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Contents

The July cover illustration is a four color photo of a collection of Hawaiian *Plumeria* cultivars. This photo and the one on page 124 are by the University of Hawaii Cooperative Extension Service.

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For United Horticulture

★★★ *to accumulate, increase, and disseminate horticultural information*

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.

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Plumerias in Hawaii

By Donald P. Watson, James T. Chinn,
Horace F. Clay and James L. Brewbaker

The *Plumeria*, originally called Plumiera after Charles Plumier, and referred to as Frangipani in some tropical areas, is affectionately called 'Pumeli' or 'Melia' by Hawaiians. The Frangipani may have originated from the similarity of the plumeria flower fragrance to a perfume extracted by an Italian named Frangipani during the Middle Ages. It may also have originated from the French word "frangipanier" meaning "coagulated milk," descriptive of the latex in the plant.

Although the native home of the *Plumeria* is uncertain, the plant is widely distributed in tropical regions of the West Indies, Florida, Central America, Polynesia, Australia, East Indies, China and India.

Being widely grown throughout Hawaii as an ornamental tree and pot plant, it is also planted for a year-round supply of attractive flowers for leis (garlands) and for the manufacture of perfume.

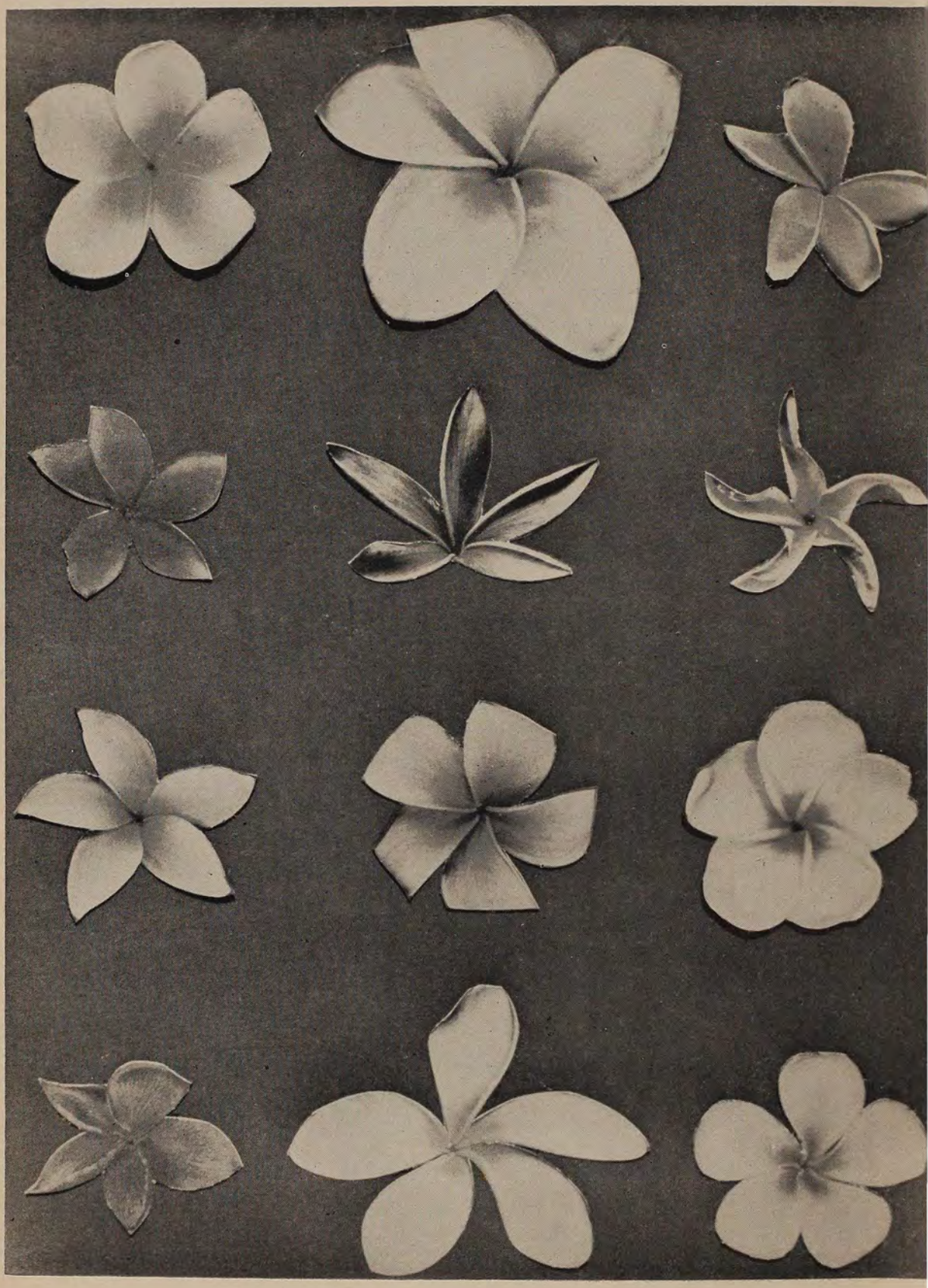
Characteristic of the approximately seven species of the genus, fragrant plumeria flowers are produced in terminal clusters on peduncled cymes with petals that unfold in a spiral fashion. Between 20 to 60 flower buds have been counted in each floral cluster. The lower petal parts are fused into a corolla tube. A short style with a bi-lobed stigma and five closely surrounding anther sacs are located at the base of this tube. Successful fertilization of the ovaries leads to the development of two leathery follicles, ranging in length from 3 to 18 inches, with as many as 30 winged seeds. The diploid number of this genus is reportedly 36.

The latex which exudes from cut branches, leaves and flowers is reported to have poisonous qualities as well as medicinal value for fevers, itch, and swellings. Chemically, the latex contains 25.5% cauoutouc (rubber), 21.9% resinous matter, 15.7% water and 36.9% undetermined substances. Medicinal use has been made of the bark, leaves, flowerbuds and seeds.

Even the wood from the branches and trunk is utilized. The white, soft, light-weight wood (37 pounds per cubic feet) is used for making drums in India. Since more mature trunks and branches of the trees are harder, heavier, and more compact, they have been found suitable for making bowls, cabinets and small furniture by Caribbean craftsmen.

In recent years interest has been generated, especially by amateur plant breeders, to select flowers with better quality within the great range in variability of flower size, from texture and

Plate 1. Pictured, about 1/3 their natural size, are some of the common *Plumeria* cultivars in Hawaii: The top row, left to right: 'Common Yellow' or 'Graveyard Yellow', 'Daisy Wilcox', and 'Gold'. Second row: 'Hilo Beauty', 'Kauka Wilder' and 'Madame Poni'. Third row: 'Puu Kahea', 'Rainbow', and 'Samoan Fluff'. On bottom row are 'Emma Bryant', 'Sherman', and 'Singapore'. For descriptions of the colors see the chart on the next page.



Horticultural Colour Chart Vol. 1 (1938) and Vol. 2 (1941)
Printed by Henry Stone and Son Ltd., Banbury, England

'Common Yellow'	'Daisy Wilcox'	'Gold'
White petal with lemon yellow center.	White petal with dawn pink marginal band lemon yellow center.	Canary yellow petal with white tips.
'Hilo Beauty'	'Kauka Wilder'	'Madame Poni'
Currant red petals.	Crimson petals with lemon center	White petals with lemon yellow bands radiating from center. Twisted petal shows crimson marginal band on back of petal.
'Puu Kahea'	'Rainbow'	'Samoan Fluff'
Canary yellow white petals with crimson marginal band.	White petal with canary yellow center and dawn pink margin	White petal with canary yellow center.
'Emma Bryant'	'Sherman'	'Singapore'
Rose red petals with yellow tint.	White petal with empire yellow center.	White petal with lemon yellow center.

color. Many seedlings have been grown but not until recently has an organized breeding program been started.

This article summarizes an evaluation of the existing clones grown on the island of Oahu, Hawaii.

Existing Species and Some Major Cultivars

While the variation in size and color of the flowers on existing clones in Hawaii is great, most of the clones resemble the following three species: *Plumeria acuminata, Plumeria obtusa,* and *Plumeria rubra.* Occasional plants of *Plumeria alba* and *Plumeria bahamensis* are grown in Hawaii, but they are small-flowered and a little aesthetic quality.

Plumeria acuminata (*P. acutifolia*)

A tree to 35 feet in height; leaves oblong to 16 inches in length and 3 inches wide, tapering at both ends, acuminate at tip, glabrous in both sides; flowers white with a yellow center, very fragrant, 3 to 3.5 inches across, the obovate corolla lobes longer than the tube; branches 1 to 1.5 inches in diameter; follicles 8 inches long and 1 inch wide.

Cultivars: Common yellow or Graveyard yellow, Gold, Sherman, and Samoan Fluff.—Plate 1.

Plumeria alba.

A tree to 35 feet in height; leaves linear oblong to oblong-lanceolatae, to 6 inches long and 1½ inches wide, tips revolute, without definite marginal vein; flowers white with yellow eye, slight fragrance, 1 to 1½ inches across, the obovate corolla lobes as long as or longer than the tube; follicle to 6 inches long and ½ inch wide.

Cultivar: none.

Plumeria bahamensis

A small tree, about 9 to 10 feet high, the branches about ½ inch in diameter; leaves lanceolate or linear-lanceolate, glabrous, 8 to 11 inches long and 1 to 1½ inches wide, acute at the apex, narrowed at the base, the midvein depressed above, prominent beneath, the lateral veins numerous, straight ascending; flowers white, about ¾ inch broad, the slender tube about as long as the lobes; follicles about 4 inches long and ½ inch in diameter.

Cultivar: none.

■ *The authors are all horticulturists at the University of Hawaii. Donald P. Watson was a visiting professor at the University's Agricultural Experimental Station in 1963-64. He is now Head of the Department of Horticulture. James T. Chinn is a Department assistant. Horace F. Clay is the Program Director, Institute for Technical Interchange, East-West Center at the University, and James L. Brewbaker is a Professor of Horticulture and the* Plumeria *project leader.*

Plumeria obtusa

A tree 13 to 20 feet high, often flowering when not more than 5 feet high, the stout twigs, the leaves and the green upright inflorescenses glabrous. Leaves oblong to oblong-oblanceolate or oblong-obovate, 3 to 8 inches long, rounded or emarginate at the apex, mostly narrowed or somewhat cuneate at the base, lateral veins nearly straight and rather widely spreading. The slender petioles 1 to 3 inches long; panicles few to several flowered; peduncle as long as the leaves or shorter; pedicels short; calyx about 1/8 inch long; flowers white with yellow eye, the petals obovate or oblong-obovate, rounded at the apex, 1/2 to 3/4 inch long, about as long as the tube; follicles 3 to 5 inches long, about 1/2 inch in diameter. This description resembles that of *P. tuberculata.*

Cultivar: Singapore—Plate 1

Plumeria rubra

A tree 16 to 26 feet high, the young branches, peduncles and pedicels pubescent. Leaves elliptic-oblong to elliptic-obovate, 6 to 16 inches long, acute or short acuminate at the apex, narrowed at the base, glabrous on both sides, the lateral veins rather distant and widely spreading, the petioles 1 to 2 1/2 inches long; drooping panicles several to many flowered, 1/2 to 1 inch long; calyx 1/8 inch long; corolla purple or red, 2 to 2 1/2 inches broad, the tube shorter than the limb, the lobes (petals) broadly elliptic, obtuse; follicles 6 to 10 inches long, about 1 inch in diameter.

Cultivars: Hilo Beauty and Emma Bryant—Plate 1

Several other flower types have been observed, some of which have been given popular names. Through constant use, these names have become generally accepted in Hawaii. On the basis of their reproductive and vegetative organs, these unusual and novel cultivars are suspected of being interspecific hybrids from among *Plumeria acuminata, P. obtusa* and *P. rubra.* A few named cultivars in this group include: Madame Poni, Puu Kahea, Kauka Wilder, Daisy Wilcox, and Rainbow.—Plate 1

The appearance of floral color variations among the species suggests either the release of variation by self-pollination of plants with heterogeneous genetic background or the initiation of variation by somatic mutation. Cultivated plants which are generally asexually propagated show this expression of wide variability in some of their characters when self-pollinated. The possibility that natural crossing among the species does occur, however, cannot be dismissed. Locally grown clones, appearing to have traits of all three species, have been reported to be of dwarf stature.

Keeping Quality

Lei makers and other users of plumerias select their flowers on the basis of attractiveness and keeping quality.

Although *Plumeria acuminata* 'Common Yellow' is generally believed to be one of the most durable, tests on the keeping ability of several cultivars at room (70° F) and refrigerator (40° F) temperatures indicated that other blossoms have the ability to last as long (Table 1).

Table 1. Effect of storage on the keeping quality of plumeria flowers.

Cultivar	Number of days flowers remained fresh at: 70° F	40° F	Scent after 1 day in storage at 70° F
Common Yellow	3	3	pleasant-mild
Gold	3	3	pleasant-mild
Hilo Beauty	2	2	pungent-strong
Kauka Wilder	1	1	pleasant-strong
Madame Poni	1	3	pleasant-mild
Puu Kahea	3	3	pleasant-mild
Rainbow	2	3	pleasant-mild
Samoan Fluff	1	2	pleasant-mild
Emma Bryant	1	1	pungent-strong
Sherman	1	1	pleasant-mild
Singapore	2	3	pleasant-mild

In order to classify these tested cultivars objectively into groups that might reflect their suitability as lei flowers, their duration of freshness under both

temperatures were averaged and used as a score. The pattern of keeping quality of the test blossoms on this basis was as follows:

Best	Common Yellow, Gold, and Puu Kahea
Better	Madame Poni, Rainbow, and Singapore
Good	Hilo Beauty and Samoan Fluff
Poor	Kauka Wilder, Sherman, and Emma Bryant

The use of a senescence inhibitor (Verdan at 10 ppm) did not noticeably improve the keeping quality. Although flower size did not affect keeping quality, those cultivars with thicker and more rigid petals appeared to keep the longest.

Refrigerated blossoms of some cultivars after being removed from the inflorescence remained fresh, turgid and free from browning or discoloration and wilting for more than three days. However, deterioration of these blossoms was slightly more rapid when they were returned to room temperatures. For this reason, storage of plumeria blossoms beyond three days should be avoided. Wilting flowers may be revived by sprinkling with tap water and repeated refrigeration.

Fragrance is an intangible and variable quality of plumeria blossoms, ranging from strong to mild and from refreshing to highly objectionable. All plumerias with yellow centers or stripes seem to be more fragrant than those lacking the yellow pigment. As a guide in the selection of cultivars or blossoms, a few subjective observations on the scent of the tested flowers have been included in Table 1.

Future Through Breeding

Studies on the breeding behavior of the plumeria are presently being continued at the Hawaii Agricultural Experiment Station. Information gained through this research will be useful in the further improvement of the plumeria.

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Note: This *Plumeria* study is sponsored by Donald Angus.

A Cold-hardy Ginger Lily

By Harold F. Winters and Edward G. Corbett

Years ago, one commonly saw the White Ginger Lily, *Hedychium coronarium,* in Southern gardens as well as in Northern botanical collections. Its near disappearance may be laid to changes in plant fads or to modern trends—our new houses leave little room for plant and root storage. The tub-grown oleander and garden cannas have largely disappeared too, although the latter are enjoying a revival. The White Ginger Lily still persists in well protected gardens along the Gulf Coast, Florida, and southern California. It disappeared from the upper South because it lacked cold hardiness. Other ginger lilies have been cultivated from time to time with much the same result, particularly *H. gardnerianum.*

The genus *Hedychium* is essentially tropical as are most members of the ginger family. Some of the species range to considerable elevation in the Hima-

▪ *The authors are both horticulturists with the U. S. Department of Agriculture. Harold Winters is in the Crops Research Division, Beltsville, Md. and has had a long aquaintance with tropical and subtropical crops. He specializes in breeding of Hibiscus and is currently President of the National Capital Orchid Society. Edward Corbett is an Ornamental Horticulturist at the U. S. Plant Introduction Station, Glenn Dale, Maryland. His training has been in Plant Breeding. Currently he is participating in a USDA/ Longwood Gardens plant exploration in the Eastern Himalayas.*

Figure 1. *Hedychium spicatum* growing outdoors at Silver Spring, Maryland. Note that it is flourishing.

PHOTOS BY THE AUTHORS

Figure 2. Inflorescence of *Hedychium spicatum*

layan foothills, however, where frosts occur annually. One of these is *Hedychium spicatum*. Seed of this species was collected by Captain F. Kingdon-Ward, British plant explorer, from plants growing in a meadow at 7,000 ft. elevation in the foothills of the Himalayan Mountains of Burma. Part of the collection was received by the U. S. Department of Agriculture on February 21, 1957, where it was assigned Plant Introduction No. 237458. Plants grown from this seed at the U. S. Plant Introduction Station, Glenn Dale, Mary-

land, were distributed to 32 cooperators during 1958. From this distribution only three plants were reported to be alive in 1964. One cooperator at Bozeman, Montana, reported that his plant made a "reasonably satisfactory, but not outstanding green plant in the greenhouse." It had not flowered. A second seedling is reported to be growing in the Norfolk Botanical Garden, Norfolk, Virginia. The other seedling was planted in the crowded garden of Dr. Roy Magruder of Chevy Chase, Maryland, where it survived four winters. Flowers were first produced during the second summer. Dr. Magruder then gave the plant to Paul G. Russell, a neighbor, who knew its history and recognized the uniqueness of its survival and flowering in the Maryland climate. On April 5, 1962, Mr. Russell brought the plant to the senior author, knowing of his lifelong interest in tropical plants. It was planted the same day in the author's garden situated near the northeastern boundary of Silver Spring, Maryland. In this location the plant probably is less exposed to cold than in Dr. Magruder's garden. The exposure is southwest, and the plant is near the foundation of a heated greenhouse. It has not been heavily mulched, however, and the ground does freeze over it. That it flourishes in these new surroundings may be seen in Figure I.

