

THE AMERICAN
Horticultural
MAGAZINE



JOURNAL OF THE AMERICAN HORTICULTURAL SOCIETY, INC. * October 1962

AMERICAN HORTICULTURAL SOCIETY

*A union of the American Horticultural Society
and the American Horticultural Council*

1600 BLADENSBURG ROAD, NORTHEAST • WASHINGTON 2, D. C.



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The American Horticultural Magazine is the official publication of the American Horticultural Society and is issued four times a year during the quarters commencing with January, April, July and October. It is devoted to the dissemination of knowledge in the science and art of growing ornamental plants, fruits, vegetables, and related subjects.

Original papers increasing the historical, varietal, and cultural knowledges of plant materials of economic and aesthetic importance are welcomed and will be published as early as possible. The Chairman of the Editorial Committee should be consulted for manuscript specifications.

Reprints will be furnished in accordance with the following schedule of prices, plus postage, and should be ordered at the time the galley proof is returned by the author: One hundred copies—2 pp \$6.60; 4 pp \$12.10; 8 pp \$25.30; 12 pp \$36.30; Covers \$12.10.

Entered as second class matter in the post office at Baltimore, Maryland, in accordance with the Act of August 24, 1912. Additional entry for Washington, D.C., was authorized July 15, 1955, in accordance with the provisions of Section 132.122, Postal Manual. A subscription to *The American Horticultural Magazine* is included as a benefit of membership in the American Horticultural Society, Individual Membership dues being \$6.00 a year.

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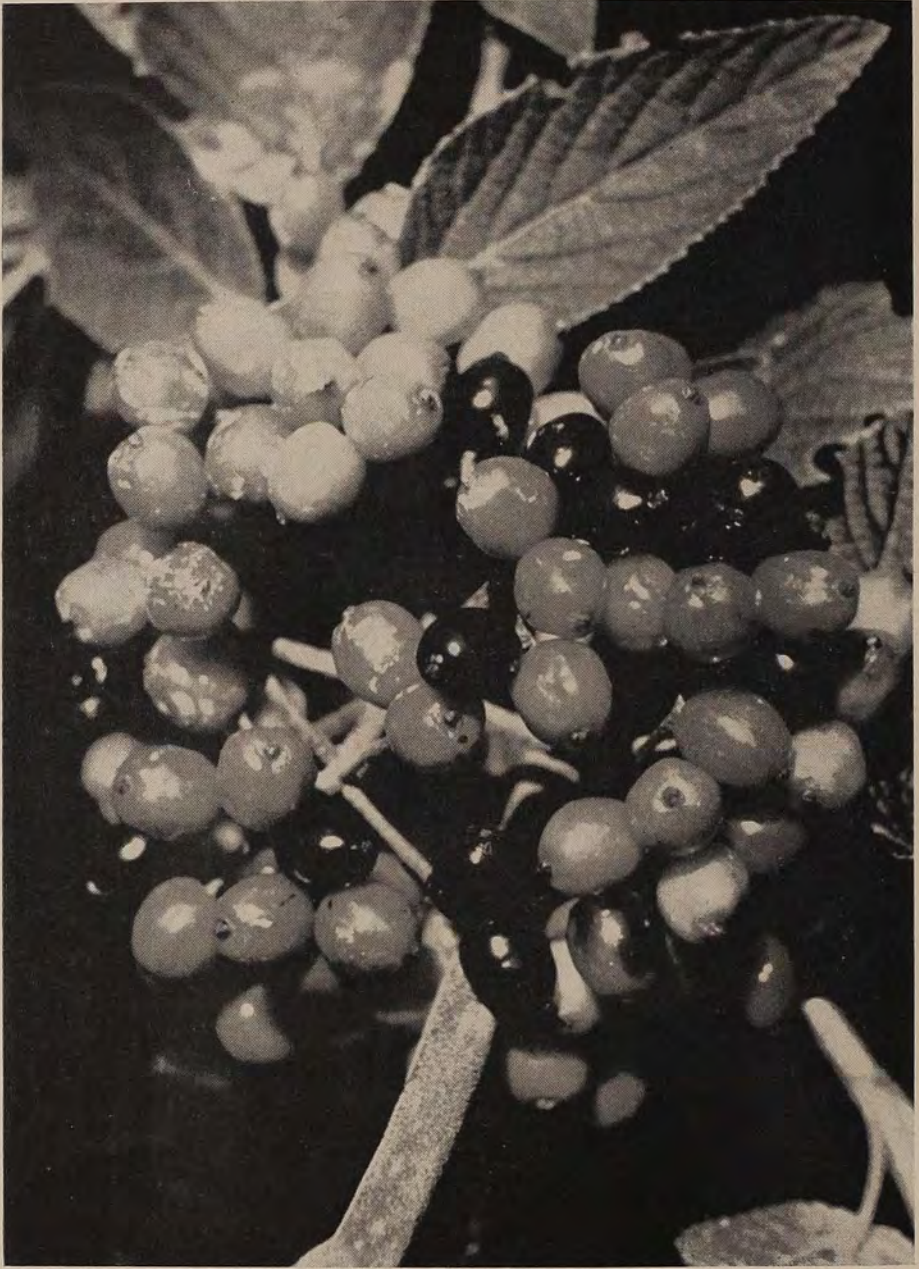
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OCTOBER COVER ILLUSTRATION

PHOTOGRAPH BY IVAN N. ANDERSON

Zenobia pulverulenta, a deciduous or half-evergreen shrub to about six feet, with arching branches and a fine show of flowers, from the massing of the smaller axillary clusters that come from the upper axils of the shoots until they appear as a great raceme of bloom. See Page 233.

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DONALD R. EGOLF

For about a week in August the Viburnum lantana, Wayfaring Viburnum, fruit clusters are a spectacular display of green, orange-red, and black fruits

[See Page 209]

Native bulbs of Israel for American gardens

ABRAHAM H. HALEVY*

Israel is a small country, about the size of Massachusetts, but this small geographical area is marked by a great diversity of topographic, climatic, and edaphic characters. Dr. G. E. Post, who, at the end of the last century wrote the first complete "flora" of this region, says in his introduction: "This region is unequalled by any of the same size on the globe, not only for the thrilling and important events of human history of which it has been the theatre, but for its unique geological structure, its great diversity of surface and climate, and its remarkable fauna and flora."

The plant-lover tourist crossing the country from west to east, will be astonished to find so many plant formations, within a two-to-three hours drive. On the Mediterranean coast he will find the typical vegetation of the sand dunes. A few minutes later he will enter the loamy soils, planted mainly with citrus groves. Further to the east are the alluvial heavy soils of the Coastal Plain, rich in native and cultured vegetation. Leaving the plain he will start ascending the mountain chains of the central part of the country (Mount Carmel, Galilee, and Judea), some of them denuded and some covered with various degrees of shrub and wood formations. Descending the mountains eastward he will arrive rather suddenly from the woods to the arid steppes, and a little farther he will find himself in complete desert. He will end his trip going down to the deep chasm of the Jordan and the Dead Sea, the lowest valley in the world, about 1,300 feet below sea level; here he may find in some places tropical-African vegetation. All this within a drive of no more than fifty to a hundred miles.

Israel is situated at the meeting place of three continents and three climatic and vegetational regions. Some basic facts of its climatic and soil conditions are, nevertheless, common to all regions of this country. The most characteristic feature of Israel's climate is the well-marked difference between the two seasons: a mild, rainy winter and a dry,

hot summer. During five to eight months, no rains at all fall in Israel. About the edaphic conditions we can say that in spite of the great differences, most soils are rich in lime and their reaction is slightly alkaline.

The three main climatic regions are:

1) The Mediterranean territory, extending along the Coastal Plain and inland into the hill country. This region receives a considerable amount of rain—14-25 inches during the six or seven months of winter. Its natural vegetation develops, when undisturbed, into a forest or maquis (a typical Mediterranean formation of high mostly evergreen shrubs).

2) The Irano-Turanian territory has a continental climate, with extreme seasonal and daily fluctuations in temperature. The average annual precipitation is 7-14 inches, and the typical vegetation is steppe.

3) The Saharo-Sindian territory comprises the desert region of South and East Israel, which receives 1-6 inches of rain a year.

In addition to these three main vegetation groups, the flora of Israel includes representatives of two minor groups: the tropical-African vegetation and the vegetation of the temperate cold zones of Europe and Asia.

As a result of the above mentioned conditions, this small country has a very rich wild flora comprising about 2,500 species of phanerogamic plants, compared, *e.g.*, to about 1,500 in the British Isles and 1,800 in Egypt. To illustrate the variety and richness of the vegetation we may state that within a radius of five miles from Jerusalem, one can find more than a thousand plant species belonging to seventy families.

The great diversity of the topography, climate and vegetation of Israel indicates that, in spite of its restricted area, elements of the native flora might be found suitable for adaptation to certain areas within the United States. It is quite obvious that regions of the south and west with relatively frost-free winters, would be most suitable especially the coastal districts of California, and

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in some areas in the Southwestern States and Florida. Knowledge of the native habitat of each species might help in finding the region in the U.S.A. suitable for its adaptation.

The native vegetation of Israel and its neighboring countries is unusually rich in geophytes, *i.e.*, plants having subterranean storage organs like bulbs, corms, rhizomes and tuberous roots. They comprise about ten per cent of all the wild phanerogamic flora—more than 250 species. Some are very common, covering wide areas; some are rare, growing only in restricted locations; and, some are even endemic, they do not grow at all outside this country.

Many of the bulbous plants have attractive flowers and pleasant fragrance, and are suitable for growing in the garden, and some also as cut flowers. A few of them were the source for well-known cultivated plants, some are grown sporadically by amateurs, and there are many others still uncultivated, which, in the writer's opinion, are at least worthwhile trying. The author will try, in this article, to describe plants of all these categories.

It may be assumed (until more accurate research can be carried out) that most local bulbs are tender or semi-hardy in many parts of the U.S.A. Thus under cultivation they should not be left unprotected during winter in the north, while in the southern regions which have dry summers, they may be left undisturbed all year round in an unirrigated corner of the garden, since irrigation of bulbs during their rest period is undesirable to most of the native bulbs. Some of them, as *Narcissus tazetta*, *Urginea maritima*, *Scilla hyacinthoides*, *Pancratium maritimum*, and *Asphodelus microcarpus*, are less sensitive to moisture in summer, but most other bulbs will suffer from rot, too early sprouting, and irregularity in flowering.

Planting time for most of these bulbs in the south will be in October and November, but those which sprout early in the season (as *Oxalis cernua*), or those which blossom in the early autumn before the rainy season starts (as *Pancratium parviflorum*, *Urginea maritima*, *Colchicum hierosolymitanum*), should be planted earlier, in August or September.

First described are plants introduced to cultivation a long time ago; thus,

many of the present common cultivars of these plants differ greatly in form from their wild ancestors. Some of the wild types of these plants are not less attractive and graceful than the cultivated varieties and might interest the plant lover and breeder. The breeding of these species occurred mainly in North Europe (the Netherlands, England, Germany, etc.). As the cultivated varieties were adapted to the conditions of these countries, it is now difficult to grow cultivated forms of hyacinth or cyclamen in their native country and in other subtropical regions like the extreme southern U.S.A. One can assume that adaptation of the wild types of these plants in the South will be much easier, in addition to their being valuable as source plants for breeding, in forming varieties more suitable for the southern gardens.

Cyclamen persicum. This is one of the most common and beloved flowers in Israel. Its flowering season extends throughout the winter, from December to April, and its beauty and grace attract one and all. They grow in all the Mediterranean districts of the country, especially on hills and mountains, in the shade of rocks and under shrubs. The flowers vary in color from red and purple to pale pink and white. They rise on purplish stalks above the beautiful leaves with their marble-like pattern and silvery spots. Each corm produces many flowers throughout the season, each of them lasting about two weeks. The plant is very suitable for the rock garden and for bordering flower-beds, especially in the shady parts of the garden.

Anemone coronaria. The Poppy Anemone is probably the most popular of the wild flowers of Israel, flowering profusely in all parts of the country except the desert, and in some places almost covering the ground with its brilliant blossoms, from January until the end of March. The prevailing color in most places is red, however, blue, violet, magenta, pink, and white varieties also are common. There appears to be a definite relation between the occurrence of a certain variety and the local soil conditions. The red variety predominates in the Coastal Plain, the Negev, Judean hills around Jerusalem, and on Mount Carmel. The slopes of the hills facing the Lake of Galilee near Tiberias

abound in white and light pink anemones, while the damp and basaltic soils of the Galilee and the Esdraelon Valley are rich in violet, blue, and magenta flowers. The number of petals is usually six. Completely double anemones are not found in the wild, but semi-double ones having up to eighteen petals are common. The local anemones resemble the De Caen varieties but are much more persistent in cultivation. Unlike the De Caen varieties, the vegetative propagation of the local anemones is very easy. Each flower lasts about ten days. They open every morning and close in the evening. The geophilous organ of the anemone is a small tuber; their natural depth in the wild is about one or two inches. In the garden, they should be planted near the surface, in well-drained soils.

Ranunculus. Of the sixteen species of *Ranunculus* native to Israel only *R. asiaticus* (Turban Buttercup) is known in cultivation. Belonging to the same family as anemone, they resemble each other in appearance and cultural conditions, growing often side by side. The most common color in both plants is red, but orange, gold, and yellow flowers of ranunculus can be found occasionally. Ranunculus starts blooming about one month after the anemones, in February, and flowers until May. One can easily distinguish between them since anemones do not have a calyx, while ranunculus flowers have five scaly sepals below the five petals. No double forms are found in the wild. The storage organ of the Ranunculus is a cluster of tuberous roots sprouting from a short root-stock.

Narcissus tazetta. The wild Polyanthus Narcissus is found in all Mediterranean countries and eastward in Asia. The two most common varieties in cultivation everywhere, are 'Paper White' and the pure yellow 'Grand Soleil d'Or.' A few wild types of Polyanthus Narcissus are found in Israel, the most common has white petals and a deep yellow corona with up to fifteen flowers to a stalk. Double forms are sometimes found in the wild. This is one of the earliest flowers of winter—starting to flower in November and blooming until February. They are found in most parts of the country except the deserts, and are especially common among rocks on hill-slopes, in wet

locations and in the deep heavy soil of the plains. Bulbs should be planted early in the season, relatively deep. *N. tazetta* bulbs are less sensitive than most other local bulbs to moist conditions during dormancy, and may be left undisturbed in the garden for several years even in irrigated plots and in regions having a rainy summer. Blooming in about the same time, but much rarer, is *N. serotinus*. It has lovely dwarf flowers on stems six to eight inches tall with no leaves at all. The only photosynthetic organ is the green flower-stem, which continues growing after blooming, reaching two and a half feet in height.

Lilium candidum. The wild plants of the Madonna Lily do not differ greatly from the cultivated clones. The violet-green flower-stem is three to five feet high and the petals are pure white. They have a sweet, Jasmine-like fragrance which is much stronger at night. This plant is probably the "Lily-of-the-Valley" and the "Lily among thorns" mentioned in the Song of Solomon (2: 1-2). (*Convallaria majalis*—known as "Lily-of-the-Valley," does not occur in the Land of Israel). The Madonna Lily blossoms in early summer (April-June) when most other flowers have already died and the fields are covered with thorns and thistles. As the Madonna Lily was considered a sacred plant, many lily bulbs were dug out during the centuries and sent overseas, mainly to cloisters. It is now almost extinct and remains in the wild only in a few places on Mount Carmel and within the wood formations of the Galilee. It grows mainly on the shaded slopes of the hills.

Hyacinthus orientalis. This beautiful plant grows wild on the Galilee Mountains and blooms from January till March. The color of the native flowers is pale to dark blue. The racemes are more sparsely flowered than those of the Dutch hyacinths and resemble the French-Roman hyacinth. Their fragrance is more delicate than that of the cultivated varieties.

Muscari. All three native species of grape-hyacinth are worth introducing to cultivation: The small, autumn-flowering *Muscari parviflorum* and taller, winter-flowering *M. commutatum* and *M. racemosum*. The first has heavenly-blue bells, and blooms immediately after the first rain of the season. The second has deep-purple flowers and a flower



A. HALVEY

A border of Asphodelus microcarpus

stem up to ten inches high. Both are common in the Mediterranean regions of the country. The flowers of *M. racemosum* are deep-violet or deep-blue; it grows mainly in mountain and steppe regions.

***Bellevalia* and *Leopoldia*.** Relatives of the grape-hyacinths and resembling them, are species of the genera *Bellevalia*

and *Leopoldia*. Some of them, as *B. trifoliata*, grow in wet fields and on heavy soils; some, as *L. maritima*, thrive on the sandy soils of the Coastal Plain; and others, as *B. desertorum*, are steppe and desert plants and may be adapted to gardens in the driest zones of the U.S.A.

***Asphodelus*.** Of the four wild species of *Asphodelus* found in Israel, the most



U. PAZ

Urginea maritima

common and suitable for cultivation is *A. microcarpus*. This is one of the most attractive winter flowers. Its flowering season is rather long, lasting from January to April. Each plant has many branched flowering stems, reaching four feet in height. The leafless scapes bear many white-pink flowers with a green-reddish midrib. They have a light sweet

scent. Each flower remains alive only one day, opening slowly during night hours and closing at the same time the next night. The fleshy tuberous roots are the only living organs during summer. *A. microcarpus* abounds in all parts of the country. Its very attractive relative, *A. fistulosus*, is more common in the arid region and even in the deserts,

and thus might be suitable for adaptation to gardens in the arid parts of the southwestern U.S.A. Less attractive, in our opinion, but more common in cultivation is *Asphodeline lutea* (Jacob's Rod). It is found wild in wet locations and among rocks in various parts of the country. Unlike *Asphodelus* the flowering stem of *Asphodeline* is leafy and unbranched, reaching three or four feet in height. The color of the flower is orange-yellow.

***Urginea maritima*.** The Maritime Squill is among the first of the fall-flowering bulbs. As a matter of fact, it starts flowering in August, when summer still prevails and the rainy season is still far ahead, but nights start getting cooler. The tall straight flowering stalks, two to five feet high, appear long before the leaves. The attractive flower spikes are sold here as cut flowers and many town dwellers do not realize that this is a wild flower. The pure white flowers in racemes appear first in the lowest floral whorls; they open at midnight and finally close, the next night. Next morning another group of about ten flowers opens above the previous whorl. The entire spike flowers over two weeks and even the top flowers open when cut and placed in water. The number of bulblets produced naturally are very few, but artificial vegetative propagation is easy by scooping, scoring, or by any cut or wound applied to the bulbs. *Urginea* bulbs should be handled with care since the sap of the scales contains a substance which causes skin irritations. *U. maritima* grows mainly in the Mediterranean regions of the country; it also penetrates into the steppe and the deserts. Another species, *U. undulata* (Wavy Squill) is more common in the Negev desert. Its flowers are purple-brown; they also bloom in early fall before leaves appear, but are less attractive than those of *U. maritima*.

***Scilla*.** Related to *Urginea* are the species of *Scilla*. Of the four species found in Israel, we would like to recommend one for garden use: the spring-flowering *Scilla hyacinthoides*. This beautiful blue flower appears at Easter-time in open racemes of up to a hundred flowers on scapes reaching three feet in height. The racemes also are often used as cut flowers. The plant is found wild in most parts of the country except in the steppes and desert regions, and will

adapt easily to many soil types and weather conditions. *S. hyacinthoides* thrives even in summer-irrigated gardens and is easily propagated.

