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JANUARY COVER ILLUSTRATION

Patio of Bellingrath Home

(Courtesy Bellingrath Gardens)

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HAROLD W. COPELAND

Calluna vulgaris 'Mrs. Ronald Gray' attractive prostrate growth with purple flowers

Plants for A Winter Garden—

Heaths and Heathers

HAROLD W. COPELAND¹

Are you interested in plants that are evergreen, with foliage beautiful and attractive throughout the year; which by selection of varieties give flowers every month including Winter, and which require comparatively no attention after planting? (Upkeep can be an important item today when help is scarce or expensive)

Such are the heaths (*Erica*) and heathers (*Calluna vulgaris*). These plants take care of themselves and as they mature, cover intervening spaces keeping weeds to a minimum. Their extensive flowering period is found in no other class of cultivated plants; in an otherwise drab Winter garden, heaths and heathers afford endless variety of color in foliage, while the *Carnea* heaths provide bloom all Winter long. Snow may temporarily hide, but as it recedes, the flowers reappear unharmed in bright colors of white, pink, lavender, and red.

The markedly growing interest in these plants is due in part to the enthusiasm of returning visitors from the moors, arboretums and gardens of England and Scotland. Realizing heath and heather can be grown successfully here, gardens are fast becoming numerous in the U. S. Little wonder heath and heather are the coming thing considering their special charm and the wide use to which they are adapted. Many gardeners of this country are already members of The Heather Society in England, an affiliate of the Royal Horticultural Society.

Charm in Variety

Lists to follow indicate the widest imaginable variation in height, form, color of foliage and flower, and blooming season. Herein lies the very special charm of this plant group.

According to variety, plants range in

height from three inches to five feet. There are endless forms,—dwarf pin-cushions, low mats of creeping ground cover, bushes densely compact, or loosely upright, and miniature evergreen trees.

Varieties are magnificent in their different foliage shades of green, gray, silver, yellow, orange, gold, copper and red. The tips of the branches of one variety are vivid pink, lovely when contrasted against the snow.

Flowers, single and double, vary widely in color depending on the variety, in a range from white, pale pink, rosy pink, bright pink, coral to crimson, rosy red, ruby, blood red, cherry, lilac or lavender, mauve and purple. One of the most satisfying and remarkable traits is the long blooming season of a single plant. For example *Erica carnea* 'Springwood White' shows cream white buds in early January, and though completely covered by several snows during the Winter, reveals as the snow recedes an increasing number of pure white flowers, until in mid-April the variety is a solid white mat. Some flowers remain into early June. Blooms on some summer-flowering varieties are similarly long-lived.

Characteristics and Distribution

A frequent question—"What is the difference between heath and heather?" To the average gardener they are alike in appearance, as they are in garden character and requirements.

Heather (*Calluna vulgaris*) has a colored calyx as the conspicuous part of the flower, longer than the corolla. Heath (*Erica*) has the corolla as the prominent part.

In heather the leaves are opposite and closely overlap each other, in fours, giving a quadrangular shape to the densely crowded twigs. The linear leaves of heath are arranged in whorls of three

¹Chatham, Massachusetts.



HAROLD W. COPELAND

Ulex europaeus yellow flowered gorse commonly associated with heather—
famous in literature for its sharp spines

or four, sometimes six; they are short and small pointed.

For centuries the common heather, or Scotch heather or ling (*Calluna vulgaris*) has covered miles of mountain and moor over Europe. Of this single species there are many varieties now growing in gardens of Europe, Canada and the U. S.

The heath (*Erica*) has many species, natives of South Africa and Europe; *Erica arborea* in Spain, *Erica australis*—Spain and Portugal, *Erica carnea*—European Alps, *Erica ciliaris*—England and Ireland, *Erica cinerea*—British Isles, *Erica lusitanica*—Portugal, *Erica mackayi*—Spain and Ireland, *Erica mediterranea*—France, Spain, Ireland, *Erica stricta*—Corsica and Sardinia, *Erica tetralix*—Northern Europe, *Erica vagans*—England and Ireland, *Daboecia*—Ireland. Many garden varieties of these different *Erica* species are now cultivated in Canada and the U. S.

Uses

Some varieties are of exceptional value for cut bloom. Double flowered kinds of heather (*Calluna vulgaris*) will last several months; sprays of Winter blooming heath (*Erica carnea*) and the hybrid, *darleyensis* are frequently used in Christmas decoration.

These small evergreen shrubs lend themselves to almost endless situations. They are effective in the rock garden, wild garden, mixed shrub border, and as carpeting ground cover, edgings and walks. Miniatures can be placed between stones in paving. Particularly recommended is a bed devoted to these plants alone; it may be only a small affair of fifteen feet diameter, or better still if area is available, a real heather garden. Here diverse colors of foliage and flowers extend in drifts of satisfaction. Dwarf or slow growing evergreens enhance the picture.

Soil and Planting

In nature heath and heather thrive in poor soil containing plenty of peat. Hence cultivated garden soil may be too rich to give the best final results; for a time the plants thrive, but finally grow lanky and out of proportion to their natural size, bearing fewer flowers with spindly foliage.

Heathers grow best in ordinary soil, sandy soil with a large quantity of peat, poor soil with peat. Avoid rich soil, clay, lime, manure, fertilizer. Leaf mold, compost and seaweed make good food.

Choose a site well drained in full sun, placing plants eighteen inches apart; most varieties will meet in three or four years. Mass groups of one variety are most striking, but even in smaller plantings at least three, preferably six of one kind should be grouped together. Though full sun is the rule, the carneas do well under scattered pines or beneath tall deciduous trees where lowest branches are say fifteen feet from the ground.

April is the best month for planting, after the ground is no longer wet or sticky; thus the new plants get a good start before danger of Summer drought. Set out immediately upon receipt from the nursery, mixing two handfuls of peat with the soil for each hole. Place so plant foliage rests on the soil up to the point where little leaves start; this enables rooting on its own foliage. Firm in by hand, do not tread in. A final top dressing of peat is doubly beneficial, preventing weeds and retaining moisture. Soak with water, and keep well watered during drought, especially the first year.

Pruning

On the moors of England and Scotland nature provides her own pruning system; sheep and grouse eat the tops in the Winter and early Spring. In this country wherever rabbits are plentiful, they not merely prune but often destroy the plants, necessitating a wire enclosure. Trimming is beneficial, making the



Calluna vulgaris 'Foxii Nana' neat rounded pin cushion

HAROLD W. COPELAND



HAROLD W. COPELAND

Calluna vulgaris 'Sister Anne' unusual tuft with woolly foliage

plants compact and bushy, improving flower sprays and general vitality.

The rule is to prune Summer flowering varieties by the succeeding March, and trim Winter blooming varieties immediately after flowering, since these kinds set new flower buds early. Exceptions are low growing varieties needing attention perhaps each two or three years.

Propagation

There are four methods of propagation; from seeds and cuttings, and by layering and division.

Seedlings do not reliably come true. Given a greenhouse, cuttings taken in August are an easy way of multiplying plants, and some varieties can be propagated by cuttings using only a cold frame.

For the average gardener the easiest and best way of increasing heaths and heathers of all varieties is by layering. Simply peg down those branches near the ground, using wire bent like a hair-

pin or a brick to keep the branch in place. Put two or three inches of a mixture of leaf mold, soil and sand under the branch, and two inches above the buried portion. Layering may be done at any time; leave the layer for two years before severing and replanting separately. Many dwarf varieties will be found, after a few years, to have layered some of their own branches; these natural offsets can be removed in Spring.

Old clumps can be dug up for division but resulting plants are not nearly as satisfactory as from layering.

Winter Protection

Though in our own garden we give no protection, in less favored climes, plants should be mulched with peat moss or pine needles around the base, with a light cover of pine needles, marsh hay, cranberry vines or evergreen boughs.

Tree Heaths as *Erica stricta* and *E. arborea alpina*, being taller (four or five feet) can be hurt by strong winds at low temperatures. Plant in a protected spot.

Over one hundred varieties are growing at Chatham, Cape Cod successfully, but in fairness it must be admitted that conditions here are most favorable with the ocean on three sides tempering the climate. While correspondence indicates that plants thrive better here than on some parts of Long Island or the Connecticut shore, it is certain that a large

number of most beautiful varieties will thrive in hardiness zone 6 where limits of average annual minimum temperature are -5°F to 5°F .

Outstanding Varieties

Some of the favorites which have performed well in our garden are listed here with reason for selection.

Calluna vulgaris varieties.

'Aurea'—yellow-gold foliage, becoming deep red in Winter.

'County Wicklow'—double shell pink flowers, vigorous grower.

'Foxii Nana'—low, moss-like pincushion habit.

'H. E. Beale'—long spikes of silvery pink rosettes of flowers.

'J. H. Hamilton'—coral pink flowers, superlative in color.

'Mair's Variety'—one of the best white-flowered varieties.

'Mrs. Pat'—new shoots in Spring are vivid pink.

'Mrs. Ronald Gray'—prostrate ground cover—found on a North Devon cliff exposed to Atlantic gales. "Wisely it decided some thousands of years ago that a recumbent position gave the best chance of survival". It has lilac pink flowers and is a great favorite.

'Ruth Sparkes'—double white flowers with light gold foliage

'Sister Anne'—crinkled mossy tuft of a plant with downy silvery foliage.

Erica species and varieties.

arboorea alpina—a tree heath, feathery, light green, miniature Christmas tree.

Grows to five feet.



HAROLD W. COPELAND

Calluna vulgaris 'County Wicklow' double shell pink flowers



HAROLD W. COPELAND

Erica vagans 'Mrs. D. F. Maxwell' growing cherry pink with dark foliage

- | | |
|---|---------------|
| <i>carnea</i> 'aurea'—bright gold foliage | |
| 'King George'—crimson flowers | |
| 'Praecox Rubra'—deep rich red flowers | |
| 'Springwood White'—white flowers | |
| 'Vivelli'—red flowers, bronze foliage | |
| 'Winter Beauty'—deep pink flowers | |
| <i>cinerea</i> 'Atro rubens'—ruby red flowers | |
| 'Golden Drop'—golden copper foliage turning red in Winter | |
| × <i>darleyensis</i> —blossoms all Winter, vigorous and hardy, rose lilac flowers | |
| × <i>darleyensis</i> 'Alba'—white flowered form of above | |
| 'Dawn'—rose pink flowers, blooms all Summer | |
| × <i>tetralix</i> 'Alba'—'Alba Mollis' silver gray foliage, white flowers | |
| <i>vagans</i> 'Lyonesse'—one of best white heaths | most |
| 'Mrs. D. F. Maxwell'—deep rose cerise flowers | attractive |
| 'St. Keverne'—bright salmon pink | plants, a |
| | "must" in any |
| | collection |

Among the newer or lesser known varieties of special merit are these:

Calluna vulgaris varieties.

- 'Blazeaway'—foliage turns gold, orange, red and flame in Winter
- 'Elsie Purnell'—improvement even on H. E. Beale
- 'Minima' (Smith's var.)—dwarf 4" cushion
- 'Multicolor'—prostrate plant with yellow, orange, bronze foliage
- 'Peter Sparkes'—deeper shade of pink than H. E. Beale
- 'Robert Chapman'—foliage turns shades of gold, bronze, orange, flame and red. Perhaps best of all foliage plants.
- 'Silver Queen'—wooly silver foliage

Erica species and varieties.

- carnea* 'Eileen Porter'—rich carmine long lasting flowers
- cinerea* 'Hookstone Lavender'—unusual fine lavender color
- " 'Sandpit Hill'—Large rose pink flowers
- × *tetralix* 'Con Underwood'—large crimson flowers, gray green foliage
- " 'L. E. Underwood'—buds terra cotta, flowers apricot silver-gray foliage
- vagans* 'Birch Glow'—rose red flowers
- " 'Mrs. Donaldson'—creamy salmon-pink flowers

Inclusive List of Varieties Grown at Chatham, Mass.

(*denotes varieties considered especially worthy)

<i>Calluna vulgaris</i>	Height	Flower Color and Blooming Time	Remarks
'Alba'	18 in.	white, July-Sept.	
'Alba Plena'	18 in.	double white, July-Sept.	
'Alba Pilosa'	12 in.	white, July-Sept.	
'Alportii'	24 in.	crimson, Aug.-Sept.	
'Alportii Praecox'	18 in.	crimson, July-Aug.	
*'Aurea'	12 in.	purple, Aug.-Oct.	foliage gold in summer rusty red in winter
*'County Wicklow'	12 in.	double shell pink Aug.-Oct.	



HAROLD W. COPELAND

Group of *Calluna vulgaris* varieties—four year plants from pots—foreground 'H. E. Beale' & 'County Wicklow'

<i>Calluna vulgaris</i>	Height	Flower Color and Blooming Time	Remarks
'Cuprea'	12 in.	purple, Aug.-Oct.	foliage gold in summer reddish bronze in winter
'C. W. Nix'	24 in.	crimson, Aug.-Sept.	
'Dainty Bess'	4 in.	Aug.-Sept.	similar to Sister Anne
'Darleyensis'	18 in.	pinkish-red, Aug.-Sept.	close curled heads
'David Eason'	18 in.	red tinged purple, Sept.-Nov.	
'Elegantissima'	24 in.	lilac, Oct.-Dec.	latest variety to bloom
'E. Hoare'	18 in.	crimson purple, Aug.-Sept.	
'Else Frye'	12 in.	double white, July-Sept.	
'Flore Pleno'	18 in.	pink & lilac, Aug.-Oct.	
'Foxii Floribunda'	6 in.	pink mauve, Aug.-Sept.	a round mat
*'Foxii Nana'	4 in.	purple, Aug.-Sept.	a pincushion type
'Goldsworth Crimson'	30 in.	crimson, Sept.-Nov.	
'Hammondii Aurea'	18 in.	white, Aug.-Oct.	new shoots are bright yellow
'Hammondii Rubrifolia'	18 in.	purple, Aug.-Sept.	spring foliage tipped red
*'H. E. Beale'	24 in.	double silver pink Aug.-Oct.	one of the best
*'J. H. Hamilton'	9 in.	double coral pink Aug.-Oct.	best of pinks for color
'Joan Sparkes'	9 in.	double mauve, Aug.-Sept.	
'Kuphaldtii'	4 in.	rosy purple, July-Sept.	growth resembles a turban
*'Mair's variety'	24 in.	white, July-Sept.	
'Minima'	3 in.	purple, Aug.-Sept.	close growing mat
'Molecule'	9 in.	pink, Aug.-Sept.	
*'Mrs. Pat'	8 in.	light purple, July-Sept.	foliage vivid pink in spring
*'Mrs. Ronald Gray'	4 in.	reddish, July-Sept.	flattest growing of all
'Mullion'	9 in.	deep pink, Aug.-Sept.	
*'Nana Compacta'	6 in.	pink, July-Sept.	pincushion type
'Plena Multiplex'	18 in.	double pink, Aug.-Oct.	
'Pygmaea'	5 in.	purple, Aug.-Sept.	
'Pyramidalis'	24 in.	white, Aug.-Sept.	
'Rigida'	12 in.	white, July-Sept.	
'Roma'	9 in.	deep pink, Aug.-Oct.	
'Rubra'	24 in.	crimson, July-Sept.	
*'Ruth Sparkes'	9 in.	white, Aug.-Sept.	light golden foliage
*'Searlei Aurea'	18 in.	white, Aug.-Oct.	golden foliage
'Searlei Rubra'	36 in.	purple, Sept.-Oct.	
*'Sister Anne'	6 in.	pink, Aug.-Sept.	downy silver foliage
'Spicata'	12 in.	white, Aug.-Sept.	
'Spitfire'	12 in.	pink, Aug.-Sept.	golden foliage turning bronze red Winter
'Tenuis'	9 in.	red purple, July-Sept.	ter
'Tib'	12 in.	rosy crimson, Aug.-Sept.	
'Tom Thumb'	6 in.	pink, Aug.-Oct.	resembles miniature Japanese conifer
'Tomentosa'	18 in.	white, July-Sept.	



HAROLD W. COPELAND

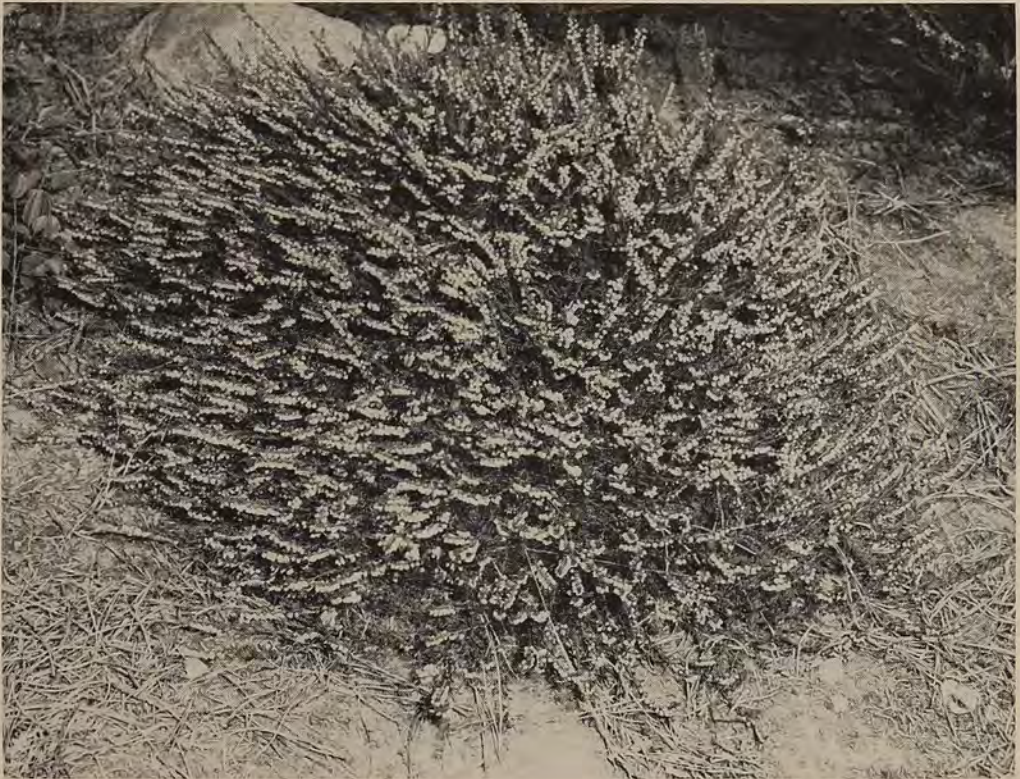
Calluna vulgaris 'H. E. Beale' foot long spires of silvery pink

<i>Erica</i>	Height	Flower color and Blooming Time	Remarks
<i>australis</i> 'Mr. Robert'	6 ft.	white, Apr.-June	a striking plant
* <i>arborea alpina</i>	5 ft.	ash white, Mar.-Apr.	resembles miniature Christmas tree
<i>carnea</i> 'Atrorubra'	8 in.	dark pink, Mar.-Apr.	
* " 'Aurea'	8 in.	deep pink, Feb.-Apr.	only carnea with golden foliage
* " 'Carnea'	8 in.	deep pink, Jan.-Apr.	
" 'Cecilia M. Beale'	8 in.	white, Jan.-Mar.	
" 'C. J. Backhouse'	8 in.	soft pink, Mar.-Apr.	The entire
" 'Gracilis'	6 in.	soft pink, Dec.-Mar.	
* " 'King George'	10 in.	crimson, Jan.-May	carnea group
* " 'Praecox Rubra'	8 in.	red, Dec.-Mar.	
" 'Rosea'	8 in.	rose, Jan.-Mar.	is very hardy
" 'Ruby Glow'	8 in.	ruby, Mar.-Apr.	
" 'Sherwoodii'	8 in.	deep pink, Feb.-Apr.	and mostly
" 'Snow Queen'	8 in.	white, Jan.-Mar.	
" 'Springwood Pink'	8 in.	bright pink, Jan.-May	winter blooming
* " 'Springwood White'	8 in.	white, Jan.-May	
" 'Thomas Kingscote'	8 in.	pink, Mar.-Apr.	
* " 'Winter Beauty'	8 in.	pink, Jan.-May	
* " 'Vivelli'	8 in.	carmine red, Jan.-May	attractive foliage
* <i>ciliaris</i> 'Mrs. C. H. Gill'	12 in.	cerise, July-Oct.	
" 'Stoborough'	18 in.	white, July-Oct.	
" 'Wych'	18 in.	pink, July-Oct.	

