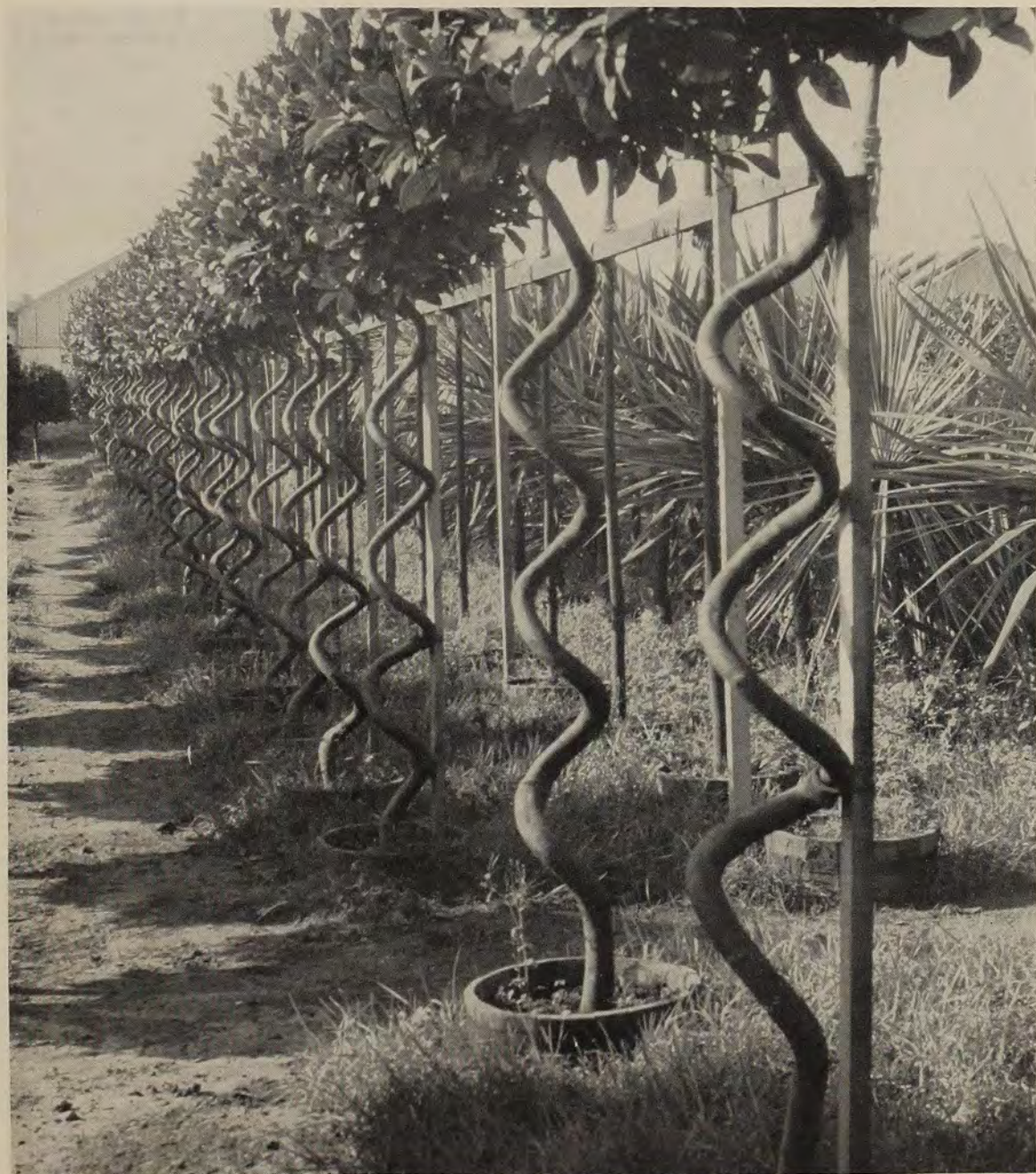


**THE AMERICAN**  
*Horticultural*  
**MAGAZINE**





# AMERICAN HORTICULTURAL SOCIETY

1600 BLADENSBURG ROAD, NORTHEAST / WASHINGTON, D. C. 20002



*For United Horticulture*

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

## *Editorial Committee*

JOHN L. CREECH, *Chairman*

W. H. HODGE

FREDERIC P. LEE

CONRAD B. LINK

CURTIS MAY

FREDERICK G. MEYER

WILBUR H. YOUNGMAN

## *Officers*

### **PRESIDENT**

RUSSELL J. SEIBERT  
*Kennett Square, Pennsylvania*

### **FIRST VICE-PRESIDENT**

JOHN H. WALKER  
*Alexandria, Virginia*

### **SECOND VICE-PRESIDENT**

MRS. JULIAN W. HILL  
*Wilmington, Delaware*

### **ACTING SECRETARY-TREASURER**

GRACE P. WILSON  
*Bladensburg, Maryland*

## *Directors*

### *Terms Expiring 1965*

HAROLD EPSTEIN  
*New York*  
FRED C. GALLE  
*Georgia*  
FRED J. NISBET  
*North Carolina*  
J. FRANKLIN STYER  
*Pennsylvania*  
DONALD WYMAN  
*Massachusetts*

### *Terms Expiring 1966*

J. HAROLD CLARKE  
*Washington*  
FREDERIC P. LEE  
*District of Columbia*  
CARLTON P. LEES  
*Massachusetts*  
RUSSELL J. SEIBERT  
*Pennsylvania*  
DONALD WATSON  
*Hawaii*

### *Terms Expiring 1967*

MRS. ROBERT L. EMERY, JR.  
*Louisiana*  
A. C. HILDRETH  
*Colorado*  
DAVID LEACH  
*Pennsylvania*  
CHARLES G. MEYER  
*New York*  
MRS. STANLEY ROWE  
*Ohio*

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

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

Reprints will be furnished in accordance with the following schedule of prices, plus postage, and should be ordered at the time the galley proof is returned by the author: One hundred copies—2 pp \$7.20; 4 pp \$13.20; 8 pp \$27.60; 12 pp \$39.60; Covers \$13.20.

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

THE AMERICAN *Horticultural* MAGAZINE

FORMERLY THE NATIONAL HORTICULTURAL MAGAZINE

VOLUME 44 / NUMBER 4

## Contents

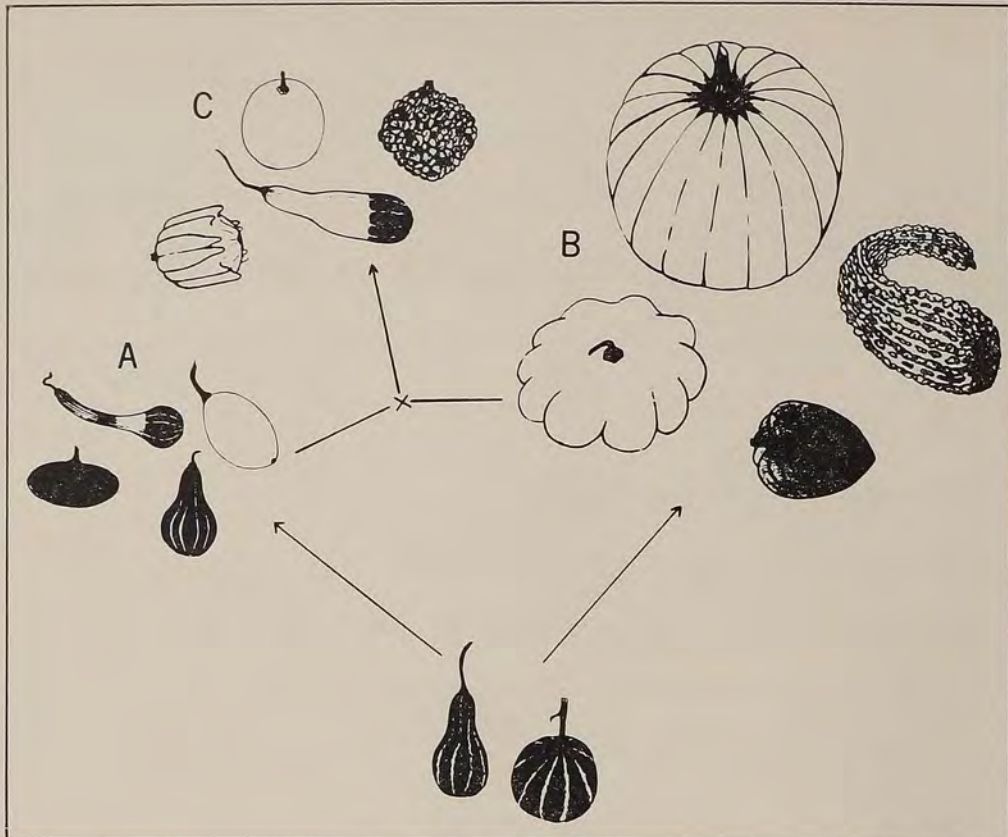
THE UNPREDICTABLE GOURDS. Oved Shifriss . . . . .	184
GARDEN CHRYSANTHEMUMS IN THE NORTHERN ROCKIES. H. N. Metcalf . . . . .	202
DISA UNIFLORA, THE PRIDE OF TABLE MOUNTAIN. Margaret Lawder . . . . .	205
BIOLOGICAL CONTROL OF GARDEN INSECT PESTS. C. H. Hoffman . . . . .	210
EPIMEDIUM AND VANCOUVERIA. Frederic P. Lee . . . . .	220
A BOOK OR TWO . . . . .	226
THE GARDENERS' POCKETBOOK	
BELGIUM—SOME FEATURES OF ITS HORTICULTURE AND GARDENS	
Frederick G. Meyer . . . . .	234
BORERS CAN CAUSE RHODODENDRON DIEBACK.	
The Editorial Committee . . . . .	237
A FAMOUS FLOWERING CHERRY OF JAPAN. John L. Creech . . . . .	238
BUTTERFLY WEED. Lucile Fonda . . . . .	239
MORE ON MONTANOA. Alex D. Hawkes . . . . .	240
LEUCOPOGON FRASERI (WHITE BEARD). Frederick W. Coe . . . . .	240
THE SOUTHERN DEW FLOWERS. B. Y. Morrison . . . . .	241

### THE COVERS

Laurel trees (*Laurus nobilis*) growing with spirally coiled stems in the Sander and Fils nursery at Bruges, Belgium. These trees are also grown in the conventional way as globes on straight standards for use in European hotel doorways. The picture was taken by Frederick G. Meyer.

On the back cover are photos illustrating ways to meet insect control problems. One method is to develop crop varieties that are resistant to insect attack. Another is through the use of insect pathogens. The pictures are from C. H. Hoffman's article 'Biological Control of Garden Insect Pests.'





DRAWING BY J. J. KINELSKI

Figure 1. Possible evolution of the cultivars of *C. pepo* L. Bottom, the wild Texan gourds. A, pure ornamental cultivars; B, edible cultivars; C, ornamental cultivars derived from crosses A  $\times$  B.

Figure 2. Diversity of ornamental fruits collected in the northeastern states during domestic exploration for the New Crops Research Branch, U.S.D.A. The cost of this and other illustrations was defrayed by the National Science Foundation.

F. J. HIGGINS





# The Unpredictable Gourds

BY OVED SHIFRISS

*"Here the variability is a thing of absolute constancy, while constancy consists of eternal changes."*

DE VRIES, 1904.

The manifestation of orderly designs in living organisms is a source of pleasure, reflection, and experiment. In this paper I illustrate the yellow-flowered ornamental gourds and discuss some of the factors which regulate the expression of the bicolor fruit pattern, the most fascinating feature of these gourds.

Present knowledge suggests that the bicolor fruit pattern originated as an ever-sporting variation. The ever-sporting phenomenon occurs spontaneously in individuals of many species of plants and animals. This phenomenon can initiate different biological mechanisms which perpetually generate variations. And variants thus generated often provide the material for the evolution of new designs in color or structure.

Experimenting with ornamental gourds has been my hobby for over twenty years. I have grown thousands of plants and observed over a million fruits. Here I share with you some of my observations.

## Classification and Relationships

The yellow-flowered ornamental gourds are varieties of *Cucurbita pepo*. The genus *Cucurbita* consists of about

twenty-five species, all indigens of the American continent. Five of these species including *C. pepo* are cultivated.

The species *C. pepo* can be divided into three groups of varieties: (a) The wild Texan gourds, often classified as *C. texana*; (b) The edible cultivars; and (c) The ornamental gourds, also known as *C. pepo* var. *ovifera*. The varieties of these groups readily intercross with each other and produce fertile offspring.

The possible evolutionary relationship between the cultivars and the wild ancestors is illustrated in Figure 1.

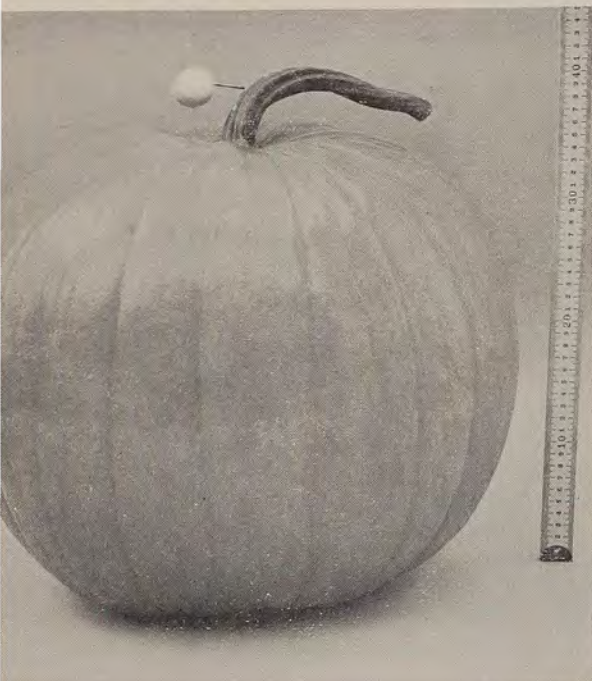
The edible cultivars have evolved gradually either from the wild Texan gourds or from similar wild forms. Archeological evidence suggests that domestication began over 5,000 years ago. Some of our present varieties, such as 'Summer Crookneck' are similar to forms which were cultivated by the Indians 1500 years ago.

The ornamental gourds closely resemble the Texan gourds in growth habit and fruit characteristics. Indeed, one ornamental strain 'Striped Pear', is practically indistinguishable from the Texan gourd. Ornamental fruits are relatively small and inedible. Their internal mass is made up of fibrous matter which becomes loose at maturity. The shell is thin but durable under favorable conditions.

The domestication of the small-fruited ornamental gourds probably began about 300 years ago by direct introduction of the Texan gourds into European gardens. Subsequent evolution has been due to selection of new mutants and of recombinants from hybrids of uncontrolled crosses between ornamental and

■ Dr. Oved Shifriss is a plant geneticist and Professor at Rutgers University. He developed 12 cultivated varieties among which were the first commercial hybrids of vegetable crops in the U. S. A. His present research deals with the genetics of sex expression in plants.





F. J. HIGGINS

Figure 3. Difference in fruit size. The pumpkin 'Big Tom' is about 2300 times larger in volume than the ornamental gourd.

Figure 4. Variation in form and pigmentation. The color of intensely pigmented fruits keeps longer.

F. J. HIGGINS



edible cultivars. These crosses occur regularly and have enriched the variation of the ornamental gourds. Many hybrid derivatives produce larger fruits but a few produce smaller fruits than those of pure gourds.

Figure 2 shows the diversity of ornamental fruits and several close-ups illustrate differences in size (Figure 3), form (Figure 4), degree of wartiness (Figure 5), and bicolor expression.

### Bicolor and Precocious Differentiation

The surface of a bicolor fruit is made up of yellow and green areas. The proximal region of the fruit toward the stem-end is prone to yellow pigmentation and the distal region around the blossom-end is usually green. But the unique feature of bicolor fruits is the *time* in development at which yellow pigmentation occurs.

The ovary of standard varieties, edible and ornamental, is uniformly green at early stages of its development prior to anthesis, i.e., prior to the time at which the flower opens. At anthesis or later, the ovary turns from green to yellow or



to other colors, or remains green throughout fruit development. In contrast, yellow pigmentation in bicolor gourds occurs long before anthesis, and this early change is termed *precocious differentiation*.

A relationship exists between the time of precocious differentiation and the size of the yellow area: the earlier the differentiation occurs during the pre-anthesis stages, the larger is the yellow area.

### Genetics of Fruit Color

Results of breeding experiments have shown that precocious and standard types of differentiation are governed by a pair of genes designated by symbols *B* and *b* respectively. Gene *B* interacts with four pigment-controlling genes which manifest their action after anthesis. These four genes are:

- W*—White fruit; *w*, non-white
- L*—Intense pigmentation; *l*, light pigmentation.

*Y*—Yellow fruit; *y*, green.

*St*—Striped fruit; *st*, non-striped.

The above genes, and several others, control the kind of pigments produced during development, the mode of distribution of these pigments over the surface of the fruit, and pigment intensity. Unfortunately the biochemistry of the pigments in relation to specific genes is not known.

In the presence of gene *W* the pigmented area of a bicolor fruit is buff; in the presence of gene *l*, yellow; and in the presence of *L*, orange. The green area of a bicolor fruit behaves as a standard *bb* tissue.

A bicolor pattern persists throughout development only if its fruit carries genes *yy* for green color. A bicolor fruit which carries gene *Y* manifests its pattern during the early stages of development but becomes uniformly yellow at maturity.