***Ornithogalum*.** A relative of the squill is the *Ornithogalum* (Star of Bethlehem.) *O. umbellatum*, often called the "True Star of Bethlehem," cannot be the true "Star," since it does not grow wild in Bethlehem, nor in any other part of the Holy Land. Ten species of *Ornithogalum* are native to Israel, six of them growing in the Judean mountains in the vicinity of Bethlehem. The most beautiful is *O. arabicum*. Its leafless flowering scapes reach almost three feet in height, bearing up to fifty large (up to an inch and a half in diameter) pure white flowers, with an elegant black center. The golden anthers and pleasant fragrance of the flowers should also be noted. Cut flowers last up to three weeks in water. *O. arabicum* is useful both as a garden and as a cut-flower plant. Natural flowering time is short, occurring at the end of March through April. Experiments, however, are now being carried out at the Hebrew University at Rehovot, in cooperation with research workers at Beltsville and in the Netherlands with the aim of extending the flowering time, both for outdoor spring-summer flowering and winter greenhouse forcing. Treatment of the bulbs mainly includes various storage temperatures. Preliminary results are promising. In one experiment, saleable flowers were obtained as early as the middle of January, grown in the field. All other local ornithogalums have a green line on the outer side of the white petals. We would like to recommend the tall (up to two feet) *O. narbonense* and the dwarf *O. montanum* for garden use.

***Pancratium*.** Blooming even earlier than *Urginea maritima*, in late summer before the rains, is *Pancratium maritimum*, a plant limited to the sandy soils near the sea shore. This is one of the few plants which resists the salty sea water sprinkled upon their leaves by winds. Its large white flowers up to six inches long, are very fragrant; they are produced in umbels of up to ten flowers borne on a solid scape up to two feet in height. The long tubular perianth consists of six segments (tepals) and an inner, bell-like crown. The flowers open before sundown and bloom during



A. SHUB

Scilla hyacinthoides

the night and next day. The plants are easy to cultivate in well-drained soils. They grow well even if irrigated during summer. Under such conditions the plant remains evergreen and sometimes flowers twice a year, in the natural blooming time (August-October) and in spring (April-May). Natural vegetative propagation of this plant is very easy. Another native *Pan*-*cratium* is *P. parviflorum*. It blooms dur-

ing fall and early winter (September-January), but is not fragrant. Its flowers are smaller (about two inches long) but last longer than those of *P. maritimum*. A white stripe occurs along the middle of the leaves. This plant is found not only in the Coastal Plain but in our mountain regions as well. The third native species of *Pan*-*cratium*, *P. sickenbergeri*, grows in the sandy soils of the Negev wilderness. Its scape is about a



A. SHUB

Pancratium maritimum in its native habitat

foot to a foot and a half tall bearing five to eight flowers, each about three inches long. The latter two species grow well in irrigated gardens, thrive in the full sun, and in half-shady places.

Ixiolirion montanum. A relative of *Pancratium*, in the Amaryllis family; it is quite distinct in form, color, and growing conditions. It has lily-like blue flowers on scapes a foot to a foot and a half high. This charming flower grows mainly in the arid steppe regions of the country—Judea and the Negev desert.

It may be of value both as a garden and as a cut flower, since it keeps well, from ten to twenty days, in water. It should be planted in well drained unirrigated soil.

Arum palaestinum is known in cultivation as Black Calla. The long spathe is greenish outside and dark-purple inside. More attractive, but having an unpleasant scent, especially at night, is *Arum dioscoridis*. Its Calla-like blooms, a foot long, are greenish-yellow, and purple-spotted within. Both species are spring-



Y. SHUB

A border of Allium neapolitanum

flowering, growing mainly in the mountains and in the Coastal Plain. Blooming at the same time in shady places and river banks is *A. hygrophilum*. Arums are grown more for their curiosity than beauty. Their flowers are built as traps into which insects fall and are imprisoned from one to ten days. Only when anthers open and insects are covered with pollen, do they escape, to be

again attracted, by the special scent, into another flower, and thus pollinate it.

Orchis. About thirty species of orchid are native to Israel, most of which are of little horticultural value, or very rare. At least one of them, however, is worth introducing into gardens, *Orchis laxiflorus*. This is a tall plant with spikes reaching two feet in height and bearing up to fifty purple flowers. It is a terres-



A. SHUB

Tulipa sharonensis

trial plant thriving on heavy damp soils and swamps in various parts of the country. It might easily be grown in gardens of southern U.S.A. having poor drainage and ample water.

Alliums. About thirty species of *Allium* are native to Israel. Although many wild onions are lovely, we would like particularly to recommend five:

A. neapolitanum is one of the prettiest native alliums with pure white flowers.

It blossoms during winter (January-April) in shady places or in full sun, on many kinds of soil. The three-angled scape, about a foot high may be easily distinguished from the round scapes of other alliums.

Resembling *A. neapolitanum* and growing with it is *A. hirsutum*. It has somewhat smaller flowers and produces up to twelve flowering stems to a bulb. *A. erdelii* grows even in the more arid



A. SHUB

Gagea damascena

places of the Negev. Its long-lasting flowers are straw-colored and bell-shaped. A charming but rare species is *A. asclepiadeum*. It is found wild only in the woods of the Upper Galilee, but grows easily in cultivation and propagates well. Its lovely, white flowers, on foot high scapes, have a dark-purple center, and a pleasant fragrance. Of the

other native alliums, we consider *A. schuberti*, the most attractive kind we know. The flower scapes, two to three feet high, bear large globose umbels, more than a foot in diameter, with numerous pink, lilac, and violet flowers. The pedicles vary greatly in length. Those of the sterile staminate flowers are exceedingly long, while those of the



Y. GALIL

Iris nazarena

fertile ones are shorter. They flower in early summer (April-May) and grow mainly in the alluvial heavy soils of the plains.

Tulips. Three of the four species of *Tulipa* native to Israel are worth introducing into southern American gardens. *T. sharonensis* and *T. oculus-solis* have bright red tepals with large, black spots and sometimes yellow margins at the

base of each tepal. Flower scapes of *T. sharonensis* are usually only five to ten inches high, while those of *T. oculus-solis* are taller, reaching a foot and a half in height. Both tulips may reach two and a half feet when grown among weeds and in half shady places. *T. sharonensis* abounds in the sandy soils of the Sharon and other regions of the Coastal Plain. *T. oculus-solis* is found



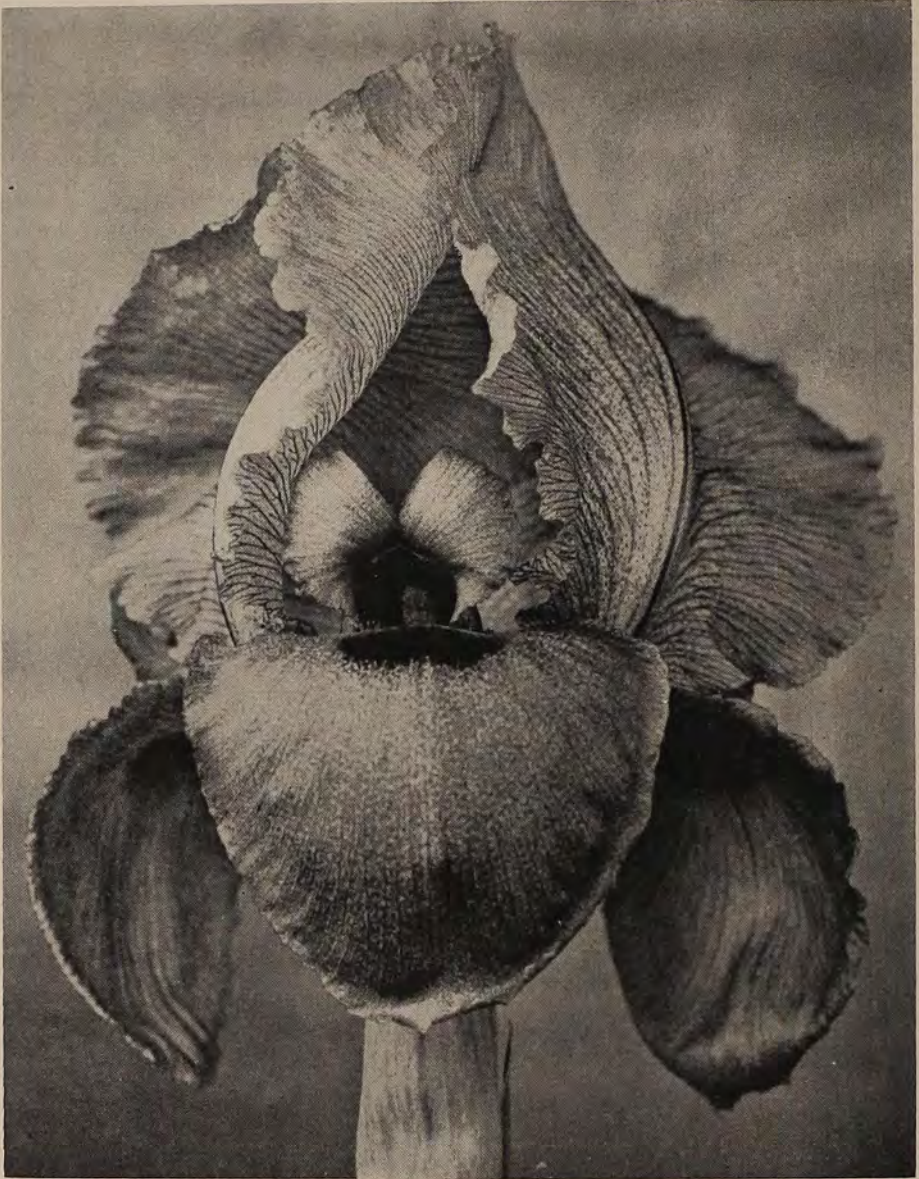
Y. GALIL

Iris mariae

mainly on the much heavier soils of the mountains—Mount Carmel, Judea, and Galilee. Both are spring-flowering plants blooming from the middle of February to April. *T. oculus-solis* is of more value for horticultural purposes. The third tulip is *T. polychroma*. It is a dwarf plant up to seven inches, with white flowers, yellow spotted at the base of each tepal. The three outer tepals have

a purple line on their outer side. Unlike the two red-flowered tulips which thrive in the Mediterranean regions of the country, the latter species is a steppe and desert plant, found mainly in the Negev. It flowers in April.

Colchicum. Many bulbs with crocus-like flowers are common among the native flora. Among them are autumn, winter, and spring flowering species. The



Y. GALIL

Iris haynei

first to bloom are species of *Colchicum*, two of which are the First-rain colchicum (*C. stevenii*) and Jerusalem colchicum (*C. hierosolymitanum*). The pink-purple flowers of both species appear in autumn and early winter, immediately after the first rain. Jerusalem colchicum starts flowering usually even before the rains begin. It is the largest and most beautiful *Colchicum* of the country,

with flowers about two inches in diameter. Both species thrive mainly in the hills and mountains. *C. stevenii* usually is found among rocks and shrubs in uncultivated hill slopes; *C. hierosolymitanum* grows in ploughed fields, vineyards, and olive groves. Its bulb is buried deep in the ground, about ten inches, whereas the bulbs of *C. stevenii* lie no more than two inches below ground.



Y. GALIL

Iris lorteti

Sternbergia. Blooming with the colchicums, but much rarer, are the sternbergias. They are called Yolk-flowers in Hebrew, and indeed they look like yolk-yellow crocuses. *S. lutea* occurs here as well as in Southern Europe; it is known in cultivation. Much bigger and more beautiful is *S. spaffordiana*, with tepals up to four inches long, brought together in a single flower of up to six inches

long. The flowers open every morning and close in the evening and on cloudy days. This beautiful plant is not found outside the Holy Land, and even here it is limited to areas in the mountain region. It, no doubt, deserves to be introduced into cultivation. It should be planted six inches deep. Natural vegetative propagation is slow, although it may be propagated from seeds.

Crocus. About a month after the appearance of colchicums and sternbergias, when the winter rains set in and weather is cooler, the crocuses come out. The most common is *Crocus hyemalis* which occurs in the cool and shady places of the hill and mountain regions. The snow-white blossoms are provided with golden stigmas, purple anthers, and a yellow throat; the flowers have a delicate and pleasant fragrance. The leaves mark the plant by the silvery line running down the middle.

Romulea. When the colchicums have quite disappeared and the crocuses are no longer found, in the middle and late winter (January-March), the charming sweet-scented flowers of *Romulea bulbocodium* make their appearance. Their crocus-like blooms are violet-colored. They appear in small groups on the hills of the Coastal Plain and among the rocks of the mountains.

Gagea. The latest flowering of the crocus-like flowers are the spring-blooming species of *Gagea*. This plant is called "golden flower" in Hebrew, to indicate its golden-yellow color. A distinguishing mark is the green line that runs down the middle of the outer side of each petal. Seven species of *Gagea* grow wild in Israel, each adapted to its own habitat, from the cool-rainy Upper Galilee to the Negev desert. We will mention two of them: *G. commutata* and *G. damascena*. They are relatively tall, reaching eight inches in height. Both grow in groups, side by side, in the mountain regions. The flowers of *G. commutata* are somewhat larger than in *G. damascena* and their tepals are acute.

Iris. We would like to conclude this article with what we consider to be the most precious treasures of our native flora, the wild irises of the subgenus *Oncocyclus*. The native irises of Israel belong to five subgenera: *Iris grantduffii* and *I. pseudacorus* of the subgenus *Apogon*. The first has greenish-yellow flowers on stems a foot high; while the second has tall stems three feet high with fragrant, deep-yellow, purple-veined flowers. Both are water-loving plants, the first grows in places where water stands in winter and dries up during summer, and the second thrives in permanently wet places. *I. palaestina* of the subgenus *Juno* and *I. sisyrinchium* of the subgenus *Gynandres* are both dwarf plants. The first has light-yellow, and the second

blue, purple or lilac flowers. Both are common in most regions of the country, including the steppe, but are of little horticultural value. *I. vartani* belongs to the subgenus *Reticulata*. It is a bulbous plant. The flowers borne on ten-inch stems are lilac-blue with green lines on the outer side of the segments. It is endemic to Israel and grows in various mountain regions.

The group best represented among local iris species belong to the subgenus *Oncocyclus*, with at least seven species. All of them are beautiful, up to two feet tall, and of high horticultural value. Nearly all are endemic to Israel and grow only in a few limited places. Some are very rare and almost extinct. A detailed description of the *Oncocyclus* irises of Israel and their habitat has been recently published by Mr. Zvi Ginsburg of the Gevim Nurseries, which is the only commercial nursery growing these plants. Interested gardeners and amateurs are referred to this article. Some hints for the grower of the *Oncocyclus* irises: Neutral to slightly alkaline soils are best, acid soil must be avoided. The natural soils of these plants are very poor in nitrogen, thus one must add fertilizers carefully. We will give here only a brief description of these irises. Following Mr. Ginsburg's method we will divide them into three groups according to their geographical distribution:

1. The Negev Species: *I. mariae* and *I. atrofusca*. Both grow in the unfavorable climatic conditions of the Negev wilderness, even in areas where annual rainfall totals about four inches or less. They thrive in cultivation even in places having twenty inches of rain, if planted on well-drained soils. *I. mariae* grows mainly on dunes and sandy hills. Its big flowers, four inches in diameter, are lilac-purple with a velvety dark purple patch at the throat. *I. atrofusca* generally grows on calcareous hills and on loess soils of the desert. Its big flowers are dark brown with black veins. In some regions where these two species grow together, natural crosses have occurred. Consequently, one can find natural hybrids with varying shapes and colors of the flowers.

2. The Coastal Plain Species: *I. atropurpurea*. This iris resembles *I. atrofusca*, but is smaller in size. It is often called "the black iris," but many shades of purple can be found in the wild, rang-

ing from almost black to golden-yellow. This is the best known and most common of the *Oncocyclus* irises, and thrives on the sandstone hills and sand dunes of the Coastal Plain.

3. The Northern Mountain Species: *I. haynei*, *I. nazarena*, and *I. lorteti*. Although all three species grow on the mountains of the northern part of Israel, each grows in a restricted area of its own. *I. haynei* is one of the largest and finest *Oncocycli*. Flowers are lilac-purple with darker veins and spots. It occurs only in small areas on Mount Gilboa. The annual precipitation there is a little less and the temperature higher than in the Coastal Plain area. *I. nazarena* is a very lovely and striking plant. Its large flowers are cream-colored with reddish-brown lines, spots and blotches on the outer segments and delicate blue veins and small purple spots on the inner segments. It is confined mostly to the Lower Galilee mountains in the vicinity of Nazareth. *I. lorteti* is the most beautiful iris we have seen and, in our opinion, the finest of all native Israeli bulbs. The basic color of the inner segments is grayish-white with fine deep pink veins. The creamy outer segments are covered with very small purple spots with a

pretty brown-red patch at the base. *I. lorteti* is now limited to only a few places in the Upper Galilee mountains. The mean temperature in its habitat is the coolest of all Israeli *Oncocyclus* iris—61°F., compared to 66° for *I. nazarena* and 71° for *I. haynei*. Where it occurs the annual precipitation is about thirty-two inches as compared to twenty-six for *I. nazarena*, nineteen for *I. haynei*, and about four inches for the Negev species.

The writer is very grateful to Professor H. R. Oppenheimer, Dr. J. Galil, Mr. Y. Alber and Mrs. H. Yahel, who read this manuscript and offered many useful suggestions.

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Malayan Fantasy—A new garden cockscomb*

WILLIAM F. GRANT

The common garden cockscomb, *Celosia cristata*, exists in a magnificent profusion of morphological forms as a result of abnormal cancer-like growths which in the plant kingdom are known as fasciations. Recent cytotaxonomic studies have shown cockscomb to be a distinct species and not a variety, or derived from, the closely related species, *C. argentea*, as once believed. Cockscomb is the oldest of the fasciated plants

on historical record, and the earliest records indicate it only as a cultivated plant. The origin of cockscomb is unknown, but some authorities consider it was originally native to India. It is believed to have been saved from extinction through the religious significance and magical superstitions which have been associated with it by the Indian, Burmese, and Chinese people who have planted and still plant cockscomb around their temples and in their gardens. Most commonly encountered are the red-flowered cockscombs in which the base of the flower through the abnormal pro-

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W. F. GRANT

A plant of 'Malayan Fantasy' showing varying degrees of fasciation of the inflorescence

liferation of cells has become broad, thick, and more or less ruffled like a cock's comb—hence the common name. Forms also exist in which the head is more feathery or plume-like. These are generally referred to as plumose types. In addition to the red-flowered cockscombs, pink, orange, and yellow-flowered plants are commonly grown. Most often the plants are green-stemmed and green-leaved, but red-stemmed and red-leaved ones occur. Studies have shown that these different forms of the common garden cockscomb are inherited true to type from generation to generation.

