colors other than red.

Material described under *furbishi* from single colony in north Georgia, flowers pink with yellow blotch, would appear from preliminary study to find probable origin in hybridization between *bakeri* or a late *calendulaceum* type and *arborescens*.

**PRUNIFOLIUM** (Plumleaf A.): Small wooded ravines in a restricted area along the southern Georgia-Alabama border; tall, to 15 ft., tending to become round-topped with age; blooms after leaves are fully developed—very late (July-August); flowers 1¼" to 1¾", usually reddish orange to orange red or red (e.g. dutch vermilion, HCC 717/1; jasper red, HCC 018/1; vermilion, HCC 18; scarlet, HCC 19/2) but also varies to orange and yellow (e.g. light orange, HCC 12/2). Several characters, including lateness of bloom, flower color, types of pubescence and form and coloring of the flower buds, are suggestive of close relationship between lowland *prunifolium* and upland *cumberlandense*, or even derivation from a common ancestor. Such an ancestor might be the red-flowered progenitor of the present yellow-red alliance.

#### **Alabamense - Atlanticum Alliance:**

With *austrinum*-like early yellow and *prunifolium*-like late red types available, an early white, especially if stoloniferous, is needed to complete the list of basic elements in the American azaleas; such material is most suitably found in this alliance. Yellow blotches and pink colors in this alliance seem to be secondarily derived from the *austrinum-prunifolium* alliance.

**ALABAMENSE** (Alabama A.): In typical form a comparatively scarce plant of dry, open woods of the hilltops of north central Alabama; low growing to 3 feet; stoloniferous; leaves glaucous beneath, fragrant; blooms late midseason, two weeks after *canescens*; flowers 7/8" to 1 1/8", narrow tubed, white, usually with yellow blotch; distinctive jasmine or lemon scent. Breeds freely with *canescens* producing pink and white intergrades, usually earlier flowering and taller, which are widespread over much of Alabama, Georgia, eastern Mississippi and Tennessee; these usually are listed as *alabamense*. Occasionally with partially petaloid sepals.

**ATLANTICUM** (Coast A.): Coastal plain

Southern Pennsylvania and Delaware to South Carolina; very low growing; in "best" forms leaves glaucous and glandular beneath; late midseason; flowers  $1\frac{1}{8}$ " to  $1\frac{5}{8}$ ", white or white flushed with pale violet red (e.g. rhodamine pink, HCC 527/1), sometimes with yellow blotch; rather pungent scent; very hardy, particularly plants from northern limits. The root system is stoloniferous as shown on page 27. An azalea with such a root system spreads by rangy horizontal underground stems that eventually turn up into vegetative shoots above ground. In consequence it can be propagated by division as well as by cuttings of below ground parts, methods not generally common among deciduous azaleas. *Atlanticum* will spread in damp woods or over a meadow bank, sometimes in rather compact clumps, at other times in colonies (single clones) as large as an acre. Intergrades with *canescens* in the southern part of its range and with *nudiflorum* farther north result in local losses of flower and branchlet glandularity, pale to rosy pink flowers, and increase of height. *Atlanticum* is shown in Plate 7 on page 27 and Plate 38 on page 133.

**Roseum-Nudiflorum Alliance:** The widespread pinks of the Luteum Subseries appear basically to have been derived out of combinations between the red end of the *austrinum-prunifolium* alliance and a white, perhaps ancestral to the *alabamense-atlanticum* alliance.

**ROSEUM** (prinophyllum) (Roseshell A.): Open woods from New England to northern Ohio and northern Indiana, southward at higher elevation in the Appalachians to Virginia. It is upright, medium height; leaves pubescent beneath; late midseason; flowers  $1\frac{1}{4}$ " to  $1\frac{3}{4}$ ". Pointed petals usually overlap (imbricated) but are sometimes separated with starry effect; clear deep pink to violet red (e.g. magenta, HCC 27/3; rose bengal, HCC 25/1; neyron rose, HCC 623/1), usually with darker brown-red blotch; stamen filaments same color as limb; pronounced clove scent; blooms about time leaves appear; very hardy. Forms least contaminated by hybridization are restricted to local occurrences on the Virginia Blue Ridge.

**CANESCENS** (Florida Pinxter A., Hoary A.): Moist woods and streamsides North Carolina to Florida coastal plain and west to Texas and Arkansas; medium to tall, attaining 15 ft. in north Florida; leaves very

hairy beneath (except in f. *subglabrum*); late midseason; flowers 1" to  $1\frac{3}{8}$ "; limb near-white to medium or deep pink (e.g. carmine rose, HCC 621/2; crimson, HCC 22/2; rose madder, HCC 23/3), tube darker pink; honeysuckle scent. Yellow blotch may indicate intergrades with *austrinum* or *alabamense*. A delicately handsome azalea for southern gardens. Plants from inland sources are hardy at Philadelphia.

**NUDIFLORUM** (Pinxterbloom A., Honeysuckle A.): Open woods and streamsides at lower elevations, Massachusetts to North Carolina, west to Tennessee and Ohio; medium to tall, sometimes dwarfer and in stoloniferous colonies (var. *andersoni*) as at intermediate elevations on the Virginia Blue Ridge; leaves usually glabrous; flowers 1" to  $1\frac{1}{2}$ ", tubes non-glandular except in intergrades with *roseum*, *atlanticum*, etc., limb near-white, pale pink or pale to deeper violet red (e.g. phlox pink, HCC 625/3; rose bengal, HCC 25/2), tube darker, medium to dark crimson. Occasional plants have semi-double or frilled flowers with revolute (turned back) petals, or with a yellow or orange blotch; stamen filaments usually white; sweet but not spicy scent; very hardy. *Nudiflorum* is shown in Plate 29 on page 100.

**OCCIDENTALE** (Western A., Pacific A.): Southern California to southern Oregon. This appears to be of this alliance, anciently derived, with its own sets of distinctive characters, and now distributionally disjunct from its other members. Intermediate to tall; very late; flowers  $1\frac{1}{4}$ " to 2", with gradually flaring tube (as in *calendulaceum*); creamy white to bronze pink, with lemon or orange yellow blotch, sometimes pale pink to rose on corolla reverse; strong, pleasant fragrance, sweet but not spicy. *Occidentale* has usually been unsuccessful in the east and is somewhat of a mystery to many eastern gardeners. This is not due to lack of hardiness to low temperatures for even its flower buds will withstand at least 11° below zero, but may be due to the warmer, more humid summers in the east. Will grow in west in flat clay bottom lands, moist in winter and very dry in summer, or on high, well-drained shallow soils. Makes a plant 6 to 15 ft. high with annual growth of 4 to 12 inches.

**OBLONGIFOLIUM** (Texas A.): Open wooded hillsides and along streams in southwest Arkansas to east Texas and Oklahoma. A little-understood species in need of re-study in its native habitat. As at present constituted, it includes smooth-leaved, white-flow-



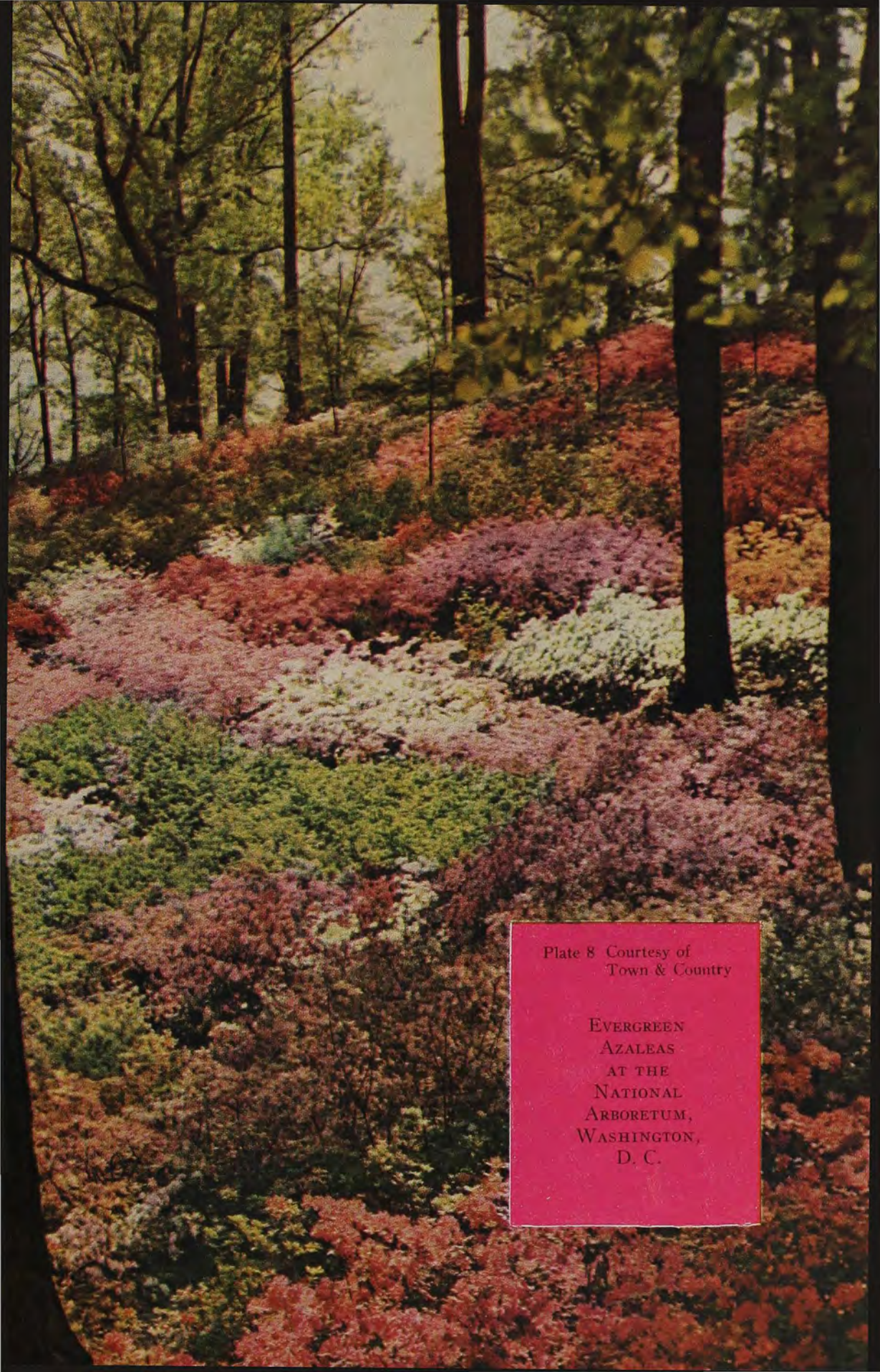


Plate 8 Courtesy of  
Town & Country

EVERGREEN  
AZALEAS  
AT THE  
NATIONAL  
ARBORETUM,  
WASHINGTON,  
D. C.



Plate 9

Lilian A. Guernsey

*Japonicum* (Japanese Azalea) 3/5X

ered individuals akin to *viscosum* or *serrulatum* of the next alliance, together with earlier flowering, pubescent-leaved forms suggestive of *canescens* or *roseum*, which occur entirely intermixed with one another. Its position in this listing is intended to indicate an apparent intermediacy between the *roseum-nudiflorum* and *arborescens-serrulatum* alliances. Further study is needed to place it with confidence. Medium in height; late; flowers  $\frac{3}{4}$ " to  $1\frac{1}{8}$ ", white to pale or medium pink; faint clove scent suggestive of *roseum*. Prefers shady, moist soil. No special merit as a garden plant.

#### Arborescens - Serrulatum Alliance:

The "late whites" of the Luteum Subseries appear to have been derived from ancestral material of the *alabamense-atlanticum* alliance, plus strong infiltrations from the red end of the *austrinum-prunifolium* alliance. In the derived *roseum-nudiflorum* alliance, early pinks predominate; in the *arborescens-serrulatum* alliance, lateness and a white color seem to have segregated in combination, but often with strong residual suffusions of red or pink in the flower parts.

**ARBORESCENS** (Sweet A., Smooth A.): Upland streamsidings and moist mountain tops from Pennsylvania to Georgia and Alabama, west to Kentucky and Tennessee; upright and tall; very late; branchlets glabrous; flowers  $1\frac{1}{2}$ " to  $2\frac{1}{4}$ ", long tubed, white, sometimes with pink or reddish flush and sometimes also with a yellow blotch; style usually red; strong heliotrope fragrance; very hardy. This species is quite variable. It blooms after the leaves are out and poor forms are not showy; the better selections, however, with glossy foliage and large flowers, can provide a display in white unequaled among late azaleas. Var. *richardsoni* merits no special recommendation either as a reputed dwarf or for its doubtfully larger flowers. *Arborescens* is shown in Plate 35 on page 122.

**VISCOSUM** (Swamp A.): Swamps and streamsidings from Maine to South Carolina and Tennessee; upright and tall (to 15 ft.) but dwarf forms exist. Low, densely branched and highly glandular var. *montanum* of moist mountain tops in the Great Smokies may represent a primitive form of the species. Blooms with or after *arborescens* (July); flowers 1" to  $1\frac{1}{2}$ "; tube slender, glandular-

viscid; limb white to cream-white; strong, spicy scent; very hardy. In the mountains of Virginia and southward this species interbreeds rather freely with *arborescens* to produce pale pink to violet red flowered intermediates, and on occasion also with the late forms of *calendulaceum* to produce a range of yellow-blotched pale pink to salmon yellow and coral color shades. In many bogs of northeastern Pennsylvania, New Jersey and New England the *arborescens-viscosum* intermixture becomes so confused that it is impossible to identify the bulk of plants as one or the other of these species. *Viscosum* is of interest for its very late flowers but, except in carefully selected forms, the flowers may be scattered in their appearance and not especially showy.

**SERRULATUM** (Hammocksweet A.): Wooded swamps of the southern coastal plain from east central Georgia through central Florida to within a few miles of Lake Okeechobee and west to southern Mississippi and Louisiana. Tall; very late (July to August or even November in central Florida); branchlets red-brown; flowers  $\frac{3}{4}$ " to  $1\frac{1}{8}$ ", with long slender tube, glandular-sticky; limb and tube white, occasionally with pale violet-red shading; variably noticeable clove scent. Reasonably hardy from more northerly occurrences. This species is essentially a southern counterpart of *viscosum*. As such, its best forms have an unquestionable place in southern gardens for their late bloom, though scarcely in the north where hardy *viscosum* duplicates most of its merits. *Serrulatum* is shown in Plate 41 on page 138.

**Molle-Japonicum Alliance:** Includes the only two Asiatic members of Subseries Luteum. Flowers of these species are broader and more open, and the tubes shorter, than those of our native azaleas. They bloom before the leaves come out. Yellow to orange-red flower colors bring this alliance most nearly akin to the *austrinum-prunifolium* alliance. However, in flower shape, in total loss of glandular hairs, and several other characters, these Asiatics have diverged so far that any implication of either close or recent association with the American species would be unjustified. They do hybridize, however.

**MOLLE** (sinense) (Chinese A.): Thinly wooded hill slopes of eastern China; upright, medium height; leaves with persistent, matted pubescence on lower surface; late midseason; flowers 2" to 2¾", yellow to golden orange (e.g. buttercup yellow, HCC 5/2) often with large, greenish blotch. See Plate 4 on page 16. With *japonicum*, a parent of the Mollis Hybrids and best known in this country in hybrid form. Neither as vigorous nor as hardy in the northeast as *japonicum*.

**JAPONICUM** (Japanese A.): Grass and scrub-wooded moorlands of the main island of Japan; upright; late midseason; leaf undersides with sparse pubescence soon lost; flowers 2" to 3", occasionally yellow but usually orange to orange red with many fine intermediate "art shades," and often an orange blotch. This variable species appears to be a combination between "red" and "yellow" ancestral forms. Very hardy and tolerant of less acid soil conditions than the American species. The preferred of these two Asiatics for general cultivation or as a parent in hybridizing. *Japonicum* is shown in Plate 9 on page 34.

#### OBTUSUM SUBSERIES

The important species in this subseries come principally from Japan with a few from Korea, China and Formosa. Their leaves are usually dimorphic, with the summer leaves at least persistent into the winter and usually evergreen. Almost every type of plant habit for shrubs will be found. The flowers have an orange red, red, pink, purple, violet and white color range, but no yellows or oranges.

Some of these species have been developed in Japanese gardens for one to three centuries. Botanists first knew these as garden plants with the result that type plants selected to represent the species and varieties were all too frequently garden plants not subsequently found wild.

**Obtusum and Allies:** the *Obtusum* Subseries takes its name from the species *obtusum* (Hiryu A.). The type form of the species, Kirishima [Island of Mist], is a garden plant, not known

in the wild and perhaps derived from the species or varieties, *kaempferi* and *kiusianum*, described below. *Obtusum* is low growing, about two feet, spreading, dense; late blooming; flowers, single, ¾", and reddish violet (e.g., imperial purple, HCC 33/2), with deeper colored throat and no blotch.

There are several important garden forms of *obtusum* or closely related to it as —

**ALBUM** (Ramentaceum): upright, tall; late; flowers single, white.

**MACROSTEMON** (PI 77690): low, spreading; late; flowers single, 1½", salmon orange, long exerted stamens. Kokinshita (PI 78379 and PI 114672) is perhaps a selected clone of *macrostemon*.

**AMOENUM** (Amoena A.): spreading, tall, very dense; early midseason; flowers single, hose-in-hose, ¾", violet red (solferino purple, HCC 26); probably the hardiest form of the species; about 5 to 7' high ultimately. The Royal Horticultural Society's garden at Wisley, England has a plant over 50 years old with a spread of about 14'. Occasionally has branches with darker flowers, reddish violet (orchid purple, HCC 31). There is a dwarf form, *amoenum* f. *obtusifolium*. E. H. Wilson, in Wilson and Rehder, Monograph of the Azalea (1921) lists *normale* (Hatsugiri) as a form of *amoenum* without hose-in-hose flowers. He states that the typical form of *normale* is known in Japan as Kocho-nomai [Butterfly Dance]. The form brought in under that name by the Division of Plant Exploration and Introduction, U.S.D.A., in 1929 is single, 1¼", reddish violet (petunia purple, HCC 32/2) with a faint darker blotch. It is an unattractive color.

Probable varieties or derivatives of *amoenum* originating for the most part in Great Britain, some of which have been brought into the United States, are—

**CALDWELL** (Bidwelli) (PI 102161), single, hose-in-hose, pale pink, hybrid around 1880 by B. S. Williams in England.

**CARMINATA SPLENDENS** (PI 78376), red. **COCCINEUM**, red.

**FLAMBEAU**, dark red, originated in France. **FORSTERIANUM**, orange red, semi-double, originated by Otto Forster in Austria.

**H. O. CARRE** (PI 78377) rose red, semi-double, late.

**HOLFORDI**, red, late.

**ILLUMINATA** (PI 78378), rose purple.

LA FRANCE, pink flushed vermillion.

MARVEL, carmine, single, hose-in-hose.

MISS BUIST, white.

MRS. CARMICHAEL (PI 78381), rose purple, semi-double, dark blotch, late.

OPTIMA, rose, late, large flowers.

PRIME MINISTER, pink.

PRINCESS BEATRICE, mauve.

PRINCESS MAUD (PI 78383) rose.

PULCHELLUM (PI 78237).

ROSEUM (PI 102162), single, hose-in-hose, bright pink.

SPLENDENS (PI 78385), rose.

SUPERBA, dark purple; single, hose-in-hose.

Two allies of *obtusum* are considered by some botanists as distinct species from which *obtusum* itself may be derived, and by other botanists as varieties or forms of *obtusum*. They are—

KAEMPFERI (Torch A.): this wild azalea is widespread in Japan. It is upright, 7 to 9' tall, eventually fills out and broadens; early midseason; flowers single, 2", orange red (e.g., light delft rose, HCC 020/2) with darker blotch; leaves deciduous in colder regions. *Kaempferi* shows variability in size of flowers, 1¾" to 2½", and also in color (e.g., jasper red, HCC 018/1, and porcelain rose, HCC 620). Some plants have semi-double, some hose-in-hose flowers; some bloom as much as a month later than others, including a lower growing clone known as Mikado [Emperor] or Damio (Daimyo) [Feudal Lord]. In the San Francisco area *kaempferi* blooms very late, near the end of the season. Indian Summer (October) is a fall blooming clone of *kaempferi* selected and named by Joseph B. Gable. The form *mikawanum* (perhaps a hybrid with *macrosepalum*) has single flowers, 2⅛", reddish violet, (e.g., orchid purple, HCC 31/1) with brown blotch. The form *transiens* is sometimes regarded as a separate species. As it appears in the clone Mikawa-murasaki (PI 77072 and PI 77083), it is single, 1¾", mallow purple, and is probably a hybrid with one

of the Ryukyu species mentioned below. *Kaempferi* is one of the hardiest evergreen species and is an excellent garden azalea. It is reported to kill to the ground at 15°F. See Plate 4 on page 16.

KIUSIANUM (*obtusum* f. *japonicum*): this is the name given to a wild azalea, found in the mountains of Kyushu, Japan, including Mt. Kirishima and Mt. Unzen. It is generally held that the Kurume group, described later, is derived from *kiusianum*. Others are of the view that *obtusum* and *kaempferi* are also part of the Kurume group parentage. *Kiusianum* is taller than *obtusum*, more spreading than *kaempferi*, and more varicolored than either, but not so hardy in most forms. The alternate name, form *japonicum*, should not be confused with the wholly different Luteum Subseries deciduous species, *japonicum*.

Several clones of *kiusianum* were known in this country long before the general introduction of the Kurumes. They are—

YAYEGIRI (Yayehiru, Scarlet Prince): upright, tall, early midseason; flowers single, hose-in-hose, 1½", orange red (delft rose, HCC 020).

HI-NO-DEGIRI (Red Hussar) [Mist of the Rising Sun]: spreading, medium height; early midseason; flowers single, 1½", red (china rose, HCC 024). This is the commonest evergreen azalea and one of the hardiest. It is a good plant of vivid color (except against a red brick wall) but much overused. The majority of Kurumes have superior flowers and are just as vigorous. *Carminata Splendens*, an *amoenum* derivative, is similar. Hino-crimson, red, is an *amoenum* × Hi-no-degiri hybrid. There is also a Hinodegiri Double which is not a double flower but a single hose-in-hose. It is similar to Hi-no-degiri in other respects.

HI-NO-MAYO: upright, tall; early midseason; flowers single, 1¼", red (tyrian rose, HCC 24/2). There is a Hinomayo Fl. Pl. that is not a double flower but a single with partially petaloid sepals. Otherwise it is similar to Hi-no-mayo.



Plate 10

Robert L. Taylor

*Scabrum* (Luchu Azalea)

**Ryukyu Azaleas:** there are three related wild species from southern Japan and the Ryukyu (Riukiu, Liukiu) Islands, *scabrum*, *ripense*, and *macrosepalum*. Apparently from these were derived some 250 to 300 years ago garden forms that later came to botanists' attention before the wild forms. In consequence these garden forms as *sublanceolatum*, *linearifolium*, *mucronatum*, and *phoeniceum*, were given species designations.

Some of the finest azaleas come from this group of species. While tender, many varieties or forms do well along the east coast up to Washington, D. C. or farther north. Curiously the white fly pest seems to confine its affections (at least as a breeding ground) to this group and their progeny.

SCABRUM (Luchu A.) is found in Okinawa and other Ryukyu islands and has been cultivated in Japanese gardens for over 250 years. It is upright but lax; early midseason; flowers single, 2½" to 4", orange red to rosy purple with a darker blotch, sepals about ½" long. The more common form (*coccineum*), intense scarlet red with somewhat frilled petals, is to be found in southern nurseries in this country under the old name, *sublanceolatum*. The flowers are some of the largest among azalea species. The Hakoneya Nurseries (K. Wada) in Japan list *scabrum* as the scarlet red form and *sublanceolatum* as a large flowered rose form blooming a month later. Some nurseries in this country list a pink, as well as the more usual red, *sublanceolatum*. *Scabrum* is shown in Plate 10 on page 38.

There are a number of clones derived from *scabrum* or hybrids with it, all with large flowers—Red Emperor, Kintaiyo, (carmine white throat), Rose Perfection, Purple Perfection, Purple Beauty, and White Pearl (probably a hybrid with *mucronatum*), Scabrica Red Perfection (probably a cross with

a Belgian Hybrid). William Judd of the Arnold Arboretum had unnamed hybrids of *scabrum* with Kurume clones, such as Yayegiri (Scarlet Prince) and Kureno Yuki (Snowflake), as the seed parents. Among the Wada Hybrids are some of *scabrum* × Kurumes.

RIPENSE grows wild in south central Japan. Its flowers are light purple, rarely white, and sometimes exceptionally large, 4½". Wakasagi is a similar garden form.

MACROSEPALUM (*linearifolium* var. *macrosepalum*) (Bigsepal A.) grows wild in the same area. It blooms early midseason; flowers 2", reddish violet (e.g., petunia purple, HCC 32/2) with red blotch, conspicuous sepals about 1¼" long and sometimes exceeding the corolla lobes in length; red clover scent; hairy leaves. *Hortense* (*decandrum*) is a similar garden form, perhaps a hybrid between *macrosepalum* and *ripense*. *Linearifolium* (Spider A.) is a form with narrow, strap-like rosy pink petals, widely separated. Koromoshikibu, perhaps a *macrosepalum* hybrid, has similar slashed petals of reddish violet (mallow purple, HCC 630/1). *Macrosepalum* is shown in Plate 11 on page 40 and Plate 2 on page 12, and form *linearifolium* in Plate 40 on page 137.

MUCRONATUM (*indica alba*, *ledifolia alba*, *rosmarinifolium*) has been in cultivation in Japan over 300 years. It is sometimes called the Snow Azalea, but is not to be confused with Kurume cl. Snow. It is spreading, medium to tall in height (in 20 years 6 ft. high and 8 ft. wide); early midseason; flowers single, 3", pure white; sepals about ½" long; hardy on the east coast to Long Island; delicate fragrance. This azalea is usually sold by the trade under the name of Indica Alba or Ledifolia Alba. The wild azaleas in Japan nearest to *mucronatum* are *ripense* and *macrosepalum*, and *mucronatum* may well be



Plate 11

Robert L. Taylor

*Macrosepalum* (Bigsepal Azalea)



an old hybrid of them. See Plate 5 on page 18.

*Mucronatum* and its derivative, the Indian azalea, Fielder's White, are excellent early midseason whites. Fielders White is tenderer. Among the clones differing from the usual cultivated form of *mucronatum* are—

NOORDTIANUM: larger white flowers, but on some plants also flowers striped or self colored rose; Bulstrode (Matapan, America, Maxwell White): a faint chartreuse blotch; Japonica Alba: pure white but scanty flowering.

SEKIDERA RYUKYUSHIBORI [Variegated Ryukyu] and KANOKA: flowers single, 3", white flushed violet red (solferino purple, HCC 26) with blotch of same color, sometimes striped (Ryukyushibori) or flecked (Kanoka) same color, and sometimes frilled. Amethystinum, Indica Rosea, Damask Rose, and Magnifica fall in with these. Indica Rosea in some plants is more flushed; Magnifica will have a more conspicuous blotch; and Amethystinum, will have smaller, more starry flowers and a faint blotch, and flowers earlier. There is considerable variation in this group but the better clones are excellent. *Mucronatum* f. *sekidera* is shown in Plate 12 on page 42.

LILACINA (*purpureum*): flowers single, 2½-4"), purple (phlox purple, HCC 632/1) with red blotch. Lady Lilac is about same although in California it blooms earlier and longer and has smaller flowers of deeper color than *Lilacina*. Presumably their heredity differs for *Lilacina* has 10 stamens, but Lady Lilac only 5; and Rubra and Salmonea vary a little in color.

PLENUM (Fujimanyo, Murasaki Botan [Purple Peony]): flowers semi-double with numerous stamens changed to petals and some green tipped or fringed, 1½", reddish violet (mauve, HCC 633/2) with darker veins. Iro Asobi (PI 77097) [Colorful Play] and Narcissiflorum (Shiro-Manyo) are somewhat similar whites.

SUSHOREN (PI 77131): flowers single, 1¼", red (phlox pink, HCC 625/1).

SHISHU (PI 77141): flowers semi-double, 1½", reddish violet (roseine purple, HCC 629/1). Beattie introduction.

RYUKYU (PI 77074): appears to be the same as *mucronatum*. Laughing Water is about the same but has smaller flowers.

PHOENICEUM: revolving somewhere

in the orbit of the Ryukyu azaleas are those grouped around this species designation. *Phoeniceum* also is known only from garden forms and is perhaps an old hybrid with *scabrum* as one parent. *Phoeniceum* var. *smithi* (*pulchrum*) as found in southern gardens and sold by the trade under the name *phoeniceum* is upright, tall; early midseason; flowers single, 2¾", violet red (rhodamine purple, RCS) with red (tyrian rose, RCS) blotch; tender. There are several other forms commonly attributed to *phoeniceum*—

CALYCINUM (Omurasaki, Oomurasaki) (PI 77095): similar to *phoeniceum*, but stronger growing and hardier, perhaps also a *ripense* × *macrosepalum* hybrid. The Indian azalea, FORMOSA, so common in the south, although probably a hybrid, is about the same. It is spreading, tall; early midseason; flowers single, 3½", violet red (mallow purple, RCS) with red (tyrian rose, RCS) blotch. There is some variation among clones under these names.

TEBOTAN: similar to *mucronatum* f. *plenum* in flower color but even more double. The foliage is less like *mucronatum* than *phoeniceum*.

MAXWELL: upright, medium height; late midseason; flowers single, 2½", violet red (rose bengal, HCC 25) with darker blotch; much hardier; probably a hybrid. Maxwelli Alba is probably not a form of Maxwelli, but a form of *mucronatum*; medium height; early midseason; flowers single, 2¼", white with faint chartreuse throat.

**Indian Azalea:** this azalea, now called *simsi* (Sims A.), is found in southern China. It was long confused with *indicum*. *Simsi* is upright, tall; early; flowers single, 2½", orange red (e.g. porcelain rose, HCC 620) with purple blotch; tender. In China it flowers in late autumn as well as spring. It is best known in this country through certain clones of the Indian (Southern, Indica) Azaleas and the supposed variety—

VITTATUM (*Vittata* Fortunei): upright, tall; early; flowers single, 2", white flaked or striped violet red (magenta, HCC 27/1),



Plate 12

Robert L. Taylor

*Mucronatum* f. *sekidera* 3/4×



Plate 13

Lilian A. Guernsey

*Poukhanense* (Korean Azalea) 3/4X



Plate 14

Lilian A. Guernsey

*Indicum* cl. BENI-KIRISHIMA

also white and magenta selfs. *Vittata Fortunei Purpurea* is a clone with  $2\frac{3}{4}$ " flowers the same as the magenta selfs on *vittatum*. In South it blooms from fall to spring. Form *beali* has redder flakes and stripes.

**Formosan Azaleas:** *oldhami* (Oldham A.) is from the island of Formosa. It is upright, medium height; late mid-season; flowers single,  $1\frac{1}{2}$ " to 2", salmon red with lilac pink blotch. *Oldhami* is tender although some plants have grown in protected locations as far north on the east coast as Washington, D. C. The leaves and stems are very hairy, more so than *mucronatum*, and the hairs are a conspicuous rust red. It is used as a parent in the Exbury Hybrids. *Rubropilosum* (Redhair A.) is also a Formosan species with hairy leaves. It is upright, tall; flowers single, 1", pink with rose blotch; tender. *Oldhami* is shown in Plate 34 on page 119.

**Korean Azalea:** *poukhanense* (*yedoense* var. *poukhanense*) is a persistent leaved, but not evergreen, species from southern Korea. It is spreading, low; early midseason; flowers single, 2", reddish violet (e.g., pansy violet, HCC 033/1; petunia purple, HCC 32/2) with reddish blotch, mild fragrance; very hardy, probably the hardiest species in the Obtusum Subseries. Much used as a parent in the Gable Hybrids. *Yodogawa* [name of river near Osaka] (*yedoense*) is a very double form, known to gardens only and not found in the wild. It is taller, flowers 2" reddish violet (cyclamen purple, HCC 30/2). *Poukhanense* is shown in Plate 13 on page 43.

**Small Leaf Azaleas:** there are three evergreen azaleas in cultivation in this country, but rare, that have small leaves and flowers. They are very hardy but rather unsatisfactory in southern areas with long, hot, humid summers. They are—

**SERPYLLIFOLIUM** (Wildthyme A.): central and southern Japan; spreading, low, dense; flowers single,  $\frac{1}{2}$ ", rose; leaves  $\frac{1}{8}$ " to  $\frac{1}{2}$ " long. *Albiflorum* is a white flowered form. See Plate 4 on page 16.

**TOSAENSE** (Tosa A.): southern Japan, upright, low; early; flowers single, 1", lilac purple; very small summer leaves about the size of those of *serpyllifolium*. *Komiyamae* is a similar species, but tall and late.

**TSCHONOSKI** (Tschonoski A.) southern Korea and central and southern Japan; spreading, low, dense; very late; flowers single,  $\frac{1}{4}$ " long and  $\frac{3}{8}$ " to  $\frac{1}{2}$ " wide, white; tiny leaves  $\frac{1}{16}$  to  $\frac{1}{4}$ " long.

**Macrantha Azaleas:** the late blooming evergreen species, *indicum* and its variety *eriocarpum*, are both from central and southern Japan. Many fine azaleas are found in forms of this species and variety and the similar Chugai Hybrids. They tend to dribble into bloom after the new spring leaves are out but once in full bloom in the Washington, D. C. area they give as fine a display as the earlier azaleas. In general the plants are smaller and dwarfer than the earlier blooming species of the Obtusum Subseries, ranging from a foot to 4 or 5 feet. They have larger flowers than the Kurumes. In quantity they make a fine late show. Small plants are somewhat tender but after a few years appear to be as hardy as *obtusum* and the Kurumes.

*Indicum* has been cultivated in Japanese gardens over 300 years and as early as 1692 there were recorded 168 garden forms of *indicum* and its variety, *eriocarpum*.

**INDICUM** (*macrantha*) is spreading, low, dense; very late; flowers single, 2", scarlet, red and violet red, hardy. In this country the trade carries the

species under the name, *macrantha*, and the flowers of the clone usually sold are red (tyrian rose, HCC 24/2) with darker blotch. It is not to be confused with the Indian Azaleas of the south or the Belgian azaleas, both of which are usually listed by the trade as "Indicas." There are numerous forms. Among them are—

**BALSAMINAEFLORUM** (Rosaeiflora): very low; very late; flowers double, about 40 petals, no pistil or stamens, 1½", orange red (delft rose, HCC 020/1).

**BENI-KIRISHIMA** (PI 77113 and PI 77128): medium height; flowers double, 2", orange red (delft rose, HCC 020/1) with darker blotch. See plate 14 on page 44.

**CRISPIFLORUM**: pink, frilled.

**HAKATASHIRO**: lower; blooms a little earlier than *indicum*; flowers white with chartreuse throat; tenderer than most *indicum* clones. *Macrantha Alba* appears to be the same.

**J. T. LOVETT**: flowers single, 2½", orange red (claret rose, HCC 021/1) with darker blotch. The Office of Plant Exploration and Introduction, U.S.D.A. clones, PI 78380 and PI 78382, are the same except for variation in color. PI 78380 is similar to the usual trade clone of *macrantha* and is red (tyrian rose, HCC 24/2) with occasional partially petaloid sepals; and PI 78382 is taller and orange red (blood red, HCC 820).

**LACINIATUM** (Kin-no-zai): medium height; five slashed or narrow, strap-like petals widely separated; orange red (delft rose, HCC 020/1) with darker blotch. *Poly-petalum* is a double form with the same sort of petals.

**SALMONEA**: 2½", single, red (camellia rose, HCC 622/1) with darker throat.

**SATSUKI** (PI 77104) [Fifth Month]: flowers single, 2", violet red (spirea red, HCC 025/2) with darker blotch, very low growing.

**TANIMA-NO-YUKI** [Valley of Snow] (Coral Ivory) is a variety (or perhaps hybrid) having red to violet red single flowers with white throat, 2". The following are perhaps selected clones, each with white throats and colored margins: Sei-Qua, red (rose opal, HCC 022/2); Sakuragata [Cherryblossom Image], violet red (fuchsine pink, HCC 627/1); Sho-Qua, salmon pink.

**VARIEGATUM** (Matsushima [Pine Island]): white with red stripes or flakes.

**WARAI-GISHI** (PI 77132): medium height; flowers semi-double, 2", red (tyrian rose, HCC 24/2) with darker blotch. See Plate 6 on page 20.

**ERIOCARPUM** blooms at the same time as other forms of *indicum* but is dwarfer and denser and slower growing than most. Flowers are lavender, frilled and large. *Eriocarpum* is known in this country by the Gumpo clones, as—

**WHITE GUMPO** (Album): upright, very low (under one foot), dense; very late; flowers single, frilled, 2¾", white occasionally flecked pink. The same except for color, are Izayoi, white flecked pink; Pink Gumpo (Yugiri [Evening Mist]), rose pink with deeper flecks; Fancy Gumpo (Rosea), pale pink; Jitsugetsuse, pale mauve.

The Hakoneya Nursery (K. Wada) in Japan also lists Wadas Pink, shell pink, blooms a little earlier; Album Giganteum, large white; Terra-cotta Beauty, terra-cotta pink, smaller flowers; and Pride of Namazu, cinnabar red, white throat.

**FUJINISHIKI** [Peerless Brocade]: medium height; flowers single, frilled, 2", white, sometimes striped lavender; like *eriocarpum* cl. Gumpo but smaller flowers and taller plant.

#### SCHLIPPENBACHI SUBSERIES

This is an Asiatic group of deciduous azaleas. The leaves appear to be in whorls at the end of the stems. The subspecies contains some plants with fine flowers. Practically no successful hybridizing has been done with members of the group, save some recent crosses of *weyrichi* and *reticulatum* by the Division of Plant Exploration and Introduction, U.S.D.A.

**Schlippenbachi** (Royal A.); the subspecies takes its name from this species which is native to Korea and Manchuria. It is spreading, tall (the University of California Botanical Garden has a plant 6' high, 8' wide and Joseph B. Gable a plant 10' high); early (late in southern regions and late midseason in San Francisco area); flowers single, 2 to 4", white flushed violet red (e.g.,



Plate 15

Lilian A. Guernsey

*Schlippenbachi* (Royal Azalea)



Plate 16

Robert L. Taylor

*Mariesi* (Maries Azalea) 3/4X





Plate 17

Lilian A. Guernsey

*Albrehti* (Albrecht Azalea)  $\frac{3}{4}\times$



Plate 18

Claude Hope

*Canadense* (The Rhodora)



Plate 19

Robert L. Taylor

*Albrechti* (Albrecht Azalea) 3/4X

rose pink, HCC 427/1-427/3) with brown dotted throat, fragrant; rather large and broad obovate distinctive leaves in whorls of 5 at the end of the branches; very hardy; flowers open with the expanding leaves. There is considerable variation in color and size. The large deeper pink form many hold to be one of the most beautiful of azaleas. The Japanese have forms with white flowers and also compact, dwarf forms. *Schlippenbachi* is shown in Plate 15 on page 47 and Plate 4 on page 16.