<i>Calluna vulgaris</i>	Height	Flower Color and Blooming Time	Remarks
<i>cinerea</i> 'Alba'	9 in.	white, July-Aug.	
" 'Alba Major'	9 in.	white, June-Aug.	
* " 'Atrorubens'	9 in.	ruby red, June-Aug.	free blooming
" 'Atrosanguinea'	6 in.	blood red, June-Aug.	
" 'C. D. Eason'	9 in.	reddish pink, June-Sept.	
* " 'Golden Drop'	4 in.	pink, June-July	foliage gold in summer, red and copper in winter
" 'Golden Hue'	12 in.	June-July	more golden & taller than above
" 'Mrs. Ford'	9 in.	carmine, June-July	
" 'Mrs. Dill'	4 in.	bright pink, June-Aug.	
* " 'P. S. Patrick'	12 in.	purple, June-Aug.	free flowering
" 'Splendens'	12 in.	rose, June-July	
" 'Violacea'	12 in.	lilac, June-July	
* × <i>darleyensis</i>	18 in.	lavender pink, Jan.-May	hardy & vigorous
* × <i>darleyensis</i> 'Alba'	18 in.	white, Jan.-May	
× <i>darleyensis</i>			
'Arthur Johnson'	18 in.	pink, Jan.-April	
'Dawn'	9 in.	rose, June-Oct.	long blooming period
'George Rendall'		deep lavender pink	
'Watsonii'		Jan.-April	
'Williamsii'		deep rose, July-Oct.	
		rosy pink, July-Sept.	
<i>mackiana</i> 'Plena'	8 in.	deep rose, May-Aug.	
<i>mediterranea</i> 'Alba'	36 in.	white, Mar-May	
" 'Brightness'	24 in.	rosy purple, Mar-May	specimen plant
* " 'W. T. Rackliff'	24 in.	white, Feb.-April	specimen plant
<i>terminalis</i> (<i>E. stricta</i>)	4 ft.	pale rose, July-Oct.	a tree heath
× <i>tetralix</i> 'Alba'	9 in.	white, June-Aug.	
* " 'Alba Mollis'	9 in.	white, June-Oct.	striking silver gray foliage
* " 'Con Underwood'	9 in.	crimson, June-Oct.	one of best of group
" 'Darleyensis'	6 in.	salmon pink, July-Oct.	
" 'Praegeri'	6 in.	pink, June-Oct.	
" 'Rubra'	6 in.	red, July-Oct.	
<i>vagans</i> 'Carnea'	12 in.	pink, Aug.-Sept.	
* " 'Lyonesse'	12 in.	white, July-Oct.	
* " 'Mrs. D. F. Maxwell'	12 in.	cherry, July-Oct.	As a group
" 'Nana'	6 in.	white, July-Oct.	<i>vagans</i> varieties
" 'Pallida'	12 in.	pale pink, Aug.-Sept.	are favorites
" 'Rosea'	12 in.	rose pink, Aug.-Sept.	because of
" 'Rubra'	12 in.	purplish red, Aug.-Oct.	hardiness and
* " 'St. Keverne'	12 in.	salmon pink, July-Oct.	excellent habit, foliage and flower.
<i>Bruckenthalia spiculifolia</i>	8 in.	light pink, June-July	Closely related to <i>Erica</i> and <i>Calluna</i>
<i>Daboecia polifolia</i>	24 in.	purple, June-Oct.	Closely related to <i>Erica</i> and <i>Calluna</i>
" <i>polifolia</i> 'Alba'	24 in.	white, June-Oct.	
* " <i>polifolia</i> 'Praegerae'	12 in.	salmon pink, July-Sept.	
" <i>azorica</i>	6 in.	rosy crimson, May-June	

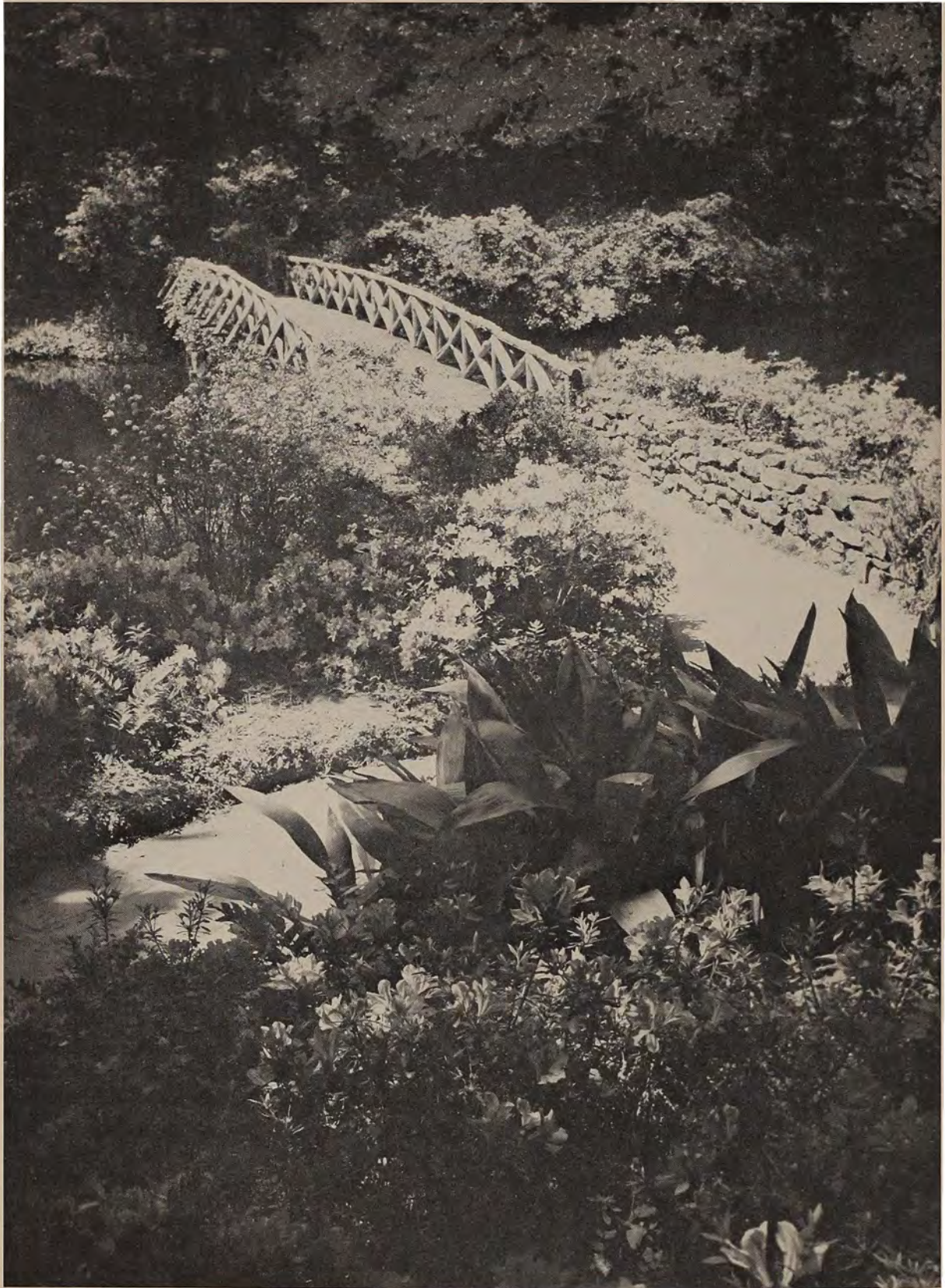
Newly Acquired Varieties

<i>Calluna vulgaris</i> 'Rosea'	12 in.	deep pink	Aug.-Sept.
<i>Erica carnea</i> 'Loughrigg'	8 in.	purple	Feb.-Mar.
'Mrs. Sam Doncaster	8 in.	pink	Feb.-Apr.
'" 'Pink Pearl'	8 in.	shell pink	Feb.-Mar.
'" 'Queen Mary'	8 in.	pink	Dec.-Feb.
'" 'Queen of Spain'	8 in.	pink	Mar.-Apr.
'" 'Rosy Gem'	8 in.	pink	Mar.-Apr.
'" 'Startler'	8 in.	pink	Mar.-Apr.
<i>ciliaris</i> 'Camla'	12 in.	coral pink	Feb.-Mar.
'" 'Hybrida'	6 in.	rose	July-Sept.
* '" <i>cinerea</i> 'Coccinea'	4 in.	rosy pink	June-Oct.
'" 'Frances'	12 in.	carmine red	June-Sept.
'" 'Knap Hill'	12 in.	cerise	June-Aug.
'" 'Rosabella'	6 in.	pink	June-Aug.
'" 'Rose Queen'	12 in.	pink	June-Aug.
'" 'Gwavas'	12 in.	pink	June-Aug.
* '" × <i>tetralix</i>		pink	June-Aug.
'Alba Mollis'	9 in.	pink	June-Oct.
'" 'Mary Grace'	6 in.	white	June-Oct.
<i>vagans</i> 'Kevernenesis		bright pink	June-Oct.
'Alba'	12 in.	white	Aug.-Oct.



HAROLD W. COPELAND

Calluna vulgaris 'J. H. Hamilton' bright double coral pink flowers



*The Rustic Bridge across Mirror Lake at azalea time. The bridge super-
structure is made of heart cedar.*

FRED W. HOLDER

Bellingrath Gardens— “The Charm Spot of the Deep South”

M. B. GREEN¹

History and Early Development

The site of Bellingrath Gardens, twenty miles south of Mobile fronting on the Isle-Aux-Oies River, was originally a beautiful coastal hammock of hardwood, yellow pine and cedar. It was acquired in 1917 by Walter and Bessie Bellingrath for use as a fishing and hunting camp—a retreat away from the noise and excitement of the city—where they and their friends might relax and be refreshed.

The Bellingraths enjoyed “Belle-camp” for about ten years, all the while becoming more and more enamoured with their beautiful woods of moss-draped live oak, water oak, gums, rich magnolia and stately yellow pine, little dreaming that here one day their modest camp would have been transformed into a world-famous shrine of landscape beauty.

The quiet beauty of this unspoiled spot—little changed from the forest primeval—in time inspired them with the idea of building their home here and, with the help of the Creator of all beauty, building their garden—the kind of a garden that would complement the native forest. They wanted their garden to be joyful and exciting, with colorful and exotic flowers artfully arranged but they wanted to preserve, at all cost, the serenity of the native woods.

So, in 1927 Mr. and Mrs. Bellingrath visited the famous gardens of Europe, studying their design, their plants and their horticultural practices in search of ideas that might help them to form basic plans for their garden.

They returned to Mobile filled with enthusiasm and with determination to get on with their garden. They began to buy large azaleas, camellias and other plants, planting them in their city garden and then around the Lodge at Belle-

camp. They were so thrilled with the effects of huge azaleas in woodland setting that they called in an American architect and later a French gardener and still later an English landscape engineer and started work in earnest. While the gardens were under development the Bellingraths studied gardens all over America and brought back invaluable information.

Then came the day one Sunday morning in the spring of 1932 when Walter and Bessie Bellingrath's dream of their garden had blossomed into reality. They had invited the people of Mobile to come to see their gardens with thousand upon thousands of azaleas and camellias and all the host of other plants in bloom. THE PEOPLE CAME in such crowds that patrolmen had to be called in to “unsnarl” the traffic jam on Bellingrath Road.

Following this demonstration of the people's hunger for the beauty of a garden it was found necessary to make an admission charge in order to control the crowds that thronged the gardens. What had begun as a hobby, to be enjoyed by the owners and their friends, in a few short years became a mecca for garden lovers the world over and famous as *one of the world's* most beautiful gardens.

Plan of the Gardens

The Gardens embrace a little over 60 acres, situated on a bluff fronting on Isle-Aux-Oies (Fowl) River on the east, on salt water bayous on the north and on the south and extending westward roughly to where the hammock ends and the yellow pine begins. They are richly wooded with live oak, water oak, *Magnolia grandiflora*, holly, cedar, sweet gum, black gum, hickory and other trees of 100 genera and species. The only areas not heavily wooded are: four acre Mirror Lake, four acres of lawn, a one acre rose garden and about seven acres in the camellia arboretum.

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FRED W. HOLDER

It's chrysanthemum time at Bellingrath Gardens with over ten thousand large plants from 8 inch pots carpeting many strategic spots in the Gardens, and several hundred large cascade plants displayed as curtains, pyramids, etc.

The Gardens are informal and naturalistic in character, the only formal portions being the rose garden and small areas of transition in the vicinity of the home. Attesting to the keen appreciation of the Bellingraths for the best in nature and the landscape gardener's art, and to the skill and artistry of the technicians who interpreted their dreams, many have described the Gardens as being a "perfect union" of the natural and the man-made landscape.

Access to all parts of the Gardens is by broad comfortable trails. The total trail length is nearly one and a quarter miles, half of hard packed earth and half of flagstone. The trails wind easily and naturally, revealing surprising and delightful vistas at every turn.

In the early years of intensive development many hundred large specimen camellias and azaleas and lesser numbers of sweet olive, *Camellia sasanqua*, *Michelia fuscata*, holly, *Photinia*, *Cleyera*, to mention a few, were brought in from all over the deep south. Many of the fine old camellia and azalea plants were more than a century old. These huge specimen were used as key plants—many as important vista and axial termini—and then thousands of smaller and lower growing plants were moved in to com-

plete the masses. Camellias and azaleas were very much in vogue in the 20's and 30's and, quite naturally, were very freely used in the over-all plantings. They thrived in the well-drained, acid soil and in the shade. In this garden in the woods there are only two areas in full sun—the rose garden and the great lawn.

As one progresses along the garden trails—the effect is kaleidoscopic—ever changing. There are: camellia gardens; azalea gardens; holly gardens; bulb gardens; rose gardens; deep, informal bays and major vistas, each featuring a fine old tree, a fine specimen or mass planting of special interest, or perhaps a superb view of Isle-Aux-Oies River. Also along the trails are hundreds of little informal nooks and bays left open in the permanent shrubbery like settings for gems. With the exception of beds planted to bulbs for natural bloom these beds are kept filled all year 'round with colorful bloom and foliage from the greenhouses.

Through the winter months quantities of forced Kurume and hybrid azaleas and other plants such as Dutch hyacinths, poinsettias, lilies, mums, etc. are used in the beds not planted to bulbs. When sub-freezing weather is forecast

the cold-sensitive plants are either taken in or covered. In late winter quantities of forced hydrangeas, *Cineraria*, *Calceolaria*, *Gloxina* and *Begonia* are also used.

Throughout the warm months, from April to November many of the subtropical flowering shrubs that are colorful all summer are used as annuals in these seasonal beds. Among these are *Allamanda*, *Acalypha* in variety, *Lantana* in variety, *Hibiscus*, *Aphelandra*, *Ixora*, *Croton*, etc. Rhizomatous and bulbous things such as dwarf *Canna*, fancy leaf *Caladium*, summer lilies, etc. are used extensively. Some of the annuals like *Salvia*, *Ageratum*, marigolds, zinnias and peppers in variety, are in bloom just about all summer.

Bellingrath Gardens is truly a YEAR 'ROUND GARDEN, where "beauty knows no season." In describing his garden Mr. Bellingrath enjoyed comparing it, in metaphor, to a lovely lady with 52 beautiful gowns—one for each week of the year. It was his way of saying that the Gardens were constantly changing their "gown" of leaf and flower, but were always beautiful—ever enchanting.

It has been said that the Gardens were a "YEAR 'ROUND SPECTACLE." Per-

haps a more apt statement would be the Gardens present a series of seasonal spectacles with the interest sustained 'tween seasons by *continuing* flower and foliage effects.

The outstanding seasonal spectacles are: Camellia Time, Azalea Time, Rose Time, Chrysanthemum Time and Poinsettia Time.

Camellia Time

Winter is camellia time at Bellingrath. Starting in October, lasting until April, and reaching its season of greatest profusion in January and February *Camellia japonica* presents a floral spectacle at Bellingrath Gardens of daily increasing interest until well into March.

Camellias contribute so much to the floral pageant at Bellingrath that they deserve more than passing mention. A native of the Orient the camellia came to Mobile through Europe more than a century ago. Possibly over 5,000 cultivars of *Camellia japonica* exist today, most of them being grown in America. Few plants flower in such diverse form and color.

During the 27 years that Mr. and Mrs. Bellingrath enjoyed building and living

A pretty summer scene in the center of the Courtyard showing the moss draped live oaks overhead and the colorful fancy leaved caladiums below.

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The Grotto in Bellingrath Gardens (near Mobile, Alabama) is located on a bluff overlooking the Isle-aux-Oies River near the Bellingrath Home. It is maintained the year round with seasonal flowering plants and provides another highlight for the visitor. It has been photographed from every conceivable angle by amateur and professional alike and has almost become a trade mark for the "Charm Spot of the Deep South".

Looking across Mirror Lake with azaleas, spirea and dogwood in full bloom and with scarcely a ripple on the water.

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This view, photographed in March, shows azaleas at the right and cinerarias at the left, with the Bellingrath Home in the center.

in the Gardens many hundreds of camellias were gathered from private yards and gardens throughout the deep south and transplanted in the Gardens. Beginning in 1956 a camellia arboretum has been under development. This collection now includes some 1,200 plants of nearly 900 cultivars.

In camellia time there are many "supporting characters." Poinsettias are very much in evidence from approximately December 15th through January. Forced lilies, azaleas and oriental magnolias contribute much color interest in January and the heavy fragrance of sweet olive fills the air throughout the Garden when it's not too cold.

Matching the crescendo of camellia bloom February brings Japanese cherry, oriental magnolia, and more and more forced azaleas and lilies and the first natural azalea bloom—that of Fortune's Vittata. It is during this month that camellia bloom is heaviest.

The camellia arboretum is certainly the feature attraction at this time. As the visitor strolls along the 12 foot grass paths he can observe most of the 900 cultivars in bloom at one time—everything from the tiniest miniature to the nine inch ones—and jot down the names of his choice.

Azalea Time

Normally the colorful azalea is very much in evidence in early March—long before the camellia show is over—and, with its "supporting characters"—red bud, dogwood, white spirea, daffodils, tulips, mountain laurel, lilies, hydrangeas—it produces an effect that is breathtaking. When the plants are in full bloom—little 6 inch plants and on up to the 20 foot plants—the bloom almost completely covers the foliage. One writer aptly called azalea time the "Flaming Drama of the South."

