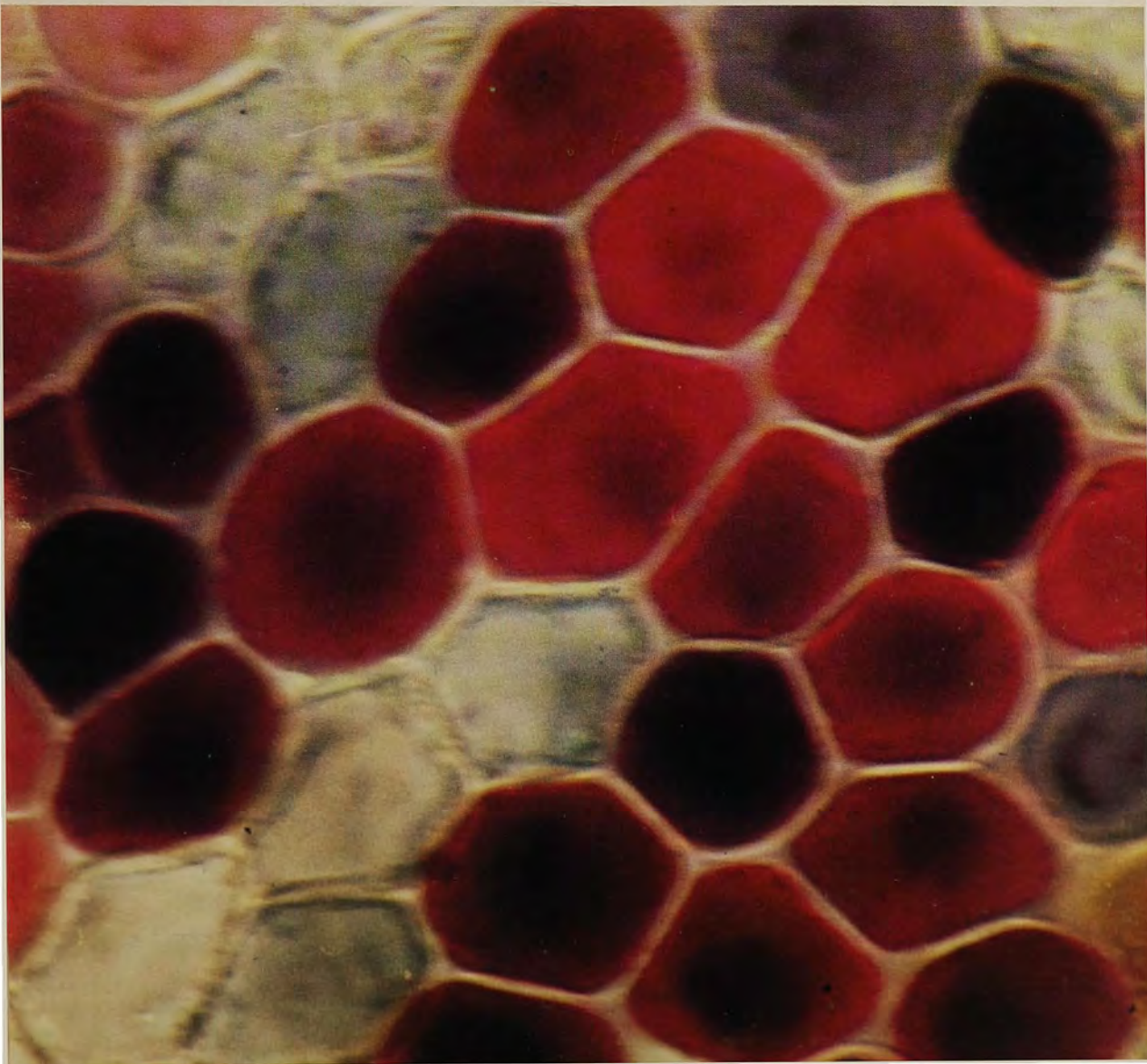




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FRONT COVER ILLUSTRATION

A photomicrograph of the epidermal cells in a spot on the lavender flower of ground-ivy (*Glechoma hederacea*). The individual cells are of quite different colors but to the unaided eye they appear as a single small purple spot. (See companion-piece, Page 33) Photo, U. S. Department of Agriculture.

BACK COVER ILLUSTRATION

Camellia japonica 'Sunset Oaks'. Registered in 1965 as a sport of 'Finlandia Variegated'. Courtesy of The American Camellia Society from *The Camellia Journal*, Vol. 21 No. 5, November 1966.

Golden Anniversary . . .



As this issue goes to press *The American Horticultural Magazine* marks the beginning of Volume 50, the golden anniversary volume. There is reason for the Society to be proud of the forty-nine published volumes culminated in the *Handbook of Hollies*, as the eighth title in its handbook series. The magazine is a symbol of the high standards of individuals and societies devoted to amateur horticulture in this country.

The roots of this Society go back at least 85 years to an earlier organization called the Mississippi Valley Horticultural Society, formed at St. Louis, Missouri in 1880. That organization became The American Horticultural Society, which existed in 1886, 1887, and 1888, with objectives similar to our own. The published *Transactions*, started in 1884, ceased with Volume 5, in 1888. Thereby died the prototype of the present Society.

In 1922, thirty-four years later, two horticultural societies came into existence: The National Horticultural Society, incorporated at Henning, Minnesota on July 1, 1922, and The American Horticultural Society, founded in Washington, D. C. in September 1922. On June 15, 1926, these two societies merged under the name of The American Horticultural Society. The *National Horticultural Magazine*, founded in 1922 by the Minnesota organization, became the official journal of the new society.

A 1960 merger with The American Horticultural Council brought important new strength to the Society but little material change to the magazine. The journal was renamed *The American Horticultural Magazine*.

Always national in scope, the magazine aspires to formulate and to guide the image of amateur horticulture. The preamble to volume 5 states that the Society is "devoted to the popularizing of all phases of Horticulture; Ornamental Gardening, including Landscape Gardening and Amateur Flower Gardening; Professional Flower Gardening or Floriculture; Vegetable Gardening; Fruit Growing and all activities allied with Horticulture."

The magazine is not a research periodical in the usual sense. Yet it is the aim to interpret new research results to the membership. The articles are to inform and to educate those with a serious interest in plants. Also, the magazine intends to foster good taste for plants and their cultivation; to sharpen the readers per-

ception and awareness as regards the use of plants in gardens; to raise the level of appreciation for new kinds of plants; to report on new advances in horticulture, cultural practices, plant nomenclature, and plant history; and to achieve a degree of excellence unique among horticultural publications in this country. The articles are original, written by amateurs and professionals—but always by experts. Accuracy is upheld to the letter and the articles are complete in themselves. High quality photographs have always been a regular feature.

In the face of rather consistent financial impoverishment, the success of the Society and magazine is to be credited largely to the volunteer labor of men and women dedicated to the education of public taste and dissemination of ethical horticultural knowledge. The Society consists of about 90 percent amateur horticulturists and 10 percent professionals. The close relationship of these two groups has been an immensely important factor in maintaining standards of excellence and continuity in the magazine and in the Society.

Limited space here prevents a listing of all of those dedicated individuals to whom the magazine owes so much. Yet it would be impossible not to mention B. Y. Morrison, one of the founders, who carried the burden of the magazine almost solely in the 1940's and served as editor for 37 years. His charming wood block prints were featured on the covers for many years. But it was the high quality of text and illustrations that early established the stature of the magazine both at home and abroad. The A.H.S. magazine is one of the few horticultural publications in this country listed in *Index Londonensis*, a comprehensive index of the world's plant illustrations, published under the auspices of the Royal Horticultural Society of England.

During the past few years, in spite of a tight budget and soaring printing costs, the format has been modernized in several respects. Color is now a regular feature, and two new sections, "*Advances in Horticulture*" and "*Plant Nomenclature*" have been added. These have stimulated much interest, but we know this is not enough. Each issue should contain something of value for every reader. We should be reaching a much broader audience nationally than has been possible to achieve with volunteer labor, a very limited budget, and insufficient office staff.

Yet as the magazine begins its 50th volume there are signs of definite improvement. The Society has reached a new peak of activity and sphere of influence. We now have wide patronage to carry out national programs on important issues, such as pollution, beautification, standards, and research. Improvements in publications and finances also have been bolstered. Special endowments support the Plant Records Center and a new Horticultural Directory. A recent funding will allow the opportunity to upgrade the publications of the Society. This will provide means for expansion of both the magazine and *News and Views* and continue the *Handbook* series which has always been popular with the membership.

We are gladdened by the new wave of interest and fiscal support. One indication of this has been the strong upturn in new life memberships, 14 in the past three years. Success begets success. The future of programs and publications now appears brighter than at any time during the history of this organization.



FREDERICK G. MEYER
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Breeding New Camellias

WILLIAM L. ACKERMAN

Interest in *Camellia* has been largely concerned with species of economic importance. In the Orient, camellias are grown for their flowers, for the oil of the seeds of certain species, and for tea from *C. sinensis*. In both Europe and the United States we know the camellia primarily as an attractive ornamental.

Camellia belongs to the tea family (Theaceae). It is the largest genus of the tribe Gordoniae that includes eight other genera *Franklinia*, *Gordonia*, *Laplacea*, *Pyrenaria*, *Schima*, *Stewartia*, *Tutcheria*, and *Yunnanea*. Sealy (1958) recognized 82 species of *Camellia* and 16 others still too imperfectly known to establish their status. There is a wide variation in floral and vegetative characters reflecting a great diversity between species.

Introduction of species of *Camellia*

Research Horticulturist, Agriculture Research Service, U. S. Department of Agriculture, Glenn Dale, Maryland 20769.

into Europe from the Orient, generally accepted as having taken place about 1740, was closely associated with the tea industry. A report by Meyer (1959) indicates a much earlier introduction into Europe by Portuguese traders who brought *C. japonica* to Oporto, Portugal about 1550. Importation into the United States occurred during the latter part of the eighteenth century.

During Victorian times, camellias were grown as conservatory plants both in Europe and northern United States and as garden specimens in the southeastern states. Popularity in camellias waned near the turn of the century. Not until shortly before the middle of this century did they again gain prominence as ornamentals. Presently, *C. japonica* and *C. sasanqua*, the two most popular species, and their cultivars are grown rather widely in the southern and Pacific coast states and, to a limited extent, in greenhouses in the north. Less frequently cultivated species are *C. reticulata*, *C. hiemalis*, *C. saluenensis*, and *C. vernalis*.



PHOTOS, U. S. DEPARTMENT OF AGRICULTURE

Fig. 1. Left, *T. virgata*, female parent. Center, hybrid showing indented venation of male parent. Right, *C. granthamiana*, male parent.

Limitations in Past *Camellia* Breeding

Most of the camellia breeding of the past has been through planned or accidental intraspecific hybridization (crosses within a species), particularly with *C. japonica*. Until recently, little attention has been given to interspecific (crosses between different species), and intergeneric crosses (crosses between *Camellia* and species of closely related genera). It has been said, Anderson (1961) and Savige (1967), that most of the useful intraspecific genetic variation has been exploited, especially in *C. japonica*. Without the introduction of new germ plasm into camellia breeding programs, the potential for new forms becomes increasingly restricted until all further progress stagnates.

Limitations in vegetative and floral characters occur in *C. japonica* and *C. sasanqua*. Flower color is confined to white through red in solid colors and variegated patterns; there is no yellow or blue. Most cultivars have the habit of retaining old withered flowers. Except for a few faintly scented cultivars, particularly of *C. sasanqua*, floral fragrance is lacking. Efforts to intensify this faint fragrance through intraspecific hybridizing have been disappointing. The natural flowering season for the cultivated species is limited to the spring for *C. japonica* and *C. reticulata*, and the fall for *C. sasanqua*. Improved cold-hardiness is desirable, since outdoor culture is largely confined at present to the southeastern and west coast states.

Less known species have all of the characters presently lacking in the cultivated varieties, with the exception of blue flowers—although purple-flowered species do exist. Most *Camellia* species are native to southeast Asia. Diversity within the genus and numbers of indigenous species indicate the center of origin to be in the region of south China and North Vietnam. Many species, described by early plant taxonomists, were never successfully exported from this area and so are not presently available for hybridization. However, Hilsman (1966) states that approximately 25-30 species have been introduced into the

TABLE I. *Camellia* species used as parents in interspecific hybrids.

Species	Source
<i>C. fraterna</i>	China
<i>C. granthamiana</i>	Hong Kong
<i>C. hiemalis</i>	China
<i>C. hongkongensis</i>	Hong Kong
<i>C. japonica</i>	China, Japan, Korea, Liu Kiu Islands
<i>C. kissii</i>	China, Nepal, Burma Sikkim
<i>C. lutchuensis</i>	Liu Kiu Islands
<i>C. miyagii</i>	Liu Kiu Islands
<i>C. oleifera</i>	China, Vietnam
<i>C. pitardii</i> var. <i>pitardii</i>	China
<i>C. reticulata</i>	China
<i>C. rosaeiflora</i>	Ceylon
<i>C. rusticana</i>	Japan
<i>C. salicifolia</i>	Hong Kong, Taiwan
<i>C. saluenensis</i>	China
<i>C. sasanqua</i>	Japan, Liu Kiu Islands
<i>C. sinensis</i>	China, Japan, Taiwan
<i>C. taliensis</i>	China
<i>C. tenuiflora</i>	Taiwan
<i>C. tsaii</i>	China, North Vietnam, Burma

United States. The U.S. Plant Introduction Station, Glenn Dale, Maryland, has 26 species of *Camellia* in its collection, 20 of which have flowered and have been used as parents. These are listed in Table I along with their sources.

Interspecific and Intergeneric Hybridizing

Although interspecific and intergeneric crosses are frequently difficult or unsuccessful, a program of wide crosses was initiated in 1960 at the Glenn Dale, Maryland, Plant Introduction Station. This breeding program was undertaken to utilize the broad germ plasm reservoir of the less known species for improvement of established types, as well as for development of a completely new race of garden camellias. The first objective was to investigate the compatibility relationships of all *Camellia* species and species of closely related genera in our collection by obtaining interspecific and intergeneric hybrids. All fertile first generation hybrids could be the beginning stages for the transfer of desirable genetic characteristics to new cultivars of the future. Also, we wished to determine the

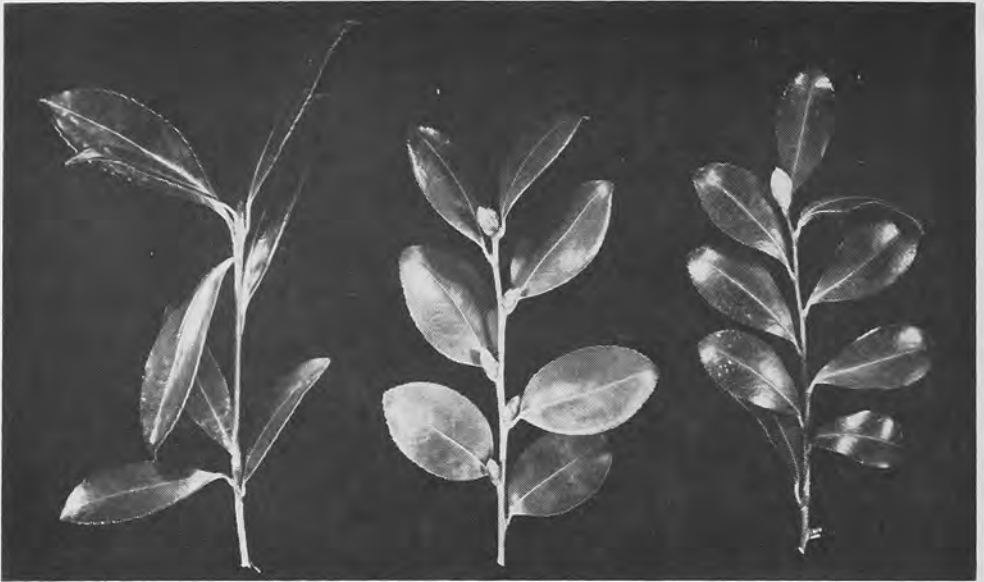


Fig. 2. Left, *T. virgata*, female parent. Center, hybrid showing leaf shape similar to male parent. Right, *C. miyagii*, male parent.

chromosome numbers of species and hybrids, and the chromosome morphology of diploid species where possible. Chromosome counts were needed to verify the validity of some hybrids and chromosome morphology serves as a further tool in the identification and separation of species and hybrids.