Fruit color in standard *bb* cultivars may change at different times during

**Figure 5. Variation among the 'Warted' ornamental gourds. Highly warted specimens are more durable than non-warted sorts.**

F. J. HIGGINS





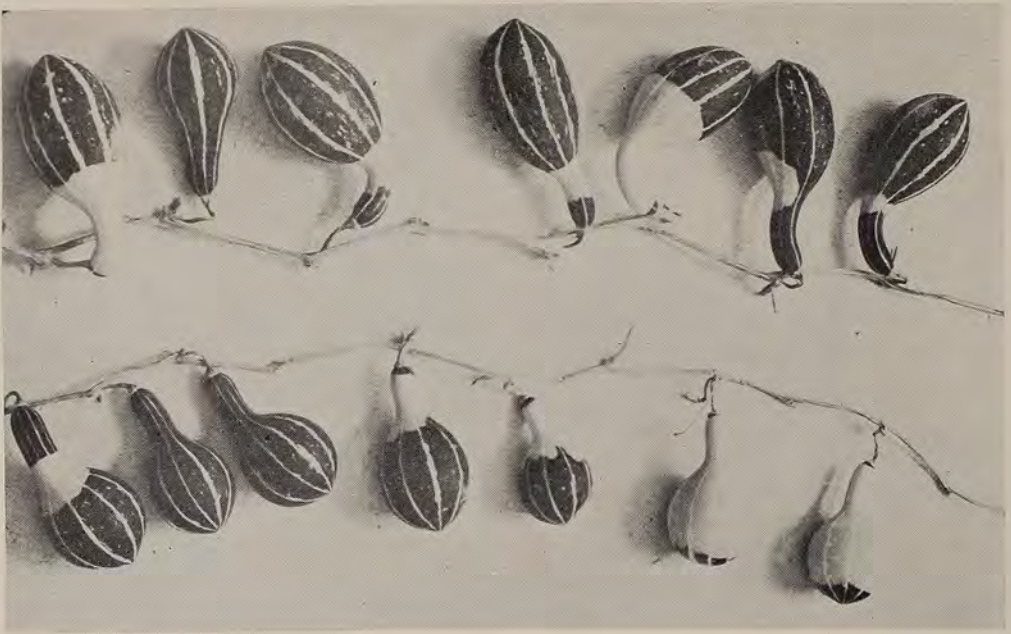


Figure 6. Fruit variation along single stems in bicolor varieties.

post-anthesis stages, depending on the genotype. Some genes for high pigment intensity appear to delay the change from green to yellow. Furthermore, heterozygous  $Yy$  fruits turn yellow at a later stage in development than comparable  $YY$  fruits.

The commercial bicolor varieties are eversporting. They do not breed true and consist of green-fruited and bicolor-fruited individuals in unpredictable ratios. A bicolor-fruited plant is highly variable (Figure 6). The fruits vary in number, size, position, and shape of the yellow areas. They remind us of variegated coat color patterns in mammals.

The following is a tentative interpretation of the behavior of gene  $B$ . First it is unstable genetic material which mutates from  $b$  to  $B$  and back. Second it is associated with the production of a diffusible substance at pre-anthesis stages. This substance brings about the breakdown of chlorophylls. In turn, the breakdown of chlorophylls in the affected area allows the yellow pigments to become visible. Essentially gene  $B$  provokes a change in timing of events.

#### Other Influences

Although the presence of gene  $B$  is required for the expression of the bicolor

pattern, the myriad variations in this pattern are influenced by several factors such as temperature, fruit polarity, and even fruit shape.

Let us consider the possible effect of fruit shape. A pattern known as "Ring" is often observed in fruit with a long slender neck but not in spherical or flattened fruit.

If two centers of diffusion occur on a spherical fruit, and these centers do not coalesce, they would appear to us as two separate spots. Such fruits are illustrated in several Figures including 2 and 14. If similar centers of diffusion affect a long neck of 'Pear' or 'Spoon' the result may be a ring pattern, the ring being the green layer which separates the two yellow areas (Figures 7 and 8). Some unusual bicolor patterns are difficult to interpret but they too may be affected by fruit shape (Figure 9).

#### True-breeding Bicolor Lines

Two true-breeding bicolor lines were isolated from an eversporting stock of 'Bicolor Spoon'. This was accomplished by selection and inbreeding for 12 generations. I was not able to isolate similar lines from other bicolor varieties.



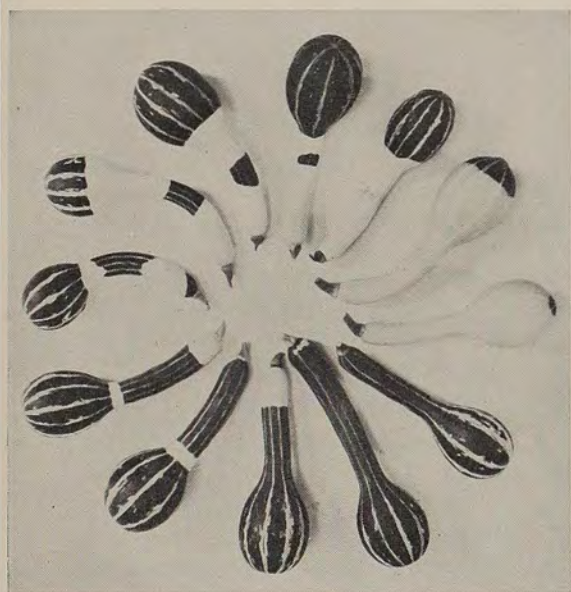
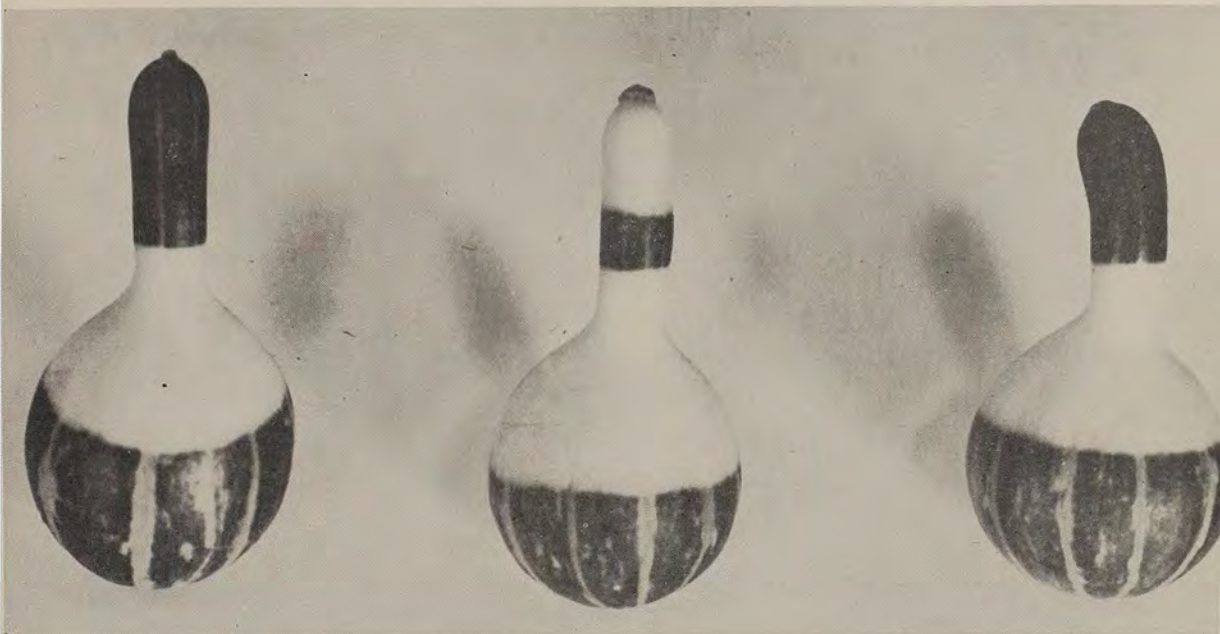


Figure 7. (Top) Bicolor patterns exhibiting uniform demarcation lines.

Figure 8. (Above) Fruit variation in 'Bicolor Spoon'. In a given environment, some inbreds bear uniform bicolor fruits of the type shown at the "11th hour" in this "clock."

Figure 9. (Right) An unusual bicolor fruit in which the distal portion around the blossom-end is yellow. This pattern was observed only in fruits which taper abruptly.





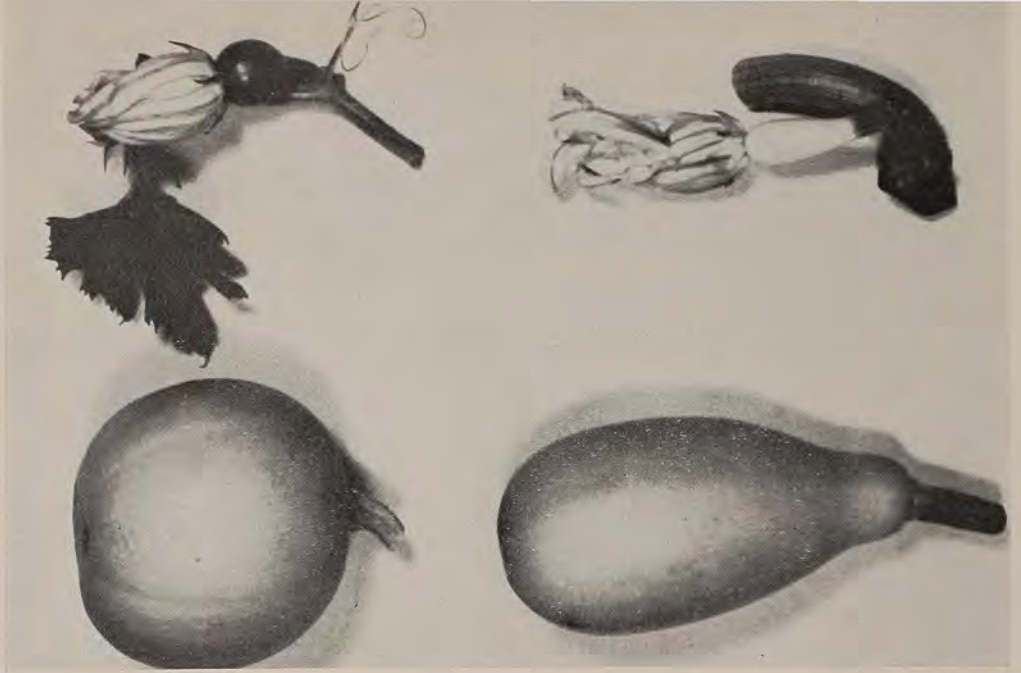


Figure 10. Ovaries and mature fruits of standard, *bb*, left, and precocious-yellow, *BB*, right, cultivars.

The behavior of our true-breeding lines of 'Bicolor Spoon' must be related to the ecological conditions under which they are grown and reproduced. In New England these lines appear to be stable phenotypically and genetically. In New Jersey they are unstable phenotypically (Figure 8), but breed true, i.e., the observed fruit variation on a single plant is transmitted to all the offspring from one inbred generation to the next.

Our observations suggest that temperature is a major factor influencing the expression and perhaps mutation of gene *B*. The true-breeding bicolor lines might behave as eversporting varieties under conditions of prolonged exposure to high temperatures.

#### Precocious-Yellow Inbreds

Precocious-yellow inbreds were developed from several eversporting bicolor varieties. A precocious-yellow inbred bears yellow fruits exclusively. The fruit color of precocious-yellow *BB yy* and of standard-yellow *bb YY* is clearly distinguishable at pre-anthesis stages but is indistinguishable at maturity (Figures 10 and 11).

Precocious-yellow inbreds were obtained through rigorous selection and inbreeding for several generations. The selection was for increasingly larger yellow areas on the fruits of individual plants.

Sooner or later in the course of inbreeding a mutant is found which bears uniformly yellow fruits.

At present we designate both precocious-yellow inbreds and true-breeding bicolor lines by *BB* since we do not know yet the nature of their difference. Perhaps they carry different forms of *B*. Furthermore, the behavior of gene *B* may be affected by the genetic background.

#### The Role of Genetic Backgrounds

A gene is a differential hereditary material which acts in concert with other genes. When the action of a gene is related to the entire gene assemblage of a particular organism, this assemblage is referred to as a genetic background.

By the use of the backcross method of breeding, I substituted gene *B* for *b* in the genetic backgrounds of three widely different cultivars: 'Striped Pear', 'Early Prolific', and 'Fordhook Zucchini'. As a result, each background is represented now by two comparable lines, a standard *bb* inbred and a precocious *BB* inbred.

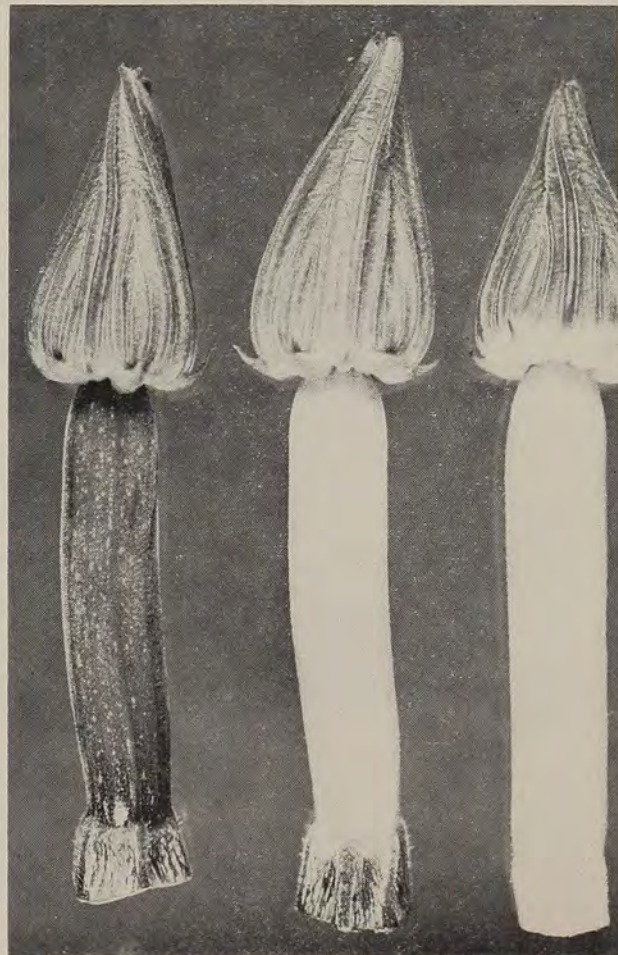
The fruits of the three precocious inbreds are uniformly yellow under field conditions in New Jersey. But when these inbreds are grown in different environments, particularly at high temperatures, some of the fruits of pre-





Figure 11. Fruits of 'Precocious-2', *BB* at different stages of development.

Figure 12. From left to right, fruits of the genotypes—*bb*, *Bb*, and *BB* of 'Fordhook Zucchini' background.



precocious 'Striped Pear' are bicolor and one in 10,000 or more fruits is completely green. Thus, the precocious inbred of 'Striped Pear' is environmentally sensitive and the other two *BB* inbreds are environmentally stable.

The difference between the three genetic backgrounds becomes more pronounced when the standard and the precocious inbreds of each background are crossed with each other. The heterozygote of 'Early Prolific' is intermediate being green as well as bicolor fruits of different grades. The proportion of green fruits is higher under conditions of high temperatures. In contrast, the *Bb* of 'Fordhook Zucchini' is fairly stable, bearing fruits which are similar to those of the homozygote *BB*. The heterozygote of 'Early Prolific' is intermediate between the two, but resembles more closely the heterozygote of 'Fordhook Zucchini' than that of 'Striped Pear.'

In each background the heterozygote *Bb* can be distinguished from both *BB*

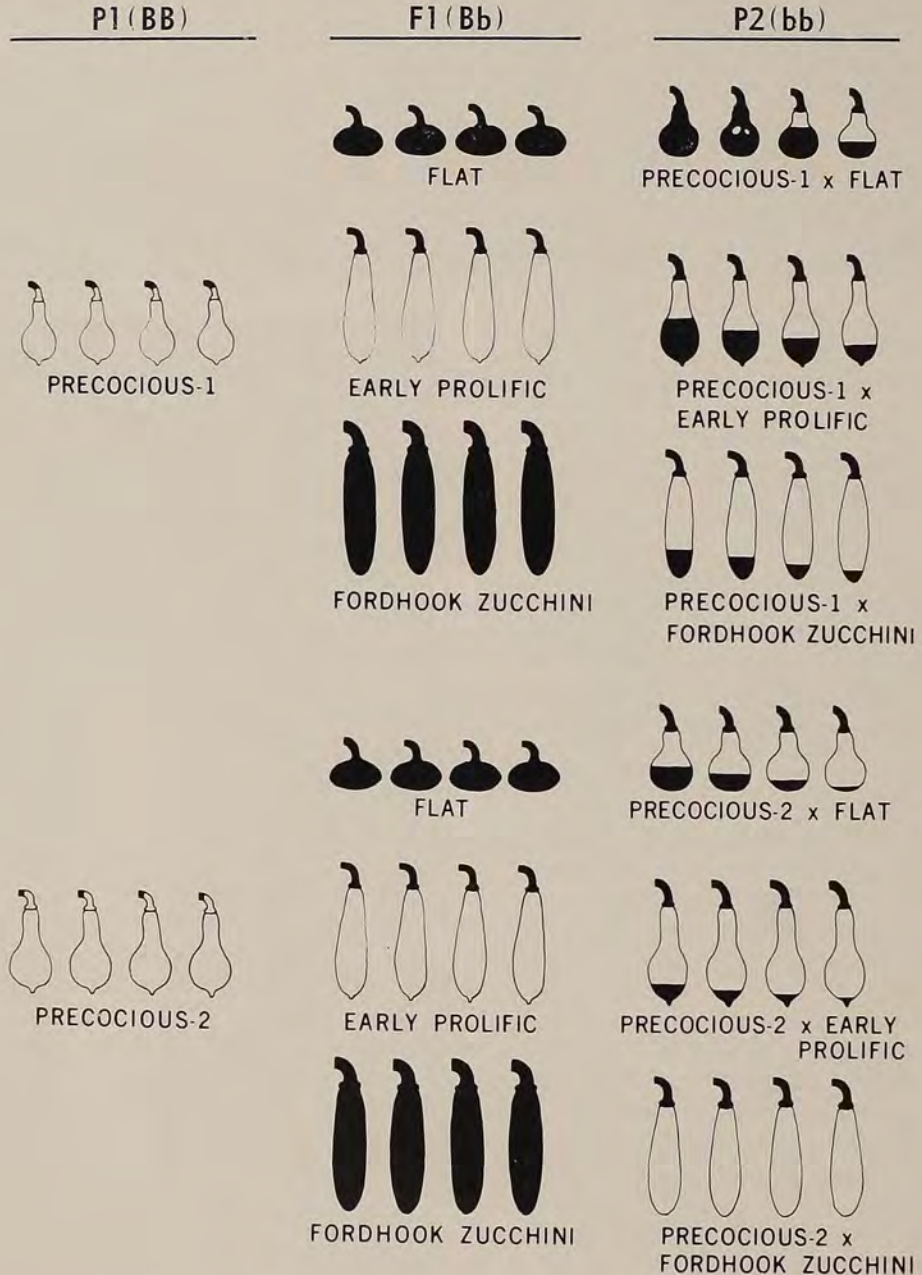


and *bb* homozygotes. In the case of 'Fordhook Zucchini' the distinction between *BB* and *Bb* is based largely on the color of the peduncle, the fruit stem. The peduncle of *BB* is yellow and that of *Bb* is green (Figure 12).