Azaleas first came to Mobile over 200 years ago. Fifise Langlois brought three colors from his childhood home in Toulouse, France. Since then several hundred cultivars have come from all over the world—from tiny dwarfs to trees and from pure white to all shades of pink, red, lavender, orange, purple and variegated.

Rose Time

Rose time begins at Bellingrath in early April, not after, but during azalea time and while even camellias are still blooming. Roses here are mostly hybrid teas, with only a few floribundas, grandifloras and climbers. In a formal garden, somewhat like the Rotary wheel emblem



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It's camellia time in February, with most of the 800 varieties in bloom. Here is a view in the Camellis Arboretum where visitors may compare the beauty and growth characteristics of the different varieties.

At chrysanthemum time over ten thousand large plants carpet many strategic spots in the Garden and several hundred large cascade plants are displayed as curtains, pyramids, etc.

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in design there are about 3,000 rose plants. Elsewhere about 1,000 polyanthas and floribundas are used as facing plants in front of shrub masses. Roses bloom from April until heavy frost in November but the spectacular show is in April when every plant seems to be in bloom.

Complementing rose bloom in April are: tulips, lilies, hydrangeas, anemone, petunia, etc. and following these are several flowering shrubs, and annuals that are at their best in the heat of middle and late summer. *Gardenia* and *Magnolia* bloom in May and June; and throughout the mid-summer and early fall salvia, ornamental peppers, *Hibiscus* and *Allamanda* are in bloom. The very colorful foilage of fancy leaved *Caladium*, *Croton*, *Acalypha* (copper leaf) are very showy all through the warm months.

Chrysanthemum Time

Chrysanthemum time is a real "spectacle" with ten thousand 8" pots of garden mums bedded out, and three hundred cascade plants displayed as

curtains, fountains, pyramids, etc. The effect is like huge, floral tapestries. The mum spectacular is in November lasting until sub-freezing weather in December, but thousands of forced plants may be seen in all gardens before and after the big fall show. Other colorful plants in October, November and early December are holly, *Pyracantha*, *Ardisia*, golden shower tree and *Camellia sasanqua*.

Poinsettia Time

Poinsettias suggest Christmas time with gayly colored plants all over the Garden—white ones—pink ones and red ones. At Bellingrath Gardens the floral effect is "MERRY CHRISTMAS!"

Other Features

In the midst of the Gardens is the Bellingrath Home with its Bessie Morse Bellingrath collection of antique furniture, priceless silver, rare porcelains and fine china. The Home was opened to the public January 1, 1956 after the death of Mr. Bellingrath according to his wishes as set forth in the Foundation Deed of Trust. Here is a wonderful op-

The Rose Garden blooms most of the year—from March to December—and is the only formal area in the "Charm Spot of the Deep South". Patterned after the Rotary Club emblem it reflects Mr. Bellingrath's deep interest in this organization.

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A view across Mirror Lake from the rockery in azalea time. The planting across the lake changes with the seasons. It's azaleas in spring, salvia in summer and mums in the fall.

portunity for those who appreciate fine works of art to not only see but to learn their origin and history. Guests are conducted through the home in small groups by well informed hostesses and former Bellingrath servants who interpret the Collection in varying manner, according to the interest of the guests.

Birds have always been most welcome in the Gardens and have been protected from hunting, trapping or molestation of any kind, but last year the area was officially designated as a Bird Sanctuary by the Audubon Society and the management began a long range development program to provide habitat condi-

tions to attract and hold not only the 43 species already here but many others.

The year 1964 will be recorded as another milestone in Bellingrath Gardens progress. A fine entrance gate facility is under construction that will provide all services and conveniences—ticket office, gift shop, snack bar, assembly room and a beautiful entrance patio—in a building of old, slave-made brick and iron lace, with a modern interior.

Another improvement that is also under way this year is a sunken garden on the site of the old lodge. And, still another fine improvement is the conversion of the garage into an air conditioned rest lounge with modern rest rooms.

Mr. Bellingrath continued to live in the Gardens until his death August 8, 1955, but ownership of them was transferred by him early in 1950 to the then newly created Bellingrath-Morse Foundation, a non-profit organization founded for the purpose of aiding charitable, religious and educational work in the South. The name "Morse" is in memory of Mrs. Bellingrath whose maiden name was Morse. The Gardens are administered by a Board of Trustees.

The Gardens are open every day of the year from 7:00 A.M. until sundown. Admission to the Gardens closes one hour before sundown, and to the Home at 4:00 P.M.

Small Daffodils for the Garden

B. Y. MORRISON

Since *Narcissus jonquilla* grows and behaves in the writer's garden, as though it were a native, curiosity to know its botanical kin, lead to the purchase at various times of such species as were available. The only one of all that have been here, that is not what could be called successful has been *N. juncifolius* and over one hundred bulbs have been planted. Whether the fault is wholly my own, in not having found a proper site cannot be guessed. It does not die out; but all these bulbs have given not more than ten blooms, coming very late in the season, which may be the main difficulty as all late blooming garden kinds are poor here, even in years when the temperatures are relatively mild.

One species has refused to grow at all, *N. watieri* and one, *N. marvieri* keeps barely alive. These two come from areas that make changes of climate of some difficulty, but if they are indeed no more than forms of *N. rupicola* which does live and bloom here, one is puzzled.

Dr. Fernandez in his paper, Sur La Phylogénie des Espèces de Genre *Narcissus* L. in Boletim de Sociedade Brotteriana, Vol. XXV (2ª Série), Coimbra 1951, gives a map showing the locations where these three species have been collected for his studies. *N. rupicola* in Spain and Portugal but the other two

species only from near Marrakech, in the Atlas Mountain area in Morocco, which may be reason enough for their failure here, even if their parent, *N. rupicola* has lived with apparent success for many years. It does not multiply by offsets much, and all seed so far has been removed at once.

The scape of *N. rupicola* bears but a single flower, that emerges from an almost paper thin, nearly translucent gray sheath. The flower faces upwards, sweetly scented with a rather distinct scent, with a perianth of Pale Lemon Yellow (Ridgway) and cup of Lemon Yellow.

N. scaberulus has been in the garden even longer than *N. rupicola* and the original planting remains, just about as it was originally set in place. Here again, all seed has been picked before ripening, but the pods are very distinct, much swollen in form, and not like any other known here. The flowers vary in number on the scape but are usually more than one. The color is a self Lemon Chrome. There seems to be little scent here, and the sheath that enclosed the buds is brown in color.

N. Fernandesi as it grows here, is the most robust of the successful kinds, with larger flowers, several per scape, a brown sheath and not a very strong scent. The color is Sulfur Yellow in the perianth and Lemon Chrome for the cup. The



VARIOUS JONQUIL SPECIES—Natural Size 1. *Narcissus Fernandesii*
2. *N. calcicola* 3. *N. scaberulus* 4. *N. rupicola*

B. Y. MORRISON

drawing shows the characteristic carriage of the latter as well as the flare of the perianth segments.

N. calcicola is larger than *N. scaberulus*, and has a sweet scent, typical of the jonquil group, but not distinct as is the case of *N. rupicola*. The sheath is gray, and the flower colors are a self that lies between Apricot Yellow and Empire Yellow.

Both *N. calcicola* and *scaberulus* were studied by Fernandez from collections made near Coimbra in Portugal.

From the map shown on page 123 (l.c.) it is his opinion that the ancestral *rupicola* spread from a site near Granada northward and westward for the three species, *rupicola*, *scaberulus* and *calcicola* while the migration that leaves *Watieri* and *Marvieri* in Morocco, was presumably made before the land broke between Europe and Africa. While he cites no collection of *N. rupicola* which he considers the ancestor of this group, from the African continent, this is implicit in his text.

As garden plants here, there are no difficulties in growing those that have succeeded, in the open border, with its typical sandy soil, not much enriched with the usual peat but with bonemeal at planting time and occasional fertilizing with ordinary commercial fertilizers. The site is sunny and in midsummer is hot as little shade falls on the one planting and only passing shade on the others.

From a landscape point, the most serious objection comes from the fact that each is represented by a meagre planting. Undoubtedly a much finer effect would be gained by plantings of fifty bulbs of each. As they can be placed close together this could simulate a colony. In a garden, that is much more "dressed up" than the writer's ever is, something might have to be devised to act as a ground cover, a difficult choice as it should not conserve too much water or make a mass of foliage through which the narcissus would have trouble in arising (in March here) for their early bloom.

All drawings show flowers life size.

Nothing has been said about the leaves of any of the species described. All represent the usual type of more or less rush like leaves, except in the case of *N. scaberulus* in which the leaves are somewhat flattened and are noted for

the slight roughness of the margins. No species here, is a precocious in leaf production as is *N. jonquilla* itself, and all will have quite ripened off and disappeared by late May in this garden.

If one reads some of the descriptions of these species as they grow wild, with notes as to soil, exposure and general character of terrain, one could be discouraged in thinking of them as garden plants. Again when one reads of their use in rock gardens, one can only wonder, if their placement there is not largely to assure the owner of the location, rather than any need of extreme drainage. It may well be that fine drainage is important, but that cannot be proven here as we have drainage in excess, and at times almost *in extremis*.

The first *bulbocodium* that appeared in the garden came by accident, as an admixture in one lot of *N. juncifolius*. None of this last has ever bloomed, but there have been at least five bulbs of what I now know is *N. bulbocodium obesus*. The next samples came as single bulbs from the Division of Plant Introduction, as it was then known, in the U. S. Department of Agriculture, collections by Dr. Frederick G. Meyer. Since all did as well in the sites chosen as any of the other species narcissus, it seemed logical to yield to curiosity and purchase whatever other names of *bulbocodium* narcissus as might be found. Practically all have come from Michael Jefferson-Brown, with a few earlier ones from Alec Gray. Now, it is difficult to find some that are here, which is regretted since these, like other small-flowered species would undoubtedly be more effective in the garden if they were in greater quantities. For any uncertain plant, it seems provident, to buy only a few until one knows that the plant will tolerate life on Coastal Mississippi.

Dr. Fernandez (l. c. page 161) has much to say about the members of the *bulbocodium* group, and the brief translation is suggestive.

"Before the opening of the Strait of Gibraltar, the ancestral species, through an accumulation of genetic mutations as well as structural alterations, gave rise to *N. Bulbocodium* L. a species which because of the frequency of its occurrence as well as the diversity of the habitats it can occupy, one may consider as the most successful of the



B. Y. MORRISON
VARIOUS BULBOCODIUMS—Natural Size 1. *Narcissus bulbocodium albidus zaianicus lutescens* 2. *N. b. Romieuxii* 3. *N. b. cantabricus* 4. *N. b. tananicus* 5. *N. b. praecox* 6. *N. b. P. I. 239061* 7. *N. b. obesus*

genus. This species retains certain characters of the ancestor, (leaves narrow, tube of the corolla large and the stamens with filaments almost free) but at the same time it has acquired certain new characters (Flowers solitary, filaments curved to one side and the corona (or crown) greatly developed."

"The opening of the Strait of Gibraltar, divided the newly formed species into two new areas, southern Spain and northern Morocco, regions that caused it to expand into new territories."

In Spain the development went northward covering the entire peninsula including Portugal, and extending into the three bordering provinces in France; in Morocco, the expansion was eastward into Algiers, and southwards on the coast to a point beyond Agadir.

Apparently this is a species that intrigued Dr. Fernandez for he seems to have made many collections, and examined all for their caryological make up, particularly those occurring in Portugal.

All of this seems far afield from a garden of small importance in southern Mississippi, but now that the writer has been reading Fernandez once again, he looks with new interest on his plants. None that has been acquired has failed though the habit of the species from northern Africa for what must be considered winter-blooming, means that they run the annual hazard of poor weather, whether of actual cold or merely downpouring rain. There seems to be some variation from year to year in the dates of the most precocious species or forms, but basically the group has more blooms in the months of January and February with more in the second month, than earlier.

As in the case of the jonquils described, the foliage is not a matter of great notice. Again, there is one species with leaves that lie flat on the ground, making a pattern that almost suggests an octopus. *N. bulbocodium obesus*. The others make slender leaves, some so slender as to appear almost fragile. Some make a quantity of leaves so that there is a foliage mass through which the flowers rise, as in the case of what used to be known as *N. bulbocodium monophyllus foliosus*, a name that is no longer acceptable, and replaced, I believe by *N. bulbocodium cantabricus*. There is one other species that Mr. Jefferson-Brown feels might be used

almost as an edging plant on account of the abundant leafage and its long persistence.

Here, they are all grown frankly and openly for my own instruction and pleasure. Only one kind has been bought in any quantity for general planting, namely *N. bulbocodium citrinum*, which pleases me greatly. It has one curious habit, here at least, that that no matter how excellent the bulbs may appear, not one will flower the first season, even when potted and kept in the cool greenhouse. Some times only a solitary leaf appears, sometimes two.

The flowers shown in the drawing are not all that might have been drawn had the writer been alert to the idea. Enough are shown to indicate that there is a diversity of form and carriage among them.

The first, with its prodigious horticultural name, that has not yet been taken apart by taxonomists, is *N. bulbocodium albidus zaianicus lutescens*. One can only suspect that this is a color form of some local form, of a whitish-colored species. The writer has no descriptive material to indicate the source or the location. It barely overtops its leaves, with flowers of Pinard Yellow, the ovary Grape Green inside the brownish sheathing bracts. Scape about 5½ inches tall. It bloomed in 1964, on February second.

Number two of the chart is *N. bulbocodium Romieuxii* a most lovely thing and a second species of which a quantity is now on order for general planting. The color is Pinard Yellow and the quality of the flower tissues is such that they appear almost of gossamer delicacy, but they are in fact very firm and stand weather well. Various color variants are or have been reported and if all are as splendid as this one, all will be worth hunting for and increasing. By seed one surmises, since increase by offset seems slow here.

The third on the chart is one of the many small bulbs that I have, from an early lot on which the labels were misplaced. Undoubtedly it belongs among the various *cantabricus* forms. The color of the flower drawn was Picric Yellow, a fine clear light yellow, and the perianth segments were tipped lightly with green. If the decision is correct that this is in fact a form of *cantabricus*, it can be reported that increase by bulb off-



DONALD S. MERRETT

Narcissus Bulbocodium

sets seems to be rapid. How long it will be before any of the infants come to flowering sizes remains to be proven.

Bulbocodium tananicus, number four on the drawing, is a small but very charming thing as its perianth makes a sprightly collar under the frilled crown, as frilled as in some of the *cantabricus* forms. The color is white, a clear and unstained white.

Bulbocodium praecox in spite of its name was not one of the earliest to bloom here, coming about in midseason. This again, is Picric Yellow, but the staining on the tube, below the perianth segments is a greenish yellow, that seems green by contrast. As the flower ages, the trumpet gets a little crapey in texture so that it suggests the *cantabricus* forms of which it is no immediate kin. There is a faint perfume, the only one noted among all the flowers drawn, but the writer is not a good judge of such.

The single example of number six, sent here for evaluation as P. I. 239061, as *N. Bulbocodium* is the smallest of all the *bulbocodiums* grown here. The color is a bright yellow, better than Light Cadmium but not quite strong enough to be called Cadmium Yellow. The pattern of green on the backs of the perianth segments is deep green and conspicuous. Lettuce Green of Ridgway.

This form has seeded and the seedlings have come up some distance from the mother bulbs. As yet there is little sign of multiplication by offsets. On account of the strong color this may well be worth increase by seed.

The last example, *N. bulbocodium obesus*, with which we began this paper, has the largest flowers, on the shortest scapes (here). It is also notable for the size of the tube, which makes a gradual line into the crown, rather than having a more slender diameter as in most. It is not as strongly patterned with green on this tube, as in some, but enough so that one notes it. This seems to be one of the forms of *bulbocodium* in which the stamens and pistil are contained within the crown, if the local observation is correct. The other drawings show the curved stamens all to one side, and the pistil extended well beyond them, as noted by Fernandez and mentioned earlier in this small piece.

As far as one can tell here, there are no problems of cultivation, and unless one cannot endure the loss of blooms from inclement weather, there seems no reason to neglect even the most precocious forms. If planted near *Tritelia uniflora* there is a nice, though elementary, contrast with the lavender blue of that equally hardy and useful bulb.

Rust of Juniper, Flowering Crabapple, and Hawthorn

CURTIS MAY¹

The two common rust fungi that cause serious diseases of juniper, flowering crabapple, and hawthorn lead an amazingly complex life. Juniper, and apple or hawthorn must be available for these rusts to survive. They cannot spread from juniper to juniper, apple to apple, or from hawthorn to hawthorn. They must shuttle from juniper to their respective alternate hosts and back to juniper to complete their life cycle. The rusts stimulate proliferation of infected juniper leaves which enlarge and form galls commonly called cedar apples.

The juniper-flowering crabapple galls are light chocolate brown, roughly globular, and one-eighth inch to 2 inches

in diameter. They mature the second spring after the juniper is infected. During early spring rains they swell and numerous, long, orange, flexible, ribbon-like gelatinous appendages are extruded from small, round depressions on the surface of the gall. The appendages, commonly called spore horns, are crowded with countless rust spores which do not all mature at the same time. Heavily galled junipers may seem to be in bloom when the yellow-to-orange spore horns are full expanded. Finally, the spore horns shrivel and the galls become woody. They may drop or remain until the next year; but old galls are functionless. Spores from the galls can infect flowering crabapple leaves. Infected leaves develop yellow-to-orange spots in which spores are produced that can infect only juniper. They may in-

¹Pathologist, Crops Research Division, Agricultural Research Service, United States Department of Agriculture, Beltsville, Maryland.



Left—Spore horns in early stage of development.

Right—Spore horns gelatinized. Spray should be applied before the horns reach this stage.

fect at once or may survive on the surface of juniper leaves and infect the following spring. Thus the cycle from juniper to apple and back to juniper is completed.

Juniper-hawthorn rust has a somewhat similar life history. The galls on juniper are irregular and greenish-brown when young, becoming light chocolate brown as they age. They also mature the second spring following infection. The dark orange, wedge-shaped, relatively few, gelatinous spore horns extrude from the galls during rains or misty weather in spring. The galls function more than 1 year. Spores from the galls can infect hawthorn. Rust spots or pustules on hawthorn and flowering crabapple are orange-to-yellow on the upper leaf surface; on the lower leaf surface they are brown, raised and have hair-like bristles. Spores produced in the spots on the lower leaf surfaces are distributed to junipers in summer. Thus the fixed cycle from juniper to hawthorn to juniper is completed.

Another rust fungus on juniper causes elongated swellings of twigs and other woody parts. The rust is perennial in the swollen tissues. Its spores pass to apple, quince, hawthorn, serviceberry, mountain ash, and pear. Damage to flowering crabapple is reported to be minor but abundant infection may occur on hawthorn fruits and twigs.

Scientific names of the rust fungi and common names of the diseases each causes are: *Gymnosporangium juniperi-virginianae* Schw.—Juniper-apple Rust, *Gymnosporangium globosum* Farl.—Juniper-hawthorn Rust, and *Gymnosporangium clavipes* (Cke. & Pk.) Cke. & Pk.—Juniper-quince Rust.

Infective spores of the rusts are largely wind-borne. Experience has shown that separation of junipers and the alternate hosts by 1 mile prevents serious outbreaks of the rust diseases. But usually separation by a mile is not possible for the gardener. Fortunately, other methods to control the diseases have been developed through research. These include sanitation, spraying, and use of rust-resistant selections.