Over a period of ten years, a total of

8,762 controlled pollinations were made representing 220 interspecific combinations, including reciprocal crosses. A total of 466 hybrid plants in 107 combinations were obtained.¹

Attempts were made to cross several *Camellia* species with species of closely

¹A list of interspecific hybrids is available by writing to the author.



Fig. 3. Left, *C. pitardii* var. *pitardii*, female parent. Center, hybrid, intermediate in leaf shape between parents. Right, *T. spectabilis*, male parent.



Fig. 4. Left, *C. japonica*, female parent. Center, hybrid showing elongate leaves similar to male parent. Right, *C. hongkongensis*, male parent.

related genera. These included *Tutcheria spectabilis*, *T. virgata*, *Franklinia alataamaha*, and *Stewartia ovata*. A total of 1,064 controlled intergeneric pollinations were made, representing 24 intergeneric combinations, including reciprocal crosses. Eleven plants judged to be valid hybrids were obtained from three combinations. These were *Tutcheria virgata* × *C. granthamiana*, *Tutcheria virgata* × *C. miyagii*, and *C. pitardii* var. *pitardii* × *Tutcheria spectabilis*. Comparisons of the leaves of the parents and hybrids are shown in Figures 1, 2, and 3. Three seed capsules developed from *Franklinia alataamaha* × *C. hongkongensis*, but as yet no hybrid plants have been produced.

Vegetative Characteristics

Indications of hybridity in a young plant are determined by a comparison of its vegetative characters with those of its parents. This evidence is later supported by comparisons of floral characters, pollen abortion, and chromosome counts.

Species possessing strongly dominant characters can be extremely useful to the plant breeder when they are used as male parents. Similarities between progeny and the pollen parent help confirm hybridity. This may be illustrated by the

dominance of hairy over smooth stems. In 108 hybrids derived from eight different interspecific combinations involving female parents with smooth stems crossed with males having hairy stems, all were hairy stemmed. When the stems of both parents were smooth, all of the progeny also had smooth stems.

Dominance in leaf and habit characters occur in the prominent leaf veins of *C. granthamiana* (Figure 1); the narrow, elongate, peach-like leaves and the characteristic purple in new shoots of *C. hongkongensis* (Figure 4); and the willow spreading plant habit with thin young shoots and dull grey-green foliage of *C. fraterna* (Figure 5).

Floral Characteristics

In hybrids, flower size and form were usually intermediate between the parents in first generation crosses. However, when small flowered, wild species, such as *C. fraterna*, *C. lutchuensis*, *C. miyagii*, and *C. kissii* were crossed with large-flowered cultivars of *C. japonica*, *C. rusticana*, *C. reticulata*, and *C. sasanqua*, the small-flowered species appeared to exert the greater influence on the progeny.

Species that contribute dominant floral characters are *C. granthamiana* with

large, elongate, frilled white petals; *C. hongkongensis* with trumpet-shaped red flowers and rough grey perules; and *C. saluenensis* with a clear rose-pink illuminative color of the petals. Transmission of this floral character of *C. saluenensis* to many of its hybrids has in large part been responsible for the popularity of the *C. × williamsii* hybrids.

Flower Fragrance

Flower fragrance is rather rare in the genus *Camellia* and is only faintly present in some cultivated species, particularly *C. sasanqua*. Six species, *C. lutchuensis*, *C. fraterna*, *C. kissii*, *C. miyagii*, *C. oleifera*, and *C. tsaii* are strongly scented. Only *C. lutchuensis* and *C. tsaii* have a fragrance which is pleasant to most people. The scent of the other four species is described as being musky and unpleasant. Floral scent appears to be transmitted to a large percentage of the hybrid progeny. Among 89 *C. lutchuensis* hybrids, 59 have flowered and all but four were fragrant. However, the flowers of most of these fragrant hybrids are small like the fragrant parent. Only six *C. lutchuensis* hybrids have flowers of sufficient size and quality to make them of possible commercial interest. Flowers of a few of



Fig. 6. Highly fragrant hybrid of *C. japonica* × *C. lutchuensis*.

the more attractive scented hybrids are shown in Figures 6, 7, and 8.

One hybrid selection, 'Fragrant Pink', Figure 9, a cross between *C. rusticana* 'Yoshida' (P.I. 228187) and *C. lutchuensis* (P.I. 226756), was named by the U.S.D.A. Crops Research Division in



Fig. 5. Left, *C. japonica*, female parent. Center, hybrid. Right, *C. fraterna*, male parent.



Fig. 7. Mildly scented hybrid of *C. rusticana* × *C. fraterna*.

1966 and has since been distributed to the nursery trade. 'Fragrant Pink' is a loose-peony form flower, $2\frac{1}{4}$ inches across by $1\frac{1}{4}$ inches high, medium pink, with ten petals and 12 petaloids. The fragrance of the flowers is similar to that of *C. lutchuensis* and it represents an improvement in flower size and form from that of *C. lutchuensis*, which is $1\frac{1}{4}$ inches across, white and single.

Seventeen *C. fraterna* hybrids have flowered to date and all except one were scented. Here again, the hybrids are mostly like the small-flowered species.

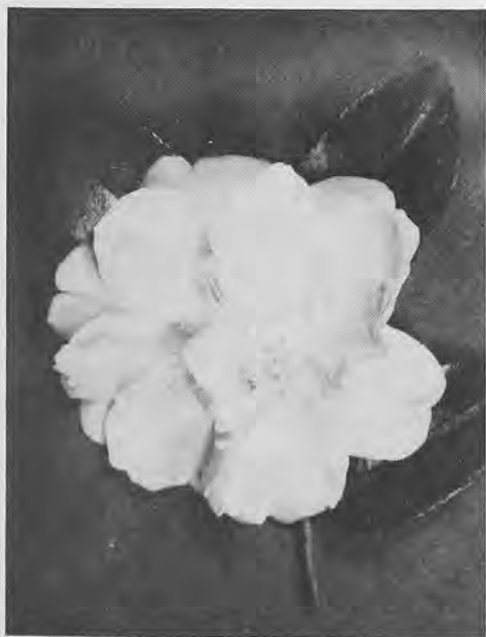


Fig. 8. Strongly scented hybrid of *C. sasanqua* × *C. miyagii*.

However, *C. fraterna* is extremely floriferous. It is not unusual for a mature plant to have six to eight flower buds per node along the entire length of each branchlet (Figure 10). This trait appeared in all 17 hybrids involving this species which have flowered. The largest flowered hybrids of *C. fraterna* are especially attractive and would seem to be potentially desirable garden specimens for a mild climate.

Breeding with New Germ Plasm

Camellia granthamiana, is a species especially promising as a breeding par-



Fig. 9. Hybrid *C.* × 'Fragrant Pink'. (*C. rusticana* × *C. lutchuensis*)

ent because of the strong dominance of the large, elongate, frilled white petals. Hybrids of this species with *C. japonica*, *C. reticulata*, *C. saluenensis*, and *C. sasanqua* are impressive for combining a number of the better floral qualities of their respective parents.

C. hongkongensis possesses a number of attractive vegetative and floral characteristics, perhaps the most striking of which is the vivid purple of newly-developed shoots and leaves. Combined in different ways with characteristics common to the familiar cultivated species, the hybrids of this species present a rather wide range of new forms.

The commercial tea, *C. sinensis*, which many people do not realize is a member of the genus *Camellia*, successfully hybridizes with ornamental species.



Fig. 10. Flowering branches illustrating typical floriferous nature of *C. fraterna* and its hybrids. Left, *C. fraterna*. Right, hybrid of *C. japonica* × *C. fraterna*.

Hybrids have interesting leaf patterns, venation and marginal variation not found among our *Camellia* cultivars. Preliminary tests also indicate that some strains of *C. sinensis* may provide a surprising degree of cold-hardiness in the hybrids.

New Potentials in Breeding

The primary objectives in breeding have been: (1) to investigate the species compatibility relationships within the genus; (2) to find out whether major sterility barriers exist between species and hybrids; (3) to examine the F_1 hybrids; and (4) suggest the most promising species combinations. The potentialities of accumulating desirable characters through hybridization becomes increasingly evident as more interspecific and intergeneric hybrids reach maturity. This is merely the first step. The interspecific F_1 hybrids are in most cases, only the raw materials from which breeding projects with specific goals may be developed.

The majority of the less-known species have not gained prominence because the overall quality of the plants and flowers is inferior to the cultivated forms of *C. japonica* and *C. sasanqua*, already widely accepted. However, it is among these less-known species that desirable traits exist that are now lacking in present garden cultivars. The problem is to transfer the best traits into new hybrids that are commercially acceptable. This is not possible, in most cases, in a single generation.

Selection among second and third generation hybrids probably will be necessary to sift out undesirable characteristics. It is here that selection among large populations may be necessary. The amateur camellia enthusiast can greatly assist in the breeding for new and unusual camellia forms. Scions of all except the most recent interspecific hybrids are available to camellia breeders by writing to the U.S. Plant Introduction Station, Glenn Dale, Maryland 20769. Crossing these hybrids with the more fertile of the commercial cultivars should provide a highly heterozygous seedling progeny. From among these, potentially valuable new types may be discovered which could lead to an entirely new class of garden camellias.

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Producing Camellias With Various Solutions of Gibberellic Acid

W. F. WILSON, JR.

The use of gibberellic acid has become widely accepted as a cultural practice in producing camellia flowers in recent years. This practice increases the size of the blooms and also results in earlier flowering.

Early flowering enables the camellia grower to increase the length of the blooming season and to have large numbers of flowers before the advent of low temperatures which injure the buds and blooms. Persons growing camellias under protected conditions can also control to a degree the blooming dates of the buds of the individual plants.

Potassium gibberellate has been marketed for use on crops of economic importance. This material, however, has not been readily available to growers in the desired concentrations (10,000 parts per million) for use with camellias. Gibberellic acid is not soluble in water, and a common practice among some growers of camellias has been to use ammonia (ammonium hydroxide aqueous solution) or sodium bicarbonate to put the acid into solution.

Effects on Efficiency

It is conceivable that the means of dissolving the acid could affect its efficiency in the final solution. In particular the cation used in several hydroxides

could affect the action on plants. A number of formulations were therefore prepared to study this possibility.

Eighty-five per cent gibberellic acid was used to prepare the 1 per cent solutions in this test. Gibberellic acid is soluble in absolute alcohol and DMSO (di-methyl-sulfoxide). Other solutions were prepared by adding the hydroxide to a mixture of water and gibberellic acid until the solutions cleared and all the gibberellic acid was in solution.

Ten buds on large plants of six cultivars which were growing among large pine trees were used for each treatment. All buds were treated the same day (Oct. 11, 1967). The vegetative bud was removed and a drop of solution was placed in the bud scale "cup." As the buds flowered, the dates of blooming and the diameters of the flowers in inches were recorded. Tables 1 and 2 show the average number of days to bloom and the average diameter of the flowers for the 10 buds of each variety.

Solutions of gibberellic acid formulated with alcohol and DMSO as solvents produced earlier flowers and

Fruit and Truck Experiment Station, Hammond, Louisiana.

(Reprinted from LOUISIANA AGRICULTURE, Fall, 1968)

TABLE 1. Number of Days from Treatment to Bloom of Flower Buds of Six Camellia Cultivars Treated with Six Formulations of Gibberellic Acid

Cultivar	Formulations					
	Na-Gib	NH ₄ -Gib	K-Gib	Ca-Gib	DMSO-Gib	Alcohol-Gib
	Number of days to bloom					
'Dear Jenny'	33.70	34.90	37.60	33.00	31.11	36.20
'Claire Renee'	41.78	36.22	36.70	35.70	37.50	49.90
'Ballet Dancer'	62.56	39.30	44.20	32.10	48.90	51.90
'Don Mac'	71.78	58.00	57.22	54.11	61.63	57.17
'Indian Chief'	67.50	49.90	71.78	53.90	58.10	53.67
'Patience'	90.57	65.78	74.00	59.67	74.22	76.50
Average	61.32	47.35	53.58	44.75	51.91	54.22

TABLE 2. Diameter of Flowers from Buds of Six Camellia Cultivars Treated With Six Formulations of Gibberellic Acid

Cultivar	Formulations					
	Na-Gib	NH ₄ -Gib	K-Gib	Ca-Gib	DMSO-Gib	Alcohol-Gib
	Diameter of bloom in inches					
'Dear Jenny'	5.09	5.07	5.21	5.51	4.90	5.05
'Claire Renee'	4.70	4.24	4.84	4.41	4.70	4.76
'Ballet Dancer'	4.43	4.88	4.55	4.64	4.64	4.65
'Don Mac'	4.74	5.10	5.14	5.28	4.79	4.89
'Indian Chief'	4.97	5.14	5.05	5.25	4.98	4.89
'Patience'	4.60	4.78	4.54	4.78	4.78	4.46
Average	4.76	4.87	4.89	4.98	4.80	4.78

some increase in the size of the blooms compared to untreated blooms. However, they were not as effective as the formulations using hydroxide solutions to dissolve the gibberellic acid.

The solution formulated with sodium hydroxide was significantly less effective

in producing earlier and larger blooms than those using calcium, ammonium, and potassium hydroxides. There were slight differences among the three latter materials in the results obtained but these differences were not statistically significant.

Why Gib Your Camellias?

Discussions on the ethics of using gibberellic acid continue. Much of the opposition comes from California where the climate is mild enough to bloom camellias all winter without protection. The chief advantage of gibbing in the Southeast is that of bringing camellias into flower before frost or hard freezes. Increase in size, crispness and keeping qualities are of secondary importance. Since camellia flower blight has not been reported during the fall season this becomes an additional reason for gibbing.

Until the advent of gibbing, there were few fall shows. Those which were held usually displayed 'Daikagura', 'September Morn', 'Arejishi', 'High Hat', 'Sasanquas' and a few freak out of season blooms of mid-season cultivars. Generally, fall shows do not separate protected and unprotected classes nor treated and untreated blooms. This is a local decision. Greenhouse flowers have no particular advantage over outside flowers before hard freezes occur. Most flowers which bloom in late October through December are assumed to be gibbed.