The environmentally sensitive *BB* inbred of 'Striped Pear' is known as 'Pre-

cocious-1'. Another *BB* inbred, known as 'Precocious-2', is environmentally stable. Each of these inbreds was crossed with 'Flat', 'Early Prolific', and 'Fordhook Zucchini'. The results are illustrated diagrammatically in Figure 13.

Some hybrids of crosses between precocious-yellow and standard green are







F. J. HIGGINS

Figure 13. (Left) Variation in the expression of heterozygotes  $Bb$  in different backgrounds.

Figure 14. Top left, standard 'Flat',  $bb$ . Top right, 'Precocious-4',  $BB$ . Bottom row, fruits harvested from a single plant of the hybrid,  $Bb$ : 'Flat'  $\times$  'Precocious-4'. Inbred 'Precocious-4' is one of several  $BB$  lines isolated from different bicolor cultivars.

extremely variable. The fruits of each  $F_1$  plant exhibit the entire spectrum from green to yellow with intermediate bicolor grades between these extremes (Figure 14).

#### Transmission of Gene B

Reciprocal crosses between precocious-yellow and standard inbreds are

identical. Therefore, this test does not reveal the existence of cytoplasmic influence.

Gene  $B$  behaves as a classic Mendelian factor in the genetic background of 'Fordhook Zucchini'. The observed ratios in the  $F_2$  and backcross generations of the cross  $BB \times bb$  do not deviate significantly from the expected monohybrid ratios.

The situation is different in the cross between standard and precocious inbreds of 'Striped Pear'. In this background the ratio of  $bb$  plants in the  $F_2$  and backcross generations is significantly lower than expected.

Detailed information was obtained from a cross between 'Precocious-1'  $BB$  and the ornamental gourd 'Flat'  $bb$ . The  $F_1$  hybrid  $Bb$  is variable and this  $F_1$  was studied and tested as follows.

Eleven  $F_1$  plants were grown under greenhouse conditions. The main stem of each of these plants was trained on a trellis (Figure 15). The position of each

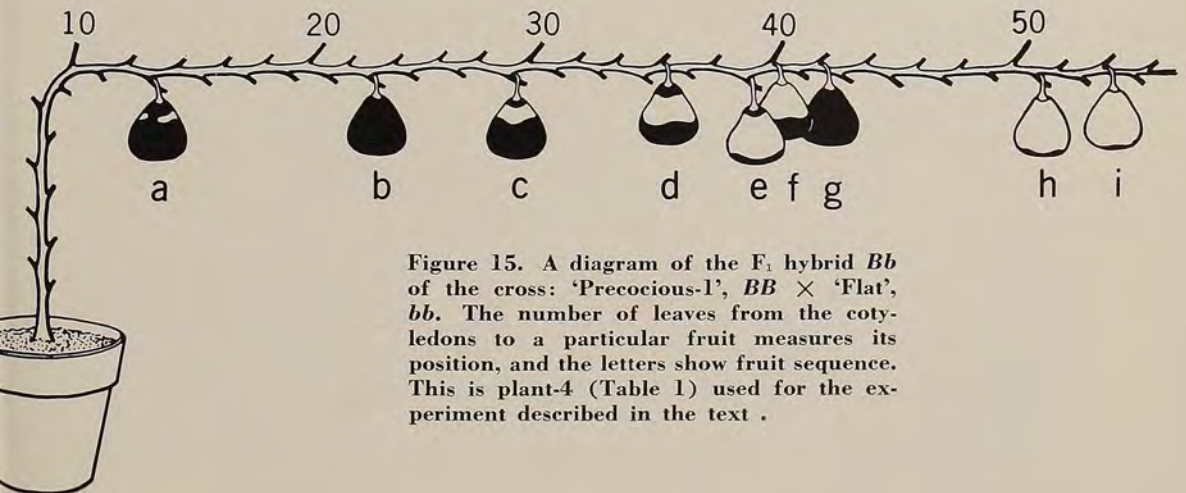


Figure 15. A diagram of the  $F_1$  hybrid  $Bb$  of the cross: 'Precocious-1',  $BB \times$  'Flat',  $bb$ . The number of leaves from the cotyledons to a particular fruit measures its position, and the letters show fruit sequence. This is plant-4 (Table 1) used for the experiment described in the text.



**Table I. Fruit Color Variation in F<sub>1</sub> Plants *Bb* of the Cross 'Precocious-1', *BB* × 'Flat' *bb* (Fig. 15). For Illustrations of Fruit Color Grades See Fig. 16.**

Plant Number	Color Grades of Sequential Fruits Along the Main Stem									Average Grade
	a	b	c	d	e	f	g	h	i	
1	0	0	4	2	8	8	8	8	6	4.9
2	4	6	0	0	8	8	8	8	—	5.2
3	4	8	2	0	2	8	8	8	8	5.3
4	2	0	4	6	8	6	0	8	8	4.7
5	8	4	4	8	8	8	8	0	6	6.0
6	2	2	4	4	6	8	8	8	—	5.2
7	2	0	2	4	8	8	8	8	—	5.0
8	2	2	6	6	2	6	8	8	—	5.0
9	0	2	4	0	2	6	8	8	8	4.2
10	8	2	2	6	8	8	8	8	—	6.2
11	2	4	6	4	2	8	8	8	6	5.6
Average Grade	3.1	2.7	3.4	3.6	5.6	7.4	7.3	7.3	7.0	5.2

fruit on the stem was measured by the number of leaves from the cotyledons, and the color grade of each fruit was also recorded. The grades varied from 0 for green fruits to 10 for almost yellow fruits. The same grading scale was used in all our experiments. This grading scale is illustrated in Figure 16. Each F<sub>1</sub> fruit was backcrossed to 'Flat' and the backcrossed seed was planted separately in a fruit-to-row test.

Table I shows the sequence and grades of the fruits borne along each stem. The data suggest that as plants grow the size of the yellow region on the fruits be-

comes increasingly larger. This confirms my observations in the field. However, I cannot yet exclude the possible influence of temperature fluctuations on this trend.

The data in Table II proves that the class of *bb* plants is significantly deficient in the backcross generation and that this deficiency is not associated with any particular color grade.

Is the deficiency due to mutation of *b* to *B* in the heterozygote?

#### Leaf Spotting

During the course of my studies, I decided to look for possible effects of gene

**Table II. Inheritance of Genes *B* and *b* in the Cross: 'Precocious-1' *BB* × 'Flat', *bb*. The Backcrossed Seed, *Bb* × *bb*, Obtained From Each F<sub>1</sub> Fruit Was Planted Separately. Thirty-Five Such Backcross Progenies Were Included in the Same Test. See Fig. 16 for Color Grades.**

F <sub>1</sub> Generation, <i>Bb</i>		Backcross Generation				$\chi^2$ (1:1)
Number Fruits Backcrossed to <i>bb</i>	Fruit Color Grade	<i>Bb</i> Plants	<i>bb</i> Plants	Total		
7	0	204	165	369	4.12*	
7	2	206	172	378	3.06ns	
8	4	215	205	420	0.24ns	
7	6	225	165	390	8.00**	
6	8	193	150	343	5.39*	
Grand Total		1043	857	1900	18.21**	
Heterogeneity among 35 progenies						38.33ns
Heterogeneity among 5 grades						2.60ns

\* Statistically significant at 5% probability level.

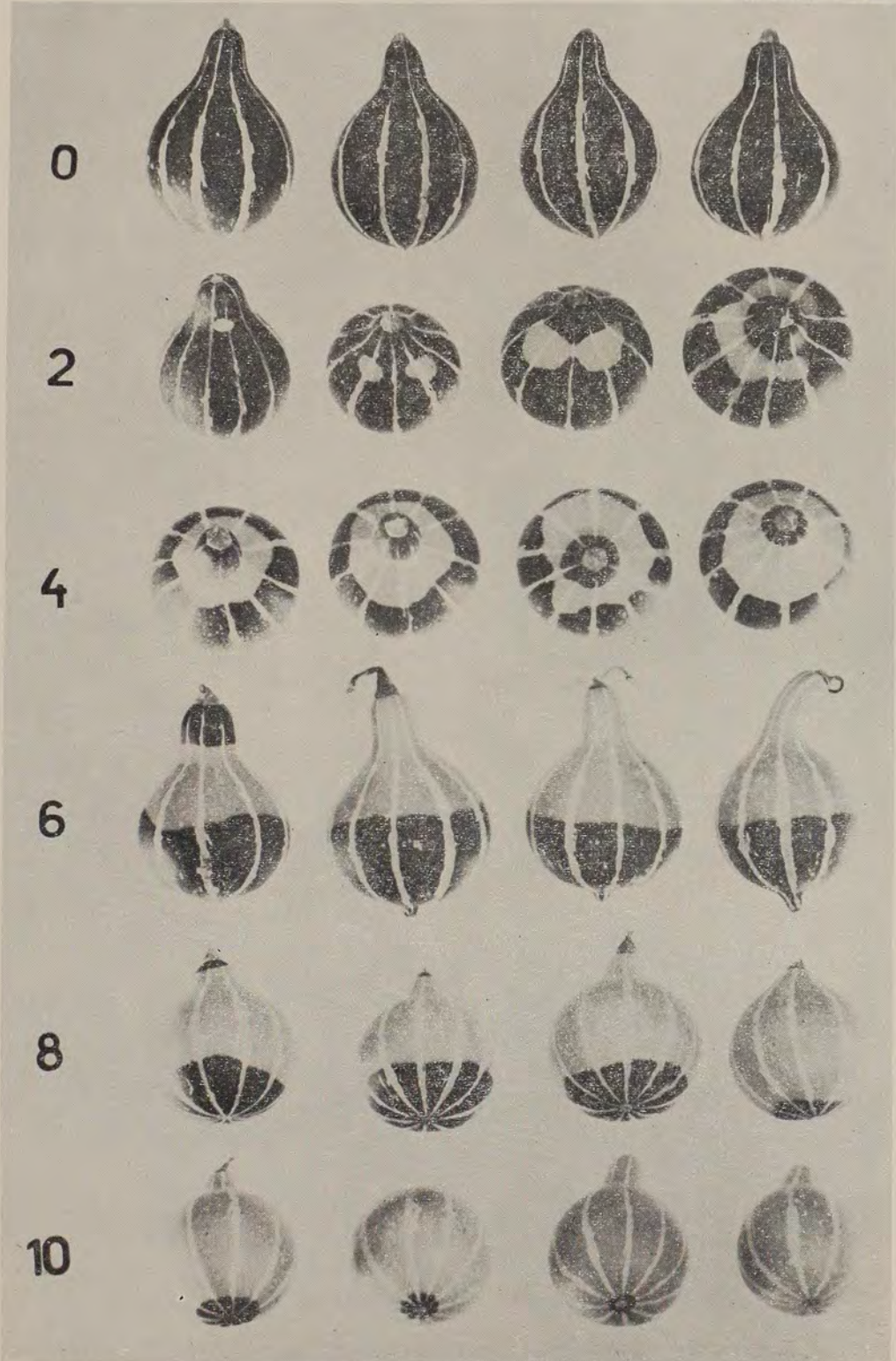
\*\* Statistically significant at 1% probability level.

ns Not Significant.



Figure 16. Fruit color grades in the variety 'Bicolor Pear'.

JOURNAL OF HEREDITY





**Table III. Incidence of Distinct Yellow Spots on Mature Leaves in *Cucurbita pepo*. The Data are Based on Ten Plants per Inbred, Five Leaves per Plant. Spring 1962, New Brunswick, New Jersey.**

Inbred	Total Spots	Average Spots per Leaf	Range of Spots Among Leaves	Percent Spotted Leaves
<i>bb</i>				
Casserta	9	0.18	0-2	16
Cocozelle	2	0.04	0-1	4
Early Prolific	6	0.12	0-2	10
Fordhook Zucchini	6	0.12	0-2	10
Seven-by-Seven	7	0.14	0-1	14
Striped Pear	5	0.10	0-3	6
<i>BB</i>				
Precocious - 1	18	0.36	0-6	30
Precocious - 2	19	0.38	0-3	24
Precocious - 4	43	0.86	0-4	50

*B* on structures other than fruits. It soon became evident that all *BB* lines exhibit distinct yellow spots on their leaves (Figure 17). This led me to search for yellow spots in standard cultivars, *bb*. Lee Craig and I examined closely several inbreds which represent the main types of edible cultivars. We found that all of them exhibit yellow spots on their leaves. But the frequency of spots in *bb* inbreds appeared to be lower than that in *BB* lines (Table III). I have grown and observed standard cultivars of *C. pepo* for many years and have not detected the occurrence of these spots before this search was made.

A more critical study was made with help of W. L. George, Jr. and Bruce Hollows. We planted seed of the  $F_2$  generation obtained from *Bb* plants of 'Fordhook Zucchini'. Forty individuals

of each of the three  $F_2$  genotypes—*BB*, *Bb*, and *bb*—were selected and five were scored for spotting. The results proved that the frequency of spots increases markedly as the number of *B* increases from zero in *bb* to two in *BB* (Table IV). It is often difficult to calculate the average number of spots per leaf in *BB* plants because an occasional leaf of this genotype manifests a "galaxy" of spots of various sizes too numerous to be counted. Therefore, the range in number of spots in *BB* was wider than that given in Table IV.

It is important to emphasize that the frequency of yellow spots on the leaves is related to temperature. A relatively high frequency of spots is observed following a low-temperature shock. Standard *bb* inbreds are prone to exhibit yellow spots when planted early in the spring in the Northern states. They may not exhibit any spots when grown at temperatures above 60°F.

Precocious-yellow cultivars are also known in *Cucurbita maxima*. The study of the inheritance of precocious differentiation in this species has not been completed but it is interesting to remark that a precocious-yellow cultivar from India is particularly prone to spotting (Figure 18).

#### Plant Transformation

Plants of some *BB* lines exhibit complete transformation from green to yellow in response to a prolonged exposure to temperatures of 60°F or below. No standard *bb* line is known to possess this ability.

Seedlings of inbreds *BB* and *bb* of 'Fordhook Zucchini' were grown in con-

**Table IV. Incidence of Distinct Yellow Spots on Mature Leaves of Plants of Fordhook Zucchini Background. The Data are Based on Forty Plants per Genotype, Five Leaves per Plant. Spring 1964, New Brunswick, New Jersey.**

Genotype	Total Spots	Average Spots per Leaf	Range of Spots Among Leaves	Range of Spots Among Plants	Percent Spotted Leaves	Percent Leaves With More Than One Spot
<i>bb</i>	29	0.15	0-3	0-5	12.5	1.5
<i>Bb</i>	178	0.89	0-4	0-11	53.5	22.5
<i>BB*</i>	801	4.02	0-50	3-83	73.5	55.5

\*An occasional leaf of this genotype produced numerous small spots which were difficult to count and therefore were not scored.



tinuous illumination, 3000 f.c., and constant temperature of 60°F. The root medium was kept at 70°F. Under these conditions, the leaves of all *BB* plants exhibited transformation and those of *bb* remained green. The transformation was gradual but complete.

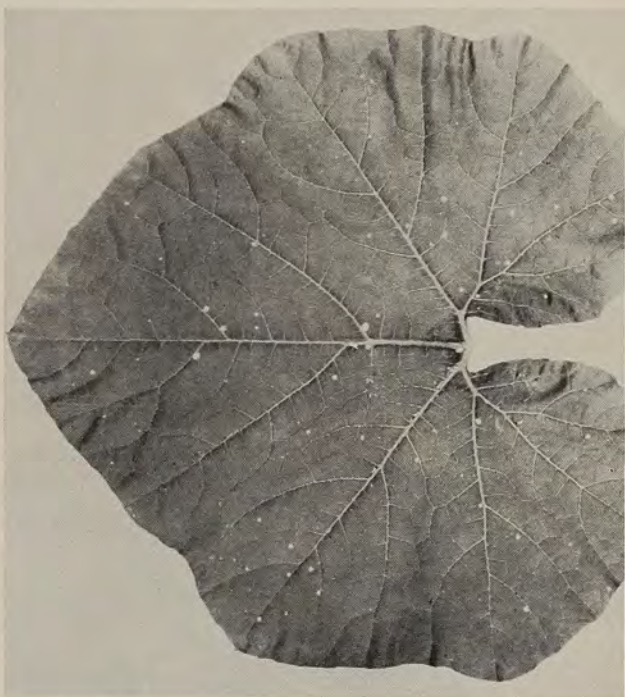
Plant transformation in *BB* of 'Fordhook Zucchini' was also observed in the field following a few cool nights at which the temperatures dropped below 50°F. (Figure 19). The comparable *bb* inbred was grown under identical field conditions but did not exhibit transformation.