Sanitation.—Removal of galls from junipers as soon as they are detected and certainly before the spore horns swell is practicable if junipers are not numerous in the area and the trees are not

too large. Where susceptible junipers are native, large or numerous, gall picking would be impracticable and ineffective. Untreated galls on wild trees could produce a multitude of air-borne spores to infect their ornamental alternate host plants. Spraying with fungicides, however, is practicable and effective.

Spraying.—Junipers. Spring Application: To prevent spread of rust spores from juniper, spray the trees with a fungicide when the colored spore horns first appear on the galls and before they gelatinize. Spread of viable rust spores from juniper can be stopped or greatly reduced by the spray. Use the antibiotic, cycloheximide. This material is available as Acti-spray² or Actidione. Use 50 of the 380 milligram tablets in 100 gallons of water or 5 tablets in 10 gallons.

Summer Applications: Spray junipers in July or August to protect them from infection by spores produced on flowering crabapples and hawthorn. Dr. J. C. Carter of the Illinois Natural History Survey has recommended a formulation containing Ferbam and wettable sulfur. Use one-half pound of Ferbam and 3 pounds wettable sulfur in 100 gallons of water (1 oz. of Ferbam and 6 oz. of the sulfur in 12 gallons). Keep the mixture agitated while spraying. Junipers produce new growth all summer and rains wash away the fungicides. Moreover, fungicides do not adhere well to juniper foliage because of the waxy covering of the needles. Therefore several, sometimes up to 6, applications of fungicide may be needed for full protection. Generally junipers are not killed by the rusts. However, there are situations where clean plants are wanted or where junipers are severely damaged. Spraying is then necessary to keep them attractive.

Flowering Crabapple and Hawthorn

Timing of spray applications is important. Spray crabapple or hawthorn in spring when spore horns first appear on the juniper galls, or when the crabapple flowers are beginning to open. Use Ferbam (1.5 lb. in 10 gal. of water) or the Ferbam-sulfur combination dis-

²Mention of a trade name or a company's product is for information only with the understanding that no discrimination is intended and no guarantee of reliability implied.

cussed above. It is well to remember that Ferbam is black and that sulfur reacts with some kinds of paint. Because severity of rust varies in different parts of the country, the number of applications of fungicide needed for satisfactory control varies. Three applications at about 10-day intervals should give good control even under conditions favorable to the rusts. No mid-summer application is needed to control the rusts on hawthorn or flowering crabapple.

Rust Resistance.—Mr. J. B. Brouwers reported in *Arborists News* of Feb. 1951 that *Crateagus monogyna* Jacq. is resistant to the hawthorn-juniper rust. Many cultivars of flowering crabapples are susceptible to the apple-juniper rust. Dr. Lester P. Nichols of Pennsylvania State University published in the March 1963 issue of *Arborists News* a list of flowering crabapples on which he had observed rust. Among these were *Malus* 'Bechtel', 'Biltmore', 'Charlotte', 'Cheals Golden Gen', *M. coronaria*, 'Dunbar', 'Dwarf Bechtel', 'Fairy', 'George Eden,' 'Georgia', 'Gladwynne', *M. Halliana* 'Spontanea', 'Improved Bechtel', Klein's Bechtel', 'Lady Ilgen', 'Mathews', 'Mercer', 'Orthocarpa', 'Palmer', 'Prairie Rose', 'Prince Georges', *M. prunifolia*, 'Fastigiata', 'Rehder Sweet', 'Robin', 'Scheidecker', 'Southern', 'Veitch', 'Wild Red', and 'Wynema'.

I know of no list of rust-resistant flowering crabapples. However Dr. Nichols reported in *Plant Disease Reporter*, Vol. 47, No. 4, numerous cultivars on which no rust was noted in surveys in 1961 and 1962.

Several years ago a rust-resistant red cedar was found by the late Dr. Anthony Berg of the University of West Virginia. The selection unfortunately was susceptible to juniper canker and, so far as I have been able to determine, is no longer available.

Drs. E. B. Himelick and Dan Neely of the Illinois Natural History Survey present in *Illinois State Nurserymen's Association Newsletter* of March 1, 1963, lists of rust resistant and rust susceptible junipers. Their lists are quoted directly here by permission.

Junipers resistant to cedar-apple and cedar-hawthorn rusts:

Juniperus chinensis

'Aureoglobosa'
'Columnaris'
'Femina'
'Fortunei'
'Globosa'
'Japonica'
'Keteleeri'
'Leeana'
'Mas'
'Oblonga'
'Pendula'
'Pfitzeriana'
'Pfitzeriana aurea'
'Pfitzeriana Nana'
'Plumosa'
'Plumosa aurea'
'Pyramidalis'
'Sylvestris plumosa'
'Variegata'
'Watereri'

J. communis

'Aurea'
'Aureospica'
'Compressa'
'Cracovica'
'Depressa'
'Hispanica'
'Oblonga'
'Oblongo-pendula'
'Pyramidalis'

var. *saxatilis*

'Stricta'
'Suecica'
'Nana'

J. conferta

J. davurica

J. excelsa 'stricta'

J. formosana

J. formosana 'glaucua'

J. glaucescens

J. hetzii

J. horizontalis

'Admirabilis'
'Adpressus'
'Argenteus'
'Douglasii'
'Eximius'
'Filicinus Minimus'
'Glomerata'
'Hudsonica'
'Lividus'
'Petraeus'
'Plumosa Compacta'
'Subglaucus'
'Variegata'
'Wiltoni'

J. macrocarpa

J. monosperma

- J. procumbens*
J. rigida
J. sabina
 'Fastigiata'
 'Pyramidalis'
 'Tamariscifolia'
 'Variegata'
J. squamata
 'Albo variegata'
 'Argesii'
 var. *Meyeri*
 'Parsoni'
 var. *Wilsonii*
J. virginiana 'aureovariegata'
 'Burkii'
 'Globosa'
 'Kosteri'
 'Horizontalis'
 'Plumosa'
 'Pseudocupressus'
 'Pyramidalis'
 'Pyramidalis glauca'
 'Tripartita'
 'Venusta'
Junipers susceptible to cedar-apple and cedar-hawthorn rusts:
Juniperus chinensis 'globosa'
 var. *Sargentii* (c)
J. horizontalis 'alpina'
 'Plumosa' (a)
J. pinchotii (c)
J. scopulorum
 'Funalis'
 'Hillii'
 'Hillii argentea pyramidalis'
 'Horizontalis'
 'Moffetii'
 'Pendula'
 'Pillaris' (a)
 'Viridifolia'
J. silicicola
J. virginiana
 (Berg's strain) (b)
 'Albospica'
 'Canaertii'
 'Chamberlaynii'
 'Cinerascens'
 'Cupressifolia' (c)
 'Elegantissima'
 'Fastigiata'
 'Filifera'
 'Glauca'
 'Nova'
 'Pendula'
 'Polymorpha'
 'Pyramidiformis'
 'Reptans'
 'Schotii'
 'Variegata'
 (a) Slightly susceptible to cedar-apple rust, resistant to cedar-hawthorn rust.
 (b) Slightly susceptible to cedar-hawthorn rust, resistant to cedar apple rust.
 (c) Slightly susceptible to both rusts.

A Visit with Lester Rowntree

By PHILIP A. BARKER*

"We must teach our youngsters the importance of conservation." So urged Lester Rowntree to students in a landscape horticulture plant materials course during a visit to the Davis campus of the University of California.

As she sat with the class under one of the Arboretum's Monterey pines (*Pinus radiata*), she spoke radiantly of the fact that values in today's society must derive from an appreciation of the simple things of life. She recalled the wilderness beauty of the natural landscape upon which was later built the

California city of Pasadena. Warning that natural areas are being depleted rapidly, she requested that today's citizens act promptly to conserve as many acres as possible in their indigenous condition. "Such areas," she added, "are an essential heritage for future generations."

Even though her age exceeded 80 years, Lester Rowntree declined all offers of transportation between Davis and her home. She replied that this would be too great an imposition and that she would drive to the home of her son, Cedric Rowntree, in Danville, California and that we could meet her there. Her story "Lone Hunter" in the *Atlantic Monthly* in 1939, suggests that it was

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Botanist and author Lester Rowntree of Carmel Highlands, California, (in white blouse at far right) faces an audience of jovial students in the arboretum at the Davis campus of the University of California where she chatted about her beloved flowers, shrubs, and trees.

with similar persistent determination that Lester Rowntree traveled the untraveled areas of much of California, studied the plants growing there, and wrote about them and the unbelievable experiences which accompanied her pursuit of them. Excerpts from it follow:

"I didn't take up this job for the poetry of it . . . I honestly wanted to find out about California wild flowers. There was little written about them in their habitats and nothing at all about their behavior in the garden, so I made it my job to discover the facts for myself . . .

"I live, when I am under a roof, on a steep hillside. In front, beyond the tops of Monterey pines, stretches the Pacific Ocean. . . . But I inhabit my hillside only from November to February, while the winter storms are blowing and the winter rains pouring. In March and April I have long shining days on the desert, in May happy weeks in the foothills, where a chorus of robins wakes me and my morning bath is in a rushing stream of just-

melted snow. In June, I am in the northern counties scented with new-mown hay and wild strawberries, in July in the higher mountains, and in August and September up in the pine zone with burro . . .

"Ten thousand or fifteen thousand miles doesn't sound like much for a season's work, but in my case it isn't the automobile mileage which counts. It's the distance covered on foot, alone or with pack animals. A person who studies plants doesn't work on the highways. The road is just the place where you leave your car—a point to start from and come back to . . .

"The plants I go to look for grow along little-used roads that are narrow, rutty, sandy, muddy, or dusty, or roads which in the desert are scarcely more than ledges . . . They are terrible from the tourist's point of view, but the botanist usually looks upon them and finds them good. They may be one-way mountain thoroughfares with an almost perpendicular bank on one side and an abrupt drop



Various members of the University of California at Davis honored Lester Rowntree at an outdoor luncheon. Clockwise from bottom left are Don Sexton, Dr. John H. Madison, Mrs. Alyce W. Lowrie, Warren Roberts (partially hidden), Mrs. Rowntree, Dr. John M. Tucker, Dr. C. Ledyard Stebbins, Dr. Lloyd L. Ingraham, Dr. Reid M. Brooks, Philip A. Barker, and Dr. Charles M. Rick, Jr.

of many hundreds of feet on the other, but I have my happiest times upon them, though they do possess certain drawbacks, chief of which is the practical impossibility of parking. Also, they are bad to be caught on at night. Because I always feel that just around the corner there is sure to be a place wide enough to pull off and go to sleep, I go on and on with dumb persistence,—along this ridge, across that spur,—till it sometimes ends in my trusting to luck that no one will be traveling that night, and going to sleep right in the middle of the road. . . .

“Occasionally—only very occasionally—I come upon men, or men and women, of like mind to myself, and bent on the same sort of work. Then how our tongues wag as we compare notes and specimens and recommend good hunting spots to each other. These few meetings are bright spots on my journeys. . . .

“[Once] I had been gayly heading north after a glorious trip into the mountains at the edge of the desert. In my car were many tin cans, once filled with beans and peaches, now holding seedlings of native plants for a rock garden which was being

evolved out of an abandoned quarry near Carmel. In a big water-filled tin was a fine assortment of cut wild flowers for a show which was just about to open. The river below me pranced seaward singing a happy song, and there were lovely places to stop; but a bed with clean white sheets awaited me, and the flower show started the next day. Briskly rounding a curve, the car met a huge boulder fallen from the mountain side. The road was narrow—to narrow for car and boulder both. The car swerved, bounced to the side of the road, and balanced itself on the brink.

“Should I jump? No—all those nice cut flowers were between me and the safe level ground, and I might damage them. But another look down into the canyon and a last teetering of the car convinced me that those flowers would never see the show anyway. So I jumped—just in time. I went one way and the car went the other. As I landed on hands and knees I heard the slow deliberate crunch, grind, crish, crash as it turned over and over on the way down to the canyon bottom and subsided there among boulders and poison oak . . .

Far into the night [a] rosy-cheeked garage man worked . . . At last came the moment when uncannily, and rather like a movie running in reverse, [the wrecked car] arose to its wheels, slowly mounted the incline, teetered once more on the spot where we parted company, and alighted on the road . . . I watched my car wobble off into the dark, hanging from the derrick of the wrecking car like a mouthful of unmastered prey from the muzzle of a dinosaur backing into his den; then I spread my bedroll in a sandy trench and went to sleep. "I generally seem able to sleep pretty well, whatever happens. . . ."

Upon meeting her in Danville, to drive her to Davis, she stated that she would just as soon be called Lester and nothing more. Soon it became apparent that, attendant with this simplicity of character, curiosity and alertness were two other important personality traits of this eminent botanist. While eating dinner at the Nut Tree restaurant near Vacaville, she asked "Where's the nut tree?" When told of its doom some years ago, Lester inquired "What kind of a nut tree was it?" The menu gave a historical sketch of its origin: indicating that the nut from which it grew was brought to California in 1859 after being gathered along the banks of the Gila River in Arizona. A picture of the tree, displayed on a wall in the restaurant, showed it to be quite large, possibly 70 feet, with limbs drooping to the ground. But its exact identity was not then de-

termined.¹

Perhaps Dr. and Mrs. T. Elliot Weier, who invited Lester to breakfast the next morning, could have identified it for her. But by then other matters were of immediate interest, such as Dr. Weier's reflecting on how he, along with Dr. Charles M. Rick, Jr., and other members of the original campus arboretum committee here, had planted the banks of Putah creek with hundreds of California natives, many being donated by James Roof from his botanical garden collection in Tilden Regional Park near Berkeley, California. Dr. Weier noted that, as young and energetic staff members, their efforts were inspired by reading Lester Rowntree's vivid accounts of California natives.

Gardening magazines on library shelves hold upwards of 100 of her articles—her autographed legacies to horticultural journalism—assessing the character, habitat, and garden requirements of California native plants. "Flowering Shrubs of California and Their Value to the Gardener" is the fitting title of one of her six books. Four of these were written especially for children.

To everyone—students and faculty—Lester Rowntree spoke glowingly of the values to be learned from observing and experiencing nature—genuineness, simplicity, serenity.

¹Apparently alluding to the particular tree for which the Nut Tree restaurant was named, Ralph E. Smith identifies it as a *Juglans major* in the University of California Agricultural Experiment Station Bulletin No. 231, dated 1912. He mentions also that this species is common throughout southern Arizona, in mountain canyons and alluvial soils of flood plains, growing at altitudes between 1,500 and 8,000 feet.

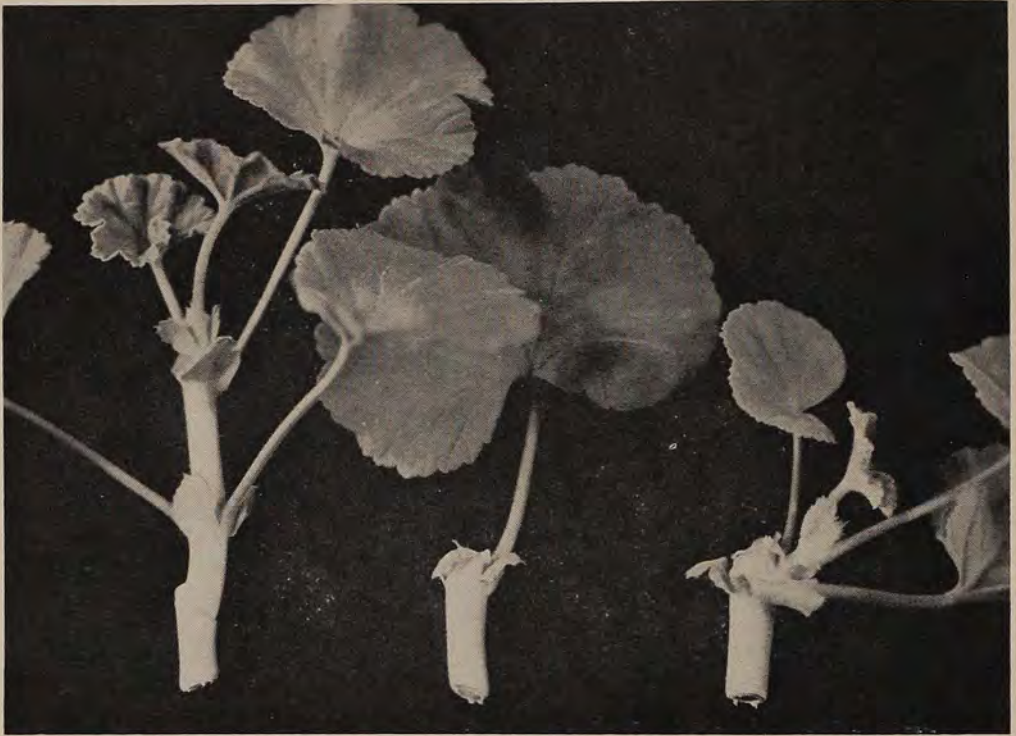
Quality Geraniums from Research at Penn State

DARRELL E. WALKER*

The Agricultural Experiment Station of The Pennsylvania State University is supporting an extensive research program on the many phases of geranium production and breeding. The floricult-

ture and plant breeding sections of the Department of Horticulture are collaborating with the Department of Entomology and the Department of Plant Pathology to study the cultural aspects including methods of propagation, soil mixes, watering methods, nutrition and disease and insect control as well as

*Pennsylvania State University, University Park, Penn. Presented at the 19th American Horticultural Congress, New York City, Oct. 1, 1964.



JOHN MASTALERZ

Types of cuttings from left to right: Terminal; stem with bud; and stem with one inch shoot.

varietal improvement through genetics and breeding.

This research may be cited as an example of how much more can be accomplished when several scientists with different but related specialties work together than any one working alone. The work described here is the combined efforts of Dr. J. W. Mastalerz and Dr. J. W. White, in floriculture; Dr. J. Tammen and Mr. J. F. Knauss in plant pathology; Dr. R. J. Snetsinger in entomology; Dr. R. Craig, Mr. W. W. Knicely and Dr. D. E. Walker in plant breeding.

Pennsylvania feels a definite responsibility to do this work since it produces almost ten percent of the 40 million geranium plants produced annually in the United States. Sales of these plants make a significant contribution to the economy of the state. These statistics refer to plants of the genus *Pelargonium*, commonly called geraniums, and are not to be confused with the large genus *Geranium* which has representatives distributed over many parts of the world. Further, most geraniums in com-

merce are included under *Pelargonium hortorum*, the common zonal geranium. However, the Regal or Martha Washington types, *Pelargonium domesticum*, are also important. There are several of somewhat lesser commercial significance such as the ivy-leaved, the scented and the miscellaneous dwarf and variegated-leaf types.

The production of high quality plants depends upon several factors: means of propagation; optimum cultural treatment; disease and insect control; and good varieties. The program at Penn State covers all of these phases and will be discussed in that order.

At present, the principal method of propagating geraniums commercially is asexually or by cuttings, however, a discussion of geraniums from seed will follow later. The quality and quantity of cuttings available is clearly dependent upon the mother or stock plants used in propagation. In asexual propagation, the cuttings produce plants exactly like the parent plant with few exceptions. It follows that if a poor quality stock

plant is chosen, the offspring will also be inferior, therefore vigorous plants that are true to type, apparently free from disease, free flowering, early blooming and of good habit should be chosen for this purpose. After a good parent plant is selected, the quality and quantity of cuttings available depends upon culture of the stock plants.