The clump has increased in size and vigor each year. During 1964 eleven culms were produced which varied from 11 to 55 inches in height. Each of the larger culms terminated in a spike of flowers (Figure 2). The flowers were produced successively, beginning at the base of the 9-inch spike. The first flowers appeared in mid-August. Duration of flowering was about three weeks.

The individual flowers of this species are less perfumed and less showy than those of the White Ginger Lily. Nevertheless they are charming and the odor is never so strong as to be offensive. The yellow buds surmounting 3-inch calyx tubes, open into narrow whitish segments each 1½ inch long. The base of each segment and the single stamen are bright tangerine. Tips of the narrow segments and the broader 2-lobed lip fade to pale ivory.

While the introduction is not striking as an ornamental plant, it is attractive. The leaves resemble those of common garden canna in general appearance but are more slender. The stems are not so stiffly erect as those of canna. The most interesting feature of the introduction is its potential as a parent to breed ginger lilies with greater hardiness. This is the main reason for calling it to the attention of horticulturists. Nothing is known about the breeding behavior of *H. spicatum,* but apparently some of the species of *Hedychium* will form hybrids. A shipment of bulbs and roots from India in 1929 contained several putative hybrids (P.I. 79995, 80002, 80004, 80005). The fate of these earlier importations is not known.

Peatmoss

By John M. Patek

Peatmoss is a popular term for what is correctly known as peat. Peat moss or bog moss are the common names for sphagnum moss which in its dead and compacted state furnishes most of the world's peat. It is from this association of words that peat is commonly referred to as peatmoss.

Classification

Peat. Peat is any partially decomposed vegetable matter consisting of plant remains which have accumulated under the relatively airless conditions of bogs and marshes. Although there is no universally recognized classification of peats, products on the American market can be divided as follows:

Sphagnum moss peats. Sphagnum peat may consist of dead sphagnum moss of one or more species, or of sphagnum moss intermixed with various amounts of acid-loving plants, such as cranberries, blueberries, azaleas, and pitcherplants.

Reed-sedge peats. These peats consist of the remains of plants which grow in shallow water or swamps and include reeds, sedges, and grasses together with other swamp plants. The recognizable vegetable matter includes shreds of the reeds and sedges together with woody stems and roots. The degree of decomposition will vary and consequently the color of various reed-sedge peats will range from yellowish to black.

Hypnum moss peats. This group consists of disintegrated plants of *Hypnum* and other woods mosses intermingled with the roots of other plants. The woods mosses differ physically and chemically from the bog mosses.

Forest peat and peat humus. This group of peats consists of disintegrated organic matter derived largely from woody plants including hardwoods, softwoods and acid-loving plants such as Labrador tea and huckleberry. Some mosses may be present. Most of such peat consists of partially decomposed twigs, leaves, stems, and roots distributed in finely divided material of the humus type.

About one third of the peat used in the United States is sphagnum moss peat, about one third is reed-sedge peat, and the remaining third includes the other types. Where peat is used in horticulture for the propagation of woody plants, controlled experimentation, and the growth of acid-loving plants, it is virtually limited to sphagnum moss peat. Other peats find their major outlets in the garden store trade, lawn building, mulching, the propagation of herbaceous plants, and the container plant trade where cost is a factor (13).

Desired Horticultural Qualities

The qualities desired of peatmoss for the strictly horticultural applications listed above are characteristically associated with sphagnum moss peat, and are listed as follows:

(a) A chemical and physical nature such as to encourage plant growth, particularly the growth of plants which normally require a moist, cool, and acid condition.

(b) A fibrous and spongy structure to hold water for release to plants and to aid in aeration of their roots.

(c) The ability to retain its fibrous nature in the soil, that is, to be resistant to decomposition so that its aerating and moisture holding properties will endure.

■ *John Patek is a supervisor, Material Standards Department, Eastman Kodak Company. He is a member of the Rhododendron, Iris, Rock Garden, and several technical societies. He is Chairman, Standard and Ethics Committee of the American Horticultural Society.*

PHOTOS BY THE AUTHOR

Figure 1. Cymbifolium or spoon-leaved type of sphagnum moss peat, Ireland.

(d) Sufficient total acidity to neutralize the basic elements in the soil, and to maintain an acid condition for plants which demand a low pH.

(e) Freedom from decomposition products, alkaline elements, or other substances which interfere with the growth of the plants, either directly or through deleterious microorganisms.

The great differences in the characteristics of peats are shown in Figures 1, 2 and 3, which are photomicrographs of three different peats taken at 5× magnification. Figure 1 is an Irish peat of the *Sphagnum cymbifolium* or spoon-leaved type where the spongy leaf structure is well preserved. This type of peat has the highest water-holding and aerating properties. Figure 2 shows a Canadian sphagnum peat with the leaf structure also clearly visible. However, the sphagnum is of the *Sphagnum capillaceum* type, and as shown in the experiment demonstrated in Figure 6, does not have the same spongy absorbant and volume characteristics of the Irish sample. Figure 3 is a Michigan reed-sedge peat, and as the picture shows, consists of vascular tissues of reeds and sedges, small woody stems, and decomposed organic material. As shown in the Figure 6 experiment, the volume and absorbant characteristics vary greatly from those of the sphagnum peats.

Sphagnum Moss

Peat moss in the strictest sense applies to living sphagnum or to dead sphagnum below the living moss. Sphagnum constitutes one genus under the Musci or mosses. The Musci belong to the Bryophyta which is a division usually placed between the algae and ferns in the history of plant evolution. The genus *Sphagnum* contains many species, the most common of which is *Sphagnum capillaceum*. What was once described as *Sphagnum cymbifolium* is now broken down into various species of spoon-leaved sphagnums including *S. magellanicum* and represents a group with large leaves, dense foliage and close-set

branches. *Sphagnum capillaceum* represents the acute-leaved peat mosses, a group with small leaves, skimpy foliage and scattered branches (9). Figure 4a shows a sketch of the acute-leaved type and Figure 4b shows the spoon-leaved type; the differences are quite apparent.

Sphagnum is restricted mostly to the swampy areas, edges of lakes, or surfaces of ponds which receding ice sheets left in their wake. The great deposits of sphagnum are associated with the cool damp periods in past climatic changes, and sphagnum's ability to thrive close to the edges of the continental glaciers was undoubtedly a factor in their location.

In the formation of sphagnum moss peat deposits, the floating plants multiply along the borders of water and gradually extend out over it. The plants grow rapidly at their tips with the living parts up to a foot high. Immersed dead leaves and stems continually drop to the bottom and accumulate until the body of water is completely filled. The compacted dead moss becomes peat.

Sphagnum differs markedly from the common mosses usually associated with cool damp woods. Most of the leaves of sphagnum consist of a network of small chlorophyll-bearing cells between which are very large colorless cells each with a perforation in the cell wall, as shown in Figure 5 (10). The existence of these empty cells permits the absorption and retention of large quantities of water and imparts to dry sphagnum its water-holding capacity (10).

Acids of Peat Moss

Bord na Mona of Dublin describes its product as coming from the upper layers of selected Irish bogs, and to be so low in decomposition that the original plant life is readily recognizable with a naked eye. This is shown in Figure 1.

The resistance of sphagnum moss peat to decomposition may be associated with constant references in the literature to the "antiseptic quality" of peat moss. Examples are cited of men and animals falling into quaking peat bogs where their bodies have been preserved for hundreds of years (11). The body of a

Figure 2. Acute-leaved type of sphagnum moss peat, Canada.

Figure 3. Reed-sedge peat, Michigan.

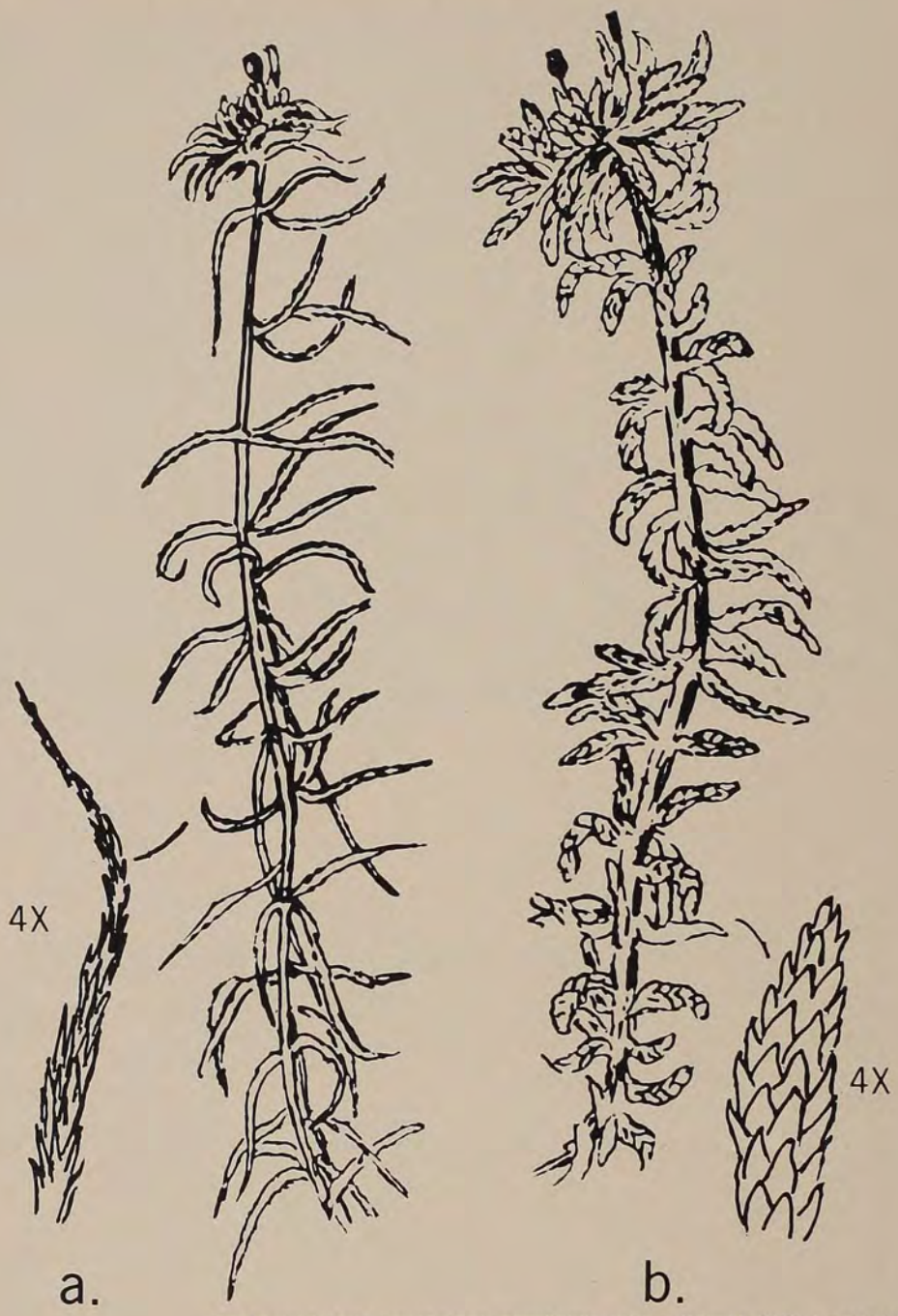
woman dressed in hair-cloth was found preserved under eleven feet of peat (9).

The lower or short chain organic acids are those sour acids which we associate with vinegar and lemons. Some of the lower organic acids such as acetic were once widely used for their bacteria deterrent properties and undoubtedly account for the resistance of sphagnum moss peat to bacterial decomposition. One can logically expect to find in peat the common plant acids such as oxalic ($H_2C_2O_4$) and malic ($H_6C_4O_5$) which would have antiseptic properties. These acids play the part of intermediates in plant respiration and photosynthesis and appear to be particularly high in plants whose limited leaf area hinders the absorption of carbon dioxide for photosynthesis (12).

In addition to the lower short chain acids there are unquestionably longer chain fatty acids. Such acids and their salts are the oily, greasy, or waxy substances found in soap and seldom considered as acids except by the chemist. In fact, waxes are recoverable from peat moss, and there may be other large molecule acids such as those of the salazinic types found in lichens (6).

Besides the original acids derived from the virgin plant material, there are other acids in peats which are the products of decomposition, principally, humic acids. Humic acids are complex colloids with molecular weights varying from 300 to as high as 10,000 comprised mainly of carboxyl and phenolic hydroxyl groups (3), and generally supposed to be derived from lignins. These are not the type of acid which the layman would recognize as an acid.

Peats of different origin and different history can have similar values for pH and even total acidity, but with quite different acids producing the measured result. A light brown undecomposed sphagnum moss peat containing short chain fatty acids might give an acidity measurement similar to a decomposed reed-sedge peat high in humic acids. If a variety of methods were used to determine total acidity, different results might be expected if the acids were of different chemical composition. This proves to be the case.



REARRANGED BY AUTHOR FROM REFERENCE NINE, "MOSSES WITH A HAND-LENS"

Figure 4. Sphagnum types. (a) acute-leaved type. (b) cymbifolium or spoon-leaved type.

The total acidity of the plants of a single species will vary considerably. In fact, it was found that some plants are higher in acidity at night than during the day (12) and that acidity will increase as temperature drops (2). It must not be assumed that all sphagnum mosses will have the same amount of acid, although it is logical to assume that the acids are of a similar chemical type.

As a practical measurement and one which can be understood more readily, it is possible to express acidity in terms of the quantity of limestone ($CaCO_3$)

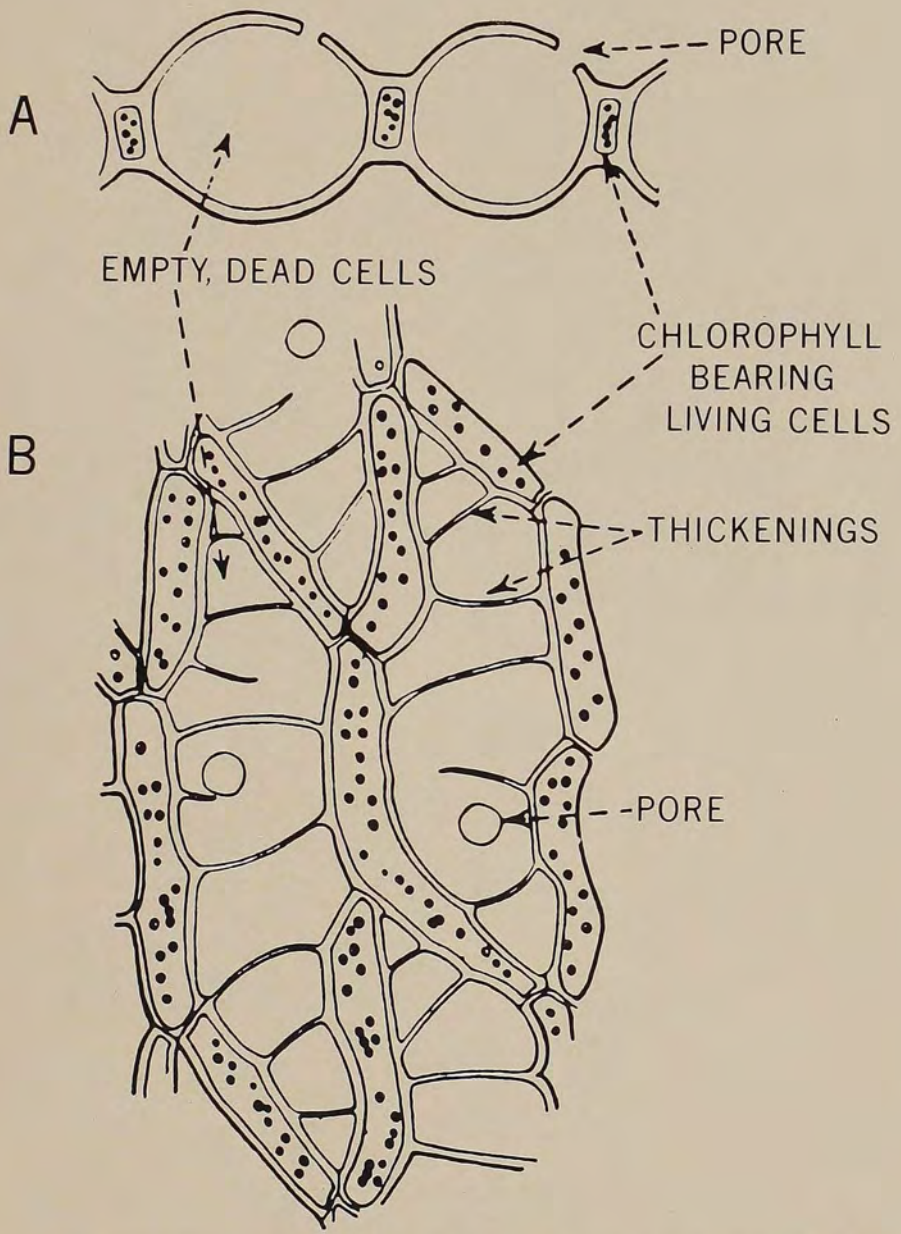


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Figure 5. Sphagnum moss. A, portion of leaf in cross section. B, portion of leaf in surface view.

required to neutralize one ton of peat. The total acidity expressed in this manner is quite different from the pH measurement which only tells how much active acidity is present at the moment, but metaphorically speaking fails to tell how much acid will come out of hiding and become active after the existing active acidity is neutralized.