Some *BB* inbreds are resistant to transformation. Therefore, this phenomenon could be controlled by interaction between gene *B* and other genes.

**Figure 17. (Top) Distinct yellow spots on leaves of precocious-yellow inbred *BB* of 'Fordhook Zucchini' background.**



**Figure 18. (Right) Yellow spots on a leaf of 'P.I. 165558', *Cucurbita maxima* Duch.**



**Figure 19. (Below) The response of two comparable seedlings—*BB* (left) and *bb* (right)—of 'Fordhook Zucchini' background to a few nights of temperatures below 50°F. Leaves of this *BB* inbred are transformed from green to yellow following prolonged exposure to low temperatures.**







Figure 20. (Above left) Variation in spotting and yellow transformation in leaves of P.I. 165558, *Cucurbita maxima* Duch., grown under different conditions. The two leaves at upper left are from field grown plants. Other leaves are from plants of the same inbred grown under continuous illumination, 3000 f.c., and constant temperature of 60°F.

F. J. HIGGINS



Figure 21. (Above) A section of stem and petioles from an inbred of P.I. 165558, *Cucurbita maxima* Duch., grown under field conditions.

Figure 22. (Left) Onset of plant transformation in an inbred of P.I. 165558, *Cucurbita maxima* Duch., grown under continuous illumination, 3000 f.c. and constant temperature of 60°F.

The cultivar 'P.I. 165558' of *C. maxima* is highly sensitive to transformation under controlled conditions. It is also more prone to transformation than *BB* of 'Fordhook Zucchini' in the field. In this variety the transformation affects the leaf blades, petioles, and stem (Figures 20 and 21). It may be significant





Figure 23. Fruits of an edible cultivar obtained from Mexico (seed, courtesy of Josue Kohashi).

that under controlled conditions of prolonged exposure to a relatively low temperature, the plants exhibit transformation but little or no spotting.

The onset of leaf transformation (Figure 22) in response to relatively low temperatures remind me of the Himalayan *albino* rabbits. The extremities of Himalayan rabbits are pigmented as a result of lower temperatures than in the rest of the body.

Spotting and transformation may be related to hereditary changes which are difficult to investigate in these gourds.

#### How Old Are the Bicolor Gourds?

Until several months ago, I believed that the bicolor fruit pattern resulted from mutation which occurred in the ornamental gourds about 200 years ago. Some of our present edible cultivars are bicolor (Figure 23) and eversporting. The mutation in these varieties could have occurred independently. Alternatively these varieties might be hybrid de-

rivatives of crosses between bicolor ornamental gourds and standard edible cultivars.

My attention was drawn recently to a photograph of Indian funerary vases. These vases are about 1500 years old. They were made in forms of fruits of *C. pepo* and were found by Safford in Indian cemeteries on the coast of Peru near Lima. There are three vases in the photograph and two are bicolor. Did the Indians evolve bicolor-fruited varieties in prehistoric times? The evidence suggests that they did.

The three vases are now in the Chicago National History Museum and one of them is shown in Figure 24. Dr. Donald Collier, the Chief Curator of the Department of Anthropology, Chicago Natural History Museum, writes to me that the lower part of the fruit is painted red and the upper portion toward the stem-end white. He remarks: "It is fair to say that the bicolor depiction is deliberate and probably does represent the condition of the fruit." Dr. Clifford Evans, the Curator of the Division of Archeology, Smithsonian Institution,



United States National Museum, with whom I have corresponded earlier, expressed the same view. He writes to me that the Peruvian potters of the Mochica and Chimu cultures were excellent realistic molders and painters. The fact that bicolor vases are in forms of fruits indicates that these potters actually had living bicolor specimens.

Has the bicolor variation occurred only once, in Indian pre-history, or recurred at different periods of time? I am inclined to think that this variation recurs at different times and that at least some of the present bicolor gourds have evolved in recent centuries.

### Evolution of Design

From the bits of information presented in the preceding pages, I would like to reconstruct the evolution of a stable bicolor design in these gourds.

The genetic system which governs pigmentation in *Cucurbita pepo* is subject to changes brought about by an unstable hereditary material. This instability is due to a mutation of *b* to *B* and is manifested under certain conditions as tiny yellow spots on leaves. As long as the mutation is confined to the leaf organ and does not adversely affect vital functions, we may not be aware of its existence.

In rare cases the same mutation affects fruit pigmentation and mutated fruits intrigue the imagination of men endowed with artistic flair. The fruit is a reproductive structure and mutations occurring in this organ occasionally affect some gametes, the cells which bridge the gap between one generation and the next. Therefore, continuous selection of such curious fruits is likely to lead to the preservation and further random play of mutable *B*.

Random play of a mutable gene often provides the plant breeder an opportunity to participate in molding new natural designs. But it is useful to have some knowledge of the rules of the game.

The action of mutable *B* is confined to early stages of fruit development, during a period at which the ovary is normally green. It provokes the pigment-



CHICAGO NATURAL HISTORY MUSEUM

**Figure 24.** A Mochica funerary vase in a form of 'Summer Crookneck' squash of *Cucurbita pepo* L., from Peru, dating 300-600 A.D. Note the bicolor pattern. The lower part of the fruit was painted with red and the upper part with white.

controlling system to act precociously and this leads to some interesting variations.

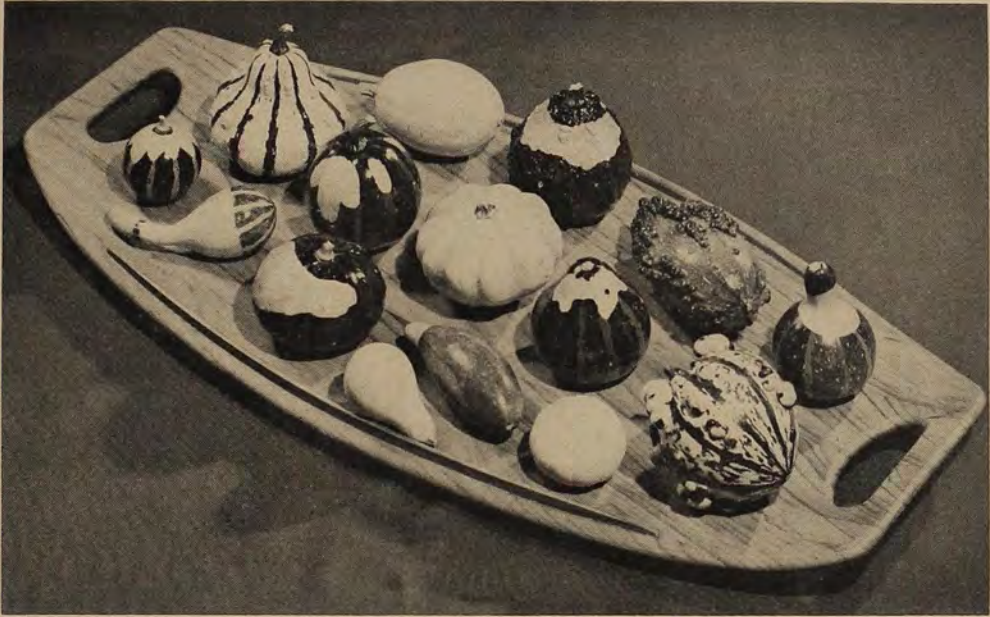
Mutable *B* is associated with several forms, such as  $B^1$ ,  $B^2$ , and  $B^3$ , each of which acts at different pre-anthesis stages. Selection of a *B* which acts extremely early in the ontogeny of the ovary leads to the establishment of precocious-yellow inbreds. And selection of a *B* which acts a little later can lead to the establishment of true-breeding lines whose fruits exhibit a stable bicolor design.

Temperature is an important ecological factor which affects the time of action and mutation of some *B* forms. Bicolor lines are particularly sensitive to temperature fluctuations. Can this situation be remedied? I think so.

Some varieties carry genes which can time precisely the action of *B*. I am tempted to call these genes stabilizers. By combining a particular form of *B* with certain stabilizers it should be possible to evolve true-breeding bicolor lines which would be highly stable under a wide range of environmental conditions.

We now have a breeding procedure for developing stable bicolor lines; yet





F. J. HIGGINS

Figure 25. A display of ornamental gourds.

instability and diversity will continue to be a source of contemplation and display (Figure 25).

Order in living things may be due in part to interaction between mutators, stabilizers, and the environment. Occasionally some mutators spring out of gear. They bring about chaos, and from this chaos new orders can evolve.

### Literature

#### Cucurbits (general)

- Bailey, L. H. 1943. Species of *Cucurbita*. *Genes Herbarum* 4, Art. 6:267-316. Ithaca, New York.
- Culter, H. C., and T. W. Whitaker. 1961. History and distribution of the cultivated cucurbits in the Americas. *Amer. Antiquity* 26:469-485.
- Erwin, A. T., and E. S. Haber. 1929. Species and varietal crosses in Cucurbits. *Iowa Agr. Expt. Sta. Bul.* 263.
- Safford, W. E. 1926. Our heritage from the American Indian. *Ann. Rept. Smithsonian Institution*, p. 406.
- Tapley, W. T., W. D. Enzie, and G. P. van Eseltine. 1937. *The Cucurbits*. Vol. 1, Part IV, *Vegetables of New York*.
- Whitaker, T. W., and G. N. Davis, 1962. *Cucurbits*. World Crops Books. Leonard Hill (Books) Limited, London. Interscience Publishers, Inc., New York.

#### Ornamental gourds

- Bailey, L. H. 1937. *The Garden of Gourds*. The Macmillan Co., New York.
- Erwin, A. T. 1938. An interesting Texas Cucurbit. *Iowa State Coll. Jour. Sci.* 12:253-261.
- Hutchins, A. E., and L. Sando. 1941. Gourds—their culture, uses, identification, and relation to other cultivated Cucurbitaceae. *Minn. Agr. Expt. Sta. Bul.* 356.
- Shifriss, O. 1955. Genetics and origin of the bicolor gourds. *Jour. of Heredity* 46:213-222.

#### Eversporting

- Brink, R. A. 1960. Paramutation and chromosome organization. *Quart. Rev. Biol.* 35:120-137.
- Brink, R. A. 1962. Phase change in higher plants and somatic cell heredity. *Quart. Rev. Biol.* 37:1-22.
- Demerec, M. 1935. Mutable genes. *Bot. Rev.* 1:233-248.
- Dermen, H. 1960. Nature of plant sports. *Amer. Hort. Mag.* 39:123-173.
- DeVries, H. 1912. *Species and Varieties. Their Origin by Mutation*. 847 p. The open Court Publishing Co., Chicago (written in 1904).
- Lewis, E. B. 1950. The phenomenon of position effect. *Adv. Genet.* 3:73-115.
- McClintock, B. 1956. Intranuclear systems controlling gene action and mutation. *Brookhaven Symp. Biol.* 8:58-71.
- McClintock, B. 1961. Some parallels between gene control systems in maize and bacteria. *Am. Naturalist* 95:265-277.



# Garden Chrysanthemums In The Northern Rockies

BY H. N. METCALF

In spite of reportedly reduced interest in cultivation of perennial flowers by gardeners in the Northern Rocky Mountain area, garden chrysanthemums are currently increasing in popularity. In the past, garden chrysanthemums were not planted to any great extent in this area, probably because available varieties were too late in maturity, failing to bloom before the occurrence of killing frosts, and of dubious winterhardiness.

To be successful under the ecological conditions of the Northern Rockies and adjacent plains areas, a garden chrysanthemum should preferably come into bloom from mid- to late summer and/or should reach full bloom no later than mid-September. It should, as a rule, have a mounded, or bushy, free-branching habit of growth since these growth habits afford a good measure of resistance to breakage by the strong winds (30 m.p.h. and more) which frequently sweep the area. It should be capable of producing abundant stolons by late September, since those cultivars with this ability have generally proven to be quite winter-hardy. To achieve adequate winter-hardiness without protection, the plants should be capable of resisting the marked short-term fluctuations in winter temperatures characteristic of the chinook belt along the east front of the Rockies. The plants must also, and very importantly, be capable of setting and developing flower buds and blooms under the long-day, cool-night conditions of the summer growing season of the

montane areas north of 40° N. Lat. Buds, blooms, and foliage should all be frost resistant, and experience suggests that there may be separate genetic factors for these characters.

That cultivars having many of these desirable characteristics are increasingly available probably stems largely from the pioneering efforts of Dr. A. C. Hildreth and his associates at the USDA Cheyenne Horticultural Field Station, Cheyenne, Wyoming. Dr. Hildreth worked for winter-hardiness in garden chrysanthemums for 20 years before achieving what he considered to be an adequate level of hardiness. The Northern Plains and Rockies have rigorous winter weather, and plants are quite regularly subjected to what may be termed "dehydro-freezing" conditions, where very low humidity often accompanies extreme winter temperatures of 30-40° F. below zero. High velocity winds may occur simultaneously. In the chinook belt, winter temperatures may suddenly rise 30° F, and as suddenly drop back again.

Because chrysanthemums are quite sensitive to environmental conditions, it seems necessary to develop sets of cultivars adapted to different geographical areas. Professor Glenn Viehmeyer, working at the North Platte Experiment Station of the University of Nebraska, and

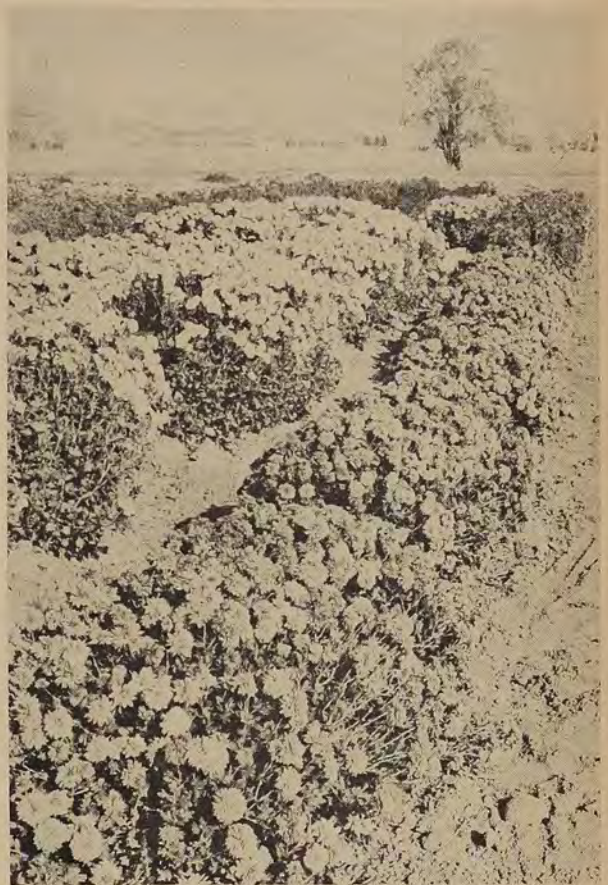
■ *H. N. Metcalf is Professor of Horticulture in the Department of Plant and Soil Science at Montana State University, Bozeman. He is a Director of the National Chrysanthemum Society, and Chairman of its Registration Committee.*



building on Hildreth's foundation, developed an extensive series of cultivars that have wide adaptation and popularity. In recent years he has concentrated on diversification of bloom form, resulting in his Space Age series. At the Dominion Experimental Station, Lethbridge, Alberta, Dr. I. L. Nonnecke has developed a series of garden chrysanthemums especially adapted to the southern Canadian prairies and adjacent higher latitude areas of the U. S. At Bozeman, Montana we have sought to develop a series of cultivars adapted to the inter-mountain valleys and foothills of the Northern Rockies. Cultivars developed at these several centers of chrysanthemum breeding are not 100% interchangeable in adaptation, and it is necessary to learn through trial which ones are adaptable at each site.

Propagators have found that garden chrysanthemums grown in 4-inch pots make a good spring sales item, since the plants can be seen in bloom by the customer who can readily select plants according to his own color and bloom-form preferences. The plants can be cut back after the spring bloom has faded, and set out in the garden with good expectation of some autumn rebloom the first year and excellent garden performance the second year.

In order to have available small-size blooming garden chrysanthemums in the spring, the propagator either maintains stock plants in the greenhouse under lights (10 P.M. to 2 A.M.) or alternatively cans up divisions of field clumps in the autumn and stores them buried in sawdust in a coldframe or protected shed until early January when they are brought into a warm greenhouse and lighted. Cuttings taken during February are rooted and potted up no later than the first week of March. While it is not necessary to light the potted cuttings at this season, a somewhat larger plant and more uniform bloom will be obtained if the plants are lighted for a week following potting. Following these procedures, flowering plants will be available for sales from mid- to late April onward, depending on the culti-



TOR FAGERAAS

Garden chrysanthemum trials at the Montana Agricultural Experiment Station. The Cheyenne Horticultural Field Station introduction, 'Buffalo', an early-flowering bronze cushion mum, is shown in the foreground.

vars employed. Some varieties will rosette unless given a period of exposure to low vernalizing temperatures. For these, the winter storage in sawdust procedure is probably best.