Dr. John Mastalerz has done considerable research on the culture and handling of stock plants and from this can make several recommendations. He has shown that a loose soil mixture composed of 3 parts silt loam, 1 part peat and 1 part perlite or other coarse aggregates such as sand or vermiculite is an excellent growing medium. He recommends sphagnum peats but agrees that local peats, pine and hemlock barks or redwood sawdust can be substituted. Stock plants should be grown in one-half bushel baskets and they should be fertilized with three pounds of 20-20-20 fertilizer in 100 gallons of water applied once a week during the spring and summer with a reduction to once every

three weeks during the winter. There are a few slowly available fertilizers that can be substituted for the 20-20-20. Two of these are urea-formaldehyde and the coated fertilizers. The former is an organic fertilizer and the latter are regular chemical fertilizers covered with a plastic coating which controls the rate of release of the chemicals. Since both types are released slowly, sufficient amounts can be mixed with the compost before planting to eliminate the need for further feeding. Adequate water should be supplied at all times to prevent undue hardening of the plants which in turn will result in a reduction of the number of cuttings.

Two distinct systems are available for handling stock plants. The conventional method, used for many years, is one in which the plants are pinched one or more times to induce branching and the terminal cuttings are harvested at regular intervals. These terminal cuttings are rooted and they in turn may be topped to produce additional cuttings. The stock plants are usually maintained



JOHN MASTALERZ

Plants resulting from different types of cuttings (left to right): Terminal; stem cutting with one node; and stem with two nodes.



JOHN MASTALERZ

Conventional type stock plant—cuttings harvested regularly.

one or two years. A more recent system has been developed and uses a single-stem, tree-type stock plant. The rooted cuttings or young plants to be used as stock plants are planted in the baskets. The top of the plant is not pinched and the main stem is trained to grow upright by tying it to a stake. The side shoots that develop are pinched regularly to produce a large number of cuttings which are accumulated on the plant. It may be necessary to remove some of the larger leaves to permit air circulation and provide more light for shoot development. When cuttings are required, the entire plant is cut up into terminal and stem cuttings to produce a large number of plants at one time. Stem cuttings produce plants of a quality equal to those from terminal cuttings. Dr. Mastalerz recommends that a stem cutting contain two nodes or eyes and care should be taken to avoid an eye that has produced a flower because it won't break after rooting. Too close spacing of stock plants causes thinner growth and thus lower quality cuttings.

Dr. Mastalerz has found that the quality and quantity of cuttings from the

two methods of handling stock plants are equal. It may be necessary to use slightly more space and light and less water when rooting stem cuttings to guard against botrytis infection at the cut end which is exposed.

An interesting by-product of this type of stock culture can result from a partial harvesting of the cuttings. If only the lateral shoots are harvested from the elongated stem and a few are left at the top a very interesting tree-type geranium of considerable ornamental value will result. Such a plant is two to three feet tall and when planted in a large container is very attractive for use on a patio. It may be desirable to pinch the shoots at the top to induce more branching. It blooms constantly and, as is the case with all geraniums, grows quite well even when neglected.

The work of Dr. John White had dealt more specifically with the culture of the rooted cuttings and the production of high quality plants. He has worked extensively with automatic watering systems. The plastic tube system with various methods of controlling the time of watering has been tested. Fertilizers can also be applied through this system. With geraniums a daily watering controlled by a time clock has been proven very satisfactory. Results indicate that the same optimum conditions for growing stock plants applies to rooted cuttings. Good soil mixes, ample water and fertilizer, high light intensity and good varieties are all important in production.

The addition of carbon dioxide to the atmosphere has been shown to enhance the growth and improve the quality of flowers of several greenhouse crops and geraniums are no exception.

Dr. Mastalerz and Dr. White suggest that with the proper combination of the environmental factors—soil mixture, water, fertilizer, temperature, light, carbon dioxide, and disease and insect control—and good varieties, production time for finished plants can be reduced from 14 to 18 weeks now required to about 10 weeks.

Geraniums are susceptible to several diseases which can be extremely devastating under certain environmental conditions. One of these is Bacterial Stem Rot and Leaf Spot or Bacterial Blight

caused by the bacterium *Xanthomonas pelargonii*. Bacterial blight is a systemic disease which means that the bacteria are carried in the plant tissues and there may or may not be any visible expression of the disease. Symptoms are particularly suppressed during periods of cool weather. Since most propagation is done during the cooler months of the year, it is difficult or impossible to select only healthy cuttings and the pathogen is propagated with the cutting.

Control of bacterial blight can be achieved by the use of pathogen-free plants propagated from culture-indexed cuttings. Dr. James Tammen has applied culture-indexing to geraniums and has provided several cultivars of bacterial-free geraniums to be used commercially. Culture-indexing is the laboratory testing of thin slices of stem tissue for the presence of absence of the bacteria. Each cutting is tested individually and if one is found to be free of the organism, this cutting is used to provide a plant in a nucleus block of disease free plants. These plants are given special treatment to prevent the reinfection of the plant because these plants are in no way resistant to the disease. Increases from these plants eventually provide sufficient cuttings for use by growers. At regular intervals, the plants in the nucleus block are again culture-indexed to maintain the freedom from the disease.

Culture-indexing also frees the plants of other root rot organisms including the black leg fungus but offers no control of virus diseases which are present in most cultivars. Tomato ringspot is the main virus in *P. hortorum*. Dr. Tammen is currently adapting the heat treatment method of eliminating viruses which has been successfully applied to chrysanthemums and carnations. The infected plants are grown three to four weeks in a growth chamber at alternating temperatures of 95°F at night and 105° during the day. They are grown under constant fertilization with 2000-3000 foot candles of light at the leaf surface. Short growing tips about one fourth inch long are taken from the treated plants and rooted on an artificial medium containing growth substances. Plants resulting are then tested on tobacco to determine if they are virus

free. This is a very tedious process with only about two to eight percent success. As new techniques are developed, it is hoped that greater success may be attained.

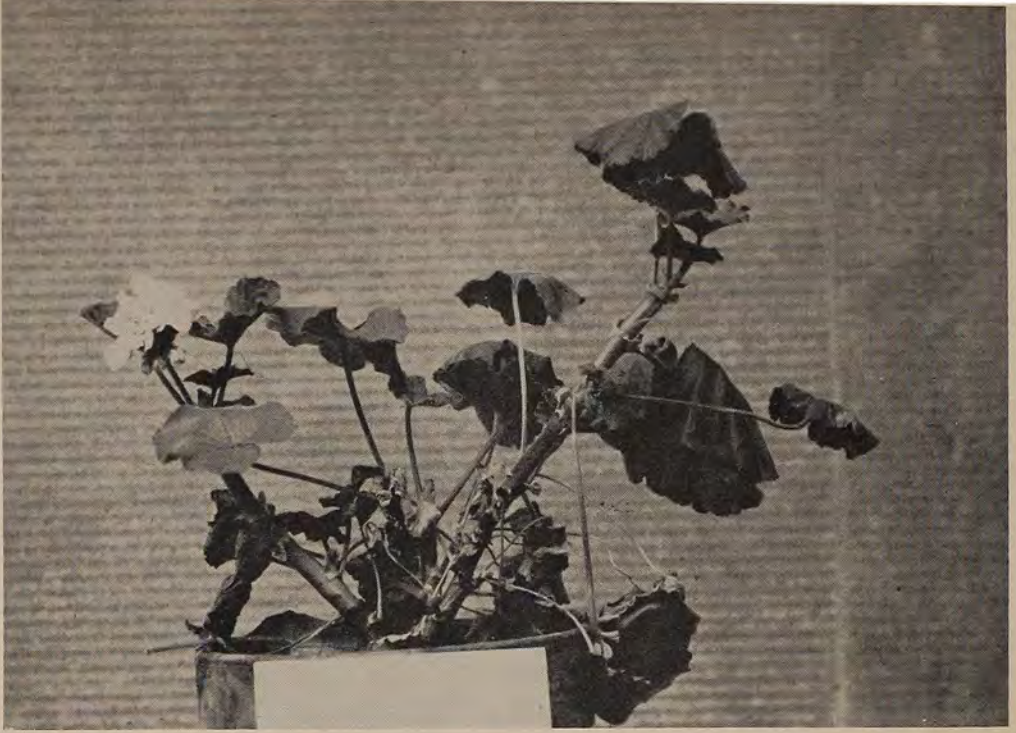
Culture-indexing and heat treatment to produce pathogen-free plants is proving to be extremely valuable to geranium growers but as indicated above, plants so produced are not resistant to the disease organism and thus every precaution must be taken to prevent reinfection. In addition, the initial culture-indexing and heat treatment require special equipment and highly trained personnel and thus is an expensive procedure.

For these reasons, the plant breeder has an excellent opportunity to make a contribution. The plant breeder immediately has two lines of approach open to him, namely, the breeding of cultivars resistant to bacterial blight, or, secondly, the development of true breeding lines which can be propagated from seed and used as open pollinated types or as parents of hybrids.

Tree-type stock plant—cuttings harvested once only.

JOHN MASTALERZ





JOHN MASTALERZ

Plant showing Bacterial Blight.

In order to breed disease resistance into existing cultivars, it is necessary to locate a source of genetic resistance. This may be found within the species *Pelargonium hortorum* or in other species. If it is found within the species, the hybridization necessary to incorporate resistance should be relatively easy. However, if it is found in *P. domesticum* or certain other species, it may be difficult to make the cross or if the cross is successfully made, the hybrid may be sterile and thus preclude further progress. Failure of the cross may be due to genetic causes or to chromosome differences between the species to be used as parents. This indicates the need to undertake two further lines of investigation. One is to search for a source of resistance and the other is to establish the cytogenetic relationships between the species and cultivars.

Mr. James Knauss, who earned his M.S. degree in plant pathology while working with Dr. James Tammen, applied the technique of screening plants for resistance and susceptibility to bacterial blight. A uniform, highly pathogenic isolate of the bacteria causing the disease was selected. This isolate was used to inoculate the plants and the reaction within the plant was used as a measure of resistance or susceptibility. With this technique several species and

cultivars were assayed and it was found that tested plants fell within the complete range of highly resistant to highly susceptible. Only relatively few of the possible types were tested, thus it will be necessary to apply this technique much more extensively in the search for a source of resistance.

At the same time that the search for resistant types was being made, Mr. Walter Knicely, a Master of Science candidate in plant breeding, was determining chromosome numbers in many of the cultivars and species. The results of his studies have confirmed previously reported chromosome numbers and have provided counts of several new species and cultivars. From these determinations it should be possible to more accurately judge the feasibility of making inter-cultivar and interspecific crosses. By correlating the results of the pathological and cytological studies, it will be possible to set up systematically a hybridization program that might provide a means for transferring genetic resistance into existing cultivars.

The breeding of disease resistant lines under optimum conditions takes several years. A quicker method to obtain results would be to develop true-breeding lines and hybrids which are not necessarily resistant but can be reproduced from seed. Plant pathologists report that

bacterial and fungal diseases are not transmitted through seed and that it unlikely than many viruses are carried from generation to generation through seeds. Therefore, reproduction from seeds would provide pathogen-free plants more easily than culture-indexing.

Dr. Richard Craig, then a candidate for the Master of Science degree in plant breeding, began work on this problem. Several *Pelargonium hortorum* cultivars were chosen because of their desirable horticultural qualities and a program of inbreeding was begun. Several inbred lines were developed that differed from each other in flower color, flower doubleness, leaf zoning, earliness of flowering, branching habit and many other characters. A surprising amount of uniformity was observed after only a few generations of inbreeding.

Within a relatively short period of time Mr. Craig observed one inbred line that showed considerable promise. This line had single, dark red flowers and foliage with a dark red zone. In addition, it showed uniformity of habit and flowering time. After testing in several parts of the country it was decided to name it and release it through Agricultural Experiment Station. Thus 'Nittany Lion Red', the first true breeding geranium line reproducible from seed, will be available to the public in 1965.

In the meantime, several other inbred lines are being observed and hybrid combinations are being tested. Within

a few years it is expected that several lines displaying different flower colors and with semi-double flowers will be available. Further it is likely that, as in many other flower and vegetable crops, the F_1 hybrid will be most desirable.

During the time that it took to develop 'Nittany Lion Red', Dr. Craig worked on several other related problems. The most important are seed germination, culture of seedlings and the inheritance of several characters.

The geranium seed is about three-sixteenths of an inch long. When harvested the seed is enclosed in a husk which is easily removed. The seed coat is shiny and smooth and very hard. This hard seed coat is quite impermeable to water and as might be expected, untreated seeds exhibit low germination and irregularity of germination. Several seed treatments were tried with the result that simple mechanical scarification was found to be sufficient to allow for almost immediate germination and a germination percentage in excess of 90.

The handling of seedlings has been found to be quite routine. The seedlings are ready to transplant in seven to ten days after sowing. A recommended procedure is to transplant the germinated seedlings into $2\frac{1}{2}$ " peat pots with later repotting into 4" clay pots. Dr. Craig and Dr. John White have determined that the culture of seedlings is essentially no different from that for rooted cuttings. It is necessary to fertilize the seedlings as soon as they are



'Nittany Lion Red' as a bedding plant.

JOHN MASTALERZ

transplanted to the peat pots. Their recommendation is to incorporate coated fertilizer in the soil and supplement this with liquid fertilizer (20-20-20) at each watering using a rate of 8 oz. per 100 gallons of water. Automatically watering once a day using plastic tubes in each pot has proven very satisfactory. High levels of fertilization had no effect on the earliness of flowering or the number of flowers per plant. This is contrasted to a delay in flowering of seedlings grown dry and at low fertility levels. Differences between lines were also noted.

The length of time from sowing to flowering is important and has been found to differ because of genetic and environmental factors. In addition to optimum levels of water and fertilizer, Dr. Craig has found that light intensity is a factor and that given amount of light energy is required for flowering. Thus in the summer months when light intensities are high, plants will flower in a shorter number of days than in the winter. Selection for earliness is probably the most important factor. Under similar conditions, some plants have been observed to flower in as few as 60-65 days while others require much longer periods with an average of 85-90 days during the spring and summer months. With selection for earliness and the proper cultural practices, geraniums grown from seed will compare favorably with rooted cuttings as regards time required to flower.

A vital part of any breeding program is an understanding of the inheritance of the important plant characteristics. For his doctoral thesis, Dr. Craig studied the inheritance of flower color, flower type, leaf zoning, and stigma color. These results have not been published but he found three genes were responsible for the flower colors of seven genotypes studied. He found a relationship between flower color, stigma color and red color in the zones of the leaves. He also described three types of leaf zones—zoneless, green zoned and red zoned—and proposed genotypes for each. It

appears that flower type is determined by one gene with no dominance. An interesting observation was made regarding insect resistance. A few mite infected plants were found in segregating population. Dr. Robert Snetsinger studied these plants and discovered that segregation for mite resistance was occurring.

Much more work remains to be done concerning the genetics, cytology, and breeding of geraniums but enough has been done to clearly indicate that growing geraniums from seed will be routine in the near future and may replace the cutting method of production. This will become a reality as soon as the breeders have time to develop lines and hybrids with the range of flower colors and with the different flower types now found in existing cultivars.

It can be seen that the research program at Penn State is quite comprehensive. The study of the methods of handling stock plants for asexual propagation and the determination of the best culture practices for producing finished plants provides valuable information to the grower on how he can produce top quality plants in a minimum of time and thus at a lower cost. No mention has been made of the investigations concerning control of insects and diseases, but research is being carried out in these areas also. New fungicides and insecticides are constantly being tested as well as the methods of application.

The production of pathogen-free plants from culture indexing has already been proven to be extremely valuable to the geranium grower. If virus-free types can also be produced, an even greater contribution will be made.

In a very short period of time the breeding program has shown the feasibility of producing geraniums from seed.

In conclusion, it might be stated again that a cooperative effort such as the geranium program at Pennsylvania State University can make valuable contributions to the art and science of horticulture.

The Versatile Crocus

OWEN M. ROGERS¹

Everybody knows crocus yet few people know *Crocus*. I will admit that this does sound paradoxical but it's true. The forms of *Crocus vernus* seen blooming in spring gardens are certainly well known, but there are many other *Crocus* species with a wide range of colors, forms, and blooming dates which are seldom grown in American gardens even where there is knowledge of their existence. This is unfortunate—like eating only the lettuce in a salad and ignoring all the rest. Take the autumn-flowering crocus, for example. People are often surprised to hear that there are fall-blooming crocus and, when they are mentioned, frequently confuse them with *Colchicum* (4). Yet, I can find ten to fifteen *Crocus* species offered for sale in this country which bloom in the fall. If you increase that number to include the cultivars developed within these species the list becomes so long that a whole garden planting could be developed around just the autumn-flowering forms. The same kind of diversity is present in the spring-blooming group. The spring garden can have crocus both before and after the common *C. vernus* by using selections from a very long list of *Crocus* species that bloom in the spring.

The variation in date of bloom is only one of the striking variations present in the genus. Color is another obvious source of variation. It can be within one color as in the fall-blooming *C. speciosus* where colors range from dark blue through light blue to white, or the variation may entail a range of colors as in the spring flowering *C. chrysanthus* where blue, white, orange, and yellow are represented singly and in combination. Variation can exist even within a selected form where color sports arise spontaneously. Also, color in organs other than the petals may also be important. *C. chrysanthus* is divided taxonomically into two varieties, for example, and the most readily discernible feature separating them is that the

anthers of one variety are black-tipped while in the other variety they are not (5).

Variation in plant form also occurs both between and within species, for such characters as leaf shape, style branching, corm tunics and double flowers. With this kind of diversity present in the genus, is there any wonder that crocus growers wax enthusiastic about its value in the garden?

Crocus History

Some forms of crocus are very old. It is known that the bright yellow dye saffron, obtained from the stigmas of *Crocus sativus*, was widely used even before recorded history, since all European and several of the Oriental languages contain the word with only slight modifications from the Arabic za-feran. During recorded history the culture of *C. sativus* for its saffron spread throughout the Mediterranean, through Europe to England and even to America (2, 6). It has been asexually propagated during this long history and this, together with conscious or unconscious selection of mutant types, has resulted in forms quite different from any of the known existing wild species. Even by the time of Linnaeus *C. sativus* was reported to be completely sterile and the identity of its native progenitors is still a matter of conjecture (2).

Histories of long cultivation and problems concerning the origin of present day variants are recorded for many other forms besides *C. sativus*. *Crocus vernus* is a typical example. Linnaeus included all the spring-flowering types known to him into the single species, *C. vernus*. Burt (2) has traced the general history of the species and the name and has been able to separate out the other distinct species which were included in the original description. Over the years, however, a great array of different forms and types has arisen, and few records exist as to the exact origin, breeder, or time of origin of many of

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P. DE JAGER & SONS N. V. HEILOO HOLLAND
Crocus kotschyanus

the present day types. The factor of commercial value has resulted in considerable attention being paid to the production and asexual increase of many variant forms (2).

Intermediate between those species known only from the wild and species such as *C. sativus* which has not been found in native populations there is a group of species, such as *C. chrysanthus*. Native forms of *C. chrysanthus* are known, but as a result of long maintenance and importance in cultivation many variant forms have arisen which have been perpetuated and increased. The problem of the origin of these variants is as obscure as with *C. sativus* and *C. vernus* (6).