In 1954, the writer collected seed from a plant of *Celosia* growing in a garden in Malacca, Malaya, with the characteristics of *C. cristata* and *C. argentea*, another species commonly found as a weed. Subsequently, plants grown from this Malayan seed were studied cytologically and found to have 108 chromosomes—three times the number possessed by the common garden cockscomb. Such plants with an increased number of chromosomes are known as polyploids. The writer has discussed the probable mode of origin of these allopolyploid plants with 108 somatic chromosomes elsewhere. Such a polyploid *Celosia* had never before been described and was named *C. whiteii*. Plants of *C. whiteii* have been grown annually since 1955.

As may be seen in the illustration, the cockscomb to be described here develops a fairly extreme type of fasciation, similar to some well-known forms of the common garden cockscomb. The original fasciated plant was discovered in gravelly soil in the greenhouse beneath a bench on which several pots of *C. whiteii* were being maintained. It is believed that a few mature seeds fell through the slats of the bench, and as a result of some unknown environmental condition a seedling mutant developed into a fasciated plant. From the original fasciated plant seeds were collected and have since been grown for three generations. So far all plants are similar to the original plant, and the progeny in subsequent generations may be expected to produce fasciated plants. The reasons why plants become fasciated are not known. Of current opinions the most favored one would attribute the sudden change to some disturbance in the metabolic system resulting from a change in nutrient requirement or lighting condition. It has

recently been shown that tumor formation is greatly enhanced in tobacco plants by the exclusion of visible light from the top half of young plants. In any case, the new fasciated plant arose presumably as a mutation of *C. whiteii* of which a description follows:

***Celosia whiteii* Grant 'Malayan Fantasy' n. cv.**

The plants have a deep red coloration of the stems and leaves, like some forms of common cockscomb, but grow much taller, reaching three feet or more. The cylindrical flower spikes resemble the wild *C. argentea* but are deep red on the upper one-half to one-third and white on the basal portion. Multiple fasciated spikes develop as the spikes mature, as shown in the illustration. The most distinctive aspects of the plant are the deep red coloration of the leaves and the colored, fasciated flowering spikes. The plants grow to three times the height of the common garden cockscomb. In a garden they may be planted as a center piece in a flower bed or in small groups for best effect. In all characteristics with the exception of the fasciated inflorescences, the new mutant plant resembles *C. whiteii*.

Plants of 'Malayan Fantasy' are much slower in growth than the common garden cockscomb. This characteristic has been found to be quite typical of certain polyploid plants. With a relatively short growing season in the vicinity of Montreal with approximately 135 frost-free days, the plants must be started indoors early in the spring if they are to flower during the summer. The plants, however, are attractive for the red foliage and may be brought indoors in autumn to bloom. This plant should reach fullest development in more southerly regions. At present, seed is available for experimental purposes only. It is hoped that within two years seed may be available for commercial distribution. Persons interested may direct enquiries to the W. Atlee Burpee Seed Company.

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The Scientific Approach to Summer Mulching

JOHN R. HAVIS*

The use of summer mulches has long been recognized as good horticultural practice. Observant gardeners have seen response to mulches in healthier, more vigorous growth of ornamentals, larger yields of vegetables and fruit. The reason for these beneficial effects, and some possible deleterious ones, may not be well understood. Our purpose, then, is to discuss the effects of mulches on soils and plants, with the gardener in mind, but drawing strictly on scientific evidence.

A bibliography on the subject of mulching would list several hundred scientific papers spanning more than a century. The research on this subject has been conducted largely on field and orchard crops, but the principles can be applied to the home gardener.

For our purposes, mulches are defined as natural materials: mineral, such as gravel; organic, such as peat, leaves, sawdust or shavings, hay, straw, or other crop wastes; or manufactured materials, such as paper, foil, polyethylene, and the like. It does not include the so-called dust or soil mulch.

Weed Control

Much has been said recently about chemicals for controlling weeds. They have a place for certain lawn problems, but weed killers should not be used in the home vegetable garden, flower or shrub border for the following reasons:

(1) Herbicides are specific in character, i.e., a chemical may be safe for one plant but deadly to another plant a few feet away—in other words, the risk of damage is too great. (2) Accuracy in application is of utmost importance and is not likely to be accomplished on the home-garden scale. Mulches are the most practical method of controlling weeds in the home garden.

The soil should be free of weeds when the mulch material is applied. Mulch reduces weed growth by blocking out light on the soil surface and, therefore, on the young weed seedlings. Weed seeds

contain sufficient stored food to support the young seedlings for a limited time. When the stored food is gone, the leaves of the young plant must be making new supplies of food, or the plants will die. To control weeds, the mulch must be deep enough that the young weed seedlings cannot grow through it on stored food, and it must block out enough light so that the seedling leaves cannot carry on photosynthesis. As far as weed control is concerned, therefore, the kind of material used for mulching is unimportant as long as those two conditions are accomplished.

There is one other point, however. The mulch material itself should not be favorable media for growing weeds, or else control may be unsatisfactory. Animal manures, often mentioned in older literature, give poor weed control for this reason, and, even worse, they are rich sources of weed seeds themselves. Dr. Ticknor compared shredded sugar cane and ground bark mulches at the Waltham Experiment Station a few years ago. His results showed that sugar cane gave better weed control than bark. The likely explanation is that wind-blown weed seeds found a favorable media for growth on the bark, but much less favorable conditions for becoming established on the sugar cane mulch.

Soil Moisture and Erosion

One of the often mentioned benefits of mulching is the maintenance of a higher and less variable moisture level in the soil. Mentioned in the same breath, and often given as the primary reason for mulching, is the prevention of soil erosion. With sufficient repetition, these advantages may be accepted without serious question but the inquiring gardener may well ask, "How does it maintain a more uniform level of moisture?" and "Why does a mulch prevent soil erosion (or washing)?" These are logical questions and their answers are interesting to explore.

One of the most important benefits of a loose, porous mulch is the ease of penetration of water from rain or irrigation.

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Most of us know from experience how slowly water penetrates a hard crusted soil surface. We know that a crust will shed much of the water from a spring or summer shower; that the plants will get little benefit, because the crust seems to be almost impenetrable, and further that such shedding of water causes soil erosion. Most of us feel that breaking up the crust (or cultivation) makes the soil more receptive to the water from showers or irrigation and, therefore, less run-off occurs. We may be surprised to learn, however, that this benefit of cultivation on unmulched soil lasts for only the first few minutes of a shower. Soil physicists have found that the action of rainfall on the soil surface is to disperse the soil particles, resulting in the packing of small particles between the larger ones so that the pores are plugged and water cannot penetrate freely. This condition of the soil, when dried, is the well-known surface crust!

Bear in mind that this action on the soil particles is merely from raindrops (or irrigation drops) falling on the bare soil. A suitable mulch over the soil absorbs the physical impact of the raindrops, delivering the water gently to the soil surface and thus preserving its pore structure or receptive ability. Surface crust does not form. This is why a porous mulch allows greater penetration of water from rain or irrigation, less run-off, and less soil erosion.

We normally think of straw, shavings, and the like as typical porous mulches that would accomplish the improved water penetration. Plastic sheeting can do the job equally as well if small slits are made at intervals to allow penetration of water.

We have spoken of how mulches keep the soil surface open and receptive to moisture. Mulches may also reduce the rate of loss of soil moisture by evaporation.

In order to visualize how mulches can check evaporation we need to understand what causes evaporation. Evaporation takes place in response to a gradient in vapor pressure. This means that moisture vapor moves from a region of high humidity to a region of low humidity and the movement becomes more rapid as the temperature rises. Thus, evaporation from soil will be reduced when the soil surface and the air immediately over the soil is cooled, and when air over

the soil surface has a high humidity. Mulches such as straw, sawdust, peat and the like obviously shade the soil and reduce the temperature as compared with uncovered soil that is exposed to the sun. (This effect on soil temperature is explored in more detail later in this article). These mulches also increase the humidity of the air immediately over the soil surface because they act as insulation slowing the movement of vapor into the drier atmosphere above the mulch.

That both shading and insulation are important was proven in experiments conducted in Nebraska by Russell. He found that merely shading bare soil reduced evaporation 36 per cent, but straw mulch reduced evaporation 73 per cent as compared with bare soil exposed to the sun and wind.

Baver in his textbook on *Soil Physics* quotes experimental data obtained in 1883 showing 84 to 90 per cent reduction in evaporation over a one month period from two inches of chopped straw, beech leaves, pine needles and fir needles. In the same experiment one-fourth inch of chopped straw reduced evaporation about 58 per cent. This thin layer shaded and thereby cooled the soil, but the two inch depth gave greater insulation.

There is evidence that mulches conserve moisture primarily in the upper 6 to 10 inches of soil. Recently reported experiments in citrus orchards of southern California showed that at four-foot depths there was no difference in the rate of moisture depletion between mulched and bare soil. Mulch gave no benefit in yield. It was explained that the roots of the trees were deep and extensive, and the important route of moisture loss was through the trees. There is extensive evidence that mulches conserve moisture in the upper layers of soil, and plants that depend largely on moisture in the upper six to eight inches show marked benefits.

A rather minor consideration, perhaps, but one that does affect loss of soil moisture is the influence that mulches may have on the relative rate of transpiration by plants. Transpiration is the loss of moisture through the leaves of plants. A highly reflective surface underneath plants causes higher radiation to lower surfaces of the leaves and increases transpiration. A recent report of experiments shows that, as compared with bare soil, mulches such as tar paper and foil caused

significant increases in transpiration. Hay, black film, and dusty translucent film had no effect.

Soil Temperature

A summer mulch of plant residues, peat, and the like usually have a cooling effect on the soil. Scores of investigators have recorded soil temperatures under mulches and bare soil. A compilation of the records shows that more striking than the cooling effect is the smoothing out of daily and weekly fluctuations in temperature. This effect is most striking in regions of highest summer temperatures, as might be expected. Records from Puerto Rico, for example, show fluctuations of as much as 38° F. in a 24-hour period on unmulched soil but only 12° F. on mulched soil. This means that the temperature does not rise as high in the middle of the day, neither does it drop as much at night. Simply shading the soil surface from the direct rays of the summer sun would account for some moderation of temperature. Some scientists speak of an insulation effect based on records that show soil temperatures less than the air temperatures in the shade. A few investigators have thoughtfully measured the mulch material itself and recorded temperatures about as high as bare soil. The soil below remains cool if the mulch material is a poor conductor of heat. This means, from a practical standpoint, that a loose and dry mulch protects against a high temperature extreme better than a wet or compacted material such as paper.

The color of the material may or may not be important. Black paper may raise the temperature higher than bare soil, whereas white paper moderates midday temperatures due to greater reflection. With poor conductors, such as hay, on the other hand, only very small differences are measured under dark, weathered material as compared with bright, unweathered straw.

This slightly cooling action in the summer, and the greater uniformity of soil temperature, are assumed to be beneficial to most plants. A saving in the rate of evaporation of soil moisture (already discussed) may be the most important actual benefit to the plants. Research literature is a bit deficient on the total plant responses to independent variations in root temperature. A disadvantage of mulching too early in the

season has often been observed in delayed growth from preventing the soil warming as rapidly as uncovered soil.

This problem of cold soils in the spring has been given some attention by research people in Connecticut, Maine, and elsewhere. Professor Whitcomb at Waltham, Massachusetts, has observed earlier ripening of melons that were mulched with black polyethylene. Several others have made similar observations with vine crops, tomatoes, beans, and strawberries. It has been commonly felt that the reason for faster growth and earlier maturity was that the black plastic raised the soil temperature early in the season and forced the plants to start faster. Dr. Waggoner, of the Connecticut Experiment Station, after taking many temperature measurements, showed that black polyethylene mulch increased the soil temperature by only about two degrees for the entire growing season. Furthermore, he found that the higher temperature resulted largely from preventing as much drop in temperature at night. He also found that the black plastic itself got very warm on a sunny day and emitted a great deal of heat to the air above it. Is it possible that the faster growth of melons could be caused more by warming the leaves than the roots?

Dr. Waggoner showed that translucent polyethylene warmed the soil faster than black polyethylene, hay, or paper mulches. This has also been shown by investigators in Kansas with the suggestion that clear plastic film be used to warm the soil early in the spring, but then to exchange it for straw when the weather gets warm. Anyone trying clear or translucent plastic as a mulch in the garden will find one disadvantage: weeds will grow profusely under the plastic because one of the requirements for weed control—exclusion of light—has not been supplied. The disadvantage of extra weeds could outweigh the advantages!

Soil Aggregation and Porosity

High porosity is a desirable characteristic of soil because it provides free movement of moisture and allows good aeration for plant roots and for activity of beneficial microorganisms. Porosity varies with the soil texture, that is, the relative proportions of different size particles. Soils with more sand and gravel being

more porous than soils with high clay content. More important, perhaps, is the improved porosity due to increases in soil aggregation. Most gardeners appreciate good aggregation intuitively. They recognize it as good tilth or say the soil "feels good." In order for the soil particles to form aggregates (or granules) a bonding or cementing agent is necessary. This cementing agent is humus, which is the decomposition product of organic material.

The improvement of aggregation is probably the most important reason for incorporating readily decomposable organic material into garden soils. It is also a benefit of mulching with organic materials that gradually decompose, with the break-down products being carried into the soil by rainfall. Of the dozen or so studies of the effects of mulches on aggregation only a few have found measurable improvement in as short a time as one or two seasons. The measurements that show great improvements are those that are made in soils that have been under mulch continuously for ten to twenty-five years. A more rapidly decaying mulch material would probably produce faster results.

The influence of earthworms on soil aggregation and porosity should not be ignored. A higher earthworm population is usually found under mulches because they are protected from temperature extremes, moisture conditions are favorable, and decomposing mulch material provides food. Counts have shown considerably higher earthworm populations under decomposing plant residues such as straw, leaves, and the like, than under relatively inert material such as paper and burlap.

We are not aware of aggregation measurements under polyethylene plastic mulches but would expect little improvement since these materials would contribute neither organic material for cementing soil particles nor food for earthworms.

Soil Acidity

Most mulching materials have an insignificant effect on soil acidity. In tests where soils under mulches become more acid, it was seen that corresponding unmulched soils also became more acid. Many gardeners mistakenly believe that sawdust and oak leaves have high acidifying effects. Boller and Stephenson in Oregon measured the pH of various

mulching materials and of the soil beneath them 15-18 months after application of the mulches. Fir sawdust had pH 5.0 and oak leaves pH 7.4. When unmulched soil had pH 6.6, soil under the sawdust had pH 6.6 and soil under oak leaves had pH 6.3. Dr. Judkins in Virginia has experimented with sawdust mulches for many years and states that "contrary to popular belief, sawdust does not cause the soil to become acid."

Soil Nutrients

The use of mulches can both decrease the amounts of certain plant nutrients and increase other nutrients. The effect depends on the mulch material that is used. Nitrogen is the nutrient that most often is made deficient for plant growth. Potash is the nutrient most often increased, with phosphate and calcium being affected occasionally and to a lesser degree.

A mulch material such as sawdust can actually rob the soil of nitrogen and cause stunting of plants unless additional nitrogenous fertilizer is added along with the mulch. The reason for this "robbing" of nitrogen is that the bacteria that decompose the mulch require a certain ratio of nitrogen to carbon for their diet. A 1 to 20 ratio of nitrogen to carbon is about the break-even point for mulches. Usually, a material that contains about one per cent nitrogen does not rob soil of nitrogen. If the mulch is carbonaceous, that is, mostly carbon and very little nitrogen, then the bacteria will take the necessary supply of nitrogen from the nearest source, which is the soil. The fact that the stolen nitrogen is eventually returned to the soil at the completion of the bacterial action is comforting but does not help the immediate situation. The obvious answer to the problem is to supply extra nitrogen from commercial fertilizer sources to approximate the ratio needed by the bacteria. For fresh sawdust this is about one pound of nitrogen to each 100 pounds of dry sawdust. The following supply one pound of nitrogen: 2.2 pounds of urea; 3.3 pounds of ammonium nitrate; 6.25 pounds of sodium nitrate; 5 pounds of 20-10-5 fertilizer; 10 pounds of 10-6-4 fertilizer; 20 pounds of a 5-10-10 fertilizer; about 16 pounds of an activated sewage fertilizer.

Many other materials often used as mulches, such as straw and shredded

sugar cane, are also carbonaceous and additional nitrogen may be advisable. Shavings and chips cause less trouble because their particles are larger and thus break down more slowly.

Potash is almost always significantly increased in soil by mulching. In most instances the additional potash is believed to have been leached out of the mulch material. Potash in plant material is almost wholly water-soluble and subject to leaching. Grasses, straws, and hays contain up to one per cent by weight potash. A generous mulch of such materials would supply a significant amount of this nutrient element.

Certain plant residues, for example tobacco stems and cocoa shells, carry sufficiently high levels of potash to cause injury to certain plants. Tobacco stems contain about 6 per cent potash, and cocoa shells about 3.5 per cent. Work at the Waltham Field Station of the University of Massachusetts demonstrated severe injury to Azalea and Rhododendron from cocoa shell mulch. Examination revealed that not only were there no roots directly under the mulch but that roots had been killed in the soil 3 to 4 inches below the mulch. Extremely high levels of potash were found in the soil, and it was believed that excess potash toxicity caused the death of the roots and subsequent injury to the plants.

Getting back to normal levels of potash, some increase in the soil has been observed under materials such as glass-wool that could not contribute the element. It has been suggested that an increase in available potash is an indirect benefit of the more uniform moisture and temperature levels under mulch.

Root Distribution

Cultivation around plants destroys roots in the upper zone that often is richest in nutrients. Drying of the surface soil also makes unfavorable conditions for root growth. Weeds and grass are strong competitors for moisture and nutrients near the soil surface. A good mulch obviously encourages surface rooting by controlling weeds, retaining moisture and eliminating cultivation.

Root growth near the soil surface, and often directly under the mulch or in the mulch itself is commonly observed. Favorable moisture and temperature conditions allow the roots to exist in

upper layers where good aeration encourages growth. Plants also develop as extensive a root system under mulches as they do in bare soil. Thus the surface roots are in addition to the usual root distribution. Sometimes the mulched plants concentrate most of the roots near the surface. This would probably occur in wet or heavy soils where deep rooting would be limited by poor aeration. The type of root distribution varies with different kinds of plants, of course.

Summary

We have seen that the use of summer mulches brings about some rather important changes in the soil and in the environment for the roots of plants. Mulches would be worth while on many situations if they accomplished nothing more than to keep down weeds. The improvement in moisture penetration and retention, moderation of soil temperature fluctuation, improvement in aggregation and encouragement of surface rooting, all amount to exceptional advantages to be gained by judicious use of proper mulches.

Mulching is not always advantageous, however, as has been mentioned. The application of a mulch early in the spring may delay warming of the soil unless a clear plastic is used to trap the heat and hasten warming. Certain materials, highly carbonaceous, can bring about nitrogen deficiencies unless some extra fertilizer is supplied. This really should not be considered a disadvantage, but merely a point to be remembered. The wrong mulch materials can cause damage to the plants. Products rich in nutrients, particularly potash, should not be used as mulches but should be used as fertilizers and at appropriate rates.

For those wishing to pursue further the scientific aspects of summer mulching, the following materials are suggested.