In most areas subject to sudden low temperatures, often followed by rapid thawing during January to early April, protected flowers have a decided advantage over unprotected. Gibbed flowers in many cases have an advantage over untreated flowers. Gibbing may sometimes have disadvantages such as purpling of deep reds, fading of blush or pink or sometimes the intensification of color which may or may not be advantageous. Gibbing sometimes causes distortions of the form.

The American Camellia Society cannot police shows. The local show committee cannot effectively control the entry of gibbed flowers as ungibbed. It is difficult to prove that a particular flower has been gibbed. Of course, if there is a growth bud removed adjacent to the flower bud and the bud scales are brown, this is a good indication, but often one or more flower buds in a cluster have been removed in disbudding to increase size. This does not necessarily indicate that the bud has been treated. It is possible to inject gib with a hypodermic needle without leaving a scar. An earlier method of gibbing was simply to place a drop between the flower and growth bud.

(Reprinted from THE CAMELLIA JOURNAL,
September, 1969)



Large mature flower bud and adjacent smaller growth bud. Growth bud broken out leaving cup of basal bud scales. Drop of gib being applied to bud cup.

In all cases show committees and judges should be very careful not to accuse someone of gibbing unjustly. We must often take the word of the exhibitor. Separation of chemically treated from untreated into different classes is a local decision. The cost of gib and the time involved in applications is slight.

When to gib? The last week in August or early September is a good time to start gibbing. Gib a few buds on each plant weekly until late fall for out of doors blooms. Greenhouse growers may wish to gib later to produce show quality blooms for January, February and March.

Is it necessary to gib any one bud more than once? Most growers consider one time sufficient, although some claim a second drop of acid increases size if applied two or three weeks after the first gibbing. The base of the gib cup should be scratched so as to allow absorption of the drop.

How to mix and what strength? You may prefer to purchase ready mixed gib. The spray cans sometimes advertised are not very effective on camellias. Either an 11,000 parts per million solution of powdered gibberellic acid or a potassium gibberellate solution are recommended. The latter is readily soluble in water.

For ready mixed gib and potassium gib powder see the following list:

E. H. Sargent & Co.
3125 Seventh Ave., N.
Birmingham, Ala. 35201
Also: 1617 East Ball Rd.
Anaheim, Calif. 92803
Also: 5815 Peeler St.
Dallas, Texas 75235

Fisher Scientific Co.
690 Miami Circle, N.E.
Atlanta, Ga. 30319
Also: 633 Greenwich St.
New York, N. Y. 10014
Also: 7722 Fenton St.
Silver Spring, Md. 20910
Also: 4102 Greenbriar Dr.
Houston, Texas 77006

W. H. Curtin & Co.
1782 Marietta Blvd., N.W.
Atlanta, Ga.
Also: P. O. Box 1546
Houston, Texas 77001

Van Water & Rogers, Inc.
1363 So. Bonnie Beach Pl.
Los Angeles, Calif. 90054

Gib acid is not soluble in water but by adding a few drops of non-sudsing household ammonia or sodium bicarbonate to make a weak alkaline solution the gib can be forced into solution. A gram of acid makes about 65cc. of solution. Add a few drops of alkali to the mixture and shake vigorously. It is important not to add more alkali than is necessary to force into solution. Once in solution keep refrigerated. The dry powder keeps indefinitely without refrigeration but should be stored in a cool dark place.



PHOTOS, T. K. SHARMA

Fig. 1. Flower heads of moss verbena (*V. tenuisecta*, left) and garden verbena (*V. × hybrida*, right).

Free Flowering Hybrid Verbenas

T. N. KHOSHOO AND O. P. ARORA

Garden verbena, *V. × hybrida*, is one of the very popular ornamentals, primarily used as a bedding annual all over the world, including the plains of North India, where it is at its best in winter months from January to March; with the rise in temperature, plants dry up by the beginning of April. Therefore, the period of its beauty lasts about three months of the year. Another species, *V. tenuisecta*, commonly called moss verbena, grows throughout the year and is a hardy herb requiring little care. It is usually used as a ground cover for rockeries, blooming almost continuously except in December, the coldest month of the year.

V. × hybrida is semi-erect with large (5-7 cm across), compact (5-6 cm long), flat flower heads of about 14 to 42 flowers per head (Fig. 1, right). Flowers are large (2 cm in diameter, Fig. 3, left) and there is a considerable range in flower color. Flowers may be single or bi-colored; in the latter case, they may be

striped or have a white eye in the middle. On account of these properties, garden verbena ranks very high among the annual ornamentals, particularly for mass color effects in beds and borders. Its performance as a pot plant is also very good, and white flowered varieties are faintly and pleasantly odorous.

In strong contrast to garden verbena, moss verbena is low growing, with a matting habit, and possesses small (3-4 cm across), elongate (16-20 cm long), dome-shaped flower heads with 45 to 60 flowers per head (Fig. 1, left). There are only three colors, white, geranium lake 20/3, and phlox purple 632 (color charts of the Royal Horticultural Society). The flowers are small in size—1.2-1.3 cm across (Fig. 3, right).

Dr. Khoshoo and Mr. Arora of the Genetics Laboratory, National Botanic Gardens, Lucknow, India, along with other members of the Laboratory, are currently working on a project, "Origin, evolution and improvement of ornamentals," and have obtained interesting and fruitful results.



Fig. 2. Flower heads of the four hybrids.

Hybrid Verbena

The two species were hybridized with a view to evolving new cultivars that could grow and flower throughout the year, with a matting habit and rather large and colorful flowers. Since 1966, selection for plants combining the above useful characters of the two parents was made among a large number of F_1 hybrid combinations and backcross progenies. Five such hybrid lines were selected and all of them have a near matting habit and flat to dome shaped flower heads that are 3.5 to 6 cm across, and 5 to 8 cm long (Fig. 2). Each flower head has about 25 to 60 flowers that are almost intermediate in diameter (1.3-1.6 cm across, Fig. 3). Although a large number of color combinations is possible, the present five hybrids, following the color charts of the Royal Horticultural Society, are white, geranium lake 20/3, geran-

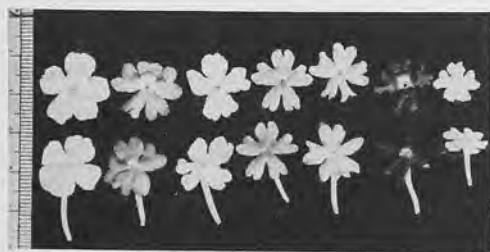


Fig. 3. Representative flowers of garden verbena (extreme left), moss verbena (extreme right), and the 5 hybrids (in between).

ium lake 20/2, scarlet 19/1 and imperial purple 33. The last three have a white eye in the flower center. The floral characters of the hybrid, along with parents, are summarized in Table 1.

Male Sterility in Hybrids

The F_1 hybrids are totally male sterile, i.e. only sterile pollen is present in stamens. However, they have a high degree of female fertility. Male sterility has arisen as a result of the interaction between the genes of the two parents (Arora and Khoshoo, 1967). The latter property has been advantageously utilized in backcrossing F_1 progeny with the parents, particularly $V. \times hybrida$, in order to enhance the ornamental value of the former. Among the backcrosses, five totally male sterile lines with desired characters were isolated. These have survived the last three summers under routine conditions of garden care in Lucknow, and maintenance of such lines is possible because of a strong tendency for vegetative propagation found in them.

As a result of male sterility, there is no seed set unless the parental species or male fertile lines grow in sufficient proximity and pollinators are readily available. Male sterility makes the hybrids very free flowering, and flower heads keep on appearing in constant succession (Fig. 4) except in the hottest months (May-July), when flowering is considerably reduced. Furthermore,

male sterility not only induced a longer blooming period in comparison with male fertile lines, but flowers in male steriles also tend to remain fresh for a longer period (Khoshoo, 1968).

Conclusions

From the above it is clear that the five hybrid derivatives combine the hardy characters of moss verbena, which enable growth all year round and survival in summer, with rich color diversity of garden verbenas. Their flower heads, flowers, habit and foliage (Fig. 3 and 5) are nearly intermediate between the parents in size and qualitative characters. Added advantage is male sterility which on one hand makes hybrids free flowering, and on the other, helps flowers to last longer. The hybrids perform reasonably well as bedding plants and as ground cover in rockeries, which become very colorful in comparison to those where only moss verbena is grown. The hybrids can be propagated vegetatively



Fig. 4. General view of a hybrid.

in all seasons except in extreme summer and winter temperatures.

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Fig. 5. Representative leaves of garden verbena (extreme left), moss verbena (extreme right), and 5 hybrids (in between).

TABLE I
FLOWER CHARACTERS OF PARENTS AND HYBRIDS

Plant	Blooming period (months)	Flower head			Diameter of flower (cm)
		Diameter (cm)	Length (cm)	No. of flowers	
Garden Verbena	3 (Jan.-March)	5-7	5-6	14-42	2
Moss Verbena	11 (Jan.-Nov.)	3-4	16-20	45-60	1.2-1.3
Hybrids					
<i>Selfs</i>					
White	10 (Jan.-April and July-Dec.)	5-6	5-6	30-40	1.5
Geranium lake 20/3	"	4-5	7-8	30-45	1.5
<i>Oculates</i>					
Geranium lake 20/2	"	5-6	5-7	30-40	1.6
Scarlet 19/1	"	5-6	5	25-40	1.6
Imperial purple 33	"	3.5-4.5	7	40-60	1.3

Fig. 1. North Terrace of the gardens of the Historical Society of Talbot County, Maryland, looking through the Charleston Gate. Handsome English walnut shades the terrace.

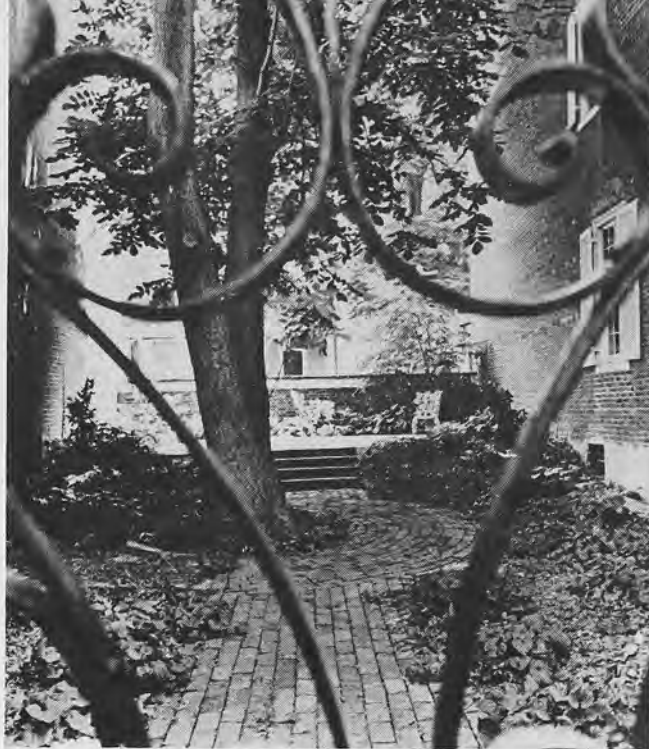


PHOTO EASTON MARYLAND STAR DEMOCRAT

An 18th Century Garden in Talbot County, Maryland

MRS. JOHN E. JACKSON¹ and
MRS. DORIS R. REND¹

Gardens that emphasize the history of their community are uniquely interesting and serve an educational purpose as well. Such a garden is the one created by Talbot County Garden Club around the Headquarters of the Historical Society of Talbot County on the main street of Easton, Md., just one block south of the 18th century Talbot County Court House. Initiated in 1959, and expanded as more land became available, it has now grown into three gardens, each one an area of seasonal bloom or year-round restful green, providing pleasure to all passers-by and some much needed open space in the business district. These are facsimiles of colonial gardens.

These gardens were awarded the Governor's Silver Bowl and a check for \$400

¹ Co-Chairmen, Garden Committee of the Talbot County Garden Club and the Historical Society of Talbot County, Md.

as top prize for "the most outstanding Civic Development Project" in a 1968 state-wide contest sponsored jointly by the Maryland State Federation of Garden Clubs and Sears Roebuck and Company.

From the beginning, the gardens have been supervised by Garden Club members, one of whom is a landscape architect, and have had the support of the community, with many individual and group gifts of talent, service, and money. More recently, management has been under a joint committee from the Garden Club and the Historical Society. Continuity of planning has preserved the original intent to keep gardens in harmony with the 18th century, which dates the major growth of Talbot County, although its origin was 17th century.

The story of the gardens properly begins in 1956 when the Historical Soci-



Fig. 2. South Terrace with picket fence showing finial representing Wye Oak acorn.

ety of Talbot County purchased for its headquarters an old brick house on a corner lot, facing the main street of Easton. Built in 1795 and greatly in need of repair, it was scheduled for demolition to make way for a parking lot. On each side of the building was a 25 foot wide plot of badly eroded ground, and a similar plot at the rear. The Garden Club contributed \$4,500 toward the purchase of the property and when the restoration was completed they were granted the privilege of establishing their headquarters in an attractive room on the second floor.

Creating the Gardens

In 1959 the Garden Club allotted \$3,000 for a garden wall to enclose the street sides of the property. The brick portions, made of century-old rose-colored brick, are a replica of the famous cemetery wall at Wye House, most historical home in the county, and on the Eastern Shore. For the most part the wall is low enough to afford views of the gardens from the street. The picket fence was copied from the Chase-Lloyd House in Annapolis. Post finials are enlarged forms of the acorns of the celebrated Wye Oak, oldest white oak in the United States, and Maryland's state tree. Sections of a simple white picket

fence pleasingly break the brick wall and feature a large American linden and two enormous sycamores.

The South Terrace Garden

In 1961, with funds left from building the wall, the Garden Club constructed a small terrace garden on the south corner of the property, complete with four brick steps and retaining walls. This garden presented special problems because of a five-foot drop resulting from erosion and daily foot traffic. The state furnished eleven truck-loads of fill. Plantings are those that would have been found in an 18th century garden: Ivy, *Vinca minor*, English boxwood, flowering white cherry, lily-of-the-valley, crocus, and French and Roman hyacinths. A handsome white Chippendale bench is the center of interest. Made in the local high school, of cypress wood and doweled instead of nailed, it is one of five memorial benches in the gardens.

The North Terrace Garden

During 1961 and 1962 the Garden Club appropriated funds to build a terrace garden on the north side of the house. Bricks from re-constructed Easton sidewalks form the herringbone pattern of the terrace and the walkway leading



Fig. 3. South Terrace. In view are American linden (*Tilia americana*), brick wall, which is a replica of the famous Wye House Cemetery wall, Chippendale Memorial Bench, and boxwood from Wye House and Fairview.

to it though a handsome New Orleans wrought iron-gate, another memorial gift. Columns for the gate are of bricks from the old County Almshouse, previously the first integrated school (1695) on the Eastern Shore. A large English walnut in the center of the walk furnishes ample shade for this almost all-green garden. Plantings include hosta, daffodils, violets, *Vinca minor*, camellias, *Styrax japonica*, day lilies, dogwoods, and a yellow-wood tree (*Cladrastis lutea*). White wrought-iron furniture on the terrace makes this little garden inviting.