**Weyrichi** (Weyrich A.): Japan; upright, tall, may become a small tree; late midseason; flowers single, 2½", orange red (delft rose, HCC 020/1) with purple blotch. Closely related to *weyrichi* are *sanctum* (Shrine A.), rose, tall, may become a small tree; and *amagianum* (Mt. Amagi A.), orange red (french rose, HCC 520) with red (neuron rose, HCC 623) blotch, very late (late June-July), larger flowers than *weyrichi*. A Japanese grower says that *amagianum* may become a 30' tree and is hardier than *weyrichi*.

**Mariesi** (Maries A.): Southeastern China; upright, tall; late midseason; flowers single, 2", rose with darker blotch; rare in cultivation in this country; close to *reticulatum* but flowers later. *Mariesi* is shown in Plate 16 on page 48.

**Quinquefolium** (Cork A.): central and southern Japan; upright, tall, early midseason; flowers single, 1¾", white with chartreuse blotch.

**Reticulatum** (Rose A.): native of central and southern Japan; upright, medium height; early but some variation in time of bloom among plants; flowers single, 1 to 4", reddish violet (e.g., imperial purple, HCC 33/1) with a few darker spots. Leaves tend towards a rhombic shape. Blooms about

same time as *Rhododendron mucronulatum* save when latter extremely early in a February or March warm spell. Joseph B. Gable reports as a supposed form of *reticulatum* a plant with blue lavender flowers 4" wide and corolla more deeply divided. The species *reticulatum* is quite variable or perhaps is an alliance of several species and natural hybrids, rather than a single species. As now constituted by some taxonomists, *reticulatum* includes the plants formerly within the species *dilatatum*, *decandrum*, *rhombicum*, and *wadanum*. Also the species *viscistylum*, *nudipes*, *kiyosumense*, and *lagopus* are similar. *Reticulatum* is shown in Plate 17 on page 49 and Plate 31 on page 106.

#### CANADENSE SUBSERIES

This subseries comprises two species from eastern United States and two from Japan, all deciduous. The flowers are bell-shaped rather than funnel-shaped, and the tubes very short. The new shoots do not, as in the other subseries, come from the terminal bud, but from separate buds below the terminal bud. In *vaseyi* and *canadense* the two lower wings of the flowers are well separated from, and wider than, the other corolla lobes making a two-lipped flower.

**Vaseyi** (*Biltia vaseyi*) (Pinkshell A.): mountains of western North Carolina; upright, tall; early midseason; flowers single, 1½" to 2¼", white flushed violet red (e.g., tyrian rose, HCC 24/3 to rose pink, HCC 427/3) with green throat and orange red dots at base of upper wings and standard; very hardy. Flowers are most attractive and have a delicate airy appearance. Form *album* has white flowers. *Vaseyi* is shown in Plate 30 on page 101 and Plate 4 on page 16.

**Canadense** (Rhodora): the subspecies takes its name from this species; east coast from Labrador to northern New Jersey; upright, low; early mid-season; flowers single,  $\frac{1}{4}$ ", two-lipped, rose purple; very hardy; prefers moisture and does not do well in warmer climates; gray green leaves; prefers very acid soil. Form *albiflorum* has white flowers. *Canadense* is shown in Plate 18 on page 50 and Plate 5 on page 18.

**Albrechti** (Albrecht A.): central and northern Japan; upright, medium height; early; flowers single, 2", violet red (e.g., rose bengal, HCC 25/2); habit similar to *schlippenbachi*, also shape of flowers similar to *schlippenbachi* but slightly smaller; hardy. *Albrechti* is shown in Plate 19 on page 51.

**Pentaphyllum** (Fiveleaf A.): central and southern Japan; upright, tall,

may become a small tree; early mid-season; flowers single, 2", rose pink; not hardy in sub-zero climates; difficult to make bloom. Frequently, when not in flower, confused with *quinquefolium* because of whorls of five leaves at end of branches as in species of the *Schlippenbachi* Subseries.

#### NIPPONICUM SUBSERIES

This subspecies includes only one species, *nipponicum*. It is from Central Japan; upright, medium height; very late; flowers single, bellshaped,  $\frac{1}{3}$ ", yellowish white with greenish blotch. *Nipponicum* has long leaves from 2 to 7" resembling those of *schlippenbachi* and turning orange or crimson in fall, and papery, cinnamon bark shredding off and leaving polished brown stems. It is important for its leaves and bark; its flowers are inconspicuous and pendant.

#### HYBRID GROUPS

Hybridists have confined themselves almost entirely to species of the *Luteum* and *Obtusum* Subseries. The major breeding work of importance prior to recent efforts was that of the Japanese in developing the *Kurumes* and *macranthas*, of the Belgians, Dutch and English in developing the *Ghent* and *Mollis* Hybrids, and of the Belgians in developing both the *Belgian* Hybrids and their precursors which are known as the *Southern* or *Indian Azaleas* or *Indicas*. The European hybridists, particularly the Belgians, were primarily interested in plants that could be forced for the florist trade. In this country the *Pericat* Hybrids and the *Rutherford* Hybrids were also developed as greenhouse azaleas for the florists. The Japanese were greatly interested in plants that could be pruned and shaped

for pot growing and formal designs. Good garden plants were for the most part a limited and inadvertent by-product of all these efforts.

The English breeders have of late improved the *Ghent* hybrids in size and color. However, not until the recent projects in this country of Joseph B. Gable and B. Y. Morrison, has azalea breeding been directed on a large scale to improved hardy hybrids among the evergreen azaleas for garden use. Gable has sought hardy azaleas for the colder areas where *Kurumes*, *Indian Azaleas*, and others are unsatisfactory. Morrison has sought azaleas of the flower size and quality of the *Indian Azaleas* that would be hardy in the Washington, D. C. area and probably farther north along the eastern seaboard, that fill in the existing gap in

the azalea blooming period in that area, and that afford a wider range of flower color and pattern and plant habit. A second Morrison project to improve the outdoor azaleas for the South is under way.

#### LUTEUM SUBSERIES HYBRID GROUPS

**Ghent Hybrids:** This group has a widely mixed parentage that now incorporates most of the deciduous azalea species. The group originated in Belgium and England in the 1830's and 1840's through crosses of *calendulaceum* × *nudiflorum* (×Mortieri), *flavum* × *nudiflorum*, *flavum* × *speciosum*, *flavum* × *viscosum* (×Ornatum), *molle* × *viscosum* (×Viscosepalum), *speciosum* × *molle*, and others. Plants developed from these groups and their merger constitute the group usually designated as the Ghent Hybrids (×Gandavense).

In the 1870's and later crosses of *calendulaceum* × *molle*, *occidentale* × *molle* (×Albicans), and double Ghent Hybrids × *occidentale* were made. Plants developed from these groups and their merger constitute the Occidentale Hybrids.

Double Ghent Hybrids crossed with Mollis Hybrids (*molle* × *japonicum*) produced the Mixtum or Rustica Flora Plena Hybrids (×Mixtum).

All the above hybrids are here called Ghent Hybrids, together with such related recent hybrids as (1) *arborescens* × *calendulaceum* (×Anneliesae), (2) *atlanticum* × *japonicum*, *atlanticum* × *arborescens*, *atlanticum* × *calendulaceum*, *austrinum* × *flavum*, *nudiflorum* × *calendulaceum*, *nudiflorum* × *japonicum*, *roseum* × *calendulaceum*, and *roseum* × *japonicum* (mostly hybrids by Joseph B. Gable), (3) *arborescens* × *occidentale*, (4) the Knap-hill Azaleas described below, and (5) plants of similar parentage. *Atlanticum*

× *japonicum* is shown in Plate 20 on page 55.

The Ghent Hybrids have deciduous leaves, are upright, tall, and bloom late. Like many shrubs they broaden with age and a century old plant of Unique is 15 x 30 feet. The Ghent Hybrids prefer a cool climate and are very hardy. Many have withstood more than 25° below zero F.; others 13° below. In both warm and cold areas own root plants do better than grafted. The flowers are from 1½ to 2¼ inches wide, have a long tube, and commonly are fragrant. They possess an extremely wide range of colors running the gamut from light yellow to violet reds, also white, and frequently are flushed or shaded a second color. The flowers are of both single and double types.

There are around 350 named clones of Ghent Hybrids. Representative clones are—

**AIDA:** upright, tall; late; flowers double, 1¾", white faintly tinted pink.

**ALTA CLARENSIS:** upright, tall; late; flowers single, white with orange blotch; a Viscosepalum Hybrid.

**AUGUSTE MECKELYNCK:** upright, tall; late; flowers single, 2¾", red (deep rose pink, RCS) with paler center stripes, blotch yellowish orange (deep chrome yellow, RCS).

**AURORE DE ROYGHM:** upright, tall; late; flowers single, 2½", violet red (rose pink, HCC 427).

**BARTHOLO LAZZARI:** upright, tall; late; flowers double, flat face, 2", orange yellow (buff yellow, RCS) shaded orange red (peach red, RCS).

**BEAUTE CELESTE (Cardinal):** upright, tall; late; flowers single, 1", orange red (venetian pink, RCS) and yellow, scented.

**BIJOU DE AMATEURS:** upright, tall; late; flowers single, red (dawn pink, HCC 523).

**BIJOU DE GENTBRUGGE:** upright, tall; late; flowers single, 1¾", reddish orange (mandarin red, HCC 17/2).

**BOUQUET DE FLORE:** upright, tall; late; flowers single, 2", orange red (geranium lake, HCC 20/2).

**BYRON:** upright, tall; late; flowers single, host-in-hose, 2¼", white.



Plate 20

Lilian A. Guernsey

GHENT HYBRID *atlanticum* × *japonicum* (Gable)

CHARLEMAGNE: upright, tall; late; flowers single, 2", orange (marigold orange, HCC 11/2) and orange yellow (maize yellow, HCC 607/2).

COMTE DE FLANDRE: upright, tall; late; flowers single, 2", orange red (carmine, HCC 21/1).

CYMODOCEE: upright, tall; late; flowers single, 2½", red (dawn pink, HCC 523).

DAVIESI: upright, tall; late; flowers single, 2¼", pale yellow to white; a *Viscosepalum* Hybrid.

FANNY (Pucelle): upright, tall; late; flowers single, long tube, petals revolute, 2¼", violet red (rose bengal, HCC 25/2) with saffron yellow blotch.

FENELON: upright, tall; late; flowers double, 1¾", orange yellow (maize yellow, RCS) flushed reddish orange (salmon orange, RCS) at tips.

FLAMBOYANT: upright, tall; late; flowers single, 2", reddish orange (poppy red, HCC 16/1), orange yellow (maize yellow, HCC 607/1), and yellow (primrose yellow, HCC 601/2).

FLORA: upright, tall; late; flowers single, 1½", orange red (begonia, HCC 619/1).

GLORIA MUNDI: upright, tall; late; flowers single, frilled, 2½", orange (saturn red, HCC 13/1) with orange blotch. *Coccinea Speciosa* is similar.

GRAF VON MERAN: upright, tall; late; flowers double, red (neyron rose, HCC 623/2).

HEUREUSE SURPRISE: upright, tall; late; flowers single, 1¾", violet red (rhodamine pink, HCC 527/2).

IGNAEA NOVA: upright, tall; late; flowers single, 2½", orange red (signal red, HCC 719/3) with yellowish orange (tangerine orange, HCC 9) blotch.

IL TASSO: upright, tall; late; flowers double, 2¼", orange red (scarlet, HCC 19/2), paler edges.

IRENE KOSTER: upright, tall; late midseason; flowers single, 1¾", white flushed red (dawn pink, HCC 523/1 to 523/3), scented. *Exquisita* is similar but larger flowers, 2¼".

JOSEPHINE KLINGER: upright, tall; late; flowers single, 1¾", orange red (begonia, HCC 619).

MILTON: upright, tall; late; flowers double, 2", white with orange yellow (empire yellow, RCS) blotch.

MINERVA: upright, tall; late; flowers single, 2¼", red (camellia rose, HCC 622/3).

NARCISSIFLORA: upright, tall; late; flowers double, 1¾", yellow (chrome yellow light, HCC 605/1), sweet scent.

NORMA: upright, tall; late; flowers double, 1¼", reddish orange (carrot red, edged old rose, RCS).

PALLAS: upright, tall; late; flowers single, 2¼", flushed orange red (jasper red, HCC 018 to 018/2) with orange yellow (indian yellow, HCC 6) blotch.

PHIDIAS: upright, tall; late; flowers double, 1½", yellow (mimosa yellow, HCC 602/3).

PRINCE HENRI DE PAYS-BAS: upright, tall; late; flowers single, 2¼", yellowish orange (tangerine orange, HCC 9) and orange red (geranium lake, HCC 20/1).

QUINTIN METSYS: upright, tall; late; flowers double, 1½", white flushed orange red (venetian pink, blotch empire yellow, RCS).

RACINE: upright, tall; late; flowers double, 1½", white flushed reddish orange (orient pink, RCS).

RAPHAEL DE SMET: upright, tall; late; flowers double, 1¾", white edged orange red (venetian pink, HCC 420/2).

REMBRANDT: upright, tall; late; flowers single, 1½", mottled red (rose opal, HCC 22/1).

ROI DES FEUX: upright, tall; late; flowers single, 2", red (neyron rose, HCC 623/1).

SANG DE GENTBRUGGE: upright, tall; late; flowers single, 1¾", orange red (signal red, HCC 719/3).

SOUVENIR DE PRESIDENT CARNOT: upright, tall; late; flowers double, 1½", yellowish orange (cadmium orange, HCC 8/2) and reddish orange (brick red, HCC 016).

TENIERS: upright, tall; late; flowers double, 2¼", orange yellow (maize yellow, RCS) flushed orange red (venetian pink, RCS).

UNIQUE: upright, tall; late; flowers single, 2", yellowish orange (tangerine orange, HCC 9/1).

WILLIAM III: upright, tall; late; flowers single, 2½", orange red (peach red, RCS), yellowish orange (cadmium yellow, RCS) blotch.

**Knaphill Group.**—More recent developments among the Ghent Hybrids are the hybrid deciduous azaleas here classified under the name, Knaphill. They originated with Anthony Waterer's Knap Hill Nursery and were de-



veloped by that nursery and the neighboring Goldsworth Old Nursery (Sloccock) in England. With these azaleas as a starting point the work was carried forward by the late Edgar Stead at the Ilam Estate, Christchurch, New Zealand, and the late Lionel de Rothschild at Exbury, Southampton, England. Thus there are four subgroups of Knaphill Azaleas, the true Knaphill, the Sloccock, Ilam and Exbury. Plants in the Knaphill Group were also developed by the late P. D. Williams of Lanarth, Cornwall, England and have been propagated by an English nurseryman, W. J. Marchant.

The flowers are wide and flat with a long slender tube and increased size, 2 to 3 inches, mostly single but a few double. Many have clusters of remarkable size, 18 to 30 flowers, some trusses are low and spreading in form, rather than rounded. Colors are pink, creams, and near whites, and stronger reds, roses, and oranges. They bloom late midseason or late. Some plants have dwarf spreading habits. Many have been named only recently. However, in accordance with British practice some of these names are not the names of clones propagated vegetatively but are hybrid group names for seedlings of a particular selected female parent supposedly self-pollinated. Individual plants under such names may therefore vary widely and in those instances the description given is merely that of the female parent. Representative named clones or groups with designation of the particular originator and color are—

- ALBATROSS (Knaphill) : pale yellow, suffused pink.
- BALZAC (Exbury) : orange.
- BASILISK (Exbury) : cream, yellow blotch.
- BEAUIEU (Exbury) : cream with orange blotch.
- BRAZIL (Exbury) : tangerine.

- BERRYROSE (Exbury) : pink, yellow blotch.
- BRIGHT FORECAST (Exbury) : salmon, deep orange blotch.
- BRIGHTSTRAW (Exbury) : deep yellow, deeper blotch.
- BULLFINCH (Knaphill) : deep red.
- BUZZARD (Knaphill) : pale yellow tinged pink, fragrant.
- CECILE (Exbury) : salmon pink, yellow blotch.
- COQUETTE (Knaphill) : carmine rose.
- FAWLEY (Exbury) : white, flushed pink.
- FIRECREST (Knaphill) : red.
- FIREFLY (Exbury) : deep orange.
- FIREGLOW (Sloccock) : orange vermilion.
- FLAMING JUNE (Knaphill) : deep red.
- FLAMINGO (Knaphill) : upright, tall; late midseason; flowers carmine rose with orange blotch, 3½".
- GEORGE REYNOLDS (Exbury) : yellow, deeper blotch.
- GIBALTAR (Exbury) : orange.
- GILBURY (Exbury) : pink.
- GINGER (Exbury) : ginger.
- GOG (Sloccock) : tangerine.
- GOLDEN EVE (Knaphill) : upright, medium height, sparse grower; late; flowers orange red with orange blotch, large.
- GOLDEN DREAM (Exbury) : yellow.
- GOLDEN HORN (Exbury) : golden yellow.
- GOLDEN ORIOLE (Knaphill) : upright, tall; early midseason; chinese yellow with deep tangerine blotch.
- GOLDFINCH (Knaphill) : spreading, tall; late; flowers 2", yellow with orange blotch, and apricot streaks and flecks, large.
- HOTSPUR RED (Exbury) : red.
- HOTSPUR YELLOW (Exbury) : yellow, orange blotch.
- HARVEST MOON (Sloccock) : pale yellow.
- HOME BUSH (Knaphill) : semi-double, 1¼", red (neyron rose, HCC 623, on a base of rose madder, HCC 23/1).
- HOOPOE (Knaphill) : deep cherry pink.
- KATHLEEN (Exbury) : pale salmon, orange blotch.
- KIPPS (Exbury) : tangerine.
- KLONDYKE (Exbury) : yellow.
- KNAP HILL PINK (Knaphill) : 2¾", violet red (phlox pink, HCC 625/1) flushed red (neyron rose, HCC 623/1) with orange yellow (saffron yellow, HCC 7/1) blotch.
- KNAP HILL RED (Knaphill) : deep red.
- KNAP HILL WHITE (Knaphill) : pale pink fading white.
- KNIGHTHOOD (Exbury) : crimson.
- LADY DERBY (Knaphill) : pale chinese yellow, tinged pink with carmine blotch.

LAPWING (Knaphill): tinged pink.

MADELEINE (Exbury): pale pink, yellow blotch.

MARION MERRIMAN (Knaphill): spreading, medium height; late midseason; flowers 3½", flat faced, 6 petals, yellow (chrome yellow, HCC 605); flushed orange yellow (indian yellow, HCC 6/1) with yellowish orange (cadmium orange, HCC 8) blotch, frilled, large truss.

MARY CLAIRE (Exbury): pink, yellow blotch.

MERLIN (Knaphill): salmon red with orange blotch, flat face, wrinkled flowers.

MRS. ANTHONY WATERER (Knaphill): upright, tall; very late; flowers pale cream, small to medium.

OXYDOL (Exbury): white.

PERSEL (Sloccock): white, pale yellow blotch.

PINK DELIGHT (Sloccock): peach pink, yellow eye.

PRINCESS ROYAL (Exbury): cream, yellow blotch.

REDSHANK (Knaphill): red.

ROBIN (Knaphill): spreading, medium height; late; flowers reddish orange, small to medium.

ROYAL LODGE (Exbury): deep red.

RUDDY DUCK (Knaphill): spreading, tall; late; flowers pale orange red with yellow blotch, medium; petals broad, bell-shaped.

SALMON ORANGE (Exbury): salmon orange.

SANDPIPER (Knaphill): upright, tall; late midseason; flowers 3", pale yellow flushed pink with orange blotch.

SATAN (Sloccock): scarlet.

SCARLET PIMPERNEL (Exbury): red.

SEVILLE (Sloccock): orange.

STRAWBERRY ICE (Exbury): pale pink, yellow blotch.

SYLPHIDES (Knaphill): pale carmine, large cone-shaped truss.

TUNIS (Sloccock): scarlet with orange blotch.

TOUCAN (Knaphill): upright, medium height, open; late midseason; flowers 3½", pale cream.

WHITETHROAT (Knaphill): spreading, medium height; late midseason; flowers double, 2", white.

YAFFLE (Knaphill): spreading, medium height; late; flowers, orange red, medium.

The Ilam azaleas are mostly unnamed. Nos. 1, 2, 3, 4, 7, and 8 are yellow and red; No. 5, red, large truss; No. 6, orange; and No. 11, yellow.

### Mollis Hybrids (×Kosteriana):

*Molle* × *japonicum* form the basis for this hybrid race developed largely by Anthony Koster and Sons, Boskoop, Holland, and Anthony Waterer's Knap Hill Nursery, Knap Hill, England, around 1880 although perhaps originated in part by others a few years earlier.

Plants are deciduous, upright, tall, not so hardy as the Ghent Hybrids, and do better on their own roots. Grafted plants are more tender, probably because of poor growth from graft union trouble and consequent lack of water supply for the top of the plant during the growing season. The Mollis Hybrids bloom in late midseason. The flowers have a yellow, orange, rose color range, occasionally white, and appear in clusters of 7 to 13. They average larger in size than those of the Ghent Hybrids—about 2"½ inches wide—are more striking in their colors, and are single.

There are around 250 named clones. Representative clones are—

ANTHONY KOSTER: upright, tall; late midseason; flowers single, 2¾", reddish orange (carrot red, RCS).

A. VERSCHAFFELT: upright, tall; late midseason; flowers single, 2", orange red (peach red, RCS) with orange blotch.

BETSY DE BRUIN: upright, tall; late midseason; flowers single, 2¼", orange yellow and orange (buff yellow and pale orange yellow, RCS) with tips of petals reddish orange (bittersweet orange, RCS) and reddish orange (grenadine red, RCS) blotch.

BOUQUET D'ORANGE: upright, tall; late midseason; flowers single, 2¼", orange red (strawberry pink flushed geranium pink, RCS).

CHEVALIER DE REALI: upright, tall; late midseason; flowers single, 1½", orange yellow (maize yellow, RCS) fading quickly to off-white.

COMTE DE GOMER: upright, tall; late midseason; flowers single, 2½", orange red (begonia rose washed peach red, RCS) with orange blotch.

COMTE DE KERCKHOVE: upright, tall; late midseason; flowers single, 2¼", orange red

(coral pink shaded strawberry pink, RCS) with orange blotch.

COMTE DE PAPADOPOLI: upright, tall; late midseason; flowers single, 3", orange red (porcelain rose, HCC 620/1).

COMTE DE QUINCY: upright, tall; late midseason; flowers single, 2½", yellow (chrome yellow light, HCC 605/2).

CONSUL CERESOLE: upright, tall; late midseason; flowers single, 3½", orange red (porcelain rose, HCC 620/1).

DANTE GABRIEL ROSETTI: upright, tall; late midseason; flowers single, 2¾", white with orange yellow blotch; buds are orange yellow.

DR. REICHENBACH: upright, tall; late midseason; flowers single, 2½", yellowish orange (light orange, yellow shaded capuchin yellow, blotch bittersweet orange, RCS).

EMIL LIEBIG: upright, tall; late midseason; flowers single, 2¾", yellowish orange (cadmium yellow, RCS) with orange (xanthine orange, RCS) blotch.

FRANS VAN DER BOM: upright, tall; late midseason; flowers single, 2½", yellowish orange (apricot, HCC 609/1 to mars orange, HCC 013).

FRED DE KONINCK: upright, tall; late midseason; flowers single, 2¾", orange yellow (maize yellow with edges tinted strawberry pink, RCS), blotch orange (cadmium orange, RCS).

GENERAL VETTER: upright, tall; late midseason; flowers single, 2½", yellowish orange (apricot, HCC 609/1 to chinese coral, HCC 614).

HORTULANUS WITTE: upright, tall; late midseason; flowers single, 2¼", yellowish orange (light orange yellow with cadmium yellow blotch, RCS).

HUGO HARDYZER: upright, tall; late midseason; flowers single, 2¼", orange red (be-gonia, HCC 619).

HUGO KOSTER: upright, tall; late midseason; flowers single, 2¾", reddish orange (poppy red, HCC 16/2) with orange blotch.

J. C. VAN TOL: upright, tall; late midseason; flowers single, 2¾", orange red (rose doree with undertone of strawberry pink, RCS).

J. J. DE VINK: upright, tall; late midseason; flowers single, 2¾", orange yellow (orange buff, HCC 507/1 to shrimp red, HCC 616) with orange blotch.

KOENIGIN EMMA: upright, tall; late midseason; flowers single, 2½", reddish orange

(light salmon orange tinted peach red, blotch bittersweet orange, RCS).

KOENIGIN WILHELMINA: upright, tall; late midseason; flowers single, 2½", reddish orange (light salmon orange with bittersweet orange, RCS) blotch.

KOERSBERGEN: upright, tall; late midseason; flowers single, 3", orange red (peach red flushed rose doree, RCS), yellowish orange (cadmium yellow, RCS) blotch.

KOSTER'S BRILLIANT RED: upright, tall; late midseason; flowers single, 2½", reddish orange (bittersweet orange, RCS).

KOSTER'S YELLOW: upright, tall; late midseason; flowers single, 3¼", orange yellow (maize yellow, RCS), orange blotch.

MATHILDE: upright, tall; late midseason; flowers single, frilled, 3", orange red (geranium pink and rose doree shaded spectrum red, RCS).

MISS LOUISA HUNNEWELL: upright, tall; late midseason; flowers single, 3", orange yellow (saffron yellow, HCC 7); plants of true clone may not be in existence. Seedlings frequently substituted.

MRS. L. J. ENDTZ: upright, tall; late midseason; flowers single, 3", orange yellow (apricot yellow, RCS), yellowish orange (cadmium yellow, RCS) blotch.

MRS. OLIVER SLOCOCK: upright, tall; late midseason; flowers single, orange yellow flushed orange red. See colored Plate 1, facing page 7.

MULTATULI: upright, tall; late midseason; flowers single, 3¼", reddish orange (grenadine, RCS) flushed orange red (peach red, RCS) with orange blotch.

NICOLAAS BEETS: upright, tall; late midseason; flowers single, 2¼", orange yellow (apricot yellow to maize yellow, RCS). Dagonet, orange yellow (buff yellow shaded mikado orange, RCS), is similar.

PRINS FREDERICK: upright, tall; late midseason; flowers single, 2¾", orange red (shrimp pink, RCS) orange blotch.

PRINS HENDRICK: upright, tall; late midseason; flowers single, 1¼", orange yellow (buff yellow to apricot yellow, RCS) with orange blotch, appears like pure *molle* but with a tubular narrow faced flower.

PROF. H. LORENTZ: upright, tall; late midseason; flowers single, 2½", orange red (rose doree, RCS), paler towards edges.

QUEEN SOPHIE: upright, tall; late midseason; flowers single, 2", orange red (geranium pink, RCS) with paler blotch.

SAMUEL TAYLOR COLERIDGE: upright, tall;

late midseason; flowers single,  $2\frac{3}{4}$ " , red (rose pink, RCS) with yellowish orange (cadmium orange, RCS) blotch.

SHAKESPEARE: upright, tall; late midseason; flowers single,  $2\frac{1}{4}$ " , orange (capuchin buff, RCS), tips shaded reddish orange (bittersweet pink, RCS), blotch yellowish orange (cadmium yellow, RCS).

T. J. SEIDEL: upright, tall; late midseason; flowers single,  $2\frac{1}{2}$ " , orange (mars orange, HCC 013/2) with darker blotch.

W. E. GUMBLETON: upright, tall; late midseason; flowers single,  $2\frac{1}{4}$ " , orange yellow (pale baryta yellow, RCS), faint greenish blotch.

#### OBTUSUM SUBSERIES HYBRID GROUPS

**Sander Hybrids** ( $\times$  Sanderi): This group is from Indian Azalea cl. Garnet  $\times$  *obtusum* recrossed with each other and *obtusum* f. *album* and later with Kurume cl. Hi-no-degiri. The group was originated around 1885 by Charles Sander of Brookline, Massachusetts at Holm Lea, the home of Professor C. S. Sargent.

The plants are mostly dwarf and compact, spreading, unusually hardy for plants in the Obtusum Subseries, and bloom from early to late midseason. The flowers are from one to  $1\frac{3}{4}$  inches wide, single, and mainly in the rose to crimson color range.

Apparently never widely distributed, only a few of this group are readily available today, Mars, Ruby, and Vivid. Other plants of the group should be extensively reintroduced because they are unique in being a relatively low growing group for the early half of the azalea blooming season, include deep, clear crimsons and scarlets, and are relatively hardy. Perhaps plants on the Coe estate on Long Island could be identified and serve as a source of propagating material.

Included with this group are Hexe (*amoenum*  $\times$  *simi* cl. Duc de Nassau) originated by Otto Forster in Austria, also about 1885, and Vuylstekeana (Hexe  $\times$  General Postmeister Steph-

an) originated by Charles Vuylsteke of Ghent, Holland, in 1908,—both with hose-in-hose flowers.

There are around 20 clones in the group. Representative clones are—

HEXE: spreading, low, dense; late midseason; flowers single, hose-in-hose,  $1\frac{3}{4}$ " , violet red (spiraea red, HCC 025). Scattered bloom most of year in Florida. There is a Hexe put out by the Blaauw firm in Holland that has different flowers,  $2\frac{1}{2}$ " , occasionally semi-double, frilled, cardinal red, HCC 822/3.

RUBY: upright, tall (others report Ruby as dwarf and dense but are perhaps referring to Ward's Ruby); early midseason; flowers single,  $1\frac{3}{4}$ " , orange red (delft rose, HCC 020) with darker blotch. The flowers of Ruby (although possibly tenderer) are perhaps the best of those of a number of plants with similar flowers blooming about the same time, as Kurume cl. Suetsumu (Flame), Kurume cl. Vesuvius, Kaempferi Hybrid cl. Othello, Kurume cl. Hardy Firefly, and Gable Hybrid cl. La Lumiere, all of which are excellent.

VIVID: spreading, low, dense; early midseason; flowers single,  $1\frac{3}{4}$ " , red (claret rose, HCC 021/1).

A full list of the Sander Hybrid clones will be found in E. H. Wilson and Alfred Rehder, A Monograph of Azaleas (1921), page 44.

**Arnold Hybrids** ( $\times$  Arnoldiana): These were developed by Jackson T. Dawson from a chance *amoenum*  $\times$  *kaempferi* hybrid at the Arnold Arboretum about 1910.

The plants are medium to tall in height, upright, rather more spreading than *kaempferi*, very hardy, and bloom in early midseason. The flowers are from 1 to  $1\frac{1}{4}$  inches in width, single, and in a narrow rose to purple color range. It is their extreme hardiness for evergreen azaleas that gives the group its merit. In this characteristic the group is superior even to *obtusum* f. *amoenum* and its derivatives. The colors, however, are poor and the group lacks quality. About a half dozen clones are available. Representative clones are—

MELLO-GLO: upright, medium height; early midseason; flowers single, 1", violet red (solferino purple, HCC 26/2).

CARDINALIS: upright, medium height, early midseason; flowers single, 1¼", violet red (phlox pink, HCC 625/1).

EARLY DAWN: upright, tall; early midseason; flowers single, 1¼", violet red (fuchsia purple, HCC 28/2).

Other named clones of the Arnold Hybrids are—

BRIARCLIFFE: 1¼", violet red (phlox pink, HCC 625/2).

DEXTER'S PINK: 1½", violet red (phlox pink, HCC 625/2).

MOSSIEANUM: violet red (fuchsia pink, HCC 627/1).

**Kurumes:** This group is composed of forms of *kiusianum* (perhaps *kaempferi* and *obtusum* parentage also) developed through selection and recrossing within the group. The primary breeding work was done some 120 years ago by Motozo Sakamoto at Kurume, Japan. Prior to 1915 the clones Hi-no-degiri, Yayegiri, and Hi-nomayo were probably the only Kurumes introduced into the United States. In 1917 Mr. John S. Ames of North Easton, Massachusetts, acquired at the suggestion of E. H. Wilson a group of Kurumes from Japan. Wilson, later Keeper of the Arnold Arboretum at Jamaica Plain, Massachusetts, was at that time a plant explorer for the Arboretum. In 1919 the Arboretum received from Japan a selection of 50 Kurumes made by Wilson. By 1927 Wilson had substituted for the Japanese names English names that are in common use here but not in Great Britain or Japan. Of these 50 only a few, Pink Pearl, Appleblossom, Cherryblossom, Peachblossom, Snowflake, Painted Lady, Daybreak, Santoi, Salmon Prince, Scarlet Prince, and Flame, are likely to be found in nursery lists in the United States today and some of these only rarely.

At the Panama-Pacific Exposition in San Francisco in 1915 Kurume azaleas were exhibited. Perhaps these along with others imported from Japan found their way to Domoto Brothers, nurserymen in Oakland, California. In any event around 1920 that company shipped a large number of Kurumes to Henry A. Dreer, Inc., of Philadelphia. In 1922 Dreer introduced some of these under the English names of Appleblossom, Cherryblossom, and Pink Pearl but whether the names originated with Wilson or Dreer cannot be said. During the same year of 1922 and the few following years Dreer introduced other Kurumes under English names, including (save for Hi-no-degiri) the two best known Kurumes, Coral Bells and Snow, and such Kurumes as Christmas Cheer, Daphne, Peach Blow, Salmon Queen, Debutante, Cattleya, and Bridesmaid.

Subsequently in 1929 R. K. Beattie introduced from Japan numerous azalea clones, including many of the Kurume character, for the Division of Plant Exploration and Introduction, U.S. D.A.

The Kurume group has been greatly widened by occasional more recent introductions from Japan and by selection of numerous seedlings grown in this country mentioned below under "Recent Kurume and *Kaempferi* Hybrids."

The plants vary in height, some tall, some medium, and are generally upright and almost always dense and shapely. They bloom early or early midseason. Flowers are single with some hose-in-hose. Life size sketches of the flowers of 60 clones appear in the National Horticultural Magazine for July 1940. The flowers range from ½ to 2½ inches in width, and have the full range of the *Obtusum* Subseries colors, scarlet to purple and also white,

and occasionally striped or flecked flowers. The Kurumes are the evergreen azaleas best known to the public except for the Indian Azaleas in the South.

There are around 300 named clones. Representative clones are—

**AZUMA-KAGAMI** [Mirror of Eastern Japan] (Pink Pearl): upright, 6' tall; early midseason; flowers single, sometimes semi-double, hose-in-hose, 2", violet pink (phlox pink, HCC 625/2) flushed a darker pink.

**BENEGIRI**: upright, medium height, early midseason; flowers single, 1¼", red (rose madder, HCC 23/2).

**CHRISTMAS CHEER**: spreading, medium height; early midseason; flowers single with partially petaloid sepals, 1¼", red (rose opal, HCC 022).

**CORAL BELLS** (Pink Beauty): spreading, low; early midseason; flowers single, hose-in-hose, conspicuously tubular, 1⅞", red (tyrian rose, HCC 24/2) with darker veins. Rose Quartz is similar but lighter color and slightly larger.

**DAPHNE**: upright, medium height; early midseason; flowers single, 1¼", reddish violet (mallow purple, HCC 630/2) with white veins.

**DEBUTANTE**: upright, medium height; early midseason; flowers single or occasionally semi-double, also sometimes partially petaloid sepals, 1½", red (spinel red, HCC 023/2) with white veins and throat and darker blotch.

**DELICATISSIMA**: upright, medium height; early midseason; flowers single, 1¼", white flushed reddish violet (mallow purple, HCC 630/1).

**EXQUISITE**: upright, medium height, but lower and more spreading than most Kurumes; early midseason; flowers single, hose-in-hose, 1½", reddish violet (phlox pink, HCC 625).

**FIREBIRD**: upright, tall; early midseason; flowers single, hose-in-hose, 1½", orange red (delft rose, HCC 020). Yaeshojo (PI 77100) about the same but flowers slightly smaller; close to a hose-in-hose Suetsumu. Yayegiri is similar.

**HATSUSHIMO** (PI 77138) [Eight Islands]: upright, tall; early midseason; flowers single, 2", flushed violet red (rose bengal, HCC 25/2) with white edging and darker blotch, possibly a *mucronatum* × *indicum* hybrid.

**HO-O** (Appleblossom): upright, tall; early

midseason; flowers single, 1¼", pink with white throat.

**HO-ODEN** (PI 77012): spreading, low; early midseason; flowers single, hose-in-hose, 2½", violet red (solferino purple, HCC 26/3) with white edges and blotch and flakes of same color; possible a *mucronatum* × *indicum* hybrid.

**KARA-NISHIKI** (PI 77048) [Chinese Brocade]: upright, medium height; early midseason; flowers semi-double, 2¼", white with some chartreuse in throat.

**KOROMO-SHIKIBU** (PI 77142): upright, tall; early midseason; flowers single, petals are narrow and straplike and widely separated, distinctive, does not have appearance of an azalea flower, 2½", reddish violet (mallow purple, HCC 630/1) with darker *macrosepalum* hybrid. See Plate 4 on page 16.

**KURE-NO-YUKI** [Twilight Snow] (Snowflake): upright, tall; early midseason; flowers semi-double, hose-in-hose, 2", white with violet red blotch.

**PEACH BLOW**: upright, medium height, early midseason; flowers single, 1¼", flushed red (carmine, HCC 21/2) with darker blotch.

**SALMON BEAUTY**: upright, medium height, early midseason; flowers single, hose-in-hose, frilled, 1¾", red (rose opal, HCC 022/2) with darker throat.

**SHERWOODI** (Sherwood Orchid): spreading, medium height; early midseason; flowers single, 2", reddish violet (orchid purple, HCC 31/1) with darker blotch.

**SHIN-UTENA** (Santoi): upright, medium height; early midseason; flowers single, 1½", white, with tips of petals violet red (spiraea red, HCC 025/1) and darker blotch.

**SNOW**: upright, 6 to 7' tall; early midseason; flowers single, hose-in-hose, 1¾", white with faint chartreuse blotch. Dead flowers are not promptly shed.

**SUETSUMU** (Flame): upright, tall; early midseason; flowers single, 1½", orange red (delft rose, HCC 020/1). Hardy Firefly and Vesuvius are similar.

**SWEET BRIAR**: spreading, medium height; early midseason; flowers single, hose-in-hose, 1½", white flushed red (neyron rose, HCC 623/1) with darker blotch. Close to a hose-in-hose Peach Blow.

**USUYO** (PI 77122): spreading, medium height; early midseason; flowers single, 2½", reddish violet (orchid purple, HCC 31/2) with reddish blotch; possibly a *macrosepalum* form; ¾" sepals.