It is important to recognize that pH does not state the total amount of acid present; it is more important to realize

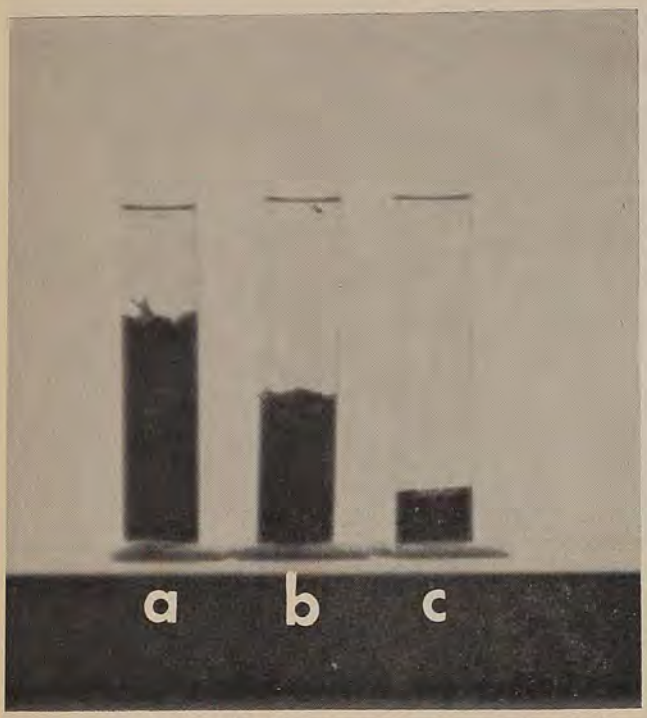

Figure 6. One-quarter gram samples of three peats in water. (a) sphagnum spoon-leaved type. (b) sphagnum acute-leaved type. (c) reed-sedge.

that those acids which are present will be distinctly different in chemical nature according to the type of peat. It is most important to know that these chemical differences will greatly affect the growth of plants.

The short chain acids not only inhibit the presence of bacteria which decompose the cellulose of the peat, but they act as chelating agents which permit the iron and manganese to remain in a soluble state available to plants. Acids of this type are sold for their chelating properties. On the other hand, the long chain acids precipitate the metal ions and make them unavailable to plants. The long chain acids were mentioned as the constitutents of soap. The familiar ring on the bathtub is the precipitate of trace elements.

Volume and Weight

The physical benefits from peat in the soil are related to its volume characteristics. Peats with a high volume to weight ratio furnish a bulky open medium suitable for root growth. When mixed with soil, they prevent compacting and allow air and water to permeate the soil.

The botanical composition of peat will in general determine its volume characteristics. A sphagnum peat relatively free of woody stems will have a high volume to weight ratio and with this an ability to hold moisture and effect aeration. The cellular structure of the sphagnum leaf, the crinkled fibrous form of the stems, and the frequent absence of decomposition products all contribute to its volume characteristics. The reed-sedge peats are commonly lower in volume and as the percentage of woody stems increase the volume-weight ratio tends to decrease further. The highly decomposed peats, the humus peats, and the mucks tend toward still lower volume-weight ratios.

Along with a low volume-weight ratio one should look for a high percentage of mineral matter, or excessively fine organic material or coarse woody material. Fines decompose rapidly and have minimum physical effectiveness in improving water holding capacity or aeration. The humus peat shown in Figure 3 is a type which contains both coarse and very fine material. Twenty percent by weight remained on a 14-mesh fly screen and consisted mainly of pieces of wood. Of the entire sample, 47 percent by weight went through a 50-mesh nylon stocking.

A test was designed to illustrate differences in the volumes assumed at maximum water saturation by the three peats shown in Figures 1, 2, and 3. Samples weighing ¼-gram each were placed in three test tubes which were filled with water and a small amount of wetting agent. Both sphagnum mosses retained some air and floated on the water, while the reed-sedge peat sank. The samples were permitted to soak for six hours, after which time two-thirds of the Canadian peat and one-third of the Irish peat had also sunk. After four days of soaking all of the peat sank. Figure 6 shows the test tubes containing the peat samples. On the left is the Irish Sphagnum

cymbifolium or spoon-leaved type, in the middle the Canadian *S. capillaceum* type, and on the right is the reedsedge type. From left to right the relative volumes of the peat in each tube was 4.7, 3.0, and 1.0, and their relative water absorption was 3.41, 2.37, and 1.00 respectively.

The above test showed some important facts about peat. As shown in Figure 5, the sphagnum mosses possess hollow cells which may contain air or water. The reed-sedge peat which lacks such cells sank almost immediately. The Irish spoon-leaved peat required four days for the cells to become filled with water, or in other words, for the peat to absorb all the water it could. A more important fact is that the amount of water which each peat absorbed varied as the volume to weight relationship increased. All three samples weighed the same, but the spoon-leaved sphagnum peat had 4.7 times the volume and absorbed 3.4 times as much water as the same weight of sedge peat. This should not be surprising in view of the common knowledge that a sponge can hold more water than an equal weight of wood.

Moisture Absorption and Release

Statements regarding the manner in which water is held in peat and the availability of such water to plants have been based on the misinterpretation of test data. Wilting point determinations were made on mixtures of acid peat and soil adjusted to pH 6.5 by the addition of lime without considering the effect of the lime on the wilting point (7). Soluble lime salts like salt water would cause plants to wilt.

However, the evaporation tests did show clearly that the water holding capacity of sphagnum moss peat is essentially mechanical or capillary, and that such peat will lose water on evaporation in the same manner as will wet sand. On the other hand, the decomposed peats which are high in colloidal substances such as humus hold a portion of their water by adsorption, or as clay or gelatin holds water. Water held in this manner is not readily available to plants, but it is also not readily lost by evaporation or drainage. Peat added to a sandy soil will greatly improve its water-holding capacity while the water holding capacity of a clay soil will be improved to a lesser extent (7).

Peat once dried will not reabsorb the water to the extent of the original peat as deposited. Oven dried peat will absorb less water than commercially air dried peat. Dyal reported that peats in which recognizable plant remains were in large part sphagnum (Figure 1) were reduced in moisture retention only slightly by air-drying (5). Peats in which only vascular tissue (Figure 3) or hypnaceous mosses were recognizable were reduced in moisture retention by an average of about 24 percent.

One method of expressing the amount of water absorption is on a fully saturated basis. Another is on a moisture equivalent basis which is the percent of moisture remaining in a saturated sample that has been centrifuged for 40 minutes at a force of 1000 times gravity.

Table 1. Moisture Holding Capacity of Peats, Percent Dry Weight

Type of Peat	Maximum water-holding capacity, percent		Moisture equivalent, percent	
	As obtained	After air drying	As obtained	After air drying
Sphagnum, (Maine)	2640	1620	562	504
Reed, (Florida)	1360	370	488	216

The latter is a soil test method to simulate a condition where excess water has been drained away from soil. Test results (1) on samples of two general types of peat shown in Table 1 furnish an idea of the range of values found in the literature.

The data in the above table shows the effect of drying on the water-holding capacity of sphagnum and reed peats. The comparatively small effect on sphagnum peats may be due to their relative freedom from colloidal decomposition products which would be expected to behave like clay on drying.

Chemical Composition of Peat

Considerable investigational work has been done on the nutrients available from peat in the growth of plants. This type of information had more importance before the era of chemical fertilizers than it has today. To utilize peat for its possible maximum 1.8 percent available nitrogen and its small quantities of trace elements would not be practical, but where large quantities of peat are used, any nitrogen present may be given consideration.

Information relating to the chemical composition of peat shows physiological differences between the organic materials from which peats are derived, and from this standpoint alone is of interest. Such differences are important in relation to the moisture retaining and releasing characteristics, the resistance to decomposition, and the support of microorganisms.

As mentioned previously, the sphagnum moss peats as a class are the highest in acidity. Although temperature, humidity, and the presence of small bodies of water have been primary influences in the existence of sphagnum moss bogs, the association of sphagnum moss with waters low in calcium and other mineral nutrients has also been noted and reviewed (4). It so happens that most of the known areas climatically suited to support sphagnum bogs are not associated with underlying limestone, so that this close relationship with lime-free waters might be partly coincidental.

The percentage of nutrients on a dry weight basis found in three basic types of peat is shown in Table 2 (1).

The nitrogen as shown in the table is about half available and then only slowly. The table indicates that sphagnum peats are lowest in mineral nutrients. This whole question is rather metaphysical, since all levels are too low to be of consequence.

Organic plant materials consist mainly of cellulose and lignin. Microorganisms first attack the cellulose, with the result that decomposed peats have had a major portion of the cellulose destroyed, and are consequently high in lignin and humus. The fact that the highly acid sphagnum peats do not readily support destructive soil microorganisms makes them resistant to decomposition. Oxidizing microorganisms which produce manganese and iron deficiencies are possibly the cause of the chlorotic condition experienced with azaleas and rhododendrons when grown in certain partially decomposed peats.

Differences in the organic chemical composition of an undecomposed sphag-

Table 2. Nutrients Present in Peat, Percent Dry Weight

Type of Peat	Organic Matter Percent	Nitrogen (N) Percent	Phosphorous oxide (P_2O_5) Percent	Potash (K_2O) Percent	Lime (CaO) Percent	pH
Sphagnum moss	95-99	0.7-1.2	0.02-0.10	0.02-0.05	0.03-0.80	3.2-4.5
Reed and sedge	85-95	1.5-3.0	0.05-0.20	0.03-0.09	0.70-5.50	4.5-7.0
Woody	75-90	0.8-3.5	0.06-0.25	0.05-0.15	0.30-1.00	3.6-5.5

num moss peat and a partially decomposed woody sedge peat are shown in Table 3 (8).

Table 3. Principal Constituents of Two Peats

	Sphagnum Orono, Maine	Woody Sedge Monroe, Wash.
Acidity, pH	3.8	4.5
Total organic matter	95.7	93.5
Water soluble	5.2	5.9
Waxes, tannins, etc.	7.8	7.7
Cellulose and hemicellulose	41.2	10.2
Lignin humus complex	18.0	38.2
Nitrogen	0.8	3.3

Summary

In review, peats cover a wide range of materials from the pure sphagnum of the *S. cymbifolium* type (Figure 1) with its spongy leaves to the woods humus containing much finely divided and decomposed organic material. At one end of this extreme is a uniform visibly identifiable water-absorbent, bulky, dead peat moss consisting of the cellulose, lignin, waxes, and acids of the original plant. At the other end is a heterogeneous material whose components are not visibly identifiable and which by comparison is relatively non-bulky, relatively non-acid, low in cellulose, high in lignin, higher in nutrients, lower in water absorbance, higher in humus, higher in soil microorganisms, and lower in permanence.

Sphagnum moss peat will hold water, aerate, and provide acids for the growth of ericaceous plants and the propagation of woody plants. Partially decomposed peats provide humus which improves soil structure, particularly that of clay soils.

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Davidia, The Dove Tree

By Edwin A. Menninger

The story of *Davidia*, the dove tree, is a combination of the triumph of Ernest H. "Chinese" Wilson in bringing into cultivation one of the world's most beautiful flowering trees, and the frustration of a thousand other gardeners and plantsmen in trying to make it grow to perfection. It is a difficult plant and its requirements are still not too well understood.

Davidia is unquestionably a magnificent sight when in flower. It is usually broadly pyramidal, to 60 feet high in the wild. In foliage it resembles a linden, and in flower it is suggestive of our beloved dogwoods, particularly the Pacific Coast species, *Cornus nuttallii*. Wilson, who was sent to China by Veitch

*Quotations herein from Wilson are from his books *Aristocrats of the Trees, Aristocrats of the Garden,* and *A Naturalist in Western China.* Doubleday, Garden City. 1914-1917.

One objection to seedling dove trees is that nobody knows what form they will take at maturity. Their shape ranges from vertical oval to very broad, squat cones like this tree growing at Rowallane, Ireland.

DONALD WYMAN, ARNOLD ARBORETUM

65 years ago with instructions to devote his entire attention and effort to *Davidia* and its introduction to England, called the tree "the most interesting and beautiful of all trees of the North Temperate flora."

Wilson saw his first dove tree May 19, 1900 southwest of Ichang on the Yangste River, 800 miles west of Shanghai. He wrote that it was 50 feet tall, pyramidal in outline, "and with its wealth of blossom more beautiful than words can portray." Armand David, a French missionary who first sighted the tree in the 1870's and whose name the tree bears, had found it another thousand miles westward, in remotest southwest China.

Wilson did get the tree well established in England and many specimens are found in cultivation there; however they are not an overwhelming success. Because the leaves appear before the flowers in that climate, the effect is rather disappointing.

In the United States *Davidia* has been grown, at least experimentally, all over the country, but it is really a successful garden subject only in southeastern Pennsylvania and in the Pacific northwest. The tree is seldom seen in collections principally because it requires a protected site where late frosts do not injure the early opening buds. In New York the tree is in bloom in early May when the first leaves of horsechestnut are expanding; nights may be chilly and the tender shoots may get frosted and turn black.

Another reason the tree has not become popular is that seedlings require 10 to 15 years to reach the flowering stage. Yet in spite of the difficulties and delays, *Davidia* is such a magnificent plant that years of study and effort should be devoted to its acclimatization,

JOHN M. FOGG, JR.

Young dove tree at the Morris Arboretum, Philadelphia, in full flower May 10, 1958. Note the oval, upright form in contrast with the tree in Ireland.

to its propagation by vegetative means to expedite flowering, and to a search for clones that will produce some uniformity in cultivated trees. In the wild some tops have an oval shape, others may be wide spreading. Seedlings being grown by nurseries in this country vary at the age they begin to flower and in the quantity of flowers they produce. No named clones are on record, so no one is ever sure when buying a seedling what kind of results will be obtained some 10 years hence. However, all these

■ *Edwin Menninger is a long-time horticulturist, particularly renowned for his writings on tropical and subtropical trees and shrubs, especially flowering species. He is responsible for the introduction of numerous ornamental plants into Florida.*

things can be standardized and controlled; the tree is very much worth the effort to make good specimens of it available to the public with some definite assurances about how well and how soon they will bloom.

The bracts of *Davidia* hang well away from the flower. One bract is twice the size of the other.

Only One Species

Only one species of *Davidia* is known, although two varieties are recognized, differing only in the underneath aspect of the leaves. Here are the distinctions:

I. *Davidia involucrata*

This is the tree originally discovered by David and is distinguished by the underneath side of the leaves being covered with dense, white down. This character however appears only on adult trees. Young seedling leaves are glabrous, with the downiness beginning to

Close-up of the flower head and showy bracts of the dove tree (*Davidia involucrata*). Pocket-handkerchiefs waving in the breeze could scarcely attract as does this native of southwest China.

J. E. DOWNWARD

JOS. A. SWEENEY

show in 4 or 5 years, increasing as the tree grows older. Another distinctive character is the red coloring of the shoots on young specimens. Wilson introduced this tree to England in 1903 or 1904, his third importation. The tree does not do as well in cultivation as the other forms.

II. *D. involucrata* var. *vilmoriniana*

The underside of the leaves are smooth and devoid of down. This variety is better known in cultivation in the United States than the type I. It was introduced to France in 1897 by Farges who sent seeds from which a single plant was raised by Vilmorin. From this plant in the Arboretum Les Barres, south of Paris, two or three cuttings and one layer were rooted. A rooted cutting was sent to Kew Gardens, another to the Jardin des Plantes in Paris, and the rooted layer to the Arnold Arboretum. Wilson brought from China in 1902 three or four living plants of this which were planted in the Coombe Wood nursery in England and grew amazingly. It was the smooth-leaved type and a year later Wilson obtained in Moupin, China, Father David's original locality, several hundred seeds of this type from which more than a thousand plants were raised in England.

III. *D. involucrata* var. *laeta*

This is like Vilmorin's plant (II) except that instead of a rich green color, the underneath side of the leaf is a yellowish green. It represents the commonest type of *Davidia* now grown in England and is the tree whose seeds Wilson introduced in great quantities in 1901.

Botanists are not agreed to which Natural Order or family *Davidia* belongs. Bailey puts it in the Tupelo Family (Nyssaceae) but Chittenden places it in the Dogwood Family (Cornaceae).

The Flowers

"The distinctive beauty of the *Davidia,*" wrote Wilson, "is in the two snow-white connate bracts which subtend the flower proper. These are always unequal in size—the larger usually six inches long by three inches broad, and the smaller three and one half inches by two and one half inches; they range up to eight inches by four inches

and five inches by three inches. At first greenish, they become pure white as the flowers mature and change to brown with age. The flowers and their attendant bracts are pendulous on fairly long stalks, and when stirred by the slightest breeze they resemble huge butterflies or small doves hovering amongst the trees. The bracts are somewhat boat-shaped and flimsy in texture, and the leaves hide them considerably, but so freely are they borne that the tree, from a distance, looks as if flecked with snow. The bracts are most conspicuous on dull days and in the early morning."

Subtended at the base by these bracts is a dense, globe-shaped head consisting of numerous male flowers with 1-7 stamens, and one perfect flower with a 6-10-celled ovary; there are no sepals or petals, and the whole is rather inconspicuous. The inflorescence with its bracts hangs on a slender curved stalk, hardly long enough to project it beyond the leaves.

The Seed

The 3-5 seeds of *Davidia* are contained in a round or ellipsoid, corrugated fruit that is hard and bony as a walnut, about 1¼ to 1¾ inches long. The color is greenish brown, slightly reddish on one side, and the shell is covered with a thin, gritty flesh. Inside the nut the several seeds, arranged around an axis, are embedded in woody tissue that is hard as flint and absolutely unbreakable.

Many growers have found that *Davidia* sets seed sporadically. Wilson got an enormous quantity of seed from 11 trees in 1900. A year later in Hupeh he found more than a hundred dove trees but from them he did not obtain 100 seeds, and during subsequent visits to China extending over a decade, he never again saw *Davidia* fruiting as it did in 1900.

Propagation

Difficulties with seed germination have plagued growers since Wilson's time. He had a rich harvest of seed in November 1900 which reached England in early spring of 1901 and these were sown in various ways—some in strong heat, some in boxes and pots and placed in various temperatures, and a large quantity outdoors in a prepared seed bed. Some were soaked in hot water, some in cold, others were filed—in short, everything a skilled and resourceful propagator could think of was put in operation. Weeks, months passed, and nothing happened. When Wilson returned to England more than a year later, not one seed had germinated and grave fears were expressed—failure almost anticipated. Those indoors under various conditions, save for being blackened, exhibited no apparent change and no signs of germination. Those in the seed-bed out of doors had been subjected to the winter's frost, and on digging out, a few signs of change were apparent. Some of the nuts exhibited slight longitudinal cracks from the summit to about two thirds down; in others a narrow valve-like shutter was forced back slightly and the tip of a root showed clearly. All was well. In a month or so thousands had sprouted, and from this bed more than 13,000 plants were potted, nearly every one of which grew. Of the seeds sown indoors scarcely a single one ever germinated.