The lawn area below the South Terrace Garden has a wall border of golden flowered *Kerria japonica*, pale yellow forsythia, daffodils, a very fragrant yellow rose of unknown name, boxwood trees, winter flowering violets, bridal wreath, hollyhocks, and blue wisteria. *Clematis jackmanii* climbs over the porch rail, and at the kitchen door a white wisteria reaches to the roof and is spectacularly beautiful in May. A seedling *Sophora* tree stands beside the double gate.

In 1961, to protect its north side, the Historical Society purchased an adjacent store building, 25 feet wide, with a nar-

row strip of land at the rear extending through to West Street and including there a small 18th century dwelling. In 1964 the Society's property was further expanded by a generous gift from one of its members for the purchase of a row of five dilapidated houses west of and adjacent to the original property. Included in the purchase was a sixth small house facing on West Street, of 18th century origin and with definite restoration possibilities. When the other five were razed, a large new potential garden area was opened up. This, together with the earlier store purchase, brought the overall property lines to 100 feet x 300 feet.

The narrow strip of land, 25 feet x 210 feet, that came with the store property is bordered with fruit trees, including 'Seckel' and 'Barrie d'Anjou' pear, 'Haas' apple, 'Fameuse' apple, 'Montgomery' cherry, 'Green Gage' plum, and flowering crabapple. All of these were used in a Federal period garden. An attractive split-rail maple fence, erected for the Society by the town of Easton, together with a row of holly osmanthus, like the ones at Mt. Vernon, edges the north boundary of this area and screens off a parking lot. Hundreds of old-fashioned daffodils are planted here.



Fig. 4. West corner Historical Society house showing old settle, kitchen door, with white wisteria climbing to the roof.

The large area that was opened up when the houses were razed was seeded and fenced and laid out for an 18th century garden. Steps from the upper level are the stone sills from the Hanson Street School building. A grass walk, 20 feet wide, centered on the Society's front to rear hallway, was planted the full length of the plot with 100 small English boxwoods, planted 4 feet apart and flaring out in a half hour-glass pattern in

the rear. Along the fence are larger boxwoods, white-flowered horse-chestnuts (*Aesculus hippocastanum*), old fashioned lilacs, pale pink 'Near East' crape myrtles, fruiting pomegranates, forsythia, bridal wreath, a varnish tree (*Koelreuteria paniculata*), that blooms in mid-summer, many day lilies and white crapemyrtle to round out the bloom from spring to fall. To the right of the boxwood allee is a 72-foot long bed of old roses, a memorial planting consisting of thirty-three cultivars of famous and almost forgotten damask and centifolia cultivars of delightful fragrance, plus shrub, moss, and bourbon cultivars as well. Some of these have been known for over five hundred years and are of Chinese, English, and French origin. They are hardy roses and, like the plantings in the other two gardens, flourish without benefit of poisonous sprays. Even the trees must rely on the birds, for the town of Easton avoids the garden in their insect control program.

Custodians of the gardens are serious horticulturists, and they insist that the old-fashioned flowers, trees, vines, and shrubs not only make a beautiful garden but also will respond vigorously to the following practices: proper planting, suitable ground cover, mulching with pine needles, straw, and old sawdust; feeding with animal manure, bone meal, ground oyster shell, limestone, and cotton seed meal; and slow watering with

Fig. 5. West Garden, showing clump of Kentucky coffee tree (*Gymnocladus dioica*), which was George Washington's favorite tree; small boxwood, 'Near East' crapemyrtle, and fruiting pomegranate.



soil soakers in time of drought. The soundness of their theories is evident in these colonial gardens as they now are.

Today the gardens represent ten years of planning and work. Progress has not always been easy. The first five years of spectacular growth were followed by three discouraging years when there were no funds for development and even daily maintenance became a problem. In 1966 the Horticultural Committee of the Garden Club took up the challenge. Their fifteen members invested and re-invested their small funds in popular re-sale items, rooted boxwood for sale, and, with the help of the Historical Society, put on several successful plant and garden accessory markets. They reduced the cost of maintenance by scheduling regular spring and fall work days at the gardens, taking their own tools and stopping only for lunch in the old kitchen. Their energy and enthusiasm were contagious. The town of Easton and the Historical Society co-operated fully and by 1967 there were numerous memorial gifts for special projects and some group contributions as well. The garden received in 1968 the special House and Garden Pilgrimage Bonus of \$400, and in 1969 the \$400 award from Sears Roebuck Company. From an almost hopeless stall in 1966, the gardens now have the nucleus of a Trust Fund, administered by the joint committee,



Fig. 6. West garden, with white crape myrtle, medium boxwood, and small boxwood.

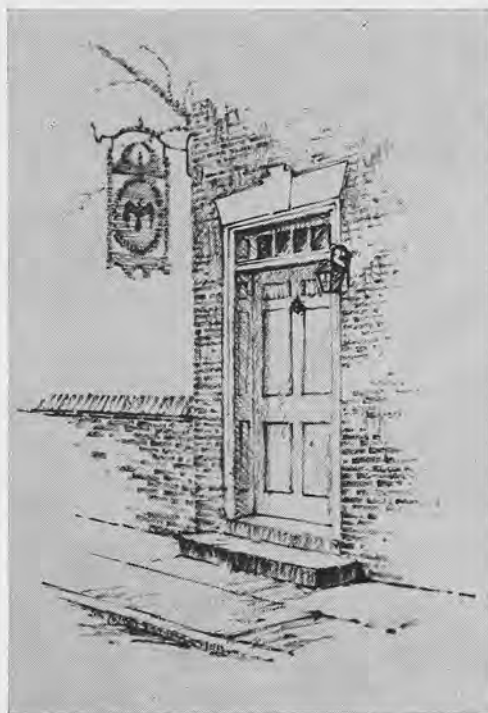


Fig. 7. John Moll drawing of entrance to the 18th Century Historical Society headquarters on South Washington Street, Easton, Maryland.

and is already looking forward to the day when the wall can be continued on Glenwood Avenue, stepped down to conform to the slope of the street and low enough for visual enjoyment of the gardens from the street. Two gifts have been made for a fountain, and a suitable one is being sought. Restoration of the store building and the two little 18th century houses would definitely enhance the interest and beauty of the gardens.

When so many people can work harmoniously toward a common goal as exemplified here, a noteworthy achievement in community involvement results. The gardens belong to all who helped to develop them and to everyone who enjoys their beauty. A local taxi driver calls them "the Flower Place." The gates are never locked, wall and fence are for dogs only, and there are many places to sit. Friendly neighborhood children and adults keep a watchful eye for vandalism. With so much loving care, the gardens flourish, undisturbed, and meaningful.

Natural and Chemical Control of Insects

JOHN C. SCHREAD

We are privileged to be living during the most advanced and productive age the world has known. Perhaps some of the achievements would have been nearly impossible if it were not for the development of a constantly widening spectrum of synthetic organic pesticides. It has been repeatedly demonstrated that many of these materials provide an easier and, a more certain control, of destructive pests.

As a result of the use of the newer pesticides, the ever present threat of disease to human beings and animals has been vastly lessened. Moreover, in many agricultural areas of the world crop production has been accelerated considerably over what it was a decade ago. An important contributing factor towards greater crop yields per acre has been the use of herbicides to suppress or completely eliminate unwanted plants; insecticides to control noxious insects; fungicides and nematocides for plant diseases and nematodes; and, additional materials used to halt virus and bacterial diseases of plants and animals. Adverse weather conditions and predators, parasites and microbial pathogens also play an important role in the suppression of noxious insect pests.

Homeowners' Need for Protection Against Insects

The increase in the number of small homeowners in recent years, in addition to the trend towards a more garden-conscious public, has created a greater demand for seeds, garden plants, trees, shrubs, and garden supplies. As a result extensive acreage of a single plant spe-

cies or several or more varieties of a species are grown in nurseries. Furthermore, new cultivars are being introduced from abroad, or developed in this country considerably augmenting the long list of plants available.

Although certain species of plants appeared to be almost free from insect enemies and diseases when grown alone or in small numbers, the recent increase in their culture has occasionally resulted in a phenomenal rise in insect pests. The increased population of black vine weevil and scale insects, that may kill many cultivars of *Taxus* and broadleaf evergreens, can be traced to the increase in host plants. New insecticides used to control the pests often resulted in the destruction of parasites and predators that help to hold noxious insects at low population levels. When the natural enemies of noxious insects are eliminated agricultural interests must then rely upon the continuous use of insecticides to assure an insect free crop.

Once a pest gets a foothold in a neighborhood park or recreational area it may spread from place to place doing considerable damage before its presence is recognized. It is advisable to be alert to the probability of their presence and to cope with them whenever they occur. Assistance in identifying a problem may be obtained from state experiment stations or a local county extension service.

Natural Control Birds and Mammals

A number of species of native and migratory song birds feed upon insects. Noteworthy among them are the purple grackle, European starling, English sparrow, cardinal, meadow lark, catbird,

Entomologist, Connecticut Agricultural Experiment Station, New Haven.

crow, robin, flicker, and the common sea gull. These and other species consume large numbers of insects which they extract from turf by scratching or pecking holes in infested lawns, and also from weeds, flowers, trees, shrubs, and row crops. In addition birds carry the insects back to the nests to be fed to their young. The sparrow, more often than other birds, dines upon adult Japanese beetles. They snatch them from foliage or capture them in flight and immediately drop to a hard surface such as a sidewalk where they crack the hard shell by pounding the beetle against the pavement. As the external skeleton of the insect weakens and breaks open the bird quickly swallows the exposed and more tender vital organs in much the same manner that man consumes the meat of an English walnut but rejects the shell.

More than 60 percent of the diet of the purple grackle during the spring season may consist of Japanese beetles. It has been reported that European starlings have reduced heavy grub populations in turf 95 percent. Chickens, ducks and turkeys greedily snatch at grubs and other insects as they are turned up during plowing or spading operations in the spring. Crows and sea gulls pull up tremendous numbers of small plugs of turf in search of insects, leaving most untidy and disordered greensward. Birds follow moving machines to snatch at scattering insects. In fact, in the final analysis birds are of inestimable value in nature's uninterrupted fight against the insect menace.

Skunks, ground moles, field mice and shrews consume enormous quantities of soil insects, frequently ridding large areas of turf of unwelcome guests.

Insect Parasites and Predators

Perhaps the largest percentage of insect species on earth are the beneficial parasites and predators. Many of them are very small and quite inconspicuous as they go about their daily job of keeping noxious insects under control. For this reason, most of us are unaware of their presence. Some species attack the eggs of their host while others destroy

the larval and nymphal stages. Many parasites and predators concentrate on the pupa and adult stages of insect pests. Unfortunately secondary parasitism may occur among certain parasitic species. This very often defeats the efforts of the primary parasite. For example, hyperparasites of the primary parasites of the Japanese beetle have been observed in the Far East. Fortunately they have not been introduced into the United States.

Bacterial and virus diseases of insects are not uncommon. A bacterium referred to as the "Milky White Disease" has been artificially propagated and released in Japanese beetle infested areas east of the Mississippi River. Although at first it may be unpredictable in its effectiveness, it has given material support to other biological agencies in the fight against the insect. A nuclear-polyhedrosis virus called the "Wilt Disease" kills many larvae of the gypsy moth. It also infects the feeding stages of other lepidopterous insects.

Pesticides

During the past twenty-five years, innumerable pesticides have been developed in the United States and abroad. This diversified class of chemicals will kill or repel insects and prevent, or control, plant diseases. Among these chemicals are insecticides, fungicides, herbicides, miticides, nematocides, and others. In the years following the second World War, accelerated research broadened our knowledge of organic compounds intended for the protection of plants, animals, and man. Prior to that time inadequate control of pests occurred throughout the world. Loss of crops and livestock and, certain debilitating and fatal diseases of man challenged research organizations to develop more effective means of protection against insects and disease. We now produce more abundant insect-free crops over greater areas of the world than in all of the history of man. Several materials partly responsible for this phenomenon are malathion, sevin, methoxychlor, kelthane, ovex, Tedion®, etc. These are the materials that may be used

on edible and ornamental plants in home gardens.

At the present time there are fewer new pesticides available for experimental trials than there have been for a number of years. Pesticides are tested repeatedly in an effort to find more effective and less toxic materials; and, to replace pesticides to which insects have developed resistance. Apparently some of the more recent experimental materials are comparatively safe compounds. These may in time be cleared for registration by the U.S.D.A. and subsequently released for general use. On the other hand, highly toxic materials may never be available for use by anyone except specialized personnel.

Protection Observed in Handling Pesticides

Pesticides must be used according to the manufacturer's directions relating to safe and proper handling, carelessly handled they are dangerous. Pesticides may poison man or animals, by inhalation, swallowing, and skin absorption. Every precaution must be taken to make certain that persons who handle them are fully informed of their toxicity. Users must also know that the effects of repeated exposure to some materials may be cumulative. Other pesticides may cause a rapid and violent reaction when carelessness occurs in their use.

Pesticide packages are labeled. Therefore, the first step in using their contents is to read the label carefully. It states the type of pesticide, the purpose for which it has been developed, the quantity to use on specific plants and the precautions necessary for safe handling.

The protection of persons intending to use pesticides is of paramount importance, especially when continuous, long-time utilization and exposure is necessary. A respirator is the most useful

piece of protective equipment. In some instances goggles should be worn to protect the eyes from dusts, mists, and larger spray particles. Hands should be protected with rubber gloves. A gauntlet type for wrist and forearm coverage is best.

Operators of large equipment (for tree, orchard, and turf spraying) should be protected by a rubber or heavy canvas coverall—trousers and jacket with attached cape or rubber hat. Under some conditions a plastic shield may be worn to protect the exposed areas of the face and neck. (In this instance goggles are unnecessary.)

Users of pesticides are advised not to smoke or eat while handling pesticides. Users should remove protective clothing and wash the exposed areas of the body before eating. When clothing becomes accidentally covered with spray material it should be removed as quickly as possible and thoroughly washed before it is worn again.

Do not use glass or metal containers for any purpose other than to hold pesticides placed in them by the manufacturer. When empty, break glass containers and bury fragments. Knock holes in metal containers.

It is extremely important that all pesticides be under lock and key or on a high shelf where children and animals cannot reach them. When small quantities of pesticides are left over at the end of the season they must be stored in their original containers—never transfer them to other containers such as milk or pop bottles when liquids are indicated, or to empty paper, metal or cardboard containers in which foodstuffs were originally packaged.

Finally, when the pest control operation has been completed remove work clothes, shower or bathe and put on clean clothing. Neither man nor animal should sleep in an area where pesticides are stored.

A Pesticide Table Developed to Show Toxicity and Hazards

(The following table is reprinted with permission from *Arnoldia*, Vol. 30, No. 2, Mar. 15, 1970, a publication of the Arnold Arboretum of Harvard University, Jamaica Plain, Massachusetts.)

The table has been compiled from a number of sources, notably *Agriculture Handbook 331* and the *Pesticide Information Manual*. It is intended to give some idea of the hazards to man and to the environment that are inherent in some of the insecticides in use today. LD₅₀ is the amount of chemical in micrograms of chemical per kilogram of body weight needed to kill one half of a population of laboratory animals. The smaller the number, the more lethal the substance.