The list of the Kurumes introduced by E. H. Wilson, together with their substitute English names as found in E. H. Wilson, *Plant Hunting* (1927), volume II, pages 239-240 is—

AGEMAKI (No. 41, Jose) : carmine.  
 AIOI (No. 43, Fairy Queen) : almond blossom pink, single, hose-in-hose.  
 ASA-GASUMI (No. 14, Rosy Morn) : rose pink, single, hose-in-hose.  
 AYA-KAMMURI (No. 19, Pinkie) : rose-color.  
 AZUMA-KAGAMI (No. 16, Pink Pearl) : see above.  
 BENEFUDI (No. 30, Sunbeam) : salmon. Beattie's PI 77069 has same name.  
 BIJINSUI (No. 13, Little Imp) : pale pink.  
 FUDESUTE-YAMA (No. 35, Poppy) : light red.  
 GOSHO-ZAKURA (No. 46, Vanity) : white striped peach color.  
 HACHIKA-TSUGI (No. 7, Prudence) : white suffused lavender.  
 HANA-ASOBI (No. 50, Sultan) red.  
 HI-NO-DEGIRI (No. 42, Red Hussar) : see page 37.  
 HINODE-NO-TAKA (No. 48, Ruby) : crimson.  
 HOO (No. 9, Appleblossom), see above.  
 IMA-SHOJO (No. 36, Fascination), bright red, single, hose-in-hose. Beattie's PI 77111 has same name.  
 IRO-HAYAMA (No. 8, Dainty) : white margined pale lavender.  
 KASANE-KAGARIBI (No. 32, Rosita) : dull salmon red.  
 KASUMI-GASEKI (No. 12, Elf) : pale pink.  
 KATSURA-NO-HANA (No. 27, Ruth) : rose-color.  
 KIMIGAYO (No. 15, Cherub) : pink.  
 KIRIN (No. 22, Daybreak) : single, 1", red (tyrian rose, HCC 24/2 with dark blotch. Beattie's PI 77064 has same name.  
 KIRITSUBO (No. 24, Twilight) : rosy mauve.  
 KUMO-NO-ITO (Suga-no-ito) (No. 31, Betty), pure pink.  
 KUMO-NO-UYE (No. 29, Salmon Prince), upright, medium height, early midseason, flowers single, 1½", orange red (delft rose, HCC 020/2) with purple blotch.  
 KURAI-NO-HIMO (No. 40, Carmine Queen) : carmine, single, hose-in-hose.  
 KURENO-YUKI (No. 2, Snowflake), see above.  
 NANI-WAGATA (No. 5, Painted Lady) : white suffused lavender.

OINO-MEZAME (No. 26, Melody) : deep rose-color.

OMOINE (No. 26, Dame Lavender) : pale lavender.

OSARAKU (No. 17, Penelope) : white suffused and margined lavender.

OSARAKU SEEDLING (No. 49, Winsome) : white suffused lavender.

OTOME (No. 18, Maiden's Blush) : blush pink.

RASHO-MON (No. 37, Meteor) : scarlet.

SAKURA-TSUKASA (No. 44, All-a-Glow) : rosy mauve. Beattie's PI 77129 has same name.

SAOTOME (No. 21, Peachblossom) : rose-color.

SEKAI (No. 1, Madonna) : white, single, hose-in-hose.

SHIN-SEKAI (No. 3, Old Ivory) : cream white, single, hose-in-hose.

SHINTOKI-NO-HAGASANE (No. 20, Rose Taffetas) : rose shading to pink, hose-in-hose.

SHIN-UTENA (No. 28, Santoi) : see above.

SUETSUMU (No. 34, Flame) : see above.

SUI-YOHI (No. 10, Sprite) : flesh color.

TAKASAYO (No. 11, Cherryblossom) : cherryblossom pink, hose-in-hose.

TAMAFUYO (No. 23, Fancy) : white striped peach-color.

TAMA-NO-UTENA (No. 45, Flamingo) : pale salmon.

TANCHO (No. 6, Seraphim) : flesh-color, single, hose-in-hose.

TSUTA-MOMIJI (No. 33, Cardinal) : bright red. Beattie's PI 77110 has same name.

UKAMUSE (No. 47, Princess Delight) : vermillion, single, hose-in-hose.

WAKA-KAYEDE (No. 38, Red Robin) : red.

YAYE-HIRYU (No. 39, Scarlet Prince, Yayegiri) : see under Yayegiri on page 37.

YORO-ZUYO (No. 4, Purity), white.

Hi-no-degiri and Yayehiryu (Yayegiri) were in this country prior to Wilson's introduction of them.

The list of the Kurumes brought in by R. K. Beattie, as found in *Plant Inventory* No. 85, Nos. 77064-77146, Office of Plant Exploration and Introduction, United States Department of Agriculture, is—

ASAHI (PI 77098) : deep rose pink, RCS.

AYA-NO-KAMURI (PI 77121) : deep rose pink, RCS.

AZUMI-SHIBORI (PI 77076) : white, single, hose-in-hose.

FUJIBOTAN (PI 77092): small flower, pinkish lilac and purplish lilac, RCS.

GIBIYAMA (PI 77091): pale amparo purple and phlox purple, RCS.

HANA-ASOBI (PI 77106): small flower, rose-color, RCS.

HATSUNAMI (PI 77075): rose-color with blotch, RCS.

HINODE (PI 77101): small flower, rose-color, RCS.

HOKOROBİ (PI 77125): white, faintly touched with rose.

KOCHO-NO-MAI (PI 77136) [Butterfly Dance]: light phlox purple, lighter in throat, RCS. E. H. Wilson states that a plant of this name is typical of the hose-in-hose form of *amoenum*. PI 77136 does not resemble *amoenum* as commonly known in this country. PI 77136 is a single flower, 1¼", petunia purple, HCC 32/2, with faint blotch.

KOGASANE (PI 77116): single, hose-in-hose, deep rose pink to rose, RCS.

KOMURASAKI (PI 77127): light rosolane purple, RCS.

KOROMO-SHIKIBU (PI 77142): see above.

KOSHIKIBU (PI 77139): white throat, pale pink margin.

KOTSUBO (PI 77133): small flower, rose, RCS.

KYO-NO-TSUMIBANA (PI 77118): 1", rose red to tyrian red, RCS, similar to Hi-no-degiri.

KYU-MIYAGIMO (PI 77114): 1¼", single, hose-in-hose, deep rose pink, RCS.

MIYAGINO (PI 77144): single, hose-in-hose, deep rose pink to tyrian pink, RCS.

MIYAKO-SHIBORI (PI 77198): rosolane pink to cameo pink, RCS.

MOMYI-GASANI (PI 77124): single, hose-in-hose, geranium pink, RCS.

OI-NO-MEZAME (PI 77135): 1", deep rose pink to rose pink, RCS.

OJI-KASANE (PI 77086): 1¼", single, hose-in-hose, white flushed cameo pink, RCS. Similar to Wilson's introduction, Takasayo (Cherryblossom).

SAKURA-KAGAMI (PI 77115): white flushed rose at tips.

SHOSHOBENI (PI 77067): single, hose-in-hose, alizarine pink, RCS.

SURISUMI (PI 77143): 1", light phlox purple, RCS, similar to Kocho-no-mai.

TAMA-NO-MIDORI (PI 77093): deep rose.

WARAI-GAO (PI 77130): single, hose-in-hose, deep rose pink, RCS.

WASEGIRI (PI 77080): strawberry pink, RCS.

YAESHOJO (PI 77100): see above.

YATSU-HASHI (PI 77119): rose pink to rose, RCS.

YO-ZAKURA (PI 77096): 2", rose purple, RCS.

Beattie also brought in a number of plants presumably Kurume hybrids, several excellent in quality. They are—

FUTAMI-AKETONO (PI 77134): 1½", deep rose pink, RCS.

HATSUSHIMA (PI 77138): see above.

HINOHAKAMA (PI 77126): flowers semi-double, 1½", red (rose opal, HCC 022/1).

HO-ODEN (PI 77112): see above.

KACHA-NO-KAWA (PI 77077): spreading, medium height; very late; flowers, 1¼", single, violet red (spiraea red, HCC 025/1) with darker blotch.

KAGARIBI (PI 77102): 2", scarlet red tinged nopal red, RCS.

KARAN-NISHIKI (PI 77084): see above.

KARENKA (PI 77088): 1", rose color, RCS.

KORAINI (PI 77137): early midseason, flowers single, 1¼", violet red (spiraea red, HCC 025) with darker blotch.

TAMA-NO-ITO (PI 77107): light rosolane purple, RCS, possible an *indicium* form.

USUYO (PI 77122): see above.

In addition to the foregoing Kurumes there will be found among the southern or Pacific coast nurseries Kurumes presumably developed in this country although in some cases duplication of names may be involved:

ALGIERS: ¾", deep rose pink to rose-pink, RCS.

AMERICAN BEAUTY: 1½", tyrian pink, RCS.

AVALANCHE: single, hose-in-hose, 1½", white, not inferior *mucronatum* form of same name.

BOUQUET ROSE: single, hose-in-hose, rose-color, RCS.

BRIDESMAID: salmon.

CANDLELIGHT: pale salmon, RCS.

CATTELEYA: white flushed mallow pink, RCS.

CHERRY RIPE: single, hose-in-hose, rose red, RCS, conspicuously tubular.

ECSTASY: 1½", deep rose pink, RCS.

ESMERALDA: single, hose-in-hose, rose.

FAIRY: white flushed pink and pink blotch.

FLAMINGO: 1½", coral, RCS.

FUJIMOYO: pinkish lavender.



FUJI-NO-ASAHI: single, hose-in-hose, white flushed salmon pink on petal tips.

HIME-KAGAMI: single, hose-in-hose, white, few pink stripes.

HORTENSIA: single, hose-in-hose, 1½", violet red (phlox pink, HCC 625/2) with darker blotch.

KINTAIYO: single, hose-in-hose, white edged bright orange.

KUMOI: single, hose-in-hose, frilled, carmine with paler throat.

LAVENDER QUEEN: 1¼", reddish violet (rhodamine purple, HCC 29/2).

MAUVE BEAUTY: single, hose-in-hose, 1¼", reddish violet (cyclamen purple, HCC 30/2).

MIZU-NO-YAMABUKI: single with partially petaloid sepals, 1", white.

MORNING GLOW: single, hose-in-hose, 1", rose to rose red, RCS.

MOUNTAIN LAUREL: white flushed pink.

PAGENTRY: 1¾", liseran purple lightened to phlox purple, RCS; probably a *mucronatum* hybrid. Dark Spring, 1¾", is redder; Lantern Parade, 2¼", is still redder. Both are similar to Pagentry.

ORANGE CORAL BELLS: semi-double, hose-in-hose, 1½", orange red (blood red, HCC 820).

PINK WINDOW: 2", rose-color, RCS.

PITTI SING: 1¼", phlox pink, deeper on edges, RCS.

RED LUSTRE: 1½", nopal red, RCS.

ROSE: single, hose-in-hose, 1¼", nopal red, RCS.

SALMON TINTS: rose red to eugenia red, RCS.

SHIMMER: rose pink, RCS.

SUN STAR: upright, medium height; early midseason; flowers single, 1", orange red (china rose, HCC 024) with darker blotch.

TORCH: 1¾", rose doree to scarlet RCS, probably a form of *Kaempferi*.

WARD'S RUBY: red.

YAKUMO: single, hose-in-hose, dark red, roundish petals.

**Kaempferi Hybrids:** These are hybrids of *kaempferi* × *Malvatica*, sometimes called *Malvatica Hybrids*. The group originated with P. M. Koster while at the Koster Nursery, Bridgeton, N. J., about 30 years ago. *Malvatica* is the name given by P. M. Koster to a stray found among a group of *Hi-no-degiri* imported from Japan to Boskoop, Holland, about 45 years ago.

The flowers were larger and purple. The parentage of *Malvatica* is unknown, perhaps a *Kurume* hybrid.

Plants of the *Kaempferi Hybrids* are upright, tall, running up to 8 and 9 feet with age, hardier on the whole than *Kurumes*, but not of enduring hardiness for the colder climates. They bloom in early and late midseason. Flowers are single with some hose-in-hose, 1½ to 2½ inches wide, and in color range from orange red to purple, also white. They have a tendency to fade in the sun.

There are around 40 named clones in the group. Representative clones are—

CARMEN: upright, tall; early midseason; flowers single, 2½", red (crimson, HCC 22/1) with reddish throat and brown blotch. Zampa is similar; lower growing, more open; flowers single, 2½", violet red (phlox pink, HCC 625/2). *Atalanta* is lower growing; flowers single, 2", reddish violet (mallow purple, HCC 630/1). Purple King has single flowers, 1¾", violet red (phlox pink, HCC 625/2).

CLEOPATRA: upright, tall; early midseason; flowers single, 2½", red (neyron rose, HCC 623/1).

GRETCHEN: upright, medium height; late midseason; flowers single, 2", reddish violet (mallow purple, HCC 630) with darker blotch.

MARY: upright, medium height; early midseason; flowers single, 2½", violet red (rose pink, HCC 427). The following are similar: *Thais*, yellowish red throat and lower growing; *Louise*, tall, flowers single, 1¼", red (rose madder, HCC 23/1); *Lakme*, paler and lower growing; *Betty*, flowers single, 2", red (neyron rose, HCC, 623/2).

NORMA: upright, medium height; early midseason; flowers single, 2½", violet red (magenta, HCC 27/2) with lighter throat and darker blotch.

OTHELLO: upright, medium height; early midseason; flowers single, 2", red (claret rose, HCC 021/1); is as brilliantly conspicuous as, and superior to, the far better known *Kurume* cl. *Hi-no-degiri*.

SWAN WHITE: upright, medium height; early midseason; flowers single, hose-in-hose, 1¾", white with faint chartreuse throat.

Other Kaempferi Hybrids are—

- AARTJE: orange red.  
 ADDY WERY: deep orange red.  
 ANNAMARIA: white.  
 ANNY: orange red.  
 AUGUSTA: rose red.  
 AURORA: orange red.  
 BALLET GIRL: dark pink.  
 CHARLOTTE: orange red.  
 EVA: rosy violet.  
 FAVOURITE: light pink.  
 FEDORA: 2", violet red (phlox pink, HCC 625/1).  
 FIDELO: deep rosy pink.  
 FRIEDA: rosy purple.  
 GARDEN BEAUTY: pink.  
 GERDA: salmon.  
 GLOW: orange.  
 HANNY: orange red.  
 HENRIETTE: pink.  
 IVETTE: salmon pink.  
 JEANETTE: rose red.  
 JEANNE: violet red.  
 JULIANA: deep pink.  
 KATHLEEN: rosy red.  
 KITTY: orange.  
 LOHENGRIN: pink.  
 MARTHA: rose, low, spreading, late.  
 MAUVE QUEEN: 2¼", reddish violet (mal-  
 low purple, HCC 630/2).  
 MIGNON: rose.  
 MRS. DOORENBOS: vermilion.  
 MRS. WERY: carmine.  
 NORA: orange red.  
 OBERON: pink.  
 PICTURE: pink.  
 ROSE: rose pink.  
 SPITFIRE: orange red.  
 SUNSET: orange.  
 SYLPH: rose pink.  
 VICTORIA: rose pink.  
 WILHELMINA: pink.  
 WILLY: clear pink.

A few closely related to the Kaempferi Hybrids and commonly included with them are—

- DOROTHY: rose.  
 JOHN CAIRNS: dark red.  
 ORANGE BEAUTY: orange red.  
 PINK TREASURE: clear pink.

Perhaps the Arendsi Azaleas of the Arends firm of Ronsdorf, Germany, also belong here. Some recently named are Agger, Bever, Gibbe, Diemel, Eder, Ennepe, Gloer, Kerspe, Lister, Moehne, Neye, Oester, Sorpe, Uelfe.

**Recent Kurume and Kaempferi Hybrids:** Groups of named clones more recently introduced and derived principally from the Kurumes and *kaempferi* or its hybrids include the Coolidge, Mayo, Yerkes, Chisolm-Merritt, Deerfield, Sherwood, and deWilde groups.

Coolidge Group: The Coolidge Rare Plant Gardens of Pasadena, California, introduced the Coolidge Hybrids in the 1930's. Some appear to have *mucronatum* or other Ryukyu azalea parentage as well as Kurume parentage. All are single; a few where noted are also hose-in-hose. They include—

- AMERATSU, 1¼", rose doree shaded scarlet; RCS; BATIK, mauve salmon, dark red blotch; BELLS OF ARCADY, 3", white, probably a *mucronatum* hybrid; BONNY KAY, cherry red; BOTTICELLI, pink with salmon margin; CORALIE, 1¼", hose-in-hose, rose doree, RCS; CRABAPPLE, hose-in-hose, pink; DARLING OF THE GODS, orchid pink; EVENING STAR, white shaded violet; FLAMBOYANT, purple; GEISHA, hose-in-hose, coral; HER MAJESTY, purple; HUMMINGBIRD, lavender; LAVENDER AND OLD LACE, lavender; MISTY, orchid; MUEZZIN, hose-in-hose, salmon pink; NING PO, rose pink; OLD WINE, rose salmon; ORCHIS, lavender; PAGODA, lilac pink; PEACOCK, lavender; PINK PERFECTION, pink; SILVER TEARS, rose lavender; SINGING FOUNTAIN, 1¼", rose doree, RCS; SNOWBIRD, white; SUNSET, coral; SURPRISE, hose-in-hose, cerise; TWILIGHT, rose mauve; VIOLETTA, hose-in-hose, violet; WHITE APRIL, white; WOOD DOVE, hose-in-hose, lavender.

Chisolm-Merritt Group: The Chisolm-Merritt Hybrids were introduced around 1947. They are primarily selected Kurume seedlings, the work during the early 1930's of Julian Chisolm, then a nurseryman at Garrett Park, Maryland. The plants were later turned over to the late Dr. E. A. Merritt, Chevy Chase, Maryland. The plants bloom early midseason, are single and also hose-in-hose (except where noted to the contrary), and are tall growing unless otherwise indicated. They include—

ALASKA, coppery pink; ALICE PERRY, coral pink; ASIA, rose pink; AUGUSTA BREZ, jasper red; BEGONIA ROSE, pink; CANTON, light pink; CELIA COSTA, deep rose pink; CHARLOTTE WEISS, rose pink; CHARMER, 1 $\frac{3}{4}$ ", orange red (porcelain rose, HCC 620/1); CHESAPEAKE, rose pink; CHEVY CHASE, rose pink; CHINA GIRL, 2", orange red (scarlet, HCC 19/1); COLORADO, light salmon pink; COLUMBIA, deep pink; CORAL CLUSTER, coral pink; CORAL SEA, light coral pink; CORNELIA, deep pink slight coppery overcast; DESSA MERRITT, partially petaloid sepals, 1 $\frac{1}{2}$ ", orange red (geranium lake, HCC 20/2); DOROTHY, light pink; DR. E. A. MERRITT (China) spreading, medium height, not hose-in-hose, frilled, 3", orange red (delft rose, HCC 020/1),  $\frac{5}{8}$ " sepals, probably a *mucronatum* hybrid, excellent; EAGLE HEART, 1 $\frac{1}{2}$ ", reddish pink; E. H. WILSON, 2", orange red (geranium lake HCC 20/2); ELEANOR, 2", violet red (phlox pink, HCC 625/1); ENCHANTRESS, rose pink; EVENING STAR, light coppery pink; FASCINATION, light pink; FLOWER QUEEN, deep pinkish red; GLORIOSA, deep pinkish red; GUNJI, 1 $\frac{1}{2}$ " violet red (phlox pink, HCC 625/1); HENRY A. WALLACE, deep pink; ISABEL CHISOLM, deep coppery red; JESSICA, light jasper red; JEWELL, light coppery red; KISKA, 2 $\frac{1}{4}$ ", violet red (rose bengal, HCC 25/1) with darker blotch; LEAH COE, medium height, pinkish red with coppery overtone; LIZETTE, light pink; MARYLAND, jasper red; MAY DAY, light salmon pink; MICKEY CHISOLM, not hose-in-hose, 1 $\frac{3}{4}$ ", orange red (delft rose, HCC 020) with darker blotch; MILLICENT, light coppery pink; Ohio, deep pink; PANDORA, clear pink; PINK LADY, not hose-in-hose, shrimp pink; PORTIA, light pink; POTOMAC, deep pink; PRINCESS, alazarine pink; PRINTEMPS, light salmon pink; ROSEBUD, pink; ROUGE CORAILE, light coppery red; RUTH STILWELL, reddish salmon; SACHEM, medium height, coppery red; SEMINOLE, rose pink; SPRING SPENDOR, deep rose pink; SUN GIRL, salmon pink; SUZANNE, coppery red; VIRGINIA MERRITT, deep pink; WINSTON, medium height, pink with lavender overtone; YOSHINO, dark coppery red.

Sherwood Group: The Sherwood Nursery Company of Portland, Oregon introduced during recent years—

SHERWOODI (Sherwood Orchid), described on p. 62 under the Kurumes: SHERWOOD RED, single, 1 $\frac{3}{4}$ ", orange red (blood red, HCC 820); and SHERWOOD CERISE, cerise. The

Sherwood Hybrids are stated to be hybrids of Hi-no-degiri and other Kurumes.

Deerfield Group: The Deerfield Nursery, Deerfield Street P. O., New Jersey, introduced the Deerfield Hybrids at the Philadelphia Flower Show in 1950. They were originated by the nursery during the period 1936-1940 and include—

BANKS LAND: spreading, medium height; early midseason; flowers single, hose-in-hose, 1 $\frac{1}{4}$ ", pink.

ESKIMO: spreading, medium height; late midseason; flowers single, hose-in-hose, 2", pink; Kurume cl. Hi-no-mayo hybrid.

FRIGID: upright, medium height; early; flowers single, 1 $\frac{1}{2}$ ", white; Hi-no-mayo  $\times$  Kurume cl. Coral Bells.

ICEBERG: spreading, low; late midseason; flowers single, 2 $\frac{1}{4}$ ", white; Kurume cl. Hi-no-degiri  $\times$  *rosmarinifolium* (*mucronatum*).

ICELAND: spreading, low; late midseason; flowers single, 2 $\frac{1}{4}$ ", white; *rosmarinifolium*  $\times$  Hi-no-degiri.

IVORY II: spreading, medium height; early midseason; flowers single, 1 $\frac{1}{2}$ ", white, Hi-no-mayo  $\times$  *rosmarinifolium*.

MME. BUTTERFLY: spreading, low; late midseason; flowers single, 2 $\frac{1}{2}$ ", white flushed lavender; Kaempferi Hybrid cl. Fedora  $\times$  *rosmarinifolium*.

NOME: upright, medium height; early midseason; flowers single, hose-in-hose, 1 $\frac{1}{2}$ ", pink; Hi-no-mayo  $\times$  Coral Bells.

POLAR: upright, medium height; early; flowers single, hose-in-hose, 1 $\frac{1}{2}$ ", white; Kurume cl. Salmon Beauty  $\times$  Kaempferi Hybrid cl. Othello.

ZERO: upright, medium height; early midseason; flowers single, 1 $\frac{1}{2}$ ", white; Hi-no-degiri  $\times$  *rosmarinifolium*.

DeWilde Group: The Rhodo-Lake Nurseries (deWilde), Shiloh, New Jersey, during the period 1947-1949 introduced several azaleas that are hybrids of a Sander Hybrid seedling and Kurume cl. Hi-no-mayo. They include—

MAY GLORY, single, red; PINK PROGRESS, single, pink; RED PROGRESS, single, red.

MAYO GROUP: These are the originations of R. P. Mayo of the Mayo Nurs-



Plate 21

Courtesy of Town & Country

GLENN DALE HYBRID CLONES

Lacquer 1/2×

Helen Fox 3/5×

Harlequin 1/4×

EWING KRAININ



Courtesy of Town & Country

Plate 22

GLENN DALE HYBRID CLONES

Helen Gunning 1/2×

Treasure 5/16×

Martha Hitchcock 1/2×

eries, Augusta, Georgia. In some instances the parentage is unknown. In general the plants bloom later than the Kurumes or *kaempferi* and have larger flowers. There are around 25 named clones. Representative clones are—

**GYPSY ROSE:** upright, tall, dense; late midseason; flowers single, 2", red (spinel red, HCC 0023) with darker blotch; a *kaempferi* hybrid.

**MAYO'S MAGIC LILY:** upright, medium height; late midseason; flowers single, with partially petaloid sepals, 2¼", flushed reddish violet (amaranth rose, HCC 530) with darker blotch.

**MAYO'S PERFECTION:** upright, medium height, dense; early midseason; flowers single, orange red; Kurume cl. × *kaempferi*; an improved Hi-no-degiri.

**MAYO'S PRIDE:** upright, tall; early midseason; flowers single, hose-in-hose, 2", red (rose opal, HCC 022/1) with darker blotch.

**PINK IMPERIAL:** upright, medium height, dense; late midseason; flowers single, frilled, 2¼", violet red (solferino purple, HCC 26/1) with darker blotch; Kurume cl. × *indicum* hybrid.

**PINK LUSTRE:** upright, medium height; late; flowers single, 1½", violet red (magenta, HCC 27/2); Kurume cl. × *kaempferi*.

**SALMON SPLENDOR:** upright, tall; late midseason; flowers single, 2¼", red (claret rose, HCC 021/1); a *kaempferi* hybrid.

Others of the Mayo Group, described generally in accordance with the introducer's data, are—

**BO-PEEP:** upright, medium height, dense; early midseason; flowers single, hose-in-hose, 1¼", orange salmon; Kurume cl. × *kaempferi*.

**FAIRY QUEEN:** upright, tall, dense; early midseason; flowers single, 2", white flushed pink; *indicum* × *kaempferi*.

**FIREGLOW:** spreading, medium height, dense; early midseason; flowers single, 1½", orange red, Kurume cl. Hi-no-degiri hybrid.

**FLAMING BEACON:** upright, tall, dense; early midseason; flowers single, 1¾", orange red with darker blotch; *indicum* × *kaempferi*.

**INDIAN SUNSET:** upright, tall, dense; flowers single, hose-in-hose, 1½", salmon pink; Kurume cl. × *kaempferi*.

**MAY FIRELIGHT:** upright, tall, dense; late;

flowers single, 1¾", orange red; probably Kurume cl. × *kaempferi*.

**ORANGE KING:** spreading, medium height, dense; early midseason; flowers single, 2", orange red; Kurume cl. Hi-no-degiri hybrid.

**QUEEN OF AUGUSTA:** spreading, medium height, dense; early midseason; flowers single, hose-in-hose, 2", salmon rose; Kurume hybrid.

**SALMON MONARCH:** spreading, medium height, dense; late midseason; flowers single 2½", salmon with darker blotch; Kurume cl. × *kaempferi*.

**YERKES GROUP:** The late Guy E Yerkes of the Plant Industry Station, U.S.D.A., at Beltsville, Maryland, developed this group. His principal objective was improved plants for propagation and forcing by florists. However, the plants are at least as hardy as the Kurumes and suitable for outdoor use wherever the Kurumes are satisfactory. Since Yerkes' retirement in 1946 and his death three years later the work has been carried on by R. L. Pryor at the Station. Some 300 plants were selected for testing and of these ten have been named. Data are not yet available as to height. The plants bloom in early or late midseason. The flowers are all hose-in-hose singles. Named clones are—

**GUY YERKES:** upright; flowers single, hose-in-hose, 2", salmon pink with darker blotch.

**H. H. HUME:** spreading; flowers single, hose-in-hose, 2", white; *mucronatum* × Kurume cl. Snow.

**MAJESTIC PINK:** upright; flowers single, hose-in-hose, 1¾", rose pink; unnamed *kaempferi* Hybrid × Snow.

**PINK PROFUSION:** upright; flowers single, hose-in-hose, 2", light pink, Hardy Firefly × Snow.

**POLAR BEAR:** upright; flowers single, hose-in-hose, 1¾", white; Hardy Firefly × Snow.

**ROSE BANNER:** upright; flowers single, hose-in-hose, 1½", rose with darker blotch; *kaempferi* × Snow.

**ROSE GLORY:** upright; flowers single, hose-in-hose, 1¾", rose with darker blotch; *kaempferi* × Snow.

**SNOWWHITE:** spreading; flowers single,

hose-in-hose, 2", white; *mucronatum* × Snow.

WHITE BANNER: spreading, low; flowers single, hose-in-hose, 1¼", white; *kaempferi* × Snow.

WHITE PERFECTION: spreading; flowers single, hose-in-hose, 2½", white; *mucronatum* × Snow.

**Indian Azaleas:** (Southern Azaleas, Indica Azaleas): This group of diverse parentage resulted from the importations of azaleas by Magnolia Gardens, near Charleston, South Carolina, perhaps as early as a century ago, and by the old nursery firm of P. J. Berckmans Co. at Augusta, Georgia, established in 1856. The importations were mainly evergreen greenhouse azaleas developed around Ghent, Belgium and in England, but found after arrival here to be hardy for outdoor growing in the South. The Indian Azaleas of today are largely the survivors of these early importations, together with their sports. Little is known to have been added to the group by way of intentional hybridization or by way of additional importation of the later greenhouse azaleas developed in Belgium and England and known as the Belgian Hybrids.

Records made in the 1870's at Magnolia Gardens show that the original plantings were composed of importations of some 230 species and clones. Relatively few survive in the South at least under the same names. Among the survivors are A. Borsig, Ceres, Charles Encke, Criterion, Duke of Wellington, Fielders White, Flag of Truce, Formosa, Glory of Sunninghill, Louise Margottin, Mme. Dominique Vervaene, Phoenicea, Praestantissima, and Vittata. Some bearing names of the early importations, as President Claeys and Triomphe de Ledeborg, do not conform to the descriptions of the originals as found in the *Tuinbouw Encyclopedie*, Vol. I, published in Amsterdam in 1938. This may be due to self-

colored sports from original plants having acquired the name. The remainder of the standard clones in the South are, except in a few instances, also Belgian and English originations prior to the late 70's, as Brilliant, Coccinea Major, Eulalie Van Geert, Iveryana, Marie Louise, Miltoni, Pluto, Prince of Orange, Venus, Violacea, and William Bull. There is some overlapping of names as Lawsal (Pride of Summer-ville, Daphne Salmon), Elegans Superba (Pride of Mobile), Cavendishi (Cavendishiana, Lady Cavendish).

The parentage of the group is reflected, at least in part, by the species that were included in the early importations — *alba* (*mucronatum*, the trade indica alba and ledifolia alba) and *narcissiflora* (a double form of *mucronatum*); *danielsiana* and *lateritia* (*indicum* Sweet, the trade macrantha) and *variegata* (a white and red striped form of *indicum*); *amoena* and *ramentacea* (red and white, respectively, forms of *obtusum*); *indica* (*simsi*) and *vittata* (a white and purple striped form of *simsi*); *coccinea* (perhaps a form of *simsi*); and *phoenicea*. *Sublanceolata* (*scabrum*) is a species also found in the Southern trade though not listed among the early Magnolia Garden importations.

Customarily the Indian Azaleas have been considered to be hybrids related for the most part to *simsi* and to a lesser degree *phoeniceum*, *mucronatum*, and *indicum* (macrantha). However, not all the plants in this group are in fact hybrids. Some are forms of such species as *indicum*, *simsi*, *mucronatum*, and *phoeniceum*. Thus the Indian Azaleas appear to fall into several categories: a considerable number of forms of *indicum*; a few forms of *simsi*; hybrids of *indicum* × *simsi* with one or the other parent dominant; a few forms of *mucronatum*; a few hybrids of *mu-*

*cronatum* × *indicum*; and several forms of *phoeniceum*.

The plants in the group may be considered as generally composed of two classes from the standpoint of habit and blooming period. One is of spreading plants of low or medium height, compact and dense, slower growing, and usually late blooming. In this group are Alba Punctata, Anthenon, Cavendishi, Charles Encke, Coccinea Major, Criterion, Duc de Rohan, Duke of Wellington, Flag of Truce, Glory of Sunninghill (Gloriosa), Harry Veitch, Iveryana, Mme. Margottin, Modele (de Marcq), Miltoni, Perfection (de Rentz), Pluto, Supreme, Zeke's Pride, and others. The second class includes the taller, more open, faster growing, and earlier blooming plants that the Southern gardener more usually regards as "indicas."

Among the Indian Azaleas the size of flowers runs large, from 2 to 3½ inches. The flowers are mostly singles, a few doubles, no hose-in-hose. On the whole the group is tender although many do well as far north on the eastern seaboard as Washington, D. C. Colors cover the range of the Obtusum Subseries. Many clones have striped and flaked flowers some of which also produce colored selfs, probably an inheritance from *simsi* var. *vittatum* or *indicum* f. *variegatum*.

The quality of the clones among the Indian group varies widely but the flowers are superior to those of most all of the Obtusum Subseries groups above described. Even so, the Indian group is wide open to extensive improvement by an intensive breeding program.

Around 75 named clones are found in the Southern nurseries. Life size sketches of the flowers of 30 clones appear in the National Horticultural

Magazine for January, 1950. Representative clones are—

ALBA MACULATA: spreading, medium height; late midseason; flowers single, 3", white, faint chartreuse blotch; probably *mucronatum* form.

ALBA PUNCTATA (Alba Punctulata): spreading, low; late; flowers single, 2", flaked magenta; probably *indicum* form.

BRILLANT: spreading, medium height, dense; late; flowers single, 2¼", red (rose with tyrian rose blotch, RCS); probably *indicum* form.

CAVENDISHI (Cavendishiana, Lady Cavendish): spreading, low, dense; late; flowers single, 2¾", red (rose madder, HCC 23/2) with darker blotch, white edges, and darker red (rhodamine red, HCC 0022) stripes; probably *simsi* × *indicum* hybrid. Some variation in flowers from plant to plant. Criterion is similar but late midseason, perhaps taller. See Plate 23 on page 74.

COCCINEA MAJOR: spreading, low, dense; late; flowers single, 2½", orange red (scarlet red, RCS); probably *indicum* form.

DIXIE: upright, tall; early; flowers single, 2½", orange red (rose doree, with tyrian rose blotch, RCS); probably form of *simsi*.

DUK DE ROHAN: spreading, medium height; early midseason; flowers single, 2¼", orange red (begonia rose with tyrian rose blotch, RCS); probably *indicum* form.

DUKE OF WELLINGTON: spreading, medium height; late; flowers single, 3", orange red (begonia rose with tyrian rose blotch, RCS); probably *indicum* × *simsi* hybrid.

EARLY LAVENDER: spreading, tall; early midseason; flowers single, 2½", violet red (rose purple, RCS); probably a *mucronatum* × *simsi* hybrid.

ELEGANS: upright, tall; early midseason; flowers single, 2", light pink; probably a *mucronatum* × *simsi* hybrid.

ELEGANS SUPERBA (Pride of Mobile): upright, tall; late midseason; flowers single, 2½", red (deep rose pink, RCS, with brownish purple blotch); probably *phoeniceum* hybrid.

EULALIE VAN GEERT: upright, tall, early; flowers single, 2½", orange red (geranium pink, RCS, with white margin and carmine flecks); probably *simsi* form.

FIELDER'S WHITE: spreading, medium height; early midseason; flowers single, frilled, 2¾", white; probably a *mucronatum* form.

FLAG OF TRUCE: upright, medium height;



late midseason; flowers semi-double, frilled, 2", white. See Plate 39 on page 136.

FORMOSA: upright, tall; late midseason; flowers single, 3½", violet red (mallow purple with tyrian rose blotch, RCS); probably a *phoeniceum* hybrid. Judge Solomon and Southern Charm are reputed to be sports of Formosa with its foliage and habit of growth but flowers similar to Elegans Superba but a little lighter.

GEORGE FRANC: spreading, medium height; early midseason; flowers single, 3", red (deep rose pink with tyrian rose blotch, RCS); probably a *simsi* × *indicum* hybrid.

GEORGE LINDLEY TABER: upright, medium height; late midseason; flowers single, 3½", white flushed violet red (magenta, HCC 27/3) with darker blotch (27/1) of same color; sport of Omurasaki, a form of *phoeniceum*, selected by Dr. H. Harold Hume. Mrs. G. G. Gerbing is reputed to be a sport of George Lindley Taber with 3½" white flowers. See Plate 24 on page 75.

GLORY OF SUNNINGHILL (Gloriosa): spreading, medium height, dense; late; flowers single, 2", orange red (spectrum red, RCS); probably *indicum* × *simsi* hybrid.

IVERYANA: spreading, low; late; flowers single, 3", white with red (rose madder, HCC 23/2) flecks or self colored flowers of rose madder; probably an *indicum* form. Anthenon (Lady Edith) is a color sport, rose madder with white margins. See Plate 33 on page 118.

MILTONI: spreading, low; very late; flowers single, 2½", violet red (magenta, HCC 27/1) with red (tyrian rose, HCC 24) blotch; probably *indicum* form.

MME. DOMINIQUE VERVAENE: spreading, medium height; late midseason; flowers single, 2¼", white flushed orange red (La France pink, RCS), white margins, red (tyrian rose, RCS) blotch; probably *mu-cronatum* × *indicum* hybrid.

MME. MARGOTTIN: spreading, low; late; flowers single, 2¼", white with occasional flecks and stripes of violet red (fushia purple, HCC 28/1); probably *indicum* form.

PERFECTION (Perfection de Rentz): spreading, medium height; late midseason; flowers single, 2½", white with faint chartreuse blotch; probably *simsi* × *indicum* hybrid.

PLUTO: spreading, medium height; late; flowers single, 2¼", orange red (scarlet red with carmine blotch, RCS); probably *indicum* form.

PRAESTANTISSIMA: upright, medium height; late; flowers single, 2½", violet red

(spiraea red, HCC 025) with darker blotch; probably *phoeniceum* hybrid.

PRESIDENT CLAEYS (Pres. Clay): upright, tall; early midseason; flowers single, 2¼", red (rose opal, HCC 022/1); probably *indicum* × *simsi* hybrid.

PRINCE OF ORANGE: spreading, medium height; late midseason; flowers single, 2¼", orange red (nopal red, RCS); probably *simsi* × *indicum* hybrid.

SUPREME: spreading, low; late; flowers single, 2½", white with chartreuse throat.

TRIOMPHE DE LEDEBERG: spreading, medium height, dense; late; flowers single, 3", orange red (begonia rose with tyrian rose blotch, RCS); probably *simsi* × *indicum* hybrid.

VICOMTE DE NIEUPORT: spreading, lax, medium height; early midseason; flowers single, 2", violet red (mallow purple, RCS).

VIOLACEA RUBRA: spreading, medium height, dense; late midseason; flowers single, 2½", violet red (rhodomine purple, RCS); probably *phoeniceum* hybrid.

WILLIAM BULL: spreading, medium height; late midseason; flowers very double, 1¾", orange red (delft rose, HCC 020), buds give a rosebud effect.