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Ornamental Fruiting and Autumnal Foliage Viburnums¹

DONALD R. EGOLF²

Viburnums are a group of shrubs which become increasingly evident in the autumn landscape. In addition to having ornamental attributes, viburnums are great bird attractors. The fruit, botanically referred to as a drupe, often persists on the bush until March. During the summer, fall, and winter the fruit is eaten by song birds, ruffed grouse, bob-white quail, pheasants, foxes, skunks, opossums, and racoons. The thicket-forming species, such as *Viburnum dentatum*, *V. scabrellum*, *V. prunifolium*, *V. lentago*, and *V. cassinoides*, provide cover for wild life and browse for rabbits and deer. Viburnums are used for conservation planting by game and conservation organizations. A few fruiting viburnums in the home landscape planting will do much to encourage birds into the garden.

The autumn fruits are sometimes more colorful than the spring flowers, and the fall foliage often has a splendor all its own. The cymose or paniculate clusters of blue, black, yellow, or red fruits may be evident for a week or persist well into winter and spring. Although few other ornamentals can rival the viburnums in fruit, it is the composite of flower, fruit, foliage, growth habit, ease of culture, and diversity of form that place viburnum foremost amongst ornamentals.

Cultural Procedures

The sturdy shrub group encompassed by the variable viburnums is undemanding and of simple culture. It offers a

solution to the home gardener seeking dependable shrubs with easy maintenance. Most species will thrive on a range of soil types and are relatively free of insect pests and diseases.

The majority of the species tolerate diverse soil types and various exposures, but most will thrive somewhat better on a deep rich, loamy soil with a pH of 6.0 to 6.5 and a moderate amount of moisture. In general, the Chinese species flourish on calcareous soils, whereas the native American species prefer a slightly acid soil. *V. acerifolium*, *V. furcatum*, and *V. alnifolium*, are exceptions that grow best on a moist, organic soil with a more acid reaction, in pH range 4.5-5.0. Species adapted to moist areas are *V. cassinoides*, *V. dentatum*, *V. lentago*, *V. nudum*, *V. scabrellum*, and *V. trilobum*. *V. acerifolium*, *V. opulus*, *V. prunifolium* and *V. rafinesquianum* are adaptable to both shady and dry conditions. Although they tolerate shade, a generous amount of sunlight and good drainage are required for best flower and fruit production. Many will thrive in the shade of the woodland but, except for several native species, *V. acerifolium*, or *V. dentatum*, all will fruit sparsely.

Late-autumn or early-winter planting is often preferable to setting new plants in the spring, but planting any time during the dormant season is satisfactory. Balled and burlapped plants can be transplanted during the summer, when in leaf, if well watered and given light shade for a few days. A wilt-proof spray applied to the foliage, previous to transplanting plants in full foliage, will be beneficial. Mulching generously with leaves, sawdust, or compost after autumn planting will preclude freezing and heaving.

¹Ornamental Deciduous Flowering Viburnums, being the first paper in a series discussing the Viburnums, appeared in the July issue of *The American Horticultural Magazine*. Evergreen Viburnums and a Checklist of Viburnum Cultivars will be published in future issues of the Magazine.

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Since the fibrous roots are fairly near the surface, the plants should only be shallowly cultivated. A high fertility level is not required. Plants will thrive on low to medium-high nutrient levels, but growth will be more lush with greater fertility. An early-spring broadcast application of fertilizer at the rate of two pounds of a 5-10-5 fertilizer per 100 square feet will maintain vigorous growth and fruiting. Heavy application of a nitrogen fertilizer should be avoided, as it will encourage soft sucker growth that will initiate few flower buds. Although many species will endure moderately dry soil, most will benefit by supplemental water during periods of drought. A thorough watering will be beneficial, but frequent light watering will encourage surface roots that are susceptible to drought and winter injury. A mulch will do much to retain moisture and sustain growth.

As a group, the viburnums are amenable to pruning, but heavy pruning is seldom required. The indiscriminate pruning of *V. plicatum* f. *tomentosum*, and *V. prunifolium* can destroy the horizontal lines of the branches. In general the species are best left to develop naturally. Infrequently the pruning shears, in the hands of the amateur, results in a bobbed mound that might be appropriate in a cemetery but not in the home landscape. Such species as *V. tinus*, *V. lantana*, *V. prunifolium*, *V. suspensum*, *V. lentago*, and *V. dilatatum*, can be sheared to yield dense hedges, while the dwarf compact *V. opulus* var. *nanum*, *V. fragrans* var. *nanum*, *V. opulus* 'Compactum', and *V. trilobum* 'Compactum,' normally develop into compact hedges without any pruning. Only the densely branching forms should be selected for hedges as the more upright and leggy forms will require constant shearing to achieve a thick compact hedge. If minor pruning is required to improve the plant shape, it should be done after flowering and not during winter or spring, as with many other shrubs. Many of the species set flower buds in late summer and fall. Usually these much expanded terminal naked or scaly buds are readily visible. Should pruning be undertaken after these have been developed, the following year's flower and fruit display will be suppressed, if not destroyed. Species like *V. grandiflorum*, *V. × burkwoodii*, *V.*

carlesii, *V. × carlcephalum*, *V. fragrans*, and *V. lantana*, will be more compact if the tips of vigorous-soft-sucker shoots are pinched. Doing this will promote branching and will not affect flower-bud initiation. Little pruning of such vigorous shoots, however, should be done after mid-July. Understock growth of grafted plants should be immediately removed.

Insects and Diseases

White fly, aphids, and dogwood twig borer are the only serious destructive insects. White fly is particularly troublesome on mature specimens of the evergreen *V. tinus* and *V. suspensum*. In early spring a foliage spray of DDT (dichloro diphenyl trichlorethane), lindane (gamma isomer of benzene hexachloride), or malathion will control this insect. With a heavy infestation, spraying may be required through the summer. On *V. opulus*, leaves and branches that have become distorted by the feeding of the snowball aphids provide an easy identification characteristic for this species and its cultivars. Sprays of malathion or lindane before the leaves have curled will readily control the aphids. The dogwood borer can become a serious pest in an old collection. The eggs are laid in the rough bark of the trunk and large branches. The 3/4 inch-long borer feeds under the bark and if the borer numbers are sufficiently great, they will girdle the trunk. Effective control can be secured by painting or spraying the trunks and branches with DDT or dieldrin, three times at 20-day intervals, starting in early May [in the Washington, D.C. area]. On occasion, populations of mealy flata, tarnish plant bug, thrips, and mites may be troublesome. A complicated spray schedule need not be followed to grow viburnums.

Bacterial leaf spot and powdery mildew are the two diseases most frequently encountered. On the leaves and young stems bacterial leaf spot appears as water-soaked spots that develop into irregular sunken brown areas. Bacterial leaf spot is seldom prevalent enough to disfigure the foliage or cause defoliation on the susceptible members of the lantana group. Leaf spot can be controlled by picking off and burning all infected leaves. To prevent new infections spray three times, at weekly intervals, with Bordeaux mixture; one of the fixed copper fungicides, Copper A, or Fermate

(ferric dimethyl dithiocarbamate). Powdery mildew, which may become evident in late summer on plants in shaded situations, can be controlled with a Karathane or a Mildex (dinitro capryl phenyl crotonate) spray. Shoot blight causes grayish brown decayed spots or may cover the entire leaf. The twigs so infected may be killed and the inflorescence may become blighted. This disease is not common and can be controlled with a Ferbam spray. Rust may infect *V. suspensum* and possibly a few other species, but this is rarely serious enough to demand control measures. Sulfur or sulfur containing sprays or dusts should not be used on viburnums. It takes but one dusting or spraying to turn the leaves black and defoliate the entire plant. Plants of the Lantana group are particularly sensitive to sulfur injury. Lead arsenate plus a sticker will likewise cause defoliation within 36 hours after application.

In suburban areas rabbits, starlings, and sparrows may become destructive. During the winter or early spring as the buds expand, birds may pick on the flower buds and thus destroy the subsequent ornamental flowering and fruiting. Bird feeding stations will usually alleviate this dilemma. During the winter the trunks and branches are susceptible to cutting and girdling by rabbits. A rabbit repellent of rosin or a prepared paint or spray on the branch and trunk will deter any damage during snow bound periods when food is scarce for rabbits, as well as for other rodents.

Propagation

Viburnums may be increased by cutting, division, grafting, layering, and seed techniques. Regardless of the chosen propagation method, only the very best cultivar stock plants should be perpetuated. The plant often offered by the nurseryman to the home gardener may be a mongrel hybrid that has been sold without any awareness of misrepresentation. Since viburnums are self- and cross-compatible in varying degrees, pollen from a poor ornamental specimen may be blown by the wind, or carried by an insect to a flower on the select clone from which seed is harvested. Although the propagator selects seed in good faith, grows the plant, and continues the cycle for a number of generations, he is not maintaining the species, but is evolving

a new race of mongrels that probably warrant little space in any yard.

Even though there will always be the odd, inferior segregates, it is not inferred that certain species cannot be grown from seed with a resultant population of reasonable uniformity in the characteristics of growth, flower, and fruit. With the ease of vegetative propagation however, greater stress need be placed on select clones that definitely produce outstanding ornamentals. There has been emphasis on seedling viburnums to insure fruiting; but this cannot be substantiated, as many of the select clones, when isolated, will be interfertile yet fruit abundantly. Possibly a few of the shy fruiting species do require a higher degree of cross pollination. The planting of several select clones will insure abundant fruit on all plants rather than relying on a heterogenous seedling population in which a third or more of the plants may be inferior.

Mass propagation is best achieved by sowing seed in outdoor bed or stratifying in sand in outdoor bed. The behavior of viburnum seed is very variable. Seed germination is complicated by epicotyl (embryonic root) and hypocotyl (embryonic shoot) dormancy, and inhibitors. Pretreatment of the seed at 68°F. will induce root development. If after a prescribed time lapse the seed is exposed to a cold treatment, 41°F., the epicotyl, or shoot, will develop. The procedure of many propagators of sowing the seed in outdoor beds in early summer and allowing the seed to freeze during the winter, will simulate the warm period followed by a cold period that initiates germination. Because many species mature seed in the autumn it is impossible to harvest the seed, remove the fleshy pulp, treat with a surface fungicide, and sow before cold weather. Germination of this late-sown seed will be delayed until after the second winter as it will not have achieved sufficient temperature pretreatment. Often viburnum seed collected from cultivation will not come true. It is recommended that propagation be carried on by cutting, layering, or grafting.

Before the widespread use of interrupted mist propagation, most viburnums were produced by seed, layerage, graftage, and hardwood cuttings. Softwood cuttings taken in mid-June and early July can be well rooted in three



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The scarlet fruits of Viburnum plicatum f. tomentosum, Doublefile Viburnum, are held upright above the horizontal branches

weeks or less, depending on the species. Cuttings, six to eight inches long, taken from vigorous current season's growth, should be inserted to a depth of at least two nodes in a medium of vermiculite, coarse sand, or a mixture of two-thirds coarse sand and one-third peat moss. Supplemental bottom heat will be advantageous, but is not a necessity. Interrupted mist maintains turgid foliage that promotes rapid rooting. The home gardener without interrupted mist facilities can achieve the same result by placing a few cuttings in a clay flower pot covered with a polyethylene bag. The covered pot should be placed in the shade as the polyethylene in the sun will

tend to be a heat trap and the cuttings may be scorched. The polyethylene bag conserves moisture and provides a near-saturated atmosphere that prevents leaf wilting and thus hastens rooting. The rooted cutting can be potted or transplanted to a cold frame for the winter. Such early propagations will make sufficient growth to winter well.

Hardwood cuttings, six to eight inches long, taken after the leaves have fallen in late November, will not root as readily as softwood cuttings and may require several months for rooting. Hardwood cuttings placed in deep pots or flats in a cold frame or cold basement will callus and root the following spring. Often with the facilities available to the home gardener a few plants can be obtained by this technique. Such hardy species as *V. opulus*, *V. plicatum f. tomentosum*, and *V. trilobum* are commercially mass-produced by burying hardwood cuttings in outdoor frames during the winter and planting in nursery rows in early spring.

Asexual propagation of select clones can be achieved by graftage, but does not produce the most desirable plant. *V. carlesii* and hybrids of this species, are commonly veneer grafted or shield budded on seedling understock of *V. dentatum*, *V. lantana*, or *V. rhytidophyllum* during the summer or winter. Such techniques produce salable plants in a shorter period than do cuttings. The competition between stock and scion, as the plant matures, may terminate with the understock being the dominant plant. The gardener on the vigil with the pruning shears may recognize the difference between the stock and scion, but the amateur may be unaware of understock growth and may realize after a few years that he has a plant of the inferior *V. lantana* or *V. dentatum* rather than a select *V. carlesii* cultivar. The compatibility and differential growth rate of stock and scion produce a weak point on the trunk suitable for bacterial or fungal infection that may result in the mature specimen suddenly being lost to graft blight.

At the Montreal Botanic Garden normal *V. opulus* was grafted on the dwarf *V. opulus var. nanum* to produce a dwarf plant. Even though many of the viburnums are too large for many landscape purposes, the use of dwarf understock has limited possibilities. Since such grafted plants will produce sucker shoots it will require constant attention to

maintain the dwarfed plants. Likewise, the cost of commercial production will probably be prohibitive. The horticulturists, however, can produce a few dwarf-grafted plants for a select garden corner utilizing one of the dwarf cultivars as understock.

Whenever only a limited number of plants are required division or layering can be employed. To produce a few plants by either of these techniques requires no extensive propagation facilities. A sucker shoot that appears near the base of the plant can often be severed from the parent plant with a few roots attached. After two to three years in the nursery row or corner of the garden, a specimen plant will have developed from the division. A vigorous young branch is tip-layered in early spring by wounding with a slight cut in the bark near the tip, and burying the branch in soil with the tip exposed. Species with stiff branches not limber enough to be bent down to the ground are best mound layered. A peat or soil mound should be made to cover the basal portions of the plant to a height of approximately ten inches. With adequate moisture, layers will strike roots the first season, but they will probably benefit by not being severed from the parent plant and transplanted until the second season. The home gardener can produce a few plants by air layerage, but the technique is not economical for commercial production. An air layer is prepared in the early spring by wounding a stem, treating the wounded area with hormone powder, and applying a generous handful of moist sphagnum that is securely held in place by a piece of polyethylene film. The rooted air layer is cut from the parent plant and grown for a season or two in a sheltered corner before planting in the shrub border. Layers and divisions should always be taken from select cultivars as poor cultivars will pay little interest, but select forms will provide dividends with abundant flowers and fruit.

The universal adaptability of viburnum does not cease with the flowering anticlimax in mid-June. The diverse foliage types and textures, such as the velvety-textured leaves of *V. buddleifolium*, the deeply rugose leaves of *V. sieboldii*, the smooth glossy leaves of *V. prunifolium* and *V. cassinoides*, the plicate opposite paired leaves of *V. plicatum*

f. *tomentosum*, the long, pendulous leaves of *V. setigerum*, the fine-textured foliage of *V. × chenaultii*, or the evergreen, wrinkled leaves of *V. rhytidophyllum*, can be combined in the border to provide a pleasing summer composition. Such foliage variants as *V. lantana* 'Aurea Marginata' with white-margined leaves, *V. lantana* f. *variegatum* with variegated foliage, *V. opulus* 'Aureum' with golden foliage that severely burns in the hot summer sun, *V. opulus* f. *variegatum* with variegated foliage and *V. sargentii* 'Puberulum' with new shoots maroon-red, can be displayed to some advantage but most foliage color variants are monstrosities with little ornamental fruit. Many of the cultivars have more subtle foliage coloration, petioles colored to compliment the foliage, or leaves with bronzed or maroon foliage which contrast pleasingly in a mass planting.

Red to Black-Fruited Viburnums

Even though the spectacular fruit display on several of the early-maturing species is of brief duration, it is often more appreciated at that season when few shrubs are in flower and fruit. *V. fragrans* (5b)*, Fragrant Viburnum, is the first species to mature fruit in late June. The pendulous, 2-3-inch diameter, scarlet clusters become black after several weeks and are readily eaten by birds. The white-flowered *V. fragrans* var. *album* (5b) has pale yellow fruits at maturity.

The horizontal rows of upright inflorescences with scarlet fruits on *V. plicatum* f. *tomentosum* (5), Doublefile Viburnum, provide contrast with the soft, medium-green foliage but are evident for only a few weeks before ripening to black in early July and being devoured by birds. After the disappearance of the fruit this select shrub passes to another ornamental phase and is enveloped with many fine purplish-red autumn hues. The native *V. alnifolium* (4), Hobblebush Viburnum, enlightens the northeastern acid woodlands with scarlet fruit for a few weeks in June and July before the fruit matures to black and is eaten by wildlife.

The scarlet *V. sieboldii* (5), Siebold Viburnum, fruits mature in August and

*The numbers in parentheses after the species in the text refer to the hardiness zone according to the *Plant Hardiness Zone Map*, U.S. Dept. Agr. Misc. Publ. 814 (See *The Amer. Hort. Mag.*, Oct. 1960). The suffix b with the hardiness zone indicates that the plant is hardy only in the warmer parts of the zone.



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The brilliant scarlet fruit of Viburnum dilatatum, Linden Viburnum, matures in September and persists on the plant into the winter

are soon obliterated by birds. After the fruit is gone the red pedicels remain to enhance the plant. The deeply rugose, shiny-dark green leaves assume a purplish bronze in autumn.

Many of the select flowering viburnums lack the autumnal display of fruit and foliage coloration. The fruits on such species as *V. carlesii* (5b), Korean-spice Viburnum; *V. bitchiuense* (6),

Bitchiu or Yeddo Viburnum; *V. × chenaultii* (5), Chenault Viburnum; and *V. × burkwoodii* (5b), Burkwood Viburnum, mature to black in early August. For but a very brief period the fruit may be colored red or orange. In mid-August the fruit display of *V. lantana* (4), Wayfaringtree Viburnum, affords a striking display for about a week, when the fruit clusters contain the

luminescent orange-red fruits in various stages of maturity from green to orange-red to black. A mature 6- 8-foot specimen is not outstandingly ornamental but it combines good traits with hardiness and adaptability to dry environments so as to provide a useful shrub for adverse sites. The more abundant fruiting *V. lantana* var. *rugosum* (4) has larger, darker green, and more wrinkled leaves. The cultivar grown under the name *V. lantana* 'Macrophyllum' (4) has larger, medium-textured leaves and fruit clusters that may be as large as 8 inches in diameter.

Blue and Black-Fruited Viburnums

The blue- and black-fruited viburnums are most prevalent among the North American species. Since blue and black do not contrast sharply with green or autumn-colored foliage, the fruit display is less showy than on the red-fruited species. However, the blue- and black-fruited species rate a select position in the viburnum border as they combine noteworthy characteristics with fruits that often includes green, pink, and red to black in the same cluster.

The eastern woodland *V. acerifolium* (4), Maple Leaf Viburnum or Dockmackie, thrives on acid soil despite shade and drought. *V. acerifolium* is common on dry woodland slopes from Quebec and the New England states southward to the mountains of Georgia and Tennessee. The common name refers to the deeply lobed leaves that closely resemble the leaves of maple. The early June cream-yellow flowers produce the upright clusters of black fruits. This serviceable 3-6-foot plant warrants extensive use in naturalistic plantings and will enhance any woodland trail with some rich purplish and crimson hues in late autumn.