Breeding of garden chrysanthemums at the Montana Agricultural Experiment Station at Bozeman began about 1948, depending heavily on basic stocks developed by Hildreth and Viehmeyer. The first releases from the breeding program were made in 1960-61, when 14 cultivars were introduced, 8 of them in cooperation with the Cheyenne Horticultural Field Station, and one, 'Montaska', in cooperation with the Nebraska Agricultural Experiment Station. One of them, 'Kiwanda', had proven especially





TOR FAGERAAS

**Garden chrysanthemum breeding plots at the Montana Agricultural Experiment Station, Bozeman, Montana. The cultivar in the foreground is the early-blooming, bright yellow 'Chico'.**

adapted in western Oregon, and was released for use in that area. The other introductions were mostly given Montana place-names, e.g., 'Bannack', 'Blackfoot', 'Custer', 'Elkhorn', 'Monida', 'Ravalli', 'Sun River', 'Sleeping Child', 'Spanish Peaks', and 'Chico'. 'Evelyn Mooney' was named for the then president of the National Council of State Garden Clubs. Photo above shows the breeding plots at Bozeman, with the brilliant yellow 'Chico' in the foreground. The cultivar 'Salish' was released in the autumn of 1964, and represents what we hope will prove to be the first of a superior series of red-flowered garden chrysanthemums. Early-flowering, non-fading, hardy red-flowered garden chrysanthemums have been particularly hard to find.

While the garden chrysanthemum is often thought of as a hardy perennial, our experience at Bozeman indicates that

vigor and performance decline rapidly after the second year in the garden. Consequently, we have found it advisable to renovate clumps every third spring. Prime bloom and display have commonly been during the second year in the garden. Greenhouse-propagated plants often give falsely early bloom dates the first year in the garden, and we have adopted a policy of making garden evaluations principally with 2-year field clumps. In our breeding program, seedlings that do not bloom by 15 September are despatched to the dump. With a fairly wide color range of adapted pompon-type cultivars now available for the Northern Rockies, we expect next to move toward expanding the bloom-forms available, and possibly toward pushing the bloom season back earlier into the summer through interspecific crosses with species of *Chrysanthemum* that normally bloom under long-day conditions.



# *Disa uniflora*, The Pride of Table Mountain

BY MARGARET LAWDER

*Disa uniflora* (Orchidaceae) is South Africa's most beautiful flower. Though it is now comparatively rare in Nature it is still found in inaccessible places on Table Mountain and besides the streams and waterfalls of the mountains of the Western Cape. It has never been found in the wild more than one hundred and ten miles from Capetown. The total distribution area falls within 32° 30' to 34° 30' South and 18° to 19° 30' East.

My husband and I, taking a day off from the work of our farm, to climb the Drakenstein Mountains behind our property, found the exquisite triangular flowers recently. The early morning sun shone through the scarlet sepals veined with yellow and on the plants with their lovely green leaves, growing beside the peaty, brown waters of a stream at about four thousand feet above sea level.

I have seen the *Disa* growing in all its perfection on the mountains many times but never fail to wonder at the grace and beauty of the flower—the two side sepals spread out like wings about three to four inches across, the dorsal sepal, hood-like above them. While we were taking the photographs, some of which appear with this article, we saw *Meneris tulbaghia*, the Citrus butterfly hovering over the flowers.

This is believed to be the only insect which pollinates the *Disa*. Below one

flowering group, we saw several clumps of tiny plants at the water's edge some feet down stream. Whether these were seedlings or off-sets from the pseudo-bulbs, washed down by the water, we were unable to determine.

*Disa uniflora* does not grow only at high altitudes. There is a place within eighty miles of Cape Town where it may be seen beside the top of a water fall, only a few feet above sea level and within a mile or two of the ocean itself. The inaccessibility of this place, though it is close to a main road, is the reason for the survival of the *Disa* at Betty's Bay so near civilization.

Dr. Schelpe defines the habitat of the *Disa* as falling into two categories. The first includes perpetually wet or moist moss mats in rock crevices or ledges about water falls—the plants embedded in fibrous aerated moss mats never glutinous or stale. The second on vertical banks of streams overhung with reed-like vegetation, the sandy soil held together with the dark fibrous roots of the reed-like *Restionaceae*. At a *Disa* colony on Table Mountain, Dr. Schelpe records that maximum and minimum tem-

■ Margaret Lawder, a new contributor, got the idea for this article from reading past issues of *AHM*. She and her husband operate Leliefontein Farm, Cape, South Africa.



peratures of 35° centigrade and 3° centigrade in summer, and 24° centigrade and 0° centigrade in winter have been observed.

Though certainly not easy to cultivate it has been amply demonstrated that *Disa uniflora* can be grown in places far from its natural homes in the mountains of the Cape.

At the Botanic Gardens of Gothenburg in Sweden *Disa uniflora* has been grown successfully for thirty years. Plants were brought there in the middle twenties by Mr. Erik Magnus, a vice president of the board of the Gardens. He procured the plants at Tubergen and they have been cared for ever since at Gothenburg by the Garden's orchid



propagator, Mr. Gullberg. The late Dr. Bertil Lindquist, a former director of the Garden, has written an interesting account of Mr. Gullberg's care and culture of the Disas. In the Autumn of 1955 the stock consisted of two hundred and twenty five healthy plants, forty

eight of which flowered from September to November. Mr. Gullberg has, of course, had his troubles. Dr. Lindquist writes that in 1951 a pest attacked the plants—unfortunately he does not specify what pest—with the result that only eight plants were left in the beginning of 1952. Hand pollination, however, resulted in a good supply of seed which was sown in October giving germination so that there were a large number of seedlings to pot out in the following March.

The South African Botanical Liaison Officer at the Royal Botanic Gardens at Kew near London, wrote to me recently that there are now no living specimens of *Disa uniflora* at Kew. A consignment received from Gothenburg in 1960 did very well for a time, he says. The plants flowered profusely and then later they all died.

In the United States, Mr. H. F. Winters of the New Crops Research Branch of the Department of Agriculture at Beltsville, Maryland, tells me that no success was achieved with two seed lots received by his department during the past eight years. As *Disa* seed is thought to lose its viability quickly one wonders if possibly the cause of this failure could have been that the seed was not sufficiently fresh. At Longwood Gardens, there are a few recently imported plants which Mr. Winters believes, are doing well but have not yet flowered.

In the Southern Hemisphere the *Disa* is comparatively tough. Considerable interest is shown in it in New Zealand. Following the appearance of an article which appeared in the leading New Zealand horticultural journal, the *New Zealand Gardener*, in April 1964, a Mr. Needham of New Plymouth reported that he had a *Disa* plant which he placed in its pot in some rough native bush—it thrived there with little or no attention and survived several degrees of frost. We await with interest reports of progress made by the New Zealanders who sowed *Disa* seed obtained from our Botanical Society recently.

The old records show that, during the nineteenth century the *Pride of Table Mountain* was successfully grown in Eu-





*Disa uniflora* flowering beside a pool in a fast-running stream in the Drakenstein Mountains near the writers' farm.

Left—*Disa uniflora*

*Disa uniflora* in bud photographed in the Drakenstein Mountains, Cape Province—the plant was growing amongst undergrowth at the side of a stream.

rope. The Duke of Devonshire had a fabulous collection, the *Disa* flourished and was greatly prized in many of the great Continental gardens and grew beautifully in the greenhouses of Straffan House in Eire. The leading gardening magazine of the times, *The Garden*, published an article by a Mr. Bedford describing a magnificent show of *D. uniflora* at Straffan—when he wrote there was a group there carrying one hundred and fifty six spikes. "Such a striking display," comments the Editor, "is rarely seen, and the fact stresses that *Disa* cul-





tivation is well understood at Straffan." This was in the 1880's.

Well understood, indeed the *Disa* must have been in those far off days. The tragedy is that now nothing remains of the collection or of the techniques used to grow the plants to such perfection six thousand miles from their native homes at the Cape.

Following an enquiry made recently through the *Irish Times*, I had a letter from the grandson of the owner of Straffan House in the days of *Disa* culture there. Sadly, he wrote that nothing now remains of the glorious gardens of two generations back. By the same post, I had a letter from the grandson of the Mr. Bedford who wrote the article in *The Garden*. His grandson told me that Mr. Bedford was the head gardener at Straffan at the time and that though the family had often heard of the collection of *Disas* they had now no knowledge or record of the methods used to grow them so well and apparently so easily.

Coming to the first quarter of the twentieth century, Miss Dorothea Fairbridge, in her charming book *Gardens of South Africa*, writes that in 1922, two years before the book was published, she saw at the Royal Horticultural Society's show in London, hundreds of plants of *Disa uniflora* all standing a sturdy two feet and each bearing three great blossoms.

Thus we have ample evidence that the *Pride of Table Mountain* has been persuaded to grow in the past in many countries far from its native habitat.

The interest in the cultivation of the *Disa* here in South Africa is certainly due to the success with which it is now being grown by Mr. Gerald Feinauer, the senior horticulturist in charge of *Disa* cultivation at our famous National Botanic Gardens at Kirstenbosch near Capetown.

*Disa uniflora* is, of course, not easy to grow under artificial conditions—even here in South Africa at Kirstenbosch which is at most a few miles from places on Table Mountain where it grows in

Nature. Nevertheless, and in spite of the fact that it dies off unaccountably sometimes, Mr. Feinauer told me recently that he thinks any reasonably competent horticulturist should enjoy success with cultivation of the beautiful plant.

The most obvious obstacle to the cultivation of the *Disa*—lack of propagating material—has been overcome since, using artificial pollination, sufficient seed has been obtained at Kirstenbosch to make possible a distribution to members of the Botanical Society of South Africa.

Mr. Feinauer uses clay pots—not tins. This, he considers important for the plants to allow air to circulate and this seems to be essential to the *Disas*. Ample drainage is essential, small stones in the bottom of the pot are covered with alternate layers of river sand and sphagnum moss. He sows the infinitely fine seed on the surface—it is not covered at all—and germination takes place in about three weeks. Last year germination was little short of one hundred per cent. The tiny plants are 'pricked out' in little clumps. The pseudobulbs are delicate in structure and could easily be damaged if an attempt was made to separate the plantlets in order to prick them out singly.

At Kirstenbosch the *Disas* are growing in a glass house but this is purely for convenience of attention and observation. The gardener must be careful to devise some simple means of filtering the sunshine which falls on the plants and good ventilation is essential. When the plants are growing well they may be watered from above—there is no need to keep them damp by standing the pots in water. In Nature one must remember, the *Disa* is often under a constant spray of water and very cold water too. It must also be borne in mind that the *Disa* is not a swamp plant—it will not tolerate stagnant water.

Mr. Feinauer protests that the *Disa* has a reputation for being more 'fussy' than it really is. Still there are some things, he admits, which it will not tol-





ALL PHOTOS BY E. F. LAWDER

**Du Toit's Kloof Pass in the Drakenstein Mountains. Photograph, taken in winter, shows snow capped peaks. The comparatively rare *Disa uniflora* is found in streams in this area; all the photos in this article were taken some miles from this scene. The rough mountain slopes shown are covered with Heaths and Protea species, besides many other flowering plants.**

erate. Firstly, let the gardener beware of 'doctored' or chlorinated water. In cities where water is treated, rain water must be used or, should it be available, stream water. Secondly, DDT and nicotine must never be used on the *Disa*—both kill the plant much more quickly than either the red spider or the green fly which the grower is seeking to destroy. A sharp lookout must be kept for these pests for early detection minimizes the damage done. A good systemic poison will control both green fly and red spider, the two pests which, in South Africa, appear to be the only ones that attack the plants.

Black spot is sometimes troublesome, but I think that Mr. Feinauer considers that this is a disaster which should not occur—it is due to a lack of ventilation. At Kirstenbosch the pots used for *Disa*

cultivation are always soaked before use in a fungicide to avoid possible soil fungi troubles.

Finally, it is hoped that with constant cross pollination between plants from different localities, a strain more amenable to cultivation will be developed.

Will gardeners and plant lovers in America take up the challenge and use their skill to add *Disa uniflora* to the list of hundreds of South African plants which they grow so successfully?

I hope so, for the Pride of Table Mountain is a flower so perfect that one cannot behold it without experiencing a lift of the Spirit—perfect in form and in color it offers a lovely reward to those who use their skill to persuade it to live and flower far from its natural homes beside the mountain streams and the waterfalls of the Cape of Good Hope.



# Biological Control of Garden Insect Pests

BY C. H. HOFFMANN

Gardeners are faced with a fearful array of destructive insects and mites, many species of which attack diversified plantings. For the present, and for many years to come, growers will depend on insecticides and other pesticides to protect their plants so as to have beautiful flowers to enjoy, perfect blossoms for the flower show, and high quality vegetables and fruits for the table. Heavy use of insecticides and miticides against some pests for several growing seasons has caused certain pests to become resistant to these materials. For example, as early as 1949 insecticide-resistant strains of spider mites appeared on roses. In succeeding years entomologists were barely able to develop new materials fast enough to control these pests. Since the late 1940's many insecticides of different types, including chlorinated hydrocarbons, organic phosphates, and carbamates, have been utilized to great advantage for control of various pests of interest to the horticulturist. Sensational articles on the hazards of insecticides have caused many growers to become skeptical of their use, particularly when food crops are involved. However, it is reassuring that no one has been able to prove that a single fatality has resulted from eating food treated before it was placed on the market with insecticides used according to good agricultural practice. However, we do know that some insecticides adversely affect pollinating insects such as the honey bee and wild bees. Moreover, certain insecticides applied to control one destruc-

tive species on a crop may destroy the natural enemies of another insect that is normally of no economic importance. The absence of natural enemies may enable such a species to increase and become destructive. To control this new pest, we must then use another insecticide. The use of insecticides in and about the garden may also adversely affect birds and other wildlife. Fortunately, wildlife has a tremendous capacity for repopulation and to date garden sprays have caused no overall permanent loss of birds. The several disadvantages of using insecticides have led some unthinking individuals to recommend banning them and relying completely on natural control.

## Balance of Nature

Some of those who criticize the use of insecticides believe that satisfactory pest control can be obtained simply by not upsetting the balance of nature. Unfortunately, pest control problems are complex and will not yield to such a simple procedure under the conditions of modern living. These critics seemingly forget that man has been upsetting the so-called balance of nature in this country since the time of the Indians and the landing of the Pilgrims. Throughout our history we have bent nature to our needs, utilizing certain species of plants and animals for economic or esthetic reasons and continually fighting those that interfered with our health, welfare, and comfort. All species of life constantly struggle for existence. Populations



fluctuate greatly and a balanced state is seldom, if ever, obtained. Obviously one of man's chief aims has been to utilize nature to his advantage. Natural control of insects has been emphasized so much by popular writers that the public is beginning to think that nature alone will adequately control most of our destructive insects. Natural control agents are indeed very valuable in helping regulate insect populations; however, the belief that they alone can meet most of the serious insect problems under modern conditions must be dispelled. The balance of nature involves definite fluctuations of the host (pest) species, above and below an average density value. The frequent high peaks attained by the pest often result in serious damage.

#### **Biological Control Agents in the Garden**

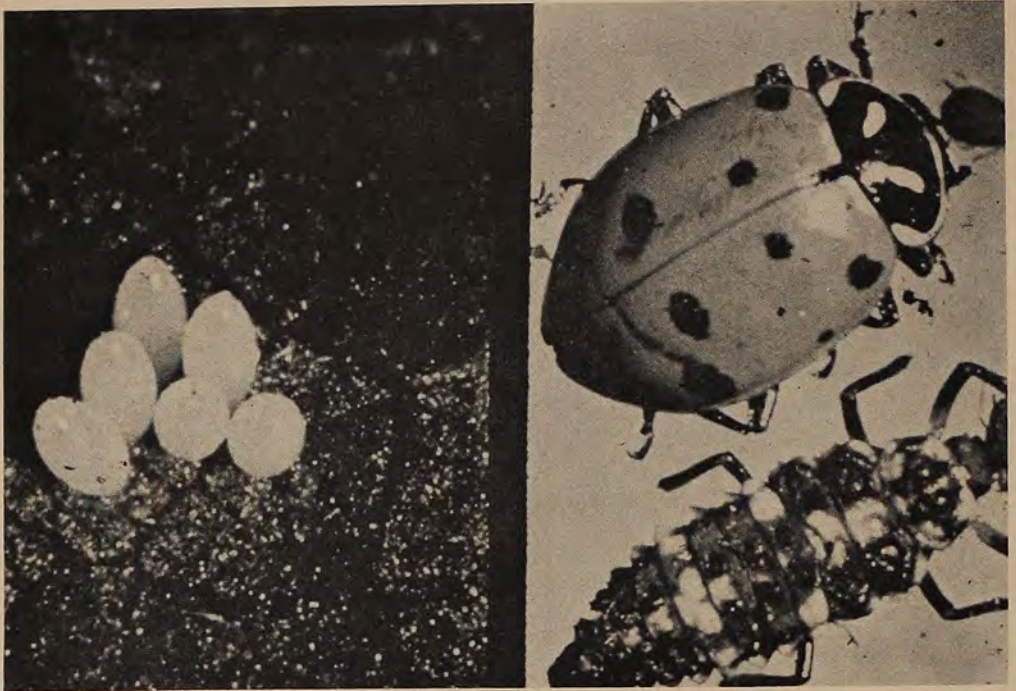
Numerous parasites, predators, and diseases are constantly at work in the home garden controlling potential insect and mite pests. Were it not for biological control in nature, we would have many more pests and far more outbreaks to combat by other means. On the other hand, there is almost no place where implementing biological control is as difficult as in the home garden. This is true because the home garden is so small, and because such a very few insects can play havoc with a beloved plant. A single corn borer larva can destroy a prize dahlia. In a cornfield, though, one corn borer is not so important. Biological control agents that hold borer populations at a reasonable level permit the grower to harvest a profitable crop. In other words, bio-control has definite limitations that frequently apply to home gardening. Although nature bountifully supplies biological agents to control insect pests in the home garden, the home gardener himself has

only begun to learn how to utilize these agents to greater advantage. He has not yet found it practical to introduce them largely because he has not found out how to manipulate and make them stay in his garden to work effectively. Man can introduce predacious insects, birds, reptiles, or parasitic wasps and flies; but usually they move either to the neighbors' gardens or completely out of the neighborhood. It is a big disappointment to the gardener to believe so thoroughly in the use of nature's natural enemies of insect pests but not be able to purchase ladybird beetles, egg parasites, mantids, chrysopid larvae, and other agents. Or, if they are available, it is equally disappointing to find that he can't make them stay on his property where they would work effectively. Perhaps future research will help us overcome some of these problems so that we can satisfactorily supplement nature's good workers.