ZEKE'S PRIDE: upright, tall; early midseason; flowers single, 2¾", orange red (geranium pink shaded rose doree with tyrian rose blotch, RCS); probably *simsi* × *indicum* hybrid.

**Belgian Hybrids:** The Belgian breeders of greenhouse azaleas did not cease their development of the azalea with those plants introduced into this country from 1850 to 1880 some of which became the Indian Azaleas of the South. Since then newer forms have followed emphasizing flowers that are double or semi-double, and frequently frilled. Plants suitable for forcing being the objective, *indicum* heredity has been minimized for *indicum* does not force quickly. These azaleas that are mostly newer and are not grown outdoors in the South to any large extent, are here designated as the Belgian Hybrids.

The Tuinbouw Encyclopedie in 1938 listed around 800 named clones over two-thirds of which had been intro-



Plate 23

Robert L. Taylor

INDIAN AZALEA cl. CAVENDISHI 3/4X



Plate 24

Robert L. Taylor

INDIAN AZALEA cl. GEORGE LINDLEY TABER 7/8X



Plate 25

Robert L. Taylor

BELGIAN HYBRID cl. JUBILEE

duced since 1880. About 100 are now in this country. The Belgian Hybrids have the reputation of being tender but in the absence of extensive outdoor trials it cannot be said that this reputation is deserved by all clones. Were such trials made in the South it might well be that as great a percentage would be found hardy and suitable as in the case of the earlier importations. The group provides many flowers of beautiful, distinctive form not found in the hardier azaleas, although a beginning has been made in a few of the Glenn Dale Hybrids more recently introduced.

In listing summary descriptions of representative clones, it is impracticable to specify habit or blooming period from the standpoint of an outdoor shrub for they have been so little grown outdoors. The plants one sees are almost always greenhouse grown, potted, grafted plants for forcing, trained to an umbrella-shaped head. As a group their blooming period would appear to range from early midseason to late midseason and a few late. Further, the doubling which is an outstanding characteristic, is variable. Almost every clone of double flowers will have some plants with some semi-double or single flowers. Representative clones are—

**BRILLANTA:** flowers double with a few small petals in center and a few larger petals that approximate the size of the corolla lobes, 3", red (between rose color and rose red, RCS).

**COLUMBINE:** flowers single, frilled, 3¼", orange red (between begonia rose and spectrum red with carmine blotch, RCS).

**DR. BERGMANN:** dense; flowers semi-double, 2¾", orange red (LaFrance pink, washed geranium pink leaving a light border and 3 upper lobes flushed rose doree, small nopal red blotch, RCS); *indicum* parentage.

**ERIC SCHAEEME:** dense; flowers double with small rosette in center, 3", orange red (hermosa pink with irregular white margins and begonia rose throat, RCS).

**ERNEST EECKHOUT:** flowers double, irilled, 3", red (tyrian rose, RCS).

**ETOILE DE BELGIQUE:** flowers semi-double, 3¾", red (rose red with pomegranate purple blotch and spectrum red throat, RCS).

**GLOIRE DE LOOCHRISTI:** flowers double, petals graduated in size, 3", orange red (between begonia rose and rose doree, RCS).

**HEXE DE SAFFELAERE** (Ad. Van Hecke): flowers single, hose-in-hose, frilled, 2½", violet red (solferino purple, HCC 26); Belgian Hybrid cl. Professor Wolters × Hexe.

**JUBILEE:** flowers double, 3", red (rose pink flushed tyrian rose, and irregular white margin, or rose pink flaked and sanded tyrian rose, tyrian rose blotch, RCS). See Plate 25 on page 76.

**MME. CHAS. VUYLSTEKE:** dense; flowers double, 3½", red (rose red, RCS).

**MME. PETRICK:** dense; flowers double with small rosette in center, 3½", red (between deep rose pink and rose color, RCS). Blooms fall, winter and spring in southern California. Mme. Petrick Alba is a white sport. Mme. Petrick Superba is another sport, deep rose pink with irregular white margin.

**MONS. MILLAUT:** flowers single or semi-double, 3¼", red (rose red with pomegranate purple blotch, RCS).

**NIÖBE:** flowers double, frilled, 2¾", white with chartreuse tint at base of petals.

**PERLE DE SWYNAERDE:** flowers double with graduated petals, frilled, 3", white with chartreuse throat.

**RUBIS** (Rubis de Merielbecke): flowers semi-double, 3¼", red (tyrian rose, RCS).

**SOUVENIR DE THEOPHILE PIENS** (Th. Piens): flowers double with small rosette in center, 3¼", orange red (eosin pink, RCS) to paler with irregular white margin.

**VERVAENEANA:** medium height; flowers double with graduated petals, 3¼", red (cameo pink with white margin and rose red blotch, RCS). The following are sports: Vervaeana Alba, white; Vervaeana Orange, orange red (rose doree, marginal flakes of hermosa pink and tyrian rose blotch, RCS); Vervaeana Saumonea, orange red (LaFrance pink deepening to geranium pink with tyrian rose blotch, RCS); Vervaeana Rosea is about same.

**Rutherford Hybrids** (× Rutherfordiana): These may perhaps be regarded as an United States contribution to azaleas of the Belgian Hybrid type. They were developed by Bobbink

and Atkins of East Rutherford, New Jersey as a result of breeding experiments begun in the middle 20's. Plant patent applications state that the single flowers are derived from *Indica Alba* (*mucronatum*) and Indian cl. Omurasaki and in succeeding generations Indian cl. Mme. Petrick, rhododendron cl. Pink Pearl, and a single *macrantha* (*indicum*); the semi-doubles from *sub-lanceolata* (*scabrum*) and Mme. Petrick and in succeeding generations Kurume cl. Salmon Beauty and rhododendron cl. Charles Dickens; and the doubles from Omurasaki and Mme. Petrick and in succeeding generations rhododendron cl. Mrs. C. S. Sargent and Belgian Hybrid cl. Vervaeneana. There is little appearance of the rhododendron influence, possibly an example of apomixis (see chapter on Azalea Hybridizing by the Amateur) so far as the rhododendron parentage is concerned.

The plants are evergreen and probably medium height and spreading. They are tender. However, several are satisfactory, although on the borderline of hardiness, at Washington, D. C.; others have proved unsatisfactory in that area. They do extremely well in the San Francisco area. The flowers are single, semi-doubles, and doubles, and some are also hose-in-hose. Many are frilled. Some are fragrant. Colors of flowers cover the Obtusum Series range of orange red to purple and also white and flower size is around 2 to 3 inches.

About 30 named clones have been introduced. No data are available as to habit under outdoor conditions. Representative clones are—

**ALASKA:** late midseason; flowers single, some semi-double, 2", white with chartreuse blotch.

**ALBION:** late; flowers semi-double, 2", white.

**CONSTANCE:** early midseason; flowers sin-

gle, frilled, 2", violet red (phlox pink, HCC 625/1) with darker blotch.

**CRIMSON GLORY:** late midseason; flowers semi-double with extra petals, 2¾", violet red (spiraea red, HCC 025) with brownish blotch; medium height.

**DOROTHY GISH:** late midseason; flowers single, hose-in-hose, frilled, 2½", orange red (delft rose, HCC 020/1) with darker blotch.

**FIRELIGHT:** early midseason; flowers single, hose-in-hose, frilled, 2", red.

**L. J. BOBBINK:** medium height; late; flowers semi-double, 3", reddish violet.

**MRS. A. W. MUELLER:** late; flowers single, 2½", reddish violet (lilac purple, HCC 031) with red blotch.

**PURITY:** early midseason; flowers single, hose-in-hose, 2½", white.

**ROSE QUEEN:** spreading, low; early midseason; flowers double, 2½", rose with creamy white throat.

**SALMON GLOW:** early midseason; flowers single, hose-in-hose, 2", red (camellia rose, HCC 622) with darker blotch.

**SNOWBANK:** late midseason; flowers semi-double, 2¾", white with chartreuse throat.

**Dawson Hybrids:** Henry S. Dawson of the Eastern Nurseries, Holleston, Massachusetts, about 1923 crossed *kaempferi* and *mucronatum*. The plants are tall, upright, quite hardy, and bloom late midseason. They are noteworthy as the first of the large flowered (¾ inches) hardier hybrids and are one of the many progenitors of the Glenn Dale Hybrids. The flowers are reddish violet, single, and particularly fine. Named clones are—

**HAZEL DAWSON:** upright, tall; late midseason; flowers single, ¾", reddish violet (cyclamen purple, HCC 30/1). See Plate 27 on page 98.

**HELEN DAWSON:** upright, tall; late midseason; flowers single, ¾", reddish violet (lilac purple, HCC 031/1).

**Pericat Hybrids:** Alphonse Pericat, a florist of Collingdale, Pennsylvania, originated a distinctive hybrid group probably first exhibited at the Philadelphia Flower Show in 1931. Only a very few plants were named and introduced by Pericat, but he sold his mixed unnamed plants rather widely and

many more were named and introduced by various nurseries, as Perkins - de Wilde Nurseries, Shiloh, New Jersey; Le-Mac Nurseries, Hampton, Virginia; Leach Nurseries, Riverton, New Jersey; Mayo Nurseries, Augusta, Georgia; and others. The introducer's name appears in brackets after the clone name below.

There are no records of the parentage of the Pericats, but it has been suggested that they are hybrids of Belgian Hybrids and Kurumes.

The Pericat Hybrids were developed as another greenhouse forcing group. Actually, they are much hardier than the Indian Azaleas, Belgian Hybrids, or Rutherford Hybrids and are all satisfactory as outdoor plants at Washington, D. C.

The plants are in general medium height, spreading, and dense although some are quite low and others on the tall side. There has not been enough experience with their growth outside to be certain of ultimate heights. They bloom early, early midseason, and late midseason. The flowers have greater variability of form than most other groups, single and semi-double, and many also hose-in-hose or with petaloid sepals. Many are frilled. As flowers of most of the semi-doubles are opening they give a rosebud effect. In size the flowers range from 1½ to 2¾ inches; the colors from carmine to purple. The better half of the clones are excelled by no other group in clarity and attractiveness of color and excellence of form of flower and habit. However, the Pericat Hybrids are difficult to procure except for a few clones. They merit far greater distribution.

Representative named clones are—

ALPHONSE PERICAT [Pericat]: spreading, low; early midseason; flowers semi-double, hose-in-hose, 1¼", red (camellia rose, HCC 622).

ANNE CHENEÉ [Pericat]: spreading, medium height, dense; late midseason; flowers single, hose-in-hose, frilled, 2½", white flushed reddish violet (mallow purple, HCC 630/2).

AUGUSTA BELLE [Mayo]: upright, medium height, dense; late midseason; flowers single with partially petaloid sepals, 1½", white flushed violet red (spinel pink, HCC 0625) with darker blotch.

DAWN [Perkins - de Wilde]: spreading medium height, dense; late midseason; flowers single, hose-in-hose, 2¾", violet red (phlox-pink, HCC 625/1) with white center and darker blotch. Madam Pericat and Morning Glow are similar. All are excellent.

EMILE RUSSAVE [Pericat]: spreading, medium height, dense; late midseason; flowers semi-double, frilled, 2¾", red (rose opal, HCC 022) with darker blotch.

FLANDER'S FIELD (Cornelia van Herden) [Pericat]: spreading, medium height; late midseason; flowers single, occasionally semi-double, 2¼", red (blood red, HCC 820/3) with darker blotch.

FORTUNE [Perkins - de Wilde]: spreading, medium height, dense; early midseason; flowers semi-double, 2½", red (claret rose, HCC 021/1).

GARDENIA SUPREME [Pericat]: spreading, medium height, dense; early midseason; flowers semi-double, hose-in-hose, 1½", white with chartreuse throat and violet red blotch.

GEM [Perkins - de Wilde]: spreading, medium height, dense; early midseason; flowers single, hose-in-hose, frilled, 1½", red (carmine rose, HCC 621) with darker blotch. Similar to Kurume cl. Salmon Beauty.

GLORIANA [Pericat]: spreading, medium height, dense; late; flowers single with petaloid sepals, frilled, 1¾", violet red (fuchsine pink, HCC 627/2) with darker blotch.

GLORY [Le-Mac]: spreading, low, dense; early midseason; flowers semi-double, hose-in-hose, 1¾", orange red (delft rose, HCC 020).

HAMPTON BEAUTY [Le-Mac]: spreading, medium height, dense; late midseason; flowers single, partially petaloid sepals, 2", red (carmine rose, HCC 621/1) with darker blotch.

HAMPTON ROSE [Le-Mac]: spreading, low, dense; early; flowers single, hose-in-hose, frilled, 1½", violet red (rose bengal, HCC 25/1); may be a Bobbink and Atkins hybrid.

HTAWATHA [Robert Craig and Co.]:

spreading, medium height; late midseason; flowers single, hose-in-hose, rounded lobes, 1½", red (rose opal, HCC 022).

MAIDEN'S BLUSH [Mayo]: spreading, medium height, dense; late midseason; flowers single with partially petaloid sepals, 1¾", red (neyron rose, HCC 623/1) with darker blotch.

MELODY [Le-Mac]: spreading, medium height, dense; late midseason; flowers single, hose-in-hose, 2¼", red (claret rose, HCC 021) with darker blotch.

ORCHID [Perkins - de Wilde]: spreading, medium height, dense; early midseason; flowers single with partially petaloid sepals, 1¾", violet red (rose bengal, HCC 25/1) with darker blotch.

MARJORIE ANN (Richesse) [Le-Mac]: spreading, low, dense; early midseason; flowers semi-double, hose-in-hose, 1¾", red (carmine, HCC 21/1).

PRIDE [Perkins - de Wilde]: spreading medium height; late midseason; flowers single, hose-in-hose, 1¾", red (claret rose, HCC 021/1).

PRINCESS AUGUSTA [Mayo]: spreading, medium height, dense; late midseason; flowers single, hose-in-hose, 2¼", flushed red (neyron rose, HCC 623/1) with darker blotch.

SENSATION [Perkins - de Wilde]: spreading, low, dense; late midseason; flowers single, hose-in-hose, 1¾", violet red (spiraea red, HCC 025/1).

SPLENDOR [Perkins - de Wilde]: spreading, medium height, dense; early midseason; flowers semi-double, hose-in-hose, 2¼", violet red (phlox pink, HCC 625/1). Harmony [Le-Mac] is similar, violet red (fuchsine pink, HCC 627/1).

SPRING DAWN [Mayo]: upright, medium height, dense; late midseason; flowers semi-double, hose-in-hose, 1½", white faintly flushed pink.

SUNSET [Perkins - de Wilde]: upright, medium height; early midseason; flowers semi-double with petaloid sepals, 1¾", orange red (delft rose, HCC 020/1).

SWEETHEART [Perkins - de Wilde]: spreading, medium height; early midseason; flowers single, hose-in-hose, frilled, 2", orange red (delft rose, HCC 020/1) with darker blotch.

SWEETHEART SUPREME [Robert Craig and Co.]: spreading, medium height, dense; late midseason; flowers semi-double, hose-in-hose, frilled, 1¾", red (camellia rose, HCC

622/2) with darker blotch, tenderer than most other Pericats.

SYMPHONY [Le-Mac]: spreading, medium height; late midseason; flowers single, hose-in-hose, 2¼", red (camellia rose, HCC 622).

TWENTY GRAND [Leach]: spreading, medium height; early midseason; flowers semi-double, 2", violet red (tyrian rose, HCC 24/2).

WILLIE BELLE MAYO [Mayo]: spreading, medium height, dense; late midseason; flowers single, hose-in-hose, frilled, 2½", violet red (fuchsine pink, HCC 627/1).

#### Other Pericat Hybrids are—

AUGUSTA BEAUTY [Mayo]: upright, medium height, dense; early midseason; flowers single, hose-in-hose, 2¼", salmon rose.

CHINA SEAS [Leach]: flowers semi-double with partially petaloid sepals, 2", pink.

DIADEM [Mayo]: upright, medium height, dense; early midseason; flowers single with partially petaloid sepals, 2", salmon orange.

ELIZABETH MAYO [Mayo]: upright, tall, dense; early midseason; flowers single, hose-in-hose, 2¼", orchid pink.

LILAC PEARL [Mayo]: spreading, low, dense; early midseason; flowers single, 1½", pink.

LILAC CHARM [Mayo]: upright, medium height, dense; flowers single with partially petaloid sepals, 2¼", lilac.

NANCY CLAY [Mayo]: spreading, medium height, dense; early midseason; flowers single, hose-in-hose, rounded lobes, 1¾", rose.

PINK ENCHANTRESS [Mayo]: spreading, medium height, dense; early midseason; flowers single, hose-in-hose, 2", pink.

RHYTHM [Le-Mac]: spreading, medium height, dense; early midseason; flowers semi-double, 2¼", salmon with darker blotch.

RIVAL [Perkins - de Wilde]: upright, medium height, dense; late midseason; flowers semi-double, hose-in-hose, 2¼", light red.

SPRING GLORY [Mayo]: spreading, low, dense; early midseason; flowers single, hose-in-hose, frilled, 2½", pink.

SPRING BEAUTY [Mayo]: upright, medium height, dense; late midseason; flowers single, 2¼", salmon with white throat and rose blotch.

**Gable Hybrids:** This group is the work of Joseph B. Gable, a nurseryman at Stewartstown, Pennsylvania, best known as an azalea and rhododendron hybridist. Primarily the Gable



hybrids are designed as extremely hardy evergreen azaleas and this objective has been attained. Introductions began in 1927 and have continued regularly since, until at present around 70 clones are available named or under numbers. A substantial number of Gable seedlings have been introduced under names or numbers as Gable Hybrids by others than Gable and without his consent. They may not have the hardiness of Gable's own named selections and it is questionable whether their designation as Gable Hybrids is proper.

Basic hardiness has been obtained from *poukhanense* × *kaempferi*. The selected hybrids are usually hardier than either parent. However, there is a wide range of other crosses and recrosses involved. Other parents used are Hexe, *mucronatum*, Kurume cl. Hi-no-degiri and Yayegiri, *macrosepalum*, and *indicum* cl. Benikirishima, while one is the only known hybrid of *tshonoski*. *Kaempferi* × *phoeniceum* cl. Maxwelli hybrids were found not to be of enduring hardiness. See Plate 43 on page 144.

Among the group are plants of every habit known to the Obtusum Subseries. The flowers cover a range of color from orange red to purple, and also white. They are mostly singles, a few semi-double or double, and many also hose-in-hose or with partially petaloid sepals. Some are frilled. The flower size is from 1½ to 2¾ inches.

Many of Gable's finest hybrids are still unnamed and available only under numbers. Representative named clones are—

**BIG JOE:** spreading, medium height; early midseason; flowers single, 2½", reddish violet (rhodamine purple, HCC 29/2) with brown blotch; *poukhanense* × *kaempferi*. Big Joe is perhaps the best of a number of plants with similar flowers blooming about the same time, as Old Faithful, Mildred Mae,

and Viola (Gable Hybrids), *poukhanense*, Lady Lilac and Lilacina (*mucronatum* forms), and Vittata Fortunei Purpurea (Indian Azalea). Glow of Dawn is a similar second, generation plant, very hardy.

**CHEROKEE:** upright, low to medium height; late; flowers single, 1¾", orange red (delft rose, HCC 020); *kaempferi* × Kurume cl. Hi-no-degiri. La Lumiere is similar.

**ELIZABETH GABLE:** spreading, medium height; late; flowers single, frilled, 2½", red (rose opal, HCC 022/1) with darker blotch; very hardy.

**GABLE'S FLAME (Gable's Scarlet):** spreading, medium height; late midseason; flowers single, hose-in-hose, frilled, 1¾", orange red (delft rose, HCC 020). Similar to unnamed B-7-G.

**HERBERT:** spreading, low to medium height; early midseason; flowers single, hose-in-hose, frilled, 1¾", reddish violet (orchid purple, HCC 31) with darker blotch; *poukhanense* × Hexe. Purple Splendor is similar.

**LA PREMIERE:** spreading, medium height; late; flowers very double, 1¾", violet red (fuchsine pink, HCC 627/2); (*poukhanense* × *kaempferi*) × *indicum* double form.

**LOUISE GABLE:** spreading, low, dense; late; flowers semi-double, 2¼", violet red (spinel pink, HCC 0625) with darker blotch; *indicum* × (*poukhanense* × *kaempferi*). Maryann is about same.

**MARY DALTON:** upright, tall; early midseason; flowers single, hose-in-hose, 1½", orange red (delft rose, HCC 020/1); *kaempferi* × Kurume cl. Yayegiri. Chinook is about same, flowers 2", orange red (porcelain rose, HCC 620/2). James Gable is similar, red (rose opal, HCC 022) with darker blotch.

**ROSEBUD:** spreading, low, dense, slow growing; late; flowers double, hose-in-hose, 1¾", violet red (rose bengal, HCC 25/2); Louise Gable × Edna. Lorna is similar but freer growth.

**ROSE GREELEY:** spreading, low, dense; early midseason; flowers single, hose-in-hose, 2½", white with chartreuse blotch, sweet scented; one of the finest early whites. One parent was a second generation *poukhanense* × *mucronatum* cross; the other (*poukhanense* × Hexe) × *kaempferi*.

**SPRINGTIME:** upright, tall; early midseason; flowers single 2", violet red (rose bengal, HCC 25/1) with darker blotch. Springtime, Big Joe (see above), Glow of Dawn and Miriam are all first generation *poukhanense* × *kaempferi* hybrids.

**VIOLA:** spreading, tall, becomes very large plant; early midseason; flowers single,  $2\frac{3}{4}$ ", reddish violet (petunia purple, HCC 32/2) with dark red blotch; *poukhanense* × *mucronatum*. Charlotte and Mildred Mae are similar. Gable Hybrid cl. Viola is not the same as Indian Azalea Viola, a synonym for Gulf Pride.

All the above Gable Hybrids were named and introduced by Gable. Others also named and introduced by him include—

**APRICOT:** flowers apricot pink, fade; very hardy; probably *poukhanense* × Hexe.

**CAROL:** low; late midseason; flowers single, hose-in-hose,  $1\frac{1}{4}$ ", violet red (spiraea red, HCC 025/1); very hardy. Caroline Gable is similar, flowers single, hose-in-hose,  $1\frac{1}{2}$ ", red (tyrian rose 24/1) with darker blotch; (*poukhanense* × Hexe) × (*kaempferi* × *poukhanense*). Edna is similar but larger flowers and not so hardy.

**CHARLOTTE:** spreading, tall; early midseason; flowers reddish violet (petunia purple, HCC 32/2) with red blotch; *poukhanense* × *mucronatum*. In 20 years makes a plant 8' high, 12' wide. Mildred Mae, reddish violet (orchid purple, HCC 31/3) is similar but more compact and not as fast growing.

**CLARET:** low, flowers single,  $1\frac{1}{2}$ ", dark red; hardy; (*poukhanense* × Hexe) × (*poukhanense* × Hexe). Little Indian is similar. Both are poor growers, quite dwarf.

**ETHELWYN:** flowers single, pink.

**FOREST FIRE:** flowers single, hose-in-hose, tiny in size, rose; *tshonoski* hy. Gable's Pixie (Pixie) is similar.

**FUCHSIA:** late midseason; flowers single, hose-in-hose,  $1\frac{1}{2}$ ", violet red (fuchsia purple, HCC 28/2); *macrosepalum* hy.

**HOWARD ANDERSON** (H. W. Anderson): spreading, low, dense; flowers white flushed pink.

**IROUOIS:** flowers single,  $2\frac{1}{4}$ ", orange red (scarlet, HCC 19/2).

**LA LUMIERE:** flowers single,  $1\frac{1}{2}$ ", orange red (claret rose, HCC 021).

**LAROCHE:** early midseason; flowers single, magenta red; hardy; *poukhanense* × Kurume cl. Hi-no-degiri.

**MARY FRANCES HAWKINS:** flowers pink; hardy.

**MIRIAM:** early midseason; flowers single,  $1\frac{3}{4}$ ", violet red (rose bengal, HCC 25/1) with darker blotch; hardy. Springtime is similar.

**OLD FAITHFUL:** early midseason; flowers

single,  $2\frac{1}{4}$ ", reddish violet (rhodamine purple, HCC 29/2) with darker blotch.

**POLARIS:** late midseason; flowers single, hose-in-hose,  $2\frac{1}{4}$ ", white with faint char-treuse throat; (*poukhanense* × *kaempferi*) × Kurume cl. Snow. White Star is similar, perhaps tenderer.

**SUSAN:** flowers single, pink.

Gable Hybrids named and introduced by Old Kent Nursery (Cannon) and others include—

**BILLY:** low, dense; flowers bright pink; *poukhanense* × *kaempferi*.

**BOUDOIR:** flowers single,  $1\frac{1}{2}$ ", violet red (magenta rose, HCC 027/1) with darker blotch.

**CAMEO:** late; flowers single, hose-in-hose  $1\frac{1}{2}$ ", shell pink.

**CAMEROON:** late midseason; flowers single 2", red (spinel red, HCC 0023) with darker blotch; (*poukhanense* × Hexe) × (*poukhanense* × *kaempferi*).

**CORSAGE:** flowers single,  $2\frac{1}{2}$ ", lavender, fragrant.

**GRENADIER:** flowers single,  $1\frac{1}{2}$ ", scarlet.

**ROYALTY:** spreading, low; late; flowers single with partially petaloid sepals,  $1\frac{1}{2}$ ", reddish violet (orchid purple, HCC 31/2) with red blotch.

**Exbury Hybrids:** These are hybrids of *kaempferi* × *oldhami* developed about 1933 by the late Lionel de Rothschild at his Exbury estate near Southampton, England. Some of the original plants are 8 to 10 feet tall, and still growing. There are about a half dozen clones named. Among them are—

**BENGAL FIRE:** spreading, tall; late; flowers single,  $2\frac{1}{2}$ ", brick red.

**EDDY:** upright, tall; late midseason; flowers single, 3", deep red.

**LEO:** spreading, low; late midseason; flowers single,  $2\frac{1}{2}$ ", bright orange.

**LOUISE:** upright, medium height; early midseason; flowers single, flat faced,  $2\frac{1}{2}$ ", flame pink.

**MARIE:** upright, medium height; early midseason; flowers single, flat faced, 3", bright red.

**NAOMI:** upright, medium height; late midseason; flowers single, flat faced,  $2\frac{1}{2}$ ", rose pink.

**SIR WILLIAM LAWRENCE:** upright, medium height; late midseason; flowers single, flat faced, 2", pale pink.

In England there are also hybrids by Ingram in 1945 of the other Formosan azalea, *rubropilosum*. One group named Cuckoo is *rubropilosum* × *kaempferi*; another group named Morning Mist is *rubropilosum* × *poukhanense*.

**Bobbink and Atkins Hybrids** (B and A Hybrids): In addition to the Rutherford Hybrids, Bobbink and Atkins of East Rutherford, New Jersey, have developed hybrids of *kaempferi* or Kurumes × *indicum*. These were introduced around 10 years ago. They have a range of blooming period from early midseason to very late. Most will probably prove to be of medium height, upright and dense. Flowers are single, some hose-in-hose or frilled, 1¾ to 2½ inches. Hardy in the Washington, D. C., area.

Among the dozen or so clones are—

**AMBER GLOW**: late midseason; flowers single, hose-in-hose, 1¾", orange red (delft rose, HCC 020/1).

**CHIPPEWA**: very late; flowers single, frilled, 2½", red (rose madder, HCC 23/2) with darker blotch. Jubilee is similar.

**DAINTY**: late midseason; flowers single, frilled, 2", red (rose opal, HCC 022/1) with darker blotch.

**GLORY**: early midseason; flowers single, hose-in-hose, 2", red (empire rose, HCC 0621). Not the Pericat Hybrid cl. Glory.

**MRS. L. C. FISCHER**: late midseason; flowers single, hose-in-hose, 1¾", red (neyron rose, HCC 623/1) with darker blotch. Salmon King is similar.

Other Bobbink and Atkins Hybrids are—

**CRIMSON KING**: upright, medium height, dense; late midseason; single, hose-in-hose, 1¾", pink.

**JERSEY BELLE**: spreading, low, dense; early midseason; flowers single, hose-in-hose, 1½", salmon.

**JUNE SKIES**: spreading, medium height, dense; very late; flowers single, rounded lobes, 2½", salmon with rose blotch.

**Chugai Hybrids**: This group is given its name from the fact that the plants were introduced by the Chugai Nursery Company near Kobe, Japan.

The company is reported to be no longer in existence. The Chugai Hybrids were brought into this country in two lots in 1938 and 1939 by the Division of Plant Exploration and Introduction, U.S.D.A., and subsequently distributed to the trade. The plants are hybrids with *indicum* as one parent and *simsi* or Belgian Hybrids as the other.

The Chugai Hybrids are low growing and generally spreading and dense, although possibly a few will obtain medium height and be taller than broad. Most bloom very late. The flowers are extremely variable in that the large majority of clones have a disconcerting habit of producing flowers of several patterns and colors on the same plant. It is frequently impracticable to select any particular pattern as being the characteristic flower for purposes of description. In general the flowers are single, large, running from 2 to 4", have a white or pink base, some self colored and others striped or flaked a different color or with different colored margins. Many are frilled.

The plants, once the stems are pencil thick, are about as hardy as *indicum* and its forms and can be grown at least as far north along the eastern seaboard as Washington, D. C.

The Chugai Hybrids rate high in excellence of flowers and habit although one might wish at times they were more restrained in their variability of flowers and thereby less confusing to the eye. However, it is easy to agree with the Chugai Nursery Company's statement in its English catalog of 1936-7, "The Flowers are of most noble and refined beauty . . . We recommend with confidence their real value of highest attainable grade which is totally unknown to outside of Japan."

About 50 named clones were brought into the United States. Representative clones are—



Plate 26

Robert L. Taylor

CHUGAI HYBRID cl. GUNBI 3/4×

**BUNKWA** (PI 127654) [Culture]: spreading, low; very late; flowers single, 2¼", white with orange red (delft rose, HCC 020/3) margins and small red (tyrian rose, HCC 24) blotch.

**GUNBI** (PI 127664) [Beautiful Cluster]: spreading, low; very late; flowers single, frilled, 3", white with red (rose madder, HCC 23/2) flecks, stripes, or tips. See Plate 26 on page 84.

**GUNREI** (PI 127665) [Lovely Cluster]: spreading, low; very late; flowers single, frilled, 2¼", white flushed red (rose madder, HCC 23/2) with occasional stripes of same color; one of the most beautiful flowers.

**GYOKUSHIN** (PI 127668) [Jewel Shaped]: spreading, low; very late; flowers single, 3", white with violet red (tyrian rose, HCC 24) flecks or stripes, or darker violet red (phlox pink, HCC 625/2) selfs. Flowers similar to *mucronatum* cl. Magnifica or Indian Azalea Criterion.

**HOW-RAKU** (PI 127672): spreading, low; very late; flowers single, sometimes frilled, 4", white with chartreuse blotch, or white flecked, striped, or sectored red (tyrian rose, HCC 24/2), or tyrian rose selfs.

**JINDAI** (PI 127674): spreading, low; very late; flowers single, 4¼", white with chartreuse throat, or white flecked or striped red (claret rose, HCC 021/2), or claret rose selfs.

**KEISETSU** (PI 127678): spreading, medium height; late (earliest of the group); flowers single, 1½", orange red (jasper red, HCC 018) with white throat; variegated leaves.

**KINGETSU** (PI 131296): spreading, low; very late; flowers single, 2½", white with red (claret rose, HCC 021/1) margin, or white flecked, striped, or sectored claret rose, or claret rose with darker blotch.

**KOW-KOKU** (PI 131299): spreading, low; very late; flowers single, frilled, 3", white, or white flecked and striped red (rose opal, HCC 022/2).

**MAI-HIME** (PI 131301) [Dancing Girl]: spreading, low; very late; flowers single, 3", red (tyrian rose, HCC 24/2) with darker blotch, or flushed tyrian rose with darker spots, or white with faint tyrian rose flush and darker spots, or white striped tyrian rose. See Plate 28 on page 99.

**SHINNYO-NO-TSUKI** (PI 131312) [Clear Moon]: spreading, low; very late; flowers single, 3", white with violet red (rose bengal, HCC 25/1) margin, tenderer than most of this group.

**TAMA-GIKU** (PI 131319): spreading, low; very late; flowers single, 2¾", white flecked, spotted, or striped orange red (delft rose, HCC 020/1), or delft rose selfs.

**TAMA-SUGATA** (PI 131320): spreading, medium height; very late; flowers single, corolla lobes rounded and tend to be revolute, 2¼", white with orange red (delft rose, HCC 020/1) margin, or vice versa, or delft rose selfs, blotch of red (tyrian rose, HCC 24).

A full list of the Chugai Hybrids brought to this country will be found in Plant Inventory No. 134, Nos. 127653-127678 and Plant Inventory No. 138, Nos. 131295-131321, Division of Plant Introduction and Exploration, United States Department of Agriculture.

**Wada Hybrids:** K. Wada of the Hakoneya Nursery, Namazushi, Japan, offered before World War II a wide range of hybrids among the evergreen azaleas. Whether they originated at the nursery or were only introduced by it, and when, is not known, nor to what extent they are still available. A few may be obtained from nurseries in this country or England.

Among these hybrids, listed according to the Nursery's own designation and stated parentages, are—

**KURUMANTHUM** (*Kurumes* × *indicum*): bloom after Kurumes but larger flowers. Fuji-no-mine, pink striped rose; Momozono, salmon. One of the Kurumes brought in by R. K. Beattie, and introduced by the Office of Plant Exploration and Introduction, U.S. D.A., also bears the name Momozono.

**MACRINDICUM** (*indicum* × Indian or Belgian Hybrids): midseason; very large flowers. Same cross as the Chugai Hybrids. Glory of Numazu, pale pink with scarlet margin or pale pink selfs; Hozan [Mountain Jewel], white; Pink Delight, very low, flowers white with rose margin.

**SCABRUME** (*scabrum* × Kurumes): larger flowers than Kurumes, tall.

**WADAI** (*indicum* var. *eriocarpum* × *kaempferi*): the nursery restricts the name Wada to this group. Usually bloom with or before Kurumes; flowers smaller than *eriocarpum* but large; plants are low and dense. Includes some excellent azaleas, among them Ariake [Dawn], rose; Asakanonare, salmon, late; Chichibu [Prince Chichibu], white, frilled, late; Hanachidori, reddish purple;

Higoromo [Scarlet Robe], scarlet; Mount Fuji, white; Yachiyo [Eight Thousand Generations], lavender, hose-in-hose.

BUNGO-NISHIKI [Bungo Brocade] (*kaempferi* × *indicum*): orange scarlet, semi-double.

**Vuyk Hybrids** (×*Vuykiana*): Azalea hybrids whose parentage combines both *Luteum* and *Obtusum* Subseries azaleas are rare. The Vuyk Van Nes Nursery of Boskoop, Holland, which originated the Vuyk Hybrids states that their male parent is Mollis Hybrid J. C. Van Tol and the female parent a *Kaempferi* Hybrid (*Malvatica* × *kaempferi*) or *phoeniceum* cl. Maxwelli, or *mucronatum*. The original crosses for the Vuyk Hybrids were made in 1921 by Aart Vuyk. Usually the objective of such crosses has been to develop evergreen azaleas with yellow and orange flowers. Here the objective was hardier evergreen azaleas with larger flowers. The habit and appearance of the mother plants predominate and these plants may be an example of apomixis (see chapter on Azalea Hybridizing by the Amateur) rather than of hybridization. The flowers range from 2 to 2½". The flower colors are those usual to the *Obtusum* Subseries, except *Sibellius* which is jasper red, an orange red on the borderline of the evergreen azalea color range and not common among those azaleas. All bloom late midseason. The plants are tall and comparatively hardy although they vary in this characteristic presumably depending on the particular female parent.

A few of the hybrids were first imported into the United States in 1926 but extensive importation did not begin until 1945. Representative clones are—

BEETHOVEN: medium height; flowers single, 2¾", reddish violet (orchid purple, HCC 31/1), with deeper blotch; Maxwelli × Mollis Hybrid J. C. Van Tol.

GERARDINE VUYK: flowers single, 2", red

(tyrian rose, HCC 24/2) with deeper blotch; *Kaempferi* Hybrid × J. C. Van Tol.

HELENA VUYK (P. W. Hardijzer): flowers single, 2½", violet red (fuchsine pink, HCC 627/2) with deep red blotch; Maxwelli × J. C. Van Tol.

JOHANN SEBASTIAN BACH: flowers single, 2½", reddish violet (cyclamen purple, HCC 30/1); Maxwelli × J. C. Van Tol.

JOHANN STRAUSS: flowers single, 2½", violet red (rose bengal, HCC 25/2) with deeper blotch; *Kaempferi* Hybrid × J. C. Van Tol.

JOSEPH HAYDN: medium height; flowers single, 2¾", reddish violet (rose purple, HCC 533) with brownish blotch; *mucronatum* × J. C. Van Tol.

MOZART: flowers single, 2½", violet red (fuchsine pink, HCC 627/2); *Kaempferi* Hybrid × J. C. Van Tol.

SCHUBERT: flowers single, 2", violet red (phlox rose, HCC 625/2); *Kaempferi* Hybrid × J. C. Van Tol.

SIBELIUS: medium height; flowers single, 2", orange red (jasper red, HCC 018/1) with chocolate purple blotch; Maxwelli × J. C. Van Tol.

WILHELMINA VUYK (Palestrina): medium height; flowers single, 2¼", white with chartreuse blotch; *Kaempferi* Hybrid × J. C. Van Tol.

**Glenn Dale Hybrids:** These were designed as a group of azaleas with as large and varied flowers as the Indian Azaleas but cold-hardy for the Middle Atlantic States and covering the entire blooming season from April to June including filling in the present gaps. The Glenn Dales replace with improved clones most of the *Obtusum* Subseries azaleas now hardy in that area, although many of the late and very late Glenn Dales are yet to be introduced.

The Glenn Dale Hybrids are the work of B. Y. Morrison, formerly head of the Division of Plant Exploration and Introduction and presently director of the National Arboretum, U.S. D.A. They take their name from the Division's Plant Introduction Station at Glenn Dale, Maryland. Plants selected for trial were propagated at that

Station and introduced to the trade by it. The hybridizing began around 1935 and went ahead on an official basis until 1939. It was resumed on a personal basis in 1945 and still continues. A few clones were introduced in 1940, others in 1948 and subsequently. These cover selections from the 70,000 seedlings resulting from the breeding work done prior to 1940 and number over 400 clones.

The Glenn Dale Hybrids introduced to date can best be viewed as a series of much smaller groups based on blooming period and habit. Usually there is a wide range of colors within each of these smaller groups including variations in color forms as stripes and flecks and variegated margins and throats. A mimeographed descriptive list of all the Glenn Dale Hybrids for introduction for trial was issued in February 1951 by the Division of Plant Exploration and Introduction. It is to be superseded later by a printed bulletin on "The Glenn Dale Azaleas."