Pesticide	LD ₅₀	Rats	Toxicity		Bees	Persistence	Hazards		Applicator
			Fish	Birds			Wildlife	Environment	
Abate ^I	2,000	slight	high	moderate	?	?	?	?	moderate
Acricide-see Binapacryl									
Aldrin ^I	39-60	high	10-14 high high	high	high	long	yes	yes	yes
Allethrin ^I	480	slight	high	slight	slight	short	(fish)	?	slight
Anthon-see Trichlorfon									
Aramite ^A	3,900	slight	480-730 slight high	slight	slight	21-30 days	?	?	? known carcinogen yes
Azinphosmethyl ^I	16-80	high	high	moderate	high	1 season	yes trained operator	yes only	yes
Baytex-see Fenthion									
Bidrin ^I	22	high	high	high	high	30 days	Not at recommended application		yes
Binapacryl ^{I, F, A}	58-63	moderate	high	slight	slight	several weeks	yes	yes	moderate
Black Leaf 40-see Nicotine									
Butocide-see Piperonyl butoxide									
Captec-see Dicapthion									
Calcium arsenate ^I	40-298	high			high	long			yes
Carbaryl ^I	500-850	slight	moderate	slight	high	3-4 months	relatively low		low
Carbophenothion ^{I, A}	10-30	high	moderate	high	moderate	7-21 days	yes	yes	yes
Chlorbenseid ^{I, A}	2,000	slight	?	?	?	one season	?	?	low
Chlordane I	335-430	moderate	high	moderate	high	long	yes	yes	moderate
Chlorobenzilate A	1040-1220	slight	moderate	slight	moderate	7-10 days	low	possible	low
Chlorthion-see Dicapthion									
Ciodrin I	125	high	moderate	moderate	high	1-3 days	low	?	yes
Compound 338-see Chlorobenzilate									
Co-Ral-see Coumaphos									
Coumaphos ^{S, I}	15-41	moderate	moderate	high	moderate	one season	yes	yes	low
Cygon-see Dimethoate									
DDD ^I	2,280	slight	high	moderate	?	long	yes	yes	no
DDT ^I	113-118	moderate	high	moderate	moderate	long	yes	yes	slight
DDVP-see Dichlorvos									
Delnav-see Dioxathion									
Demeton ^{S, A, I}	2-6	high	moderate	moderate	minimum	one season	yes trained operator	low only	yes
Diazinon	76-108	moderate	high	high	high	two months	(birds)	?	yes

I = Insecticide, A = Acaricide, F = Fungicide, S = Systemic.

Pesticide	LD ₅₀	Rats	Toxicity Fish	Birds	Bees	Persistence	Hazards		Applicator
							Wildlife	Environment	
Dibrom-see Naled									
Di-Captan-see Dicapthon									
Dicapthon ^I	500	moderate	moderate	?	?	4-5 weeks	?	?	?
Dichlorvos ^I	56-80	high	moderate	slight	high	1 day	slight when used as directed		yes
Dicofol ^A	1000-1100	moderate	high	slight	minimum	months	no	no	low
Dieldrin ^I	46	high	high	high	high	long	yes	yes	yes
Dimecron-see Phosphanamidon									
Dimethoate ^{S,A,I}	215	moderate	moderate	high	high	1-3 months	yes	yes	yes
Dioxathion ^{A,I}	23-43	high	high	high	minimum	6 months	yes	yes	yes
Dipterex-see Trichlorfon									
Disulfoton	2-7	high	high	moderate	moderate	one season	yes	yes	yes
Di-Syston-see Disulfoton									
Dithio-Systox-see Disulfoton									
DNBP ^{A,I}	37-60	high	high	high	?	short	yes	yes	yes
DN-289-see DNBP									
Dylox-see Trichlorfon									
Elgetol-318-see DNBP									
Embathion-see Thion									
Endosulfan ^I	18-43	high	high	high	moderate	one season	yes	yes	moderate
Endrin ^I	5-18	high	high	high	moderate	long	yes	yes	yes
EPN ^{I,A}	7-36	high	moderate	high	high	3 months	yes	yes	yes
Entex-see Fenthion									
ERN-300-see EPN									
Ethion ^{I,A}	27-65	high	high	?	minimum	one season	yes	yes	moderate
Fenthion ^{A,I}	215-245	moderate	moderate	high	high	2-3 months	yes	yes	yes
Genite	500	slight	slight	slight	minimum	30 days	slight	slight	slight
Guthion-see Azinphosomethyl									
Heptachlor ^I	100-162	moderate	high	high	high	long	yes	yes	slight
HETP-see TEPP									
Isomeric-see Dicapthon									
Kelthane-see Dicofol									
Kepone ^{I,F}	125	moderate	high	moderate	?	one season	yes	yes	? no
Korlan-see Ronnel									
Lead arsenate ^I	10-1050	high				long			yes
Lindane ^I	88-91	moderate	high	moderate	high	long	yes	yes	? low
Malathion ^I	1000-1375	slight	high	high	high	2-4 weeks	yes	slight	yes
Marlate-see Methoxychlor									
Meta-Systox R-see Oxydemeton									
Methoxide-see Methoxychlor									
Methoxychlor ^I	5,000	slight	high	slight	minimum	long	yes	?	slight
Mevinphos ^{S,A,I}	3-6	high	moderate	high	?	1-3 days	yes	yes	yes
Mitox-see Chlorbenside								trained operator only	
Morestan ^{F,A}	1100-1800	slight	?	moderate	minimum	2 months	yes	yes	low
Morocide-see Binapacryl									

Pesticide	LD ₅₀	Rats	Toxicity Fish	Birds	Bees	Persistence	Hazards		Applicator
							Wildlife	Environment	
Naled ^I	250	moderate	moderate	moderate	high	1-4 days	low	low	moderate
Nankor-see Ronnel									
Neguvon-see Trichlorfon									
Nialate-see Ethion									
Nico-Fume-see Nicotine									
Nicotine ^I	50-60 83	high	high	slight	minimum	one day	low	low	yes
Orthotran-see Ovex									
Ovex ^A	2000-2050	low	moderate	?	minimum	one month	?	?	low
Ovotran-see Ovex									
Oxydemetonmethyl ^{I,A}	65-75	moderate	moderate	moderate	?	3 weeks	yes	yes	yes
Pallethrine-see Allethrine									
Parathion ^{I,A}	3-13	high	high	high	high	1 month	yes trained operator	yes only	yes
Paris green		high				long			yes
Piperonyl butoxide	7500- 11,000	low	high	low	?	?	?	?	?
Phorate ^I	1-2	high	high	?	moderate	2 months	yes	yes	yes
Phosdrin-see Mevinphos									
Phosphamidon ^{S,I,A}	16.5-23	high	moderate	high	high	3-5 days	yes	yes	yes
Pynamin-see Allethrin									
Pyrenone-see Piperonyl butoxide with pyrethrins									
Pyresin-see Allethrin									
Pyrethrins	1,500	slight	high	slight	minimum	contact	no	no	no
Resitox-see Coumaphos									
Rothane-see DDD									
Rogor-see Dimethoate									
Ronnel ^{I,A}	1250- 2630	moderate	?	slight	moderate	2 months	no	no	no
Rotenone ^I	50-75	moderate	high	slight	minimum	1 month	(fish)	(water)	no
SD 3562-see Bidrin									
Sevin-see Carbaryl									
Sodium arsenite						long			
Spectricide-see Diazinon									
Systox-see Demeton									
TDE-see DDD									
Tedion-see Tetradifon									
TEPP ^I		high	high	high	high	1-3 days	yes trained operator	yes only	very
Tetradifon ^{I,A}	14,700	slight	moderate	slight	minimum	2-4 weeks	low	low	low
Thimet-see Phorate									
Thiodan-see Endosulfon									
Thiodemeton-see Disulfonon									
Tiguvon-see Fenthion									
Toxaphene ^I	90-80	moderate	high	moderate	minimum	long	yes	yes	low
Trichlorfon ^{S,I}	450-500	slight	moderate	high	minimum	1 week	(birds)	?	moderate
Trithion-see Carbophenothion									
Trolene-see Ronnel									
Vapona-see Dichlorvos									
Vapotone-see TEPP									
Zectran	25-37	high	high	?	high	?	yes	yes	moderate

The American Horticultural Society 1970 Awards and Citations

Nine distinguished leaders in the field of horticulture received the Society's annual awards for excellence during the Awards Dinner of the 25th American Horticultural Congress at Miami Beach, Florida, Nov. 4.

The Society's awards program, in recognizing the outstanding leaders in the horticultural field, emphasizes and encourages standards of excellence for all horticulture.

Members of the 1970 Awards and Citations Committee were: Frederick Heutte, Norfolk, Virginia; Mrs. Elsa Knoll, Menlo Park, California; Mrs. Julian W. Hill, Vinyard Haven, Massachusetts; Victor Ries, Columbus, Ohio; and Mrs. Francis Patteson-Knight, McLean, Virginia. The committee was chaired by Dr. Fred B. Widmoyer, Las Cruces, New Mexico.

The Liberty Hyde Bailey Medal to Dr. Aubrey C. Hildreth, Denver, Colorado

A pioneer in developing suitable horticultural techniques for the Rocky Mountain States.

Dr. Aubrey C. Hildreth retired as Director of Denver Botanic Gardens in 1966 having assumed that position immediately after retiring from the Central Great Plains Field Station at Cheyenne, Wyoming in 1959.

His thirty years of service at the Cheyenne station was twice interrupted. He was in charge of the U.S. Department of Agriculture's Guayule Research Project in California during World War II and later, served for two years in Afghanistan on a foreign aid mission for the U. S. State Department.

The recipient of many awards and honors for his horticultural attainments. Dr. Hildreth received his Ph.D. Degree from the University of Minnesota. His Bachelors Degree in agriculture was earned in his native state of West Virginia at the University in Morgantown.



Citation to Dr. George S. Avery, Quaker Hill, Connecticut

For contributions to the advancement of botanical gardens and arboretums.

Dr. George Sherman Avery, who for an eventful 25 years was director of Brooklyn Botanic Garden, is a professional botanist, researcher, author, teacher and interpreter of botany and ornamental horticulture.

A graduate of Tulane University, he received his Master's degree from Dartmouth and his Doctorate from the University of Wisconsin. He has served as a consultant for local and national garden clubs and on matters pertaining to organization and maintenance of botanic gardens here and abroad.

As president of the Botanical Society of America (1957) and through personal crusades and involvement he has furthered the establishment of many new botanic gardens and arboretums.



Citation to Dr. Martin J. Bukovac, East Lansing, Michigan

For his research contributing to an understanding of plant activities by the use of growth regulators and radioisotopes.

Dr. Martin J. Bukovac, Professor of Horticulture at Michigan State University is known internationally, for research activities that have given a better understanding of such horticultural problems as the foliar uptake of plant growth substances and the chemical controls of flower and fruit development and of abscission.

He has contributed to international congresses, served as visiting lecturer in Japan, and as an advisor to the International Atomic Energy Agency in Vienna.

In 1965-66 he was NSF Senior Postdoctoral Fellow at the Universities of Oxford and Bristol and also in 1966 presented seminars at a number of European universities.



Citation to Lester Rowntree, Carmel, California

For her contribution to the knowledge, distribution and perpetuation of native plants.

Mrs. Rowntree is one of the legendary figures of horticulture in this country. Now over 90 years old, she planted her first wildflower garden at her home in England at the age of two years.

Lester Rowntree launched a professional seed and plant collecting career with botanic gardens, arboretums and private individuals as customers. She has collected in almost every state, financing her collecting trips by giving addresses at garden clubs and schools.

Mrs. Rowntree is the author of *Flowering Shrubs in California* and *Hardy Californians* and numerous articles in magazines and scientific journals. She has also written several entertaining children's books.



Citation to Kathleen V. Nelson, Bainbridge Island, Washington

For her leadership in using horticulture for environmental improvement.

Mrs. Nelson is Chairman of the Operation Triangle, Seattle Beautiful Program in Seattle, Washington. She has been responsible for the landscaping and beautification of many of that city's 'pocket parks' and for this work has received the commendation of President Richard Nixon, The Governors Award for top beautification project in Washington state and the acclaim of people nationwide.

She is a former student of opera who also enjoys writing, antique collecting, refinishing old furniture, gardening, gourmet cooking, outdoor sports and travel. Her principle interest, however, is in the area of urban planning and environmental improvement.





Citation to Eunice Fisher, Oshkosh, Wisconsin

For her gardening leadership and service.

Mrs. Fisher is a lifelong gardener who has been active in many horticultural organizations. She and her husband make their home on the Wisconsin farm they purchased in 1921.

Trees, shrubs and flowers fill the farm yard and the gardens have become noted especially for the large collection of *Hosta*. Mrs. Fisher had donated many species and cultivars of *Hosta* to the Milwaukee City Parks to help establish a collection for that city's parks.

Citation to Professor Clarence E. Lewis, East Lansing, Michigan

For his distinguished service as an outstanding teacher.

Professor Clarence E. Lewis has been Professor of the Department of Horticulture at Michigan State University since 1964, after serving at the same university as associate professor in that department and in the department of urban planning and landscape architecture. His professional experience also includes instruction at State University, Farmingdale, New York and lecturer in plant ecology at New York University.

A contributing author to professional journals, magazines and books, Professor Lewis acts as advisor to several arboretums. In 1966 he was granted sabbatical leave to photograph plants and gardens in Great Britain, Holland, Belgium and France.



Citation to Julia S. Berrall, Upper Montclair, New Jersey

For her contributions to the literature of horticulture and art.

Mrs. Lloyd Berrall is a Vassar graduate and trained museum worker who has been associated with staffs of the Newark, New Jersey Museum, and the Montclair Art Museum.

A gardener, world traveler, author, photographer, flower arranger, exhibitor, Mrs. Berrall has lectured extensively in the United States and Canada and has escorted several European garden and fine arts tours for small groups.

She is the author of four books: *Flowers and Table Settings*, *Flowers in Glass*, *A History of Flower Arrangement*, and *The Garden—An Illustrated History*.

Special Citation to Henry J. Hohman

For his contribution to U. S. horticulture through the plants he has introduced among which are Dwarf Buxus, Dwarf Ilex and Azalea 'Mary Frances Hohman' and Azalea 'Gina Hohman'.

Mr. Hohman is one of America's foremost plantsmen. A highly skilled propagator, his nursery contains an enormous inventory of rare plants. Horticulture is indebted to him for his generous contributions, especially to botanic gardens and arboreta.

He is a plant testing collaborator of the Plant Introduction Station at Glen Dale, Maryland, and a founder and past president of the Maryland Nurserymen's Association.

He is one of the greatest benefactors of the National Arboretum in Washington, D.C., having donated over a thousand plants represented by approximately 750 species and forms.



Factors That Determine Flower Color

R. N. STEWART, S. ASEN AND K. H. NORRIS

The gardener grows his flowers, among other reasons, for their color—the strong, primary colors as well as the many hued pastel shades. The story of plant and flower color is a fascinating one even though our present understanding is fragmentary.

Few of us realize what we observe as a single color may actually be many different shades that are present in adjoining cells or groups of cells. Our eyes integrate these colors into the shade we "see".

Both anatomical features and chemical substances are responsible for color and researchers are now unraveling the mystery of how they interact. The story of the advances being made in this area is told in this up-to-date, authoritative report.—Neil W. Stuart, Editor

In the evolution of plants, the selective advantage of color seems to have been based upon its attraction of pollinators to flowers. Insects, thus attracted, increase seed-set while bird foragers aid in seed distribution. Of the higher animals only the primates are sensitive to color, but they all arrived on the evolutionary scene too late to have had an effect on the evolution of plant pigment systems. The only other animals in which color perception has been demonstrated are some birds, fish and insects.