In the meantime, it would be prudent of the home gardener to learn to recognize and protect the various parasites, predators, and other biological control agents present in his garden. Does the average gardener recognize his biological control friends and protect them? Instead of protecting beneficial wasps, yellow jackets, and spiders, many gardeners deliberately destroy them. Would you recognize the nymphs and adults of the minute pirate bug that is such an important predator of thrips inhabiting rose flowers? Just one of these insects is capable of destroying as many as 20 thrips a day. As recently as 1956 entomologists believed this predator was of greater importance in thrips control on roses than the best insecticides known at that time. These beneficial organisms can also be protected by the judicious use of selected insecticides, applied only when necessary and then the treatments alternated so that perhaps only half the garden area receives the material at any one time. Other methods are available for controlling some pests without hazard to their natural enemies. Some of these include certain cultural practices, mechanical barriers, washing aphids off

■ Clarence H. Hoffman is associate director in the Entomology Research Division of the Agricultural Research Service, U. S. Department of Agriculture, Beltsville, Md. An entomologist, Dr. Hoffman is engaged in research administration which includes investigations on the biology and control of insects of interest to horticulturists.





Eggs, larva, and adult of a lady beetle, a common predator of many injurious insects.

roses or other plants with a forceful stream of water, and hand picking or worming where practical.

Scientists in this country have been studying ways to obtain biological control of insects for many years. Although a complete review of the methods involved would not be appropriate at this time, the most important areas of pest study, some new approaches being explored, and plans for the future should be mentioned.

#### Insect Parasites and Predators

For more than 75 years entomologists have been searching for and introducing natural enemies of insect pests. Over 650 parasites and predators have been introduced into the United States and about 100 of them have become established. The greatest activity in biological control has been in countries settled by Europeans in comparatively recent times; the United States, Australia, New Zealand, and islands such as Hawaii. The United States has benefited from many worthwhile introductions. In turn, we have furnished other countries with many valuable native parasites, includ-

ing those attacking the woolly apple aphid, (*Eriosoma lanigerum*), and the San Jose scale, (*Quadraspidiotus perniciosus*).

Since most of our plants are not native and the bulk of our serious injurious insects has come from a foreign country, initially our biological control studies consist of surveys to locate parasites and predators in their native lands. When our people working abroad have collected enough material, they usually ship it by air in special containers to a quarantine station in this country. The procedures involved in importations are carefully controlled by the U. S. Department of Agriculture because of the risks of introducing potential new pests as well as organisms that may attack our native or introduced beneficial insects. During quarantine a further search is made for any extraneous material that might inadvertently have been sent along with the desired beneficial insects. After the quarantine period, we study the habits of the imported insect to see whether it attacks and reproduces only on the destructive pest species against which it is being introduced, if such a



study has not already been made in the country of origin. Subsequently, the insect is usually mass-reared and then released at a time when the destructive host in this country is developing.

### Scale Insects and Mealybugs

Some insects most commonly infesting perennial garden plants, shrubs and trees are scales and mealybugs. Parasites and predators have very effectively controlled these pests. In fact, about 40 percent of the successes in biological control on a worldwide basis have been against scales and mealybugs. In this country, complete control of the cottony-cushion scale (*Icerya purchasi*) on citrus was obtained with a ladybird beetle and complete control of the citrophilus mealybug (*Pseudococcus gahani*) with two parasites. Other parasites have afforded substantial control of the following insects: yellow scale (*Aonidiella citrina*) and black scale (*Saissetia oleae*) on citrus, olive scale (*Parlatoria oleae*) on olive, Comstock mealybug (*Pseudococcus comstocki*) on apple, and the nigra (black) scale (*Saissetia nigra*) on ornamentals. Partial control has been obtained with the use of parasites against the California red scale (*Aonidiella aurantii*), the purple scale (*Lepidosaphes beckii*) and the citrus mealybug (*Planococcus citri*), all on citrus; the San Jose scale on deciduous fruit trees; and the fig scale (*Lepidosaphes ficus*) on fig. A complex of natural enemies has given partial control of the longtailed mealybug (*Pseudococcus adonidum*) on citrus (DeBach 1960).

### Aphids

Aphids attack hundreds of species of plants, feeding on the stems, leaves, flowers, buds, and roots. They reproduce rapidly and hence are watched carefully by the gardener. Over 200 species of parasites have been recorded as attacking different species of aphids, some specific for a particular aphid and others capable of destroying as many as 30 different species. Each female wasp may kill 150 to 500 aphids. Of the common aphid predators perhaps the best known are the brightly colored lady beetles. The

newly emerged female must find aphids in sufficient quantity to produce and lay eggs. Ordinarily she eats from 200 to 500 medium-sized aphids before she produces her first eggs. The alligator-like larvae also feed voraciously and may consume 300 to 400 medium-sized aphids before changing to the pupal stage. The green lacewing larva is another predator that may consume several hundred aphids before pupating. Lacewing larvae effectively kill many aphids because they attack by sucking out the body contents rather than by consuming the entire body. The syrphid or hover flies are also important aphid predators. The flies hover above aphid-infested plants and deposit their eggs among the aphids. Later the larvae hatch and feed voraciously on hundreds of aphids before entering the pupal stage. Other insects, such as assassin bugs, nabid bugs, flower bugs, and mirids are also important predators of aphids. In addition, about 15 species of fungi attack and kill different species of aphids.

An outstanding example of the effectiveness of a parasite was the transfer from the eastern United States to the Pacific Northwest of the parasite *Aphelinus mali* that attacks the woolly apple aphid. Presumably the aphid gained a foothold in the Northwest from the East but without this parasite. After its introduction the parasite spread rapidly in the Northwest and reduced the aphid to a noninjurious status. In fact, effective control of the woolly apple aphid by this parasite continued until DDT and other insecticides, used to control the codling moth, practically eliminated the parasite from the orchards. However, we have sent this parasite to many foreign countries, where it has become an important factor in the control of the woolly apple aphid.

### Other Insect Pests

Of 26 parasites introduced to combat the oriental fruit moth (*Grapholitha molesta*), none became sufficiently well established to assist in control. We attributed the failure to the absence of acceptable alternate hosts. However, we discov-



ered that larvae of the fruit moth were heavily attacked by parasites native to the United States, of which *Macrocentrus ancylivorus* was the most important. This species was reared and widely distributed with generally good results.

Both imported and native species of parasites have been studied for possible release against the Japanese beetle. A million and a half parasites, representing 34 species, have been imported from the Far East. Of five species now established, *Tiphia vernalis* is the most effective and widely distributed, sometimes parasitizing over 60 percent of the Japanese beetle grubs.

The European corn borer (*Ostrinia nubilalis*) is not only a serious pest of corn but also of many garden and ornamental plants. During the past 35 years over 3 million parasites have been imported from Europe and the Orient. Equal numbers were reared and released to help control the pest in this country. Actually only six species have become established, two of which are of considerable importance. The parasitic fly *Lydella grisescens* is probably the most effective species, since it is widely distributed and has a field parasitization rate ranging from 10-75 percent. The wasp *Macrocentrus gifvensis* (*M. grandii*) is found largely in eastern United States and parasitizes up to 52 percent of the borers. We believe such levels of parasitization have been a vital factor in limiting the abundance and destructiveness of the European corn borer, even though complete control is not achieved.

With the widespread use of insecticides to control insect pests on various crops, many natural enemies have been killed and some species of mites have emerged as pests. Incidental to a study we set up to develop an integrated biological-chemical control program, we observed that certain species of mites effectively kept other mite species under control. For example, it was found that active immature forms of *Phytoseiulus persimilis* consumed an average of 6.3 eggs of the destructive two-spotted spider mite (*Tetranychus telarius*) and 7.1 of *T. cinnabarinus*. The average daily consumption of an adult *P. persimilis*

was 18 to 20 eggs and approximately 1.5 adult females of either host species. Moreover, female *P. persimilis* mites deposited about three eggs per day when confined with either injurious species and successfully completed their development with either species as the host.

Leaf miners, *Liriomyza* spp., serious pests of vegetables and ornamentals, are sometimes held in check by natural enemies. Of 15 species of parasites found in Arizona, three chalcids destroyed from 78 to 92 percent of the leaf miners on cantaloups. In the Salt River Valley lettuce and cantaloups provide a sequence of host plants. The parasites that overwinter on the lettuce become available to attack the leaf miners on cantaloups in the spring. However, if the parasites do not overwinter successfully, the cantaloup crop may be damaged by the leaf miners.

### Insect Pathogens

Much interest centers about using insect pathogens, including viruses, bacteria, fungi, and protozoans, for insect control. More than 1,000 of these pathogens are known to infest and kill insects in the laboratory. For some time the milky-disease bacteria, *Bacillus popilliae* and *B. lentimorbus*, have been commercially available in spore dusts that can be applied to the soil to infect and kill the grubs of the Japanese beetle. From 1939 to 1953 an intensive program of colonization was carried on in cooperation with various State and Federal agencies to accelerate the spread and establishment of the disease. These milky disease spores are now widely distributed in the eastern United States and play an important role in holding the beetle population to a fairly low level.

After considerable research by State and Federal agencies, the U. S. Department of Agriculture recommends the crystalliferous, spore-forming bacterium, *Bacillus thuringiensis* var. *thuringiensis*, for control of the imported cabbage-worm (*Pieris rapae*), the diamondback moth (*Plutella maculipennis*), and the fall armyworm (*Laphygma frugiperda*) on broccoli, cabbage, or cauliflower. Al-



though research has shown this bacterium to compare favorably with insecticides for controlling these pests, growers generally have not yet accepted it for this purpose.

Research continues to develop virus diseases that may be used to control insect pests of interest to the horticulturist. For example, in southern California a nuclear polyhedrosis virus disease has proved to be effective in controlling early stages of the cabbage looper (*Trichoplusia ni*) on cabbage, cauliflower, and lettuce. Another virus is exceedingly effective against larvae of the corn earworm (*Heliothis zea*), also known as the tomato fruitworm. However, additional research on the overall effectiveness of these viruses and their safety to higher animals must be conducted before we can recommend their use. Also of interest is the discovery by researchers at our fruit insect laboratory in California of a virus disease of mites on citrus. This is the first record of a virus disease of mites. Perhaps we now can find ways to use this virus so as to avoid residues associated with miticides applied to fruit trees.

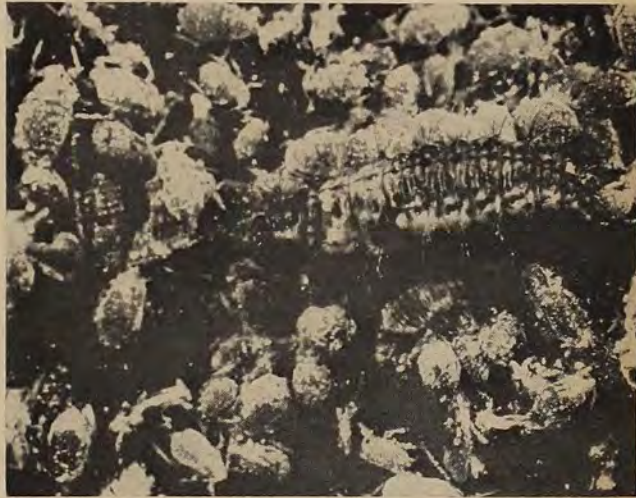
#### Plant Resistance to Insect Attack

One of the best ways to meet insect control problems is by developing crop varieties that are resistant to insect attack. This method is effective, cheap, and without the side effects that may accompany the use of insecticides. Unfortunately, it may take entomologists and plant breeders from 10 to 25 years to develop suitable insect resistant varieties. It will also be necessary to develop varieties that are adaptable to different parts of the country. Growers cannot wait so long for a solution to insect problems and thus will demand other control measures. However, the productive research of the past clearly points up the desirability of fostering research on this method of insect control in the future. The emphasis in developing insect-resistant crops has been placed mostly on forage and grain crops. In this regard, we should specially mention development of the many corn hybrids that are resistant to the European corn

borer and the corn earworm. The method is also promising for controlling a variety of insects on vegetables. Researchers are presently studying ways to obtain insect-resistant beans, cantaloups, collards, sweet corn, onions, peppers, potatoes, and squash.

#### Sterility by Gamma Radiation

Releasing male insects sterilized by gamma radiation into a wild population of insects of the same species is a most promising new approach to insect control or eradication. The occurrence of large numbers of individuals of destructive insects, and the large areas generally involved in well-established populations, make it unfeasible to utilize this procedure alone for meeting most of



Chrysopid larva (larva of lacewing fly), a general predator feeding on cabbage aphids.

our insect problems. However, under certain circumstances this method, integrated with other methods, should be of great value in controlling our most important economic species. Current methods of pest control, involving the destruction of organisms with chemicals, are efficient when the pest population is high, but inefficient when the population is low. In contrast, the sterile insect release method is generally inefficient when the pest population is high, but highly efficient when it is low. Integration of the two methods provides a degree of





Left, syrrhid adult; Right, syrrhid larva, a predator feeding on aphids.

control not available when either method is used alone.

After years of studying how to utilize the sterility principle in controlling the screw-worm (*Cochliomyia hominivorax*) the following basic conditions must be present if this principle is to be applied successfully against insect pests:

1. A method of mass rearing the insect must be available.
2. Adequate dispersion of the released males must be obtained.
3. The sterilization procedure must not adversely affect the vigor and mating behavior of the males.
4. The female of the insect to be controlled must normally mate only once, or if more frequent matings occur the sperm from the gamma-radiated males must compete with those from fertile males.
5. The population density of the insect must be inherently low or the population must be reduced by chemicals or other means to a level at which the release of predominant numbers of sterile males over an extended period of time would be economically feasible.

After successful experimental eradication of the screw-worm from the island of Curaçao, a large Federal-State program was undertaken to eliminate this

pest, a serious enemy of livestock and wild game from the Southeastern United States. By maintaining a constant rate of release of sterilized males, each succeeding generation of flies was further outnumbered by the sterile males until the pest was eliminated in 1959, approximately 17 months after the program was initiated (Knippling 1957, 1960).

Currently the USDA is cooperating with Texas, New Mexico, Oklahoma, Arkansas, and Louisiana, and with the Southwest Animal Health Research Foundation, in combating the screw-worm, which the livestock producers in the area estimate costs their industry as much as \$100 million a year. The eradication campaign was initiated in February 1962. The release of sterilized flies since the fall of 1963 has ranged from 100 to 150 million per week. The great decrease in screw-worms since 1962, based on the small numbers of larval cases confirmed by laboratory identification, speaks for the remarkable effectiveness of this program in the Southwest. It is estimated that since the program began 3 years ago, incidence of screw-worm cases in this area has been reduced by 99.9 percent.

The second insect to be eradicated from a particular area by release of insects sterilized by cobalt 60 gamma rays



was the melon fly (*Dacus curcurbitae*), a pest of melon and vegetable crops. This was a pilot experiment conducted during 1963 on the 33-square-mile Island of Rota in the Pacific. The experiment involved both biological and chemical control. First, a malathion-protein hydrolysate bait reduced the numbers of wild melon flies on the most heavily infested farms so that widespread overflooding with sterile flies could be achieved very quickly. In cooperation with the U. S. Navy and the Trust Territory of the Pacific Islands, entomologists of our Division released a total 180 million melon flies that had been sterilized by gamma rays. The sterile males, either dropped from aircraft or released from cages on the ground, mated with native flies and the resulting eggs did not hatch. Repeated and systematic releases of sterile males eventually wiped out the native melon fly population. Within 3 weeks, the sterile flies overflooded the native flies by a ratio of 13 to 1 and then gradually increased as the natural population declined. Eradication was accomplished about 3½ months after the first sterilized flies were released.

The spectacular eradication of the screw-worm and the melon fly by the sterile male technique has caused research workers, pest control officials, and governmental authorities to ask about applying it against many other injurious insects. Although it is unlikely that this technique can be used against many insect pests, it is conceivable that careful research could show its applicability for the control of other important insect pests. In this country researchers are beginning to study its application against such horticultural pests as the subtropical fruit flies, drosophila, Mexican bean beetle (*Epilachna varivestis*), codling moth, European corn borer, and spider mites.

#### Sex Attractants

After years of research, chemists of the Entomology Research Division made a great breakthrough by isolating in pure form and identifying the extremely potent sex attractant secreted by the female gypsy moth (*Porthetria dispar*).