This delay in germination might have been because the seeds were kept dry a considerable time before sowing, with a consequent hardening of the shell. At any rate, at Kew in 1924 some freshly gathered seeds were cleaned of their fleshy covering and sown immediately. These germinated the following Spring, and in a year the seedlings were 18 inches high. Uncleaned seeds took longer to germinate.

A bulletin published by the Arnold Arboretum on *Propagation of Woody Plants by Seed* says that *Davidia* seed has a condition called "double dormancy"—a dormancy in the shoot bud after

the seed has germinated. Such "two-year seeds" require warm, fluctuating temperatures followed by a cold period to be prepared for germination. The bulletin continues: "Pretreatment of seeds must be in two stages. They are mixed with medium (half sand, half peatmoss) and placed in polyethylene bags. For warm stratification (5 months) they should be provided with a location where the temperature will fluctuate, such as a window sill or similar situation, where the day and night temperature varies. After the period of warm stratification has been completed, the bag is placed in the refrigerator for its cold requirement (3 months)."

"Seeds with second dormancy can be started in polyethylene bags. Toward the end of warm stratification roots will appear and the unit is then ready for the second or cold stage of stratification. If this is not given the roots will continue to grow until food stored in the seed is expended and the seeds die. Through the transparent wall of the bag the stage of development can be observed."

At the Strybing Arboretum, San Francisco, difficulties with seed germination are reported, and stratification has been found necessary. However, cuttings have been rooted under mist from current year's wood taken in July, and Eric Walther, first director of the Arboretum, found that layering of lower branches of established trees proved a ready means of propagating.

H. SMITH

Some dove trees are much more floriferous than others, hence the importance of selective breeding. This picture was taken in England.

Culture

The authorities agree on one point in the culture of *Davidia*—it must have deep, rich soil that is reasonably moist. Walther found that shelter from cutting winds was important and he reported that planting in partial shade had proved desirable, but other growers have succeeded in full sun. All authorities emphasize the need of abundant moisture at the tree's roots, and caution that the tree will not thrive where the soil becomes very dry in summer.

Cultivation of the tree on the west coast of the United States appears to be successful only far north. Dr. William Hertrich of Huntington Gardens has grown the tree but regards it as unsuitable for southern California. Three small trees at the Los Angeles State and County Arboretum at Arcadia have started blooming. In the Strybing Arboretum are five trees, ranging from 12 to 30 feet, which bloom prolifically in late April and early May.

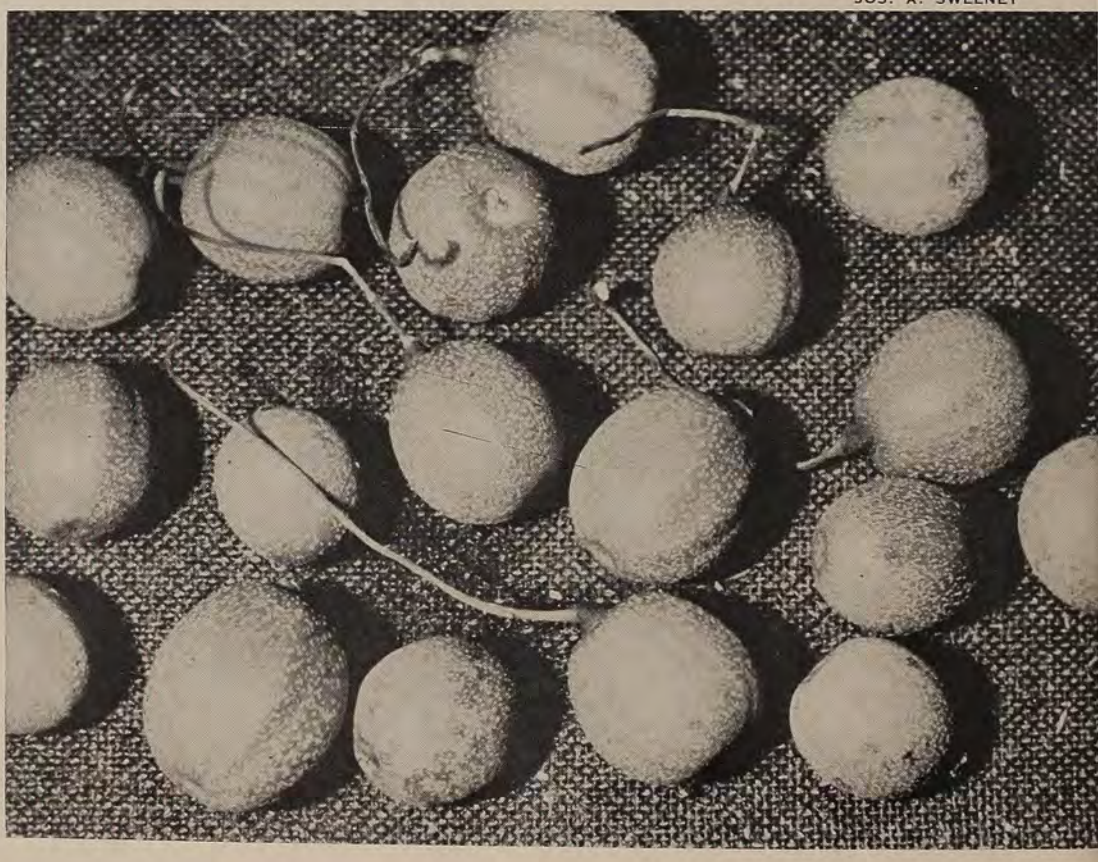
There are large *Davidia* trees in southern British Columbia and in the Portland-Willamette Valley area of Oregon. In Seattle are a good many mature trees. The largest specimens flower and fruit very freely, stand 35 to 40 feet high, and have a handsome oval crown. In the University of Washington Arboretum are several specimens; the oldest is 20 feet tall at age of 15 years and has just begun to flower well. The Seattle trees require no special care, once established, although the November 1955 freeze cut many young plants nearly to the ground; these have since recovered and are growing vigorously.

Donald W. Stryker, Langlois, Oregon, says the biggest *Davidia* tree either in the United States or abroad, is in the garden of Donald Graham, Seattle. A fairly old specimen stands in one of the parks in Salem, Oregon, and another with particularly fine bracts at 2008 Floral Hill Drive, Eugene, Ore. Stryker says a specimen near his home, flowers well only 6 miles from the ocean.

Davidia trees have been tried unsuccessfully throughout the middle west and the south, and no mature trees are to be found today either south or west of Washington, D. C. Young trees at the National Arboretum in Washington, D. C. are up to 11 feet tall and growing vigorously. At Longwood Gardens, Kennett Square, Pa., after nearly 10 years of effort, several young trees appear to be getting established. At the Barnes Arboretum and the Morris Arboretum near Philadelphia, a number of fine specimens are growing and they put

Seeds of *Davidia involucrata* have a distinctive ribbing and speckled finish.

JOS. A. SWEENEY



RICHARD B. CHILLAS, JR.

Arnold-Forster in his book *Shrubs for the Milder Counties* (of England), says that on the dove tree "one sees these curious bracts like handerchiefs suspended, each with a blob of black on it." Actually there is no "black blob" on the bract; apparently this reference is to the flowers. These appear in a small ball and the stamens come out yellow, gradually turning purplish or blackish. From a distance the effect might be a "black blob."

on a magnificent show at flowering time.

Davidia is well established in New Brunswick, N.J., and in the parks at Rochester, N. Y. It is hardy at the Arnold Arboretum in Boston, and grows well in Rhode Island, particularly at Newport.

Plants and Seed Available

In the hope that more tree lovers will attempt to grow *Davidia,* study its needs, and get it established on the American landscape, the following list of nurseries which stock seedlings, is provided through the courtesy of the L. H. Bailey Hortorium, Cornell University, Ithaca, N.Y.

The Bamboo Man, Box 331, Saddle River, N. J.

Edward H. Scanlon, 7621 Lewis Road, Olmsted Falls, O.

J. Blaauw & Co., Lincroft, N. J.

Brimfield Gardens Nursery, 245 Brimfield Rd., Wethersfield, Conn.

C. Malmo Nursery, 4700 256th Ave., N.E., Seattle, Wash.

Carl S. English, 8546 30th Ave., N.W., Seattle 7, Wash.

Kingsville Nurseries, Inc., Kingsville, Md.

Wayside Gardens, Mentor, O.

Tingle Nursery Co., Pittsville, Md.

Princeton Nurseries, Princeton, N. J.

The following institutions offer seed of *Davidia*:

Central Nursery Co., 2675 Johnson Av., San Luis Opisbo, Calif.

F. W. Schumacher, Sandwich, Mass.

Herbst Bros., 678 Broadway, New York 12, N. Y.

A Search for Ornamental Mountain Ash in the Northern Rockies

By George E. Evans

The European Mountain Ash *(Sorbus aucuparia)* is a tree widely planted for its brilliant autumn foliage and fruit. In the Northern Rocky Mountain area a major defect is its susceptibility to sunscald of the trunk unless planted in winter-shaded sites. Little attention has been given to native western North American mountain ashes as ornamentals in themselves, or as possible hardy stem-builders for *S. aucuparia.*

In northwestern United States, there are two native species of mountain ashes, both of them generally shrubby in habit. *Sorbus scopulina* is known as Greene's Mountain Ash, and *S. sitchensis* is known as Sitka or Pacific Mountain Ash. The discovery of superior material of these two species would extend the landscape usefulness of the genus in cold climates.

Both species are reported (cf. Hitchcock, et al., Vascular Plants of the Pacific Northwest, pt. 3, pp. 188-190, Seattle, 1961) to have a geographical distribution extending, in the west, from Alaska southward to northern California. On the eastern side of their ranges, however, *S. scopulina* occurs much farther south than does *S. sitchensis,* reaching the Dakotas, Colorado, and New Mexico, while *S. sitchensis* is known only as far south as northern Idaho, northwestern Montana, and southwestern Alberta (fide Moss, Flora of Alberta, p. 303, Toronto, 1959). Both species occur from foothills to alpine elevations.

These species are usually multiple-stemmed shrubs with ascending to nearly upright branches. Mature heights are reported to range from 3 to 12 feet, rarely to 18 feet. In Alaska, *S. sitchensis* is reported to attain the stature of a small tree, 15 to 40 feet in height, with trunk diameters to 5 inches (cf. Little, Check List of native and naturalized trees of the United States, USDA Agr. Hndbk. 41, p. 408, Washington, 1953). Occasionally arborescent specimens of *S. scopulina* have been observed in the Montana mountains. Because of these characteristics, they have a potential for use in foundation and border plantings.

Although interspecific hybridization between these species is a suspected occurance, they can be distinguished, usually, by differences in leaflet shape and serration, fruit color and shape, and by winter bud characteristics.

Sorbus scopulina (Figure I) is characterized by narrow lanceolate leaflets with rather acute apices, and fine serrations along nearly the whole leaflet margin. Its fruits range in color from yellow to orange-red, usually being round in outline, and usually having shiny surfaces. Winter buds are glutinous and possess only small amounts of white pubescence.

▪ *George E. Evans is a horticulture instructor in the Department of Plant and Soil Science at Montana Agricultural Experiment Station. This is part of Montana State College, located at Bozeman, Montana.*

In contrast to *S. scopulina, S. sitchensis* (Figure 2) has rather ablong leaflets, with obtuse apices and coarse serrations located primarily on the distal portion of the leaflet margins. Its fruits are usually red, oblong, with the surfaces dulled by the presence of a glaucous covering. The winter buds are not glutinous, and have long, yellow-brown hairs.

In the autumn of 1964, the author had the opportunity to engage in an exploration of portions of the Northern Rockies for forms of *S. scopulina* and *S. sitchensis* of potentially superior horticultural merit. This exploration was sponsored by Western Regional Research Project W-6, with direct field support by the New Crops Research Branch of the Agricultural Research Service, USDA.

The exploration, conducted between 14 September and 3 October, 1964, was timed to allow selection on the basis of fall foliage color, fruit color, and plant habit. Based on these ornamental characteristics, a total of 21 selections, consisting of 2 selections of *S. sitchensis* and 19 selections of *S. scopulina,* was collected from natural populations in the Northern Rockies. The exploration was divided into two separate trips. Clonal budwood, seeds, and duplicate herbarium speciments were taken for each collection made. Sets of herbarium speciments are on deposit with the Montana State College Herbarium at Bozeman and with the U. S. National Herbarium.

The first segment was devoted to searching the mountains of northern Idaho and northwestern Montana for *S. sitchensis* and *S. scopulina,* covering the area from Moscow, Idaho north to the Canadian border. This area is thought to be within the range of *S. sitchensis* var. *sitchensis,* and *S. scopulina* var. *scopulina*. The exploration did not extend far enough west to cover the populations of these varieties, nor of *S. sitchensis* var. *grayi* (Wenzig) C. L. Hitchc., nor of *S. scopulina* var. *cascadensis* (G. N. Jones) C. L. Hitchc., in the Cascades.

TOR FAGERAAS

Figure 1. *Sorbus scopulina* Green illustrating typical fine serrations of the leaflets along nearly the entire margin. Note also the lanceolate outline of the leaflets.

The largest group of collections, 6 in number, was made at the Freeze-out Pass area northeast of Clarkia, Idaho. This very scenic pass, running east and west, at approximately 5800 feet altitude, contained a very large population of mountain ash, primarily *S. scopulina,* exhibiting extremely vivid autumn coloration. The area appeared to have been burned over by fire, making the site quite open. *Sorbus* in this area extended from the south to the north facing slopes.

Among the more interesting collections made at Freeze-out Pass was a large, somewhat sprawing plant of *S.*

TOR FAGERAAS

Figure 2. *Sorbus sitchensis* Roem. illustrating the contrast in leaf morphology from that of *S. scopulina* Greene. Note the generally oblong shape and limitation of leaflet serration to the apical half.

scopulina with interesting yellow autumn leaf coloration. Its fruits, however, were few and of only average ornamental value. One specimen of *S. sitchensis* was also collected in this area. Its dark red fruits were of particular interest.

An interesting side light was the fact

that many of the plants on this site, at first, appeared to be dwarf, since some were fruiting and measured scarcely 18 inches in height. By means of growth ring counts, however, it was determined that they ranged from 4 to 8 years of age. Annual growth on many of them measured only 1 to 3 inches.

Of the two *S. scopulina* collected on the Desert Mountain Lookout road northeast of Martin City, Montana, near Glacier National Park; one with a very strict upright branch habit was most impressive. It measured 5 feet wide and 8 feet tall. Its yellow-orange fall color was probably due to the east exposure on which it was growing. The altitude of this site was approximately 4800 feet.

Another of the potentially ornamental lines collected was a semi-trailing form of *S. scopulina* found at the roadside between West and East Glacier, Montana. In addition to bright orange fruit, this plant exhibited an excellent bronze-red autumn leaf coloration. It measured 5 feet tall and 16-18 feet wide.

The second section of the exploration covered the northeast corner of southern Idaho, northwestern Wyoming, Grand Teton and Yellowstone National Parks, and portions of south central Montana. Only *S. scopulina* was found in these areas.

The largest single population of *S. scopulina* observed during the entire exploration was located on Teton Pass, 2 miles west of Wilson, Wyoming. Plants in this area were located primarily on southeast facing slopes and extended from approximately 8000 feet to 8400 feet altitude at the summit. Fruit color ranged from orange to orange-red. A single collection was made of a plant with larger-than-average fruit measuring 10 to 12 millimeters in diameter. Most plants on this site were defoliated due to natural fall abscission.

A collection of a single plant with excellent golden yellow fall foliage color and large bright orange fruit clusters, measuring 3 to 6 inches in diameter, was made 7 miles south of the Yellowstone National Park entrance on the east shore of Jackson Lake. It was one of two *S. scopulina* located in the immediate area.

Since this exploration covered between 7 and 8 degrees of latitude in the Northern Rockies there was an opportunity to observe the course of fall maturation of the foliage and fruit under a variety of conditions. Many of the populations sampled in the northernmost populations of Idaho and Montana, and in south central Montana, all areas north of 45° north latitude, were nearly defoliated, and the fruit was essentially mature. Populations observed in the southern portion of the exploration area in Idaho and Wyoming were not yet showing well developed fall color, and the fruit was mostly correspondingly less mature. Fall color was more pronounced at higher than at lower elevations. It will be interesting to observe whether these maturity differences are maintained in the plants when cultivated at Bozeman.

Progeny from the seed collected as well as individual plants propagated from budwood placed on suitable understocks will be grown to maturity and evaluated for adaptability as cultivated ornamental plants. As a result of this work, it is felt that attractive shrubby forms of these native mountain ash may be forthcoming in the near future.

The African Violet Species

By Toru Arisumi

The genus *Saintpaulia* is an interesting group of about 20 species native to a relatively small area in tropical East Africa (3). What factors are responsible for preserving the identity of species in their natural habitat are not known. Since breeding experiments (2, 4) reveal practically no barriers to hybridization among most species, the geographical or ecological barriers that prevent hybridization would be the dominant contributing factors in the evolution of these species. African violets are not wind-pollinated; except for rare instances of accidental self-pollination, crosses and self-pollination would normally require some insect or animal vectors for transporting pollen from stamen to pistil. In the greenhouse seed set is obtained only after hand-pollination. Studies of interspecific hybrids show that the gross morphological dif-

S. amaniensis E. Roberts—This species has the trailing and branched habit. Its small leaves are thin and flexible, with medium, yellowish green surface and pale green reverses. Periodically, this species produces many blue-violet flowers, 1 inch across in clusters of 4 or 5 flowers per stalk. But the species is not so floriferous as most of the others in the genus.

ALL PHOTOS BY USDA

***S. confusa* B. L. Burtt—The flowers of this species have deep violet, somewhat narrow petals, and about 1⅛ inches across. The flowers are borne 4 or 5 to a cluster, usually above the crown. This species blooms heavily, periodically, but not as often as some of the other species. The leaves are tough and flexible, light yellowish green with white reverses, sometimes quite hairy. This is a rosette plant which has a strong tendency to sucker, and which is therefore difficult to maintain as a single-crowned plant.**

ferences between species are due to differences in many genes. Thus many characteristics of the original parental species of interspecific hybrids are not easily lost in later generations when these hybrids are crossed to other species.