Doubtless few, if any, azalea breeding experiments have approached in magnitude the efforts that lie behind the Glenn Dale Hybrids already introduced and those to follow from the later breeding experiments.

The wide range of parents includes clones from many species and hybrid groups in the Obtusum Subseries, — for the most part, Kaempferi Hybrids, *mucronatum*, *indicum* in various forms, Kurumes, the hardier of the Indian Azaleas from the South, and the Japanese *indicum-simsi* hybrids. Four of the introductions so far have *poukhanense* blood. Flowers run large, up to 4½"; habit, both upright and spreading, and low, medium, and tall heights. Most flowers are single, sometimes also hose-in-hose; a few are semi-doubles and doubles. The existing gap in blooming period prior to the *indicums*

(mid-May through early June in Washington, D. C.) has been in large part filled.

It is difficult to select representative clones in view of the newness of most introductions, the lack of large plants in gardens (save of those introduced in 1940), and the testing to which clones are yet to be subjected in the hands of nurserymen and others. The descriptions below are taken from the mimeograph descriptive list mentioned above. The color terms refer to the Ridgway chart.

#### 1. Early—

AMBROSIA (PI 163899): upright, tall; flowers single, 2", orange red (begonia pink, RCS) aging to pale apricot.

ANTARES (PI 160063): upright, tall; flowers single, 2¾", orange red (nopal red, RCS) with red (pomegranate purple, RCS) blotch.

ASTARTE (PI 160078): upright, medium height; flowers single, red (amaranth pink shading to tyrian pink, RCS), tyrian rose blotch, white throat.

BALLET GIRL (PI 160043): upright, tall; flowers single, hose-in-hose, 2", orange red (light jasper red, RCS) with red (pomegranate purple, RCS) blotch.

BOPEEP (PI 160009): upright, medium height; flowers single, 2½", white with red (rose pink, RCS) margins and blotch.

BRIDAL VEIL (PI 160006): upright, medium height; flowers single, 3", white with chrysolite green, RCS, blotch.

CAPELLA (PI 160037): upright, tall; flowers single, partially petaloid sepals, sometimes clusters 14-15 flowers, 2½", white rarely flaked reddish violet (mathew's purple, RCS).

CHLOE (PI 160049): spreading, medium height; flowers single, frilled, 3", red (tyrian rose, RCS).

CYGNET (PI 163954): spreading, dense, low; flowers single, 1½", white with pale yellow blotch.

DAYSRING (PI 141780): spreading, tall; flowers single, 2", white with red (pale rose pink, RCS) margins.

DELIGHT (PI 160000): upright, tall; flowers single, 4", white with few flakes of violet red (phlox purple, RCS) and occasional stripes.

DREAM (PI 160047): spreading, tall; flowers single, frilled, 3", red (deep rose pink, RCS) with red (rose color, RCS) blotch.

FAIRY BELLS (PI 160075): spreading, tall; flowers single, hose-in-hose, pendant, 2½", red (spinel pink, RCS).

GLADIATOR (PI 160024): upright, dense, tall; flowers single, 1¾", orange red (nopal red, RCS) with (bordeaux red, RCS) blotch.

MARVEL (PI 160007): upright, medium height; flowers single, 3½", red (deep rose pink shaded rose color, RCS) with red (tyrian rose, RCS) blotch.

MODESTY (PI 160048): upright, medium height; flowers semi-double, 3", red (tyrian rose flushed rose color, RCS).

MOTHER OF PEARL (PI 160127): upright, tall; flowers single, partially petaloid sepals, 1¾", white with red (pale amaranth pink, RCS) margins.

PIXIE (PI 141777): spreading, medium height; flowers single, revolute lobes, 1½", white with rays and blotch and occasional stripes of red (spinel pink, RCS).

REFRAIN (PI 163762): upright, tall; flowers single, hose-in-hose, 2", flushed violet red (rosolane pink, RCS) with white margins, red (rose color, RCS) stripes and red (tyrian rose, RCS) blotch.

SAMITE (PI 141791): upright, tall; flowers single, partially petaloid sepals, 2", white.

SIMPLICITY (PI 160059): upright, tall; flowers single, 3", reddish violet (mauvette, RCS) washed lilac.

TANGO (PI 160064): upright, tall; flowers single, 3", orange red and red (lower lobes eosin pink, upper lobes deep rose pink with pomegranate purple blotch, RCS).

TEMPLAR (PI 160130): upright, tall; flowers single, 3", wide and overlapping lobes, 3", violet red (light mallow purple, RCS) with white throat.

## 2. Early midseason—

ABBOT (PI 160169): upright, medium height; flowers single, frilled, 3", red (rose color, RCS).

ACME (PI 160141): upright, tall; flowers single, 3", violet red (pale rosolane purple, RCS) darkening to red (rose color, RCS) at margins.

ANCHORITE (PI 141900): spreading, medium height; flowers single, 2", red (rose pink, RCS). Aphrodite is about same but paler.

ARABY (PI 160119): upright, medium

height; flowers single, rounded lobes, 3", orange red (jasper red, RCS) with red (tyrian rose, RCS) blotch.

ARGOSY (PI 160095): upright, medium height; flowers single, 3½", orange red (geranium pink, RCS) with red (tyrian rose, RCS) blotch.

ASTRA (PI 160123): upright, medium height; flowers single, rounded overlapping lobes, 3", violet red (mallow purple, RCS) with white throat and red (amaranth purple, RCS) blotch.

CARNIVAL (PI 163097): upright, medium height; flowers single, 4", reddish orange (salmon color, RCS) with dull red blotch.

COLLEEN (PI 160012): upright, tall; flowers single, 2", orange red (geranium pink, RCS).

CON AMORE (PI 163940): spreading, medium height; flowers single, rounded overlapping lobes, 3", red (deep rose pink, RCS) with lighter margins.

DELILAH (PI 163952): upright, tall; flowers single, 2½", reddish orange (salmon orange, RCS).

FASHION (PI 141788): upright, tall; flowers single, hose-in-hose, orange red (begonia rose, RCS) with red (tyrian rose, RCS) blotch; blooms spring and fall in San Francisco area.

F. C. BRADFORD (PI 160071): spreading, medium height; flowers single, sometimes large clusters, 2½", red (rose color to rose red, RCS) on margins and red (amaranth purple, RCS) blotch.

GLACIER (PI 160073): upright, medium height; flowers single, 3", white.

GLAMOUR (PI 141908): upright, medium height; flowers single, 2½", red (rose red, RCS).

GREETING (PI 141901): upright, medium height; flowers single, frilled, 2", orange red (coral rose, RCS).

GYPSY (PI 160058): upright, tall; flowers single, 3", violet red (mallow purple, RCS).

IVORY (PI 160060): spreading, medium height; flowers single, 3 x 4", white.

JOYA (PI 141905): spreading, medium height; flowers single, 3", red (rose pink, RCS).

KENWOOD (PI 141800): spreading, dense, medium height; flowers double, 2¾", red (spinel pink, RCS).

MADRIGAL (PI 163096): spreading, low; flowers single, 3½", red (pale rose pink, RCS).

PHOEBE (PI 182874): spreading, medium height; flowers single, 3", orange red (jasper



red flushed old rose, RCS) with red (rose pink, RCS) blotch.

PICADOR (PI 141899): spreading, medium height; flowers single,  $2\frac{1}{2}$ ", orange red with darker blotch.

RANGER (PI 141807): spreading, medium height; flowers double,  $2\frac{1}{2}$ ", white.

REFULGENCE (PI 160096): spreading, dense, low; flowers single,  $1\frac{3}{4}$ ", red (rose color with tyrian rose, RCS) blotch.

SENECA (PI 160067): upright, tall; flowers single, open face,  $3\frac{1}{2}$ ", violet red (mallow purple, RCS) with red (rose red, RCS) blotch and white throat.

SHEILA (PI 160140): upright, tall; flowers single,  $3\frac{1}{2}$ ", red (amaranth purple deepening to tyrian pink at margins, RCS).

SUWANEE (PI 160139): upright, medium height; flowers single, 3", red (rose pink with tyrian rose blotch, RCS).

TREASURE (PI 160125): spreading, medium height; flowers single, 4", white. See Plate 22 on page 68.

ZULU (PI 163935): spreading, medium height; flowers single,  $3\frac{1}{2}$ ", violet red (mallow purple with aster purple blotch, RCS).

### 3. Late midseason—

ANGELA PLACE (PI 163960): spreading, medium height; flowers single, 3", white.

ARCTIC (PI 163810): spreading, low; flowers single, 3", white with greenish blotch.

BAGDAD (PI 163985): upright, medium height; flowers single, 3", red (rose pink with tyrian rose blotch, RCS).

BOUNTIFUL (PI 163956): spreading, medium height; flowers single, 3", frilled, violet red (phlox purple, RCS) with red (tyrian rose, RCS) blotch.

CHALLENGER (PI 160124): spreading, medium height; flowers single, 3", flat faced with overlapping lobes, orange red (between geranium pink and rose doree, RCS) washed pale lavender with very conspicuous blotch of red (between rose color and tyrian pink, RCS).

CORDIAL (PI 163818): spreading, medium height; flowers single, frilled, 3", red (spinel pink with spinel red blotch, RCS).

CRINOLINE (PI 163943): spreading, medium height; flowers single, frilled, 3", red (between tyrian pink and tyrian rose, white throat, RCS).

EVEREST (PI 163953): spreading, medium height; flowers single, 2", white with chartreuse blotch.

FELICITY (PI 160040): upright, tall; flowers, single, 3", red (deep rose pink, lighter

throat, blotch between tyrian rose and amaranth purple, RCS).

GAIETY (PI 141910): spreading, medium height; flowers single, 3", red (rose pink with red rose blotch, RCS).

GAWAIN (PI 182875): spreading, dense, medium height; flowers single, lavender with dark purple blotch.

HARLEQUIN (PI 163958): spreading, medium height; flowers single, 2", white striped and flaked violet (phlox purple, RCS). See Plate 21 on page 67.

HELEN CLOSE (PI 163961): spreading, dense, medium height; flowers single, 3", white with pale yellow blotch.

HELEN FOX: upright, dense; low; flowers single,  $2\frac{1}{2}$ ", orange red (lighter than eugenia pink, flushed begonia pink, darker blotch), white margin. See Plate 21 on page 67.

LACQUER (PI 163856): spreading, dense, low; flowers single, 3", white with orange red (old rose, RCS) stripes and flecks. See Plate 21 on page 67.

LOVELINESS (PI 160033): upright, tall, flowers single, overlapping petals, frilled,  $2\frac{3}{4}$ ", red (deep rose pink, RCS).

MARTHA HITCHCOCK (PI 163955): spreading, medium height; flowers single, 3", white with magenta margins, but young plants and extremely vigorous shoots often produce purple flowers. See Plate 22 on page 68.

PROGRESS (PI 163957): spreading, dense, medium height; flowers single, exerted stamens, violet red (mallow purple darkening to rhodamine purple, RCS), whiter throat.

SAFRANO (PI 163850): spreading, medium height; flowers single,  $3\frac{1}{2}$ ", white with faint chartreuse blotch.

### 4. Late—

ADORABLE (PI 163765): spreading, medium height; flowers single,  $3\frac{3}{4}$ ", violet red (phlox pink, RCS) with red (tyrian rose, RCS) blotch.

AVE MARIA (PI 163771): spreading, low; flowers single, ruffled, 3", white flecked violet red (phlox purple, RCS) with greenish yellow blotch.

BRAVURA (PI 163908): spreading, medium height; flowers single, 3", white with red (pale rose, RCS) margins; small leaves.

CARRARA (PI 163798): spreading, very low; flowers semi-double, 3", white with yellowish blotch.

CHANTICLEER (PI 163872): upright, dense,

medium height; flowers single, 2", red (amaranth purple with rose red tube, RCS).

COPPERMAN (PI 163927): spreading, dense, medium height; flowers single, overlapping lobes, flat, 3", orange red (begonia rose shaded orange, RCS) with red (rose color, RCS) blotch.

CREAM CUP (PI 163842): spreading, dense, medium height; flowers single, 2", white flushed chartreuse, few red flecks.

CREMONA (PI 163901): spreading, medium height; flowers single, somewhat frilled, 3", red (rose color with amaranth purple blotch, RCS, lighter throat).

DARKNESS (PI 163815): spreading, dense, medium height; flowers single, 3", orange red (pompeian red with carmine blotch, RCS).

DAZZLER (PI 163797): spreading, low; flowers single, frilled, 3", red (deep rose pink with rose color blotch, RCS).

DRIVEN SNOW (PI 163933): upright, tall; flowers single, 3", white.

FANDANGO (PI 163816): spreading, dense, medium height; flowers single, 3", violet red (rosolane purple, RCS) with red (spinel red throat and carmine, RCS) blotch, reverse of corolla and stamens orange red.

FUTURITY (PI 163851): spreading, low; flowers single, hose-in-hose, 2½", white with violet red (rosolane purple, RCS) stripes.

HELEN GUNNING (PI 163967): spreading, medium height; flowers single, flat faced, frilled, 2½", white center, red (tyrian pink, RCS) margin, some young branches produce self colored flowers. See Plate 22 on page 68.

JANET NOYES (PI 163965): spreading, dense, low; flowers single, 2½", red (rose color, RCS) with orange red tube and throat.

KILLARNEY (PI 163792): spreading, medium height; flowers single, frilled, 3¼", white with chartreuse blotch, few purple flecks.

KOBOLD (PI 163877): spreading, dense, medium height; flowers single, 2", red (between pomegranate red and bordeaux, RCS).

LILLIE MAUDE (PI 163968): spreading, medium height; flowers single, frilled, 3", red (tyrian pink, RCS).

LOUISE DOWDLE (PI 163969): spreading, medium height; flowers single, 3", red (tyrian pink with dense blotch of tyrian rose, RCS).

MARY MARGARET (PI 163920): spreading, medium height; flowers single, broad overlapping lobes, 3", orange red (rose doree suffused dull purple, RCS) with red (amaranth purple, RCS) blotch.

MOONBEAM (PI 163836): spreading, me-

dium height; flowers single, frilled, 4-5", white.

NOBILITY (PI 163880): spreading, medium height; flowers single, 2½", violet red (pale rose purple, RCS), white margin, violet red (rosolane purple, RCS) blotch, occasional violet red (liseran purple, RCS) stripe.

POLAR SEA (PI 163795): spreading, low; flowers single, frilled, flat faced, 3", white with chartreuse blotch.

SAGA (PI 163793): spreading, low; flowers single, frilled, 3", red (amaranth pink with tyrian rose blotch, RCS).

SILVER CUP (PI 163773): spreading, medium height; flowers single, 3¼", white with few flakes of violet red (light amparo purple, RCS).

SNOWCLAD (PI 163949): spreading, medium height; flowers single, frilled, 3½", white with chartreuse blotch.

SNOW WREATH (PI 163882): spreading, low; flowers single, 3½", white with faint chartreuse blotch.

SURPRISE (PI 163857): upright, dense, low; flowers single, 3", orange red (eugenia pink flushed nopal red, RCS), white margin.

##### 5. Very late—

AZTEC (PI 163906): spreading, low; flowers single, 3", orange red (between rose doree and peach red with rose red blotch, RCS), frequently white throat.

CRUSADER (PI 163909): spreading, low; flowers single, round overlapping lobes, 2¾", orange red (geranium pink with rose red blotch, RCS).

EPILOGUE (PI 141785): upright, medium height; flowers single, 1¼", reddish orange (salmon orange, RCS).

EROS (PI 163902): spreading, low; flowers single, overlapping lobes, 3", orange red (eosin pink, RCS).

MOUNTEBANK (PI 163911): spreading, low; flowers single, frilled, 3", red (deep rose pink with rose red blotch, RCS).

PEARL BRADFORD (PI 163904): spreading, very low; flowers single, round, 3", red (deep rose pink with tyrian rose blotch, RCS).

SAGITTARIUS (PI 163905): spreading, very low; flowers single, slightly frilled, 3", orange red (between LaFrance pink and geranium pink, RCS) with red (tyrian rose, RCS) blotch, white throat; small leaves.

SNOWSCAPE (PI 163932): upright, tall; flowers single, 2", greenish white.

STUNNER (PI 163912): spreading, low; flowers single, round, flat faced, 3", red (deep rose pink, RCS).

## LIST OF AZALEA NURSERYMEN

The difficulty in ascertaining sources of supply for all save a few of the more common azaleas makes any list of such sources a valuable aid despite its temporary and incomplete character. The list below includes nurseries with a substantial range of varieties in one or more groups. Omission of any such nurseries merely indicates lack of information on the part of the compilers of this list. Some nurseries listed do not publish price lists; others carry many varieties in addition to those specified in their published lists; also, they usually carry other azaleas than the groups mentioned opposite their names below. Nurseries engaged exclusively in supplying the florist trade or that do not ship or that sell only locally, have been omitted.

- AIKEN NURSERIES, PUTNEY, VT. — native species.
- ANDORRA NURSERIES, CHESTNUT HILL, PHILADELPHIA, PA.—forms of *mucronatum*.
- ARMSTRONG NURSERIES, ONTARIO, CALIF.—Rutherford Hybrids, Indian Azaleas, and Kurumes.
- AZALEA GLEN NURSERIES, LOXLEY, ALA.—Indian Azaleas, Kurumes.
- BLACKWELL NURSERIES, INC., SEMMES, ALA.—Kurumes, Indian Azaleas.
- J. BLAAUW AND Co., BOSKOOP, HOLLAND—Mollis Hybrids, Ghent Hybrids.
- BOBBINK & ATKINS, EAST RUTHERFORD, N. J.—Rutherford Hybrids, Mollis Hybrids, Ghent Hybrids, Bobbink & Atkins Hybrids.
- S. D. COLEMAN NURSERIES, FORT GAINES, GA.—rare natives.
- COOLIDGE RARE PLANT GARDENS, 889 N. FOOTHILL BLVD., EAST PASADENA, CALIF.—Kurumes, Belgian Hybrids.
- COTTAGE HILL NURSERIES, RT. 2, MOBILE, ALA.—Indian Azaleas, Kurumes.
- CRANGUYMA FARMS, LONG BEACH, WASH.—Knaphill Hybrids.
- EVERGREEN GARDEN NURSERY (H. E. PERRY), McMINNVILLE, TENN.—native species.
- FELIX AND DIJKHUIS, BOSKOOP, HOLLAND—Mollis Hybrids, Ghent Hybrids.
- FLOWERWOOD NURSERY, RT. 1, MOBILE, ALA.—Indian Azaleas, Kurumes.
- FRUITLAND NURSERIES, AUGUSTA, GA.—Indian Azaleas, Kurumes, Glenn Dale Hybrids, Chugai Hybrids.
- GABLE, JOSEPH B., STEWARTSTOWN, PA.—Gable Hybrids, native species.
- GALLOWAY, CASON F., BLUE SPRINGS FARMS, HAMILTON, GA.—*prunifolium*.
- GERBING CAMELLIA NURSERY, FERNANDINA, FLA.—Indian Azaleas, Kurumes.
- GLEN ST. MARY NURSERIES Co., GLEN ST. MARY, FLA.—Indian Azaleas, Kurumes, *austrinum* and *canescens*.
- GOLDSWORTH OLD NURSERY, LTD. (WALTER C. SLOCOCK), WOKING, SURREY, ENGLAND—Knaphill Hybrids, Ghent Hybrids, Mollis Hybrids.
- F. J. GROOTENDORST AND SONS, BOSKOOP, HOLLAND—Mollis Hybrids, Ghent Hybrids.
- W. C. HAGE & Co., BOSKOOP, HOLLAND—Mollis Hybrids, Ghent Hybrids.
- HAKONEYA NURSERIES (K. WADA), NUMAZU-SHI, JAPAN—miscellaneous species, *eriocarpum* forms, *indicum* forms, Kurumes, *scabrum* forms, Wadai Hybrids, Belgian Hybrids.
- KELSEY-HIGHLANDS NURSERY, EAST BOXFORD, MASS.—native species.
- KINGSVILLE NURSERY (HENRY HOHMAN), KINGSVILLE, MARYLAND—Kurumes, Chugai Hybrids, Glenn Dale Hybrids, Gable Hybrids, *indicum* forms, *mucronatum* forms, Ghent Hybrids, Arnold Hybrids, Kaempferi Hybrids, Yerkes Hybrids, miscellaneous species.
- KNAP HILL NURSERY, LTD., WOKING, SURREY, ENGLAND—Knaphill Hybrids, Ghent Hybrids, Mollis Hybrids.
- KOSTER NURSERY, SEABROOK FARMS, BRIDGETON, N. J.—Mollis Hybrids, Kaempferi Hybrids.
- M. KOSTER AND SONS, BOSKOOP, HOLLAND—Mollis Hybrids, Ghent Hybrids.
- LABAR'S RHODODENDRON NURSERY, STROUDSBURG, PA.—native species.
- LAYRITZ NURSERIES, VICTORIA, B. C., CANADA—Kurumes, Rutherford Hybrids, Ghent Hybrids.
- LE-MAC NURSERIES, HAMPTON, VA.—Kurumes, Pericat Hybrids, Gable Hybrids, Kaempferi Hybrids, *mucronatum* forms, Glenn Dale Hybrids.
- IRVING B. LINCOLN, 637 N.W. SKYLINE CREST, PORTLAND 1, OREGON—Ghent Hybrids, Mollis Hybrids, Kaempferi Hybrids, Vuyk Hybrids, Kurumes.

- MAGNOLIA GARDENS AND NURSERIES, JOHN'S ISLAND, S. C.—Indian Azaleas, Kurumes, other hybrid groups.
- MAYO NURSERIES, RT. 2, AUGUSTA, GA.—Pericat Hybrids, Mayo Hybrids, Kaempferi Hybrids, Kurumes, Indian Azaleas, Bobbink & Atkins Hybrids.
- McILHENNY NURSERIES, AVERY ISLAND, LA.—Indian Azaleas, *indicum* forms.
- MITSCH NURSERY, AURORA, ORE.—Kurumes, Kaempferi Hybrids.
- ORTON PLANTATION, WINNABOW, N. C.—Indian Azaleas, Kurumes.
- OVERLOOK NURSERIES, CRICHTON STATION, MOBILE, ALA. — Indian Azaleas, Belgian Hybrids, Kurumes, *indicum* forms, Kaempferi Hybrids, Glenn Dale Hybrids.
- PARRY NURSERIES, SIGNAL MOUNTAIN, TENN.—Kurumes, Ghent Hybrids, Vuyk Hybrids, native species.
- PETTYJOHN NURSERY, BAINBRIDGE, GA. — Kurumes and Indian Azaleas.
- PRINCETON NURSERIES, PRINCETON, N. J.—Kaempferi Hybrids, Kurumes.
- REUTHE, G., LTD., NURSERIES, KESTON, KENT, ENGLAND—miscellaneous species.
- ROBBINS, E. C., ASHFORD, N. C. — native species.
- ROCK CREEK NURSERIES (M. G. COPEN), ROCKVILLE, MD. — Gable Hybrids, Glenn Dale Hybrids.
- ROSEFIELD GARDENS, TIGARD, ORE.—Kurumes, Kaempferi Hybrids.
- ROYSTON NURSERY, ROYSTON, VANCOUVER ISLAND, B. C., CANADA—various species, *eriocarpum* forms.
- SEMMES NURSERIES, CRICHTON, ALA.—Indian Azaleas, Kurumes.
- SHERWOOD NURSERY CO., 141 S.E. 65 AVE., PORTLAND, ORE.—Sherwood Hybrids, *occidentale*.
- SIMONS NURSERY, R. 4, CHARLESTON, S. C.—Indian Azaleas, Kurumes.
- FREDERICK STREET, HEATHERMEAD NURSERY, WEST END, NEAR WOKING, SURREY, ENGLAND—Ghent Hybrids, Mollis Hybrids, Kaempferi Hybrids.
- SUNNINGDALE NURSERIES, WINDLESHAM, SURREY, ENGLAND—Ghent Hybrids, Mollis Hybrids, Knaphill Hybrids, Exbury Hybrids, Kaempferi Hybrids, Vuyk Hybrids, Wada Hybrids, Kurumes, *mucronatum* forms, *eriocarpum* forms, miscellaneous species.
- TEN OAKS NURSERY AND GARDENS (ANDREW ADAMS), CLARKSVILLE, MD.—Glenn Dale Hybrids, Yerkes Hybrids, Kurumes, Gable Hybrids, *mucronatum* forms, Arnold Hybrids, miscellaneous species.
- THOMASVILLE NURSERIES, INC., THOMASVILLE, GA.—Indian Azaleas, Kurumes.
- TINGLE NURSERY CO., PITTSVILLE, MD. — Glenn Dale Hybrids, Kurumes, Gable Hybrids, Arnold Hybrids, Chugai Hybrids, Kaempferi Hybrids, *mucronatum* forms.
- TOWSON NURSERIES, INC., TOWSON, MD.—Kurumes, Ghent Hybrids.
- VERKADE'S NURSERIES, WAYNE, N. J.—Belgian Hybrids.
- VERMEULEN, JOHN, & SON, INC., NESHANIC STATION, N. J.—Mollis Hybrids, Kaempferi Hybrids.
- VUYK VAN NES NURSERY, BOSKOOP, HOLLAND—Vuyk Hybrids.
- R. WALLACE AND CO., THE OLD GARDENS, TUNBRIDGE WELLS, ENGLAND—Ghent Hybrids, Mollis Hybrids, Kaempferi Hybrids, Vuyk Hybrids, *eriocarpum* forms.
- WATERER, JOHN, SONS & CRISP, TWYFORD, BERKS, ENGLAND—Knaphill Hybrids, Mollis Hybrids, Ghent Hybrids, Kaempferi Hybrids.
- WAXAHACHIE NURSERY CO., WAXAHACHIE, TEX.—Indian Azaleas.
- WESTON NURSERIES, INC., WINTER STREET, WESTON, MASS.—various species.
- WIGHT NURSERIES, CAIRO, GA.—Indian Azaleas, Kurumes.
- The Arboretum Bulletin, Winter 1946 and Spring 1947 issues, published by the Arboretum Foundation, University of Washington, Arboretum, Seattle 5, Washington, gives an extensive list of Pacific Coast nurseries offering various azaleas.

## VI. Azaleas for Various Areas

### HARDINESS

To most gardeners hardiness means the lowest temperature that the plant can successfully withstand. However, that minimum temperature is not fixed and uniform for all plants of a particular species or variety for all years under all conditions. Different plants within the same species or variety may vary in hardiness at the same time and under the same conditions. This variation is likely to be more apparent between plants from the northern and southern limits of the range of the species or variety in the wild.

A young azalea plant whose stem has not reached pencil thickness may be tenderer than a 4 or 5 year old plant of the same species or clone. Twigs and buds able to resist a low temperature when cooled gradually, may kill when that temperature is reached suddenly. A mulch or snow blanket, in addition to the soil itself, has an insulating effect on roots. It takes a greater duration of the minimum temperature to kill roots than the uninsulated top of the plant above ground, mulch, or snow level. In consequence a plant may be root hardy, but not top hardy, at a given site, and grow out again even though the top is killed.

Failure of a plant to harden in the fall before advent of freezing temperature increases the likelihood of cold injury. Hardening is characterized by an increase of hydrophilic colloids in the plant cells that inhibits freezing. Hardening may not have occurred because of lack of a period of cool weather prior to an early frost. Poor growth, a small leaf area, and lack of vigor attributable to drought, insect injury, disease, or mechanical damage, and

conversely, growth prolonged into the late fall by unusually warm temperatures or heavy rains, — all reduce the concentration of hydrophilic colloids in the plant and minimize hardening.

Some are of the view that, at least in cold climates, unthrifty old wood kills more quickly than vigorous, active tissue when exposed to severe cold, and that presumably the xylem tissues (the woody tissues that convey water and serve as a mechanical support) are more sensitive to cold injury than are the phloem tissues (those that conduct food materials). Hence, the vigor of the wood may be a factor involved in hardiness. This, as noted elsewhere, is, in turn, often affected by water supply during the growing season, in which the graft-union may be a limiting factor. Hence, own-root plants may be more resistant to cold winter temperatures than are grafted plants, especially among the deciduous sorts.

Inability of the roots in winter to absorb sufficient soil water results in drying out of plants and wilting. The inability may be attributable to a fall or winter drought, and consequent lack of soil water, or to frozen soil coupled with high transpiration of water from leaves of evergreen plants. The high transpiration is caused by exposure by wind to air substantially drier than the more humid air normally next to leaves, or to exposure to sunlight that warms the leaves and dries the air next to them.

Flower, and sometimes leaf, buds following the period of rest or dormancy will be damaged by a late frost that would not have damaged them earlier. This is especially true of flower buds showing color or of leaf buds opening

as a consequence of early warm spells.

Winter hardiness is by no means solely a matter of inherent resistance to low temperatures. It is also dependent on the age and condition of the plant, the duration of the low temperature, presence of mulches or snow blankets, exposure to wind and sun, the vigor of the plant, its stage or condition of growth, and the prevalence of early or late frosts or open periods of rapidly alternating thaws and freezes.

Injury due directly to low temperature and freezing of plant tissues comes quickly to the uninsulated portion of the plant. Slowness in the rate of thawing following freezing of plant tissues seems to have little effect on the amount of injury.

A common manifestation of winter injury is bark splitting on the stem just above the ground. If the stem is girdled or the splitting is otherwise extensive death follows, but often not until late the next spring or summer.

#### REGIONAL SUITABILITY

Winter hardiness is only one measure of the suitability of a plant for an area. The plant may not do well because it is not adapted to the soil or soil water conditions, the amount of rainfall or its spacing throughout the year, the summer climate, or the amount of light and shade. The data that follow tell the gardener whether the plant is "satisfactory" in a given area — whether it grows and blooms well — not merely whether it will under certain circumstances withstand a specified minimum temperature. Even so, conditions may vary greatly between two plantings only a short distance apart. A report that a plant is satisfactory therefore means no more than that at least some gardener under his particular growing conditions has

found the plant satisfactory outdoors in his area. A comparison of his growing conditions with yours may afford clues as to the probability of your success with the plant.

The tables below set forth (1) state and city where plants were grown; (2) name of reporter; (3) minimum temperature, Fahrenheit, for last half dozen years and average rainfall in inches; (4) kind of shade used, if any; (5) kind of soil and, if any used, kind of mulch; and (6) list of species and varieties grown and whether satisfactory or unsatisfactory "from standpoint of plant and bud hardiness of established plants, quantity and quality of bloom, and other characteristics." Where a substantial number of clones of a hybrid group are grown and the conclusions as to the clones are substantially uniform, only the group name, not the clone names, are listed with exceptions individually noted. The fact that the plant is listed as satisfactory for his area by a reporter, is no indication as to whether he would rate it (and particularly its flowers) as excellent, good, fair, or poor.

#### ALABAMA, Mobile.

REPORTER: K. SAWADA, OVERLOOK NURSERIES, INC.

21° to 11°; 70".

Lath shade or among trees and other shrubs.

Light sandy loam; mulch not necessarily needed, sometimes use pine straw.

*Satisfactory:*

Indian Azaleas, but Duc de Rohan, Praestantissima, and Pride of Dorking are rather tender.

Kurumes.

Lateritia alba (indicum form).

Mucronatum.

Phoeniceum and f. Maxwellii.

Sander Hy. Hexe.

#### CALIFORNIA, San Fernando.

REPORTER: EDWARD B. ARNESEN, CALIFORNIA CAMELLIA GARDENS.

24°; 15".

Filtered shade.

100% peat moss, no mulch.

*Satisfactory:*

Belgian Hys. Adriaan Steyaert, Albert-Elizabeth, Avenir, Day Break, Dr. Bergmann, Eclairer, Erie, Hollandia, Jean Haerrens, Mme. Petrick, Mme. Petrick Superba, Mme. Chas. Vuylsteke, Mrs. Fred Sanders, Orchidaeflora, Paul Schaeme, Pink Pearl, Professeur Wolters, Prosper van der Daele, Temperance, The Bride, Triumph, Van Langham, Vervaeneana, Vervaeneana Coral, Violacea, Willem van Oranje.

Indian Charles Encke.

Kurume Coral Bells.

Pericat Hys. Mme. Pericat, Seraphim, Sweetheart.

Sander Hy. Hexe.

*Unsatisfactory:*

Belgian Hys. Brillanta (sparse bloomer), Etoile de Belgique (too open), Niobe (hard to grow), Paul Schaeme Frise, Perle de Swynaerde (too slow), Super Orange (too open).

Molle (climate too mild).

Kurumes Christmas Star (too open, too fast grower), Snowdrift (too late).

### CALIFORNIA, Oakland.

REPORTER: CORA A. BRANDT.

39° to 27°; 26" to 13".

High shade at least in afternoon, north and northeast exposure; more sun for deciduous azaleas.

Pure peat and sand for evergreen azaleas; leaf mold for deciduous azaleas.

*Satisfactory:*

Altaclarensis Hys. unnamed.

Belgian Hys., except Vervaeneana striped sport has variations in flowers.

Calendulaceum (leaves appear before flowers).

Chugai Hys. except Row-getsu and Mai-Hime regarded as fair and unsatisfactory, respectively, because of variation in flowers.

Gable Hys. Loyalty and Corsage.

Ghent Hys. Knaphill vars. (need more sun than evergreens, grafted plants).

Glenn Dale Hys. except Picador is only fair.

Hexe.

Indians, except Duke of Wellington is only fair and Fielders White needs lath shade.

Indicum and forms, except Firmament is only fair.

Kaempferi Hy. Purple King (slow growing).

Kurumes except Hi-no-degiri is not over-vigorous and Crabapple is unsatisfactory.

Mucronatum forms.

Pericat Hys. Mme. Pericat and Twenty Grand.

Rutherford Hys., except Indian Chief is unsatisfactory.

Schlippenbachi.

Viscosum.

### DELAWARE, Winterthur.

REPORTER: H. F. DUPONT.

8° to 1°; 45".

High, light shade.

One foot layer of soil 3 parts, leaf mold 2 parts, and peat moss 1 part; stones for drainage in bottom of hole.

*Satisfactory:*

Arnold Hy. Dexter Pink.

Gable Hys.

Indicum f. Balsaminaeflora.

Japonicum.

Kaempferi Hys.

Kurumes.

Flavum.

Mucronatum and forms if in full sun.

Natives—calendulaceum, vaseyi, viscosum.

Poukhanense and f. Yodogawa.

Schlippenbachi.

### DISTRICT OF COLUMBIA.

REPORTER: JOHN E. GRAF.

12°; 42".

High, filtered shade, west slope, protection from winds.

Clay and rotten rock, humus and peat moss added in quantity; mulch of oak leaves.

*Satisfactory:*

Indicum and forms.

Kaempferi.

Kaempferi Hys.

Kurumes.

Molle.

Mucronatum and forms.

Natives—serrulatum, atlanticum, bakeri, oblongifolium, alabamense, prunifolium, canescens, austrinum, furbishi, speciosum, viscosum, vaseyi, calendulaceum, nudiflorum, roseum, arborescens var. richardsoni.

Pericat Hy. Mme. Pericat.

Phoeniceum f. Maxwelli.

Poukhanense.

Schlippenbachi.

**DISTRICT OF COLUMBIA.**

REPORTER: FREEMAN WEISS.

-6°; 40".

High, filtered shade of tall oaks.

Loam, some heavy some friable, all thin and poor; mulch of red oak leaves mixed with peat moss or spent tan bark.

*Satisfactory:*

Hexe (too low and sprawly, shy bloom).

Indians Fielders White and George Lindley Taber.

Indicum and forms, but Warai-gishi is rangy and has too many leaves before flowering.

Kaempferi (fair).

Kaempferi Hys.

Kurumes except Flame (sparse bloom, often frosted), Orange Beauty (lacks hardiness, shy bloom), Flamingo (lacking in vigor).

Mollis Hys.

Mucronatum and forms except lose a few buds in winter. However, var. Amethystinum is unsatisfactory.

Natives—arborescens, viscosum, nudiflorum.

Obtusum vars. amoenum and amoenum superbum.

Pericat Hys. Hampton Rose and Sweetheart.

Phoeniceum f. Maxwelli (loses a few buds in winter).

*Unsatisfactory:*

Calendulaceum (soil too dry and hard).

Indians Cavendishi (some buds winter kill), Coccinea Major (buds winter kill).

Roseum (barely lives).

Vaseyi (barely lives).

**FLORIDA, Orlando.**

REPORTER: R. KENNETH SOPER, ORLANDO NURSERIES.

24°; 52".

Low light shade of laths and Spanish moss, or under oak trees, or some in open sunlight.

Peat or sandy muck, no mulch.

*Satisfactory:*

Belgian Hys. Albert-Elizabeth, Triumph, Vervaeneana, Vervaeneana Alba, Vervaeneana Orange, but most Belgian hys. need special care.

Black Hawk.

Indians Brillant, Crimson, Duc de Rohan, Elegans, Fielders White, Formosa, George Franc, George Lindley Taber, Glory of Sun-

ninghill, Iveryana, Lawsal, Nora Lee, Orchid, Praestantissima, President Claeys, Pride of Mobile, Prince of Wales, Violaacea Rubra.

\* Hexe.

Indicum forms macrantha double, single pink, and single salmon.

Kurumes Snow, Apple Blossom, Pink Pearl, Coral Bells, Flame, Christmas Cheer.

Lorraine.

Mucronatum (Indica Alba).

Pericat Hy. Mme. Pericat.

Phoeniceum and f. Maxwelli.

Sublanceolata (scabrum).

*Unsatisfactory:*

Belgian Hy. Niobe.

**GEORGIA, Augusta.**

REPORTER: R. P. MAYO, MAYO NURSERIES. 27° to 15°; 38".

Shade of tall pine woods; also slat frames; some frost pockets that result in frozen buds but no injury to wood.

Sandy loam; mulch of pine straw.

*Satisfactory:*

Black Hawk.

Bobbink & Atkins Hys.

Chugai Hys. Keisetsu, Kagetsu, and Rowgetsu.

Glenn Dale Hys.

Indian Azaleas.

Indicum forms.

Kaempferi Hys.

Kurumes.

Mayo Hys.

Pericat Hys.

Phoeniceum.

Sachem.

Sander Hys. Vivid, Hexe, and Ruby.

**ILLINOIS, Chicago.**

REPORTER: ELDRED E. GREEN.

-20°; 32".

Partial or light shade.

Sandy loam with oak leaf mulch, clay with oak leaf mulch, or sand and peat moss.

*Satisfactory:*

Japonicum.

Kaempferi and several Kaempferi Hys.

Flavum.

Mollis Hys.

Natives—canadense, calendulaceum, arborescens, nudiflorum, roseum, vaseyi, viscosum.

Obtusum.

Poukhanense and f. Yodogawa.

Schlippenbachi.



**ILLINOIS, Lisle.**

REPORTER: E. L. KAMMERER, MORTON ARBORETUM.