They also synthesized a sex attractant named gyplure, which is closely related to one occurring naturally in the gypsy moth. This attractant can be produced rather cheaply. It guarantees a source of material for detecting new infestations, for measuring the effectiveness of chemical control programs, and for use in small containers dispersed over the forest as a possible means of controlling the gypsy moth by confusing the males and making it impossible for most of them to find mates. This breakthrough on the gypsy moth sex attractant has encouraged work at laboratories throughout the country. Excellent leads on sex attractants have been obtained with other insects of horticultural interest. These include the peach tree borer (*Sanninoidea exitiosa*), lesser peach tree borer (*Synanthedon pictipes*), tomato hornworm (*Protoparce quinquemaculata*), cabbage looper, Southern armyworm (*Prodenia eridania*), salt-marsh caterpillar (*Estigmene acrea*), codling moth, and the banded cucumber beetle (*Diabrotica balteata*). We anticipate that we can use these specific attractants to advantage, either alone in traps or in combination with toxicants or chemosterilants, to control the most important insect pests.

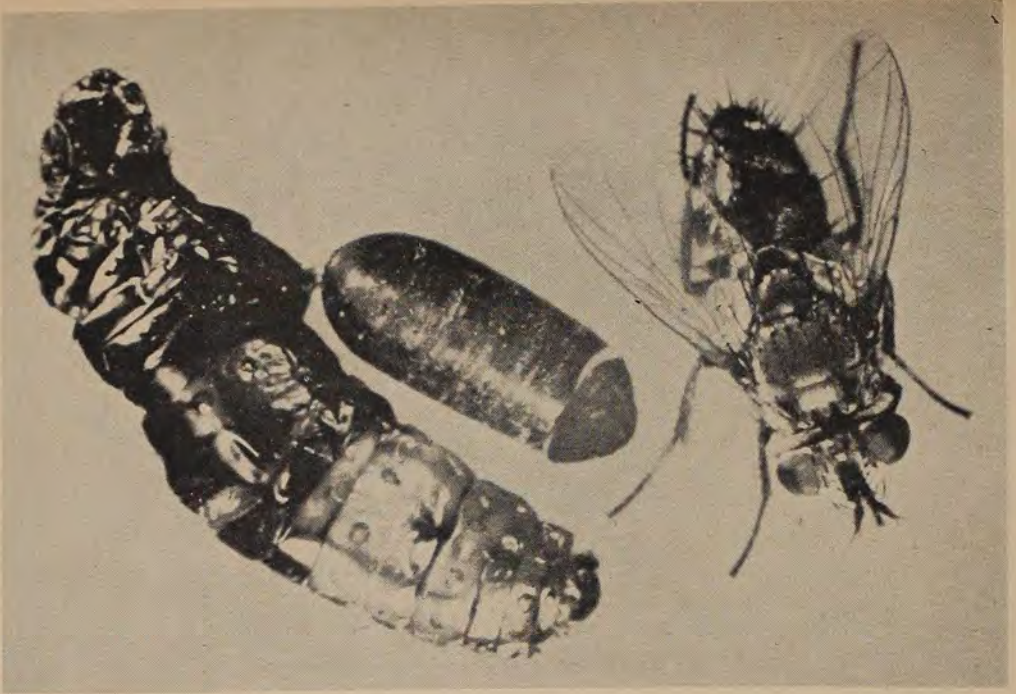
#### Integrated Control

In recent years we have paid more and more attention to integrated control, that is, the utilization of different insect control methods concurrently or successively. Our objective is to obtain satisfactory insect control with specific chemicals or to diminish the amounts of insecticides that would otherwise be used. Kelthane is a good example of a chemical having a specific use for the home gardener. It is available for control of mites on flowers and vegetables. The advantage of this material over many others is that it is effective against mites but causes little or no damage to parasites and predators of the mites or other insect pests.

#### Research Needs in Biological Control

To enhance opportunities for success when we are planning to introduce parasites and predators to control insect





**Tachinid parasite of European corn borer with empty puparium and host remains. This dipterous parasite (*Lydella grisescens*) is an important corn borer control agent.**

pests, we must study in detail the biology and ecology of the beneficial insects as well as their hosts. Some of the important biotic factors are host continuity and density, degree of synchronization in the life histories of parasite and host, availability of alternate hosts, host distribution, host-parasite interaction, and searching ability of the parasite or predator in the new environment. Methods of introducing and colonizing imported species can greatly influence the success of such a program. We need to develop methods for mass rearing beneficial insects as well as tests to determine whether continued mass releases of some species might tip the balance of nature and thereby bring certain economic insects under control. We will undertake certain of these lines of work in our new Biological Control of Insects Research Laboratory, at Columbia, Missouri, to be completed in 1966. Basic investigations carried on in this Laboratory will apply to insects in all parts of the country.

Scientists at our Insect Pathology Pioneering Research Laboratory at Beltsville, Maryland, are conducting basic studies on insect pathogens. These studies include identification of pathogens; methods of propagating, separating, and purifying them; determination of their

cultural requirements; and factors governing infection and spread under different conditions. We especially need field studies to determine the value, under different conditions, of mass liberations of disease organisms, dispersed either by conventional spray equipment or by contaminating insects. Future use of many insect pathogens will depend on development of successful methods of mass-rearing insects. We need to be able to provide sufficient host material on which to grow the pathogens or else to develop synthetic media to accomplish the same purpose.

Proper support for the long-term research studies required to develop plants resistant to insect attack is long overdue. This method offers many opportunities to obtain effective and economical control of destructive insects without serious adverse consequences.

Researchwise, the sterility approach to insect control is new and therefore an almost untouched field. Fortunately, our Division will have a group of scientists studying the basic requirements for utilizing the sterility principle of insect control. These scientists will occupy our new Metabolism and Radiation Research Laboratory at Fargo, North Dakota. They



will be finding out how radiation affects the genetics and cytology of a variety of noxious insects.

Discovering potent sex attractants in several economically important insects has opened up a whole new field of investigation which needs to be fully explored by entomologists and chemists. Conceivably, quantities of natural sex attractants or synthesized sex attractants could be used alone or in combination with other methods of insect control to develop safer ways to control insect pests.

Perhaps our most fertile but difficult field of research deals with integrated control. Utilization of two or more methods to control a given insect requires a thorough knowledge of population dynamics and careful timing in applying the different methods to obtain the greatest benefits. As a means of overcoming insecticide residues and solving the problems caused by insect resistance to insecticides, integrated control has already been exceedingly useful. Future exploitation of the method will depend upon research resources and how we are able to emphasize this line of attack.

### Summary

Annual losses by insects to garden insect pests are estimated to be over \$879 million. Gardeners face a fearful array of destructive insects and mites and must depend considerably on insecticides for their control. Natural control agents are very valuable in helping regulate insect populations; however, the belief that they alone can meet most of the serious insect problems must be dispelled. On the other hand, every effort must be made to recognize the many biological control agents that are so useful in the garden in preventing outbreaks of insects and protecting these beneficial insects. Results of biological control studies relating to a number of destructive insect species attacking horticultural and garden plants in this country are reviewed. Such studies include insect parasites and predators, insect diseases, the development of plants resistant to insect attack, utilization of the sterility principle in insect control, sex attractants, and

integrated control. These different aspects of biological control have great potential. But research to date is so limited that we do not know how to utilize the approaches to greatest advantage. Considerable emphasis, therefore, must be placed on research of the future to determine the role that biological controls are to play as dynamic, efficient, and safe ways to control destructive insects.

### References

- Allen, H. W., J. K. Holloway, and G. J. Hauesler. 1940. Importation, rearing, and colonization of parasites of the oriental fruit moth. U. S. Dept. Agr. Cir. 561, 62 p.
- Dahms, R. G. 1960. Use of resistant varieties—the ideal way to control insects. *In Handbook on Biological Control of Plant Pests, Plants and Gardens* 16 (3):82-7.
- DeBach, Paul. 1960. Biological control of scales and mealybugs (Coccidae). *In Handbook on Biological Control of Plant Pests, Plants and Gardens* 16 (3):19-27.
- Elmore, J. C. 1961. Control of the cabbage looper with a nuclear polyhedrosis virus disease. *J. Econ. Entomol.* 54 (1):47-50.
- Fleming, W. E. 1958. Biological control of the Japanese beetle, especially with entomogenous diseases. *Proc. 10th International Cong. Entomol.* (1956) 3:115-125.
- Hills, O. A., and E. A. Taylor. 1951. Parasitization of dipterous leaf miners in cantaloups and lettuce in the Salt River Valley, Arizona. *J. Econ. Entomol.* 44 (5):759-762.
- Jacobson, M., M. Beroza, and W. A. Jones. 1960. Isolation, identification, and synthesis of the sex attractant of gypsy moth. *Science* 132 (3433):1011-12.
- Knipling, E. F. 1955. Possibilities of insect control or eradication through the use of sexually sterile males. *J. Econ. Entomol.* 48 (4):459-462.
- Knipling, E. F. 1957. Control of screw-worm fly by atomic radiation. *Sci. Monthly* 85 (4):195-202.
- Knipling, E. F. 1960. The eradication of the Screw-worm fly. *Scientific Amer.* 203 (4):54-61.
- Reid, W. J., and F. P. Cuthbert, Jr. 1964. Control of caterpillars on commercial cabbage and other cole crops in the South. *U. S. Dept. Agri. Far. Bull.* 2099, 24 p.
- Schlinger, E. I. 1960. Natural enemies of aphids. *In Handbook on Biological Control of Plant Pests, Plants and Gardens* 16 (3):36-42.
- Smith, F. F., T. J. Henneberry, and A. L. Boswell. 1963. The pesticide tolerance of *Typhlodromus fallacis* (Garman) and *Phytoseiulus persimilis* A. H. with some observations on the predator efficiency of *P. persimilis*. *J. Econ. Entomol.* 56 (3):274-8.
- Taylor, E. A., F. F. Smith, and W. D. McClellan. 1956. Flower thrips in outdoor roses. *American Rose Mag.* 13 (20):8-9.



# Epimedium and Vancouveria

BY FREDERIC P. LEE

Epimediums are low-growing perennials. While the tops die down late each year and there is annual renewal of growth above ground, the creeping rootstocks or rhizomes below ground and the roots are perennial. Epimediums may be regarded as herbaceous, although the wiry stems are slightly woody. They are used as edging, ground covers, or small accents and are suited to partial shade in woodland nooks, rock gardens, or facing shrubs. While useful in these many ways, epimediums are the sort of plants invariably described in terms less humdrum than useful, such as dainty, graceful, winsome, and lovely.

Depending on the variety, the mound of leaves ranges from 8 to 22 inches tall. The individual leaflets are heart-shaped. The flowers may be red, white, yellow, or violet red. They are small but are airy or ethereal, like a miniature columbine. The largest flowers are only  $1\frac{1}{4}$  inches wide. While epimedium blossoms individually are not conspicuous, an edging a few feet long and a foot wide makes a bright sheet of bloom. Epimediums are hardy and easy to grow. Their handsome leaflets and graceful flowers make them desirable garden plants.

Epimediums are not in common use—perhaps the name is a deterrent. There

appears to be no well-recognized common name. Occasionally one sees applied the unpleasant name, Barrenwort, and even less frequently, Bishops-hat. The botanical name of the genus, *Epimedium*, derived from the Greek, is of uncertain meaning, perhaps indicating grown in Media. Linnaeus used the name.

## Leaves and Flowers

The leaf stalks of epimediums are stiff and rise from the ground. The leaf on each stalk is compound, being divided into groups of three leaflets. The leaves are almost evergreen and with some varieties retain their good appearance well into the winter. The old leaves should be cut back to the ground in late winter before the new leaves emerge in early spring. While the leaflets vary in size on any one variety, they are all usually over 1 inch long. However, the largest leaflets of the variety, depending on what it is, may run up to 2 or 3 or even 4 inches. The leaflets have denticulate or soft spiny toothed edges and sometimes colored margins with mottled coloring over the rest of the leaf. Rubrum is an example. Leaves also color in the fall. Epimediums bloom in April and May before the leaves have fully matured, and the stature of the plant continues to increase after blooming.

The form of the flowers is difficult to describe. The sepals are eight, in two whorls, an inner and an outer whorl, each with four sepals. The sepals of the outer whorl are tiny and sometimes not green, but grayish or brownish. The se-

■ *Frederic P. Lee, a lawyer by profession, is a member of the Editorial Committee of the American Horticultural Society. He is author of The Azalea Book and chairman of the Advisory Council, United States National Arboretum. Mr. Lee's particular horticultural interest is in plants for shady gardens.*





MARIAN A. LEE

### *Epimedium grandiflorum* 'Album'

pals of the inner whorl are petaloid, looking and being colored like petals. There are four true petals that form a cup or crown, as in a daffodil, only, of course, much smaller. In most varieties the petals have spurs or nectaries or pouches that extend out over the whorl of inner petaloid sepals, sometimes part way and sometimes beyond the end of the whorl. There are four stamens, usually yellow. The flowers are carried in racemes or panicles, each having in some varieties up to as many as 30 small blossoms. The effect is delightful even though miniature in scale.

#### Cultivation

Cultivation is simple, a loamy soil on the acid side and preferably with plenty of humus and partial shade. The variable light under high trimmed deciduous trees is good. A reasonably moist soil is desirable but the plants withstand considerable dryness. They are hardy and need no protection. The plants are propagated by division at any time but more readily in late summer or early fall. They spread underground by rhizomes and with fair rapidity, making a good-sized clump in a few seasons. So far I have been afflicted with no diseases

of epimediums save occasionally a leaf rust on some plants.

#### The Different Kinds

*Epimedium* species are natives of Japan, China, southern Russia, Asia Minor and the Balkans. There is a closely related genus, *Vancouveria*, whose species are all native to our west coast.

Some botanists conclude that there are as many as 20 species in the genus, *Epimedium*. Many of these are unknown to gardens. Other botanists, more conservative, greatly reduce the number of species. They hold that some of the plants with Latin names and heretofore classified as botanical species are not species, but are probably garden hybrids; and that still other plants should be classified not as species but as varieties of species or the garden hybrids. Gardeners and nurserymen usually lag behind taxonomic readjustments. In consequence, the names of epimediums in gardens and nurseries are confused.

Among the species, hybrids, and selections of species or hybrids found in gardens or nurseries today, the following are desirable:

First, a red-flowered *Epimedium* × *rubrum*, thought to be a hybrid of *alpinum*





MARIAN A. LEE

and *grandiflorum*. It is 15 inches in height. The leaflets have red margins and are sometimes mottled red, up to 4 inches long. The petals of the flowers are white, or perhaps a very pale yellow, but the cup formed by them has red margins and the color extends back towards the center. The petal spurs are white and run out to the end of the inner sepals, which are red (India lake, HCC 826—Horticultural Colour Chart, Royal Hort. Soc., England). The spurs give the effect of a white cross on a red background. The four sepals on the outer whorl are grayish. They drop off soon after the flower opens. *Rubrum* is one of the showier members of the genus, the flowers being red in total garden effect and large, up to one inch wide.

*Alpinum* is similar to *rubrum*, but less robust, and is from central and southern

Europe. *Grandiflorum* (syn. *macranthum*), is from Japan and Manchuria. It has flowers with purplish sepals. The petals are white with white spurs that lie on the inner sepals and extend out beyond them. The leaf mound is 12 inches tall and the leaves up to 2 inches long. There is an all white form called *grandiflorum* 'Album'.

'Rose Queen', also a variety of *grandiflorum*, is another red and is the largest epimedium here considered. The leaf

**Flower of *Epimedium grandiflorum*  
'Rose Queen'**

*Epimedium youngianum* 'Niveum'

*Epimedium* 'Sulphureum'

W. H. HODGE







W. H. HODGE

mound may reach a height of 22 inches, although the flowers bloom when the leaf stalks are around 12 inches tall. The leaflets run up to 4 inches in length. The flowers,  $1\frac{1}{4}$  inches wide, are lilac purple (HCC 030) and the petal spurs, while not lying on the inner sepals, extend out beyond them.

The best white flowers are found in  $\times$  *youngianum* (syn. *musschianum*) and one of its varieties. *Youngianum* is believed to be a hybrid of *grandiflorum*, already mentioned, and *diphyllum*, a dwarf white, also from Japan. The plants, regarded as typical for *youngian-*

*um*, are 12 inches tall, with 3 inch leaflets and white flowers. One of the finest epimediums is *youngianum* 'Niveum' (syn. *macranthum* var. *niveum*, *grandiflorum* var. *niveum*). It is low-growing (9 inches) and has small leaflets. It is generally more compact and floriferous than most. The inner sepals and the cup of petals ( $\frac{3}{8}$  inch high) are pure white. The outer sepals on unopened flowers are brown. The petal spurs turn up and do not lie flat on the inner sepals.

When it comes to yellow-flowered epimediums, there is continued confusion. Plants can be obtained under the name *Epimedium* 'Sulphureum'. They grow about 15 inches tall with leaflets up to  $3\frac{3}{4}$  inches long. The inner sepals are canary yellow (HCC 2/3) and the cup formed by the petals is somewhat darker. The petal spurs do not lie on the inner sepals but are about as long. *Sulphureum* is said to be derived from the hybrid  $\times$  *versicolor* (*grandiflorum*  $\times$  *pinnatum*).

A yellow flowered species from Persia is *pinnatum* var. *colchicum*. The petals have very short supr. There is also  $\times$  *versicolor*, a supposed offspring of *pinnatum* var. *colchicum* and *alpinum*. Whether 'Sulphureum' of the trade is a variety of species *pinnatum*, or is a variety of the *pinnatum* hybrid,  $\times$  *versicolor*, makes little difference to the gardener. Under any name it is a good plant and spreads rapidly, irrespective of its taxonomic troubles.