The present popularity of African violets is due mainly to the many beautiful cultivars of the species *S. ionantha* and to the ease with which they are propagated and grown as house plants.

■*Toru Arisumi is a geneticist working with ornamental plants in the Crops Research Division, Beltsville, Maryland. In addition to his work on African Violets he is also conducting research on daylilies. Dr. Arisumi has worked for several years in this field and considered an authority on the development of tetraploids.*

The flowers and foliage of these plants are showy, and with proper cultural care they bloom nearly all year long. Some of the striking differences between the modern cultivars and the wild *S. ionantha* and other species are due to mutant genes that are inherited as simple Mendelian dominants or recessives in breeding tests (7). Up to now no similar mutants of ornamental value have been found in the wild species, but when these species are cultivated more extensively for use by plant breeders and growers, the likelihood of discovering important mutants may increase.

The purpose of this paper is to describe briefly certain ornamental characteristics of the species and to provide information on the culture, breeding,

S. difficilis B. L. Burtt—This species has large thin leaves that are light green above and pale below. The young leaves are crinkled but lose much of the rough appearance and crinkling when they mature. Deep violet flowers, 1⅛ inches across, are borne 6 to 8 per cluster. It should be grown as a single-crowned plant.

S. diplotricha B. L. Burtt—This species has pale blue flowers, 1—1⅛ inches across, with about 6 flowers to a cluster. The plant is compact and is not a vigorous grower. It blooms heavily but only periodically. It is easily grown as a single-crowned plant. The plant shown in the figure has ovate leaves, but there are clones with nearly round leaves and more vigorous growth habit. One clone of this species has leaves with red reverses that is due to a single dominant gene. The clone shown here has ovate leaves that are medium green above and pale green below.

and propagation for those not familiar with African violets. As a general rule, the cultural requirements of the species do not differ from those of the modern cultivars. Many improvements in cultural methods suggested for the cultivars by African violet experts should apply equally well for the species. For articles of interest dealing with current research and news about African violets and related gesneriads, the reader is referred to two periodicals devoted entirely to this family (1) (5). For details of history, taxonomy, and cultural methods not covered in this paper, the paper by Burtt (3) and books by Moore (6) and Wilson (8) are recommended. Mrs. Wilson's recent book (8) is comprehensive and includes articles of interest for both beginners and experienced growers of African violets.

Cultural Methods

Light. All of the species described here will thrive and bloom under natural or artificial illumination if given 5000 to 8000 foot-candle hours a day. None will tolerate long exposures of direct sunlight above 1000 ft-c. These species, when grown in the greenhouse, should be shaded. High light intensities will cause the foliage to turn pale green or yellowish. When grown under insufficient illumination the plants fail to bloom and gradually become spindly and chlorotic. Healthy plants can be grown using fluorescent lights as the only source of light energy or to supplement the natural illumination.

Temperature. The optimum temperature range for the species is from 65-75°F. Although most will survive in temperatures of 55-65° for many months if given the required amount of light energy, growth and bloom will be retarded. The species are also susceptible to freezing temperatures; a few hours of cold below 40° are sufficient to cause injury. The leaves of plants exposed to freezing temperatures become discolored within a day or two.

High temperatures are also harmful to African violets. Even species that tolerate summer temperatures better than others will deteriorate rapidly when grown at continuous temperatures above 85°. Most of the species will survive temperatures from 90-100° for a few hours a day during the summer, but as a rule none do well under these conditions.

Sudden changes in temperatures are also harmful. When plants grown continuously at 65° are transferred to 75°, or when those grown at 75° are moved to 65°, the plants resume normal growth only after two or three weeks adjustment. Daily temperature drops of about five degrees between day and night temperatures does not affect these plants.

Humidity and Ventilation. All of the species prefer high humidity for optimum growth. With high humidity it is necessary to provide adequate ventilation to prevent fungus decay. A practical way to provide sufficient humidity is to place the pots on a bed of wet pebbles or sand. Under extremely dry conditions with high temperatures, the plants will do better if the pots are left standing in shallow pans filled with water.

Potting media and containers. I use a mixture of about equal volumes of peat moss and soil for young seedlings and plants and equal volume of soil, peat moss, and perlite for older ones. Smaller plants and seedlings are grown in 2-inch clay pots until ready for 3-inch pots. Many species can be grown in larger containers whenever larger plants are preferred, but the 3-inch pot is adequate for most species. Some growers prefer plastic to clay pots. Sometimes the salts accumulating on the rim of clay pots burn the leaves or petioles that are constantly touching the rim. The rim of clay pots may be covered with aluminum foil or coated with an asphalt base paint to protect the plant from this type of injury. Plastic pots are harmless to leaves.

Watering and feeding the plants. The plants may be sub-irrigated in a shallow pan of water or they may be watered from the top. The water temperature is not important when plants are watered from the bottom. But that it should be at room temperature when the plants are watered from the top is extremely important. Even a single

S. grandifolia B. L. Burtt—This is a large plant that can be grown in pots 3 to 6 inches in diameter. The leaves are thin, yellowish green above and pale green to whitish below. The bright, blue violet flowers are 1⅛ inches across, and borne in large clusters of about 16 flowers. The flowers are showy when they are not hidden between the large leaves. This plant is easily grown as a single crown plant but it requires more space than the others.

S. grotei Engl.—Not as floriferous as some of the other species, this species is the most vigorous trailer of the group. The bright blue flowers are about 1⅛ inches across and borne 2 or 3 to a stalk. Most of the flowers are hidden among the foliage. Its trailing habit, flexible leaf blade, red petiole, and red stem are quite attractive and of value in breeding. When *S. grotei* was crossed with *S. orbicularis*, the resulting F_1 hybrids had the trailing habit somewhat like *S. grotei* with more flowers borne well above the foliage.

S. intermedia B. L. Burtt—This species has a semi-trailing habit and is best grown as a multiple-crowned plant. The upper surface of the dark, reddish green leaves are covered with dense, short hair, while the lower surface is smooth and red with prominent greenish veins. The bright blue flowers ⅞-1 inch across are borne in clusters of 5 or 6 to the stalk. The leaf blades are tough and flexible. Most of the pale color of the veins on the upper surface of younger leaves are lost at maturity, and this pale color persists only over the midveins.

application of cold water on African violet leaves may cause many straw-colored spots, streaks, and rings of various sizes within two or three days.

Under the same conditions clay pots dry faster than plastic pots and small pots faster than larger ones. Watering should be adjusted according to temperature, humidity, and potting medium. High temperatures and low hu-

midity mean faster drying conditions, also light media dry much faster than heavier media. As a rule it is safe to water the plants whenever the soil surface becomes dry.

Since the species require light feeding, I add soluble 20-20-20 fertilizer at a rate of about 1 tsp. to each gallon of irrigation water twice a month. When the potting medium gets too acid, lime may be added to bring the pH level up to 6.5 or 7. African violets tolerate pH 5.8 or lower, depending on the soil mixture; according to the experts a neutral pH is better.

Diseases and pests. In order to minimize the chances of invasion by pests and disease organisms all new plant accessions should be isolated from healthy plants until it is reasonably apparent that they are free of disease, mites, and nematodes. The potting media and containers should be sterilized to get rid of nematodes and soil-borne disease organisms. The plants should be kept clean by regular removal of dead leaves and flowers which support the growth of decay organisms. Various chemicals for treating diseased plants may be purchased from garden stores. Plants infected with virus diseases should be discarded, there being no easy cure.

Propagation

Vegetative propagation. Rosette species become leggy and unattractive as they get older. Those that have the trailing habit may become too large or pot-bound with age. These plants may be replaced by vegetative propagation by using leaves, suckers, or the younger portion of the main crown. With rosette species one can have a fairly large flowering plant within two or three months by rooting the upper portion of the main crown of an old plant about to be discarded. Large suckers can also be rooted to produce a large plant within a short time. With trailing species the growing tip of older plants may be cut back four or five inches and rooted. Also, the young shoots may be used.

Both rosette and trailing species can be propagated by leaf cuttings. In this method the petiole of a detached leaf is struck in moist perlite or sand, with the leaf-blade nearly touching the rooting medium. The rooting bed and leaves are watered periodically, with water held at room temperature. The propagating bed should be illuminated by diffuse natural light or by cool artificial lights and kept at 65°-75°F. If all goes well, the leaves should develop a good root system within a month and few to many plantlets by the end of two or three months. When the plantlets are from one-half to one inch high, the rooted leaves may be re-potted in the soil mixture. The "plantlets" are separated and potted in 2-inch pots when they develop sufficient roots of their own. It takes longer to obtain flowering plants from leaf cuttings than from suckers or crowns; depending on the vigor of the species, 9-12 months are

S. *ionantha* H. Wendland—This species is a good bloomer. Each flower is about 1¼ inches across and the flowers are borne in clusters of 10-12 well above the foliage. Leaves are dark green above and light to medium red below. This species is best grown as a single-crowned plant. The cultivated forms of *S. ionantha* are ornamentally improved forms of the wild type. The present day group of *S. ionantha* cultivars shows more diversity than all of the other species combined.

S. magungensis E. Roberts—The outstanding characteristic of this species is the almost round, dark-green leaf that tends to cup downward. The plant is attractive when properly grown. It is branched and trailing but not as vigorously trailing as *S. grotei*. The bright blue flowers are 7/8-inch across and are borne 3 or 4 to a cluster. Most of the flower clusters are hidden among the foliage. Like the hybrids of *S. orbicularis* × *S. grotei*, the hybrids of *S. magungensis* × *S. orbicularis* have the trailing habit of both parents, with an improved flowering habit.

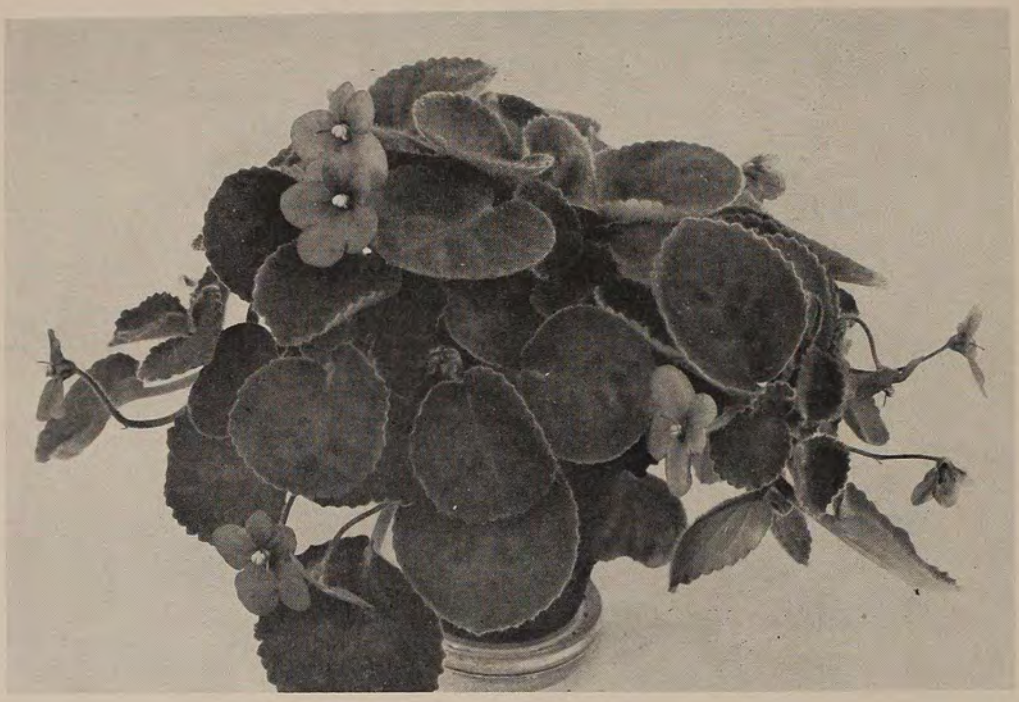
S. nitida B. L. Burtt—The most striking characteristic of this species is the round, smooth, and shiny green leaf. The leaf blade is thin and flexible and borne on long bluish-red petioles. Although this species can be grown as a single-crowned plant, it has a tendency to elongate and form suckers much sooner than most of the rosette species. It is best grown as a multiple-crowned plant. The deep bluish-violet flowers, about one inch across, are borne in clusters of 14 or 15 flowers on stalks that usually sag from the weight of the flowers. The flowers blend with the bluish-red petioles and are not showy.

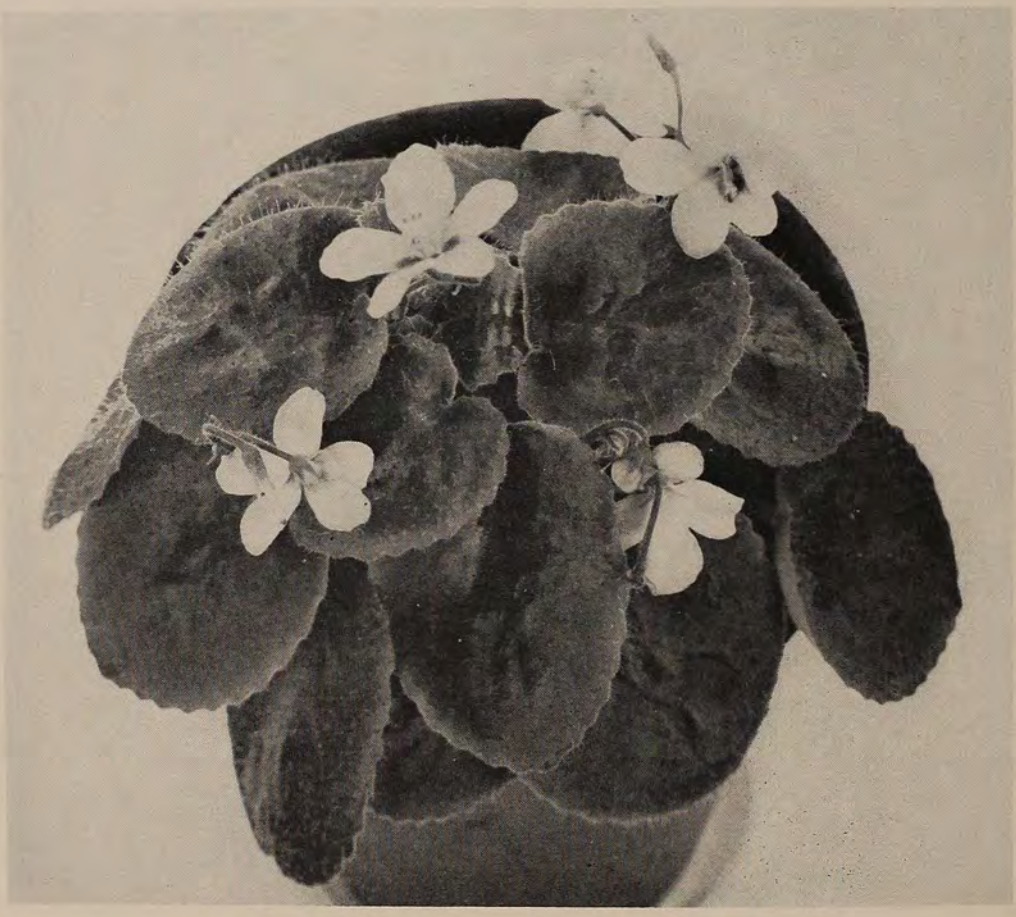
***S. orbicularis* B. L. Burtt—This species is extremely floriferous most of the year. Its pale violet flowers have deep violet centers and are about 7/8-inch across. The flowers are borne well above the foliage in clusters of 8 or 9 per stalk. The leaves are small, pale green, thin, and flexible. This plant is best grown with multiple crowns.**

required from leaf cuttings to flowering plants of the size normally grown in 3-inch pots.

Propagation by seed. Most of the species are self- and cross-fertile, and the mechanics of self- or cross-pollinating violets are simple. The pollen is obtained by pulling the petals apart and removing the corolla and the anthers attached to the corolla tube. Pollen is squeezed out of the anthers on the tip of the thumbnail and transferred to the stigma of the seed parent. All crosses and selfs should be labeled. A thin metal or plastic stake should be used to support the flowering stalk and fruits. It is better to set no more than three fruits per flowering stalk. The flowers are ready for pollination about two or three days after opening. Seed set is good at 65-75°. It takes longer for seeds to mature at the lower temperatures. Depending on the species, it takes 4-6 months for the seeds to mature at 75° and 6-8 months at 65°. The fruit is ready for harvest when it becomes dry.

Each fruit or capsule may contain few to several hundred tiny seeds. I prefer sowing the seeds on the surface of fine quartz sand in 2-inch clay pots. The sand is filled up to about one-quarter inch from the top. The pot bottoms are left standing in shallow pans of water until the seeds germinate. It is a good idea to fix a thin plastic cover over each pot to prevent excessive drying when the pans dry out. Given diffuse sunlight or artificial illumina-





S. *pendula* B. L. Burtt—Most of the flowers in this species are borne single or, rarely, in clusters of two. The pale blue flower is 1¼-inches across but it looks larger because of the broad petals. The yellowish-green appearance of the leaves is due to a blending effect of the medium-to-dark-green surface and pale yellowish-green veins. This species has a trailing habit, with many stiff and succulent branches. The leaves are small and not as stiff as they appear to be. The stems are weak and break easily. (left)

S. *tongwensis* B. L. Burtt—This species does not sucker as freely as most of the others, and is easy to maintain as a single-crowned plant. The mature plant, when not in bloom, is very symmetric, and the crown is not as dense as the other species. The airy and symmetric appearance of this plant is due to well spaced leaves with long petioles and relatively narrow leaf blades. The upper surface of the leaf blade is smooth and dark green except for the area near the mid-vein which is marked by a broad band of pale green color. About 10-12 flowers are borne on flowering stalks that are too short for the size of the plant. When the plant is blooming heavily, most of the space between the leaves is filled with flowers borne on the short stalks; and the plant loses much of its symmetrical and balanced appearance. Each pale blue flower is about 1½-inches wide. This species and *S. ionantha* tolerate the summer temperatures better than the other species. (right)

S. *shumensis* B. L. Burtt—This species, a miniature, is of value as an ornamental and for breeding miniature violets. Unfortunately, it does not hybridize as readily as the other species. Hybrids of this species are fertile and should be of value in the breeding and selection of miniatures. The flowers are about ¾-inch across; very pale to nearly white with deep violet spot near the center; and borne in clusters of 5 or 6 to a stalk. The bright-green leaves are small and shiny. (left)

tion and temperature between 65-75°, the seeds germinate within three weeks and the seedlings may be transplanted into soil mixture within two or three months. For the first three or four months after germination, the seedlings are fertilized with a dilute solution of soluble fertilizer once a week. I use about one-tenth the amount normally given to mature plants. It usually takes 6-8 months from germination to first flower.