—30°; 35".

Shade of large oaks.

Clay loam (neutral); mulch of decomposed oak leaves.

*Satisfactory:*

Gable Hys. Elizabeth Gable (fair) and Herbert. Branches of both kill above snow line occasionally.

Kaempferi but flower buds tender to extreme cold.

Poukhanense but flower buds tender to extreme cold.

Schlippenbachi but flower buds tender to extreme cold.

**KANSAS, Ottawa.**

REPORTER: HARRY V. SEEVERS.

min. —21°, max. 108°; 35".

Lath shade of 75 to 50%, only japonicum, viscosum, and Gable hy. Elizabeth Gable will take Kansas sun summer or winter.

Soil of  $\frac{1}{2}$  to  $\frac{3}{4}$  rotted oak sawdust,  $\frac{1}{2}$  to  $\frac{1}{4}$  coarse river sand; 1" sawdust mulch each fall.

*Satisfactory:*

Arnold Hy. Mossieana.

Gable Hys. Cameo, Charlotte, Chinook, Edna, Elizabeth Gable, La Lumiere, La Roche, Louise Gable, Miriam, Old Faithful, Rose Greeley, Royalty, Susan, Viola, C-3-G.

Ghent Hys. Altaclarensis, Bouquet de Flore, Daviesi, Coccinea Speciosa, Hugo Koster, Il Tasso, Norma, Pallas, Mrs. L. J. Endtz, William III, but usually only if on own roots.

Japonicum.

Kaempferi.

Kaempferi Hys. Atalanta, Betty, Cleopatra, Fedora, Gretchen, Lakme.

Natives—arborescens, atlanticum, vaseyi, viscosum.

Poukhanense.

*Unsatisfactory:*

Calendulaceum.

Gable Hys. Cameroon, Corsage, Mary Ann, Mildred Mae, Grenadier.

Kurume Kagaribi.

Molle.

Mucronatum.

Poukhanense var. Yodogawa (grows well, but shy bloomer).

Ghent Hy. Narcissiflora (grafted).

Schlippenbachi.

Reticulatum.

**MARYLAND, Bethesda.**

REPORTER: FREDERICK W. COE.

5°; 41".

High, light shade.

Clay loam; rotted oak leaf mulch.

*Satisfactory:*

Chugai Hys. after first year.

Indian Praestantissima.

Indicum and forms, and var. eriocarpum Gumpo.

Japonicum.

Kaempferi.

Kurumes, including Chisolm-Merritt Hys.

Flavum.

Macrosepalum.

Mariesi.

Mayo Hys.

Mollis Hys.

Mucronatum forms.

Natives—atlanticum, nudiflorum, cumberlandense, calendulaceum, canescens, viscosum, prunifolium, alabamense, arborescens, austrinum, serrulatum, speciosum, vaseyi.

Pericat Hys., except Sweetheart Supreme loses buds.

Reticulatum.

Schlippenbachi but buds sometimes caught in late freeze.

*Unsatisfactory:*

Linearifolium.

Roseum (does not bloom).

**MARYLAND, Glenn Dale.**

REPORTER: ALBERT W. CLOSE, PLANT INTRODUCTION GARDEN, U.S.D.A.

8° to —9°; 46".

High, filtered shade.

Sandy loam; natural mulch of oak leaves.

*Satisfactory:*

Chugai Hys. if protected first two winters.

Dawson Hy. Hazel Dawson.

Glenn Dale Hys.

Indicum.

Kaempferi.

Kaempferi Hys.

Kurumes.

Flavum.

Mucronatum.

Natives—alabamense, calendulaceum, canescens, nudiflorum, speciosum.

Phoeniceum f. Maxwelli.

Poukhanense.

Reticulatum.

Schlippenbachi.

Simsi (some clones).

*Unsatisfactory:*

Oldhami (upper flower buds usually freeze).

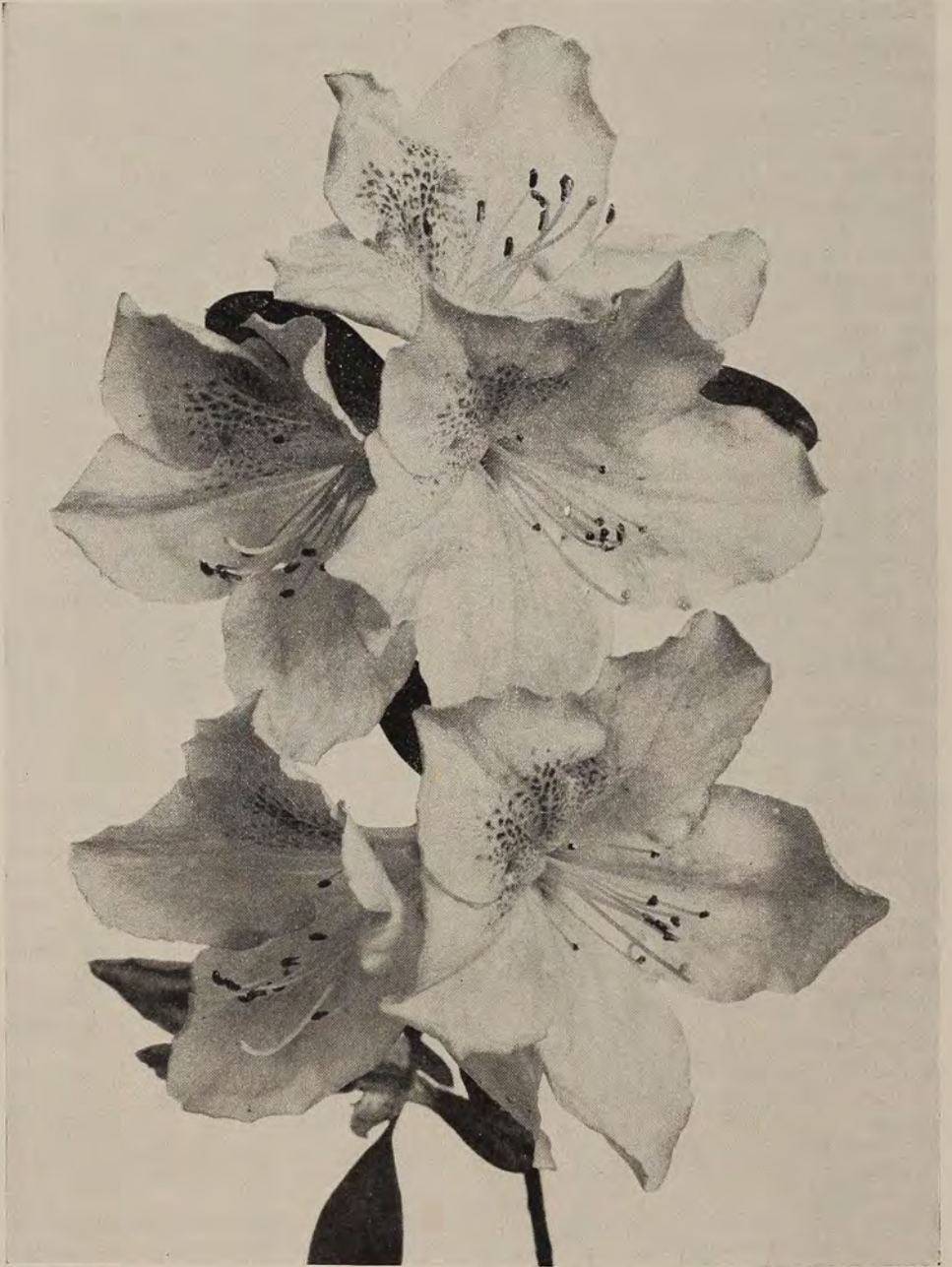


Plate 27

Robert L. Taylor

DAWSON HYBRID cl. HAZEL DAWSON 3/4×



Plate 28

Robert L. Taylor

CHUGAI HYBRID cl. MAI-HIME 3/4×



Plate 29

Lilian A. Guernsey

*Nudiflorum* (Pinxterbloom Azalea)



Plate 30

Robert L. Taylor

*Vaseyi* (Pinkshell Azalea) 5/8X

**MARYLAND, Kingsville.**

REPORTER: H. J. HOHMAN, KINGSVILLE NURSERIES.

5° to -12°; fair rainfall, dry spells of 2 to 3 weeks.

High shade of cleared oak woods, trees 50' apart.

Oak woods soil; mulch of leaves or straw.

*Satisfactory:*

Note: Many listed are satisfactory only if planted under canopy of trees; otherwise tender.

Arnold Hys. (very hardy, leggy).

Chugai Hys., although many only to 6° or 0°, protection of canopy of trees important.

Gable Hys., all "very" satisfactory; reports do well as far north as Rhode Island.

Ghent Hys.

Glenn Dale Hys. except Fantasy and Joya; many "very" satisfactory; reports many do well as far north as Providence, R. I., and a few, if protected, at Buffalo, N. Y.

Indicum and forms.

Japonicum.

Kaempferi Hys., "very" satisfactory.

Kurumes, "very" satisfactory.

Flavum.

Macrosepalum.

Molle.

Mucronatum and forms except Fujimanyo, but protection of canopy of trees important.

Natives—arborescens, calendulaceum, nudiflorum, vaseyi.

Oldhami but needs protection.

Phoeniceum f. Maxwelli.

Poukhanense.

Reticulatum.

Schlippenbachi.

*Unsatisfactory:*

Canadense.

Chugai Hy. Joh-ga.

Obtusums vars. Kocho-no-mai and Macrostemon.

Poukhanense f. Yodogawa.

Serpyllifolium.

**MARYLAND, Silver Spring.**

REPORTER: LEWIS A. HURST.

5°; 40" to 50".

High shade of oak trees.

Loam; mulch of oak leaf compost.

*Satisfactory:*

Belgian Hy. Vervaeana (tender, needs protection).

Chugai Hys.

Ghent Hys.

Glenn Dale Hys.

Indians George Lindley Taber, Brilliant,

Fielders White, Criterion, Vittata Fortunei, Pink Beauty, Vittata Fortunei Purpurea, Daphne Salmon, President Claeys, Pride of Thomasville, Iveryana, Mme. Dominique Vervae, Anthenon, Flag of Truce, Viola-  
cea Rubra.

Indicum and forms.

Kurumes, except Hi-no-degiri and Coral Bells (prefers some of Glenn Dales) and Flame (fades quickly).

Macrostemon.

Mollis Hys.

Mucronatum and forms.

Natives: atlanticum, arborescens, calendulaceum, nudiflorum.

Pericat Hys. Mme. Pericat, Sweetheart Supreme, Harmony, Hiawatha, Euphony.

Phoeniceum and f. Maxwelli.

Poukhanense.

*Unsatisfactory:*

Indians Formosa, Pride of Mobile, Perfection, Brilliant, Elegans.

Poukhanense f. Yodogawa (not good bloomer).

**MARYLAND, Takoma Park.**

REPORTER: B. Y. MORRISON.

5°; 40".

High and low light filtered shade from trees.

Micaceous loam; mulch of ordinary leaf fall, rare additions of peat and leaf compost.

*Satisfactory:*

Indicum and forms, — best habit and more blooms in full sun.

Gable Hys.

Ghent Hys.

Glenn Dale Hys.

Indians Mme. Dominique Vervae, Cavendishi, Criterion, Anthenon, Charles Encke, Flag of Truce, Marie Louise, Eulalie van Geert, Pride of Dorking, Pluto.

Japonicum.

Kaempferi and var. mikawanum.

Kurumes including Beattie importations.

Macrosepalum.

Mariesi.

Molle.

Mollis Hys.

Mucronatum and forms Sekidera, Japonica Alba, Narcissiflora, and Amethystina, — need sun for good bloom.

Natives — canadense, vaseyi, occidentale (bud tender), calendulaceum, roseum, atlanticum, viscosum, prunifolium.

Obtusum and f. amoenum.

Oldhami (winter kills in part in variable winters).

Pericat Hys. Sweetheart Supreme and Mme. Pericat.

Phoeniceum forms Omurasaki, Maxwelli, and Tebotan.

Poukhanense (needs sun for good flowering) and f. Yodogawa.

Reticulatum.

Schlippenbachi.

Seryllifolium album, needs sun.

Simsi and var. vittatum.

Vuyk Hys.

Weyrichi.

*Unsatisfactory:*

Albrechti.

Indians Elegans, Pres. Claeys (doubtful), Pride of Mobile, Formosa (does not flower).

Flavum (fair, dies slowly).

Oblongifolium (slow, never flowered).

Phoeniceum (buds kill).

Quinquefolium (probably all right).

Scabrum (grows in cold pit, flowers rarely).

Serrulatum.

Tschonoski (poor growth, rare flowering).

### MARYLAND, Takoma Park.

REPORTER: PAUL OTTERBACH.

5°; 41".

High, filtered shade of oaks, north exposure.

Clay loam and sandy loam mixed with oak leaf mold and woods mold; mulch of oak leaf mold, tan bark being tried.

*Satisfactory:*

Chugai Hys.

Glenn Dale Hys.

Indians Formosa, George Lindley Taber, and Iveryana.

Indicum and forms.

Kaempferi Hys.

Kurumes.

Mucronatum and forms.

Pericat Hy. Mme. Pericat.

Phoeniceum f. Maxwelli.

Sander Hy. Hexe.

### MASSACHUSETTS, Jamaica Plain.

REPORTER: DONALD WYMAN, ARNOLD ARBORETUM.

-10°; 59" to 43".

Acid soil, about 5 pH.

Mulch of hops when obtainable.

*Satisfactory:*

Albrechti.

Arnold Hys.

Ghent Hys.

Japonicum.

Kaempferi (but often winter kills in other areas nearby).

Kaempferi Hys.

Macrosepalum.

Mucronatum (not always winter bud hardy).

Natives — arborescens, atlanticum, calendulaceum, nudiflorum, roseum, vaseyi, viscosum.

Poukhanense and f. Yodogawa.

Schlippenbachi.

*Unsatisfactory:*

Ghent Hy. Altaclarensis (sometimes winter injury).

Japonicum (sometimes killed), plenum (has difficult time).

Hi-no-degiri (just barely hardy).

Kaempferi var. mikawanum (doubtful).

Flavum (not hardy).

Obtusum f. amoenum (barely exists).

### MISSOURI, Webster Groves.

REPORTER: CLARENCE BARBRE.

-10°; 44".

High shade.

Mixture equal parts oak sawdust and clay, or 1 bale of peat moss per 100 sq. ft. of soil, prepared 18" deep.

Mulch of 8" of oak leaves each fall, reduces to 2" over winter.

*Satisfactory:*

Gable Hy. Caroline Gable.

Ghent Hy. Altaclarensis.

Kaempferi.

Kaempferi Hy. Fedora.

Flavum.

Mollis Hys.

Natives—bakeri, calendulaceum, canescens, nudiflorum.

Obtusum forms Amoenum, Hi-no-mayo, Hino-crimson, and Kurumes Hi-no-degiri, Sherwoodi, and Snow; some lose flower buds about one year in seven due to warm weather early March followed by sharp temperature drop.

Poukhanense.

*Unsatisfactory:*

Arnold Hys. (doubtful).

Kurume Coral Bells.

Hexe.

Indicum (doubtful).

Mucronatum.

### NEW YORK, Maine.

REPORTER: CLEMENT GRAY BOWERS.

-30°; late spring frosts, moderate summer heat; 40".

Medium or low shade, fully shaded part of day; frost pocket; some, but not much, wind protection.

Peat moss overlying silt loam, sparse mulch of oak leaves.

*Satisfactory:*

Ghent Hys. Pallas (when on own roots) and Daviesi (with protection); believes many other Ghent and Mollis hybrids would be hardy if on own roots.

Japonicum (fair).

Molle (some when on own roots).

Natives—arborescens, calendulaceum, cumberlandense, canadense, atlanticum, nudiflorum. Roseum, viscosum, and vaseyi are all three "very" satisfactory.

Poukhanense (fair, needs shelter).

*Unsatisfactory:*

Canescens.

Kaempferi (kills to ground at  $-15^{\circ}$ ).

All of Obtusum Subseries except poukhanense.

### NEW YORK, Yonkers.

REPORTER: J. H. BEALE, BOYCE THOMPSON  
ARBORETUM.

$-5^{\circ}$ ; 43".

Mostly without shade.

Loam; leaf mold mulch.

*Satisfactory:*

Ghent Hy. Altaclarensis only fair.

Japonicum, but only for a few years.

Kaempferi.

Flavum (stem borers).

Natives—arborescens, calendulaceum, canadense, canescens, nudiflorum, roseum, vaseyi, viscosum.

Obtusum forms (flower buds and twigs sometimes kill), Hi-no-degiri (flower buds kill in exceptionally severe winters).

Poukhanense.

Schlippenbachi.

*Unsatisfactory:*

Indicum unless protected.

Macrosepalum and f. linearifolium.

Phoeniceum f. Maxwelli.

Reticulatum.

### OHIO, Cleveland.

REPORTER: ARNOLD M. DAVIS, THE GARDEN CENTER OF GREATER CLEVELAND.

$-6^{\circ}$ ; 33".

Filtered sunlight.

Yellow clay of pH 8 with sawdust and peat mulch.

*Satisfactory:*

Calendulaceum.

Ghent Hys.

Kaempferi on sunny slopes.

Kurumes (winter burn).

Flavum.

Mollis Hys.

Mucronatum (rosmarinifolium).

Obtusum f. amoenum (winter burns).

Poukhanense and f. Yodogawa.

Schlippenbachi.

Viscosum.

Vuyk Hys.

*Unsatisfactory:*

Nudiflorum.

### PENNSYLVANIA, Philadelphia.

REPORTER: HENRY T. SKINNER, MORRIS  
ARBORETUM.

$16^{\circ}$  to  $0^{\circ}$ ; 40".

Partial shade except for Ghent and Mollis Hys.

Loam, somewhat heavy in places, overlying mica schist, enriched with peat and leaf mold; mulch of leaves or sawdust plus fertilizer at time of application.

*Satisfactory:*

Albrechti.

Gable Hys.

Arnold Hys.

Ghent Hys.

Glenn Dale Hys.

Indicum and forms but some flower buds tender.

Japonicum.

Kaempferi.

Kurumes (some)

Flavum.

Macrosepalum.

Mollis Hys.

Mucronatum and forms.

Natives—alabamense, arborescens and var. richardsoni, atlanticum, austrinum, bakeri, calendulaceum, canescens, cumberlandense, fastigifolium, furbishi, nudiflorum, roseum, serrulatum, speciosum, vaseyi, viscosum.

Obtusum f. amoenum.

Phoeniceum f. Maxwelli.

Poukhanense and f. Yodogawa.

Reticulatum.

Schlippenbachi.

Vuyk Hys.

*Unsatisfactory:*

Kurumes (some)

Mollis Hys. (too weak).

Oblongifolium.

Occidentale.

### PENNSYLVANIA, Swarthmore.

REPORTER: JOHN C. WISTER, ARTHUR  
HOYT SCOTT HORTICULTURAL FOUNDATION,



## SWARTHMORE COLLEGE.

0°; 40".

Half shade.

Partly rocky hillside, partly garden loam plus humus; mulch of leaf mold and decayed leaves.

*Satisfactory:*

Arnold Hys.

Gable Hys.

Ghent Hys. (if on own roots, but not if grafted and not Occidentale Hys.).

Indicum (slight branch or tip killing in severe winters) and f. J. T. Lovett.

Japonicum.

Kaempferi.

Kaempferi Hys.

Kurumes.

Mucronatum and forms.

Natives—vaseyi, calendulaceum, nudiflorum, roseum, atlanticum, viscosum (better in N. J. swamps), arborescens.

Obtusum and f. amoenum.

Poukhanense f. Yodogawa.

Schlippenbachi.

*Unsatisfactory:*

Chugai Hys. (probably lost by summer drought).

Mollis Hys. (grafted).

**VIRGINIA, Hampton.**

REPORTER: KENNETH MACDONALD, LE-MAC NURSERIES.

12°; 45".

Full sun summer, winter shade of lath screens.

Sandy loam; mulch of peat moss and pine needles.

*Satisfactory:*

Gable Hys.

Glenn Dale Hys., most are satisfactory.

Indians Formosa, Atropurpurea, and Omurasaki, although all are tender.

Kaempferi Hys.

Kurumes, except Orange Beauty is tender.

Mucronatum and forms.

Pericat Hys., except Harmony is not too hardy and Sweetheart Supreme is very tender.

Yerkes Hys. probably but still on trial.

*Unsatisfactory:*

Indian Pride of Mobile.

**WASHINGTON, Puyallup.**

REPORTER: LEONARD F. FRISBIE.

-12°; 30".

No shade.

Light soil; peat mulch.

*Satisfactory:*

Albrechti.

Arnold Hys.

Ghent Hys. Knaphill vars. (on own roots).

Indicum and var. eriocarpum Gumpo.

Kaempferi.

Kaempferi Hys.

Kurumes Hinomayo, Sherwoodi, Orange Beauty.

Malvatica.

Mollis Hys.

Mucronatum and forms.

Natives—canadense, vaseyi, occidentale, calendulaceum, alabamense, atlanticum, canescens, roseum.

Phoeniceum f. Maxwelli.

Sander Hy. Hexe.

Schlippenbachi.

Tschonoski.

Vuyk Hy. Sibelius.

*Unsatisfactory:*

Rutherford Hys. (not hardy outside).

**WASHINGTON, Seattle.**

REPORTER: ROBERT J. HANSEN, UNIVERSITY OF WASHINGTON ARBORETUM.

3°; 34".

Some in sun, others in high, filtered shade of conifers or low shade of Japanese cherries.

Clay or sandy loam; mulch of mixed leaves, sawdust or shavings.

*Satisfactory:*

Albrechti.

Arnold Hys.

Chugai Hy. Mai-Hime (some damage).

Ghent Hys.

Glenn Dale Hys. Dayspring, Fantasy, Carmel, Anchorite, Buccaneer (slight damage), Gaiety, Greeting, Tanager, Aphrodite.

Indicum (slight damage).

Japonicum.

Kaempferi.

Kaempferi Hys. (a few plants damaged by cold).

Kurumes Daphne, Snow (slight damage), Daybreak.

Flavum.

Mollis Hys. Adriaan Koster and Anthony Koster.

Mucronatum forms, amethystinum and sekidera (some plants satisfactory, many unsatisfactory).

Natives—vaseyi, nudiflorum, speciosum, calendulaceum, occidentale, arborescens, viscosum.

Poukhanense f. Yodogawa.

Sander Hys. Mars and Ruby.

Vuyk Hy. Mozart.

*Unsatisfactory:*

Chugai Hy. Shinnyo-no-tsuki.  
 Glenn Dale Hys. Joya, Revery.

Kurumes Appleblossom, Mauve Beauty,  
 Pink Pearl, Peach Blow.  
 Poukhanense.



Plate 31

Claude HOPE

*Reticulatum* (Rose Azalea)

One of the earliest blooming azaleas in northern areas. Deciduous and flowers appear before leaves.

## VII. Azalea Growth Factors

### NUTRITION

Mineral elements that are essential to the growth of azaleas and that may be lacking or unavailable in soils are iron, nitrogen, calcium, potassium, magnesium, phosphorus, boron and manganese. Others, if essential, are required in such minute traces as rarely, if ever, to present a deficiency problem. The need for the essential minerals is illustrated by the fact that Kurume cl. Coral Bells is likely to show deficiency symptoms if recently matured leaves contain less than 2.00% nitrogen, 0.20% phosphorus, 0.80% potassium, 0.20% calcium, and 0.17% magnesium.

**IRON.** No soil likely to be used for growing azaleas outdoors will be lacking in iron. The question is one of the availability of the iron, that is the ability of the plant to make use of the iron present. Lack of iron or lack of available iron manifests itself in the plant as iron chlorosis, a splotchy paleness in the green chlorophyll color between the veins of the younger leaves. If the condition becomes serious these leaves become yellow, cream, and finally white.

Poor root growth by reason of compacted soils, overwatering, poor drainage, low temperatures, or over-fertilization or unbalanced fertilization may result in inability to absorb sufficient iron and consequent iron chlorosis. A deficiency in calcium, potassium, or manganese apparently makes iron unavailable and the initial symptoms of these deficiencies are iron chlorosis followed later by their own particular deficiency symptoms. But the most common reason for iron chlorosis is an excess, rather than a deficiency, of calcium, as indicated by alkalinity or too high a pH. Soil alkalinity and acidity

is measured by pH units with pH7 as the neutral or turning point between acidity and alkalinity. pH6 has an active acidity of 10, pH5 of 100, pH4 of 1000, and pH3 of 10,000. On the other hand a soil solution with a higher pH than 7 would be alkaline. At the higher pH levels (as pH6 or 6.5) there is likely to be not only more calcium present as calcium carbonate (limestone) in the soil, but also there is likely to be a more ready replacement of iron by calcium in the soil solution or even in the plant tissues, and consequently iron chlorosis appears.

In general azaleas grow best in a soil having a pH range of 4.5 to 6.0. Some species of azaleas make their best growth within even narrower limits, as *canescens*, *viscosum*, and *canadense* pH 4.5 to 5.0; *arborescens* pH 5.5 to 6; and *nudiflorum* pH 4.5 to 5.5. Outside the azalea's preferred range iron becomes more and more unavailable to the plant until a point of likelihood of serious injury is reached. Thus while *viscosum* prefers a range of pH 4.5 to 5.0, it will tolerate pH 4.0 to 6.0 but beyond these points in either direction growth will probably be seriously affected. *Roseum* is supposed to be more tolerant of less acid soils than most other azaleas.

Among the more common reasons for soil becoming high in calcium and insufficiently acid in an area normally free from limestone is the use of hydrated lime or nitrogenous fertilizers that after the nitrogen is consumed, leave an alkaline residue, as calcium nitrate or calcium cyanamide. Sodium nitrate or potassium nitrate as fertilizers will raise the pH and will cause iron deficiency and chlorosis although

not nearly as rapidly in a relatively calcium free soil as will either of the calcium fertilizers first mentioned. Extensive use of city water will also cause iron chlorosis for most water from city mains has been treated so as to be slightly alkaline. In many areas outside cities "hard" water also prevails and this will cause an excess of calcium sufficient seriously to impair the soil for use for azaleas after even a few waterings. Plants near masonry walls may suffer from lime or other alkaline substances washed by rain from the mortar. Even in some areas where surface soil is acid, water from deep wells may be alkaline.

Sulphur makes soil more acid, producing sulphuric acid which in turn converts calcium salts to highly soluble calcium sulphate readily lost from the soil by leaching. Iron thereby becomes more available. The finer the soil particles, the more sulphur is required to increase acidity, i.e., more for a clay than a loam, and more for a loam than a sand. Also more sulphur is required if free lime is present. It is usually impracticable greatly to reduce acidity in a clay soil or one with much free lime. Use of aluminum sulphate will likewise increase acidity, but the amount needed is about six times more than sulphur, and too much soluble aluminum is toxic to plants. Increase in acidity tends to deplete phosphorus, and magnesium, as well as calcium, by leaching, and to increase availability of manganese, boron, copper, and zinc, as well as iron.

Azalea leaves will absorb iron directly and if sprayed with a ferrous sulphate solution iron chlorosis will quickly disappear for a few weeks. Without soil adjustment, however, such leaf treatments are at best temporary in their effect.

**NITROGEN.** If nitrogen is lacking all

leaves become a yellowish green. Old leaves turn rapidly to greenish yellow, yellow, and later red (or reddish blotches) and are finally shed; new leaves remain small and yellowish green. Growth and flowering are restricted; new growth is thin and woody; and plants become ragged in appearance.

Ammonium sulphate and rotted manures which have not been treated with lime or other alkaline materials, are sources of nitrogen that have acid, not alkaline residues, and so do not reduce the acidity of the soil. Mulches consisting of oak leaves, pine needles, and more particularly sawdust or extensive use of peat moss, may temporarily result in a nitrogen deficiency because of the absorption of nitrogen by bacteria decomposing the organic materials. An additional supply of nitrogen may be necessary if mulches are used. This is discussed later in the chapter on Azalea Soil and Mulches.

**CALCIUM.** Azaleas detest excess calcium or lime and do poorly in a limey or limestone soil. However, calcium at a proper nutritive level is essential for an azalea's growth. Both an excess or a deficiency of calcium tends to produce, and appear first as, an iron chlorosis. This is followed by severe tip burn of young expanding leaves or production of small yellow leaves twisted at the tips, and finally, by death of terminal and lateral buds. Hydrated lime as a source of necessary calcium has an adverse effect because it is too sudden in its calcium release and its reduction of acidity. Ground dolomitic limestone (magnesium limestone) and ground oyster shell are better sources of calcium because they act more slowly. Super-phosphate and gypsum (calcium sulphate) are good sources of calcium whenever very rarely a calcium application may become necessary.

**POTASSIUM.** A deficiency in potas-



Plate 32

R. L. Pryor

## AZALEA NUTRITION

Kurume cl. Coral Bells. Top, growing in quartz sand: left to right deficient in nitrogen, phosphorus, and potassium, respectively. Middle, growing in quartz sand: left, all nitrogen from calcium nitrate; right, two months after substituting ammonium sulfate for calcium nitrate. Bottom, growing in woods soil, leaf mold, and sand fertilized at two week intervals with nitrogen, phosphorus, and potassium, respectively.

sium likewise first appears similar to iron chlorosis, particularly along margins of leaves. This is followed by leaf tip burn, inward curling of leaves, a conspicuous bronzing of leaves, and finally leaves are shed. Growth virtually stops.

Potassium sulphate and potassium chloride (muriate) are sources of potassium with an acid, not an alkaline, residue.

**MAGNESIUM.** A magnesium deficiency also first appears similar to iron chlorosis. Reddish purple blotches follow and brown dead areas on tips and margins may occur. Leaves are shed. The effect on plant growth is not so serious as some of the other deficiencies.

Epsom salt (magnesium sulphate) is a source of magnesium with an acid, not an alkaline, residue.

**PHOSPHORUS.** This deficiency manifests itself by dull, abnormally dark green leaves, which then turn red on the undersurface along the midrib, develop reddish purple blotches, and become purple brown and dry up, remaining attached to the stem for several days before falling. Growth is slow. There is no initial appearance similar to that of iron chlorosis.

Superphosphate and ammonium phosphate are usual sources for phosphorus.

**BORON.** A deficiency in boron first appears as small brown flecks on young expanding leaves. The first new leaves develop to usual size and shape; those a day or two later develop large dead areas and become distorted. Then terminal and lateral buds die. Boron deficiency is practically limited to alkaline soil and hence not found among azaleas growing naturally.

Borax is the usual source for boron.

**MANGANESE.** A deficiency in manganese appears similar to iron chlorosis

except that the leaf tissue near the veins remain green.

Manganese sulphate is a source of manganese with an acid residue.

Your State Experiment Station or State Agricultural College will for a small fee test your soil for acidity and for mineral deficiencies.

#### MYCORRHIZAE

The association of a filamentous or mycelial fungus with the roots of a higher plant is a mycorrhizal relationship. The fungus usually forms a felt-like sheath covering rootlets and separating them from the soil. It penetrates between and into the root cells forming absorbing organs in contact with the living protoplasm of the cells and, through the delicate threads of the fungus, with the soil. The fungus that combines with the root, is a mycorrhiza. Mycorrhizae are common on or within the roots of plants of the heath family, including azaleas. Although azalea seedlings sprouted in sphagnum moss will have root hairs, azalea roots do not ordinarily have root hairs when growing naturally. Mycorrhizae may take the place of root hairs in absorption, digest organic portions of the soil that the plant could not otherwise absorb, synthesize compounds that the plant cannot adequately supply, and increase soil acidity. Suitable initial soil acidity, high humus content, a constant supply of incompletely decomposed organic litter, and adequate moisture are necessary for mycorrhizae.

If, despite good soil conditions and nutrition and absence of disease, azaleas do not grow well, lack of the mycorrhizal fungus may be the difficulty. However, science knows little as yet about mycorrhizae in garden soils. The particular fungus partner or partners to the relationship, if absent, may be obtained by inoculating the soil through

addition of soil from places where the species is growing wild or of soil from around the species where it is established and growing well in gardens. Leaf mold from oak and pine woods, besides its many other virtues, may be a help in the growth of mycorrhizae. The better success of balled and burlapped plants in certain hard-to-move groups results in part from the plants arriving with a good supply in the ball of soil of fungus inoculum for the young roots as they develop.

#### LIGHT AND SHADE

The intensity of direct sunlight is often over 12,000 foot candles (f.c.) at noon in the summer, although on the darkest rainy day it may be as low as 700 f.c. Screen shade will cut down light intensity almost half, as 6,000 f.c. when 10,000 f.c. in the open. On the same day lath shade will cut down light intensity to 900 f.c. while the plant is in the shadow of the lath, and 9,000 f.c. when exposed. The filtered light under high deciduous trees will vary constantly, ranging from 400 f.c. to 2,000 f.c. to 10,000 f.c. when wind blows or an open space appears. In one garden an area surrounded by three walls opening to the north and a weeping cherry overhead gives a light intensity never over 600 f.c. and often as low as 100 and 200 f.c., even though at the same time light intensity may be 10,000 f.c. in the open.

Where deciduous trees are relied on to shade a planting, there is, of course, in winter, when leaves have fallen, more exposure to sunlight than in summer. However, in winter full sunlight is less intense (although even then on a bright day it may reach a maximum of 11,000 to 12,000 f.c.) and the plants are inactive.

Azaleas of the *Obtusum* Subseries grow and flower well under all the

above conditions. Light intensity is not too important to their flowering. It does, however, affect their habit. With more light stems are shorter, leaves more crowded, the plant more dense and compact, and the flowers massed together. With more shade the plants are more open and taller, the stems longer and showing through the leaves, and the flowers, though not fewer, appear scattered over the plant instead of serried. In woods shade many old Kurumes will be so tall that one can walk under a canopy of their leaves overhead.

Volunteer seedlings will grow under a mother plant where light intensity never exceeds 400 f.c. and sometimes as low as 30 f.c., but rarely under a mother plant grown in full sun, but in this connection moisture relationships are also involved.

Not all azaleas respond in the same way to shade. *Indicum* gives its greatest masses of flowers in full sun; *micronatum* gives less bloom as shade increases. However, unless the mound of leaves and flowers found on the sun-grown plants is a desired objective, partial, or even rather dense, high woods shade can generally be used and still a fine display had from most azaleas. At the same time, in woods shade fading and burning of flowers and the insect problems of sunny sites are minimized or avoided, additional winter protection from wind and sun obtained, and a leaf mulch supplied by the forest canopy.

The requirements of deciduous azaleas for light vary somewhat from those of the evergreen azaleas. The deciduous azaleas do best when they receive close to full sun for a portion of the day. They do poorly if grown in full sun at all times, at least in southern regions, and also do poorly in dense or low shade. On the other hand, in the

North deciduous azaleas, as *roseum*, that bloom sparsely in woodland semi-shade, will develop a greatly increased number of flower buds when transferred to an open situation. Also some azaleas, as *atlanticum*, will at times be found growing in full sun, although they seem to do their best in a light filtered shade.

The average ratio of hours of sunshine to total day length varies among regions. At Philadelphia and San Francisco it will be 60 to 70% and in New England 50 to 60% in spring and summer. In the Seattle area it will be 40 to 50% spring and summer and in winter far less than the other areas named. Despite the greater length of day, actual hours of sunshine will run, April to October, from 14 to 43% less in Seattle than in Washington, D. C. A more open site in a region of less sunshine will afford the plant no more light than a more shaded setting in sunnier regions. A shaded setting is less desirable in the North than in the South. Most hardy azaleas do better in regions of greater sunshine and extremes of temperature than found in Great Britain and our Pacific Northwest.

#### WATER

Azalea species are native to areas where the annual rainfall averages at least 30 inches and usually higher—from 40 to 80 inches. The eastern United States (i.e., from the east coast to the line west of the Mississippi where the forested areas end and the prairie grass areas begin) and the Pacific Northwest qualify as to the annual amount. The eastern area has an annual rainfall of 40 to 50 inches and the northern portions frequently 50 to 60 inches. The Pacific Northwest has an annual rainfall of 32 to 52 inches, occasionally higher up to 80, or even 120,

inches in a few isolated areas at present unimportant for azalea growing. However, azaleas prefer regularity of rainfall to seasonal rainfall. In the eastern area the rainfall is in general uniform throughout the year; in the Pacific Northwest, most of it comes from October to April, some in May, June, and September with July and August quite dry.

Further, azaleas prefer a climate where relative humidity (i.e., the percentage of moisture possible in the air under the existing temperature and pressure conditions) runs high. Such humid and superhumid climates are found in the eastern area and the Pacific Northwest, the superhumid climates being almost entirely confined to the Pacific Northwest. Climate in terms of humidity reflects precipitation effectiveness—the residual amount of rain that becomes available for plant growth after runoff and evaporation. The Pacific Northwest not only has more rain but much greater amounts of it remain available for plant growth, keeping in mind, however, the offsetting factors that the rain is concentrated in the winter period and that there is less sunshine for growth functions.

**MOISTURE LOVING AZALEAS.** While their water requirements are high, azaleas at the same time require good drainage. Loss of plants is almost certain where flooding occurs, soils are waterlogged, the water table is too high, or stagnant water stands. Only *viscosum* requires a moist soil, and only a few others (all native deciduous azaleas, as *arborescens*, *austrinum*, *canadense*, *canescens*, *occidentale*, *prunifolium*, *serrulatum*, and *vaseyi*) seemingly prefer moist soils.

**SOIL, WATER AND AIR RELATIONSHIPS.** Both air and water must be available to roots. In the near absence of oxygen from air, roots cease to func-



tion. Azalea roots have a high air requirement. Soil particles decrease in size or increase in fineness from gravel through sand, silt, and clay, to peat. The soil water (actually dilute solution of soil nutrients) remaining after excess water has drained off by gravity, adheres as a film to soil particles. The finer the soil particles, the more particle surface per volume of soil and the more soil water film and the less air present in the soil. Good drainage is necessary to prevent loss of soil air, especially so where the soil is composed of finer particles. For sandy soils additions of peat and humus serve to increase the water holding capacity. The water available for absorption by roots in a coarse sandy soil may be 3 or 4% by weight of the soil, in a clay or clay loam 15 to 30%, in a muck or peat, 30 to 60%.

**USES OF WATER.** Azaleas require water in two ways. First, like other plants they are composed in large part of water. This is the water used to dissolve and combine with minerals from the soil and carbon dioxide from the air, to transport these nutrients within the plant, and to keep plant tissues turgid. By far the greater need for water is to replace that lost by transpiration or evaporation which occurs when the air immediately outside a leaf is less saturated with water (less humid) than the air in the leaf.