The horizontal black branches with abundant spur growth of *V. prunifolium* (4), Black-Haw or Stag Bush Viburnum, compose a large upright shrub or small tree 15-feet high that somewhat resembles some of the crabapples. The Black-Haw is generally more rigid and twiggy than *V. lentago* becoming thick and broad through the middle and forming almost impenetrable native thickets. The pointed, slate-gray buds unfold into broad-elliptic to ovate, sharply serrate

The large multiple-colored fruit clusters of Viburnum lantana 'Macrophyllum' are well displayed on a large shrub

DONALD R. EGOLF





DONALD R. EGOLF

The contrast of the glossy green leaves or russet autumn foliage and the glossy scarlet fruit places *Viburnum wrightii*, Wright Viburnum, among the select fruiting species

leaves, which are a glossy green in summer and turn wine red to shining red in autumn. The mid-May cream-colored flowers are followed by fruits that droop pendant fashion from the heavily laden branches. In August and September the maturing ornamental, multicolored fruits in the same cluster are green, rose, blue, and black and covered with a heavy bloom. The fruits are palatable and sweet after being exposed to frost, but rather dry. The *V. prunifolium* naturalistic appearance and tree-like growth habit are combined with mass flower display, abundant blue-black fruit, and fine foliage to provide an ideal landscape specimen for the modern designed home on a small lot. A weeping form 'Holden' (4) was selected at the Holden Arboretum, Mentor, Ohio. The cultivar 'Gladwyne' (4) is an exceptionally fine fruiting specimen included in the unique garden of select native plants created by Mrs. J. Norman Henry, Gladwyne, Pennsylvania.

The southern counterpart of the Black-Haw is *V. rufidulum* (6), Southern Black-Haw or Rusty Black-Haw. This native from Virginia to Florida is a large shrub or small tree to 30-feet tall that has stiffer and more horizontal branches

than *V. prunifolium*, buds that are velvety dark brown and elliptic-obovate, 2-3-inch leaves that are glossy green above and rusty pubescent beneath. The flowers are cream colored and the fruits bright blue-black covered with a glaucous bloom. Autumn foliage colors are in tones of maroon, red, and purple. *V. rufidulum* is a suitable plant for southern culture but in northern areas *V. prunifolium* is the superior plant.

The somewhat more open *V. lentago* (3), Sheepberry, Nannyberry, or Wild Raisin Viburnum, is closely allied to the Black-Haws. *V. lentago* is a much-branched shrub or small tree up to 30 feet tall found native in meadows and open pastures from the Hudson Bay area south to Georgia and Mississippi. The finely toothed, shiny green leaves change in fall to tones of orange, scarlet, and red. The bright-blue fruits in drooping clusters ripen to black in September and October and will persist on the plant into the winter. The graceful arching branches of the round-topped *V. lentago* produce an excellent shrub for specimen planting, screens, or windbreaks, but in either case must be given ample room. The form *V. lentago* f. *sphaerocarpum* (3) with globular fruits is not signifi-



J. HORACE MC FARLAND

The Viburnum setigerum, Tea Viburnum, branches are often arched under the weight of the abundant, oval-shaped fruits

cantly different from the species and is an inferior ornamental.

The hybrid *V. × jackii* (4), (*V. lentago* × *V. prunifolium*) originated in the Arnold Arboretum before 1900 and was noted by J. G. Jack in 1908. *V. × jackii* is intermediate between the parents and not of significant ornamental merit. Another hybrid *V. × vetteri* (5), (*V. lentago* × *V. nudum*), between two North American species, originated before 1879. *V. × vetteri* is known only to be cultivated at the Cambridge Botanic Garden, Cambridge, England. *V. × vetteri* and *V. × jackii* have blue-black fruit.

V. cassinoides (4), Withe-rod, Swamp Viburnum, Swamp Black-Haw, False Paraguay Tea, Wild Raisin, or Appalachian Tea Viburnum, is a swamp native of the Atlantic coast of North America. The common name Withe-rod refers to the practical application as a switch by country school teachers in pioneer times. The thick, dull-green elliptic or ovate to oblong, finely toothed, wavy margined leaves turn orange-red in the autumn. In early June the yellowish-white flowers appear in loose 4-5-inch flat clusters. The multicolored fruit clusters are spectacular in August and September as the fruit changes from green to pink to blue

to black. In the wild the plant is often a straggly shrub, but in moist acid gardens it becomes a symmetrical plant 6 feet tall. *V. cassinoides* var. *nanum* (4) is a distorted compact plant with crinkled leaves that appears to have been the perpetual residence of aphids. *V. nudum* (6), Possumhaw Viburnum, is closely akin to *V. cassinoides* but more adaptable for southern planting. *V. nudum* is a larger plant than *V. cassinoides* and has 3-4-inch long, lustrous leaves, which become dark red in autumn. The blue-black fruits mature in September. *V. nudum*, likewise, is a plant for moist areas in gardens south of central Pennsylvania.

Although a multiple-stemmed plant of *V. dentatum* (3), Arrowwood Viburnum, may be 15 feet tall, plants in the native environs of eastern North America will produce thickets in moist areas. The glossy, russet, autumn foliage will accent any naturalistic planting. The abundant blue-black fruits mature in September and remain on the plant until winter, when they provide an excellent source of food for birds. The Arrowwood Viburnum is a shade-tolerant filler plant for the large shrub border or naturalistic woodland trail. *V. dentatum*

var. *pubescens* (3), *V. recognitum* (3), *V. scabrellum* (6), *V. bracteatum* (6), *V. molle* (6), and *V. rafinesquianum* (3) are related species. Only two of these species are ornamentally significant from *V. dentatum*. The 12-foot *V. molle*, Kentucky Viburnum, has interesting peeling bark that reveals a shiny under surface. *V. rafinesquianum*, Downy Arrowwood, is a compact shrub 3-6 feet tall that has fine-textured foliage and grows naturally in dry-rocky soils.

Yellow-Fruited Species

The four yellow-fruited viburnums are worthy of cultivation as there are relatively few yellow-fruited ornamentals. As the fruits mature they pass from pale yellow to dark orange and brown on *V. opulus* f. *xanthocarpum* (3b), the Yellow-Fruited European Cranberrybush Viburnum, *V. sargentii* f. *flavum* (5), the Yellow-Fruited Sargent Viburnum, and *V. setigerum* f. *aurantiacum* (6), the Yellow-Fruited Tea Viburnum. The firm pale-yellow fruits of *V. dilatatum* f. *xanthocarpum* (5b), Yellow-Fruited Linden Viburnum, persist much longer on the plant than on the other yellow-fruited viburnums. The yellow-fruited selections will complement plantings of other species. The plants of the yellow-fruited forms are similar to the species; however, the foliage will be lighter yellow green. *V. opulus* f. *xanthocarpum* and *V. sargentii* f. *flavum* will display good yellow foliage in the autumn.

The plants of *V. dilatatum* f. *xanthocarpum* received at the Arnold Arboretum from J. H. Bowditch, Pomfret, Conn., in 1919 fruited first in 1921. The Arnold Arboretum was the home of *V. sargentii* f. *flavum*, which was raised together with typical *V. sargentii* from seed sent in the autumn of 1904, by the Japanese botanist Uciyama from Korea. *V. sargentii* f. *flavum* is a bush of imposing stature that fruits as abundantly as the species and is superior to *V. opulus* f. *xanthocarpum*. Among plants raised from seed sent in 1907 by E. H. Wilson from Chang-lo-hsien, Hupeh, China, to the Arnold Arboretum was *V. setigerum* f. *aurantiacum*, which bore fruit of a bright-orange. Young plants tend to be leggy and open at the base, while mature specimens are decidedly vase-shaped. The compact round-topped *V. opulus* f. *xanthocarpum* was cultivated prior to 1840.

Three other yellow-fruited selections have been reported, but are not known to be in cultivation. A plant of a yellow-fruited *V. acerifolium* was located in northern New York. A yellow-fruited *V. trilobum* was cultivated at East Lee, Massachusetts, but apparently has now been lost. In Europe *V. betulifolium* 'Auranticum' has been cultivated, but no authentic plants have been located. In the future, selections with additional fruit colors will undoubtedly be located among seedling populations that will further enhance the viburnum shrub border.

Red-Fruited Viburnums

Because red provides a more distinct contrast than yellow, blue, or black, the persistent red-fruited viburnums are the most highly prized. Except for *V. opulus* from Europe and *V. edule* and *V. trilobum* from North America, the red-fruited species are all of Asiatic origin. The Asiatic red-fruited viburnums may not be as hardy as their North American relatives, but they are adapted to most parts of the United States and southern Canada.

The brilliant-scarlet fruit of *V. dilatatum* (5b), Linden Viburnum, combined with masses of cream-white flowers in May, compact growth habit, and russet-red autumn foliage, place this plant near the top of any select-species list. *V. dilatatum*, a native of China and Japan, was introduced into England in 1846 by Robert Fortune. Not until 1888 did plants raised from seed received from the Agricultural College, Sapporo, Japan flower at the Arnold Arboretum. The leaves are variable in size and shape, 2-5 inches long, often broad, orbicular-ovate or obovate, usually terminating in an obtuse point, densely pubescent and coarsely toothed. The bright-red fruits borne in 5-inch diameter clusters are ovate, much flattened, and about 1/3-inch long. The fruits mature in September and will persist on the plant into the winter. An 8-foot specimen covered with fruit can provide a focal point to any landscape. The form *V. dilatatum* f. *pilosum* (5b) differs from the species in having the leaves and stems densely covered with stiff-black pubescence. The planting of cultivars such as *V. dilatatum* 'Moraine' and 'Improved' will guarantee a fine fruiting specimen, whereas the usual seedlings sold by nurseries will

produce shy fruiting as well as good fruiting plants.

Unfortunately the superb *V. wrightii* (5b), Wright Viburnum, marauds as a misnomer to many nurserymen under the disguise of an inferior form of *V. dilatatum*. In 1892 C. S. Sargent collected seed in Japan, which was subsequently grown at the Arnold Arboretum. A mature *V. wrightii* plant 9 feet tall has ovate, glabrous leaves and shoots with the terminal bud enclosed by red bud scales. *V. wrightii* is distinct from *V. dilatatum* which has soft pubescent leaves, densely villous branches, and gray-brown pubescent bud scales. The fruit of *V. wrightii*, which is larger than that of *V. dilatatum*, begins to color a glossy scarlet in early August and persists on the plant for several months. The plant commonly sold as *V. wrightii* is only a pubescent variation of *V. dilatatum*. Many inferior seedlings will result from seedling populations of either of these species. The dwarf compact, 5-foot *V. wrightii* var. *hessei* (5b), which fruits as abundantly as the species, was named after Herman Hesse, Weener, Germany, who introduced the plant about 1900.

The Chinese red-fruited *V. lobophyllum* (6b) was introduced from Western China by E. H. Wilson in 1901. *V. lobophyllum* is an upright shrub, which grows 15 feet tall. The leaves are broadly ovate, abruptly narrowed at the apex, rounded at the base, shallow toothed on the margins, bronzy-green in summer, and a claret color before falling in the autumn. The shiny red berries in 4-5-inch diameter clusters are more densely borne on older plants, but at maturity the abundant clusters persist until cold weather, when birds find them a source of food.

V. betulifolium (6), Birch-leaved Viburnum, which was introduced in 1901, may be confused with *V. lobophyllum*. The leaves of *V. betulifolium* are ovate to diamond-shaped, broadly wedge-shaped at base, the terminal part gradually tapered, and coarsely toothed. Probably the seed, referred to as a stone, is the best distinguishing characteristic for separating *V. betulifolium* and *V. lobophyllum*; in *V. betulifolium* smaller and nearly circular in outline, and in *V. lobophyllum* ovate, tapering to a point at one end and more deeply grooved. Young plants of *V. betulifolium* fruit

sparingly but older 12 foot high, wide-arching specimens are masses of pendulous, vivid-red fruits. *V. betulifolium* is not a reliable plant in the North and will usually be severely winter killed; however, in milder climates the fruit display surpasses that of other species. *V. betulifolium* 'Trewithen Form' (6) is an exceptionally good fruiting selection from the garden of the late G. H. Johnstone, Trewithen, Cornwall, England.

Augustine Henry discovered *V. hupehense* (6), Hupeh Viburnum, near Fang, Western Hupeh, in 1888 but it was not until 1908 that E. H. Wilson collected seed. The 2-3 inch long, ovate leaves, subcordate at the base, densely pubescent on both surfaces, turn purplish bronze in autumn. The stellate-pubescent branches are laden with fruit, at first yellow-orange but at maturity bright red. The rather insignificant floral display is only a prelude to the autumnal splash of fruit on a specimen 6-8 feet tall.

The leaves of *V. setigerum* (6) (*V. theiferum*) Tea Viburnum, are used by the monks on Mt. Omei, Szechuan, China, to make an infusion of sweet tea, which is famed for its medicinal properties and sold at much profit to pilgrims. The tea is described as sweet with the flavor of coarse congou (a kind of black Chinese tea) with a plentiful addition of brown sugar. The Tea Viburnum was first introduced into cultivation by E. H. Wilson in 1901 from Kui, Hupeh, and distributed by the Veitch Nurseries. *V. setigerum* is an ungainly, leggy plant growing 12 feet tall, and with arching branches. The ovate-oblong leaves, 2½ to 4 inches long, glossy dark green above, glabrous except for silky hairs on the veins beneath, are tender and will often be nipped by late-spring frosts and again in the fall in northern zones before any appreciable yellow-orange coloration has developed. The branches often are arched under the weight of the large clusters of brilliant orange or red, oval-shaped fruits dangling on long stems. Upon exposure to freezing, the fruits become translucent and soon brown. In milder regions the plant will attain a vase shape and grow to 12 feet tall; but in northern areas the plant is subject to winter injury and is a scraggly shrub, rarely more than 6 feet tall. *V. phlebotricum* (7) is closely akin to *V. setigerum*. *V. setigerum* is distinguished from the lower growing *V. phlebo-*



J. HORACE MC FARLAND

The abundant pink and blue-black fruits of *Viburnum cassinoides*, Withe-Rod, are complimented by the glossy-green leaves

tricum by its larger and longer stalked, thicker, denticulate-serrate leaves, by the longer stamens, and by the outermost scales of the winter buds being more than half as long as the whole bud. The Tea Viburnum is a much more vigorous shrub and will fruit freely if given sunlight and good drainage.

Several other red-fruited Asiatic species which are less ornamental than the

foregoing are—*V. dasyanthum* (6b), *V. erosum* (6), Beech Viburnum, *V. foetidum* (8), *V. ichangense* (7), Ichang Viburnum, and *V. wilsonii* (5b), Wilson Viburnum. *V. dasyanthum* was introduced from central China in 1907. The ovate to oblong dark-green leaves have purplish petioles that are near the red-brown to dark purple color of the branches. The bright-red, ellipsoid fruit,



DONALD R. EGOLF

The blue-black Viburnum prunifolium, Black-Haw, fruits are borne on the tips of spur growth

borne in 4-5-inch clusters is of firm texture and most spectacular. The 6 foot tall Japanese *V. erosum* has been cultivated at the Arnold Arboretum since 1880. The slender much-forked branches are sparsely covered with the oblong-ovate leaves and produce lax, pubescent, long-stalked clusters of red fruit. The disagreeable odor of the bruised leaves well explains the name of *V. foetidum* (8). This semi-evergreen variable species from India and China has scarlet-crimson fruits packed close together in 4-inch clusters. The plant is a fine compact shrub with handsome fruits, but rather tender. The leggy 6-foot tall *V. ichangense* was introduced by E. H. Wilson in 1901. The slender branches laden with small scarlet fruits are spectacular in the autumn. *V. wilsonii* was introduced from Szechuan, China, by Wilson in 1908. A mature *V. wilsonii* plant will be 6-10 feet tall.

Among the Cranberry bush group of viburnums with deeply lobed, maple-like leaves are several select red-fruited forms. These species are represented in both the Eastern and Western hemispheres by *V. opulus* (3b), the European Cranberrybush Viburnum, from Europe; *V. kansuense* (6), Kansu Viburnum, *V.*

orientale (6), Oriental Viburnum, and *V. sargentii* (5), Sargent Viburnum from Asia; and *V. trilobum* (2), Pembina or American Cranberrybush Viburnum and *V. edule* (2), Squash-bush or Mountain Guelder Rose, from North America. The flowers on all these species except *V. kansuense* are cream white and comprise an inflorescence of many small fertile florets encircled by a marginal row of enlarged sterile florets in a Queen-Anne's-Lace arrangement. The fruit is oval to spherical in shape, contains a flattened seed, is highly acid, becomes translucent at maturity, and persists on the plant until late winter.

The American Cranberrybush Viburnum, *V. trilobum*, grows far north into Canada and will survive the severest winters. However, it is less frequently cultivated than the European Cranberrybush Viburnum, *V. opulus*. The prevalent aphid distortion serves as a *V. opulus* identification characteristic, but *V. trilobum* is immune from this disfiguration. These two species are much bemuddled and the true *V. trilobum*, which has three-distinct-broad lobes, small glands at the petiole base, a narrow, grooved petiole, branches smooth light gray-brown, and an overall wide spread-



DONALD R. EGOLF

The native Viburnum trilobum, American Cranberrybush Viburnum fruits heavily and is a select ornamental for northern regions

ing habit of growth, is not readily obtainable. The fruit of *V. trilobum* is edible and makes fine jelly or jam; that of *V. opulus* is bitter.

V. trilobum is common on hummocks in acid bogs, along streams, and wooded uplands from Newfoundland and British Columbia south to New Jersey and Oregon. The plant will grow 8-10 feet tall but will be somewhat coarse in appearance with leaves 4-6 inches long and more suitable for large places. The growth will be superior in cool, moist regions, and the plant will not survive, except in mountainous regions, much south of Pennsylvania. The nearly glabrous dark-green, lobed leaves turn orange-yellow to reddish-purple in the autumn landscape. The large, long-stemmed, drooping clusters of fruit start to ripen in late July and turn scarlet before becoming soft and translucent. The acid juicy fruits are not apparently the chosen food of birds as they remain on the plant until late winter. These red fruits add interest to the winter garden blanketed with snow.

In portions of the northern states and the prairie provinces of Canada, the Pembina or American Cranberrybush *Viburnum* is utilized as a jelly fruit and

a substitute for cranberries. However, the cranberry harvested from bogs is not related to the American Cranberrybush *Viburnum*. A clear, fine-flavored jelly is made from the fruits, which are rich in pectin. A jelly that approximates that of currant can be quickly prepared. The ripe fruits are covered with water and boiled for a minute, the juice strained off, an equal amount of sugar added, boiled for 2 minutes, skimmed and the jelly is done. The remaining pulp can be used for jam.

A. E. Morgan undertook the improvement of *V. trilobum* at East Lee, Massachusetts. By a study of fruit from Alaska to Newfoundland he noted the natural variation. A more intensive search for select plants was pursued by personal survey of sections of New York and New England. Plants assembled from this survey established the plantation in the Berkshire Mountains, at Jacob's Pillow near East Lee, in 1915. About 3,300 plants propagated from these select clones were distributed to cooperating experiment stations. In the spring of 1921 the plantation was turned over to the Bureau of Plant Industry of the U.S. Department of Agriculture. After a period of observation, three of



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The translucent, red fruits persist on Viburnum opulus, European Cranberry-bush Viburnum, and provide a winter display in those areas where Viburnum trilobum cannot be successfully grown

the best selections were named 'Andrews,' 'Hahs,' and 'Wentworth' and introduced through commercial nurseries in 1922. Several ornamental selections were made, but these have apparently been lost. After 10 years of critical evaluation of the *V. trilobum* accessions the plantation was abandoned by the U.S. Department of Agriculture. In the intervening years the underbrush became competition for the viburnum selections and many succumbed. The author visited the site in 1960 only to learn that the major portion of the planting had been obliterated by the construction of the Massachusetts Turnpike. Only on an isolated corner do about a dozen plants still survive.