Breeding African Violets

Interspecific crosses. All the species described in this paper except *S. shumensis* and *S. nitida* are self- and cross-fertile (2). These two species are usually sterile in most crosses and selfs but some hybrids have been obtained from these species. Crosses between *S. nitida* and *S. shumensis* are more fertile than crosses between these species and others. All species thus far studied proved to be homozygous, because selfed progenies were identical to their parents. The F_1 hybrids were uniform and had the blended characteristics of both parents. Reciprocal crosses were identical also. The F_2 progenies exhibited some variation, as expected; but differences between seedlings showed only in degree of expression rather than in the absence or presence of certain parental characters. Seedlings of backcrosses look more like the recurrent parent, but all retain in varying degrees most of the characteristics of the non-recurrent parent. These results suggest that the differences between species are controlled by many genes, each having a small effect, rather than by a small number of genes with large effects.

Crosses between species and cultivars. An interesting and useful breeding objective is to combine the ornamental

***S. velutina* B. L. Burtt—This species is worth growing for its foliage alone. It is also quite floriferous most of the year and can be easily grown as a flat-single-crowned plant. The flowers, about one inch across, are medium violet with a deep reddish-violet center; and they are borne about 7 to a cluster on stalks that extend well above the flat surface of the crown. The leaves have a velvety textured upper surface and are of a reddish-green color that contrasts sharply with the deeply indented pale green veins. The lower surface is red, with thin but prominent pale green veins.**

qualities of wild species and the modern cultivars. Also, the species could be a source of genes for disease or insect resistance, or for greater tolerance to unfavorable growing conditions. My attempts to transfer major genes from cultivars to the species show that with some modifications the dominant or recessive genes of the modern cultivars have the same effect in intra- and interspecific crosses. The dominant genes for "girl" foliage and double flower are dominant in all crosses; and the genes for flower color such as the "recessive" white, or pink are recessive to the wild blue color of the species. These recessive phenotypes may not, however, be recovered in the expected ratios, or they may be completely absent in the first segregating generation due to interactions or complementation with genes of the wild species.

Breeding at the polyploid level. Natural tetraploids are not known among the wild species of *Saintpaulia*. The species have 15 pairs or 30 somatic chromosomes. There are, however, many natural or artificially induced tetraploids among the modern cultivars. These could be bred with the species whenever tetraploid species become available. I have obtained 12 tetraploid species by treating leaf petioles with colchicine. Although these artificially induced tetraploids are not so fertile as diploids, sufficient seedlings have been obtained from them for effective breeding and selection at the tetraploid level. The immediate results of tetraploidy is increased substance and size of flowers, stronger flowering stalks, and thickened leaves. Since flexible and resilient leaves are more desirable than the thick, brittle leaves that are caused by tetraploidy, the doubling of chromosomes could have some disadvantage among certain species. Nevertheless, breeding at the tetraploid level should extend the present range of diversity in African violets.

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A Book or Two

Espaliers and Vines for the Home Gardener

Harold O. Perkins, D. van Nostrand Company, Inc., 120 Alexander St., Princeton, N.J. 1964. Illustrated. 206 pp. Price $6.50 (Library) Members price $5.53.

This interesting book is, I believe, unique in its subject matter, the first one to be devoted entirely to espaliers and vines from the point of view of their use by a home gardener.

In the first half of his book, the author has well described the uses and basic patterns which have been developed for espaliers, the types of supports which must be prepared for them, the proper methods of planting and starting their training, and the continued care needed to assure good training and health. Furthermore, he has provided valuable information on fifty ornamentals considered particularly appropriate for use as espaliers. In this section as well as in the comparable one on vines later in the book he follows generally the desirable format used by Dr. Wyman in his books on trees, shrubs and vines. The description of espaliers concludes with a chapter on espaliered fruit trees. Recollections of the row after row of espaliered pear trees and in the commercial orchards west of Paris and the many uses of espaliered pear and apple trees in the home gardens of France and England made this chapter a particularly interesting one to me.

The second half of the book provides essentially the same type of information, organized in the same way, for both annual and perennial ornamental vines.

This well organized book with its many excellent illustrations and sketches should be of great value to those who desire to take advantage of the almost two dimensional character of espaliers and vines in landscaping their homes.

JOHN SYLVESTER

Plants and Civilization

By Herbert G. Baker. Published by Wadsworth Publishing Co., Inc. Belmont, Calif. 94002 1965. Illustrated, 183 pages. Paperback $1.75. (Library)

An interestingly written book on the role of plants and man beginning with his use of plants in preagricultural times. The history continues through the early greek writers as Aristotle and Theophrastus and the early development of what we call botanic gardens. The story of the role of plants—especially spices—in exploration is told. Several chapters are devoted to the important food plants such as wheat, maize (corn), sugar producing plants, beverage plants, the legumes and plants that furnish oils. Other plants considered in groups include those that furnish drugs, rubber, timber and dyes. A final chapter suggests further uses of plants to supply food and fiber. Plants are important sources of protein in areas of the world where animal production is more difficult. Algae are another source with a future food potential. A selected list of references is included for additional reading.

CONRAD B. LINK

(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 Membershfp 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.)*

Dwarf Conifers

H. G. Hillier and E. E. Kemp, published jointly by the Alpine Garden Society, 58 Denison House, Vauxhall Bridge Road, London, S. W. 1, and The Scottish Rock Garden Club, D. Elder Esq., "Jessamine", 37 Kirkhill Road, Penicuik, Midlothian. Printed by W. C. Henderson & Son, Ltc., 80 Market Street, St. Andrews, Scotland. 1964. 83 pages (25 black and white photographs.) Approx. $1.50. (Library)

The little handbook under the above title was prepared jointly by two of the most respected horticulturists in the British Isles. Mr. Harold G. Hillier is one of those rare nurserymen who not only tends to the business of selling plants, but who can also turn out a most formidable fund of knowledge about the plants he grows. Mr. E. E. Kemp, as head curator of the Royal Botanic Garden, Edinburgh, Scotland contributes a highly useful bit on the propagation and use of dwarf conifers in the garden.

We might have expected somewhat more from these experts, but one has to admit that much useable information has been packed into the 83 pages of this handbook. Over 300 kinds of dwarf and slow growing conifers are listed, almost all of which have been grown by Mr. Hillier in his long career. The handbook includes 25 black and white portraits of dwarf conifers.

What is a dwarf conifer is not always an easy question to answer, but in Mr. Hillier's context, the word "dwarf" is a comparative term. For example, the Big Tree *(Sequoiadendron giganteum* 'Pygmaea') is now only 5 1/2 ft. x 5 ft. in the author's garden after 20 years. This qualifies this plant as a dwarf as compared with the normal growth rate of this plant as it performs in British gardens. Then there are natural dwarf conifers, such as *Juniperus horizontalis,* the Creeping Juniper, and *J. conferta,* the Shore Juniper of Japan. Some kinds of conifers may be slow growing and quite dwarf as young specimens only to outgrow this condition as the plant matures.

The personal notes by Mr. Hillier give the handbook its special flavor and practical value. The following entry is typical: "*Chamaecyparis lawsoniana* 'Forsteckensis'. Possibly the best of the dwarf grey-green globular forms. A slow growing, dense, rigid, globe with congested, moss-like growth. Leaves crowded, scale-like 2 mm. long, tips free, blunt. A specimen growing at Winchester on chalk is at 30 years old about 3 ft. x 4 ft." While it is true that growing conditions in England are often vastly different from many parts of this country, a large percentage of the conifers listed will grow in the "conifer belt" of the United States. Many are native of North America in the first place.

Mr. Kemp gives much practical advice on propagation by cuttings, selection of cuttings and time of insertion, propagation by layering, and grafting. Another section covers the use of dwarf conifers in the garden as to soil requirements, exposure, and placement.

It is a pity that most American nurserymen refuse to grow the dwarf and slow growing conifers, because in this group we find some of the most durable and decorative of ornamental plants for our climate. The reason some nurserymen give is that these plants eat into "overhead" costs on account of slow growth. This part makes sense, but the gardening public at the same time are without some of the best garden plants. However, there is hope. More and more people are beginning to grow dwarf and slow growing conifers in this country, and a few nurserymen now stock quite a few kinds. This awakening may be due to the keenness of a few individuals, such as the late James Noble of California and Mr. William Gotelli of New Jersey, who recently gave his very large collection of dwarf and slow growing conifers to the National Arboretum in Washington, D. C.

F. G. M.

All About Geraniums

By Peggy Schulz. Doubleday and Co. Inc. 501 Franklin Ave., Garden City, New York 11531. 175 pages, illustrated. 1965. $4.95 (Library) Members price $4.20.

The author is enthusiastic about geraniums and this shows in her writing. In fact she is so enthusiastic that there is excess chattyness at times and repetition with even slight variations in recommended practices. In several places the author makes references to articles or research by others but with such a vague mention that it would be difficult for the reader to locate the specific article. Since such references were made in the text a complete citation should have been included at a footnote or in a references cited list.

Geranium culture is described in all of its aspects from propagation by seed or cuttings to growing outdoors and winter care or greenhouse growing. Suggestions are given on ways in which this plant can be used in decorations both indoors and as garden subjects. There are over 100 pictures, a few in color that add to the interest of the book.

CONRAD B. LINK

Bonsai for Americans

George F. Hull, Doubleday and Company, 501 Franklin Avenue, Garden City, New York 11531. 256 pages. Illustrated. $5.95 (Library) Member's price, $5.05.

The author states that the viewpoints basic to this book for Americans interested in bonsai

are these: that bonsai are for enjoying now; that this type of enjoyment is attainable immediately with many types of plants. He says, "I think most of us must follow a pursuit and personal route to rewarding results in the beginning," and "Perhaps a more lasting bequest to our grandchildren will be the greater understanding we develop for the beauty of trees, both in our home gardens and in the forest stretches of our nation."

The book, as the author says, offers no magical short cuts to masterpieces, nor is this a book on the esthetics of bonsai. Rather, this is a book based on his personal experiences in caring for and adapting plants for bonsai, his observation of other bonsai hobbyists and much correspondence.

The book opens with some information as to how the Japanese practice bonsai and then goes into the way that Americans are using the art. Then how to get a head start by using older plants is discussed and how to start seeds and cuttings if you wish to grow your own plants from the beginning. Some interesting guidelines are discussed as well as soils, potting, collections for color, training, and routine care of the plants. Also how to adapt bonsai to your home and climate.

The Glossary includes Japanese names as well as the more everyday words used in connection with bonsai. A short list of books on bonsai is also given at the end of the book. Many excellent black and white photographs are used showing habits, wiring, and various types of plants and pots. Several line drawings by Florence Hull give added charm to this well-rounded book which is surely a must for the American who has been bitten by the bonsai bug.

F. P-K.

Orchids of the Western Great Lakes Region

By Frederick W. Case, Jr., Cranbrook Institute of Science, Bloomfield Hills, Michigan 48013. 148 pages. 1964. Colored cover plate, colored frontispiece, plus numerous text-figures, 8 color plates and 24 black and white plates, 52 maps. $7.00. (Library)

For the amateur as well as the professional orchid student this book will prove very rewarding. Presented in a clear-cut, straight-forward manner, it opens with a brief account of the Orchid Family as a group, some notes on the evolution of orchid species, and practical uses and legends about orchids. Orchid ecology, with a discussion of seed germination and development as well as soil and habitat relationships, follows. Then comes a detailed account of the habitats and distributional patterns of orchids in the Great Lakes Region. Where and how to grow orchids in home gardens is very well covered. The need to understand mycorrhizal relationships in orchids is effectively stressed.

The keys and descriptions of the orchids found in the Great Lakes Region are exceptionally well presented, both as to text and illustrations.

Because I favor placing marginal illustrations near the related text I find this one of the highly commendable features of the book. Others are the clear black and white plates, and the useful glossary. The excellent editing also deserves mention.

Some of the color plates however, are a bit too intense in color; for example, the plate of *Cypripedium acaule* should be pink to pink-purple, not orangish burnt-red. Also, I do not like to find the description on one page, the the picture on another, and the map for distribution on still another. This involves needless effort. All the knowledge might better be available at a glance for any one species. Also, half a page or more left vacant at the end of chapters seems a waste. There is surely more to be said about any item, and this could be put to good use in these empty spaces. For example, a small sketch of orchid germination, orchid seedling culture, soil mixing, or other items could have been put at the end of the chapter dealing with growing Native Orchids. Much could have been put at the end of the first chapter on the history of the Orchid Family, to fill up the two-thirds of a page left empty.

It seems to me that a nicely stamped identification of the book on the front cover would have been preferable to the glued-on picture of an orchid already pictured as the frontispiece. I question the utility of a book with a glossy glued-on label in the field.

However, the overall format and material dealing with the Orchids of the Great Lakes Region is excellent, and this little book is a fine addition to our knowledge of the flora of the North-Central United States.

CLYDE F. REED

Dwarfed Fruit Trees

By H. B. Tukey. The MacMillan Company, 60 Fifth Ave., New York, N. Y. 10011. 1964. 562 pp. Illustrated. $15.00. Members Price $12.75. (Library)

What is a dwarfed fruit tree? Where did they come from? What are the features, limitations, and possibilities of dwarfed trees? All of these questions and more are answered by the first comprehensive book on dwarfed trees published in America. There is a current cycle of great interest in dwarf apple orchards, and it is toward the commercial orchardist that this book is slanted. In the home garden there is also a cycle of renewed interest in dwarfed fruit trees as more Americans find more time for garden-

ing. The amateur is not ignored in this book; indeed, he will find interesting information throughout this extensive, well-written manuscript, and several sections written exclusively for him.

Dwarfed fruit trees can be found in recorded history dating back 2,000 years. The history of dwarfs is recorded in the early sections, and is followed by an especially well written section dealing with the features, limitations, and possibilities of dwarfed trees. Anyone contemplating a commercial planting of dwarfed trees should first read this section, as well as Part Six dealing with orchard performance of dwarfed apple trees. A complete history and classification of present day dwarf stocks is given, followed by a chapter on the propagation of dwarf stocks. The establishment, management, and performance of a dwarf apple orchard is presented in detail. In this section (Chapter 16) the author deals with well organized considerations of site, microclimate, and climate control—important principles to understand *before* planting a dwarf orchard. Of special significance is the section dealing with pruning and training of the dwarfed tree. The prnciples of training are well outlined, and this is followed by a special chapter on summer pruning, the practice used so extensively in European dwarf orchards, and so little understood in America. The latter chapters of the book are of direct interest to the home gardener. They deal with the Bonsai, or Japanese dwarfed plants, with training of dwarfed fruit trees to novel and artistic forms, and with the use of dwarfed fruit trees in the garden as ornamental plants.

This book is written in an easy style that is very readable, and should appeal to the amateur as well as the professional horticulturist interested in dwarfed trees. The amateur would perhaps wish for more pictures, while all readers would appreciate sharper reproduction of the limited photographs included. However, the many sketches throughout the book are excellent. This reviewer would find the physical size of the book more acceptable if the publisher had reduced the very large margins on the side and bottom of each page. Most of these large areas are blank and of no use to anyone except those few who like to write notes in the margins. In this case, copious notes are possible.

ARTHUR H. THOMPSON

Your Guide to the Weather— "An Introduction to Meteorology"

By George L. Cantzlaar, Barnes and Noble, Inc., 105 5th Ave., New York 3, N.Y. 249 pp. Cloth bound. Illustrated. $4.50. (Paperback) $1.50. (Library)

The author is a member of the American Meteorological Society and is a Commander in the U. S. Naval Reserve. He has written several manuals on meteorology for training of Naval personnel. Published in 1964, this hand book on weather is intended for the enlightenment of those who are interested but have less than a professional knowledge of the subject.

Expressed in "layman" language the reader will encounter terminology used by meteorologists and will come to grips with causes and effects which result in what is commonly known as weather, good, bad or indifferent. The Guide contains twelve interesting chapters which are well outlined in the table of contents. The text is profusely illustrated and explains goings-on in the atmosphere from Zephyr to hurricane, from "very cold" to "very hot", from dry to wet and from clouds up high to fogs down low. The reader will learn that a tropical cyclone in the Atlantic region is a hurricane, in the North Pacific a typhoon, in Australia a willy-nilly, and in the Philippines, a boguio, or in weather terms, a tropical low-pressure system.

A student of the guide will learn to read various cloud formations and can predict in a general way what kind of weather they represent. He will also learn what a cloud is, how it is formed and why. He will also learn about air masses, how they are classified and how they enter into the weather picture. He will discover that there are various "fronts" of air, and that the cold ones move rapidly and the warm ones are slower.

The reader will learn something about weather instruments and how they are used. He will read that progress is being made in understanding and more accurately forecasting and reporting weather. Some space is devoted to a summarization of research and development in the field of meteorology.

FRED P. ESHBAUGH

Plant Analysis & Fertilizer Problems (Vol. IV)

Edited by C. Bould, P. Prevot, and J. R. Magness. The American Society for Horticultural Science, 301 Horticultural Building, Michigan State University, East Lansing, Michigan. 1964. 430 pp. ill. $7.50. (Library)

Ths volume contains 29 papers dealing with fertilizer and plant nutrition research that were presented at the fourth colloquium on that subject at Brussels, Belgium in 1962.