**WILTING.** When the water film around soil particles becomes so thin through depletion of soil water or so unavailable through soil freezing that the absorptive force of the roots can

obtain no more water from the soil, wilting occurs. There are many factors that retard wilting. Mulches reduce runoff during rains, evaporation from the soil, and freezing of the soil and thereby increase the amount of available soil water. Transpiration loss is less in a humid atmosphere. A wind-break minimizes the likelihood of air currents that would displace the humid air next to the leaves with drier air.

Temporary wilting may occur at midday when absorption of water by roots does not keep pace with transpiration of water by leaves.

Excess soil water also causes wilting by driving out air necessary to root functioning and thereby destroying roots, thus preventing adequate absorption of soil water. Yellowing of foliage and dwarfing of growth are also other symptoms of excess soil water.

Deciduous azaleas are especially sensitive to water relations, particularly shortages of water when new growth is active. It is then that grafted plants may display a "mosaic" type of chlorotic mottling of the leaves (similar to symptoms of a virus disease) along with an abrupt diminution of growth. This checking of growth prematurely induces the formation of unthrifty wood that subsequently appears to be susceptible to winter injury. Perhaps the graft-union inhibits the flow of water upward from the roots to the leaves, causing checked growth and increased liability to winter-killing. Similar effects may be observed on own-root plants when for other reasons the water supply is inadequate at the height of the growing season.

#### A BOOK ON SOILS

CHARLES E. KELLOGG, *OUR GARDEN SOILS*, The Macmillan Co., 1952, 232 pp. on soils, organic matter, mulches, fertilizers, water, and acidity by the chief of the Division of Soil Survey, U.S.D.A. Excellent for the amateur azalea gardener although dealing with plants generally.

## VIII. Azalea Soil and Mulches

Soil (and the air and water within it) is the plant's main source of moisture and nutrients. Soil is also an anchorage for the plant.

The best soil for azaleas is one in which native azaleas have grown well. Plants growing on a soil produce chemical and physical changes that make that soil more productive for such plants. The azaleas first planted in a soil that has not been growing azaleas, have a harder time than those that follow later. Perhaps a mycorrhizal factor is involved.

In general azaleas prefer a soil that has developed over the centuries in a humid region under a forest, rather than a grassland vegetation, even though a grassland soil will likely contain more organic matter. In a forest soil decomposing organic matter, as dead leaves, wood, insects, and fungi, forms organic acids. Rain becomes acid from the carbon dioxide of the air. On the other hand most trees feed lightly on calcium and other alkaline ingredients and so return little of them to the surface through the processes of growth, death, and decomposition. The acid water leaches through the portion of the soil occupied by plant roots and there is no substantial counteracting supply of calcium. The forest soil is consequently acid. Beeches and maples growing in a limestone region will, on the other hand, return enough calcium to the surface to keep the soil neutral.

In acid garden soils organic matter decomposes, goes into neutral solution, and leaches out of the top portion of the soil. Little organic matter is left behind eventually and the soil will not remain acid. To keep such a soil sufficiently acid for growth of azaleas, the supply of organic matter must be re-

newed regularly. A mulch affords such a supply. The possible alternative is the repeated use of minerals, such as sulphur, aluminum sulphate, and ferrous sulphate, that produce an acid reaction in combination with organic materials.

A mulch is obtained either through growing the plants under high shade and allowing natural leaf and wood fall to remain on the ground around the plants, or through adding mulching materials, or both. Many organic materials are used for mulches for azaleas, among them leaves, pine needles, sawdust, wood chips, wood shavings, excelsior, redwood fibre, oak tow, twigs, and bark; coarse peat moss; spent tanbark; acid muck; and ground or shredded crop rubbish such as corn-cobs, sugar cane stalks (bagasse), peanut hulls, tobacco stems, straw, cotton waste. Lawn grass clippings are not satisfactory because they pack down and decompose too quickly.

But a mulch has other important effects as well as maintaining soil acidity. It minimizes freezing of soil and plant wilting in winter and prevents untimely thawing in the spring. It creates humus and thereby favors water penetration into the soil and restricts runoff of rain water. It minimizes evaporation of soil moisture and wilting in the summer. It prevents tight packing of the soil, keeps it better aerated, and aggregates soil particles into larger sized particles. It reduces competing weed growth. It encourages mycorrhizae and other biological activity in the soil.

A mulch of 6 to 8 inches of oak leaves in the fall will decompose and mat down to 3 inches or so by spring. Chips, shavings, twigs, and bark de-

compose more slowly and do not mat down quickly.

Sawdust is one of the more readily available and cheaper materials for mulching azaleas. Sawdust varies in acidity: cypress, pH 3.5-3.9; yellow pine, spruce, white oak, black oak, and redwood, pH 4.1-5.0; blue beech, larch, red oak, white birch, sugar pine, maple, pin oak, Japanese larch, red pine, pH 5.1-6.0; and locust, elm, and hemlock, nearly neutral, pH 6.1-7.0. Use of sawdust produces a slight increase in acidity, but temporary in effect unless the mulch is renewed. The decomposition of sawdust, like leaves, pine needles, and other plant litter, is brought about by bacteria and fungi. They require a source of nitrogen that the sawdust, being low in nitrogen, does not supply. Accumulations of nitrates in the soil are therefore used up. This nitrogen depletion may last from one to three or four years depending on the amount and kind of sawdust used and its rate of decomposition. To offset this nitrogen depletion and make nitrogen available for the azaleas when using sawdust as a mulch, it is necessary to add about 150 lbs. of ammonium sulphate or 100 lbs. of ammonium nitrate per ton of fresh dry sawdust. This equals about 1.0 and 0.7 lbs., respectively, per bushel of such sawdust. Use of an organic fertilizer at the same time, as cotton seed meal or soy bean meal, facilitates bacterial action in breaking down the sawdust.

Sawdust is also low in phosphorus as well as nitrogen, and bacteria also use phosphorus while decomposing sawdust. Consequently, a small supple-

mental addition of superphosphate to the sawdust is needed as an offset to phosphorus depletion.

The more decomposed the sawdust, leaves, pine needles, or other plant litter, the more close it is to becoming humus and the less added fertilizer is required.

The humus formed from sawdust amounts to about 15 to 25% of the weight of the sawdust.

Lack of moisture and nutrients in the surface soil and a bare soil surface will result in azalea roots growing deep and long unless prevented by a hardpan layer or a high water table. Azalea roots require both oxygen and moisture. With abundant soil moisture the lower soil layers are low in oxygen; therefore the azalea root system grows and develops in top soil layers near the surface for they are better aerated. With low soil moisture, the soil layers have adequate oxygen; therefore the azalea root system does not grow and develop in the top soil layers which are too dry but in lower soil layers which have more moisture and at the same time are adequately aerated. Thus, azalea roots grow at whatever soil level both oxygen and moisture are found in proper balance.

In a deep, well dug bed, azalea roots may grow 15 to 18 inches deep. Usually, however, the azalea root system is rather shallow and composed of many fine rootlets close to the soil surface. Transplanting is therefore relatively easy. A mulch encourages this type of root growth. In general deciduous azaleas have a deeper, less compact root system than the evergreen azaleas.

## IX. Cultural Directions for the Azalea Gardener

These are the "Do's" and "Dont's" for growing azaleas. If you insist on knowing why, most of the reasons will be found in the preceding chapters. However, the growing of plants is still more of an art than a science.

These directions frequently refer to "organic matter." For present purposes this means (1) leaf mold (particularly under hardwood trees or conifers or acid soil shrubs) consisting of soil, roots, and partially decomposed leaves or pine needles, twigs, bark, and wood; (2) coarse and acid peat formed primarily from sphagnum moss, or heath family shrubs and trees, or reeds and sedges; (3) acid muck from swamps or streamsides; (4) sawdust, wood chips, wood shavings, redwood fibre, and oak tow; or (5) ground or shredded sugar cane stalks (bagasse), corncobs, peanut hulls, tobacco stems, and straw or cotton waste. If organic matter is mixed into the soil or added as a mulch it should be accompanied by use of a nitrogenous fertilizer that leaves an acid residue—or better yet two such fertilizers, one of which is organic and the other inorganic. For the inorganic fertilizer use, for example, around 150 lbs. of ammonium sulphate or 100 lbs. of ammonium nitrate per ton of fresh dry organic matter. The addition of the fertilizer is particularly important if the organic matter is rather fresh with little or no decomposition started.

1. ACQUISITION OF PLANTS.—a. Buy from established nurserymen, preferably those who specialize in azaleas. Do not take chances by buying from peddlers, temporary highway stands, department stores, or similar places. Usually their selection of species and varieties is poor, their plants are in bad condition from lack of adequate care or

mishandling, or their prices very high for the quality received.

b. Buy either plants with a ball of soil wrapped in bagging (burlap is commonly used) or plants that are potted. Exceptions are small plants obtained locally to be replanted immediately, and deciduous azaleas obtained in fall or spring when dormant and without leaves.

c. Examine ball of earth on plant. Plants with undisturbed root balls are best. Sometimes bare root deciduous azaleas are dipped in clay mud (puddled) before shipment. This is not a true ball of the soil in which the plant was grown although it protects roots from drying out. Puddled roots should have the clay washed off and be spread out when planted. If left in the clay ball when planted the roots will grow slowly or not at all. Sometimes potted plants are root bound. They have been held too long in too small a pot. When planting break up the ball a *little* and spread out the roots.

d. Small (6 to 18 inches) plants are as good to buy as larger plants (and sometimes are more vigorous) provided you give additional care to the smaller plants for the first two or three years. They need protection from animals and careless human feet and extra winter protection in cold areas by heavy mulching and applying lath or other broken shade. Some growers prevent winter injury of tender, young, small plants by covering them over in the fall before heavy frosts with cut honey-suckle vines, excelsior, or other organic matter that is light and airy and will not pack down. The covering is weighed down at the ground to prevent blowing away. It is removed when buds swell in the spring.

e. If you buy plants in the South

from petal blight areas, then on receipt of plants remove and destroy all flower buds showing color and the top inch from the ball of soil.

f. Keen amateurs who live or have the means of travelling in areas where azaleas grow in the wild may experience the urge to collect some of these plants for garden decoration. If relatively small plants are selected, if they are dug carefully, if they are kept continuously moist, and if they are pruned back severely (almost to the ground) after transplanting, a fair degree of success may be expected—never so good, however, as in the purchase of well grown nursery plants. The collection of wild plants, however, is a practice which should not be encouraged by anyone who has real sympathy with the outdoors, the cause of conservation, and the feelings and rights of his fellow men. A scattered plant from here and there over a wide collecting area makes little difference to the wild population in a group that regenerates as easily as azaleas usually do. Unhappily this kind of collecting has seldom been the rule. The record is already far too long of instances, particularly in the southern states, where some of the most outstanding, and usually rare, azalea populations have been wiped out in their entirety by estate owners who cared nothing about the total elimination of these plants in the wild. Over vast tracts of forest land, particularly in the Southern Appalachians, where private or even Federal forest ownership has cared nought for anything besides the production of marketing timber, once abundant azalea populations have been reduced almost to the vanishing point by collectors largely representing a few nursery interests. The situation is hard to understand in view of the fact that under proper management any nurseryman—or amateur—in a matter of two

or three years could grow one hundred times as many good, marketable plants from merely a bag or two of seed pods, leaving the wild plants wholly undisturbed.

2. TRANSPLANTATION.—a. Transplant deciduous azaleas only when without leaves. Transplant evergreen azaleas at any time, even when in full bloom, but preferably between early fall and late spring when the ground is not frozen, and not during hot, dry summer weather. Spring planting of plants at least three years old is preferred in mid-West. Do not transplant to northern gardens plants grown in warmer regions when there is danger of heavy frost before the plants can become reestablished. Transplanting in late spring or summer before flower buds have set, may lose next year's bloom.

b. Dig a hole large enough to accommodate the roots readily. Forget about holes two feet deep and four feet wide, with rocks or sand at bottom for drainage. Azalea roots know their way around any soil in which azaleas can be successfully grown and the strength of a root is much greater than that of your back. Of course, if your soil is unsuitable and you are replacing it (this is discussed a little further on), then the larger the hole, the greater the amount of suitable soil that can be used in filling and that will become available to the plant.

c. Soak the burlapped ball or bare roots for a short time before replanting if the plants have been shipped a considerable distance and look wilted.

d. Whether setting out a balled and burlapped plant, a bare root plant, or shifting a plant from nearby with a ball of soil but not burlapped, do not set a plant lower or higher than it was growing previously. Do not place soil over the ball, rather tuck it in firmly



Plate 33

Robert L. Taylor

INDIAN AZALEA cl. IVERYANA 3/4X



Plate 34

Robert L. Taylor

*Oldhami* (Oldham Azalea) 3/4×

around and under the ball or bare root. If you dig a deep hole and use a large amount of loose compost under the plant, it may settle 3 or 4 inches and the plant will then be too low. Use fine soil free of lumps to fill in around bare roots or ball of soil and make as good contact as possible with adjacent soil without compacting soil tightly. After the plant is properly set in the hole, water it both to wash in soil and eliminate air pockets and to moisten soil thoroughly at least to the level of the bottom of the root ball. Repeat after 4 or 5 days unless nature takes over the watering job with ample rains. It may be advisable with large plants temporarily to form a low circular ridge or dike on the surface of the soil around the roots to hold water in place. During the 2 or 3 weeks it may take for the plant to become adjusted to its new site, the soil around the roots should not be allowed to dry out.

e. It is preferable to shade plants with cloth, paper, lath, and the like until the first good rain after replanting.

f. Place mulch around plant.

g. As to planting distances, take your choice of—

Wide spacing of plants to permit full ultimate development. Such a planting will look bare and forlorn for years. Ultimate spread is only rarely known if you are talking in terms of a quarter century's growth.

Setting plants close together and permitting them to grow into a mass. This will look better at a distance but the individual plants will not develop to full size or symmetry. However, you will have a good massed effect at once.

Setting plants close together and transplanting and spacing them out once or twice as they grow older. This is perfection and more work, but after all azaleas transplant comparatively easily.

3. SOIL.—a. Use of existing soil is better than wholly or partially replacing it except in areas where soil is not sufficiently acid or where building operations have resulted in removal of the topsoil or in addition of trash or mortar or free lime. Mixing in one to six inches of organic matter is helpful if the soil is a light sandy or a heavy clay soil or is low in humus. Let the mixture settle a few weeks before planting. Some use sand, instead of humus, to mix into heavy clay soil. In limestone regions pure peat moss may be used instead of the existing soil or a high percentage of peat moss may be mixed into that soil.

b. Have an analysis of the soil made at your State Agricultural College or Experiment Station. If the soil tests above pH6, add sulphur about a month in advance of planting, with occasional watering, at the following rate for each  $\frac{1}{2}$  pH reduction in acidity: for a clay loam about 1.2 lbs. per 100 sq. ft.;  $\frac{2}{3}$  that for a sandy loam; and  $\frac{1}{3}$  that for a sand. Soil must be well drained. In addition use about a cup or  $\frac{1}{2}$  pint of ferrous sulphate per 100 sq. ft. Read over pages 107-8.

c. After the plant has become re-established add fertilizer to make up for mineral deficiencies in soil as shown by the analysis. Use the amounts recommended by the State Agricultural College or Experiment Station but be sure the fertilizers used are those with an acid residue. Repeat fertilization thereafter annually in early spring or before growing season starts. Read over chapter VII under the heading "Nutrition."

4. SITE—Plant azaleas—

a. In regions where there is at least 30 inches of rain a year and the soil solution reading is not higher than 6.5 pH. This assumes you are not interested in artificial growing conditions as irrigation and soil reconstruction.



b. In high shade, especially in the South.

c. In areas protected from winds by trees, hedges, or hills, not on an exposed hilltop.

d. On hillsides or level land rather than bottom of hill or ravine which is likely to be a frost pocket.

e. Where the soil is not a heavy clay or pure sand. However, added organic matter will correct these conditions.

f. Where there is good drainage and the soil is not waterlogged or subject to flooding.

5. **MULCHES.** Mulch plants heavily with organic matter and keep the mulch on them the year around. Maintain the leaf or other mulch about 3 inches deep even in summer, renewing it on top yearly as it decomposes underneath. Do not cultivate around azaleas with hoe, rake or other tools. Weeds that come through a mulch will be few. If it is necessary to remove the weeds, they can readily be pulled by hand.

6. **IRON CHLOROSIS.** If azalea foliage turns light green or yellow in the areas between the veins while the veins themselves remain green, deficiency or unavailability of iron is indicated. If the leaves turn yellow all over, and have brown tips and margins, a more complex kind of chlorosis is to be suspected and should be corrected by assuring good drainage and soil of proper texture and acidity. Iron chlorosis can be diagnosed—and temporarily cured—readily by spraying the foliage with iron (ferrous) sulphate solution made by dissolving one ounce of the chemical in one gallon of water. It is advisable to add a tablespoon of flour (soybean is best but wheat flour will do), first made into a thin paste, to improve the adherence of the spray. Apply in the late afternoon or evening so that the spray will dry slowly. If iron deficiency is the difficulty, an improvement in

color will be noticeable usually within a week. A second application may be necessary. If no improvement results try magnesium sulphate (Epsom salts) applied in the same way. Instead of spraying, you may apply these minerals to the soil at the rate of 1½ lbs. per 100 sq. ft. but the response will be slower. Graft-union trouble, resulting in impaired water supply in growing season, will simulate iron deficiency by producing a mosaic type of chlorosis.

7. **PRUNING.** Do not prune except (a) to cut out dead or dying wood or remove branches that obstruct walks or driveways. (b) to obtain from older plants flowering branches for decorative use inside the house (azaleas are excellent cut flowers), (c) to thicken up the plant and increase bloom the way a florist does by cutting back branches and new shoots a few inches in early summer, or (d) to make a compact, rather than an irregular and open, azalea head. To accomplish this latter a few of the heavier canes can be cut almost to the ground. They will be replaced by strong basal shoots that will thicken the plant and at the same time provide an abundant supply of heavy flower clusters.

Some deciduous azaleas, notably Mollis and Ghent Hybrids, will do better if older wood is removed as soon as it looks unthrifty, in order to encourage vigorous new growth from the base. When wood becomes old and hard, distribution of plant food is reduced, and the wood becomes unthrifty and more susceptible to winter injury. By always maintaining at least a few good vigorous young shoots on the plant, its life may be insured. This is especially important in cold, northern regions where hardy deciduous azaleas, if vigorous, will endure temperatures of  $-30^{\circ}\text{F}$ . It is the unthrifty wood that always dies first.

N.B. Few rules are 100% sound. Violate any of the above you choose if you know you have green fingers and toes as well as a green thumb. On the other hand, if you are a beginner, see if you can find someone in your own neighborhood who has already grown azaleas with success. His garden will show you what to do more quickly than any amount of reading. Watch for one

year noting the time of the periods of top growth. Immediately preceding such periods are the ideal times for planting new bushes. Remember that any newly transplanted plant has suffered amputations in its feeding system and will need more care for the next year than an old plant. A plant is not a piece of furniture that you move about casually.



Plate 35

Edgar T. Wherry

*Arborescens* (Sweet Azalea)

## X. Azalea Enemies

The present or prospective azalea grower should not approach this chapter as he would a chamber of horrors. It aims only to be helpful in the event of actual or threatened trouble due to the inroads of other organisms than man which have found azaleas somehow to their liking. Hardly any azalea gardener is fortunate enough to escape all depredations of pests, since some of them, like red spider and lacebugs, are all but universal. On the other hand, probably none is so unlucky as to fall victim to all or even most of the azalea enemies here described at any one time. The azalea, when compared with the great majority of garden ornamentals, is pre-eminently a trouble-free plant, given only its natural preferences as to soil and atmospheric conditions. Ordinarily it requires nowhere near the frequent attention to pest control that some other garden plants require—the rose, for instance, however estimable it otherwise may be. Therefore, this chapter should be read only to be forewarned but not dismayed. It should be a guide and help and not place one in a state of mind of expecting difficulties. Azaleas can and should be grown for enjoyment.

A few general observations — the lacebug attacks mainly evergreen azaleas grown in the sun. Azaleas grown in high shade in a soil with adequate humus and mulch rarely suffer extensively from lacebug, or for that matter, from the Japanese beetle. The white fly is apparently limited to *mucronatum* and related Ryukyu species and their progeny although a heavy infestation may spill over into other nearby species and varieties but the insects will not breed on them. Moisture and shade discourage the red spider. Flower

blight is serious but, fortunately for many of us, is confined in general to the warmer southern areas. Leaf gall is shocking in appearance but of little importance. Infective wilt is rare. Further, years vary in the intensity and prevalence of a particular insect pest or disease. Finally, do not confuse winter injury that causes the death of plants during the following late spring or summer, lack of adequate moisture, or chlorosis or other nutritional disturbances with insect or disease injuries.

### INSECT PESTS

LACEBUG: Probably the most common azalea insect injury is from the azalea lacebug, *Stephanitis pyrioides* Scott, see page 125. This is a small insect, about 3/16 inch in length, and has gauze-like reticulated wings marked brown and black. Despite its wings the lacebug does little or no flying. It feeds gregariously on the undersurface of the leaves. The groups of lacebugs destroy chlorophyll in the leaf, produce a spotted, grayish discoloration on the upper surface of the leaves, and spot the under surface of the leaf with excrement. In severe attacks the leaves may turn almost white, then brown, and late in the season they may drop off. When there is a heavy attack, the plants are useless as foliage plants and the flowering capacity of the plants is reduced for the following year. The eggs are bottle-shaped and are deposited along the larger leaf veins on the underside. All of the eggs on any leaf hatch at approximately the same time and the young feed together in a group until they are fully grown. The female that deposits the eggs usually remains with her brood until they have become

adults. There are five nymphal stages in each brood and normally three broods per year. The insects live over winter in the egg stage.

In the Pacific Northwest the rhododendron lacebug, *Stephanitis rhododendri* Horv., which attacks azaleas, is found instead of the azalea lacebug.

**RED SPIDER:** The two-spotted mite or red spider, *Tetranychus bimaculatus* L., is a mite, not a true insect. It also feeds on the under surface of the leaves. The mites live over winter in the egg stage and start their activities very early in the season. Consequently, it is necessary to use a spray before the blossoms come out. In warm dry weather the red spider multiplies enormously and does a tremendous amount of damage to the foliage. The damage appears first as small white stippling on the upper surface of the leaves, and as the numbers of mites increase, the damaged spots coalesce. Even in the absence of damage from the lacebug, plants that are heavily infested with red spider may turn light brown by the first of August. The mites are such general feeders that most cultivated azalea plants in the sun are likely to have an infestation at times. The mites are microscopic when first hatched from a small glistening egg. Sometimes the mites are light green or they may go through an entire range of color up to brick-red individuals. As they become more numerous, they spin minute webs on the under surface of the leaves under which the eggs are deposited and many of their activities occur. This web makes it essential that strong spray pressure be used in any attempt to control heavy infestations.

**WHITE FLY:** The azalea white fly, *Aleyrodes azaleae*, D. & M., injures *mucronatum* (*indica alba*) and related Ryukyu species and their de-

rivatives. It is rarely injurious to the Kurumes. The insects may build up to large populations in late summer. They secrete honey dew upon which a black fungus grows and the combined feeding on plant juices and interference with the photosynthetic function of the leaves by the coating of black fungus may reduce very materially the growth and the subsequent flowering. The adults are winged, about  $\frac{1}{8}$  inch in length, completely white, and fly about when disturbed. The eggs are microscopic and the nymphs remain fixed in position on the under surface of the leaves.

In the Pacific Northwest the rhododendron whitefly, *Dialeurodes chittendeni* Laing, which attacks azaleas, is found instead of the azalea whitefly.

**LEAF ROLLER OR MINER:** There is one leaf roller that is quite injurious at times to azaleas. This is an imported species that folds over the edge of the leaf or mines within the two surfaces of the leaf leaving a brown blister. The adult is a small moth, *Gracilaria azaleella*, Brants. This is primarily a greenhouse pest but may be carried into the field and can readily become established outdoors. Its damage is in reducing the feeding surface of the leaves. It makes the plants very unsightly.

**SOFT SCALES:** Two scale insects that are of major importance are recorded from various places in Maryland and southward, and are probably distributed throughout areas of azalea cultivation in the East. In several instances these pests have been extremely injurious.

One of these scale insects is the azalea bark louse or mealybug, *Eriococcus azaleae* Comst., see page 125. This insect winters in the South mainly in a nymphal stage and probably the same is true in the more northern areas. The

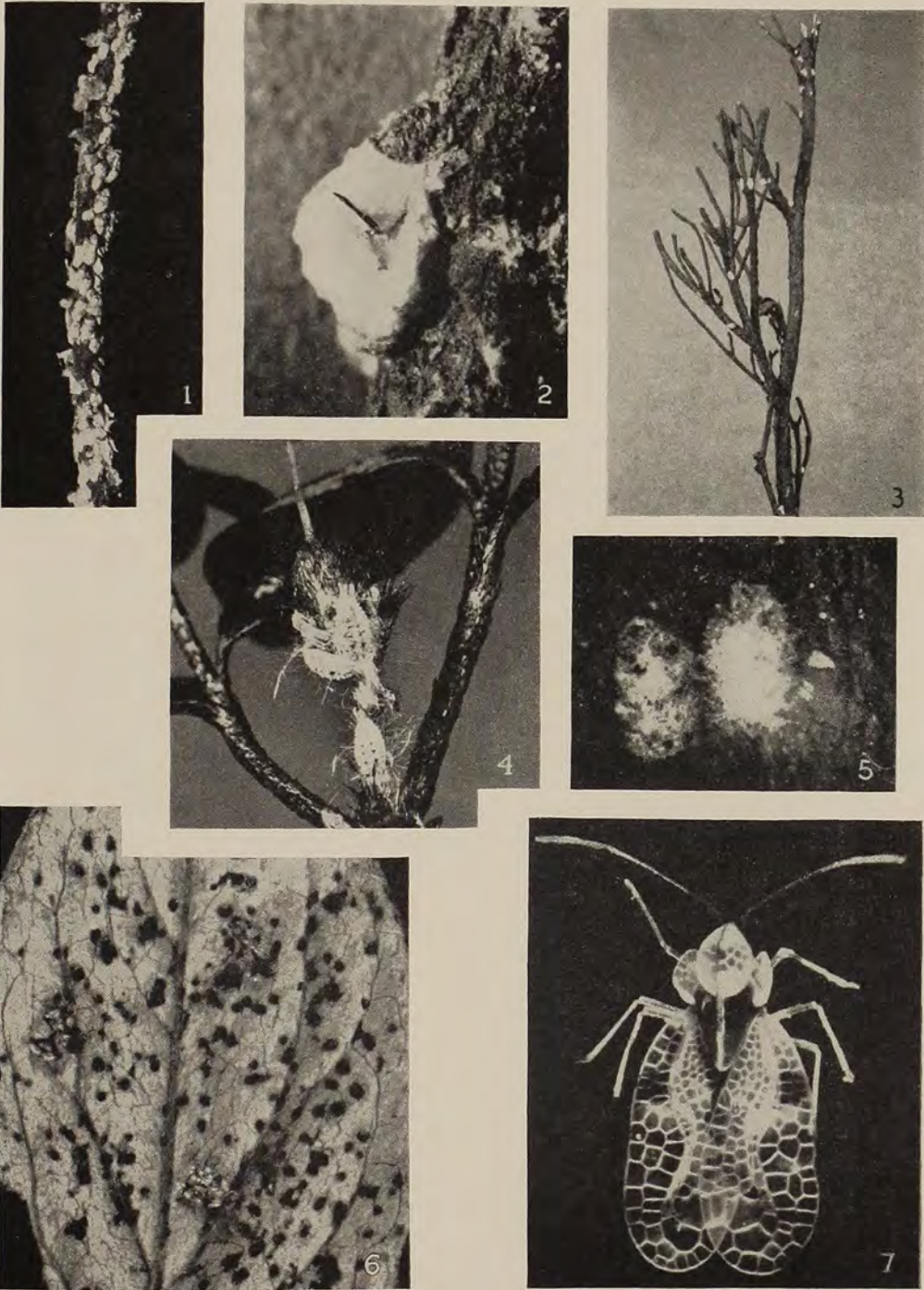


Plate 36

AZALEA PESTS

Fig. 1: Soft scale (*Pulvinaria ericicola*) on twig; reduced approximately 1/2. Fig. 2: Same, old female scale and egg sac; greatly enlarged. Fig. 3: Bark louse, general appearance on dead or dying twigs; greatly reduced. Fig. 4: Same, mature female scales, approximately life size. Fig. 5: Same, egg sacs; enlarged about 4 times. Fig. 6: Lace bug and excrement spots on under side of leaf; enlarged about 4 times. Fig. 7: Same, adult insect; greatly enlarged.

female produces a cottony sac under which the eggs are deposited. The exhausted female dies within the sac and as the young hatch they emerge and establish themselves on the twigs and leaves. The old and empty sacs remain on the twigs for some time. The nymphs gradually increase in size and produce long waxy filaments that partially cover the insect's body. Most of the nymphs become established in the axil of the twigs or leaves. When they become mature the waxy filaments become matted to form the egg sac. The nymphs might be overlooked in a slight infestation but the old egg sacs, white and  $\frac{1}{8}$ " long, are readily seen. The plants gradually become unthrifty and ragged in appearance.

The other soft scale insect is *Pulvinaria ericicola* McConnell, see page 125. This insect was described from specimens collected upon the native species *nudiflorum*. It has also been taken on *viscosum* in the woods and on Mollis Hybrids, Kaempferi Hybrids, and Kurumes in cultivation. It is usually found near the base of the plant but in heavy infestations the prominent white egg sacs may be so numerous along the stems as to make these appear white along the entire aerial portion. The egg sac is  $\frac{1}{4}$  to  $\frac{3}{8}$  inch long. These scales overwinter as fertile, but not fully grown, females. Formation of the ovisac and egg production begins in June. The young establish themselves on the twigs. There is only one generation per year.

**PEONY SCALE:** This scale, *Pseudonidia paeoniae* Ckll., is common in the South and has been found occasionally as far north as Washington, D. C. It infests the small twigs and sometimes larger branches up to a half inch or more thick. As a result the foliage becomes thin and twigs and entire branches may be killed. The

hairy outer bark of the twigs often overgrows the scale, more or less concealing it, but producing a globular swelling or nodule about  $\frac{1}{10}$  inch in diameter. Badly infested twigs have a bumpy appearance. If the nodules are carefully lifted the purple sac-like body of the female scale may be seen, and when the old scale coverings are sloughed off a white waxy layer is exposed which readily distinguishes this scale. Eggs are deposited underneath the scale and remain over winter. Hatching occurs from late March to early May, producing young crawlers which migrate to other twigs, there to settle down and feed meanwhile secreting a new covering. There is only one brood each year.

**BLACK VINE WEEVIL:** This insect, *Brachyrhinus sulcatus* S., has numerous hosts but extensive damage to azaleas is limited mainly to the Pacific Northwest. It is a glistening black snout beetle about  $\frac{2}{5}$  inch in length. The hard wing covers are marked lengthwise with furrows. Most of the damage is done by the larvae, small dirty white grubs with brown heads that feed on the roots. At their largest they are about a half inch long. However, the beetles may eat out round notches in leaves and girdle bark near the base of a twig or stem. The weevils overwinter mostly as nearly mature larvae. The adults appear about the middle of June.

A similar beetle, the strawberry weevil, *Brachyrhinus ovatus* L., also damages azaleas in the Pacific Northwest.

**STEM BORER:** This is the larva of a beetle, *Obera myops* Hald, that girdles the tips of azaleas, other rhododendrons, and mountain laurel. The beetle places an egg below the girdle. The larva that hatches from the egg is a grub. It bores downward expelling frass or sawdust from holes along the

twig. It continues down into the roots and may cut off some branches near the ground. The larva is yellowish and about one inch long when growth is complete. Cutting infested twigs below the point reached by the larva is recommended. The cuttings should be burned.

#### CONTROL OF INSECT PESTS

All azaleas that suffer substantially from foliage infesting pests, as lacebug, red spider, white fly, or leaf roller or miner, should be sprayed in the spring as soon as the threat of over-night freezing has passed and before any plants have blossomed. The best material for this purpose is two teaspoonfuls of Tetraethyl pyrophosphate to one gallon of water. The insecticide Hexaethyl tetrphosphate is sometimes sold under various trade names and contains Tetraethyl pyrophosphate. See the "Caution" below. A second spray, using the same material at the same dilution, should be applied immediately after blooming. This will be around June 15. About July 5 a third spray should be applied using three table-spoonfuls of 25% DDT emulsion to one gallon of water. A fourth application may be desirable about the first week in August, consisting of the same material and amounts as used in the third spray. All sprays must be directed towards the underside of the leaves. A fine forceful mist is most desirable.

The important point is to prevent the buildup of red spider by applying a spray prior to blossoming. It is during the long period of blossoming that insects and other pests tend to multiply. A first application after the blossoming seldom gives satisfactory control.

**CAUTION: Hexaethyl tetrphosphate and Tetraethyl pyrophosphate are extremely poisonous and all of the**

**directions given upon the container should be followed explicitly. In general, keep out of the drift of the spray and use care in preparing the material that none is spilled on the bare skin. If any is spilled on the hands, wash it off promptly. These two materials disappear from the plant within 24 hours, so there is no residue problem.**

Some gardeners may be averse to using sprays which, though highly efficient, involve some hazard to the user or to birds and pets that may come in contact with recently sprayed plants. Red spiders and other mites have long been among the most difficult pests to control, and special materials have had to be devised for their destruction. Some of the recently introduced ones that show much promise and offer little or no hazard to the user are Aramite, a product of the United States Rubber Co., and Ovotran, produced by the Dow Chemical Co. Still others are in the process of development; it is impracticable to mention them all. If an unfamiliar preparation is specifically claimed by the manufacturer to control mites and be non-hazardous to persons, it may well be worth a trial, and of course the manufacturer's directions for its use should be followed explicitly. It should be remembered, however, that such materials as DDT, methoxychlor, and benzene hexachloride, as well as all the familiar older insecticides such as nicotine, pyrethrum, and rotenone, have little or no effect on mites. Trade products that depend on these ingredients to control spider mites should be regarded with skepticism.

In the event that the ethyl phosphate compounds are not used for the control of spider mites and at the same time for the control of white flies, the DDT emulsion, as recommended for the control of lacebugs, can be im-

proved for white fly control by adding one or two teaspoonfuls of Black Leaf 40 per gallon of spray. This should be used at once, and not allowed to stand around before applying.

A consultant from Georgia states that the best formula for early spraying against lacebug and red spider, under conditions prevailing there, is Florida Volck paste emulsion 1 to 100, to which is added Isotox wettable No. 250 (containing lindane)  $\frac{1}{2}$  pound to 50 gallons. The Volck is said to be effective against both lacebug and red spider, while the Isotox, besides adding to the effectiveness on lacebugs, also controls various chewing insects, under favorable conditions having a 30 day residual effect.

To control the two soft scale insects or the peony scale it is necessary to make a separate application of 2% Volck Oil or any other summer oil. These oils are usually made from "Superior" oil and are safe for summer use if so claimed on the label. The bushes must be completely covered by the spray and some excess allowed to run down around the base of the plants as one of the scales shows a tendency to go below the accumulation of loose humus and soil at the crown. High pressure is most desirable, in fact, almost necessary, to get a high percentage of kill. It will usually require one person to open up the plant so that the second person operating the spray gun or nozzle can be sure of securing complete coverage of all the stems.

In the Washington, D. C., area this spray should be put on from July 15 to August 1 for the two soft scale insects. Egg hatching will not be complete before July 15 and the established young are quite likely to be resistant to sprays after August 1. Efficient control of the peony scale also depends on proper timing of the application; it

must be made soon after hatching begins and before the crawlers have settled down and begun to secrete new coverings. In the South this period is from mid-April to early May. Two applications of summer oil may be necessary if the migration of the crawlers is prolonged.

The vine weevil and the strawberry weevil are difficult to control. The best material available is an apple chip bait with about 3% sodium fluosilicate as the active ingredient. It is sold under the name of Go West. Some success has been achieved with the ordinary bran mash with soaked raisins added as the attractant.

Recent investigations on the control of these weevils, chiefly in relation to their occurrence on other host plants but including also experiments on rhododendrons, have shown great promise of the new insecticides technically known as the chlorinated hydrocarbons. Most important in this connection among these are chlordane, lindane, and most recently aldrin. They are used as dust applications to the soil surface and are carried into the soil by leaching and diffusion. They are effective in phenomenally low concentrations, especially aldrin, of which only a pound or two of toxicant per acre is required. As the experimental work on these materials is still in an early stage no specific recommendations as to dosage are attempted here, but azalea gardeners are urged to get the latest available information from their local agricultural experiment station.

**RABBIT INJURY:** Some azalea growers stoutly maintain that rabbits are a disease, others equally denounce them as pests. Growers differ also as to appropriate means of preventing "rabbit injury." Perhaps the surest method is to enclose the garden in a rabbit-proof fence. Some have found that a token



barrier, such as a cord or wire strung on stakes about 6 inches above the ground will deter them. A more positive barrier can be made of poultry netting 18 inches high, obtained by dividing the 36 inch height lengthwise and turning up about 1 inch of the cut edge. This is attached to low stakes with the selvage at the ground level and the bent top edge directed outward (but you had better carry nylon insurance when lady visitors come to inspect your azalea garden). Doubtless some of the new synthetic chemicals that are being developed for agricultural purposes will prove to be rabbit repellants. A lime-sulphur dormant spray should at least make azaleas distasteful to rabbits, and is inimical to overwintering insects and their eggs. Furthermore, azaleas are quite tolerant of it when they are fully dormant. The spray should not be used stronger than 1 to 30 (dilution of liquid lime-sulphur by volume) on evergreen azaleas. Dusting sulphur, applied by means of a dust gun, or merely shaken from a cheesecloth bag over small plants, would probably serve a similar purpose, and can be applied safely at any time except in very warm weather.

## DISEASES

**FLOWER BLIGHT:** Without doubt the foremost threat to uninhibited enjoyment of azaleas is the flower blight caused by the fungus, *Ovulinia azaleae*. With seemingly deliberate malevolence this disease attacks and quickly destroys the flowers alone, leaving the rest of the plant unscathed. No matter how favorable the cultural conditions, or how successfully other pests and difficulties have been overcome throughout the year, let the flowering season for azaleas be attended with suitable weather conditions for this disease and it is capable of ruining within

a few days the finest floral display of azaleas that can be achieved. See Plate 37 on page 130.

The fungus is an immigrant from Asia, and came to the United States soon after the introduction of the modern Kurume azaleas in the early 1920's. It burst out conspicuously and destructively at Charleston, S. C., in 1932, but had probably been building up unnoticed for several previous years. Now it has spread through most of the region where the Indian and other large-flowered evergreen azaleas have long been popular, especially the southeastern coastal plain from North Carolina to Florida. There are outlying centers of infection in Norfolk, Va., Washington, D. C., Houston, Tex., and Los Angeles, Calif. Practically all types of azaleas are susceptible to some degree, but the large-flowered kinds, especially the Indian Azaleas and the Belgian and the Mollis Hybrids are most conspicuously damaged. Some of the Kurume azaleas escape severe effects of the disease, perhaps because of the small flowers and early blooming season; others are as badly damaged as the large-flowered kinds. The native azaleas of the Luteum Subseries are less susceptible, or at any rate not conspicuously affected, but this is related in part to their sparser blooming habit.