The range of spectral sensitivity of the compound insect eye is broader than the human eye and includes all the ultra violet wave-lengths in the sunlight which reach the earth.

It has been suggested that flower color in temperate zones has evolved toward blue because of the greater sensitivity of bees to those shorter wave lengths. Birds are sensitive to red and aid in both pollination and seed distribution. There remain a great many spectacular displays of color in nature, in both plants and animals, whose evolutionary function is completely obscure.

While we see no apparent evolutionary effect of plant color on man, or vice versa, there is no question as to the reality and importance of his emotional response to color in plants and in his whole environment. Color is used and, sometimes, abused in every aspect of our daily lives.

Chemists have isolated and described the structure of many of the pigments involved in all kinds of agricultural products used by man. Geneticists have worked out the inheritance of color pigments in a number of species where relatively few distinct color classes were involved.

The paradox which has become apparent is that while the chemical basis of flower color appears relatively simple, there are an infinite number of colors in living tissues. In garden roses alone, flower breeders have selected thousands of cultivars with distinctive colors.

The *flavonoids* are one of the most important groups of water soluble pigments found within plant cells. The flavonoid pigments are found principally in flowers and fruits but also color other plant parts.

The flavonoids are responsible for the orange, scarlet, crimson, mauve, violet and blue colors and contribute as well to many light yellow, ivory and cream

Respectively, Horticulturist, Plant Physiologist and Director of Instrumentation Research Laboratory, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

colors. Yet, it is difficult to assess the role of these pigments in plants.

No vital function in growth and metabolism of the plant has been clearly attributed to flavonoids in spite of extensive recent research in this field. Experimental evidence suggests that flavonoids may have some activity as growth regulators. Other roles suggested are as anti-fungus agents, as catalysts that speed up chemical reactions, or, as end products which gradually build up in the cell.

The most significant function of the flavonoid compounds is their property of giving color to the plants in which they occur. They selectively absorb the radiation (sunlight) to which they are exposed; thus, various organisms detect differences in distribution and amount of the pigments. The flavonoid pigments to which the human eye is sensitive are the anthocyanins which produce the red, mauve, violet and blue colors.

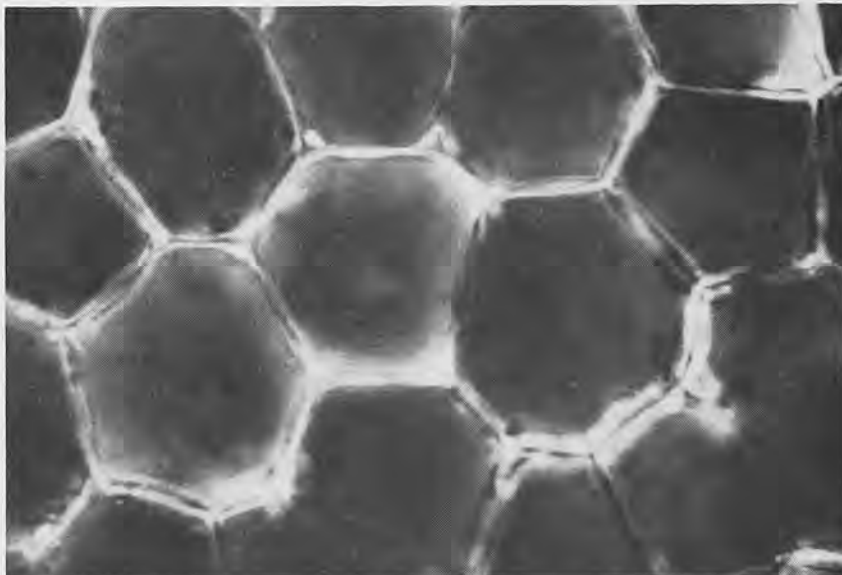
A number of factors have been shown to affect the basic colors of the anthocyanins and while much is known about their behavior in the test tube, far less is known about their natural condition in the living cell.

Next most important after the flavonoids are the *flavonols* whose peak of absorption is in the ultra-violet range, but they also absorb at the region of the spectrum which gives man the suggestion of light yellow, ivory and cream.

The emphasis of our current research, in the Agricultural Research Service of the U. S. Department of Agriculture, with flavonoid pigments is on how the color of the living cell or tissue is determined. Some of the anatomical features which we describe as influencing color have been known for years but their significance was not appreciated.

In epidermal cells of colored petals there is a large central space (vacuole) in which the flavonoid pigments are normally in solution. In comparison with a basketball, the pigments would occupy the space comparable to the air, the cytoplasm of the cell comparable to the rubber bladder, and the cell wall comparable to the leather cover.

Figure 1 is a surface view of a layer of epidermal cells peeled from a rose petal. In some flowers fat-soluble carotenoids (yellow and orange pigments) are found in discrete particles (chromoplasts) within the cytoplasm.



PHOTOS U.S. DEPARTMENT OF AGRICULTURE

Fig. 1. Surface view of living epidermal cells of a petal of a 'Forever Yours' rose. The large central vacuole is filled with the dark red anthocyanin solution surrounded by the clear cytoplasm and the dark line of the cell wall.

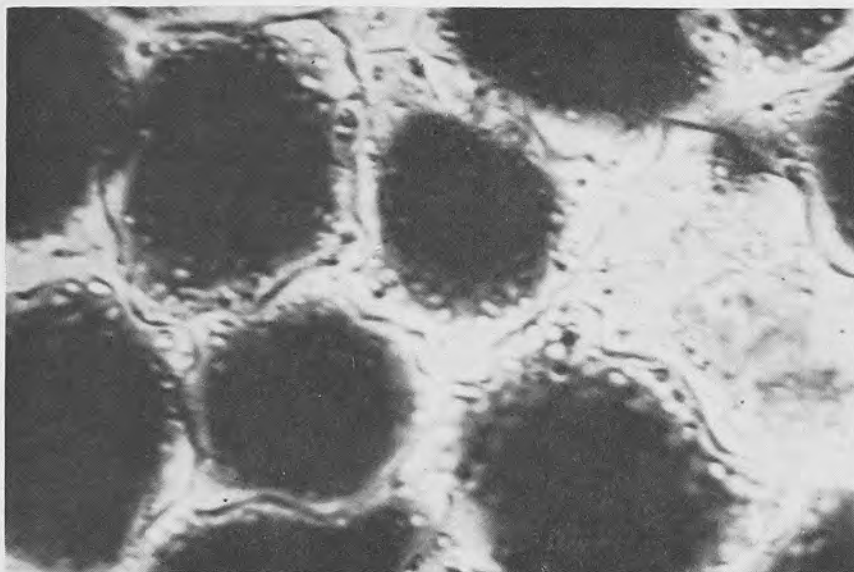


Fig. 2. Surface view of living cells of hibiscus flower. The central space (vacuole) is filled with red anthocyanin. In the surrounding cytoplasm the clear granules are the yellow chromoplasts. The empty cell at the right was injured in preparation of the slide and the anthocyanin diffused away.

Figure 2 shows the surface view of a layer of epidermal cells from an hibiscus flower which contained a red anthocyanin pigment in the vacuole and yellow carotenoid in chromoplasts in the cyto-

plasm. In cells of this type, the red pigment in the vacuole is physically separated from the yellow pigment in the cytoplasm, producing a very different color effect than a combination of yel-

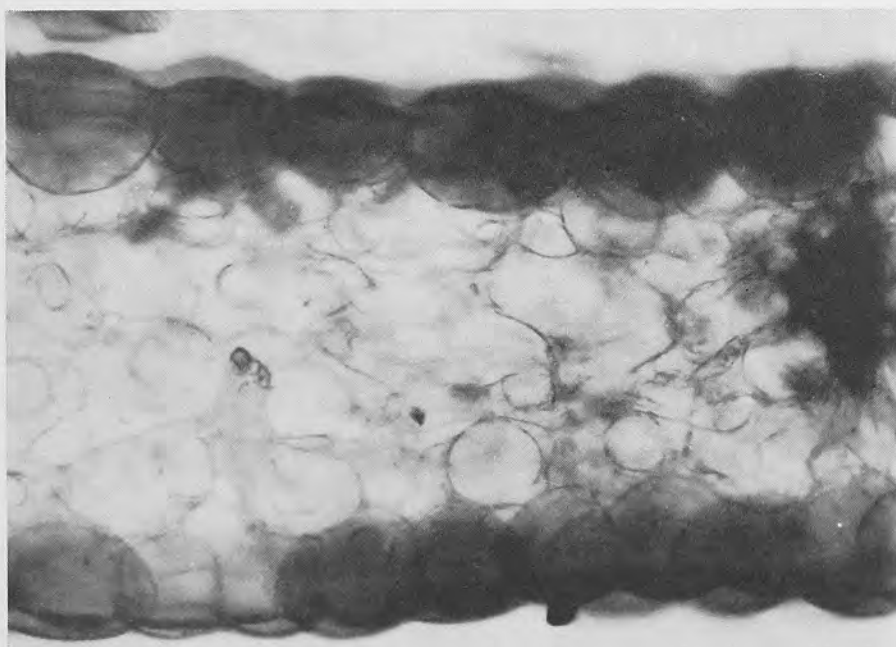


Fig. 3. Cross-section of living azalea petal. The cells of the 2 epidermal layers have large central spaces (vacuoles) whose cell-sap contains a red anthocyanin. The internal cells are colorless.

low flavonols and red anthocyanins, both in the vacuole where they may interact. The cells which contain the pigment are very small units of structure which cannot be seen by the unaided eye.

The color illustration on the front cover of this magazine shows that all the cells in a spot on a flower petal are not the same color. While this is an extreme example there are usually color differences between cells within every petal. Thus the color we see is a blend of small particles of different color.

The pigment in true petals is almost entirely confined to epidermal cells (Fig. 3). These cells are very small and the intense color of a petal in 'Forever Yours' rose is from the 2 epidermal layers of cells, about 1/500th of an inch thick. This means the pigment is present in very high concentration. We have found this naturally occurring high concentration difficult to duplicate in a test tube.

A second factor which influences color of a flower petal or a fruit is the shape and composition of the surface. The surface of an azalea petal is almost flat and is covered with a thin cuticle (Fig. 3). A rose petal surface is uneven with each cell sticking up like an egg in a carton

(Fig. 4). The cuticle is thickest at the peak of each cell and striations run from the center down the slopes. On the upper surface of a pansy petal each cell has a much longer and thinner projection than the rose cell into which the vacuole and pigment extend, giving the velvety look common to these flowers.

In flowers with colored bracts instead of petals, such as dogwood and hydrangea, the color is below the epidermal layer of cells which are usually smaller and often have extensive extra-cellular air spaces (Fig. 5). This structural screening greatly decreases the color evident to the eye.

A third factor which greatly affects color is the spectral composition of the radiation (light) illuminating the flower. With the increased use of fluorescent lighting in many buildings, many cultivars with red flowers appear much duller and bluer in color than with incandescent light. This has become an important factor in breeding florists' cut flowers and pot plants. Proper display of flowers should make use of the most effective color-enhanced lamps which are available.

In trying to understand color in plants, we are constantly faced with the fact



Fig. 4. Side view of living epidermal cells of a petal of 'Forever Yours' rose. The large central space (vacuole) is filled with dark red pigment. The clear cap is the cuticle.

that very few anthocyanidins occur in forms which produce the thousands of shades and colors we see displayed in plants. Within the cell anthocyanidins are combined with one or more sugar molecules and can be isolated, purified and identified. In this natural form they are called anthocyanins. The number of sugar molecules involved have an effect upon the color of the pigment. The color of an anthocyanin is also affected by the acidity of the solution in which it is dissolved. Acid solutions are red and more alkaline solutions become bluer.

One might suggest that some of the color differences seen in the cells on the cover of this magazine are due to differences in acidity (pH) but the pH of the cell sap of single cells of this type has not yet been reliably measured. In addition, the bluish forms of anthocyanins are not stable and their color disappears so that other factors than pH are certainly involved.

A common example is the florists' hydrangea which has blue flowers when aluminum accumulates and red flowers when aluminum is restricted.

Our recent studies have indicated that stable blue pigments can exist in the cell

without metals as the result of a phenomenon called *co-pigmentation*. It has been suggested that great changes in color could be due to anthocyanins complexing with other organic substances (co-pigments) but little direct evidence has appeared. We have now shown that the blue pigment of the 'Blue Ribbon' iris is the result of co-pigmentation of an anthocyanin with a number of flavonols.

The color photomicrograph on the cover illustrates the variation in color which can occur within a small group of genetically identical cells from the same tissue. Their different colors and densities are the result of developmental processes which are being studied using flowers such as iris, azalea, and rose where different cultivars provide large amounts of tissue of each color for study and analysis.

An understanding of the components of natural color and of how the plant synthesizes and combines them to maintain color is basic to successful attempts to control the development and retention of color in agricultural products. Man's very strong response to color is an important factor in the profitable merchandising of these products.

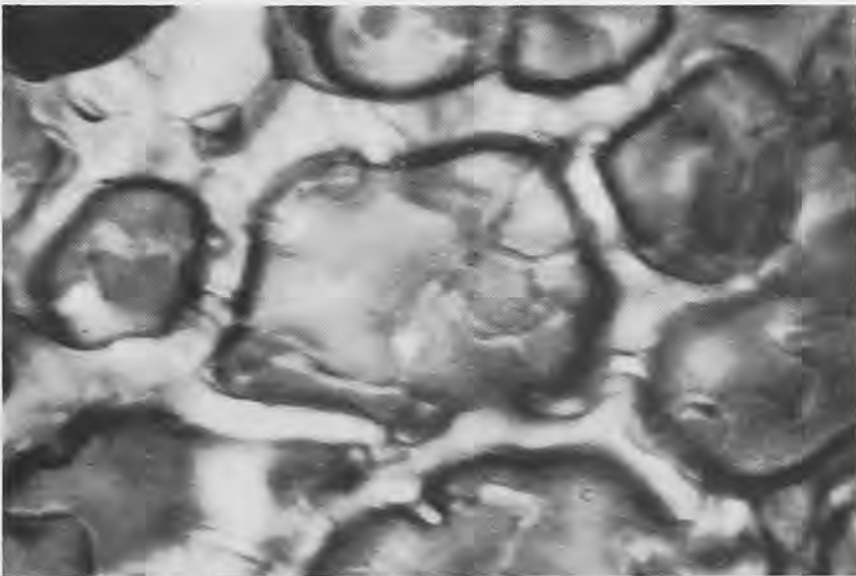


Fig. 5. View of internal cells of pink dogwood bract. The faint lines are the walls of the colorless epidermal cells which were above the focal plane of the microscope. The network in focus is made up of rod-shaped pigment-containing cells joined end to end. The large openings are intercellular air spaces.

WEEDS AND THEIR CONTROLLORAN L. DANIELSON¹**Common Names for Weeds**

Though each weed is known by a single binomial Latin name, a number of common names have come into use for each species over the years. *Amaranthus retroflexus* has, for example, been known by several common names including amaranth pigweed, green pigweed, redroot pigweed, rough pigweed, carelessweed, and others. This has led to confusion in our discussions of weed problems.