The papers cover a wide range of research with such crops as citrus, banana, pineapple, grape, raspberry, celery, pear, potatoes, tomatoes, cotton, sugar beets, oats, rubber trees, tea, tung and chrysanthemums and also covers effects of nematodes, salinity and weather conditions on plant nutrition.

The papers were contributed by outstanding specialists in their respective fields. The volume

should be available to students, teachers and research workers in horticulture. It is a valuable reference for those interested in the soil fertility aspects of crop production.

ROY E. MARSHALL

Bulbs

Hardy Bulbs, Penguin Books, Ltd., Harmondsworth, Middlesex, England, 1964, prepared in conjunction and collaboration with the Royal Horticultural Society of Great Britain, paper covers. Also obtainable from the Society, Vincent Square, S. W. 1, London, England.

Book 1, E. B. Anderson, 176 pages with 117 plates, $1.50.

Book 2, Cyril F. Coleman, 220 pages with 132 plates, $1.50.

The Complete Guide to Bulbs, Patrick M. Synge, E. P. Dutton and Co., Inc., 201 Park Ave. South, New York, N. Y. 1962. 320 pages with 24 plates in black and white and 32 plates (illustrating 330 bulbs) in color. $6.95.

The Wonderful World of Bulbs, Bebe Miles, D. Van Nostrand Company, Inc., Princeton, New Jersey. 1963. 348 pages with 37 illustrations in black and white and 19 in color. $7.50. $6.38 to members. (Library)

These four books all deal with plants that grow from bulbs, corms, rhizomes or tubers, or have thickened roots. Most are what we would call hardy or near hardy bulbs, although hardiness understandably differs between Great Britain, where three of the authors live, and the United States, as well as between regions in the United States. Mrs. Miles' book also covers many of the more common tender bulbs.

In the Northeast many gardeners confine their familiarity to the two outstanding spring bulbs, tulips and daffodils, and to potted hyacinths, and the spring crocus. Also they have likely grown the summer blooming gladioli and dahlias and perhaps cannas. In the South and on the West Coast, the corresponding selection differs considerably and is not quite so limited. All these books serve excellently to extend widely the gardener's knowledge of available species and varieties and their cultural requirements.

E. B. Anderson *(Hardy Bulbs,* Book 1) is a biochemist with many horticultural honors, past president of the Alpine Garden Society of Great Britain and recipient of the Veitch Memorial Medal and the Victorial Medal of Honour of the Royal Horticultural Society. His book deals with around sixty genera. There are succinct descriptions of the species in these genera useful for gardens and (where they exist) of some of the better known named garden varieties (clones and hybrids), with cultural notes for each genus and an excellent general discussion of cultivation, propagation, and pests and diseases. When it comes to those groups with great numbers of garden varieties, as hyacinths, narcissus, and tulips, Mr. Anderson leaves the treatment of these to Book 2, but covers the tulip species, the smaller narcissi of the less popular divisions, and the hyacinthus species. Lilies are to be dealt with in a future volume in the series.

Mr. Coleman *(Hardy Bulbs,* Book 2) is a surveyor and a daffodil breeder and exhibitor. His book covers the garden varieties of daffodils, tulips, and hyacinths along with descriptions of outstanding recommended varieties. Culture (outdoors and indoors), breeding, pests and diseases are adequately treated, and there is considerable historical material. One might wish for more on the outdoor culture of tulips and daffodils. The extensive account of daffodils makes the book a rather complete handbook on these flowers, save for the miniatures covered by Book 1. Developments by breeders and others in Holland, New Zealand, Australia and the United States, however, receive scant attention.

Hardy Bulbs, Books 1 and 2 are all the average gardener could wish for, reliable, handy in size, and moreover, inexpensive and not likely to overwhelm him with detail. More books of this type are needed for today's home gardeners.

Patrick M. Synge, *(The Complete Guide to Bulbs),* is well known as a horticulturist and editor of the Journal of the Royal Horticultural Society. His book is for the more serious amateur gardener and the specialist. It is one of the recent outstanding garden books—wide in its range and accurate in its species descriptions, but still easy for the gardener to read. Some 100 genera of bulbs are covered. The better of the named garden varieties (clones and hybrids) are also listed and succinctly described. Some cultural hints are given, but not as many as one would like. The more recent American developments among lycoris, lily hybrids, and narcissus are omitted or only lightly touched.

Mrs. Miles *(The Wonderful World of Bulbs)* has written for the less experienced gardener primarily interested in decorating the home grounds. Her book deals, as it should, with those bulbs easiest to grow and buy, and breathes encouragement and optimism for the homeowner who seeks help. He will obtain it from this book in a form he will relish. The elements of cultural practises are discussed, including indoor culture, and many of the tender bulbs are included.

FREDERIC P. LEE

Poisonous Plants of the United States and Canada.

John M. Kingsbury. 626 pages, illus. 1964. $13.00 Prentice-Hall, Inc., Englewood Cliffs, New Jersey 07632. Library (members price $11.05).

This "clinically, physiologically, and pathologically oriented approach to the literature on poisonous plants" updates Muenscher's book on the subject. It will be invaluable to the physician, the toxicologist and particularly the veterinarian. The layman who studies it carefully will find many potentially harmful and even lethal plants, a number of which may be growing in his garden. They are listed, analyzed and documented (the Bibliography gives 1715 titles) in Dr. Kingsbury's work, although he disclaims completeness.

The first chapters discuss the background of our knowledge of the subject, and the poisonous substances found in plants. Following this are some 700 species, each described botanically and giving its distribution and habitat, poisonous principle, toxicity, symptoms, lesions, and conditions of poisoning.

The layman will find the Index his mainstay, since the plants are listed by their botanical and common names. He will not find a table of plants which have caused loss of human life. It would be of less value than a similar citation of the many potentially-lethal objects found in our homes, if the statistics are compared.

This does not eliminate the ever-present hazards, so attractively displayed, of many of the plants in my garden. I do not intend to rip my garden apart as result of Dr. Kingsbury's book, but you may be sure I shall conduct a Short Course for the neighborhood kids. They will be warned about sampling the various roots, stems, leaves, flowers and fruits they find in the wild—or in gardens. No matter WHAT Boo-Boo Bear says! No, I won't be specific, for that would court deliberate experimentation!

J. W. Stephenson

Ecology of Soil-Borne Plant Pathogens. Prelude to Biological Control

By K. Baker and W. C. Snyder, University of California Press, Berkeley 4, Calif. Illustrated 571 pages. 1965. $12.00. (Libary)

This book presents a comprehensive review of our present knowledge of soil-inhabitating plant pathogens and suggests methods of reducing losses caused by them. Prospects for future development of this general field of research are discussed. Noted authorities of the United States and from abroad have contributed excellent technical papers. The book is well documented with 3200 references to literature. Its value is greatly enhanced by illustrations.

This is a book for students and professionals interested in the problems of root diseases and soil-inhabiting pathogens. The advanced gardener will find much of interest.

Curtis May

What Every Rose Grower Should Know

Edited by C. H. Lewis and R. C. Allen—Sixth Edition, American Rose Society, 4048 Roselea Place, Columbus, Ohio, 43214 1965, 84 pages, illustrated. Paperback $1.75. (Library)

A practical manual for the home rose gardener written in an easily read and understood manner. It is well organized to cover the culture of roses throughout the United States. An excellent handbook for the amateur.

Other Books added to the Library

Studies of the Germination of Seeds of Colorado Alpine Plants

Erik K. Bonde, Paperback, 15 pages. Illustrated. The University of Colorado Press, Boulder, Colorado 80304. 1965. $.50 (Library)

Beneficial Insects

Lester A. Swan, Harper & Row Publishers, 49 E. 33rd St., New York. 1964. 430 pages. Illustrated. $7.95. (Library)

The Gardeners' Pocketbook

Two Amaryllids/The Scarborough Lily and the Guernsey Lily

These two beautiful "lilies" might very properly be assumed to be natives of the region around Scarborough in Yorkshire, England and to the Channel Island of Guernsey respectively. This is far from the truth, for neither of these is a lily and both came from South Africa. The way each got its common name is similar and interesting.

The Scarborough Lily (*Vallota speciosa*) gained its name when bulbs washed ashore near the Yorkshire town from a wrecked Dutch East Indiaman bound for Holland from the Cape in 1800. The ease of growing this plant as a pot subject makes it still a favorite as a cottage window plant. Not only in England, but in many window gardens throughout Europe it is frequently seen blooming in late summer.

Vallota is a monotypic genus and grows in the shady forests of the Knysna and George districts of the Cape where it is called the George, Knysna, or Berg lily. Where it thrives most luxuriantly in the Knysna forest the bulbs grow in mud and bloom in January or February. The beautiful scarlet flowers come six months later in our northern climate and are happy in a pot of sandy loam with occasional feedings of liquid fertilizer during the summer.

The bulbs are quite large, up to three inches in diameter, and form numerous offsets. Shining evergreen strap-shaped leaves are produced with the flowers and are 8 to 10 inches long and 1 inch to 1½ inches broad. The strong, foot or more high stalk is topped by an umbel of 6 to 10 funnel-shaped scarlet flowers, 3 inches wide, which open over a period of three weeks and darken slightly as they age. Several color forms are recorded including the rare pink 'Delicata'; white 'Alba'; cherry red 'Elata'; throat white with a crimson feathering v. *eximia,* and a dwarf form 'Minor'. All are choice and readily grown.

As the plant is evergreen it needs small amounts of water even when not in active growth during the winter.

In 1659 a Dutch ship was homeward bound via the Cape from the Far East and was wrecked on the Channel Islands. On board the ship were boxes of Cape bulbs being sent to Holland. When these washed ashore on Guernsey they took root and in due course produced sparkling scarlet flowers. The bulbs thrived and bunches of the "lilies" were sent to London. There they were, and still are, popular as cut flowers. The botanists believed the source of the plant was Japan. Indeed the flowers look like *Lycoris* in many respects and it was Francis Masson, nearly a hundred years later, who identified the true home of *Nerine sarniensis* as the Cape mountains. The generic name *Nerine* is after the water nymph, while the spe-

F. W. COE

DICK CHANGNON/PHOTO SHOP

Nerine sarniensis, a choice Cape bulb and a member of the Amaryllis family. It grows on the heights within 40 miles of Cape Town.

Vallota speciosa, the Scarborough lily. It gained its name when bulbs washed ashore near the Yorkshire town from a wrecked Dutch East Indiaman bound for Holland from the Cape in 1800.

cific name *sarniensis* comes from Sarnia, the Latin name for the Channel Islands.

Nerine sarniensis is a choice Cape bulb and a member of the Amaryllis family as is *Vallota.* It grows on the heights within 40 miles of Cape Town including Table Mountain. There the sparkling scarlet flowers bloom in April while here the blooms come in September and October. In contrast to the *Vallota* this is a deciduous bulb blooming as the foliage just begins to get under way. The frilly reflexed flowers with strap-like petals are produced in an umbel of 6 to 12 at the top of a foot tall

stalk. The petal material has faceted cells with lens-like tops imbedded in it which in sunlight gives a glittering, gold-flecked appearance to the flowers. The leaves that follow the bloom are ½ to ¾ inches wide, glaucous and reach 10 inches in length during the winter growing season.

Bulbs are 2 to 3 inches in diameter and bloom best when crowded in a pot with the neck of the bulb well above the surface of the soil. After a rest on its side in a warm spot during the summer a top dressing with a small amount of fresh soil mixed with bonemeal is beneficial. In this climate bulbs thrive in sheltered positions outdoors, and I have seen a healthy group of plants beneath a back porch planted in the heavy adobe soil in Berkeley. The porch served as a shelter from summer watering of the rest of the garden.

Where to get these bulbs is a problem. *Vallota* is seldom offered in the trade,* although it is found here in retail nurseries at times. *Nerine sarniensis* also may be offered by bulb specialists although the pink *N. bowdenii* is much commoner, and also hardier.

—Frederick W. Coe
Ross, California

* *(Listed by C. G. van Tubergen, Haarlem, Holland.—ED.)*

Alstroemeria pulchella

For the gardener who can grow successfully any of the other species of *Alstroemeria,* this is the least likely to claim attention, though it has its uses.

In many old Southern Gardens, it has been "in residence" so long that most persons have forgotten when they first had it or from whom it had come. In short, unless the garden is arid dry, it is almost indestructible, and in good gardens it can become a nuisance.

It was in the garden here when the writer came to live, and until he had to make some changes in the borders, the roots had never been seen. They are fleshy, many of them short, almost like tuberous roots, nearly white in color, and permanent. From them start out the annual feeding roots which are fibrous. The storage tubers cluster about the bases of last years flowering stems.

In late autumn, short non-flowering stems rise to heights that vary from 4 to 8 inches, with almost glaucous leaves arranged in neat whorls, and make a pleasant contrast with the darker green leaves of other herbs. Only very severe cold will damage them. The flowering stalks come in early summer and rise to varying heights, here mostly about 14 inches, with narrow clasping leaves and a terminal umbel of lily-like flowers. These have unequal segments of green bordered with a bright red, on which are dull brownish dots. As the petals do not flare, the flowers do not appear as large as they really are.

IVAN N. ANDERSON

Alstroemeria pulchella

In this garden, the plant is permanently located, not planted in various mixed borders and makes a touch of color at seasons when nothing else is in bloom here. All the borders are well

enriched with humus and either are moist naturally or are watered in season.

During the time of bloom, the chief attraction for us, is the lure they make for the humming birds common in this region. These poise in front of the umbels and move from head to head, and away to other colonies. If there were no other virtue than this, it would suffice here.

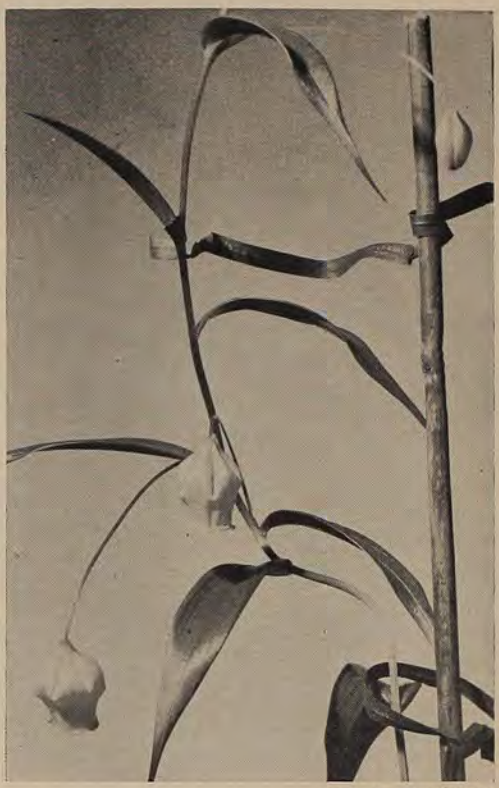
After flowering, seed capsules form that are attractive in shape and marked by the formation of tiny spurs. If they are cut for drying before the seed capsules explode, the gardener may be astonished at the sounds as the seeds are expelled from the drying capsules. Here, seed has been poorly produced, although the capsules appear normal. This, however, may be a delusion, as young plants appear in many places to which we have not moved roots.

Nearly all failures to establish this plant when given from our garden to others have been due to the lack of water at the critical moment. Usually, even in otherwise poor conditions, even small pieces of roots will survive and astonish the gardener who thought all lost. This again, should be a warning, that the plant may become a nuisance, and no gardener should plant it thinking he can get rid of it, unless he will use chemical means.

The above note on Alstroemeria pulchella *and the following notes on* Sandersonia aurantiaca *and* Lilium Brownii *were written by B. Y. Morrison, former editor of the "American Horticultural Magazine." Mr. Morrison also comments on letters he received about his "Gardeners' Pocketbook" notes published in the October, 1964 issue. All readers are encouraged to comment likewise on material appearing in AHM.*

Sandersonia aurantiaca

Presumably it is a perilous thing to base any description of a plant from a single specimen, but if one must wait as many years as the writer did to see the plant, and it is worth a note, discretion is abandoned.



IVAN N. ANDERSON

Sandersonia aurantiaca

The subject of this note is not a plant that will make a huge display under ordinary garden conditions, but as its near relatives the gloriosas are becoming better known not just as hothouse plants in the North but as good garden subjects in the South, it is worthy of some attention, probably more than the other member of the group, the *Littonia.*

The single root that came, after the years of waiting, was a small whitish affair like a rhizome, with one good tip and what appeard to be a bud for growth. As it looked so fragile, it was planted in a bulb pan, with a mixture of soil rich in humus but so mixed as to insure perfect drainage. A growing shoot developed in a short time, that looked in a way, like a feeble gloriosa shoot, except that the leaves have no tip, that curls to form a means of climbing by attachment. The growth continued to a height of abut 18 inches,

with buds appearing, as in *Littonia,* almost in the middle of the shoot, not at the upper levels. Since the plant seemed slender and not robust it was fastened to a light bamboo stake as can be seen in the illustration.

The flowers are pendent, and of most interesting formation, and coloring. The six parts of the flower are joined to form the bell-like bloom, with clear indications of the segmentation, showing as tips of color at the top, and recurving lips along the margins of the corolla at its mouth. As the flower appears, it is a greenish yellow but the color alters as the bloom develops, with only the tips of the segments remaining as Calliste Green (Ridgway). The inflated upper portions begin as Mikado Orange but lighten to Deep Chrome, and the lower parts start as a yellowish green but change to Deep Orange Yellow. Later, as the bloom ages, all color fades again until one has a papery, almost parchment-colored bloom that persists for weeks. Here no fruits were set, but no attempt to hand pollinate was attempted.

In about one month the shoot showed signs of withering and watering was reduced so that it ripened normally.

Later, when the pot had not been moved to cover so that no rain fell on it, a new shoot appeared, that grew to a somewhat greater height, and showed the same manner of flowering, below the uppermost axils of the leaves. This lasted about the usual month and again, no seed was formed.