Fortunately the three varieties 'Andrews,' 'Hahs,' and 'Wentworth' have been preserved. 'Andrews' was selected by Frank Andrews, one of Morgan's field collectors, in 1917 near Lancaster, New Hampshire. The plant is a sturdy, erect grower, with dark-green foliage, and about 6 feet high. The individual brilliant-red fruits, which are late ripening are larger than those of the other cultivars and the clusters are held erect by stout stems. The cultivar 'Hahs' was

selected by Roy Hahs, another of Morgan's collectors, in 1915. The clusters and fruit of medium size ripen in September. 'Hahs' was selected because of the vigor of the bushes, its productiveness, and its high pectin content. The cultivar 'Wentworth' was selected by Frank Andrews on the farm of O. E. Wentworth near Lancaster, New Hampshire. 'Wentworth' is a vigorous, spreading bush with large, somewhat drooping clusters that matures fruit early.

Of more recent origin are the cultivars 'Manito' and 'Philips.' 'Manito' was named by Morden Experimental Farm, Morden, Manitoba, in 1947. This cultivar found by an Indian, growing in the wild at the south end of Lake Manitoba, near Delta, Manitoba, was selected for its larger than normal fruit. In 1956 an unusually fine plant near West Acton, Maine, which was free of the odor and flavor typical of *V. trilobum* was brought to the attention of the University of New Hampshire and named 'Philips.' A pink-flowered *V. trilobum* has been raised from seed collected in Peace River District of Alberta, Canada. *V. trilobum* 'Compactum' (2b) grows 5 feet tall and produces many thin stems that fruit well.

The *V. opulus* red fruit remain attractive all winter. For more southern areas *V. opulus* can withstand the heat and prove a tolerant shrub for dry situations. Where the 12-foot *V. opulus* may be too large the cultivar 'Compactum' (3b), which rarely exceeds five feet in height, will be adaptable. The compact form fruits freely. For foreground planting, hedges, or edging the 2 foot tall *V. opulus* var. *nanum* (3b) can be recommended; seldom, however, will any flowers or fruits be produced. The large-fruit selection *V. opulus* 'Notcutt' (3b) is a noteworthy substitute for *V. opulus*. The autumn foliage of *V. opulus* contributes some good orange-reds.

V. sargentii was raised at the Arnold Arboretum in 1882 from seed collected on the mountains near Peking, China. The Sargent Viburnum differs principally from *V. opulus* by having thick, often dark, corky bark on older branches, larger marginal florets, longer stalked purple anthers, smaller fruit, and dark-green leaves with elongated terminal lobes, especially on young vigorous growth. The thick, dark-green leaves, which are superior to the foliage of *V. opulus*, acquire an orange-red color that accentuates the landscape. Usually the fruit is less abundant than that on *V. opulus* and *V. trilobum*.

V. edule, *V. kansuense*, and *V. orientale* are seldom to be found in American gardens. *V. edule*, 5 feet tall, is a plant

for half-shady, moist, cool situations. This straggling shrub commonly grows in peat bogs and along streams. The Chinese *V. kansuense* belongs to the *Opulus* group but differs in that the flower inflorescences lack sterile marginal florets and that the 1-2-inch leaves are more deeply lobed. The pale-pink flowers in May are followed by red fruit that is usually sparse. *V. orientale*, native of the Caucasus and Asia Minor, produces large red ornamental fruits on a 10-foot shrub. The type plant is not known to be in cultivation in the U.S.

Recommended Viburnums

From the diversity of blue-, black-, yellow-, and red-fruited viburnums many selections could be made that would be equally effective in the landscape. To condense the selections and assist the home gardener with little space the following species are recommended: blue and black fruit: *V. acerifolium* (4), *V. cassinoides* (4), *V. dentatum* (3), *V. prunifolium* (4); yellow fruit: *V. dilatatum* f. *xanthocarpum* (5b), *V. sargentii* f. *flavum* (5), *V. setigerum* f. *aurantiacum* (6); red fruit: *V. dilatatum* (5b), *V. hupehense* (6), *V. lobophyllum* (6b), *V. opulus* 'Compactum' (3b), *V. opulus* 'Notcutt' (3b), *V. sargentii* (5), *V. setigerum* (6), *V. trilobum* 'Compactum' (2), *V. trilobum* cultivars (2), *V. wrightii* (5b), *V. wrightii* var. *hessei* (5b).

The Variations of the Australian *Crinum flaccidum*

L. S. HANNIBAL

Crinum flaccidum Herbert [Curtis's Botanical Magazine, t. 2133 (1820)] of Australia is described as having white flowers with open tepals about three or four inches long and three-fourths of an inch wide at the midpoint. A current survey of the species, which is still under way, has disclosed a very wide distribution of the plant and the existence of a number of local specific variants. The bulb originally described by Herbert probably came from the Darling River area as plants growing near Gilgandra

and Quirindi in New South Wales often comply with this general description. However in the vicinity of Quirindi a natural hybrid population has recently been found which varies from pale pink to a wine red. The tepals on many of the plants are quite broad and often overlapping, and to confuse the botanists still more, the tepal tubes are straight in lieu of being curved. Thus until further studies are made this natural hybrid seemingly involves two *Crinum* subspecies: *Codonocrinum* and *Stenaster*,



A. R. R. HIGGINSON

Crinum flaccidum, close-up of the blossoms of the yellow-flowered form (above) and the habitat in Saltia, Pichi Richi Pass, Port Augusta, South Australia

DAVID SYMON



a hybrid* which we would not expect to be fertile or give such a wide distribution of hybrid segregates. Selected deeply-colored wide-petaled forms are reported to resemble magnolia blossoms in effect since the bulk of the pigmentation is on the exterior of the blossom leaving the interior a soft pastel shade.

Area 1. The majority of the Darling River bulbs are found almost entirely in alluvial silt or overflow land and drive down to a depth of twelve to eighteen inches. Part of the population, however, has wandered out into the desert and has adopted drier conditions. The general population area is roughly 250 miles north-west of Sydney. The climate is quite dry and very similar to Southern California except that the bulk of the rains fall in midsummer. A three inch rain can bring literally thousands of plants into flower along the river terraces.

Area 2. A second distinctive growing area is 300 miles to the south in the Murray River basin where it bounds New South Wales and cuts through South Australia. The typical form has slightly narrower petals than the white flowered Darling River type, but in addition to this white form, which is rather thin in substance, there is a pale cream type with a light amber tube. These bulbs all grow in alluvial soil and are usually found near water. In addition to these local variants there is a type with a bulb not unlike *Crinum moorei* which grows along the high benchland bordering the lower portion of the Murray River about 40 miles due east of Adelaide. The soil in this area has a pH of 8 or 9. All of the variants have been erroneously described in the literature as "*C. pedunculatum*," a subtropical species found in Queensland.** Locally the plants are known as the Murray River Lily.

Area 3. A third growing area is in the open desert near the Andamooka Opal Mines some 300 miles north of Adelaide near the western shore of Lake Torrens (usually a dry salt sink). This particular group has very long narrow tepals and a tepal tube of five or six inches length. The overall coloring of the

blossoms are a light cream or amber. A mature bulb drives down some thirty inches into the desert sand and reportedly has a twelve foot root system which is an amazing adaptation when one realizes that the bulb itself is rarely more than three inches in diameter. There is usually less than six inches of rainfall annually in this area. The storms generally strike in the winter but at odd intervals a heavy monsoon summer storm may strike inland. Flowering occurs after a heavy storm, either in the spring or in the summer. To our knowledge none of these bulbs have been collected.

Area 4. The final form is nearly unknown. It has a showy open cluster of 10 or 15 blossoms which are a bright butter-yellow, resembling a cluster of *Sternbergia lutea* in color and shape. The tepals are considerably wider than the *Crinum flaccidum* type-form and range in colors of citron and green to a near golden yellow. The tepal tubes vary from 2½ to 4 inches in length. Some are nearly straight with spreading anthers which again suggests a proximity to subgenus *Stenaster*. The most accessible specimens are found growing on the rocky north-east slopes of Pichi Richi Pass near Quorn in South Australia. Here heavy contractile roots pull the young bulbs down some 20 to 30 inches into rocky formations where digging is nearly impossible. Other isolated colonies range to the north of Flinders Mountains up to Birdsville some 450 miles to the north,—an uninhabited, dry, bleak desert region of eroded hills and wind-swept washes where the thermometer may hit 125 degrees Fahrenheit on a mild summer day, and rain is an undependable and scarce as at Andamooka.

Like the Andamooka bulb these plants have been adapted to desert conditions. Foliage and flowers appear after the rains only to dry up and vanish when the moisture is exhausted. In a true sense the plants are not deciduous, but at times they must go dormant for several years in order to carry over dry spells.

***Crinum pedunculatum* is very similar to *C. asiaticum* and belongs to the subgenus *Stenaster*. The flowers of a *Stenaster* species have radial symmetry, a straight tube, linear segments, and spreading stamens. The subgenus *Codonocrinum* which contains *C. flaccidum* has a funnel shaped perianth, a curved tepal tube which gives the blossom bilateral symmetry, oblong segments, and declinate stamens and style which are contiguous. Normally one would expect a crossing of subgenera to give sterile hybrids. The borderline features of several of the *C. flaccidum* variants is therefore of unique interest.

*Since preparation of the manuscript for this article, it has been found that *C. flaccidum* belongs to subgenus *Platyaster* in lieu of *Codonocrinum* as long supposed. The error occurs in the drawing of the stamens in *Curtis's Botanical Magazine*, t 2133. The colored form is merely a variant.

In a garden where the bulbs receive an occasional watering the foliage remains evergreen.

Light colored pink variations may exist in the Flinders Range but have not been collected. The Darling and Murray River forms are definitely unknown in the inland desert areas. Several hundred miles of elevated waste land which is a southerly extension of the Grey Hills completely separate the river forms from the inland desert types. In geological times the interior of Australia was not so arid and a plant bridge between the two areas could have existed, but long isolation has produced a number of ecological populations which may justify division into several subspecies.

Examples of several *C. flaccidum* forms including the Quorn yellow flowered type have been imported and seedlings may eventually be available. Their delightful fragrance should make the

plants a popular garden specimen in any locality, but a word of caution is worth mentioning. Desert *Crinum* cannot tolerate much summer moisture. They would rot under Florida conditions, and like most crinums they will refuse to flower if the average winter temperature is much under 50°F for any prolonged length of time. Transplanted bulbs should never be watered, and water should be withheld until the root systems reestablish themselves. The yellow flowered form promises to be a good breeder and in all probability when crossed with the wine-reds or pinks will give orange-bronze hybrids. To our knowledge *C. flaccidum* has not been used for breeding purposes.

We are deeply indebted to A.R.R. Higginson, David Symon, and T. R. N. Lothian [Jour. R.H.S. p. 344, Aug. 1957] who have furnished the bulk of the information on *Crinum flaccidum*.

A Book or Two

Diseases of Turfgrasses

Houston B. Couch. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, New York. 1962. xiv + 290 pages. Illustrated. \$10.00. (Library).

Those interested in turf grass management will find in this book detailed descriptions of symptoms of diseases, their causes, importance, and methods of control by chemicals, cultural practices, and use of disease-resistant grasses.

There are cross indexes of names of grasses and of fungus and nematode names. The book would be a suitable college-level text.

Authoritative information is given about fungicides, nematocides, and their use. Coined names of pesticides are listed alphabetically. The literature list has 198 references. Three color plates and numerous black and white reproductions of photographs and lined drawings help one to identify diseases. The amateur may find this book rather technical, but rewarding for its accuracy, comprehensiveness, and logical organization. M.

Ground Covers for Easier Gardening

Daniel J. Foley. Chilton Company, Book Division, 56th and Chestnut Streets, Philadelphia 39, Pennsylvania. 1961. 224 pages. Illustrated. \$5.50. (Library).

Ground covers are not only a valuable substitute where grass is hard to grow but provide many opportunities for landscaping. The book lists over 100 cover plants in addition to which many varieties of rose, ivy, phlox, heather, ferns, vines and dwarf shrubs are included.

For each is given common and scientific name, height, suitable hardiness some together with general characteristics and conditions favoring their growth. General consideration is given to soils, planting, feeding, mulches, care and maintenance. To many gardeners cover plants will supply a new and rewarding garden activity. The illustrations are excellent and 4 color plates detail parts of 32 different plants. A hardiness zone map is included.

J. E. G.

(Books available **for loan** to the Membership are designated: (Library). Those not so designated are in private collections and are not available for loan. Books available **for sale** to the Membership are designated with the special reduced price and are subject to the usual change of price without notice. Orders must be sent through the American Horticultural Society accompanied by the proper payment. Please allow two to three weeks for delivery. Those not designated for sale to the Membership at reduced prices can be purchased through the Society, however, at the retail prices given. In these instances the full profit is received by the Society to be used for increased services and benefits of the Membership.)

All About Vines and Hanging Plants For Interior Decorations, in the Landscape, in Container Gardening

Bernice Brilmayer, Doubleday and Company, Inc., 575 Madison Avenue, New York 22, New York, 1962. 384 pages. Illustrated. \$5.95. (Library).

This book is in two parts: the first dealing with the aspects of use, culture, propagation, and pests of vines and hanging plants; the second, a descriptive listing in alphabetical arrangement of vines and plants suitable for hanging purposes. It is divided somewhat equally between these two parts and an appendix adds information on sources of plants, containers, and lists some references.

Certain aspects of the first part will not be new to the reader—these deal with propagation, watering, mulching, soil, and fertilizer. Probably the treatments on use indoors and in the garden will contain new ideas for most readers. As for the plant list, it is a good one, containing the authentic Latin name and the common name for each species discussed. I think the range of adaptation is somewhat conservative. For example, I grow *Fatsyhedera lizei* outdoors in Maryland and *Stauntonia hexaphylla* can also be used as a vine in the vicinity of Washington, D. C. These are minor issues and the book is generally authentic and thoroughly prepared.

J. L. C.

Rhododendrons and Azaleas Their Origins, Cultivation, and Development

Clement Gray Bowers, The Macmillan Company, 60 Fifth Avenue, New York 11, New York, 1960. Second Edition. 525 pages. Illustrated (in color) by Franck Taylor Bowers and the author; and with pen and ink drawings by the author. \$25.00. (Library).

This is a revision up-dating a volume first published in 1936. The review of the first edition appearing in the National Horticultural Magazine at the time stated that "One has great admiration for the thoroughness of the plan and its execution. . . . It is quite possible as times goes by . . . that additional volumes [on rhododendrons and azaleas] will be needed, but they probably will never displace this parent work, which is as it should be." Time has proved this prediction correct and this review might well terminate without more.

Bower's book deals with both the "true" rhododendrons and azaleas. Since its original publication there have been two additional comprehensive American horticultural works on rhododendrons and azaleas, also of high quality and directed to the serious amateur gardener. One is Leach's *Rhododendrons of the World* (1961) devoted to the "true" rhododendrons only, reviewed in the July 1962 issue of the American Horticultural Magazine. The other is *The Azalea Book* (1958) sponsored by the American Horticultural Society, and devoted to azaleas only. Neither displaces Bower's parent work and both owe much to it.

In the second edition substantial portions of the original text have been rewritten. Ex-

amples are discussion of improvements in propagation techniques over the past quarter century and listings of species and horticultural varieties. Sleumer's rearrangement of the series in the genus *Rhododendron*, including his treatment of Malaysian species, is generally followed. Descriptions of the origins of the various azalea groups have been modified and expanded. Hardiness and merit ratings are still those of the British and not those of the American Rhododendron Society, the latter better reflecting our climatic conditions.

The lovely color plates of the first edition made from colored drawings by Franck T. Bowers and the author, are retained, as well as the author's numerous line drawings and two maps of rhododendron regions. The second edition continues to present full discussion of site, planting, hardiness, insects and disease, and other cultural problems and of hybridizing. The recommended lists of rhododendrons and azaleas for various regions in this country are completely revised.

One wishes that publisher's limitations had not prevented even more extensive revision, particularly when the publisher's price of the second edition, despite a few less pages, is \$25.00 as against \$10.00 for the first edition. Incidentally the first edition is out of print and rare, selling frequently in the secondhand market for \$50 to \$75 or more.

FREDERIC P. LEE

Contemporary Flower Arrangement and Workbook of Containers, Stands and Mechanics

Rae L. Goldson, Hearthsides Press, Inc., 118 East 28th Street, New York 16, New York. Revised and Enlarged Edition 1962. 127 pages plus bound-in supplement of 31 pages. Illustrated. \$4.95. (Library).

The author's approach is apparently for the neophyte. To the homemaker and the young in the field of study in the art of flower arranging, much valuable information can be obtained from this book. Her illustrations are not nearly as contemporary as I had expected by the title. However, along with her massed line arrangements there are some with figures and sculptural pieces used as a part of the arrangements, and some done in the manner of the Japanese.

The chapter on plant materials and where to find them is invaluable. This should be particularly interesting to those with limited availability to flowers. This chapter also includes some information on conditioning flowers.

The "Workbook of Containers, Stands and Mechanics" can be had in a separately bound edition [for \$2.50] but it is also incorporated in this volume. For the mechanically talented this chapter might well be the most interesting. The author has given some excellent instructions for designing containers of wood and metal. In the thirty one page chapter on "Workbook of Containers and Mechanics" there are approximately seventy pictures and diagrams so there is little room for a great amount of reading material. This holds true to some extent to the book in general. Pictures are

important especially to those looking for new ideas in materials and style, but to those especially interested in flower arranging who have accumulated a library of books on flower arranging it becomes very monotonous to find some pictures used over and over in other publications.

M. W. L.

After a Hundred Years

The Yearbook of Agriculture, 1962

Alfred Stefferud, Editor. U. S. Government Printing Office, Washington 25, D. C., 1962. 688 pages. Numerous illustrations. \$3.00. (Library). [Your Senators or Congressman usually have available copies for free distribution.]

This volume contains over 100 articles by experts discussing the developments in various fields of activity of the United States Department of Agriculture since its establishment in 1862. Publication of this particular volume in the Yearbook series is part of the Department's celebration of its Centennial.

Of interest to the amateur horticulturist are articles on plant exploration by John L. Creech, on plant growth responses to light by Harry A. Borthwick, on effect of chemicals on plant growth by John W. Mitchell and Paul C. Marth, on the National Arboretum by Henry T. Skinner, on viruses by L. C. Cochran, and eleven articles on various insects and their control. General groupings include articles on conservation, forests, domestic animals, markets, homes, agricultural economics, educational activities, plants, and several fields of technology.

The articles are well and simply written but at the same time the information is accurate and up-to-date. The several hundred illustrations are most interesting and of high quality and the whole format enviable. The Nation should be proud of the Department's accomplishments as outlined in this volume.