The Weed Science Society of America, recognizing the scope of this communication problem, appointed a nomenclature committee to study the problem and make recommendations. The committee has been active nationally and internationally for more than 10 years. As a result, the Weed Science Society has issued a list of accepted common names for weeds. These common names are used in publications and oral presentations. Thus, we all speak the same language and communication is much improved. The list is available from Fred W. Slife, Treasurer-Business Manager, Weed Science Society of America, Department of Agronomy, University of Illinois, Urbana, Illinois 61801. The cost is sixty cents for publication and

mailing. Incidentally, the accepted common name for *Amaranthus retroflexus* is redroot pigweed.

Weed Problems Encountered in 1970

Many telephone calls and letters requesting identification of weeds and methods of control have been received. These requests run the gamut from the problems of the home gardeners to those of the commercial producers of all kinds of horticultural crops. Mention of some of the problems and suggested solutions may be of assistance to many gardeners.

Control of dodder. Control of dodder (*Cuscuta* spp.) is the subject of many questions. These are usually requests for control of established dodder in plantings of chrysanthemums, English ivy, and other perennial woody ornamentals and herbaceous species. There are no herbicides that will kill growing dodder without injuring ornamentals. We have conducted preliminary research to develop methods to control the spread of dodder in chrysanthemum plantings. Results show that DCPA (Table 1) applied as a thorough overall spray when the first strands of dodder appear, will reduce ability of the pest to form additional attachments and minimize its

¹ Plant Physiologist, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

TABLE 1. Common, Chemical, and Trade Names of Herbicides

<i>Common name</i>	<i>Chemical name</i>	<i>Trade name</i>
DCPA	dimethyl tetrachloroterephthalate	Daethal
chlorpropham	isopropyl <i>m</i> -chlorocarbanilate	Sprout Nip
trifluralin	α, α, α -trifluoro-2,6-dinitro- <i>N,N</i> -dipropyl- <i>p</i> -toluidine	Treflan
CDEC	2-chloroallyl diethylthiocarbamate	Vegadex
AMS	ammonium sulfamate	Ammate X
amitrole	3-amino- <i>s</i> -triazole	Amizol, Weedazol, Amino Triazole
diphenamid	<i>N,N</i> -dimethyl-2,2-diphenylacetamide	Weedkiller 90, Cytrol Dymid, Enide

spread. Small trials of this method are suggested.

If you have had dodder in your garden this year, you should plan to treat the soil early next spring with DCPA or chlorpropham before dodder seeds germinate. Germination usually occurs when the temperature average 65°F to 70°F.

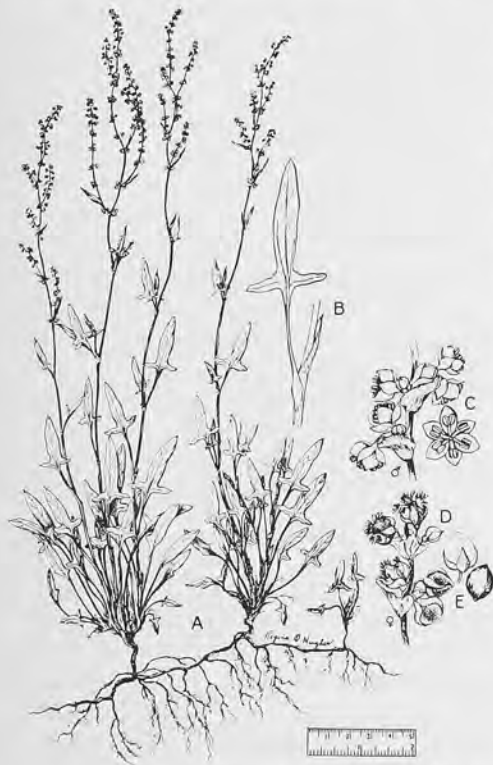
Control of weed grasses in ground cover plantings. Annual weed grasses including crabgrass (*Digitaria* spp.) in plantings of ground covers of English ivy and periwinkle continue to be problems to many of you. An early spring application of a granular formulation of herbicides such as chlorpropham, trifluralin, CDEC, or DCPA is effective for control.

Control of sprouts around tree stumps. Requests for help on this problem are frequent. Sprout growth can be pre-



PHOTO, U. S. DEPARTMENT OF AGRICULTURE

Fig. 2. Flowering and vegetative red sorrel plants showing the general growth habits and relative sizes.



DRAWING BY REGINA O. HUGHES

Fig. 1. Red-sorrel (*Rumex acetosella*). A. Two plants originating at nodes of a rhizome. B. Individual leaf showing shape, venation, and attachment to stem. C. Staminate flowers. D. Pistillate flowers. E. Seed shown separately and attached to calyx.

vented by applying the herbicide AMS to slashes in the bases of the trunks a few weeks before trees are cut down. AMS moves throughout the top and roots, killing all parts, so that sprouts cannot form. Sprouts formed after an untreated tree is cut down can be controlled by applying AMS to slashes in their bases. Carefully localized treatments will prevent injury to turf and adjacent ornamentals.

Control of poison ivy. Requests for information on the control of poison ivy (*Rhus radicans*) have continued to be numerous. Careful spraying of the actively growing foliage each year for 2 to 3 years with amitrole will destroy all existing plants. Spot spraying of new infestations of poison ivy plants each year may be necessary because of the spreading of seeds by birds.

Control of Red-Sorrel

One of the most persistent broadleaf weeds is the perennial red-sorrel (*Rumex acetosella*). It is increasing in numbers perhaps due to the control of other broadleaf weeds with herbicides that do not affect it. It reproduces by seed and rapidly spreading rhizomes and is widely distributed throughout the United States. It is especially prevalent in the Mid-

Atlantic States and in coastal Washington and Oregon.

The stems of red-sorrel are slender and may reach a height of 10 to 12 inches. The roots and rhizomes are shallow and extensive. Several stems emerge from a single crown or from nodes on rhizomes. Leaves are arrow-shaped, with two matched opposite basal lobes. The smooth leaves are 1 to 3 inches long. The small yellow to red male and female flowers are produced on separate plants as slender racemes in panicles at the upper terminus of the stems. The seeds are glossy, reddish brown, three-sided achenes approximately 1/16 inch long.

Red-sorrel can be controlled by diligent annual removal of every plant as soon as it appears. Rhizomes and roots can be removed by stripping them from the soil with hand tools.

If desired, herbicides may be used to control sorrel in plantings of some ornamentals. Application of diphenamid to the soil in early spring will kill germina-

ting red-sorrel seeds. The established plants in ornamental plantings can be controlled by careful application of amitrole solution from an oil can on individual plants. Repeated, carefully localized applications of standard solvent dry cleaning fluid from an oil can on the crowns of individual plants will kill them without danger to other plants.

Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture, and does not imply its approval to the exclusion of other products that may also be suitable.

All agricultural chemicals recommended for use in this report have been registered by the U.S. Department of Agriculture. They should be applied in accordance with the directions on the manufacturer's label as registered under the Federal Insecticide, Fungicide, and Rodenticide Act.

PAGES FROM YESTERDAY

The paragraphs that follow, clipped from the pages of early editions of The National Horticultural Magazine, will review for today's amateur and professional horticulturists, the earliest aims of these who founded the National Horticultural Society and the American Horticultural Society.

They are offered here in celebration of The American Horticultural Magazine's 50th anniversary edition.

From *The National Horticultural Magazine*, Volume 34, Number 4, October, 1955:

THE JOY OF GROWING PLANTS

The shadows of life grow long. They stretch back over eventful and confusing years. Great wars have been fought, the difficult discussions of peace spread their alarms, old friends have died, new names have come on the stage of life, accustomed ideas have vanished, and new subjects engage the people. Yet my plants remain, full of vigor, bright in their colors, bringing memories and mementoes of other lands; and they are silent.

These plants are desired for the joy and the surprise of growing them. The wonder of it grows with the years—how an inert item called a seed can spring into life and from it come an aspiring organism true exactly to its own kind and relationship even though planted half way around the world from the place of its origin and in soils and climates wholly strange to it. This is a perpetual miracle, none the less amazing because we are now so inquisitive about it with microscope and retort.

L. H. BAILEY

Ophiopogon planiscapus

ELIZABETH McCLINTOCK

A lily-turf with purple-black leaves has been grown in California since 1959 when it was listed by Mr. J. N. Giridlian of Oakhurst Gardens in Arcadia. Mr. Giridlian called it *Ophiopogon* "arabicus" and said it was "a real discovery and one that is being offered for the first time in this country." Hume (1963) gives a brief description of the plant in an article on "The *Ophiopogon-Liriope* Complex" and it is pictured in the third edition of *Exotica* (1963). In 1964 I sent a specimen for determination to the Bailey Hortorium of Cornell University and from there Dr. John Ingram sent it to Dr. Jisaburo Ohwi of Tokyo. Dr. Ohwi determined it to be *Ophiopogon planiscapus* Nakai of Japan and wrote of it: "this is the only garden plant of *Ophiopogon* with such dark purple leaves. Our gardeners call it *Koku ryu*, i.e. black dragon but this may be an abbreviation of 'Black dragon-beard' as dragonbeard is the Japanese name of *Ophiopogon japonicus*."

The purple-black leaves of *Ophiopogon planiscapus* distinguish it from the green-leaved *O. japonicus*. In addition *O. planiscapus* has leaves to about 1/4 inch wide while those of *O. japonicus* (L.f.) Ker-Gawler tend to be narrower usually about 1/8 inch wide. Both of these lily-turfs have slender underground rhizomes along which are scattered tuber-like swellings (see Hume, 1961, fig. 52 on p. 143).

The purple black lily-turf is much slower growing than the green-leaved one (*Ophiopogon japonicus*) but it is equally attractive. Because of slower growth it has remained scarce and also more expensive. It is propagated vegetatively.

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Nase Changes in *Metrosideros*

Metrosideros is a genus in the Myrtaceae (Eucalyptus family) of about twenty species of trees and climbers in the South Pacific. Eleven species occur in New Zealand. Of the four species in cultivation in California, the two most frequently seen have been misnamed until recently. *M. excelsa* Solander ex Gaertner, published in 1788, has been known by its synonym *M. tomentosa* A. Richard, published in 1832. Sometimes called New Zealand Christmas tree by the early settlers, *M. excelsa* was an introduction dating back to the 1850's in the San Francisco area.

Metrosideros kermadecensis W. R. B. Oliver has always been known in California as *M. villosa* Kirk. It is a more recent introduction. The late Eric Walther imported it from the nursery firm of Duncan and Davies in New Plymouth, New Zealand, probably in the 1930's, but whether this is the only introduction is not known.

Both of the above mentioned species



PHOTO MATHEWS & DURAN

***Metrosideros excelsa*, the so-called New Zealand Christmas tree. Cultivated in California since the 1850's.**

of *Metrosideros* are evergreen trees with reddish flower clusters and leaves grayish and hairy on the lower surface. They differ in their leaf shapes and sizes. *M. excelsa* has elliptic leaves two to four inches long while those of *M. kermadecensis* are broadly ovate and to about one inch long.

Metrosideros excelsa occurs in New Zealand in the coastal forest of North Island. It has a yellow-flowered form in cultivation known as cultivar 'Aurea'. *M. kermadecensis* occurs only on two

islands, Kermadec Island and Raoul or Sunday Island, both off the north coast of North Island, New Zealand.

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California Academy of Sciences
San Francisco, California 94118

PAGES FROM YESTERDAY

From *The American Horticultural Magazine*, Volume 41, number 1, January 1962:

CURCUMA ROSCOEANA

One of the delights of moving into any new area comes from indulging ones curiosity not only about the new plants one may find in the gardens there, but in pursuing the relatives of these same plants, which only the newcomer seems likely to do.

Although the "South" is said to be filled with "Hidden Lilies" all of them presumably *Curcuma petiolata*, the present writer is still stubbornly holding to the idea that the plants in the garden here are not that species but Heaven alone knows which. Other curcumas have been bought and while as yet that have produced only terrifically tropical looking foliage, one unknown almost of dwarf banana proportions, the most amazing species is the most tropical and according to Mr. Wyndham Hayward from whose splendid nursery, the root came, is the only species that tolerates a pot, and in this case, it is a "must."

B. Y. MORRISON, Pass Christian, Mississippi.

From *The National Horticultural Magazine*, Volume 1, number 1, August, 1922:
PART OF THE NATIONAL HORTICULTURAL SOCIETY'S PREAMBLE

Great strides have been made in the increase of horticultural knowledge, but much work in this field still remains to be done, and popularization is yet in its infancy. Many are taking an active interest in practical horticulture, but the home gardener, as a rule, is greatly handicapped on account of the lack of cooperation, and his outlook is one-sided in many instances from too narrow specialization. There was no central clearing house for horticultural knowledge in this country that covered the entire field; no altruistic national organization for the purpose of popularizing horticulture, and after a period of discussion, a committee of amateur horticulturists sponsored *The National Horticultural Society* which came into legal existence on July first of this year. The proposals of federating or uniting the existing horticultural societies proved to be impracticable, and the problem was solved by the creation of a national society which covers the entire field of horticulture, and which rounds out the work now carried on by isolated units by paying special attention to the odds and ends that are not sponsored by the existing national societies.

HAMILTON TRAUB, *Secretary*

Garden Notes

The Matilija Poppy

MARJORIE G. SCHMIDT

The matilija poppy, *Romneya coulteri*, is a giant of the family, and often called the magnificent poppy. Tall and statuesque it varies in height from four to eight feet, with several leafy, erect branches from a semi-woody base. Leaves are firm and smooth, light bluish-green, three to four inches long and parted into irregular lobes, which dentate on the margins. Flower buds are tight, pale green spheres with each sepal slightly recurved for a beak effect. From these come single flowers of frilled, white, crepe-textured petals centered with a pompon mass of orange-yellow stamens. A sweet fragrance is emitted from the flowers, a surprising fact since few would expect perfume in the poppy family. It is most discernible on warm days where there are extensive colonies. In the wilds, plants bloom in May, and in gardens this period is extended into late summer, often into early autumn.

Matilija poppy is of restricted distribution being native from Santa Barbara to San Diego Counties and south into Mexico. Dry, rocky foothills, gravelly washes and canyon slopes are its native habitat. The term "matilija" is of Indian origin, and was applied to the poppy because of its abundance in a canyon of the same name in Ventura County, in southern California. Plants may still be seen here as well as other foothill regions, but the original abundance is now much reduced from digging of the plants.

Most gardeners know this plant as a rampant subject as it increases from vigorous underground suckers. This tendency should be recognized and the poppy used in situations where it will not become a nuisance. It is especially pleasing among shrubs, against a wall, to the rear of a wide border, or in an unwatered situation. Where properly used



PHOTO, SANTA RANCHO ANA GARDEN

Upper is *Romneya coulteri* var. *trichocalyx* 'White Cloud'; lower is *Romneya coulteri*.

and with sufficient space, this giant poppy is spectacular during its flowering season. It is unexcelled when used with native flowering shrubby perennials such as wild mints, bush lupines, or the St. Catherine's buckwheat. In southern California it is often grown with *Fremontia mexicana* and species or cultivars of *Ceanothus*.