The plant is now dormant and under cover, so that no water falls on it, and presumably will not start to growth again until spring, as these notes are written in February. Whether or not the rhizome has branched remains to be seen and no investigation will be made, for fear of damaging the whole, as it possibly cannot be replaced "on demand."

If and when it is possible to get roots of this in greater number it will be of interest to plant it in the open, since most of the gloriosas are good garden plants in this area, and the species *G. rothschildiana* which is the major one for spring flowering, sometimes dies down and then reappears in the same season in the fashion of *Sandersonia* as reported. The writer is told that in a nearby garden, this is true always for the Rothschild gloriosa, but that garden has deeper soil and more regular watering. If one had ten or more roots and could plant all in a great clump with the proper staking for growth upward, the effect of the small orange bells would be fine, even with no second flowering.

Lilium Brownii

Such bulbs of this lily as are in the garden here in Pass Christian, Mississippi, were raised from seed sent the writer from a private grower in Hong Kong. Seeds have been given to the Society for the Exchange list and will be again this season (1964-65). This is mentioned only because, other seeds of the same species have been offered, and they may be more typical of the lily as described in texts, than the lilies resulting from our seed.

IVAN N. ANDERSON

Lilium Brownii

The basic difference here is the great lack of color patterns on the exterior of the petals, in fact an almost total lack of color.

In general the trumpet lilies, as far as tried, have not been a complete success here, no matter what attention was given, and the excuse most likely to be offered is that they did not receive ade-

IVAN N. ANDERSON

Lilium Brownii

quate feeding. They often persist and occasionally bloom, but one would not consider them as sure things in any garden planning.

This particular lily, as grown here under really poor conditions, with no feeding and rarely any watering, and most shameful of all, practically no weeding in the area, has been in place for over ten years, with bulbs of varying size, from the youngest or the slowest, even now yielding no more than a single flower, and the most successful over 8 feet in height and with up to 6 or 8 glorious flowers, that are larger than any other trumpet lily we have ever had. As the buds develop and approach the time for opening, the effect is almost as striking as when the flaring petals that are wider than is usually thought, open. The first color as the buds develop and on the morning of the day when the petals separate, is a faint yellow, so that one foolishly hopes that it may stay, but like many other fine plant yellows, this is perishable in light and the open flower is glistening white. There is a delightful scent that fills the air, though not as strong a perfume as that exhaled by the Philippine Lily that comes into bloom a month later. Here *L. Brownii* is usually at prime bloom in mid-June to late June and the Philippine is from mid-July till early August with a few stragglers, usually seedlings that were slow to make their first flower.

If there are any complaints to offer, here, they would be only one, namely that the lily seed which germinates the first year, almost at once when sown, is slow to grow on and make a bulb that will grow on to flowering. As no two, under the casual cultivation, or lack of it, that is given here, develop at the same speed, one has lilies of all sizes of plant and variations in number of blooms.

Critical Comment

After the publication of the note on *Allium triquetrum,* with a "good character" given it for the writer's garden in Mississippi, a letter came from Dr. Frederick O. Coe, in Ross, California, to warn me, that there and in coastal gardens, it was a most invasive species, that spread apparently by seeding. Dr. Coe urged that if used, all seed heads should be cut before the seed could ripen and spread.

Certainly in the garden here, the spread is only from seed, and here as reported, seed is not formed in abundance. Even so, gardeners should remember the risk involved in its use.

Another letter had to do with *Androstephium caeruleum.* Mr. Barr agrees that the plant has not had a "good press" but suggests that it might have been even better than was given. He writes in part: ". . . Actually it is many years since I have grown corms of good size and have had maximum blooming. William Chase Stevens in *Kansas Wild Flowers* says that for a number of years the number of blooms to the umbel increases, and I seem to remember that my best umbels carried six or eight

flowers. A second reason is that—if you can abide the criticism—your segments appear pinched or quilled in the lower portion. This appears strange to me. Checking with Stevens, his photo does not show that defect, if I may call it that, but are reasonably wide and flat, as I believe they normally are with me. . . ."

As a beginner with the plant, the writer offers no explanation of the difficulty here, that may have been responsible for the less-than-fine appearance of the bloom in the garden here, but there may be explanation in the age of the corms themselves, here only two years, in the difference in soil and moisture and a thousand and one possible additional factors, for there is certainly a vast difference between Coastal Mississippi and the Great Plains.

So, whatever the short comings of the flowers as shown in the October, 1964 issue of the magazine, the plant remains worthy of the attention of other and better gardeners than the writer.

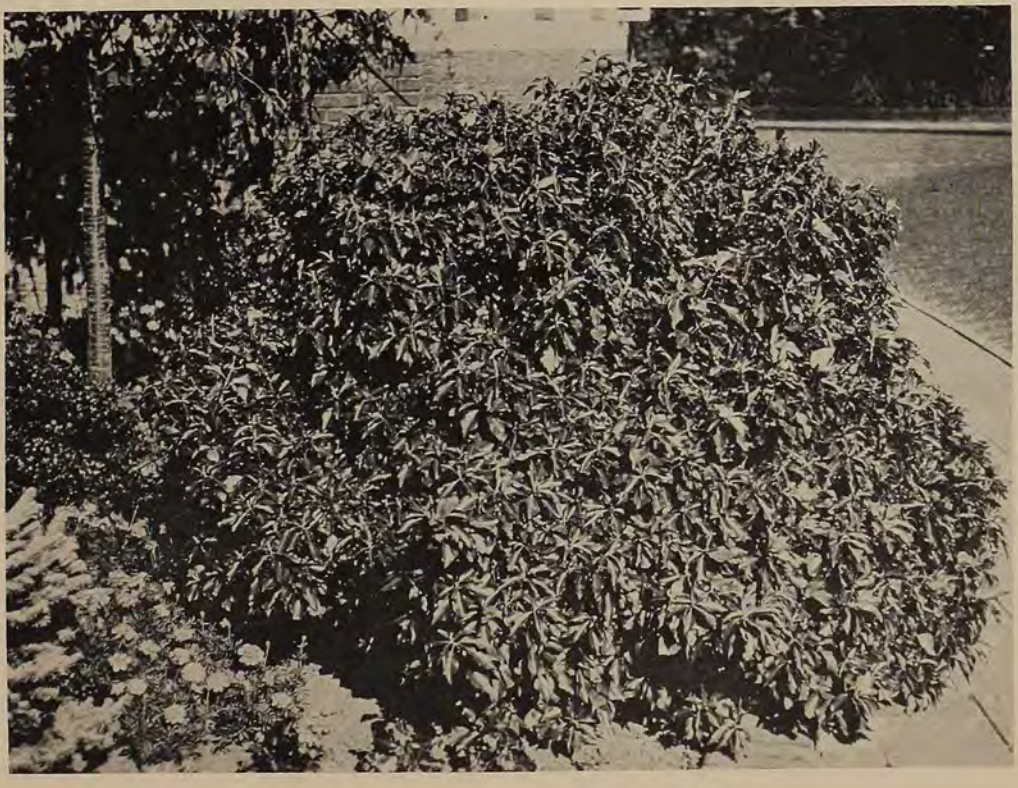
—B. Y. Morrison
Pass Christian, Mississippi

The Nurseries of Boskoop, Netherlands

We are informed that as far back as 1573, Boskoop was a horticultural center with a thriving export trade of fruit and ornamental trees to surrounding countries. Today, the Boskoop nursery area near Leiden and Rotterdam thrives more than ever in our modern era of horticultural affluence.

Indeed, Boskoop is unique among nursery areas of the world. Most impressive are the neatly tended nursery plots, the innumerable canals, and the colorful houses of the nursery owners. In all, approximately 675 nurseries are located on 1,400 acres, once the bed of an ancient lake. The area virtually is a

***Hedera helix* 'Arborescens', shrub-ivy 4 to 5 feet tall, in front of town hall, Bosoop, Netherlands.**
F. G. MEYER



latticework of canals. In fact, canals are the main thoroughfares of trade in this town of more than 8,000 people. Attractive homes of the nurserymen, with thatched roofs, lawns and flowerbeds, extend to the edge of the canals, which in summer are infested with duck-weed (*Lemma*) and mosquito-fern (*Azolla*).

The Gouwe River, a highly commercial arterial waterway, flows through the area at about 8 feet above the general level of the town and the surrounding nurseries. The rich fen soil, an abundance of water, and a relatively mild climate are conditions copiously available at Boskoop. With a water table of about 12 inches below the soil surface over much of the area, water becomes almost an insurmountable plague to the nurserymen. In recent years, however, pumps have been installed as a means of lowering the water table below present levels. Already, nurserymen are finding better growth and root development in nursery stock as a result of this improvement.

A 15-foot layer of fen soil of a peaty, sandy consistency covers the area—⅓ humus, ⅓ clay, ⅓ sand—with a pH of 4.5 to 5.5. Loss, on the other hand, of valuable top soil resulting from the tens of thousands of balled plants which leave the nurseries twice each year, is a serious problem at Boskoop. Happily, the natural conditions which prevail for soil recovery is part of the saga related to the continued success of the nursery industry in this area. The superabundance of water, the canals, and especially the floating water plants growing on the canals play favorably into the hands of the nurserymen. Each year after hard frosts have killed the thick green carpet of duck-weed and mosquito fern, very soon, everything settles quietly to the bottom of the canal to decay. The black

View of nurseries bordered by canals.

EXPERIMENT STATION, BOSKOOP.

EXPERIMENT STATION, BOSKOOP.

Cargo of living plants ready for shipment.

muck deposit which forms is a natural source of rich organic material valuable for plant growth. Nurserymen allow two or three years to elapse for a build-up of the decayed matter to a depth of several inches. During the summer months the muck is scooped from the bottom of the canals into scows and later transferred into piles on the nursery beds. The slick organic ooze is first allowed to dry out. Later it is incorporated into the nursery beds to replenish the loss of soil from previous years. The ability to recover lost soil in this special way, while not the only natural asset available to Boskoop nurserymen, is basic to their success. This allows the nurserymen to maintain a relatively high fertility level in the nursery soils at little expense, an all important consideration in the overhead costs of any nursery operation.

The nurseries of Boskoop mostly are small one-man operations on 2 to 4 acres of land. The largest consist of about 20 acres. Through efficient land use and good prices for his product, one man can earn a substantial living for his family. A cooperative association among the nurserymen helps to make this possible. Indeed, nursery management at Boskoop rivals the efficiency expected when crops are cultivated under glass.

Plants produced in greatest abundance of Boskoop encompass three major groups—broad-leaved evergreens, deciduous flowering shrubs, and conifers. Of broad-leaved evergreens, the following are important: Rhododendrons and azaleas (*Rhododendron*), holly (*Ilex*), and barberry (*Berberis*). Deciduous flowering shrubs, such as *Forsythia, Magnolia, Weigela, Deutzia,* and *Ligustrum,* are grown on an extensive scale. Conifers,

especially dwarf-growing kinds, are featured in nearly every nursery, although tall growing sorts, such as the well-known Koster and Moerheim blue spruce (*Picea pungens* 'Kosteri' and 'Moerheimii') are still grown at Boskoop in large numbers. Polyantha and floribunda roses are produced on a limited scale, but no hybrid tea roses are grown. Russell lupin (*Lupinus*), *Astilbe,* and *Salvia* × *superba* are grown extensively by a few nurseries specializing in perennials.

Plants from the Boskoop nurseries are shipped to about 40 countries, with the largest consignments going to England, West Germany, Canada, United States, Sweden, Belgium, and Switzerland, in that order. The nurseries are a hub of activity twice a year, spring and autumn, when shipping is at its peak. Nursery stock is first dug, then loaded on barges anchored in the canal alongside the nursery. Plants are transferred to packing sheds, where they are carefully prepared for shipment by rail, ship, and plane.

—Frederick G. Meyer
U. S. National Arboretum
Washington, D. C.

***Salix matsudana* 'Tortuosa', the contorted form of the Peking willow growing at the Strybing Arboretum, San Francisco, California.**
P. H. BRYDON

Two Forms of the Peking Willow, *Salix matsudana*

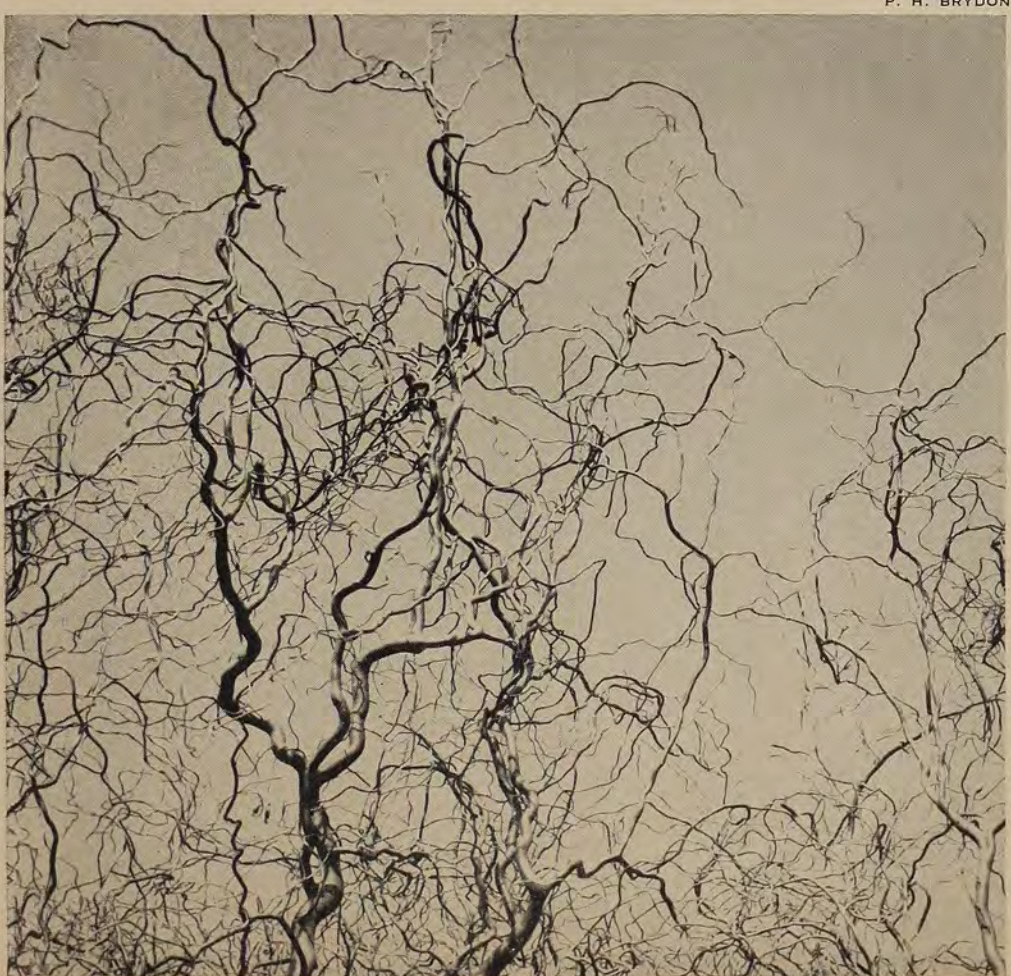
Perhaps some readers will be interested in a close-up of the curious branching of *Salix matsudana* 'Tortuosa'. I saw this tree last February at the Strybing Arboretum, San Francisco, California. The charm of its peculiar habit prompted me to ask the Director, P. H. Brydon, to photograph the tree for the American Horticultural Magazine. The habit photograph also accompanies this note. Like other forms of the Peking willow, the tree habit is dense and upright. In addition the branches are grotesquely contorted and tortuous. Aside from its merit as a garden specimen, the 'Tortuosa' willow has a unique value in oriental flower arranging. Trees available in nurseries probably originated from the 1928 USDA introduction when plants were obtained from the Vilmorin Nursery near Paris, France. The Chinese name "lung chao liu" means dragon's claw willow.

An earlier introduction of *Salix matsudana* is the form 'Umbraculifera'. It is shown here growing on the barren plains of northern China. This form has a dense, semi-globose head giving the impression that the whole tree has been carefully pruned. This habit results from the more-or-less equal growth of the branches and lack of a central leader. It is excellent dry-land tree and a rapid grower. Trees at Chico, California, growing under a low rainfall regime have attained 20 feet in height in six years. It can be expected to grow 50 feet tall. The 'Umbraculifera' form was first introduced by the USDA in 1906 when the famous explorer, F. N. Meyer, sent cuttings from China. The Chinese call it the "bread" willow because of the habit.

—John L. Creech
Hyattsville, Md.

A close-up of the tortuous and twisted branches of *Salix matsudana* 'Tortuosa' is suggestive of the interesting appearance of this tree.

P. H. BRYDON



Pistacia texana

(These are photographs of *Pistacia texana* taken on a recent Houston (Texas) Museum of Natural Science trip and sent to the AHS by Lynn Lowrey of Houston. Mr. Lowrey wrote a "Gardeners' Pocketbook" note about the Texas pistacia for the April *American Horticultural Magazine*. At this time no pictures of this superior Texas ornamental tree were available. He is concerned about how *Pistacia texana,* already so rare in the U. S. that few people have seen it, is destined soon to become extinct in the wild. The trees pictured here will probably be covered with water when the Amistad Dam across the Rio Grande near Del Rio is completed.—ED.)

PAUL McGEE

The warm water of Goodenough Springs boils up under this overhanging cliff a mile north of the Rio Grande and about six *Pistacia texana* are growing along the short canyon. A *Pistacia* grows just above the water at the head of the canyon (arrow).

Cuttings of the farthest north *P. texana* being taken by Paul McGee of the Houston Museum of Natural Science, January 1965.

L. LOWERY

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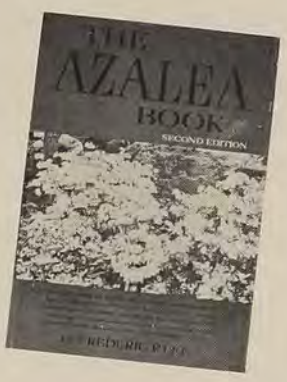

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Salix matsudana 'Umbraculifera', a dense upright form of the Peking willow. This variety has long been planted around Peking and is highly tolerant to drought and heat.