Crocus Are Available

Crocus are increased by asexual propagation both commercially and in native populations. This method of propagation has perpetuated many forms and variants which under obligate seed reproduction might have been lost. While many of these forms are known only in botanical collections, a goodly number are readily available to gardeners. Several of the Dutch Bulb companies which retail in this country have crocus listings of several pages and offer mail-order service to any point in the United States. No gardener can say that crocus

are not available. Nor are they expensive. Many forms are priced at four or five cents apiece with the price decreasing to two or three cents when purchased in lots of 100. The most expensive crocus I can find listed sells for \$1, while the same catalogs list choice daffodils at \$10. to \$20. each. If a gardener is willing to buy from un-named collections or mixed lots, \$10. could buy from 250 to 500 corms. Crocus can be used lavishly even with restricted garden budgets.

Classification

Taxonomically, *Crocus* contains 75 to 80 species of Mediterranean or southwest Asian origin (1, 3). Commonly the forms are divided into autumn-flowering and spring-flowering types. This distinction is artificial and depends on the severity of the climate. In areas of moderate conditions, where growth can continue throughout the winter, a graded winter-flowering series becomes evident among types which are spring-bloomers where conditions are severe.

The basic reference for the classification of the genus is a monumental monograph by George Maw (6) written in 1886. For anyone interested in taxonomy this is a fascinating volume and well worth the trouble of finding a library which has a copy of the book which Maw claimed "pleasantly occupied my leisure hours from business for eight years."

The genus is classified on technical points such as the presence or absence of a basal sheath and the character of the corm tunic. Maw and other taxonomic authorities (3, 4, 5) fully describe these characters and for the enthusiast these points make fascinating study, particularly the differences in corm tunic types, but for the gardener an understanding of the genus from the point of view of how the crocus grows is more important for its use in the garden.

All *Crocus* species send up leaves in the spring and form the new corms and initiate next year's shoots and flower buds during the summer months. After shoots and buds are initiated in a relatively warm temperature, a cold treatment of varying duration is necessary for bud development. Thus, those species which require little or no cold treatment will flower in the autumn

with the remainder flowering in a progressive series as their cold requirement are satisfied. In areas where winter temperatures are moderate, such as in England, there will be a continuous series from the autumn types through the winter and into the spring. Under these conditions no additional protection is necessary except a cold frame for some of the tender forms which flower in mid-winter. In areas such as northeastern United States where winter temperatures are low enough to prevent growth, flowering is divided into autumn and spring periods with a period of growth cessation in the winter. Under these conditions some species are killed and only the hardy species are recommended for garden use.

Species Description

It is always difficult to select a few forms to recommend for use over a wide range of the country, but here are some that are readily available, have given good results, and are among the hardiest so that they can be grown in northern gardens. This should be considered as a base list, a kind of starter collection. Gardeners to the south will be able to add to the list immediately by including some of the less hardy forms described in catalogs, and northern gardeners can increase the number by experimentation in their local area.

FALL-BLOOMING SPECIES:

C. speciosus is one of the largest-flowered of the fall species. There is a range of blue forms from the bright blue of the species to the pale blue of the cultivar 'Aitchisonii' and the dark blue of cultivars such as 'Globosus' and 'Oxonian'. A white flowered form, 'Albus', is also available. This species will appear suddenly in the fall as the flowers shoot up in a day or so after the shoot has reached the ground surface. The color of the outside of the petals is as bright as the inside, so this crocus is attractive whether the flowers are opened or closed. When the flowers do open, the large, much-branched, showy stigmas are revealed. They are usually a bright orange and this color combined with the yellow anthers against the blue petals makes a most conspicuous color pattern.

C. kotschyanus is the proper, though less pleasing, name for the species that

Maw named *C. zonatus*. *C. zonatus* is still seen in commercial listings, but most dealers now treat it properly as a synonym for *C. kotschyanus*. The species has pale lilac flowers, often with a blush of pink about them and a ring of bright orange spots at the base of the petal segments. The species is very easy to grow and will increase rapidly from cormlets which are formed in profusion. There is also a form with a white throat (*C. kotschyanus* var. *leucopharynx*) which is unlike any of the other autumn crocus.

C. medius is one of the showiest fall bloomers having a lilac blue color with darker purple markings at the base of the petals and again a spreading orange-scarlet stigma. The species blooms after *C. speciosus* and is supposed to be slightly fragrant although my senses—dulled by tobacco—have never been able to detect it.

C. ochroleucus. A cream-white flowered species suffused with orange toward the base with white anthers and orange stigma. It is a very hardy, free-growing plant which tends to bloom later than the other fall blooming species, so that the blossoms may need some protection from unseasonably early winters. The creamy flowers and bright orange ac-

Crocus speciosus

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C. chrysanthus 'E. P. Bowles' (left) *C. tomasinianus* 'Whitewall Purple' (middle) *C. chrysanthus* 'Zwanenburg Bronze' (right and back).

cents make it an excellent addition even in the open garden where one gambles that early weather will not spoil the bloom. Protected in a cold frame, its cheeriness seems to forestall the onset of winter.

C. sativus. Here is the crocus of history. This is the saffron-producing crocus that could, it was claimed, cure every disease, dye hair, and flavor foods. Fortunes were made in its production and men died to procure the corms. Against such a background, how can a garden be considered complete without at least a few plants of *C. sativus*? There is an answer to this question. *C. sativus* is hard to grow (not to keep alive) and to get flowers requires a hot summer and frequent resetting with good doses of fertilizer. Granted that it is a difficult garden specimen, the results are worth the effort. The large lilac flowers with the huge orange-red stigmas are reward enough to recommend it. However, don't grow it unless a space can be devoted solely to *C. sativus* where care can

be given and where the corms can be lifted and reset at least once every three years.

C. cartwrightianus. This species is closely allied to *C. sativus* and some catalogs still list it as a variety of *C. sativus* but most authorities today consider it a separate species. It is of considerably easier culture than *C. sativus* and its freely-produced pure white blooms with large blood-red stigma make it a most striking addition. If there is no place for *C. sativus* in the garden, grow this one instead. Better yet, grow this one and then if possible add *C. sativus*.

SPRING-FLOWERING SPECIES:

Crocus chrysanthus. The desirable variation in this species has led to the production of an array of cultivated varieties ranging in color from white to yellow to orange to blue with every conceivable combination and variation of streaks, spots and speckles. Commercial catalogs list more forms of *C. chrysan-*



CLAUDE HOPE

Crocus alata

thus than any other except the Dutch Crocus (*C. vernus*) and with good reason. *C. chrysanthus* is an easily-grown, very free-flowering species in which several of the named forms such as 'Moonlight', 'Snow Bunting', 'Warley White', 'Blue Pearl', 'Cream Beauty', 'Nanette', 'Suzie', 'Zwanenburg Bronze', and 'Blue Giant' have all earned awards of merit or distinction for their originators. Two

of the best are 'E. P. Bowles' and 'E. Aug. Bowles'. Their names commemorate the late Mr. E. A. Bowles. There are still hybridizing opportunities in the group and hybrids will be formed by bees among forms growing in the garden. This can be disturbing to the botanical collection but can add a new dimension to the home garden as seedlings will appear over the years, many

to be discarded but always with the possibility that one will be outstanding. Any spring-flowering collection of crocus should contain some forms of *C. chrysanthus*. It is one of the earliest of the spring types and its use increases the range of bloom dates considerably.

C. biflorus. Called for some unexplained reason the Scotch Crocus. The fact that it is very hardy, very early, and very free-blooming recommends *C. biflorus*. The flowers are, in general, small but available in a range of colors from white to blue to violet. The individual flowers have been described as exquisite and dainty, while the mass of bloom from an established clump provides bright areas of color in the garden.

C. etruscus has large, well-formed flowers, frequently with gray or buff outside markings. The 'Zwanenburg Variety' is larger and more robust than the species. An established clump will produce beautiful bluish flowers for a long period, often more than a month. A soft pink form is also known, although it is rare enough to be quite expensive.

C. sieberi. This is not the earliest blooming species although it does precede *C. vernus*. The straight species and cultivars such as 'Violet Queen' have blue flowers with golden throats which give the flowers brilliance when open and a cool bluish violet when closed. In addition, some cultivars, notably 'H. McD. Edelsten', have brilliant combinations of white-tipped, lilac petals, and a silvery lilac interior with a yellow throat and orange stigma. All forms produce flowers in profusion.

C. tomasinianus. The range of colors from blue to ruby purple to white in the forms of this species are all striking. Allied to *C. vernus*, it is a smaller daintier version of *C. vernus* except that it blooms very early. The form 'Taplow Ruby' comes the closest to red of all the crocus and when the slender, tightly-wrapped buds open to reveal the brilliance of the inner petals it is truly an outstanding addition to any collection. *C. tomasinianus* seeds freely and seedlings will appear any place the seeds are scattered, and they have been spread in gardens even through compost. I find this feature desirable unless they intrude into rarer, more carefully maintained plantings.

C. angustifolius. This is the proper name for the plant often listed in catalogs as *C. susianus*. Sometimes it is called just Cloth-of-Gold Crocus, but whatever name it deserves a place in the spring garden. It has a small flower, bright yellow with mahogany outer markings, so that the overall effect resembles a "cloth of gold" spread out over the garden.

Culture

Crocus is of easy culture. The most important consideration is drainage. Crocus will grow in almost any soil as long as there is good drainage in the top eight inches. A sandy loam rich in organic matter is best although the organic matter should be well decomposed. Manure is not recommended since it harbors problem organisms even if it is a year or so old. If one follows the general rule of planting bulbs with the tops at a depth of three times the diameter of the bulb, then most crocus will be set four to six inches deep. Any of the vigorous growers can, however, be set lower and if there is to be an overplanting, bulbs set eight to ten inches deep will allow some surface preparation without disturbing the crocus. In my own garden we regularly set small annuals among the crocus to provide summer color. The annuals start small and do not interfere with the natural maturation of the bulb foliage—which is a must for maintenance of vigorous bulbs—and later on the annuals completely fill in the area with their own riot of color. Clumps and drifts of crocus are more effective from a design point of view rather than single plants or formal rows and to my mind easier to plant. I dig out a hole or area to be planted, then set the corms one inch apart over the bottom of the whole area. With this method there is an opportunity to add organic matter such as peat moss and a slow release fertilizer such as bone meal into the bottom of the hole before planting. There is also an opportunity to mix color and species according to predesigned patterns. If different types are to be planted together one trick is to plant different tunic types side by side. The tunics of crocus vary widely and separating two similar tunic types with a different one will materially ease future sorting when the corms are handled during the dor-



CLAUDE HOPE

Crocus aureus
Flowers 4" tall, bowl-shaped, golden yellow.

mant season. Another trick that is helpful is to plant the corms in a one inch layer of sand. This tends to improve drainage in the immediate area of the bulb, helps prevent some of the rots and decay that can happen if the bulb is in contact with fresh rapidly decomposing organic matter and, more to the point, serves as a location indicator

when the corms are dug up for re-handling.

Crocus do not have to be reset as often as many other bulbs but as the clumps spread and increase, resetting (say every third or fourth year) will increase the amount of and size of bloom. I'm a lazy gardener, and some of the drifts of crocus under shrubs and

in mixed borders do not get divided even that often. The dividing, sorting, and resetting should be done when the corms are dormant in the summer. The fall blooming types should be reset immediately but the spring bloomers can be left until September or even early October if there is a cool, dry storage area available.

Like all plants, crocus respond to a fertile soil but it is a long term process. It is not like fertilizing annuals where the effects can be seen in a week or so but rather the fertilizer this year helps produce a bigger corm which means better bloom next year. Thus, slow release fertilizers worked into the soil are probably best. Things like superphosphate bone meal have been used successfully for many years. Again my lazy-gardener approach comes out. I have most of my bulbs associated with other plants, so I make one fertilizer do for both. I use a 4-12-4 every year over most of the garden. This is ideal for the bulbs and for shrubs and, with the addition of some quick release nitrogen, good for most of the quick-growing summer annuals.

Don't forget that bulbs need moisture especially during the active growing season. Mulches or other covers over the ground will help conserve moisture and also shade the soil during the summer. This summer shade is important since a lowered soil temperature will increase the size of the corm. Winter mulches are also desirable to prevent heaving of the corms and the resultant root damage. Put on a good garden mulch after the ground has frozen but be sure to watch in the spring to get it off before the new sprouts are tall enough to be damaged. Perhaps a grouping of the earliest flowering forms so that the mulch can be removed in sections would be desirable.

Pests

Probably, mice are the most serious pests of crocus. If mice find the planting they can be a serious problem. If mulch is placed on too early mice will move in and make their winter home under it and can then feed on the corms at leisure and the damage will not be noticed until spring. If there is any indication of mice I recommend an all-out attack including traps and baits. Mice do not travel over a very large distance so if

they can be eradicated from the bulb area you are fairly safe. By all odds the best mouse control is a hungry cat. This is sufficient for us even though my wife does not like cats and we have to depend on the neighbor's black and white tom.

Beyond this, good sanitation will prevent most crocus pests from gaining a foothold. This means no manure near the corms in the soil, clean-up of dead and dying plant material on top of the soil and general garden spraying. If some of the corm rots do get started they can be treated in a similar manner as rots on gladiolus corms. Or, considering the price of crocus corms, it may be much easier to discard the whole clump and start again in a different spot with new clean stock.

Use Situations

Since crocus are inexpensive they can be used lavishly in many parts of the garden. They can be used as underplanting around deciduous shrubs where they will produce a carpet of spring color and then the covering leaves of the shrub will hide the maturing bulb foliage. They will not do well under shrubs which throw a deep shade but along the edge of the shrub border or under fine-foliage shrubs they do very well.

Crocus, of course, go well in mixed borders. One of the best combinations is spring-blooming crocus and chrysanthemums. These are shallow rooted and can be handled with a minimum danger to the crocus corms. In the spring the chrysanthemums green up very early but stay close to the ground to provide a green carpet under the crocus blooms. After the time of crocus bloom the foliage grows up to hide the bulb foliage. Or, try fall-blooming crocus in a low growing ground cover such as *Vinca minor* in a sunny spot. The *Vinca* will have its own blue flowers in the spring and provide a "foliage" for a crocus such as *C. speciosus* in the fall.

If there is plenty of garden space, a bed might be set aside just for crocus reserving this area for the rarer kinds and letting the beauty of the crocus bloom season compensate for lack of color the rest of the year. One luxury that is reasonable is to devote a cold frame to crocus for the latest fall bloomers and the earliest spring spring bloom-

ers. Thus, the blossoms can be protected from unexpected spells of bad weather such as ice or wind. If the garden cannot afford these luxury spaces, I'd suggest the rock garden for the unusual or rare species where a little spot can be set aside for the exclusive use of four or five choice crocus corms.

I enjoy putting a few crocus right up against the exposed foundation on the south side of the house. The heat from the wall will bring those crocus up one to two weeks ahead of corms planted only two or three inches out into the garden. This is not the best place to grow crocus because it stays hot all summer, but I can afford a few replacement bulbs every few years and in the meanwhile I bask in the glory of having the first crocus in bloom in the neighborhood.

I've left naturalization to discuss last because it doesn't work for everyone. There are two problems. First, if the corms are to continue they must be able to mature naturally and this means no grass cutting until at least late June. Most small properties cannot afford such an area. The second problem is competition by the grass or whatever natural undergrowth is present. Only the most vigorous growers such as *C. tomasinianus*, *C. chrysanthus* and *C. vernus* among the spring group and *C. speciosus* and *C. kotschyanus* of the fall group should be tried in a natural planting. I don't want to discourage the use of at least a trial of natural planting because, where soil conditions are right and the natural growth not too thick, crocus will establish themselves and there is nothing more striking than drifts of crocus along a wood's edge or scampering among a rocky outcrop or in sheets on a meadow prominence. I am told that along the cool, moist coastal regions of eastern Maine there are areas where crocus do so well naturally that they can become weedy and must be restrained from invading lawns and gardens. If there is a question in your area, wait until you are dividing the garden clumps and then take the increase plus the cormels and any stray seedlings and try these in the natural setting. If they do well money can be invested in large number or the practice of using the natural setting as an overflow garden can be continued.

Forcing

If crocus herald spring outdoors they can also preview it indoors as a forced pot plant. Select only large new corms and plant several in a pot. I like the squat bulb or azalea pans best. Place the corms about an inch below the soil surface putting in almost as many as the pot can hold (corms almost touching each other). Then, bury the pot outdoors or place it in a cool (40° F.) bulb or vegetable cellar for about three months or until the shoots are about 1-1½ inches above the soil. After the corms have had the temperature treatment they can be forced in a sunny cool location in the house—55° is the best, 60-62° is all right while 70° will make the growth rather soft. Try a few on a cool sun porch or on a cool window sill. They will do much to brighten the drab winter months.

Hybridization

To have crocus in the garden is to have seedlings, since many of the species are very fertile. With this situation many gardeners like to try some hybridization. The crocus is a very easy flower to work. To make controlled crosses the anthers should be removed from ready-to-open buds and pollen transferred from the pollen parent as soon as the stigma branches reflex, generally by the first day the flower opens. Then, protect the flower from future unwanted pollinations and mark it. All this can be done with tweezers while on your hands and knees in the garden; or, if a number of crosses are planned, the luxury way is to plant each of the different kinds in separate pots sunk in a cold frame. Then, when the crosses are to be made, the pots can be lifted to a table top or even brought into the house for the crossing. The marking is a problem because each plant produces several blooms and the ovaries are underground at the time of flowering. The easiest method I have found is to mark the whole pot and make the same cross to all the flowers in that pot, removing any flowers that do not get crossed. After the cross, patience is required because the ovary is underground and cannot be examined until the seed is ripe. As the time for seed maturation approaches, daily inspection is necessary because along in May or early June the

stalk under the ovary begins to extend and raises the seed up to ground level so that, if the cross has been successful, one day a large plump seed capsule will appear at the surface of the ground. These capsules should be collected as soon as any brown appears on them because the capsule splits easily—and it is the devil's own job to find and identify seeds that have spilled out onto the ground.

The seed should be planted in a small pot and plunged in the cold frame or other spot where it can be left undisturbed except for weeding for two years. If growth has been good there will be small corms the size of peas in the bottom of the pot at the end of that time. These can be planted out and handled like any small crocus. Some will bloom next year but others will take still another year for the first bloom. If there are too many problems associated with controlled crosses, don't give up the idea of hybridization; let the bees do the crossing and just collect the seed. If this is done every year, once the first cycle of waiting is over there will be new seedling blooms to examine every year.

The name crocus should mean more than just *Crocus vernus*. It should mean an exciting range of colors, forms, shapes and sizes with a wide range of spring and fall bloom dates. It should mean a small garden bulb that has many uses and can be useful in many places. It should mean an opportunity for interesting hybridization. And, above all, it should mean a "must" plant for every garden regardless of size.

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Editorial Note: Plates by Claude Hope from NHM 29, April, 1950.

A Book or Two

The Life of Plants

E. J. H. Corner. World Publishing Co. Cleveland, Ohio, 1964. 315 pages with 32 pages of photographs and 8 pages of color plates \$12.50 (Library).