FREDERIC P. LEE

A Book About Soils for the Home Gardener

H. Stuart Ortloff and Henry B. Raymore. M. Barrows and Company, Inc., 425 Park Avenue, South, New York 16, New York. 1962. 190 pages. Illustrated. \$3.95. (Library).

This book is a discussion of soils from their formation to their utilization by the gardener. The material is divided into two parts: Part 1, the nature of soils; Part 2, soil management. Under the first part are discussed physical and chemical fitness, composition, acidity, fertilizers and plant growth. Under Part 2 are covered soil tests, irrigation, drainage, plant feeding, tillage and cultivation, and time of soil preparation. A zone map of plant hardiness and map of annual precipitation are included plus a short bibliography. Beyond these subjects, the book provides much knowledge useful to the expert and amateur alike and is thus an appropriate gift for any gardener.

J. E. G.

The Silent Spring

Rachel Carson. Houghton Mifflin Company, 2 Park Street, Boston, Massachusetts. 1962. 368 pages. Illustrated. \$5.00. (Library).

Rachel Carson's *The Silent Spring*, which appeared in three issues of *The New Yorker* (June 16, 23, 30) and is scheduled for publication in book form in October by Houghton Mifflin Company, has stirred up a summer storm of protest among responsible horticulturists, agriculturists and scientists. Many members of The Pennsylvania Horticultural Society have expressed a feeling of shock after having read Miss Carson's treatise on insecticides and herbicides because the articles imply that any one who has ever used chemical pest control materials has contributed to upsetting the "balance of nature." Her vehemence makes good reading and will have widespread repercussions, and because *The Silent Spring* has been chosen as an October selection by the Book-of-the-Month Club, it will, no doubt, enjoy a large distribution.

There are a few factors which we feel must be pointed out because it is too easy to become emotionally involved with what Miss Carson has written and to miss some of the hard facts of life in our time.

First of all, the author gives the impression that scientists, especially those who have been involved in pest control research, are a radical, non-thinking, irresponsible group. This is not so.

Another point which must be recognized is that the "balance of nature," of which Miss Carson sings in swan song notes, is a term which has been much over used by certain groups who would have us return to some sort of life as it once was. Civilization, by its very character, is upsetting to nature. Man long ago upset things when he first cleared land and planted crops. In time these gardens developed into vast acreages of one kind of plant such as wheat, corn, potatoes or apples. While Miss Carson recognizes this factor, she does not give enough attention to it as an artificial situation requiring artificial techniques if the harvest is to be assured. Birds cannot control beetles in a 200 acre potato field, the codling moths in a fifty acre apple orchard or the boll weevils in a hundred acre planting of cotton.

Without pesticides it would be impossible to feed 180 million Americans and a large segment of the world's population in addition to our own. A single farmer must produce not only enough to feed his own family but enough to feed twenty-eight other individuals as well. He can do this only because modern farming techniques make it possible, and modern pesticides are a part of the technique.

Miss Carson abhors the loss of shelter for wildlife caused by the spraying of weedkillers along roadsides. Everyone recognizes that grassy road embankments are a safety factor necessary to increased vision. Weedkillers provide an economical and effective method of controlling these hazards and for better or for worse, this is necessary to our way of life. However, only a small portion of wildlife cover is lost as the result of such spraying. Far more is destroyed when vast acreages are cleared for housing developments and wildernesses are torn apart for super highways; these also are necessary to our civilization.

A major point which Miss Carson brings out, and rightly so, is that many of the modern gar-

den chemicals are dangerous to handle. This is true, but so are many other materials. The author cites several examples of death or severe illness because of accidents involving users of some of these materials, but she does not tell how many thousands of individuals have handled pest control materials without injury to themselves. Miss Carson also does not point out the difference between the toxicity of a material and the hazards of using it. Toxicity is inherent; a material is very poisonous, mildly poisonous or not poisonous. Hazard involves the how, when, where and how much of its use. Intelligence demands that insecticides, fungicides and herbicides be handled with extreme diligence. Even the remotest possibility of accident must be anticipated. (As an example, the largest fish kill in the Delaware River occurred when a farmer left a bag of insecticide in a field overnight and the material was carried into the stream during a cloudburst.)

It is vastly important that anyone using any pest control materials follow directions exactly as printed on the label and to use them only when necessary and only to the extent necessary. Spraying should never become a Saturday morning ritual. Only in this way can hazard be reduced to a minimum, not only to man, but to all living organisms.

A marine biologist, Miss Carson wrote *The Sea Around Us* with obvious love. It is an outstanding work, but in *The Silent Spring* we feel that she has found an issue which she has over embroidered and over sentimentalized. While she points out the dangers of which we should be aware, here is a one sided viewpoint.

Most serious of all is Miss Carson's charge that the actions of modern chemicals are irreversible. All forms of life are interdependent, and we cannot continually destroy more than we rebuild. If Rachel Carson has made us more conscious of this fact, she will have accomplished much.

(Reprinted through the courtesy of the Pennsylvania Horticultural Society, *News*, September 1962, Vol. III, No. 8.)

A Second Treasury of Christmas Decorations

Beth Hemingway. Hearthsides Press, Inc., 118 East 28th Street, New York 16, New York. 1961. 128 pages. Illustrated. \$3.95. (Library).

Here is a book published in 1961, which covers the customs and symbolism of Christmas, and should certainly prove useful to those planning to make their own decorations for the holidays.

The book contains suggestions for the making of many different types of arrangement, and there are some useful tips on storing the more permanent things, as well as helpful hints to beginners.

Traditional and modern styles are both illustrated and explained, and there are chapters dealing with tree decoration, and the wrapping of packages, nor are the children forgotten; and the illustrations cover simple things that they can make as well as those for the more advanced arranger. If you do not have this book, here is one you should put on the list for your Christmas stocking!

F. P.-K.

Miniature Plants for Home and Greenhouse

Elvin McDonald. D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, New Jersey. 1962. xii+274 pages. Illustrated. \$5.95. (Library).

Essentially a book on the culture of small plants in the home. These include the naturally smaller forms of well known house plants as the geranium, Saintpaulia, ivy, and begonias as well as young plants of evergreens, the miniature roses and the smaller types of spring flowering bulbs. Cultural suggestions are given for many kinds of plants with more detailed information on some of the larger groups as the geraniums, Saintpaulia, ivies, evergreens and bulbs. As a model for the ideal miniature plant, the author selected the miniature gloxinia, *Sinningia pusilla*, and describes the culture of this tiny plant.

Some will be possible entirely in the house, while others may have only a part of their life cycle indoors with the remainder outside in beds or a cold frame. The many plants suggested should be a challenge to house plant fancier or one with a small greenhouse.

C. B. L.

Trees for New Jersey Streets

New Jersey Federation of Shade Tree Commissions, Blake Hall, Rutgers College of Agriculture, New Brunswick, New Jersey. 1961. 48 pages. Paperback. Illustrated. \$1.00. (Library).

The Federation under the direction of its capable Secretary has made in this bulletin a contribution of value to municipal and park tree planting plans. Although the selections are primarily for New Jersey, they will be found useful for nearby localities. No list of recommended trees will find universal acceptance and this list is no exception; in general one can find but little fault with it. In addition to the lists of trees, there are worthwhile suggestions on planning a planting program, planting, and maintenance. Lists are given of trees that withstand drought, poor drainage, for acid soils, small malls or plazas, near the shore. Trees are also classified as to shape and mature size. If you are interested in shade tree planting, get a copy of this paperbound publication.

M.

Pressed Flower Pictures and Citrus-Skin Decorations

Ruth Vorhees Booke. D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, New Jersey. 1962. xx + 228 pages. Illustrated. \$6.95. (Library). (AHS Members' Price, \$5.90.)

This is an intriguing book devoted to the ancient art of using dried plant materials for decoration. It deals with this art as it was in our grandmothers' day—but continues on in to modern day designs and materials. The four parts—one, Selection, Pressing, Mounting; two,

Designing the Pictures; three, Seed and Citrus Skin Decoration; and four, Practical Uses of the Hobby, are well presented with easy to follow step by step instructions. Within part two are several delightful chapters on Petal Point Pictures; Memory Pictures; Samplers; Botanical Studies; and Legends and the Language of Flowers. In part three, the decorations with citrus skins were most amazing—the pictured plaque is a thing of beauty and not at all the amateurish products one usually sees. This reviewer enjoyed reading the text from start to finish, found it entertaining and educational. The sketches by the author and both the black and white and color photographs are excellent. Gardeners, flower arrangers, arts and crafts fans, scout and 4-H club leaders should find many helpful ideas in this work, and be spurred on to greater heights—keeping in mind the quotation from Lord Dunsany the author used in part four—"Good work makes beautiful things."

G. P. W.

Home Orchid Growing

Rebecca Tyson Northen. D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, New Jersey. 1962. xiv+320. Illustrated. 10.95. (Library).

This is a complete revision of the author's first book on orchid growing. All chapters have been expanded and rewritten to include up-to-date information on the subject. Many illustrations have been added, including several excellent color plates.

The book is essentially a text designed not only to teach the beginner in orchid culture what constitutes an orchid, but how to grow it. The basic anatomy of the family is explained in text and by illustration, and the more commonly cultivated tribes discussed in considerable detail. The requirements of the different groups as to light, temperature, moisture, fertilizers, and potting media are discussed, as well as the diseases to which each is subject. The chapter on hybridization of orchids explains genetic control of flower color and other characteristics particularly as applied to the *Cattleya* orchid. The various steps in sowing orchid seeds and care of the seedlings are explained and illustrated. The book is easily read and is full of useful information.

HAROLD F. WINTERS

Outdoor Gardening in Pots and Boxes

George Taloumis. D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, New Jersey. 1962. xii+236 pages. \$5.95. (Library).

Many of our readers will want to include this book in their library. It is a timely subject, one not especially restricted by climate or geography as other forms of plant culture and the whole idea of outdoor pot culture affords versatility. Many European countries feature this technique and it is a "must" for the gardeners of Japan.

As Mr. Taloumis points out, the movement

to the outdoor patio, barbecue area, and just a general increase in outdoor living has stimulated the popularity of container culture.

This book with its fine illustrations will give the reader plenty of new ideas for it contains information on choice places for pots, planters, and other containers; specific plants to use; good suggestions of unique containers, and finally ideas of interest to not only the homeowner but also to the business establishment and the city beautification planning groups.

Mr. Taloumis has recognized a need in an horticultural literature and very nicely covers the subject.

J. L. C.

Japanese Flower Arrangement Notebook

Patricia Kroh. Doubleday and Company, Inc., 575 Madison Avenue, New York 22, New York. 1962. 160 pages. Illustrated. \$5.95. (Library). (AHS Members' Price, \$5.05.)

The author has written in simple language an interesting and enlightening book. She selects many of the legends, and explains many of the symbolic meanings pertaining to the culture of the Japanese people. There is a chapter on Japanese gardens that explains the elements and methods used by garden designers to illustrate their philosophies. She explains mechanics and methods for arranging in the manner of the schools of Ikenobo, Enshu, Ohara and Sogetsu. Her illustrations of styles and methods are clear and easily understood. A chapter explains the proper containers to use for flower arrangements in the classical manner such as Ikenobo or Enshu schools, as well as for the more modern Ohara and Sogetsu schools. An enlightening chapter on Western arrangements as compared to those of the east is included in this book, as well as a glossary of Japanese words (with pronunciations) used in connection with Ikebana. There are twenty-five color illustrations and seventy-seven in black and white, including diagrams. The author has given some interesting side lights on trips to the shopping districts, specialty shops and eating places in Tokyo. This book written with clarity gives an illuminating insight in the art of Ikebana.

M. W. L.

Other Books added to the Library Modern Guide to House Plants

Ann Warren. (A Dolphin Handbook—paperback) Doubleday and Company, Inc., 575 Madison Avenue, New York 22, New York. 1962. xii+108 pages. Illustrated. 95¢. (Library).

The Home Owner's Tree Book

John Stuart Martin. Doubleday and Company, Inc., 575 Madison Avenue, New York 22, New York. 1962. 166 pages. Illustrated. \$3.95. (Library).



G. HAMPFLER, LONGWOOD GARDENS

Cantua buxifolia

[See page 235]

The Gardeners' Pocketbook

Zenobia pulverulenta

One of the plants native to our eastern sea coast states that I have long wished to grow, now seems established here, as if it were at home. One can assume that, from the fact that it is now not only growing and flowering well, but has sent out underground stems at very considerable distance from the original plant. This habit is not mentioned in any of the texts that have been consulted, and is worth knowing as it should prove a fairly easy means of propagation.

The usual description calls it a deciduous or half evergreen shrub to six feet, with arching branches and a fine show of flowers, from the massing of the smaller axillary clusters that come from all the upper axils of the shoots until they appear as a great raceme of bloom. It is usually noted that in the typical form there is a fine gray color to the leaves and a definitely whitish under surface.

Since shrubs that approximate gray in leaf color are not common here, this is an added attraction, as much of the garden effect comes through the portions of the year when none of the main attractions are in flower—azaleas, camellias, and magnolias. In fact, it is really a green garden with certain times of great color only.

The illustration was made from some of the shorter twigs, and gives only an approximate notion of the effect when there are twenty or more groups together. It does show, however, the fine quality of the individual flowers which are firm and last well on the bush and when cut they are pure white. We found no scent. The first year after planting, there were no seed, but this season (1962) there seems to be normal fruit forming and one hopes for seed.

The only requirements that seem vital, are those of acid soil and uniform moisture. Uniformity is more important than quantity, as the plant seems to adjust to a regular schedule, with either more or less as Nature and the gardener provide. It is said to be happy in very moist positions, but there are no data available here on that point, as it is a native of this area.

It is not a plant that could be used in masses to replace the common shrubs used for such purposes, if its behavior here is typical, but it is certainly an accent plant of great interest.—B. Y. MORRISON, *Pass Christian, Mississippi*.

Iris danfordiae

The description of *Iris danfordiae*, a bulbous,* early flowering species from Asia Minor, prompted me to try single bulbs of it a couple of times with no results as far as bloom was concerned. Last year, however, on the third try, this time with a number of bulbs, the outcome was a potful of lovely, blooming plants in full flower in January.

My plants were grown in a cool greenhouse, just protected enough to exclude frost although they could have been grown outdoors. *Iris danfordiae* is a low grower around six inches tall, good mostly for pot or rock garden culture. The plants need no special coddling, but should be planted in late summer.

The flowers of this "bulbous" iris are a canary yellow, shading into green on the style arms. The falls are full and nicely rounded but the standards are very small. The foliage is narrow, reedy, and about the same height as the flowering stems. As an added attraction the blossoms are exquisitely fragrant. This was a surprise to me inasmuch as I had never seen it mentioned in the meager descriptions of this plant.

When grown out of doors the bulbs are said to split up badly after blooming but mine were of fair size after the foliage had ripened and died down. I left them in the pots of dry soil all summer after which they were started again, hopeful that I may get more bloom next season. In any case, even if the first bulbs do not bloom a second time the flowers are good enough to replace with fresh bulbs each season.—MRS. LEILA B. STAPLETON, *Oroville, California*.

*The so-called bulbs of certain species of iris are really corms.

Taste and Smell as Aids to Identification

Taste and smell are excellent aids in identifying some plants whose flowers and fruit are easily confused with others of similar appearance as well as plants not in bloom.

Even farmers are often unable to tell *Ailanthus* from black walnut. The smell of a crushed leaf makes it simple to distinguish either. Balsam poplar need never be confused with any other once its scent is learned. Sassafras, spicebush, and sweet birch can all be identified even in the depth of winter by the taste of their twigs, especially by those who as children chewed such twigs instead of bubble gum.

In my undergraduate days a prankster presented a group of botanists with a branch in whose identification he asked help. He had broken it from a seedling apple growing beside a road that crossed a sandy plain covered with scrub pine, a seedling dwarfed by starvation and forced into prostrate growth by passing wagons. The prankster emphasized the sandy soil, the surrounding scrub pine, the prostrate growth. The botanists were utterly confused except for the oldest. He reached for the twig, took one sniff, and announced, "I don't care where that grew or how it grew. That's apple. I could never be fooled on the smell of apple foliage."

The quickest way to identify oxalis and sheep sorrel is by the taste of the leaf. In cranberry country *Chiogenes*, or creeping snowberry, is often found growing intermingled with cranberry. To the inexperienced there is no perceptible difference. *Chiogenes* leaves, however, have the taste of wintergreen and the tiniest nibble is enough for identification. Taste of the red berries is also the easiest way to tell wintergreen from bearberry, two more plants that bear no resemblance to the trained eye, no difference to the untrained.

Unfortunately neither scent nor flavor can be described satisfactorily nor classified into a key. Botanists have taken cognizance of scent in naming such species as *Dryopteris fragrans*, *Cirsium odoratum*, *Anthoxanthum odoratum*, *Viola odorata*, *Nymphaea odorata*, *Abies balsamea*, *Rhus aromatica*, *Symplocarpus foetidus*, *Philadelphus inodorus*. Gray's Manual makes frequent reference to the presence of scent and now and then of

taste. Both scent and taste, however, must be learned by smelling and tasting, preferably in childhood. Children who have had an opportunity have always learned more about the plants around them by sniffing and tasting than their parents suspected. They have probably run no more risk of poisoning than they have run of electrocution by household gadgets.

Some odors survive drying. Sweet grass baskets may keep their fragrance for years. I have known balsam fir pillows to be highly aromatic after 45 years. On the other hand many odors disappear quickly and may be lacking in all dried herbarium specimens, with the result that species botanically described from herbarium specimens rarely have any mention of scent no matter how pronounced it may be in the fresh specimen. I learned that as a student when I collected *Ribes hudsonianum* whose fruit is incredibly aromatic when gathered and odorless in dried specimens.

The matter of scent is further complicated by the fact that the forests are full of natural hybrids between fragrant and nonfragrant species, as, for example between *Calycanthus floridus* and *C. fertilis*—a fact that may possibly have some bearing on the scentless calycanthus sold by some dealers today.

To make the matter still more complicated some species give off scent only when wet, some only when warm, some only at dusk, some at one stage of development but not at another. There are various other complications. In my own experience the foliage of *Bumelia lycioides* cannot be induced to give off scent except when being skeletonized by an unidentified little larvae. Then a single tree will scent a sizeable hillside with the fragrance of Hall's honeysuckle.

In a recent book the author states that while *Trillium erectum* is supposed to be ill-scented she had never found it so. In my own experience one can—or could long ago—walk through acres of *T. erectum* in bloom, or could carry an armload of the flowers for miles on a hot day without detecting a trace of unpleasant smell. But after the flowers are kept in a closed room for a couple of hours they give forth such a stench that one wonders why Gray did not describe the flower as nauseating instead of just as "ill-scented."—MAUD R. JACOBS, *South Carrollton, Kentucky*.



G. HAMPFER, LONGWOOD GARDENS

Cantua buxifolia

Most horticulturists are aware of the long list of worthy ornamental plants which, for reasons unexplained, are seldom seen in cultivation. Many of these are of great beauty and not difficult of culture, but have just not "caught on." *Cantua buxifolia* is one of this number.

Certainly this flower was highly esteemed by the Incas before the Spanish

Conquest and was given a place of honor in the adornment of temples and in religious festivities. It is often referred to as "The Sacred Flower of the Incas." The Peruvians have made it their national flower and call it *Ccantu*, or Magic Tree, from its ability to recover quickly from the effects of drought. Its generic name is taken from the vernacular.