The matilija poppy may be propagated in several ways, the easiest being to remove rooted suckers and replant where wanted. Autumn root cuttings may be taken from young lateral roots and put in a sandy medium where they will form a compact root system in about three months. Horticulturists strongly suggest that cuttings be made from superior stock,—plants which are compact and bear large flowers. Growing the matilija poppy from seed is a slow and less certain method that few try since propagation from cuttings is relatively easy. In late autumn old stalks should be cut to within a few

inches of the ground, and the plants then mulched. New shoots will appear with the first rains. This poppy is tolerant of some cold and may be grown throughout the Pacific States and east to New York state where it should have a sunny, sheltered location. Plants always require full sun, well drained soil, and moderate amounts of water.

Romneya coulteri var. *trichocalyx* differs from the type by having hairy, beakless flower buds, and is considered to be superior, and to have larger flowers. An intermediate strain has been selected by Armstrong Nurseries of Ontario, California, and named 'White Cloud'. Bushy in habit, it bears many eight inch flowers on six foot plants.

Admirers of this giant poppy have long urged its greater use in roadside planting, parks, large scale landscaping as well as home gardens. A fine example of its use occurs in Tilden Park Botanic Garden, Berkeley, California, where bold clumps have filled the space between a curving rock wall, and on the slope above. From almost any angle the masses of large white flowers against clean, blue-green foliage, is outstanding. This outstanding wild flower was among the first to become a popular garden subject in southern California. It has long been cultivated in southern England where it is often trained against a warm wall. It was first exhibited there in 1888. While some may consider this poppy to be coarse, the size of flowers and foliage is in excellent proportion to the plant. Even though of restricted distribution it is a typical example of California's unique flora.

Flowering of the Giant Timber Bamboo at Chico, California

BRYAN C. WILLINGHAM

Flowering of the giant timber bamboo (*Phyllostachys bambusoides* Sieb. and Zucc.) probably takes place every 60 to possibly 120 years (1). A marked change in the appearance of a few culms in our

Research Technician, Agricultural Research Service, U.S. Department of Agriculture, Plant Introduction Station, Chico, California.



PHOTO, R. L. SMITH

Fig. 1. Inflorescence of *Phyllostachys bambusoides*, the giant timber bamboo.

grove at Chico, California, in May 1967 led to the discovery that the bamboo was beginning to flower. The normally open foliage on the culm branches was replaced by dense tufts of pseudospikelets, with many yellow anthers streaming from long filaments.

Initial flowering may have begun a year or two earlier on small, undetected culms. A later search of the grove revealed that some culms up to 8 feet high had flowered and died. About a fifth of the grove was in flower in 1967; by 1968 nearly the entire grove had flowered.

The original rhizomes were obtained through the Yokohama Nursery Company, Yokohama, Japan. They were received at the Plant Introduction Station, Chico, California, on October 31, 1904 as P.I. 12180. A span of 63 years had elapsed between receipt of the original introduction and the initiation of its flowering.

This grove, established in 1907, was enlarged in 1925 to cover about half an acre. It is kept within bounds by a stream on the north and by a pavement on the south. Rhizomes have never grown under the pavement or into the stream. Elsewhere, the grove has been confined by applying water within its desired limits. Culms that appear outside the area are cut back or broken out yearly.

The flowering culms ranged in size from 3 to 14 feet high, with a basal diameter of 1/2 to 1-1/2 inches and 30 to

60 feet high, with a 2 to 5 inch basal diameter. In the spring of 1968 a dense growth of small culms developed within the grove; the majority flowered immediately.

Our evidence indicates that age of culm is not relevant to flower initiation in this species. A number of culms were tagged the year they emerged, from 1946 through 1958, to determine the length of time each would remain alive. Among those tagged and still alive in 1968-69, flowering occurred simultaneously on all culms regardless of age.

Maximum flowering of a culm takes place the first year of bloom. Some flowers are produced the second year. A culm tagged in 1954 flowered in 1968; it still had new spikelets preparing to flower in February 1969.

Culms do not die soon after flowering, but take over 2 years to do so. Most of the culms that flowered in 1967-68 were still alive in July 1969 and retained a few green leaves.

The lowest minimum temperature recorded at the Chico Plant Introduction Station in the winters of 1967-68 and 1968-69 was 24°F. All through the years 1967 and 1968, even when colder temperatures prevailed, we found flowers on the small culms. The flowers were killed at temperatures below freezing.

Thirteen large culms emerged in 1968. Formation of dense tufts of leaves occurred on three of these in 1969, but no pseudospikelets developed. In June 1969, emergence of large culms increased threefold. These also remained vegetative.

Time from flowering to mature seed is not yet clear. Seed from spring flowers apparently mature by mid- or late fall. In June 1967 only partially formed seeds were found in the drier spikelets. A small culm, marked in June 1967, had mature seeds in December 1967. Observation of large culms (to 60 feet high) was not practicable.

To obtain an estimated yield of the probable quantity of seed produced by a culm, the potential yield of a culm was determined. From the quantity of seeds found, a yield estimate of 3.8% of the



PHOTO, B. C. WILLINGHAM

Fig. 2. Grove of giant timber bamboo growing at the Plant Introduction Station, Chico, California in early spring of 1968.

potential yield of seeds per culm was calculated. The yield estimate was probably somewhat low, for the rachilla will easily abscise upon seed maturity.

A germination test was begun December 16, 1967, by placing 32 seeds on moist filter paper in petri dishes (16 seeds to a dish) at room temperature. The germination level reached 64 percent by December 20, 1967.

Groves established from rhizomes of this introduction were reported in flower at the University of California, Los Angeles, in 1967, and the University of California, Davis, in 1968.

From about 1960 through 1969, widespread flowering of this species has been reported in Japan (2). As far as can be determined, this was the first time this species and clone has flowered in the United States.

Present observation of our grove at Chico shows that the flowering of this

species begins slowly, reaches a climax in a two year period, and gradually decreases.

Whether, and in what manner, this grove of giant timber bamboo will restore active growth are among questions that suggest further observation.

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Midget Karelaa 'The Pride of Sorath'

AMILAL J. DHAKY

This small Karelaa (bitter gourd), *Momordica charantia* 'The Pride of Sorath' is grown in the vicinity of Veraval-Patan on the coastal area of Junagadh District of the Gujarat State, India. Mostly it is planted on the border of irrigated fields.

It can be grown in almost all types of soil; but sandy loam and silt-loam soils are more suitable for rich production of this midget Karelaa.

The seeds are thin and small in size, of yellowish white color. They are sown by the end of February in furrows at 4 ft. intervals between two plants. Within a month the creepers flower, and small Karelaas set in fifteen days thereafter. Watering twice a week, and airing through supports encourage the growth of creepers. Summer and rainy season are favorable for Karelaas. The slender stems with small leaves, yellow little flowers and baby Karelaas, all in miniature, present an attractive sight. The rich vine enchants the eye before its fruits please the palate.



Karelaas ready for the Kitchen.

The fruit of this special cultivar is roundish in shape, of whitish green color with a few white dabs on thin skin. Each Karelaa weighs 8 to 10 grams, and contains 8 to 10 seeds. Mostly Karelaas are bitter, but this variety is very tasteful. Here, in India, it is added to flavor curry.

The creeper gives regular fruits up to November. Harvesting is done when Karelaas are young and tender. Picking may be done every third day. On ripening the fruit changes its color from whitish green to yellowish saffron and the marrow turns reddish as seeds mature.

The fruit is rich in iron and vitamins A, B, and C. Its calorific value is enhanced when fried in butter. Karelaa is said to be good for rheumatism and diabetes. Study trials show that this cultivar of Karelaa is worth propagating.

(Editor's Note: Other forms of the bitter gourds, also called balsam pear, are not infrequently cultivated in the United States. They are frequently used as one of the vegetables in Chinese dishes and as ornamentals.)

Rhododendrons

Gerd Krüssman. Published by Ward Lock Ltd., Warwick Howe, 116 Baker Street, London. 1970. 96 pages. Illustrated. \$6.00

This latest contribution of the Director of the Botanical Gardens of Dortmund, Brunningshausen-Germany, provides a concise and readable coverage of the main aspects of *Rhododendron-Azalea* information, their natural occurrence, their improvement, evaluation, and culture presented for the primary benefit of the amateur growers of western Europe. Though published in England, we suspect that it will prove most useful to an increasing number of continental *Rhododendron* fanciers. This comment is not made with critical intent for more books of regional impact are needed—in the United States and elsewhere. It suggests, only, that while the American reader will find many useful hints on culture, companion plants, etc., he should not be unduly dismayed to find some favorite species or varieties treated either lightly or entirely omitted.

The numerous plates in color, or black and white, and some 40 or more line drawings are all of excellent quality and abundantly compensate for the minor jolt occasioned by noting a beautiful hillside spread of *R. macrophyllum* "in its native habitat" in the Smoky Mountains of North Carolina.

HENRY T. SKINNER

Trees, Shrubs, and Vines

Arthur T. Viertel. Syracuse University Press, Syracuse, N.Y. 1970 178 pages. Illustrated, \$2.95. (Library) Spiral Bound.

The subtitle of this manual is "A pictorial guide to the ornamental woody plants of the northern United States exclusive of conifers." Leaf drawings for 593 plants are included, with this keyed to a paragraph of description of the plant. An easily followed key is given as a start in the identification of a plant. Illustrations of leaf, flower, and twig details serve to help in the identification. This manual is a good one for the non-botanist, the interested gardener and the home landscaper to use.

Bulbs for Summer Bloom

John P. Baumgardt. Published by Hawthorn Books, Inc. 70 Fifth Avenue, New York, N.Y. 1001, 1970, 232 pages. \$8.95 (Library)

When bulbs are mentioned many think immediately of the hardy spring flowering kinds as tulip or narcissus. However, this book reminds the reader of many kinds of bulbs—bulbs in the common usage meaning—that is, the true bulbs, corms, tubers and fleshy roots that are useful for summer flowering.

The book opens with a non-technical description of the several terms, bulbs, tubers, corms and other plant structures with illustrations to give the reader an understanding of the plant part. This is followed by chapters on the general cultural aspects, in garden use, as cut flowers, winter storage, and the control of pests.

Fifty-five genera of plants are discussed with separate chapters first on the tuberous begonias, gladiolus, lilies, and dahlias. In these chapters specific culture is described as well as the horticultural and botanical classification of the species, types and cultivars of garden value. This is important to the gardener as he makes an intelligent selection of kinds to grow.

The large remaining section is concerned with all others from *Achimenes* to *Zephyranthes*. In each case there is information on the culture, propagation, the cultivated kinds with specific suggestions where necessary.

This book brings together horticultural information for the gardener of an important group of plants which add much to summer flowering and several offer a challenge to the gardener to grow them.

CONRAD B. LINK

The After-Dinner Gardening Book

Richard W. Langer. The Macmillan Co. 866 Third Ave., New York, N.Y. 10022. 1969. Illustrated, 198 pages. \$4.95. (Library)

An entertaining account of growing "unusual plants" in an apartment. The "unusu-

al plants" are those produced from various fruits and vegetables.

The author searched for the unusual—less common kinds of fruits and vegetables, many of which he could only find in the speciality shops. They included familiar kinds as pineapple, yams, the citrus, and avocados, and less familiar kinds as prickly pears, papayas, pomegranates, loquats, coconut, litchis and sugar cane. After enjoying them as food, he saved the part capable of growing as the seed or top, or just did not eat all he bought and then planted them.

It required patience to wait for seeds to germinate or stems to root but he waited. Being an apartment dweller, he had problems of soil and pots which the outdoor gardener may not appreciate. He went to libraries to read about the plants and has included some of this background information (he could have culled some of the out of date information) and his actual experiences. It is a book for light reading, not for reference.

Conrad B. Link

1000 Beautiful House Plants and How to Grow Them.

Jack Kramer. William Morrow and Co., 105 Madison Ave. New York, N.Y. 10016. 1969. 178 pages, Illustrated \$12.95 (Library)

Plants in the home and indoors in offices, lobbies and other areas within buildings offer the fresh, decorative materials to make any room attractive. The author of this book gives practical suggestions on the culture of many kinds, some familiar and others less commonly grown. His instructions are given on the general use, care, propagation and culture in the opening chapters. This is followed by the section on the 1000 House Plants.—from *Abutilon* to *Zygopetalum*. Each is identified with the common name, family to which it belongs and the best temperature range for growing. Brief cultural instructions are given for each plant, any special requirements, and species and cultivars that are most useful.

Since plants are tolerant of rather varied environmental conditions your experience may not be the same as suggested by this author. He does not set up elaborate procedures for their culture but suggests easily obtainable conditions. If you want extensive, detailed information on a given plant you may have to refer to some of the references which he includes.

CONRAD B. LINK

Ornamental Bulbous Plants

S. L. Jindal. Published by Indian Council of Agricultural Research, New Delhi, 1968, 190 pages, illustrated. (Library).

This book is written for the gardener in India. For the American gardener it is interesting because of the great number of bulbous kinds that are described. Some of these are useful only in the southern regions of the United States or in areas that are entirely frost free.

The American Camellia Yearbook 1970

Edited by Joseph H. Pyron. American Camellia Society, Fort Valley, Georgia, 31030. 1969, 314 pages, Illustrated. \$7.50 (Library)

This is a well balanced yearbook of a specialized plant society. It includes such society topics as places and personalities of camellia interest. For the gardener there are camellia topics on camellia species, cultivars, and new introductions.

For the more research minded and advanced gardener there are such topics as the use of gibberellic acid on flower buds, on interspecific and intergeneric hybridization, germination of reticulata and hybrid seed, and a study of cold resistance of flower buds.

One of the most interesting articles is "Camellia 'Daisy Eagleson'—A Chimera," which describes the unusual growth of this plant for 15 years showing a mixture of *C. japonica* and *C. Sasanqua* 'Maiden's Blush' tissues. A description is given on how this plant developed from the graft union to show a mixture of tissues of the stock and the scion to produce this graft chimera. This is not common in plants although many of the variegated plants are of this genetic makeup.

Andalusian Flowers and Countryside

C. M. Stoken. Published by Chandlers Ltd, Bexhill-on-Sea, Sussex, England. 1968 184 pages, Illustrated. \$4.00 (Library)

A travelers guide to the native and introduced ornamental plants of the eight provinces of southern Spain, Gibraltar and Morocco. The author describes the flora in travels through each of the provinces telling about the plants with some description of the country as well.

Date of Publication: Feb. 1, 1971



THE HANDBOOK OF HOLLIES

Published jointly by

The Holly Society of America
and

The American Horticultural Society

This new edition of *The Handbook of Hollies* marks a repeat of a successful joint effort of The American Horticultural Society and The Holly Society of America, Inc. in 1957. A completely revised, enlarged and updated version of the original 1957 edition, the 1970 handbook offers valuable and comprehensive information on the cultivation of *Ilex* from planting to pruning to hybridizing and an extensive section on uses of holly. The book charts the history of the species, documenting the development of the various branches of this popular plant family. Lists of new *Ilex* introductions, hollies available in the trade, and official holly arboreta and test centers are also included. Dorothy Ebel Hansell, long time member of both Societies and currently editor of the journal of the American Association of Botanic Gardens and Arboreta, is editor of *The Handbook of Hollies*. To this job, she has brought a lifetime of experience as professional journalist and outstanding amateur gardener. 192 pages. 165 black and white photographs and drawings. Paperback—\$5.50.

The American Horticultural Society

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