This explosive volume looks like an ordinary botany textbook but turns out to be an extraordinary account of how plants have become what they are. Instead of following the usual botany fundamentals of leaf, flower, and fruit, this author reaches these end products only in his final chapter. Before he gets there he has begun with single, individual living cells and taken the reader through their countless stages of evolution and adaptation, their movement to and development on the land. There shaped by fertility, heredity, environment, growth, and decomposition, developed the primitive forest and eventually the highly diversified plant life that now covers the earth. Of considerable importance in this drama is the cooperation of plants and animals, the plants supplying food which the animals cannot produce, and the animals being responsible for mobility which the plant unaided might never have achieved.

This author has revolted against the commonplace methods of botany, "so thoroughly dull and dully thorough," hoping by ultramicroscopic examination of the dead remains of plants to solve the mystery of their life, when the real growing points of knowledge in this field are back upstream in the living plant's existence. Developing the theme that the beginnings of botany are in the sea, the author devotes three chapters to the fundamentals there and how seaweeds developed. He explains: "When the strangeness of seaweeds is overcome and their intricacies are familiar, land plants are understood as seaweeds selected from the great multiplicity, . . . dried off on the surface, waxed against evaporation, rooted, piped for water flow, built up with transparent bricks made from the excess of sugars, yet still reproduced by seaweeds."

Tracing the movement of animals from existence in the sea to living on the land, Corner shows that botany parallels this migration except that the details are hidden by the nature of plants, and the life line cannot be traced by "looking in the sea for the seaweed relatives of moss or fern, such as fish is to frog, or lobster to grasshopper. These relatives are, by the nature of plants, extinct. The nature of the animal is to move, and to conquer and escape the environment as much as possible; therefore it may transfer from sea to land.

The nature of the plant is to become a static part of the environment and its interceptor. As there is no environment now between land and sea, there are no sea-land plants to intercept it. The ancient and extinct environment that brought plants to land had the plants which became the modern land plants; with the passing of that environment those ancestors disappeared. To look therefore for them in the sea, in the manner of zoology, is to misunderstand the whole botanical process."

The author acknowledges that there is no clue how plants came to land. He speculated a bit because "there must have been a time and place when seaweeds grew into the air, such as they cannot do now," but because primitive plant life, by its soft nature, left no fossils to point the way, scientists can only guess at the links that fill the gap. The very fact that the qualities of the extinct are being bred into new generations of plants, is proof enough that there definitely was a past, primitive state of which no records remain.

Corner's book is a refreshing, stimulating excursion into the intricacies of plant development and was made possible only by his twenty years botanizing experiences in the tropics where plant life reaches its maximum expression, where primeval forces and their divergencies are most apparent and where fungi and bacteria find maximum development as factors in the evolutionary process. One cannot fail to be impressed by the mass of data assembled in support of the author's insistence that the living plant tells more than its carcass ever can.

Edwin A. Menninger

Plants of the Fiji Islands

J. W. Parham. Printed and published by the Government Press, Suva, Fiji. 1964. 353 pages, plus 40 pages of indexes of botanical and Fiji common names. Boards. \$5.

This worthy successor to Mrs. H. B. Richenda Parham's book *Fiji Native Plants* that was published two decades back by the Polynesian Society and long out of print. Fittingly, this new book is the work of Mrs. Parham's grandson, a botanist with the Fiji Department of Agriculture.

It makes no pretense beyond its title, but the author knows Fiji plants and he has done an excellent, careful job of checking nomenclature both scientific and vernacular, and he has found time to insert a lot of interesting descriptive observations of the principal plants, where they are found, which ones are particularly ornamental, the utility of some to the na-

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

tives, etc., and he has included more than 100 illustrations, mostly taken from out-of-print works on Fiji of which there are so few. The bibliography and the index are extensive and invaluable.

This book may be obtained in the U. S. from the reviewer at Stuart, Fla.

Edwin A. Menninger

The Picture Book of Perennials

Arno and Irene Nehrling, Hearthside Press Inc., 118 E. 28th St. New York 16. 1964. 286 pages. Illustrated \$5.95 (Library) Members price \$5.05.

Both the beginning and the intermediate gardener will find quantities of useful information in this book. The text itself is about 100 pages of readable, illustrated material dealing with propagation, disease and pest control, basic gardening methods, and layout of plantings. This text section is especially useful to the beginner as it provides many tips that would otherwise require several years of mistakes to discover. The last part of the book contains a calendar of things to do, a list of definitions and a chart of perennial locations and blooming periods, all of which can easily be found in other garden books. The first section is the most useful containing short passages on about 150 perennial genera with shorter commentaries on a number of species within each group. There is information about ideal location, strengths and weaknesses, size, color, and shape of plant foliage and blossom. Not only will the gardener find much new information about familiar plants, but also he will discover many new possibilities of what to plant. Again in this section, the photographs and illustrations are useful.

Lucinda Murphy

America's Gardens

Better Homes and Gardens. Meredith Press. Des Moines. 1964. 208 pages, largely consisting of color and black and white photographs with descriptive texts. (quarto size (Library.) Price \$9.95.

This book is a pictorial display of American gardens and familiar garden plants with the objective of providing an armchair visit to some of our more famous plant collections. It consists of photographic material, largely in the style of the parent periodical and is divided into three parts; Visits to America's Gardens, Gardens that Specialize, and Gardens for All Seasons.

Part I is an assemblage of views of what one might regard as the Aristocracy of American gardens. These are the large "National Trust" gardens, a few botanical gardens and arboreta, and some privately managed estates. For each, there is a brief descriptive statement, usually the history, present status, and occasionally a suggested season for a visit. The majority of the gardens are those of the eastern part of the country, swinging south to the Gulf States indicating the dependency on those establishments reflecting a historical as well as horticultural aspect. Except for the St. Louis Botanic Garden with its Climatron, the scene shifts immediately to the Pacific Coast and suggests that the broad mid-portion of our country has little to contribute to horticulture.

In Part II, gardens of special interest have been featured. This includes Japanese gardens, topiary gardens, rock gardens, and a multitude of other forms of plant use. Unfortunately, these begin to lead one away from the subject matter and are perhaps of more interest purely from a photographic slant.

The purpose of Part III is to show gardens which have special seasonal flower attractions, such as Sherwood Gardens for its tulips, the Coe Estate for azaleas. Otherwise, the color work is devoted to the flowering plants themselves. There is not much more to offer the reader in this section other than some beautiful color work and garden photography. Little new from a horticultural aspect can be expected from a book of this type.

Despite such shortcomings as depth of purpose and direction, this is a nicely carried out piece of work, one that if you have around will surely be picked up and looked through. As the preface points out, "To enjoy our garden journey, you need not be an experienced horticulturist."

JLC

Herb Gardening in Five Seasons

Adelma Grenier Simmons, D. Van Nostrand Company Princeton, New Jersey. (Library.) Price — \$6.95, Member's price — \$5.90. 337 pages, illustrated. Index, Pronunciation glossary.

This is rather more than just another herb book with recipes for cooking and for making potpourri. There are chapters such as the one headed "Herb Teas and Tea Parties" which not only go into when to serve tea, but how to brew tea and which herbs to use in what quantity for various teas.

Plans, with perennial, annual, and biennial herb lists, are given for herb gardens. Herb shows, harvesting and drying herbs, happenings at the author's home at Christmas fill the pages.

There is an excellent dictionary of fifty selected herbs. Here a nice drawing by Kathleen Bourke faces the text which gives the botanical name, the common name, the plant family, and, also, the uses, cultural requirements, and description of the herb.

A list of Early American herbs prepared in 1672 followed by herbs listed for use in the flower garden, herbal trees, herbs for moist soils, herbs for dry soils, and much more is to be found at the back of the book—not the least useful being a useful list with the phonetic pronunciation of herb names.

F. P-K.

Gardening and Cooking on Terrace and Patio

Mary Childs Hogner, Doubleday and Company, Garden City, New York. (Library.) Price—\$3.95, Member's price—\$3.35. 168 pages. Index.

The two previous books by this author dealt with herbs, their growing and use in cooking. The new book is dedicated to the legion, ever-increasing, of gardener-cooks who ply both the garden trowel and the kitchen fork.

The opening chapter on containers both con-

ventional and home-made—tubs, terrace pots, hanging baskets, wall planters, or bulb-crate planters—shows the wide variety of types and materials being used in outdoor living areas.

After some notes on the soils used in potting and repotting plants in containers, the decorative plants, annual and perennial, are listed. Unfortunately, only the common names are given and the descriptions, uses, and culture of the plants as the author has them seems skimpy.

A chapter on suitable culinary plants to grow on the terrace is followed by a chapter on wheel-spoke and border gardens with several sketched plans for such gardens.

The rest of the book is given over to menus and the preparation of food to be eaten on the terrace or patio.

F. P-K.

The Florentine Codex — Earthly Things

Bernardino de Sahagun (16th cent.) The School of American Research, Santa Fe, New Mexico, 1963. 300 pp. ill. \$15.

Considering the interest which all of us must (or should) have in Mexican plant life, it is good to at last find a translation into English of the GENERAL HISTORY OF THE THINGS OF NEW SPAIN of which this Vol II, is a part. Using contemporary Aztec sources this indefatigable priest, with the help of the knowledge of educated natives, recorded in the Nahuatl language (1529-1590) every facet of life in Mexico which was explorable. Long available in Spanish translation, here at last in English are the engaging and informative comments on the inorganic and organic, the flora and fauna, of that great center of American culture. The illustrations, done much in the same manner as those in the famed Badianus manuscript, are by Aztecs working in the mode dictated by their pictorial writing.

Mineralogists will find here a discussion of rocks and their uses, while bird lovers will read about Mockingbirds and Wrens or about the home "cultivation" of the Turkey with (illustrated) instructions for fattening. Bugs, butterflies, bees and beasts—they are all here.

Coming to plant life one will find a number of pages given to a full discussion of Corn and Beans (most important to the life there) while Chocolate, Vanilla, Cacti, and grains are all displayed and discussed. As might be expected (and as the contemporary Hernandez explored fully) much space is given to medicinal plants and other plants of economic value. But the ornamental plants are not neglected for the early Mexicans treasured fragrant and colorful plants for use in the home and temple and we read about these. Several pictures of garden operations are included to prove that point.

The translators Anderson and Dibble have done a tremendous job in rendering the Nahuatl into English in the spirit of the age and no library on American life should be without this truly *first* writing on the subject.

From the useful and critical viewpoint, one could wish that an index of English or Scientific names of flora and fauna might have been included but footnoting does take care of some of this lack.

Nelson Coon

These Fragile Outposts

Barbara Blau Chamberlain, Doubleday & Co. Inc. 575 Madison Ave N.Y. 22. 1964, 327 pp. ill. \$6.95.

The gardener who works with more than the city lot, or who lives anywhere in the glaciated part of the United States well understands the meaning of a word like "hardpan" and the implication of its presence. Yet all too few, possibly, have a real understanding of the geologic processes by which this and our other manifold types of soil were formed and their corresponding effect on vegetative growth. Thus it is for this reviewer that some hours have been well spent, reading about (sub-title) A GEOLOGICAL LOOK AT CAPE COD, MARTHAS VINEYARD, AND NANTUCKET, for, as one geologist is quoted, "To know the geology of the region is to know its soil."

The author of this book has taken a relatively small section of our great country and carefully pictured the successive processes by which this area has achieved its variety of soils, processes which, with variations, have been in operation from Wisconsin to Maine.

Thus—whether or not the reader of this review is a resident of the great coastal outwash area (including Long Island) or of any other part of the glaciated United States, a perusal of the book will be repaid in a better understanding of all the "micro-soils" whose compositions so conduce to a degree of acidity, fertility, workability and productivity. One will find that soil composition may be just as important as the presently much discussed "micro-climates", climates which indeed are often the result of geology and geography.

In its thoroughness THESE FRAGILE OUTPOSTS offer us the kind of writing that Rachel Carson gave us in THE SEA AROUND US but as words and thoughts make this a much more important book for the horticulturist.

Nelson Coon

New Zealand Flowers and Plants in Color

J. T. Salmon, D.Sc. 210 pages, quarto. A. H. & A. W. Reed, Wellington.

This beautiful book with 543 color plates, is the most comprehensive, useful, and colorful work on the New Zealand flora ever published. The author is not only a distinguished botanist but a highly skilled nature photographer, and he spent years traversing New Zealand to picture the unique plants of that country in their natural habitats from shore to mountaintop. A large number of the flowers and fruits in this volume have never been photographed before. The book is mostly pictures, grouped by habitat—shore, coastal, scrub, forest, mountains, etc. and the pictures are accompanied by the scientific, common, and Maori names, brief explanatory captions, and a record of flowering or fruiting times. Elsewhere in the book is a more general discussion of the flora, with cross references to the plates.

This book is obtainable in U. S. from the reviewer at Stuart, Fla.

Edwin A. Menninger

Other Books Added to the Library

Farmer's World (The Yearbook of Agriculture—1964)

Agriculture, U. S. Dept. of Government Printing Office, Washington, D. C. 20402. 1964. 592 pages. \$3.00. (Library).

Adventure Lit Their Star

Allsop, Kenneth. Crown Publishers, New York 16, New York, 1964. 222 pages. \$3.95. (Library).

Big Men, Big Jobs

Duncan, Clyde H. University of Missouri, Columbia, Missouri. 1964. 150 pages. \$.50. (Library).

Vascular Plants of the Pacific Northwest (Part II)

Hitchcock, C. L., A. Cronquist, M. Owenbey, and J. W. Thompson. University of Washing-

ton Press, Seattle, Washington 98105. 1964. pages. Illustrated. \$7.95. (Library).

Perennial Garden Flowers—Sort Guide to the (Plastic Box of cards)

Kelly, George W. Crown Publishers, New York 16, New York. 1964. 152 cards. Illustrated. \$4.95. (Library).

Bird Songs: Adventures and Techniques in Recording the Songs of American Birds

Stillwell, Norma. Doubleday & Company, Inc., New York, New York 10017. 194 pages. 1964. \$4.95. (Library).

Beneficial Insects

Swan, Lester A. Harper & Row Publishers, Inc., New York 16, New York. 1964. 429 pages. Illustrated. \$7.95. (Library).

The Genera of Amaryllidaceae

Traub, Hamilton P. The American Plant Life Society, La Jolla, California. 1963. 85 pages. Illustrated. \$5.00. (Library).

Gardeners Pocketbook

A Question About Shidekobushi—

A Re-examination of *Magnolia stellata* Maxim.

Botanical descriptions of this lovely spring-flowering subject seem to require some modification, as studies continued for several years have shown that a high ratio of opening flowers have small inconspicuous sepals on the same order and, in fact, indistinguishable from those of *Magnolia Kobus* DC., rather than sepals similar to the showy petals. It appears that the erroneous idea was based on fully opened flowers from which bud-scales and sepals had already fallen, or even from dried herbarium specimens on which the evanescent sepals would hardly persist. Maximowicz used the purported sepal character as a separation in his diagnosis of the *Magnolias* growing in Japan (Bull., Acad. St. Petersb. 17:419, 1872.), in which the line "Sepala petaloidea petalis aequilonga" leads to *M. stellata* and *M. conspicua*, as he knew them. Fully opened flowers of Shidekobushi rarely show any sepals, or sometimes just one or two. This plant is characterized by delicate lanceolate sepals 1—2 cm. long which usually fall away as the petals are expanding.

Plants known as *Magnolia stellata* in nurseries and gardens have been propagated almost entirely by grafting and

budding, but many specimens produce viable seeds and this means of propagation has been followed in some cases. Several of the clones with pink petals (of which there are at least three in American nurseries today) have been obtained in this way. However, it is common knowledge among specialists that these seedlings grow into a mixed lot, and they are often used as understocks on which to graft the true dwarf plant. If grown for a number of years, the greater portion of *M. stellata* seedlings show looser and more open growth and their flowers have broader obovate petals. Furthermore, the petals are usually fewer in number, often ranging from 9 to 15, and occasionally as few as 6. In fact, these seedling plants show graduations in flowers, shoots and leaves, and habit of growth between their parent and *M. Kobus*. As stated in an article in the American gardening periodical noted below, genetic behavior does not justify maintaining *M. stellata* as a botanical species, and one is tempted to conclude that it originated as a selection, probably of a mutation, of *M. Kobus* made by an observant flower-lover in Japan many years ago.

A more conservative weighing of evidence in floral parts and in the dwarf compact growth differing so markedly from *Kobus*, and particularly from the more vigorous Hokkaido *Magnolia* (*M.*

*Magnolia stellata* Maxim

BENJAMIN BLACKBURN

Kobus var. *borealis* Sargent) which appears to be the prototype of the species, leads to presenting Shidekobushi here as a variety, rather than in the lesser category of form. The synonymy may be given as follows:

Magnolia Kobus A. P. deCandolle
var. *stellata* (Siebold et Zuccarini)
status novus

Buergeria stellata Sieb. et Zucc. in Fl.
Japonica Fam. Nat 1: 78, 1845.

M. stellata Maximowicz in Bull. Acad.
Sci. St. Petersb. 17: 418, 1872.

M. Halliana Parsons in Garden 13:
572, 1878.

M. Kobus forma *stellata* (Sieb. et
Zucc.) Blackburn in Popular Gard-
ening 5, 3: 68, 1954.

Some of the original data on flower parts in this study were obtained from plants of Shidekobushi growing in gardens in Tokyo and Yokohama. If ob-

servers in Japan will communicate with the author, or send pressed specimens of opening flowers considered to be of this plant clearly growing in the wild, their collaboration will be most welcome. It is an amusing note that the vernacular names Himekobushi and Shidekobushi are more accurate in pointing out the natural relationship of this plant to *M. Kobus* than the artificial designation maintained for so many years in botanical records.—BENJAMIN BLACKBURN, Department of Botany, Drew University, Madison, New Jersey, U.S.A.

—reprinted from *Amatores Herbarii* 17: 1-2, 1955.
Japan

A New Way to Raise Seedlings

Anyone who raises plants from seed, or handles the ensuing seedlings, is offered numerous suggestions for preparing the compost. For planting seeds, the usual medium suggested by many



ROBERT M. SENIOR

Containers with about twenty different seedlings.

nurserymen is to use equal parts of good loam, leafmold or peat, and sharp sand. In England the so-called John Innes mixture is widely used: it consists of two parts sterilized loam, one part of coarse sand, and one part peat, to which is added a small amount of superphosphate and ground limestone. For potting seedlings, the John Innes formula is seven parts sterilized loam, three parts peat, and two parts sand, to which a small amount of limestone and fertilizer is added. One nurseryman in this country states that he is raising practically all of his plants in sterile sphagnum mixed with a little perlite, and of course, when necessary, watering the plants with liquid fertilizer.

Over the course of many years we have tried almost all of the above-mentioned composts. In the last year we have experimented with a new method for raising seedlings, at least a method that is new for us. A short account of how we happened to try this may be of some interest to readers.

Last year an acquaintance in the nursery business was traveling in Germany, where he observed that a container holding a large number of seedlings was used rather widely in that country.

Briefly, he bought a number of them, and in due course, gave us one to try. The manufacturer called them "multipots": the picture gives an idea of their appearance, together with the seedlings that we planted. In this "multipot" there are 28 containers, but I understand that there is also a larger size with 48 pots.

The material from which this invention is made is a lightweight plastic, so light in fact that a little child could easily carry it, even when filled with seedlings. At the bottom of each pot there is a small hole, so that, if desired, the entire container can be put in a large pan of water, and the contents thus watered from below.