The genus *Cantua* with a few species endemic to the Andes of Peru, Chile, and

Bolivia, are shrubs closely related to Phlox and show their kinship in the flowers which, however, are pendent and larger than in Phlox. The plants at Longwood Gardens have a tube about three inches long, flared at the mouth to form a trumpet-shaped flower. The outer surface of the lobes is a rich red-purple (RHS Color Chart Solferino Purple 26/1) fading to a light orange on the tube. The inner surface is slightly lighter and fades to white in the center. No description is adequate to impart the grace of these flowers as seen in the hanging corymbs at the tip of each branchlet. They appear from February to April, depending upon the season, with each flower lasting two or three days.

A figure of this species is to be seen in *Curtis's Botanical Magazine* for 1851 (Tab. 4582) where it is reported as successfully passing through two winters in Devonshire. Its nativity would indicate the need for a cool climate with never more than a few degrees of frost. It may be anticipated that this plant will thrive wherever the growing season remains cool as in the San Francisco Bay region. Indeed, it is reliably reported from that area, but by no means is it common there.

In the north the plant makes an excellent cool-house plant and its culture causes little trouble. A well-drained soil with ample organic matter is indicated. Only two minor faults may be listed: its tendency to be brittle and difficult to handle, particularly when laden with flowers, and its susceptibility to infestation with red mites. Both of these are of little consequence to the careful grower and are easily avoided.

This is a plant certainly worthy of trial outdoors in cool nearly frostless areas of this country, and one which may be regarded as a choice greenhouse specimen in the north.—RICHARD W. LIGHTY, *Longwood Gardens, Kennett Square, Pennsylvania.*

Multipurpose Humus

Here, on the Appalachian Piedmont, we live on that caprice of nature, the Red Clay Belt, also known as the Cherokees' Revenge.

When it is dry, it is as friable as a brick. When wet, it has the consistency

of axle grease. But when it is opened up with a durable humus, the red clay will grow just about anything. And for that purpose, we are blessed with the best—sawdust.

The entire area is marked with the remains of small lumbering operations of twenty or more years ago, each one including a huge pile of coarse sawdust, blackened with age, but still hard and granular in texture. To a gardener this is the most valuable by-product of the Appalachians. It is free for the hauling and when dug into the red clay (about half by volume), it produces a well-drained, well-aerated, friable, acid soil. And what more could an azalea wish for?

I have never noticed any nitrogen deficiency resulting from the use of this sawdust, although I *do* stand by with a bag of cottonseed meal and keep a sharp watch over newly prepared beds.

Sawdust also makes an excellent mulch. I prefer pine straw on sloping beds, however, since it is less likely to wash away in a heavy downpour. But on level beds, sawdust does the job admirably.

"What about termites?" someone is always asking.

"What about them?" I counter.

Every garden stake, every fallen branch, every chip of wood in the yard is infested with them, but I've rarely seen termites in sawdust. I suspect the open texture frustrates them.

Finally, this same aged, coarse sawdust makes the best rooting medium I have ever tried. Used alone, it drains perfectly, but retains the optimum amount of moisture. I am now using cypress flats (they are virtually indestructible) filled with sawdust and placed in the mist-house. For the past three years, I have obtained a hundred per cent rooting of azalea cuttings. There may be other media just as good, but why change? Peat moss is almost five dollars a bale. Sawdust costs five dollars for two cubic yards—the price of hauling!

And if you, too, are a person of modest income, converting a yard, one-hundred by three-hundred feet, from red clay to azalea beds, that difference in price means the difference between the practical and the impossible.—GRAHAM HEID, *Atlanta, Georgia.*

Cold Damage in North Louisiana

This is June 12, a long time since the big freeze on January 12. But it has taken this long to truly assess the damage from the zero weather—yes, two below zero here in North Louisiana. Many shrubs cut to the ground are sprouting from the root. But my beloved yellow Lady Banksia rose (*Rosa banksiae*) is gone beyond hope. It did put out a few shoots after the big blizzard, but hard freezes in February and early March finished off these tender sprouts. This rose formed a veil of soft yellow from the ground to the top of my rock chimney, and with delicate pink Kurume Azaleas was inexpressibly lovely.

Strangely enough, this yellow rose was on the south side of the house, while the white Lady Banksia on the north side was not killed entirely, though had to be cut back severely. *Rosa* × *fortuneana* (supposed to be a natural hybrid between *R. banksiae* and *R. laevigata*) was badly nipped back, but is putting out nicely. Lovely *R. laevigata* was killed to the ground, as was the Red Cherokee. These two, at last, are sprouting from the root.

The weather that precedes a zero spell has a great deal to do with the resistance of plants. In 1951, when it went only to zero, Lady Banksia roses were killed outright, bark split on many azaleas, and native *Callicarpa* was cut down to the ground. But a warm December and early January had kept shrubs tender. This year, there had been one hard freeze after another before the big blizzard, and plants had built up cold-resistance.

In both years, Crape Myrtles were severely damaged, strangely enough the watermelon-red suffered much worse than the white and pastel colors. For the first time, my *Osmanthus fragrans* was almost killed, also the dainty *O. delavayi*. But *O. heterophyllus* 'Illicifolius'; *O.* × *fortunei*, and *O. fragrans* 'Aurantiacus' were only slightly nipped.

The two *Daphne odora* at the front door were rather badly burned, lost most of their leaves, and top twigs had to be trimmed off. With slight protection, two younger plants came through unscathed. It seems to me the shrubs that survived zero weather deserve to have the tag "tender" left off. This description keeps most nurserymen from listing this de-

lightful plant. My two largest ones have now lived through zero weather twice—with no protection.

The Asiatic magnolias had wisely hardened off during previous freezes and were undamaged. In fact, the bloom was more perfect than I have ever seen it. Alternating warm days and hard freezes play havoc with these beautiful flowers.

Among the cultivated azaleas, the Kurumes are truly "toughies," coming through with no damage, and blooming better than ever before. The one called 'Formosa' seems to be the most tender, while big-flowered 'George Lindley Taber' was untouched. Loquat (*Eriobotrya japonica*) trees were badly damaged and had to be cut back severely. For a long time, I thought that both *Myrtus communis* and *Feijoa sellowiana* were gone. They were cut to the ground, but are vigorously producing shoots from roots. *Callistemon viminalis* seemed to be dead, but it has now sent up new shoots.

I would choose this year to try brunsvigias out in the open! By turning cartons over them the leaves were saved in previous freezes, but the zero weather got them. I was in despair, but they have put forth vigorous new leaves, and maybe—just maybe—they will bloom for me in due season. Daffodils seem to love the cold, for they were never more beautiful—saving me from the Slough of Despond.—CAROLINE DORMON, *Saline, Louisiana.*

Lady's Mantle

There are many subalpine and quite a number of alpine species of Lady's Mantle in the European mountains, so it is no surprise to find in the book on Norwegian wild flowers (*Norske Flora* by Dr. Johannes Lid, Head of the Botanical Museum and Garden at the University of Oslo) seventeen pages of alchemillas, with silhouettes of their leaves in addition to scientific descriptions of the kinds. Yet, in this country, only one species, *Alchemilla vulgaris* seems to be available and then only from rather special establishments devoted to herb growing.

It is a decorative plant, not fussy about soil, or sun or shade, doing well and sturdily in either, around New York. Its leaves are delightfully folded and scal-



EDWARD G. LEWIS

A four-parted hemerocallis flower

loped and its delicate, loose heads of flowers are an unusual shade of chartreuse yellow. What is more, they stay about that same hue when dried for winter bouquets.

Almost no one who visits my garden knows it, except Europeans and herb specialists, so I continue to tout it as a desirable one among lesser known plants. Yet, for myself, and for those who already have it and love it, I wish some one in this country would bring in stock of some of the subalpine forms.

Alchemilla alpina, for example, as we have found it in the Swiss Alps and in the Pyrenees, as well as in the High Savoy, is a handsome, dark green shiny thing, with digitate leaves edged white. The flowers are daintier than in the subalpine versions, the foliage leathery and probably of good texture for drying. It would be a highly decorative thing in this region and should have no difficulty with our winters, given good drainage

and possibly a mulch in winters when snow is not heavy.

It does lack one special virtue found in the low altitude alchemilla, *A. vulgaris*, that of making itself look most beautiful with large "dew" drops that decorate every scallop on the edge of the cape-shaped leaf—a diamond-studded mantle of My Lady, the Virgin Mary, of course. The "dew" is actually exuded moisture from the vascular system of the plant, not humidity condensing on it from the atmosphere.—MRS. WINTHROP J. MEANS, *Rumson, New Jersey*.

A Hemerocallis Variation

Every now and then flowers of *Hemerocallis* appear with parts in fours instead of the threes typical of the Lily Family. For years I have been told such variations appear and disappear according to no rule and that it is impossible to develop a four-parted clone. My own experience makes me wonder whether



IVAN N. ANDERSON

Styrax americana

it is indeed impossible or just one of those things that take longer.

My own four-parted flowers appeared in a clump of a *Hyperion* seedling. I discovered it when a neighbor asked why my flowers were so much larger than hers, though hers were from a start of my plant. For the first time in years I took a close look at my flowers and found that two of them were four-parted. Later that summer three other scapes bore flowers in fours. In each case the four-parted flower was the first to appear on the scape followed by flowers that were normal. More than half the scapes had borne their first flower before I began checking so I had no idea how many had bloomed with fours. The next summer fifteen scapes of the 51 in the clump bore four-parted flowers at first and three were produced farther down the scape. Four scapes produced four-angled seed pods though no well-developed seed. Over the years I had given away three starts of the clump and all three of these had four-parted flowers though none of the owners bothered to find out how many.

That summer I divided my clump, giving all divisions that had borne four-parted flowers a more favorable location.

When flowering time arrived it was impossible for me to be at home to see the results. Later it became obvious I would have to give up the project. Because no one could be found to continue it the plants were given to neighbors interested only in their beauty. I find it hard to believe, however, that when nearly a third of the scapes of a clump bore one or more four-parted flowers with a tendency to bear four-angled seed pods, there was no chance to develop a four-parted strain.—MAUD R. JACOBS, *South Carrollton, Kentucky*.

Some Notes on Occasional Plants of the North Gulf Coast

The term "occasional" is the writer's perhaps inaccurate way, of describing a native shrub that seems to appear, only now and then, when one goes on a field trip. In this part of our country, such plants as *Amelanchier canadensis*, *Oxydendrum arboreum*, *Viburnum densiflorum*, *Halesia carolina*, *Quercus velutina*, *Q. alba*, and even *Styrax americana* or *Kalmia latifolia* occasion more than a little interest when encountered. It appears to me that habitats suitable for

these species are "occasional" except possibly for *Styrax*. All of the plants named have one more thing in common, their value as ornamentals.

Viburnum densiflorum is an interesting species. When I first encountered it on a dry piney hillside, it appeared with functional leaves into January, though normally deciduous, and I first thought I had the nearly related *V. acerifolium*. The differences are apparently slight—*V. densiflorum* with undulating leaf margins and *V. acerifolium* with maple-like 3-lobed leaves. Hard pruning has made the wild plant into a heavily branched, sprightly ornamental.

Styrax americana I feel has considerable ornamental value. When seen in the lowlands, bordering streams, it might appear to have an indifferent value, but like the wild azaleas, it can be transformed in cultivation into a floriferous deciduous shrub with much more blooming wood than I have ever seen in the wild. This transforming process may require as much as three years to recover from the shock of transplanting and to form new shoots from the base.

Halesia carolina (Silverbell), as all know, is an excellent addition to the list of small flowering trees. Transplanted from the wild, the plant will need several years to become a good looking tree. Some pruning and training are necessary to form a straight trunk and after that the tree takes command. Its nodding, bell-shaped white flowers are so unusual in these parts, that they never fail to cause some comment.

Oxydendrum arboreum (Sourwood) is a rare tree in this area found only in ravines and near creeks as an understory plant with some oaks and the southern beech. This contrasts with its occurrence in the Piedmont, on dry, often rocky hillsides. The one plant I have moved into the garden has been slow to recover, and has not yet given me the shapely form of which it is capable.

Finally a word about *Amelanchier canadensis* (Serviceberry). Of the trees thus far mentioned, this species is the most difficult to find, perhaps the most rare. It is always associated with a host of moist soil competitors and it so closely apes the wild plum that a close inspection is necessary to single it out. Long

ago, someone must have planted one as a street tree in Mobile, possibly thinking it was a plum. Today this tree is twenty-five feet tall, with a trunk diameter of 10 inches. In late February, when it blooms, it is a striking sight, heightened in effect by contrast with redbuds, planted near by. It's strange to see a Serviceberry tree here, after having read of the part it plays in park planting along Lake Ontario.—E. J. HORDER, *Mobile, Alabama.*

Pterostyrax hispida

With all the present interest in small flowering trees, not only the fine tropicals that interest Mr. Edwin A. Menninger in Florida, as depicted in his new book, *Flowering Trees of the World*, but for smaller properties, some attention should be paid to the Epaulette-tree, *Pterostyrax hispida*.

Because the editor of this magazine made some mention of his interest in *Styrax*, a closely related genus, one of our members in Wilmington, Delaware, told of her interest in this tree, represented in the Editor's garden only by small seedlings that are growing well as if they approved of Gulf Coast Mississippi. Others given to a member in Tennessee are reported as doing equally well, but neither in their present state suggest the fine appearance of the tree in Wilmington, grown with several stems. The first illustration shows the fine habit of the tree and the detail of the inflorescences shown in the second illustration should be even more persuasive.

Our member writes from her experience that "the article in Bailey's *Cyclopedia of Horticulture* describes it well in every detail, but when June comes and it is full bloom, nothing can describe it. It is one of the most beautiful things in the garden. The flowers hang in panicles similar to wisteria and the tree is a mass of fragrant white flowers, especially attractive to lightening bugs! The name *Pterostyrax*, with the Greek prefix *ptero* meaning winged, is borne out by the wings of the blossoms, and these give the tree its fantastic appearance. Here it grows to between twenty and thirty feet, but there is one very large old tree in Philadelphia and a few specimens scattered farther north, though I believe



SANBORN STUDIO

Pterostyrax hispida

that Philadelphia may be considered the northern limit.

"It seems to be very easy to propagate from seeds, especially if the seeds are planted as soon as they are ripe and dried. To everyone's surprise the plants start blooming in a few years, and in about ten years there are quantities of beautiful blooms. This continues for many years. Seeds have been sent to the

Society for distribution on the Seed Exchange List."

After all this the editor took a new look at his own small plants, and then, thought to write to Mr. Bernard Harkness, in Rochester, New York, to know if he had any experience with it there, as so many surprising things do succeed in sheltered places under his care in the Rochester parks. He replied that it did



MRS. WILLIAM K. DU PONT

A close-up view of the Pterostyrax hispida flowers

survive but suffered winter killing so regularly that it could not be considered as a useful plant for them.

The editor's first knowledge of the plant came from very old trees in the old Mall in Washington, D. C., a planting made in the old victorian style and long since wiped out for the new modern plan that belongs to the master development there. Those trees had been trained to single stems or trunks and were about eighteen feet tall, but were then over-shaded by larger deciduous trees and

probably had root competition of some intensity. They were also under-planted with Mondo Grass, the plant more recently brought to fame and treated with other kin in Dr. Hume's new study recently published in *Baileya*.

Surely we need to be reminded of fine things that seem to slip in and out of cultivation for no really sound reason. Unless they are preserved in gardens of private individuals, many will be lost.—B. Y. MORRISON, *Pass Christian, Mississippi*.

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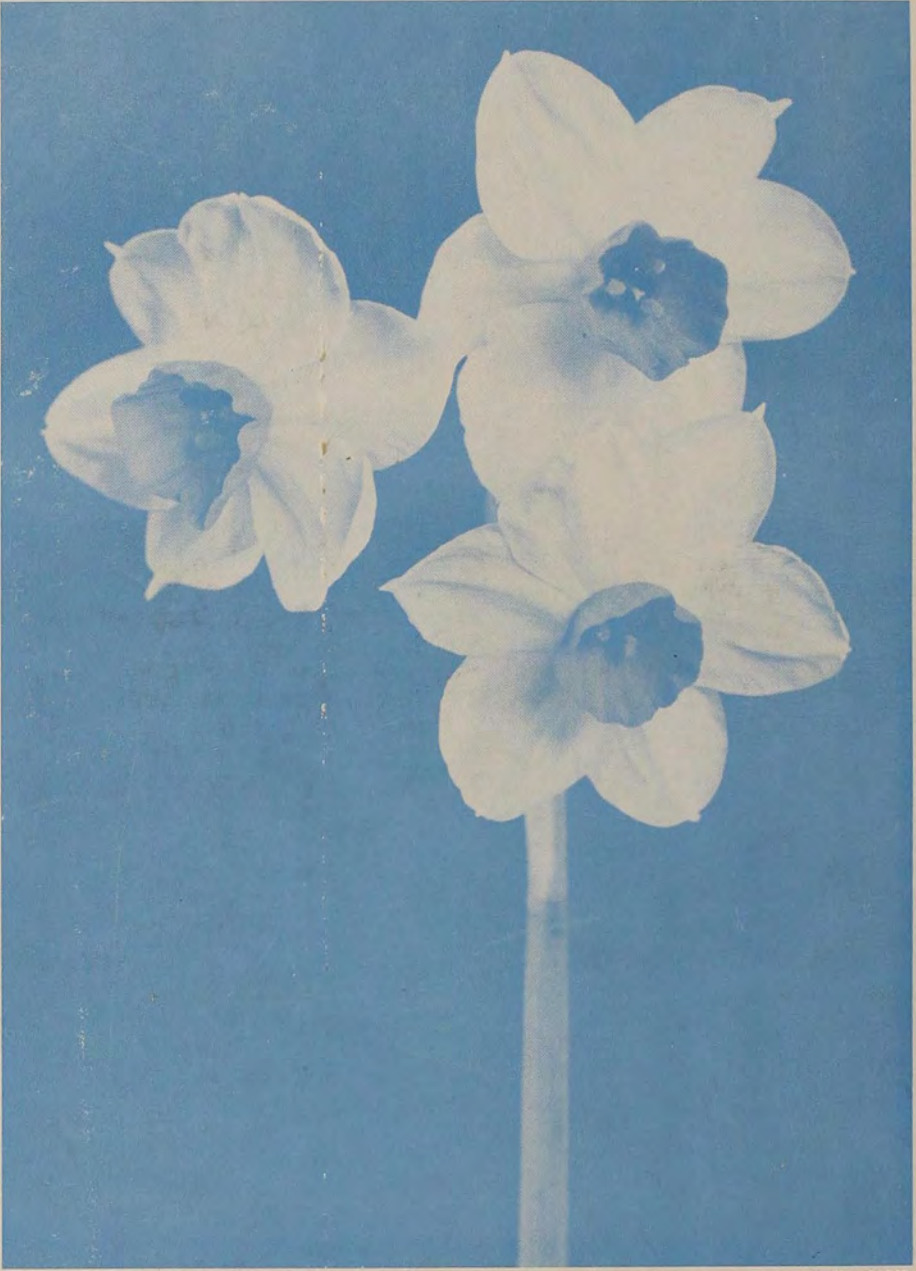
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