The disease has been variously called flower spot, petal blight, and limp blight; in different stages it is all of these. Starting with a small fleck on the corolla, indistinguishable then from the punctures and scratches made by clambering bees, the flower-blight lesion enlarges rapidly when the temperature is within the range 60° to 80°F., especially if the flower is moist with dew, and overnight becomes a soft blister. In another day or two the entire corolla is transformed to a soggy

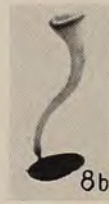
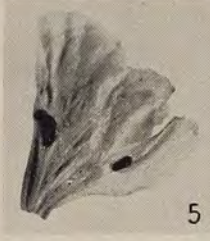


Plate 37

AZALEA DISEASES

Figs. 1-8, 10: stages of flower spot caused by *Ovulinia azaleae*. (1) Dark (rust-colored) spots on white flower; (2, 3) pale spots on buds and flower of colored variety; (4) petal blighted stage; (5) sclerotial stage; (6) blighted flower cluster, sclerotial stage starting in 7; (8a, b) two stages in growth of fruit body from overwintered sclerotium (enlarged); (10) shriveled flowers with sclerotia persisting on twig. (9) Leaf spot caused by *Septoria azaleae*. (11) Leaf gall caused by *Exobasidium vaccinii* on *nudiflorum*.

shapeless mass, which eventually dries up on the twig and lacks even the decency to drop off and get out of view. In the meantime the fungus has provided for its own dispersal and survival. It has done this, first, by producing thousands of spores on the blighted corolla, which can be carried by wind and the splashing of rain to adjacent flowers, or by flower-visiting insects to distant azaleas, perhaps a mile or more away. In the second place the fungus survives by developing in the disintegrating flower tissue one or more black, seedlike bodies that drop to the ground and rest there until the approach of another azalea flowering season. Then, closely timed to conform to the period of azalea bloom, each resting body produces one to several tiny stalks bearing a terminal cup, in which a different type of spore is produced. This spore is adapted to forceful expulsion so that it can be shot into the air and reach azalea flowers. When this contact is made under suitable weather conditions, the spore produces a fleck infection, similar to that with which this account started. This completes the primary cycle of the disease. Thereafter, the secondary or repeating cycle ensues as already described.

Control of the disease consists primarily in covering the azalea flowers as soon as they begin to open with a fungicide capable of killing the mass of young *Ozulinia* threads (mycelium) that grow from any spores happening to light on the flowers. The earlier this is done the better, since there are relatively few spores produced from the resting bodies in the primary phase of the disease, but they multiply many thousand-fold once a few flowers become infected and the secondary cycle begins.

A fungicide adapted to flower application must first meet the requirement

that it leave no unsightly residue, next that it spread evenly over a surface that is difficult to wet, and last that it causes no direct injury to the flower tissue that is much more delicate than the leaf tissue upon which sprays are ordinarily used. An ideal fungicide for this purpose has not yet been attained. The best available one is Dithane D-14, made by the Rohm & Haas Co. of Philadelphia, Pa. This is sold in a complete packet with certain necessary accessories for spraying azaleas, and the use of this package insures the correct ingredients and proportions. One can also obtain Dithane by itself and supply the accessories from other sources. A satisfactory formulation is Dithane  $1\frac{1}{3}$  quarts, zinc sulphate (25%) 1 pound, hydrated lime  $\frac{1}{2}$  pound, and Triton B 1956 1 ounce or Dreft 4 ounces, per 100 gallons of water. For 3 gallons of spray the corresponding amounts are Dithane 3 tablespoonfuls, zinc sulphate  $\frac{1}{2}$  ounce, lime  $\frac{1}{4}$  ounce, Triton B 1956  $\frac{1}{8}$  teaspoonful, Dreft  $\frac{1}{2}$  teaspoonful. The ingredients must be mixed in the order given.

Applications of the spray must be repeated often enough to keep all flowers covered as soon as they open. A fine light mist must be maintained, and heavy drenching avoided. Early in the flower season two sprayings a week may be adequate; but as the flowers begin to open more rapidly, this must be increased to three applications a week, and, if a rain immediately intervenes, the application should be repeated. In small plantings picking and destruction by burning of infected flowers is of material aid in hindering spread of the disease and production of the resting stage of the fungus, but this soon becomes an impossible task in large azalea gardens. Recovering azalea beds with a fresh mulch of sawdust, leaves, or similar material just before

flowering begins may serve at least in part to "blanket" down the resting bodies of the fungus, and hinder their discharge of spores, but this is only an expedient for small gardens and isolated plantings. Protection of new flowers by spraying is by far the most successful control thus far found.

**LEAF GALL:** In comparison with the menacing flower blight other azalea diseases (as distinguished from damage by various insect pests) are minor troubles. There is, to be sure, the azalea leaf gall caused by the fungus *Exobasidium vaccinii*, which is troublesome in wet seasons and to particularly susceptible varieties. Sometimes entire shoots and flower parts are similarly deformed, making a sort of cockscomb excrescence. Although the fungus and its relation to the disease have been known for many years, there are important gaps in the knowledge of its course in nature, for example, where and how it overwinters, and whether the race that attacks azaleas is the same as that or those found on various azalea relatives such as "true" rhododendrons and blueberries. See Plate 37 on page 130.

The galls appear with the growth of new leaves in late spring, and a layer of spores appearing like the "bloom" on some kinds of leaves and fruit is borne on their surface. These spores can infect other young and succulent foliage, but not mature leaves. The fungus does not appear to be systemic, that is, perennial from year to year within the tissues of particular twigs or plants. Though there is but little experimental basis for recommendations, it appears that copper fungicides afford adequate protection. A weak Bordeaux mixture with a minimum of lime (3 or 4 ounces of copper sulphate or bluestone, and 2 ounces of hydrated lime to 3 gallons of water) or equiva-

lent commercial preparations may be used. From 1 to 3 applications during the period of leaf growth, depending on the amount of rain, should be adequate for any ordinary situation. For most small gardens the simplest procedure is to pick off the deformed parts and burn or otherwise destroy them.

**OTHER DISEASES** There are a few leaf-spotting fungi that attack azaleas but they develop for the most part on the full-grown leaves and after these have overwintered and are nearly ready to fall. Young leaves are rarely attacked, at least under outdoor conditions, although leaf spots sometimes become troublesome in greenhouse culture of azaleas. As a rule, leaf spots are not important enough on garden-grown azaleas to require special control measures, but should more serious indications develop, especially an attack upon young and developing leaves, the spray treatment prescribed for leaf gall should give adequate protection. See Plate 37 on page 130.

Some additional, usually minor, diseases of azaleas have been recorded. A form of branch gall, quite distinct from leaf gall, has been found on azaleas that is very suggestive of crown gall or cane gall on certain other shrubs, but whether the branch gall on azaleas is caused by a tumor-inciting species of bacteria is unknown. Galled canes are unproductive and short lived. Any such abnormality should be promptly excised. If it reappears on other branches, this means the disease is systemic and the plant should be destroyed.

The branches or main trunks of azaleas sometimes "wilt" suddenly or show a progressive decline and loss of vitality from the top down. The wood of such branches becomes extraordinarily hard, and the bark often shows fur-

rows or depressions; the interior turns a dark brown. The disease has been aptly called "hardening of the arteries," because it appears that the vascular, or water- and food-conducting elements, are impaired, but the precise cause is not known. Affected plants can sometimes be regenerated by pruning, but usually are doomed and should be destroyed.

**FROST DAMAGE:** Azalea flowers are often damaged by late frosts, or by prolonged wet chilly weather, and then turn brown and collapse somewhat like those attacked by flower blight. An important difference in symptoms is that frost-damaged flowers remain co-

hesive, their tissue is moist but tough, whereas those attacked by *Ovulinia* disintegrate to slime or liquid when they are squeezed between the fingers. Frost-injured flowers are often attacked by molds, especially the gray mold, *Botrytis*. This mold forms black resting bodies somewhat resembling those of *Ovulinia*, but smaller, roundish, and rough in appearance instead of flat and smooth. Furthermore, the spore-bearing stage is distinguished by the coarse brownish-gray threads and powdery spores as seen with a hand lens. It attacks only fading and injured flowers, and requires no special efforts to control.



Plate 38

Edgar T. Wherry

*Atlantimum* (Atlantic Azalea)

## XI. Propagation of Azaleas

The propagation of azaleas involves no procedures that are different from those to be found in the propagation of any other shrub of which there are both species and horticultural clones in cultivation. The differences lie chiefly in details of management.

### SEED

Seed of many azalea species can be purchased from dealers in tree and shrub seed. One may gather seed from his own bushes if they are old enough. The capsules will be plainly visible by midsummer and should be watched from then on for the best time for harvesting. In the South this will come soon after the capsules have first turned brown, sometimes as early as late August; in the North, it usually comes about the time of the first frosts. If there is any doubt, gather the capsules as soon as they are dark brown in color and store at room temperatures in any container that will not allow the seed to spill. When dry the capsule opens spreading the five locules away from the central column and allowing the seed to scatter out. As many as 500 seed may be had in one capsule.

All species can be raised from seed. When the seed parents are both of the same species, the resulting seedlings will show only the range of variation natural to that species. Where the seed parents are of different species, or one or both are hybrids, the plants will not duplicate the parents except in a few cases where a variety of a species or hybrid has been inbred so long that it is as fixed as in an annual. This is said to be the case for such plants as Mollis Hybrid strain J. C. Van Tol.

The easiest method to use is the

well known "sphagnum moss" method in which the seed is sown on a thin surface layer of  $\frac{1}{4}$ " or so of screened sphagnum moss which may cover a pot or flat filled either with chopped and packed sphagnum moss or with a soil mixture usual for azaleas. This latter should be acid in reaction (the exact pH is of no great importance) with enough sand added to make it drain perfectly and enough humus added so that the mixture will maintain a uniform degree of moisture without much attention. The former argument for the use of the soil layer, that in case of delays in transplanting the seedling roots could reach a nourishing layer, is no longer valid since flats have been kept with untransplanted seedlings in pure sphagnum for over two years without feeding. Sphagnum is sterile, at least with reference to ordinary plant disease organisms, and use of it does away with any need of seed disinfection.

Sowings should be made at any time convenient to the worker provided only that he can keep the young seedlings in active and continuous growth for as long a period of time as possible before a winter season. Under greenhouse conditions mid-February is preferred, with night temperature of 55° and day temperature of 72°F. Under unheated greenhouse or cold frame conditions mid-April is preferred for sowing.

Depending on the species and the freshness of the seed, germination takes place in two to six weeks. In only extremely rare cases is there a scattered germination the second spring after sowing. Usually germination is complete within a month.

In either routine the pots or flats are well watered before sowing and the surface covered with a pane of glass and a screen to shade them until germination takes place. The amount of shade given by one thickness of newsprint is adequate. Watering is always given by placing the flat or pot in a pan of water but if the original preparations were correct no watering will be needed for a period of four to six weeks.

Transplanting can commence according to the skill and facilities of the worker either with the first seedling leaves under greenhouse conditions or later with the development of several true leaves. The soil in transplant flats should be that for fully grown azaleas with the addition of enough coarse sand to insure swift drainage. Spacing can be determined by convenience, — closely spaced plants if they can be retransplanted as necessary or widely spaced (minimum 3 inches each way) if they are to remain in place for a year. The usual precautions of shading and moist atmosphere are given the transplants.

For a second transplanting under glass the first year it is usually possible to cut between the rows and between the plants in the row and lift out the plants with a block of soil filled with roots. These can be placed in pots or beds, with less risk of losses in the latter. If feasible the plants should have a winter protection comparable to that of a cold frame.

Transplanting to nursery beds can be carried out the following spring for deciduous kinds and throughout the entire following spring and summer for evergreen and semi-evergreen sorts, except when the flush of new growth is soft. Even then it is possible if one can spare time and give adequate care in watering and shading.

If the plants are kept growing under greenhouse conditions they can be brought into bloom in about 14 months for evergreen species, but much longer for deciduous sorts, even up to four years. Under outside conditions all types will give some bloom the third spring and general bloom the fourth, although some deciduous species will be even slower.

In the nursery beds as in greenhouse beds, the plants should be kept in active growth as long as possible within periods of safety from frosts. There should be a minimum of six weeks in which growth is not encouraged before the known average date of first frost. Winterkilling of seedling tops often does not kill the plant for many new shoots will arise from the base and make an excellent plant before another winter season.

If you are working in a region where the water is hard, use rain-water or distilled water for the watering of azalea seedlings or cuttings, as alkaline salts will gradually build up in your seed-pots and ultimately ruin the acidity of the soil if hard water is used. In some areas the water is so hard that such injury will occur after only a few waterings.

#### CUTTINGS

Under ordinary conditions and facilities, the generalization that all evergreen sorts will root as cuttings and the deciduous sorts will not, may be accepted. Most of the deciduous species have been rooted as cuttings under very carefully controlled conditions, but usually in percentages that would not be economically sound for the commercial grower. A few deciduous species, such as *atlanticum* and *arborescens*, will root more readily from cuttings than the others, but in order to make them grow on, the rooted cut-

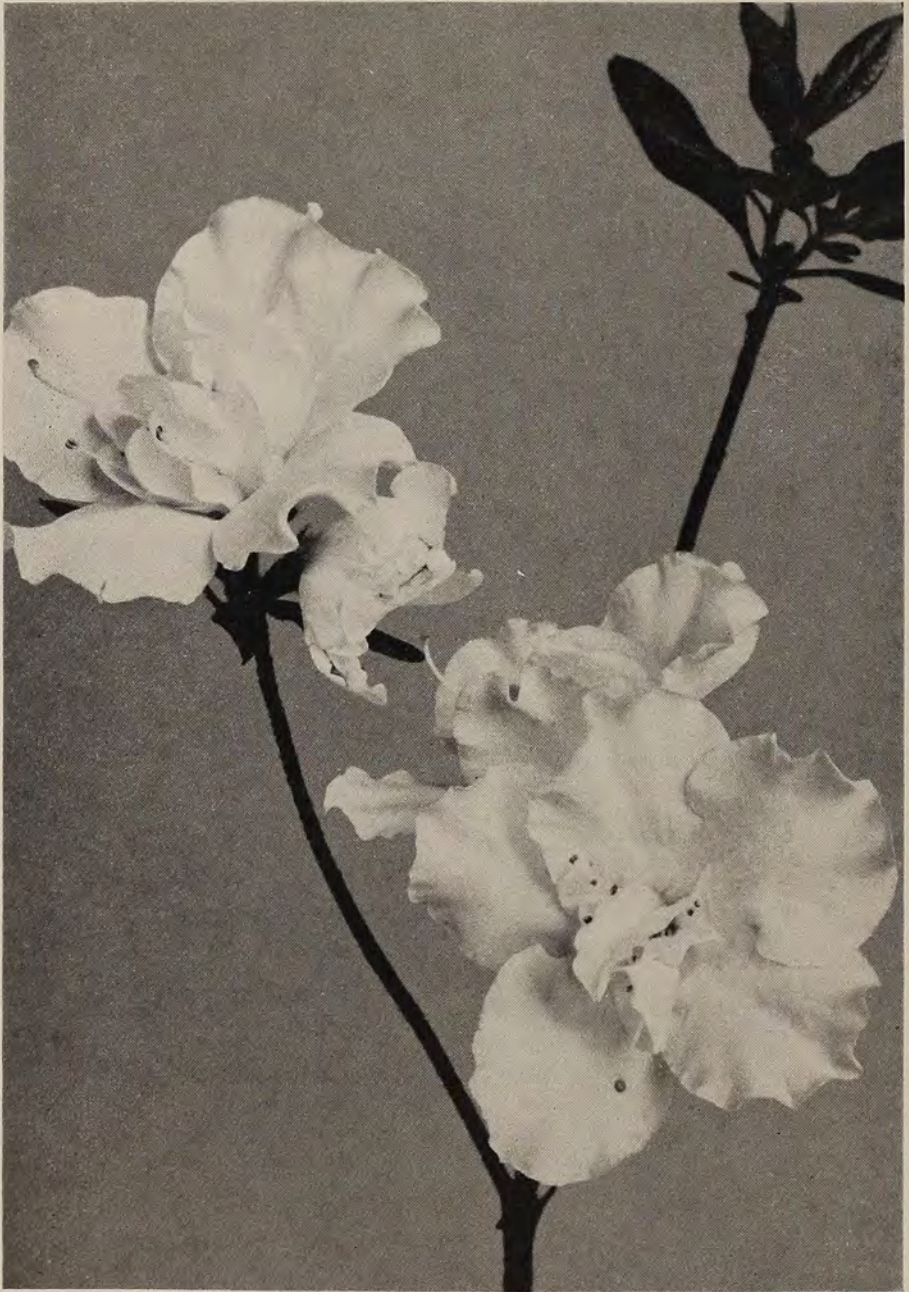


Plate 39

Robert L. Taylor

INDIAN AZALEA cl. FLAG OF TRUCE





Plate 40

Lilian A. Guernsey

*Macrosepalum* f. *linearifolium* (Spider A.)



Plate 41

Lilian A. Guernsey

*Serrulatum* (Hammocksweet Azalea) 3/4X



Plate 42

Lilian A. Guernesy

*Flavum* (Pontic Azalea)

tings must be given an artificial winter at the normal time. *Schlippenbachi* roots freely from juvenile cuttings taken as shoots from the base of old plants.

For evergreen and semi-evergreen species and clones, the best routine practice is summer propagation, usually beginning in June and ending in October but depending always on the condition of the wood in the particular season. This must be repeated, for success or failure depends on the condition of the wood of the *current* season's growth, though older wood will root in time. The old saying that the "cutting must not be soft enough to bend as if it were made of rubber nor brittle enough to snap like a match stem" is a "folk saying" that is quite adequate if one makes a few allowances. Another safe guide is the curving of the growth at the end of the shoot that indicates the formation of a terminal bud. Such cuttings are in good condition for use. No one becomes a competent propagator save through learning from experience—including failures.

Cuttings should be chosen preferably from the short shoots, such as those that break below the flower that has faded, rather than from the strong shoots that are making new growth for the skeleton of the shrub. Cuttings may be as short as two inches or as long as five inches; longer cuttings are wasteful of material. Cuttings may be taken off at any place without reference to a node as the root masses emerge from the sides of the stem and not from a basal callus, unless the cuttings are soft. In the case of a softwood cutting, cut at a node as the node will heal quickly and so prevent basal decay.

All the lower leaves should be cut off cleanly, though with practice one may come to strip them off if he is quick and skillful and does not tear the bark. Stripping leaves is likely to tear

the bark, particularly if the cutting is soft. This caution is especially needed in handling cuttings that have soft-hairy leaves. The cuttings should be placed in the rooting medium in such a way that none of the leaves touch the medium when watered. This again, is most important with species or clones that have soft-hairy leaves.

The rooting medium may vary with the preference of the worker. For the man in constant attendance, pure sand is ideal; for the amateur a 60-40 mixture by bulk of sand and peat is safer as it does not dry out as quickly or need such frequent watering. Entirely satisfactory results have been had with vermiculite, flue ash, and various mixtures of either with sand, peat, or both sand and peat. No advantages are found in the use of these over the use of pure sand and the sand and peat mixtures. The medium should be firmly packed and well watered before cuttings are placed in it.

In putting the cuttings into the greenhouse, cold frame, or other bed, a two inch board can serve as a guide. With a knife cut a three inch deep line along the board into the rooting medium. Place the cuttings in it after dipping the bases in some root inducing substance if desired, then place the board on the other side of the line to guide the next line and preserve an even distance between all lines. When the board has been moved into the new position, tamp the cuttings that have just been inserted firmly without removing the board and before actually cutting the next line. The usual method is to work from left to right in the bed.

In the South propagation of azaleas from cuttings is frequently done in the open. Sand is the preferred rooting medium in such instances in order to obtain adequate drainage.

Watering of cuttings after placement should be managed in such a fashion that water does not lodge in the leaf bases, particularly in case of those species and clones with soft hairy leaves. Decay starts in the hairs and eventually destroys the leaf blades and finally the growing tips and the whole cutting.

For persons with greenhouse facilities, cuttings can be pushed into active growth and kept growing for the production of more cuttings or of large plants using ordinary greenhouse methods. For the amateur working with cold frame or less, the production of a good root mass before cold weather is enough.

The spacing of cuttings in the bed must suit the worker. Two inches between rows is adequate. If the cuttings can be handled promptly, they may be placed as closely in the row as one wishes, even touching. If they cannot be handled quickly, four inches between rows will help. The only disadvantage of close placement will be in the fewer shoots that develop in the spring and the less regular shape of the little bush. Both of these can be corrected in the nursery bed.

In greenhouse work where more cutting material is needed as quickly as possible, the cuttings can be moved as soon as well rooted into benches of pure peat. This produces excellent growth usually without much extra pinching. This is not advised for the home gardener, as the plant grown on in pure peat needs very careful handling when transplanted into soil. Even if the new soil is well prepared, care is required to prevent drying out of the peat moss about the main axis of the plant, or in the case of heavy natural soil, injury from excess moisture that may drain into the planting hole.

Growing on small rooted cuttings by

moving them into cold frames, trays, or specially protected beds with a mixture of about equal parts of leaf mold, sand, and moss or sedge peat, is probably the best practice for the amateur. Let the plants become three years old before setting them out in the open ground.

If one is taking a series of cuttings from azaleas of different lineage, the wood is likely to be ready in more or less the same sequence each season: first, kinds with soft or thin leaves such as *poukhanense* or hairy leaves such as *mucronatum* or *kaempferi*, then those with leaves of the texture of the Kurumes, and last of all those with leaves resembling the hard leaves of *indicum*. In gardens where the plants are well watered to stimulate growth, cuttings will not be ready as early in the season as in gardens where there is no such attention. Rainy seasons will make the same disturbance but, here as always, the indication of the growing shoot itself, as mentioned above, is the safest sign.

#### LAYERS

Practically any azalea will form roots on branches pegged down into the soil and covered with an azalea soil of the usual sand-humus mixtures, but one generally prefers to bury wood that is two years old. No cut is needed, though a slight incision lengthwise in the buried portion of the stem will help. Layering is of great value in home propagation of deciduous azaleas that do not root readily from cuttings.

The European method of mound layering has not been much used in this country for the increase of named clones of deciduous azaleas. It is simple and satisfactory but slow until one has worked up a large stock of mother plants, preferably in triplicate. The mother plant should be on its own

roots, should have as many shoots as possible from the base, produced if need be by cutting all the existing shoots to within 6 inches of the soil level and forcing the production of new shoots from the base. Allow the new shoots to grow one full season and in the autumn bury them, tips just showing, in a mound of azalea soil of the usual sand-humus mixture. Sometimes mounding by stages as the shoots grow will give quicker rooting. The site must be one in which the soil moisture level is fairly constant; the "mound" must not be allowed to dry out. The shoots will root during the next year. The following spring they may be removed by cleaning out the mound and cutting off the shoots just above the old ground level, leaving the mother plant with even more stumps for the production of a new set of shoots. The newly rooted shoots are carefully planted in nursery beds and grown on like any young plants. Since each mother plant produces an increasing number of shoots after each operation, the increase in production grows larger and larger. With three sets of mother plants any nursery can be sure of a crop of new small plants each year.

Another European method not much employed in this country except for evergreen rhododendron hybrids is accomplished by lifting the mother plant, planting it anew on its side, spreading the tops out fan-wise, and pegging down every suitable shoot for rooting.

The recent development of "air-layering," which is an outgrowth of old marcotte methods, has been very successfully applied to deciduous azaleas. A shoot of one year old wood is cut with an upward knife stroke a short distance and not deeply, merely enough to allow the insertion of a little root-inducing powder. The shoot above and below the cut is surrounded by a hand-

ful of moist, but not wet, sphagnum moss. This is enclosed in one of the moisture proof plastics, such as polythene, and tied top and bottom with rubber bands.

The air-layering is usually done just as the current year's growth has commenced to harden a little. No attention will be needed until autumn when it will be found that the sphagnum moss is filled with roots. The shoot is then cut from the parent. The young plants should be taken into a cool greenhouse where there will be little chance of drying out. They must not be subject to frost until one is assured that the roots are established in the new bed. Then the plants can be moved into a colder place that will give the "winter chill" needed for deciduous species and clones, and then moved back into heat in late February or kept for planting outside in cold frames. The great advantage of this method is that one gets a plant of some size in one year; the disadvantage is that one rarely has at one time any large numbers of shoots suitable for the treatment.

#### GRAFTING

Grafting is not much used in this country for propagating azaleas except for the production of the umbrella shaped florist's azaleas. In Europe it is also used on deciduous azaleas of the Ghent and allied types. The standard procedure is winter "bench grafting" using for stocks seedlings raised in cold frames. The usual whip-graft is used (the scion being inserted as near the old ground line as possible and tied) and the plants buried in moist, but not wet, peat moss to heal the union. The temperature should run about 40°F. in the room and there need be little light. Once the union is assured the plants can be transplanted to a similar bed at a slightly lower temperature and

so held for spring planting, preferably in frames with glass sash to temper spring weather and lath shade to ease the plant into summer. After transplanting, the graft union should be slightly below ground level.

No data have been found to indicate how many species or clones are used as stocks. However, since all one needs for any scion is a stock of proper hereditary relationship, of similar rate of growth, and with the ability to make adequate root masses, the problem should not be difficult. The reported common stock of European nurseries is *flazum*. American species that would make trouble in case of suckering of the root stock, have not been used so far as is known.

No explanations are offered as to the causes of failures in imported grafted deciduous azaleas. From the examination of a fair number of specimens it would seem that the root systems are not always adequate to support the tops under our climatic conditions where the tops often grow too rapidly for the roots to supply moisture and food through the graft union. However, little difficulty is observed at the point of graft union itself. (If the data are correct that it takes four years to produce a seedling stock for grafting, one might wonder if the wood is not too hard to accept the younger wood of the scion).

It is reported that Belgian Hybrids grafted in this country are usually grafted on rooted cuttings of some clone of *phoeniceum*, frequently the clone known as Concinna. In the only commercial nursery observed the grafting is done in summer using soft growth grafted into the cut-off tops of single stemmed, vigorously growing, young potted stocks. By November the grafted plants are in benches in cool greenhouses and ready for the removal of any top left from the stock and for the

first pinching in the development of the new head. These are pinched again and again until the familiar umbrella shaped crown is made.

#### DIVISION

This is not common in nursery practice, but it sometimes happens, especially in home gardens, that old plants of deciduous azaleas can be divided. One lifts the plant in autumn, divides the plant as much as the root system will permit, and replants immediately. The tendency to the production of many shoots from the base can be increased by cutting the existing shoots at ground level or slightly below ground level, and allowing a season or two to pass with the formation of more shoots before division is attempted. All must be own root plants. Grafted plants cannot be divided. *Atlanticum* by reason of its stoloniferous root system is especially suited to propagation by division. This is shown in Plate 7 on page 27.

#### FLUORESCENT LIGHT

Owners of the recently developed special propagating cases lighted with fluorescent lamps and heated by electricity below the level of the rooting medium, have ideal cases for the growing of seedlings or the rooting of cuttings. Grafts of evergreen rhododendrons have been made in them as well.

In actual practice the chief danger that besets the amateur is his own impatience to "get going." He starts too soon and finds that he has more seedlings than he can continue to maintain in the case and no greenhouse into which to move them. Usually it is too late to transfer them to a cold-frame that is the other standard item of home equipment. The same problem can arise with premature rooting of cuttings, or out-of-season rooting of cuttings, but if the amateur can arrange for the ac-

commodation of his output, he has all the advantages of a small greenhouse. The great advantage to the amateur is that in such a propagating case with its equable humidity, temperatures, and light, he can safely attempt the rooting of cuttings in a softer condition than would be usable in a cold frame.

In handling seedlings, cuttings, or small plants of azaleas, it should be remembered that azaleas are really very tolerant of considerable differences in soil mixtures, but are frequently impatient of slight variations in moisture. If one must err, it is wiser to err in favor of dryness than of saturation. In

the latter case, the plants and/or cuttings drown; in the former, they merely slow up. The more regular one can be in attention to his propagations, the more certain he will be of success. The special propagation case is nearly "fool-proof" but it too can be dried out or given too much light, not more than 200 foot candles being ample.

By shading, where mentioned above, is meant the old practice used by all gardeners when dealing with plants going through an "emergency" period, whether young plants or plants-to-be as yet without roots. Shade should be used with discretion.



Plate 43

Lilian A. Guernsey

GABLE HYBRIDS *poukhanense* × *maxwelli* (left) and *poukhanense* × *kaempferi* (right) 2/5×



## XII. Azalea Hybridizing by the Amateur

In commenting here on the production by the amateur of new azalea plants through hybridizing, the objective is to inform the amateur of the mechanical or manual skills or practices useful in hybridizing azaleas and of a few of the limitations to be observed and results to be expected in a general way. The objective is not to lay down a program for gathering data for the geneticist or interpreting it in his terms. Neither is it to lay down a summary of the laws of genetics applicable to plant breeding.

The dangers in hybridizing by amateurs do not lie so much in lack of genetical knowledge as in lack of knowledge of azaleas and familiarity with the many species, varieties, forms, and clones and in lack of discrimination in appraising new plants and in selecting and naming them for distribution. On the other hand practically all that is good today in azalea hybrid clones comes, not from the geneticist, but from the amateur gardener or professional horticulturist whose work is carried on more nearly as an art than as a precise application of genetical science.

The first "rule of thumb," borne out in practice, rather than by test, is that all species within each subseries of the Azalea Series will interbreed.

The second rule is that the hybridizer must have a clear concept of what he wants to attain. This may be merely one step in a longer series of crosses or an end in itself.

Between these two all other matters become of secondary importance.

In general azaleas are self-sterile, but cross-fertile. The stigma of a flower cannot be successfully pollinated by pollen from the same flower or from

another flower on the same individual plant but can be pollinated by pollen from the flower of another individual of the same species or hybrid group, or by pollen from the flowers of another species in the same subseries. There is some evidence that some crosses can be accomplished between plants of different subseries, but the known and recorded examples are few.

As examples of the races produced by interbreeding within a subseries, one may cite the Ghent Hybrids, the result of combinations within the Luteum Subseries. For the Obtusum Subseries, one may cite the Rutherford, Pericat, and Glenn Dale hybrids and most of the Gable hybrids. There is reason to believe that the Belgian Hybrids belong here although some few are claimed to carry heredity of *molle*. As examples of crosses beyond the limits of a single subseries, the most extreme are the azaleodendrons with a few clones, such as Broughtoni Aureum, Smithi Aureum, Hybridum, and others, in which one parent is a rhododendron outside the Azalea Series. The difficulty in being certain of the parentage of wide crosses, unless the characteristics of both parents are clearly apparent in the offspring, lies in the possibility of apomixis. This is reproduction without fertilization in which seeds are apparently formed. However, these apomictic seeds give rise to plants identical with the mother plant. Apomixis is, in substance, another form of vegetative reproduction.

Among azaleas polyploidy will rarely be a hindrance to hybridizing. The "basic" number of chromosomes for rhododendrons, including azaleas, is 13. Species usually have twice that number, or 26 chromosomes. Only two

azaleas are known to be polyploids, that is, have a greater number of chromosomes than 26. These two are *calendulaceum* and *canadense*, each of which are tetraploids with 52 chromosomes. All the other species and varieties of azaleas so far investigated (48 including practically all the species mentioned in this volume) are the usual diploids having 26 chromosomes. The significance of these facts is that hybridizing between azaleas with different chromosome numbers is always difficult, if not impossible, for usually either viable seed will not be produced or the seedlings will be unable to survive. However, this difficulty will not exist unless *calendulaceum* or *canadense* is one of the proposed parents and the other is a diploid.

Mechanically the hybridizing operation is simple as the parts are large and easily handled. In all cases examined, the pollen is ready to fall from the apical pore of the anther before the stigmatic surface of the pistil of the same flower is ripe to receive it, so that emasculation of the flower may be accomplished as soon as the flower opens. It has been entirely feasible to carry the stamen in the hand to the flower to be pollinated and shake out the pollen on the stigma without resort to brushes or any other aid. Pollen may be stored in an ordinary desiccator at room temperatures for at least six weeks. A satisfactory practice is to place whole stamens in small glass vials, anthers nearest the open end; no stopper. A label on the vial records the name of the clone. Some pollen will be wasted in shaking the stamens out for use, but relatively little.

No studies have been made to retard or to hasten flowering, but many combinations have been possible by using pollen from flowers of newly rooted cuttings on stigmas of flowers of older

established plants. If one has a series of plants always in propagation, a marked irregularity in flowering is possible. If one grows azaleas in a cool greenhouse, other irregularities of blooming arise.

When one works in the simplest fashion possible and without a carefully controlled genetic program, his techniques are always open to question as to their wisdom. However, an examination of numerous flowered crosses shows that very little contamination ever arises. Flowers are emasculated as nearly after opening as feasible and pollen is applied later the same day or the following morning. If there is any great delay, the "set" is still accomplished, but the total resulting number of seeds is reduced. In a few cases, pollinations are repeated on the same flowers to be sure of fertilization, but this is rarely necessary. The pollinated flower should be tagged to show the number and date of the cross and the male and female parents.

Bags need not be used. Observation over many years shows that the insect visitors early in the spring are searching for pollen and rarely visit emasculated flowers. Later in the season, the search is for nectar and both bees and flies can and do reach the bases of the corolla with little disturbance except as they may jostle the bases of style or filament. If the stamens are removed, there will be only the style to brush against. The only instance where danger arises is in these cases where the corolla of the seed parent is small and the body of the insect actually touches the stigma.

In practically every case examined, the corolla of hand-pollinated flowers drops off more quickly than those of its fellows. The style usually remains green and erect far into the summer. The ovary develops rapidly and the re-

sulting capsule is often its full size within six weeks. It usually keeps its green color until frost and the circle of sepals that subtend it in most cases is equally green and fresh. A frost at 32°F. or less will cause the capsules to crack open from the apex and a portion of the seed is always lost. To avoid this, pods should and can be gathered while still green in color (about October 15th in the Washington, D. C. area) with no apparent loss in the maturing or viability of the seed.

The capsules for each cross are placed in an open coin envelope with the number of the cross on the envelope. These are stored in the house at room temperature and cleaned during the winter as may be convenient. Seed held over for one year before planting loses about 50 percent germination power under these conditions of storage. No experiments have been tried to prevent such loss.

One capsule may yield between 200 and 500 seeds so that one need not pollinate many flowers, unless the pollen is known to be poor in quality. As an observation only, it would appear that pollen from many white varieties, some striped varieties, and certain varieties that have arisen as bud sports is uneven in quality with many infertile grains.

After many years of observation there are no notes to suggest that weather conditions (other than torrential rain) have much effect on the accomplishment of the cross. There are lower percentages of success in the earlier part of the season when the temperatures are uniformly low. For the Washington, D. C. area this period would be from the end of March through the first week or ten days of April.

No suggestion is offered as to the minimum number of seedlings that

should be raised from any one combination. The personal preference of one hybridizer is for 100, but some small populations have been excellent and some larger quite uniformly worthless or mediocre. The more named clones already in existence in a hybrid group of a particular parentage, the larger should be the seedling population from which to make new selections if a "break," that is, a worthwhile new and distinctive plant, is to be obtained. At least this is true in theory but dumb luck frequently plays havoc with the laws of chance that govern combinations of obscure and unknown recessive characteristics or crossing over or segmental interchange among chromosomes.

A few hybrids between species, some of which are reciprocal, offer no evidence so far of any advantage in reciprocal crosses. Even though not explicable in terms of genetical science, some amateur breeders believe their experience shows the desirability of choosing as a mother plant the species or clone that shall be most influential in all matters save flower pattern. To date back crosses (child-parent crosses) have generally not been worth the labor and space involved. The few sib-crosses (sister-brother crosses) flowered as yet are not promising. The best results, again a dangerous generalization, have come in those combinations where one parent is a species and the other a clone of a cross of quite distinct origin.

Seedlings raised between parents with flowers of markedly different sizes usually give flowers of intermediate sizes. Seedlings from parents blooming at widely differing seasons (times) give an intermediate season of bloom. No very definite suggestions can be offered as to color inheritance, except that pattern in the form of stripes inherits as a recessive to solid color.

Plants with this inheritance produce as bud sports both the pattern in which there is a pale ground color with darker stripes, a light colorless ground with a pigmented margin, and the colored flower with or without stripes and an irregular colorless margin. Not all hose-in-hose flowers (petaloidy of calyx) are seed sterile, but this character is easily transmitted by pollen. Doubleness (stamen transformation) can be transmitted either by pollen or egg cell. Data on this are not complete, however. Sterility is fairly general in double and hose-in-hose forms. Some double flowers have been observed to accept pollen from hose-in-hose flowers; others not. Actual trial seems to be the only way to ascertain sterility in this situation.

The above practices and conclusions are based on work within the Obtusum Subseries. As to inter-subseries crosses—attempts to cross between the Obtusum and Luteum Subseries have given seed, low germination, a high percentage of albinos that die, and a few runts that die without flowering. Attempts to cross *schlippenbachi* and *reticulatum* have given no results. The Plant Introduction Station at Glenn Dale, Maryland, has at present pots of *weyrichi* fertilized by *reticulatum*. A cross between *canadense* and *japonicum* ( $\times$ *fraseri*) has been made successfully and there are living plants at the Arnold Arboretum that have spread by stolons and formed a considerable clump.

As to future developments, aside from the improvement in quality in all groups, the most desirable goal would be the development of pure yellows in the Obtusum Subseries. Yellow pigment is now present in some plants of that subseries, probably of a sap-soluble type and therefore pale in color value and when present more or less obscured by the stronger soluble anthocyanin pigments. Doubtless, even the lovers of the Luteum Subseries would appreciate a further widening of the color range among their cross-bred material. The introduction of *fine* scents into the Obtusum Subseries would be splendid since only *macrosepalum*, *mucronatum* and its forms, and one or two others carry a faint scent and that not noticeable to all observers. If by contrast a group of Luteum Subseries hybrids could be evolved quite free of the animal-like odors of the glandular hairs on the leaves, all would rejoice.

Whether or not one would get really beautiful flowers by tinkering with the species of the Schlippenbachi Subseries in which the species *schlippenbachi* itself is already a marvelous example of beauty in azaleas, is open to debate and difference of opinion or taste. Further, *schlippenbachi* and others in its subseries are difficult to pollinate with pollen from plants of other species, and particularly of plants outside their subseries. Apomixis is the usual result of attempts.

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