I do not know of a more unscientific method of handling seedlings than the one which we have employed. We didn't sterilize the soil, we didn't measure a certain amount of sand, or a certain amount of fertilizer. All we did was to take some granulated peat, possibly as much as would fill a four or five inch pot, add a small handful of Perlite, a sprinkling of 5-10-5 fertilizer, and fill the "multipots" with this mixture. In each one of these we inserted a seedling, in all, about twenty different kinds, including *Androsace sarmentosa*, *Gentiana hascombensis* and *G. septemfida*, *Campanula betulaefolia* and *Codonopsis ovata*.

Our seeds were originally planted in flats: whenever seedlings emerged that were too close together, we would pull one or two in the cotyledon stage, and replant them in the container. Generally we waited until the first tiny leaf appeared before we withdrew it. Probably no seedling was much over an inch high when it was transplanted. I suppose that here too we broke some of the rules often suggested by experts, nevertheless, our procedure proved highly satisfactory to us: all the plants thrived with possibly the exception of one or two.

And now, for us, came the most interesting part of the experiment. After our seedlings were well rooted, possibly after two or three weeks, we prepared to lift them from the pots. For this purpose, the manufacturer furnishes a little two pronged plastic fork. Inserting this deeply into the pot, and possibly holding the stem of the plant toward its base, we drew it out, surrounded by a perfect cylinder of the compost, in many

instances leaving the empty pot almost entirely free from any dirt on its sides. Carrying the cylinder to a 2½ to 3 inch clay pot, in which we had put pebbles at the bottom for drainage, we gently dropped the cylinder into it, and filled the spaces on the side with a regular potting mixture, containing a little fertilizer. On the surface we scattered a small handful of pebbles. After watering the plant, we placed the pot for a few days in a shady corner. This operation was completed some time in June: since then the potted plants have continued to thrive.

The name and address of the manufacturer is Herman Heifert, Duisburg-Meiderich, Postfach 81, Germany. I believe he has appointed an agent in this country.—ROBERT M. SENIOR, Cincinnati, Ohio

Two Groundcovers Native to Japan

Japan has contributed a number of useful plants to our gardens, some of which have been especially successful and others which are restricted in use

either because of limited hardiness or lack of familiarity. Two groundcovering species native to Japan fall into these types, *Pachysandra terminalis* Sieb & Zucc. and *Ardisia japonica* (Thunb.) Bl. Most gardeners in the eastern part of the country are familiar with *Pachysandra*. Its use on banks, under conifers and elsewhere as a groundcover is quite expected. It is hardy without question, especially in areas where there is a good snow cover to afford protection. Few gardeners know *Ardisia japonica*.

In Japan, *Pachysandra terminalis* is known as Fukki-so and is used for garden purposes equally as much as in the United States. It is naturally distributed throughout all the islands and it can be found in the moist woods in lowlands all the way from Kyushu to Hokkaido. I suspect that with this broad range of distribution there might be considerable variation in hardiness but since it has performed so well for us this appears not to be a need. A variegated form is in cultivation and is grown in both Japanese and American gardens. As



J. L. GRECH
Ardisia japonica has formed a solid ground cover in dense shade at Ayukawa, northern Honshu. Covering trees are Camellia, Ilex, Machilus, and evergreen oaks.

might be expected of a variegated form it is not as vigorous as the common type and does best in shaded places. *Pachysandra terminalis* is far more hardy than our native species, *P. procumbens*, and is classed as one of our best evergreen groundcovers.

Ardisia japonica, on the other hand, is not too well known in the United States and is limited in culture to the Southeast. We usually think of *Ardisia* in terms of the small pot plant with bundles of red berries growing in a conservatory, but *A. japonica* is more like *Pachysandra* both in habit and natural distribution than to any of its close *Ardisia* relatives. There are a number of prostrate species in this Genus of some 250 species and two of them occur in Japan (see Nat. Hort. 37, 4: 266-67, 1958). These are *A. japonica* and *A. pusilla* and they differ from each other, horticulturally, in hardiness and manner of proliferation. Our plant, *A. japonica*, produces underground leafless runners which poke up through the soil and eventually start a new clump. It is, like *Pachysandra*, widely distributed throughout Japan but unlike that species does not enter Hokkaido and may be found only on the off-shore island of Okushiri. In the forests near Sendai, on the northern Pacific coast of Honshu, *A. japonica*, literally covers the forest floor. It also occurs in China, having been collected by F. N. Meyer. The leaves are lustrous green and the stems purplish in color. There are small white or pinkish flowers from August to October followed by small solitary red berries which last all winter. The Japanese refer to this plant as Yabu-koji. I have not seen it cultivated to any extent by the Japanese, so there are not any variegated forms to be expected. It is only when these master craftsmen of horticulture get their hands on a plant do we find bizarre forms.

In the United States, the largest planting I have seen is that in one of the small wall gardens at the McIlhenny Estate, Avery Island, Louisiana. Here it performs in the manner that is demanded of a good groundcover. In my garden in Maryland, *Ardisia japonica* has been outside for only two years but the plants have come through both winters without any sign of injury and have begun to spread. This is a shade plant, more so than *Pachysandra*, but it will

serve similar garden duty in milder climates perhaps with a bit more grace since it is not as vigorous a plant.—J. L. CREECH, Hyattsville, Md.

Plants from a California Garden

Aphyllanthes monspeliensis (leafless flower)—This native of the western portion of the Mediterranean is well named, even though the name itself sounds a great deal like some virulent skin disease. The true leaves are small and membranous and are at the foot of the reed-like grey-green unbranched flower scapes which here in the Bay region around San Francisco are more than double in height the four inches which is apparently common when grown in England. When happily wedged between two stones in a dry, sunny spot in the rock garden it blooms freely during May. The flowers, star-like, and a good sky blue, are about an inch across and borne singly in a head at the top of the "leaves". Two or three appear successively out of small chaffy brown bracts, each lasting for two or three days. They look like one had stuck a large blue-eyed grass flower on the very top of a reed stem. As might be expected these stems act as leaves after the flowers have faded. During the winter many of the stems die down as new ones form and push up among the small leaves.

The fibrous roots grow best in a sandy loam and propagation is either by seeds which seldom set in this climate or divisions which are difficult to reestablish.

Orthrosanthus multiflorus (morning flower)—This relative of our native blue eyed grass (*Sisyrinchium*) is one of eight species, five of them—including this one—found in southwest Australia while the other three are found in the Andes. This plant occurs in shaded, moist humus-filled soil and gives a good show in the latter part of spring. Here it blooms the last week of May and through the middle of June.

As the name implies the flowers open in the morning and in normal weather are closed and gone by mid-afternoon. The flower is at first cup-shaped, but by mid-morning it has opened flat to nearly one and a half inches and gradu-

ally reflexes slightly. It finally folds inward again and closes like a clenched fist. One to four flowers may open daily on a one-sided raceme 16 inches long, each bud appearing out of a separate many-flowered spathe above somewhat lax, grassy foliage a foot high. It is always a question in the evening whether there will be one or several flowers in bloom on the raceme the following day. On very hot days the flowers may last only until noon, whereas on cool, cloudy days they may last until four.

The color of the flowers is a good misty blue. Seeds are set quite readily but I have not sown them. Propagation is easy by division of the short rootstock. The foliage is burned by temperatures below 20 degrees but the roots can probably stand 15 degrees for a short time.—FREDERICK W. COE, *Ross, California*.

Some Aspects of Horticulture and Gardening in the West German Republic

The position of horticulture and home gardening in West Germany today enjoys such an aura of prosperity, one wonders what might be the next step forward. Since World War II, eight major horticultural shows called Federal Horticultural Exhibitions (*Bundesgartenschau*) have been held in as many cities. In scope, these horticultural fairs are unlike anything ever attempted in the United States.

West Germany has a thriving nursery industry, with more than 2,000 nurseries, mostly located in East Friesland in the far northwestern part of the country and in an area around Pinneberg just north of Hamburg. Home gardening has become an integral part of modern life as never before, and the "kleingarten" movement provides recreation which has become traditional among thousands of people. Worth visiting, too, are a few of the old "schloss" parks in various parts of the country, developed by the landed gentry in the 18th and 19th centuries. Such places are the Berggarten and Royal Garden of Herrenhausen at Hannover; the parks of Ludwigsburg; Veitshöchheim; Wilhelmshöhe, near Kassel; and of Sanssouci near Berlin (now in East Germany); and the great English garden and *Hofgarten* of Nymphenburg at Munich.

Others also exist. A modern garden maintained in the grand style is owned by Count Bernadotte on the Island of Mainau in the Bodensee (Lake Constance).

Botanic Gardens of West Germany

In Europe the botanic garden carries with it a time-honored tradition in university life dating from the Italian gardens, first at Padua in 1545. In Germany, the earliest botanic garden was established at Leipzig in 1579. Now, nearly 60 botanic gardens are found in the country, including East Germany. The largest and best known are those in Berlin-Dahlem, Bremen, Munich-Nymphenburg, Frankfurt am Main, Darmstadt, Dortmund, Hannover, Essen, Hamburg, and Kiel. The university botanic gardens are designed primarily for academic purposes with little or no emphasis on horticulture at the level of the layman. In contrast, the municipally operated botanic gardens at Frankfurt am Main (Palm Garden), Cologne, and Dortmund are maintained solely for the public with emphasis on horticultural plant materials at the popular level.

Botanic gardens in West Germany definitely are in an era of expansion. Since World War II, the botanic garden in Berlin-Dahlem has undergone much reconstruction as a result of war damage that nearly destroyed the glasshouses, although the arboretum was left intact. In fact, the arboretum of the botanic garden was spared while other parks in the city virtually were denuded of trees for firewood in the perilous winter of 1945-46, the first after the war. In Hannover, the glass houses in the Berggarten have been completely rebuilt to replace the old palm house and its famous collection of palms, all destroyed by the war. In Heidelberg, the old garden was abandoned, in favor of a new site across the Neckar River where a completely new garden has been established. The garden in Cologne has been reconstructed; at Dortmund, an ambitious expansion program by the present director, G. Krüssmann, has brought into existence a completely new range of plant conservatories designed solely for exhibition purposes; the new plantings of hardy woody plants in the Dortmund Garden are reputed to be the largest assortment in West

Germany. In the small botanic garden at Kassel, an active program of expansion is under way, and new glass houses have been constructed since the war.

To a botanist, horticulturist, or serious amateur, a visit to a German botanic garden, either municipally or university operated, can be a rewarding experience, if for no other reason than exposure to a sizable segment of the earth's flora in so small a space. Indeed, botanic gardens are a good source of germ plasm for use in a plant introduction program.

German Horticultural Exhibitions

Federal Horticultural Exhibitions called Bundesgartenschau held in various cities of West Germany since World War II are the largest ever attempted in the country. These colossal shows are a plan to promote German horticulture at the level of the average home gardener. The results have been extraordinarily successful if attendance figures are indicative.

These exhibitions run from May 1 to October 31 in odd-numbered years, and require 2 years to prepare. The local municipality sponsoring the show in cooperation with the Central Association of German Horticulture underwrites the entire cost. During the show all expense of maintenance is borne by the municipality. The exhibitions usually are held on about 100 acres of relatively undeveloped land, the objective being to establish the area as a permanent park and garden of the city. At the end of the show the municipality purchases plants desired for the permanent plantings.

The exhibitors of these exhibitions consist largely of nurserymen and commercial horticultural sundrymen who contribute all materials. Every aspect of the horticultural trade is represented, including the latest in garden architecture; many gardens are built fully to scale. Rose gardens, rock gardens, health gardens, and an extensive exhibit of "kleingartens" usually are represented. Cemetery landscaping is featured at some of the shows. New garden machinery, greenhouses, horticultural sundries, and a large horticultural book section are also prominent features.

Popularity of these horticultural fairs is evidenced by the 1959 exhibition at

Dortmund which attracted 7 million paid admissions at 50 cents each. This is a city of over a half million persons. Indeed, these garden shows are object examples of what can be accomplished on a national level in an area of interest such as horticulture and gardening, especially when the necessary coordination is available.

Floral festivals at the local level are not uncommon events in a number of German communities. In many cities of West Germany annual garden shows are held, with a scope we find in the larger American cities as a prelude to spring. Dortmund, for example, annually holds a spring show for 10 days in March. As many as 3,000 flowering rhododendrons up to 6 feet tall are brought into these exhibitions. Bremen holds an annual rhododendron show.

The German "Kleingarten"

For people living in large cities and industrial areas, the German "kleingarten" movement satisfies the native desire to cultivate the soil. The municipalities provide the land, usually on the edge of the city, and apportion lots, about one-eighth to one-quarter of an acre in size. The aim is to provide gardening space for city dwellers who would not otherwise be able to cultivate their own vegetables and flowers.

The Kleingarten tenant always erects a small house for use on weekends. Indeed, the Kleingarten is treated very much like the cabin at the beach in the United States. Dortmund alone has 70 kleingarten-parks, each with 50 to 100 weekend residents. Competitions are held between cities, and the Golden Harvest Crown is awarded the winner at the end of the season.—F. G. MEYER, *U. S. National Arboretum, Washington, D. C.*

Louisiana Violets

The study of the indigenous flora of the Gulf Coast Area is carried on a year-round basis at The University of Southwestern Louisiana. The spring plan includes the collecting of the violets, live, and for the herbarium. The state of Louisiana is host to several violets—according to Dr. John Kunkel Small, in his *Manual of the Southeastern Flora* (1933)—13 species; some of them are typically southern, some are

varieties of northern species, and some are more northern with an extended range into our area. In the years from 1957 through 1962 field trips were made in Allen, Beauregard, Bienville, Evangeline, Lafayette, Livingston, Sabine and Vermilion parishes to hunt for violets. Ten were located so far in Louisiana from the thirteen known species and we hope to have in time a complete collection of our native violets. Live plants are growing at USL and the exsiccata are deposited at the USL Ornamental Horticulture Herbarium. The violets located in our state up to this date follow in alphabetical order:

VIOLA LANGLOISII Greene. The plant emerges from a fleshy rootstock. The character leaves are glabrous, elongate-triangular with serrate margins. The large and showy flowers surpass the leaves considerably. The petals are light violet, the three lower ones with dark veins; the two lateral ones are clavate.

Collected in Vermillion parish in various soils with a pH of 6.4-6.7.

VIOLA LANGLOISII VAR. *PEDATILOBA* Brainerd. The variety can be distinguished from the species by its character leaves which are 3 to 5 pedate.

Collected in Livingston and Lafayette parishes in various soils with a pH of 6.1-6.8.

VIOLA LOVELLIANA Brainerd. The plant emerges from a thick rootstock. The character leaves are three-lobed, pedate, glabrous, rarely minutely pubescent; the middle lobe narrows toward its base. The flowers surpass the foliage by several inches. The petals are violet, the three lower ones are densely clavate with dark veins on a white base. All petals are bluish white outside.

Collected in Sabine parish in a light sandy soil with a pH of 6.6.

VIOLA MISSOURENSIS Greene. The plant emerges from a multi-branched thick rootstock. The character leaves are triangular in outline with a cordate base, the margins of the basal lobes are sometimes folded in. The flowers surpass the leaves. The petals are pale violet to violet, all of them with a white base and with dark veins; the lateral ones are bearded.

Collected in Allen parish in heavy clay with a pH of 6.7.

VIOLA PEDATA VAR. *CONCOLOR*

Hoelm. The plant emerges from a thick short rootstock. The character leaves are deeply cut, thus divided in several narrow sections. The flowers are born on peduncles to 6" long. The petals are all of the same color (in contrast with the species which has two dark and three light petals) varying from near-white to dark violet, the lower petal has a white base and the two lateral ones are *beardless*.

This is our most spectacular violet cherished by gardeners all over the world.

Collected in Evangeline and Sabine parishes in light soils with a pH of 6.4.

VIOLA PRIMULIFOLIA L. The plant emerges from a strong but short rootstock. The leaves are pubescent (the northern form has glabrous leaves), oblong to elongate ovate, sometimes cordate and sometimes decurrent. The flowers surpass the leaves. The petals are white, the three lower ones veined with dark blue, the two lateral ones are *beardless* or sometimes bearded. This violet grows in Sphagnum bogs, on banks with seepage, and in wet depressions.

Collected in Allen, Beauregard, Bienville, Sabine and Vernon parishes in Sphagnum bogs and damp places, in soils with a pH of 6.2-6.7.

VIOLA ROSACEA Brainerd. The plant emerges from a fleshy rootstock. The character leaves are heart-shaped and somewhat scabrous above. The flowers surpass the leaves. The petals are rosy-violet, the lower one veined with dark lines, the lateral ones are bearded. This violet was first discovered near Crowley, Mississippi is the only other state where it is known to grow.

Collected in Lafayette parish in sandy soil with a pH of 6.4.

VIOLA SAGITTATA Aiton. The plant emerges from a very short, almost corm-like rootstock. The narrow and glabrous leaves have a somewhat rounded apex, are scalloped at the base, and are arrow shaped in outline. The lowest leaf segments point downward. The petals are violet. The three lower ones are bearded and are veined on a white base.

Collected in Sabine parish in bogs with a pH of 6.2.

VIOLA TRILOBA V. *DILATATA* Brainerd. The plant emerges from a

thick rootstock. The character leaves are three-lobed pedate, usually densely pubescent; the middle lobe is narrow and elongated, the lateral lobes are three-parted. The flowers surpass the foliage. The petals are of bearded and veined dark on a white base. This violet is the southern variety of *Viola trifolcis*, Schweinitz.

Collected in Evangeline parish in sandy soils with a pH of 6.7.

VIOLA WALTERI House. This violet is easily recognizable by its trailing habit. The plant emerges from a somewhat woody rootstock; the growing stems lie flat on the ground and root at the tips as they grow. The leaves are orbicular to cordate, small; the veins are bordered with dark green on a silvery green base. The flowers are small and either surpass the leaves by one or two inches or are borne on short pedicels, the petals are light violet; the two lateral ones are bearded, and the three lower ones are veined. This violet has a good chance to become a showy groundcover for shady places in the garden or in rockeries.

Collected in Evangeline parish under *Fagus* and *Magnolia grandiflora* in light soils with a pH of 6.2-6.4.—SIGMOND L. SOLYMOSEY, *Univ. of Southwestern Louisiana, Lafayette, La.*

Texas Crab Apple

Houston's climate doesn't suit most of the flowering crab apples that are such useful ornamentals in the north.

Malus angustifolia, the Southern crab does well and is used some although the flowers and fruit are not as showy as many Asiatic hybrids.

Another species likely to do well in our area is the Texas crab apple, *Malus ionensis texana*. This tree from the Edwards plateau has almost been wiped out, mainly by the browsing of goats. There are some wild trees remaining near Blanco, 15 miles south of Johnson City.

Pink fragrant flowers are borne on thickly branched sometimes shrubby trees. Many root sprouts are produced forming thickets. The fruit is greenish yellow and was valued highly for preserving.

The need for more good flowering trees here should cause the Texas crab to be given a good trial. The importance of adapted varieties has been proven by the erratic growth here of many northern varieties with high chilling or other climate requirements. Southern varieties of sugar maple, red maple, red bud and many other trees grow off better than northern varieties of the same species. It is logical to expect that the Texas crab apple would have lower chilling requirements than *Malus ionensis* strains from the north.

Like several other rare trees on the verge of extinction the Texas crab should not be allowed to disappear. It may be a good parent for hybridization with Asiatic crabs.—LYNN LOWREY, Rt. 8, Box 308, Houston, Texas.



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