A violet-red flowered plant is the one sold in the trade as *Epimedium* *lilacinum*, or *lilaceum*, or *roseum*. It is 8 inches tall. The flowers are magnolia purple, HCC 030/2. The petals have no spurs and make a looser cup than in most epimediums. Botanists now regard the plant as another variety of the hybrid *youngianum* and designate it as  $\times$  *youngianum* 'Roseum'. It may be noted that one of the supposed parents of *youngianum*, namely the species *grandiflorum*, already mentioned, has a variety *violaceum*, in the violet red range, although pale.

A rather different appearing epimedi-





W. H. HODGE

um is the species *pubigerum* from the Balkans and Asia Minor. With me it is 8 inches tall, but the flower panicle extends up some 15 inches, much further above the foliage than in most *Epimediums*. The white flowers are very small,  $\frac{3}{8}$  inch across. The inner sepals are concave and the petal spurs set down in them. It is a more fragile appearing and less elegant plant than those described above.

The genus *Vancouveria* is the North American analogue to the genus *Epimedium*. The leaves of the *Vancouverias* are more rounded at the tip and the flower has 6 inner sepals, petals, and stamens instead of the four in *Epimediums*. *Vancouveria hexandra*, the best known species, is found wild in Washington, Oregon, and California. It is 12 inches tall, the leaflets are  $1\frac{1}{2}$  inches long, and it blooms in May, a little later than most *epimediums*. *Hexandra* has all

*Epimedium* × *rubrum*

*Epimedium youngianum* 'Roseum'

*Epimedium pubigerum*

MARIAN A. LEE





the good characteristics of an epimedium and may be treated as one by the gardener.

In Bethesda, Maryland, I have without difficulty grown  $\times$  *rubrum*,  $\times$  *youngianum* 'Niveum' and 'Roseum',  $\times$  *versicolor* 'Sulphureum', *grandiflorum* 'Album' and 'Rose Queen', and *pubigerum*; also *Vancouveria hexandra*. There are, of course, others, in fact, botanists list up to twenty-one species and some other garden varieties I have not grown. A few merit mentioning: Among the epimediums are *perralderianum* from Algeria, with yellow flowers; *sagittatum* from China up to 20 inches tall with

whitish flowers;  $\times$  *warleyense* (likely a hybrid of *alpinum* and *pinnatum* var. *colchiam*) with yellow petals and red outer sepals, also up to 20 inches tall. Among the *Vancouverias* both from Oregon and California are *chrysantha*, up to 16 inches tall, with yellow flowers, and *planipetala*, the Redwood Ivy, up to 20 inches tall, whitish flowers.

The various *Epimediums* have so many garden uses, are so easy to grow, and make such admirable plants with their superb leaves and graceful flowers, they should be planted more widely and in more variety.

W. H. HODGE





# A Book or Two

## **Rhododendrons and Azaleas**

By Judith Berrisford. First published in the United States by St. Martin's Press, New York, N.Y., 1965. 288 pages. Twenty-four black and white and four color illustrations from photographs. Price \$9.00. Members price \$8.08.

Mrs. Berrisford is a British gardener and naturally reflects British experience and viewpoints, including her own problems with an alkaline (pH 7.5) soil. Also, aside from references to around eight Gable and nine Glenn Dale hybrid azaleas, little awareness is shown of the tremendous amount of work that has been done here in the breeding both of "true" rhododendrons and azaleas, and in plant exploration and introduction work designed to improve the understanding of our native and the Japanese species and hybrids.

The book is a friendly book, sometimes directed to the experienced amateur, at others to the enthusiastic neophyte. Thus the chapters on Rhododendrons and Azaleas on Limy Soils and on Soil, Shelter and Site are both elaborate and suited to the gardener who has completed his probationary period. Emphasis is placed on the conclusion of Dr. Henry Tod of the Edinburgh School of Agriculture that in neutral to alkaline soils chlorosis may in rhododendrons be more a manifestation of magnesium, than of iron or manganese, deficiency.

On the other hand, discussion of the origins and listings of descriptions of varieties are suited to the beginner.

Several chapters deal in pleasant and valuable fashion with various rhododendrons for rock-and-

peat gardens, for small gardens, and for woodland and large gardens.

Mrs. Berrisford urges that botanists should not (as do the majority of them at present) lump azaleas along with other rhododendrons, but that azaleas merit separate generic status. This expresses the view of most amateurs and nurserymen. Azaleas usually wind up at the rear of the parade when regarded as merely one of the numerous series of rhododendrons. This book itself reflects the difficulties of affording separate but equal, much less fully desegregated, literary treatment for azaleas.

Mrs. Berrisford has a couple of naive misunderstandings as to geography of the United States, but this is not the first instance of that sort in British horticultural works. Nevertheless, this is an excellent book for the United States, as well as the British, novice who has serious intentions in his pursuit of rhododendrons.

FREDERIC P. LEE

## **The Easy Magic of Japanese Flower Arrangement**

By Lee Early Quinn, published by Charles E. Tuttle Company, Rutland, Vt. Price \$7.50. 1965. Illustrated, 180 pages. (Library) Members Price \$6.38.

Congratulations to Mrs. Quinn and her brilliantly witty illustrator Saburo Suzuki, who must have peeked in at many a work-shop session to capture all his insight into western woman's approach to ikebana. This book is a

*(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.)*



winner on presentation skill of author, clever cartoons and beauty of illustrations, many in full color.

This book is a MUST for the uninitiated and a delight to anyone who heretofore has had a jaundiced eye on the antics of ikebanists! Whether you ever intend to join their ranks or continue as a rank outsider, the hilarious cartoons (husbands please note page 28) alone are worth buying the book for, and personally, I wouldn't mind the longest wait in the doctor or dentist's reception room which provided such a gay and entertaining book on a subject which, heretofore, has been kept under wraps as "too complicated"—this author has brought a fresh approach by her use of humor to brighten the subject of ikebana, in which she is very skilled and introducing us to the school of Ichiyo. Since I have been informed there are over 3000 Schools on the subject of ikebana in Japan most of us in the western world may never get to the Land of the Rising Sun so we are, indeed, grateful to a writer of such insight as Mrs. Quinn presenting her special School of Ichiyo, which ranks high along with Ikenobo, Sogetsu and Ohara. Graduates of these 4 schools are teaching here.

Those of us who feel like Mrs. Quinn about the rash of abstract design for ikebana, will find the cartoon on page 150 spells them out, and the accompanying chapter is both revealing and revelant.

The beginner will find Mrs. Quinn's line drawings and instructions invaluable aids to a sane and simple ikebana arrangement. Her lists of material for ikebanists, too, are helpful. Her charge that our western florists are reluctant to part with foliage (have you ever tried to get a carnation with a bud or two left on it!!!!) is so true. Wonder why here in the East I have never come across a flower shop run by an oriental—surely this field would find a ready market and he would be able to introduce the Japanese custom of pre-packaging bunches of suitable flowers and foliage for use in ikebana. Let us hasten the day when we are so conscious of the beauty of a simple, single flower that our main streets will have as many as 7 flower shops on one stretch of avenue and ALL of them successful and busy as bees. And a "rose is a rose is a rose" whether one or three, they will give a spiritual lift to the beholder and how we need that lift in this world today. Thank you, Mrs. Quinn for giving us this sensible approach to a happy hobby—ikebana.

KAREN FOSS

### ***Annual and Biennial Flowers***

By A. P. Balfour. Published by Godfrey Bles. London, England, 1963. 153 pages. 108 black and white and 8 color plates.

This is the latest version in larger type and hard cover of the 1958 Penguin handbook prepared by the author in conjunction and collab-

oration with the Royal Horticultural Society of Great Britain. The author, A. P. Balfour, has since 1921 been on the staff of the famous seed firm of Sutton & Sons, Reading, England. He is responsible for many of the fine strains of annual and biennial flowers current today, and holds the Society's Victoria Medal of Honour.

The book deals with hardy, half-hardy, and tender annuals and biennials. It first lists and discusses twenty-five that are widely known, and this is followed by a more general list and discussion of others. Newer strains and forms are brought to the attention of the gardener and there is advice as to culture and use, as well as detailed instructions on seed propagation.

Not an elaborate work, like C. O. Booth's *An Encyclopaedia of Annual and Biennial Garden Plants* of eight years ago, Balfour's book gives in compact form and at a modest price assistance that is wholly adequate for the not-too-experienced gardener and that should lead him or her to do more than buy a few seed packets from a rack in the local hardware store or supermarket.

FREDERIC P. LEE

### ***The A B C of Flower Arranging***

By Julia Clements, published by D. Van-  
Nostrand Company, Inc., Princeton, New Jersey, 1964. Illustrated, 96 pages. \$4.95. (Library (Members price \$4.20).

This 11th book by Julia, Lady Seton, is an interesting addition to her others on flower arrangement. Julia Clements, as Lady Seton, knows full well the deep love her fellow-Britishers have for the lush, full mass "bouquets" and we find the latest book does not let us down. The skill she has garnered through the past 25 years is, perhaps, summed up in this "primer" which has in it also the new and widespread interest ikebana has achieved also in the British Isles.

Since floriculture and horticulture is the salient interest in Flower Shows in Great Britain, we are not surprised to find that the Lady Seton calls flower arrangement a "fascinating craft" whereas we, in these States, like to consider it has reached maturity and may be called "art."

The book has an especially nice feature, it opens and stays flat while you examine and study the excellent black-and-white finished photograph and then, on the opposite page, learn step-by-step how she put it together.

The author has included plant material which may be difficult to find at the florist or greenhouse here but which the lovely English gardens have an abundance of; she uses also a new introduction weathered wood, and graceful line arrangements, those who do not know how to make use of their old discarded long-playing



records now that everyone has Hi-Fi, will learn how in detail;—all the photographs are sharp and clear, but one only, the frontispiece is in full color.

The tricks of the trade chapter shows us that in Great Britain flower arrangers are sisters-under-the-skin with our own.

Her last chapter lists plants, some which may be home grown even here, very worth trying.

Collectors of Lady Seton's books will find this a worthy addition; beginners will find it helpful while all of us will realize that the British way with a flower is very closely akin to our own.

KAREN FOSS

### ***How to Know the Wild Flowers***

By Mrs. William Starr Dana. Dover Publications, 180 Varick St., New York, 14, N.Y. 1963. Illustrated, 418 pages, paperback, \$1.85. (Library)

The preface states: "The real contribution of the book lies in the comments and supplementary information. . . ." This is true, but another good feature is the 174 black-and-white line drawings. These would make easy identification for the plants illustrated. For the rest the brief descriptions do not give much help in identification, and one would hardly be tempted to try to use them for that purpose. The remarks about the habits and use of the plants, legends connected with them, and other non-botanical information may make up for the lack of use of the book in the field where drawings are not given.

The author purposely devoted the most space to the plants which she considered "entitled to prominence on account of their beauty, interest, or frequent occurrence." Some of those treated with just a touch might be classed by other persons as at least frequent if not beautiful and deserve fuller treatment. But in general her choices are good.

My recommendation would be to use this not as a field book for identification, for which it has only limited value, but just to read through casually, enjoying the interesting sidelights on the wild flowers which she has gathered from many sources, thus adding bits of information to one's general store of knowledge as we read along. For this alone it ought to be worth the small amount of money that it costs.

RALPH W. BENNETT

### ***Flower Arrangement with Antiques***

By Beth Hemingway. Hearthsides Press, Inc., 381 Park Ave., South, N.Y., N.Y. 10016. 1965. Illustrated, 191 pages. Price \$5.95. (Library) Members \$5.05.

From the first, the author states how much antiques appeal to the devoted flower arranger, and that the book is designed to give the ar-

ranger and collector a simple and lucid account of the ways by which one art can enrich the other by showing actual examples of the relationship between the two.

There are the usual hints on conditioning materials, on mechanical aids, tricks with foliage and flowers, and some tricks on techniques, some of these were new to the reviewer.

There follows a series of photographs of arrangements, made by many different flower arrangers, on the facing page written material describing the arrangement. Some of the photographs are excellent and every conceivable type of container and every form of arrangement are shown, some of the arrangements are quite formal, others are simple, but all are designed with the antique container in mind. There are no abstracts to distract one, nor paraboloids! A few color plates are included.

The book is arranged so that each chapter is made to apply to some specific area in the house, for example 'Flower arrangements for the Living room and Library' or again 'Flowers for other places in the House' or 'Centerpieces and other Dining room decorations'.

This book should have some appeal for the flower arranger who likes to look at pictures for inspiration.

F. P. K.

### ***Japanese Free Style Flower Arrangement***

By Lee Early Quinn, published by D. Van Nostrand Company, Inc., 120 Alexander St., Princeton, New Jersey. 1964, illustrated, 116 pages. \$5.95. (Library) Members price \$5.05.

Presenting her school which is the Ichiyo School of Floral Art, Tokyo where she studied for several years, Mrs. Quinn illustrates her easily read book with countless black-and-white photographs and one color picture.

Free form and abstract design in ikebana is as outgrowth from the classical and, to the onlooker is either liked or disliked by his own inclinations, if it is to music by Bartok, art by Jackson, he likes—if it is to Beethoven's music or Picasso's Blue period, he may have qualms.

Mrs. Quinn has written a helpful approach to a difficult subject, and particularly where the transition from traditional asymmetric triangular forms is involved, describes her Sensei Kasuya's five basic types of line, perpendicular, oblique, curving, spiraling and refractory, and the controversial use of crossing lines. She stresses that rules are only a starting point and the development of one's own judgment,—in free-style, you are, she says, "exercising that judgment."

Those to whom classical, traditional ikebana is associated with beauty of realism, this book introduces the new look of line as taught by the Head Master of Ichiyo School, Sensei Meikof Kasuya. The 23 basic free form black-and-white



drawings with comments lead the student into the book. The 75 excellent photographs are each carefully explained by the author so that the reader may know what the picture represents, abstract or free form, or free "style."

This is a book for the initiated who will find it well-written and enjoyable, and for the beginner, the serious student of ikebana, a helpful guide into the mysteries of this rather recent concept of ikebana, which is having a world-wide acceptance.

The frontispiece which appears in full color, appears with full explanation of its make-up on page 62 and points up how much is lost in effectiveness where flower arrangements are NOT shown in full color. Let's hope the day isn't far distant when color photography costs will permit ALL flowers are depicted in their natural color.

KAREN FOSS

### *Arranging Church Flowers*

By Molly Purefoy. Hearthside Press, Inc., 381 Park Ave., S., N.Y., N.Y. 10016. 1964. Illustrated. 80 pages. Price \$5.95. (Library) Members \$5.05)

Reading this slim volume reminded me of an incident which befell me some years ago, I had been invited to decorate the village church in the English country side where my Mother had lived for many years, as I started out of the door she remarked 'Don't upset the village!'

I wonder how many American church flower arrangers will be startled (or upset) to find that in England, flowers are often placed on the floor or on pedestals, and that in even quite small churches the arrangements are very large.

For some years now it has been the vogue over there, to place these large bouquets either against a pillar in the body of the church, or upon the steps leading to the altar, rather than on the retable.

Let me first mention the section of the book which appealed to me, this is the last half of the book which is devoted to some excellent photographs. Here one can see the staging on pedestal, window ledge, and table. The photographs clearly show the kind of flowers and foliage used (for example, on page 60), there appears a large bunch of peonies, gladiolus, Solomon's seal, and rhododendrons in flower, all placed on a large stone pedestal in front of one of the huge piers of Canterbury Cathedral. The text of the book which is chatty rather than technical really applies to the English arranger, and the English garden and gardener, there is brief mention of church architecture, some of the mechanics used by the flower arrangers, who the author refers to as 'FLO-RISTS', she discusses more fully the merits of a team of workers, a rota, or the personal vase (?) also what to do when confronted with the Altar, font, or window-sills, she also mentions FREE Churches (?) She has some novel

suggestions for vases, egg crocks, palm pots and the like, in fact to quote 'almost anything of good shape and water holding capacity can be used for floral arrangements in the church, and it is quite unnecessary to stick to the conventional type (of container) on all occasions.'

I was interested to learn that in England, dried flowers, foliage, and seed pods are now often used between Advent and Lent, and that bay trees are also used in the churches during the winter, (these are used, it seems, in the larger churches.)

Mrs. Purefoy's mention of flowers which I know well in church work, glads, mums, and the dahlia, began to lull me into a sense of false security, but when I turned the page . . . I suffered a shock far greater than any the village would have received from my efforts! for I read of a lady who had deceived even the 'real' gardeners with her magnolia grandiflora in bloom in the dead of winter!!!! the blooms being 'blown white egg shells fastened to the center shoots of the magnolia, the lady had even delicately painted some shading onto the egg shells. . . . I think this *would* have shocked the village where my Mother lived, 'specially since the magnolia seemed to have lasted all winter!

F. P. K.

### *Flower Design with Accessories*

By Merelle Soutar, D. Van Nostrand, 120 Alexander St., Princeton, N.J. 1964. Illustrated, 177 pages. Price \$6.95. (Library) Members Price \$5.90.

Mrs. Soutar's beautifully printed, well-written and handsomely illustrated book tells us the story of how the much-followed Horticultural Show has permitted the chink in their armor to grow large enough not only to permit women to "do" flower arrangements but the story of how this led to the formation of their National Association of Flower Academy Shows of which she is, evidently a leader.

She has dedicated her book to California's J. Gregory Conway to whom she gives the credit for the start of modern design in Great Britain.

The "Subject is Roses" might be the theme for her mass arrangements since I found her typical British arrangements in mass, used their rose, of which every British garden has a plethora.

Her own work-shop shelves illustrated in glorious full color in the frontispiece, is again depicted in on page 130, in merely black-and-white in the very complete chapter on her suggestions for "Your Accessory Collection."

Mrs. Soutar uses twelve of her own accessories in graphic descriptions well illustrated, as the interesting finale of her interesting book.

Judges of our own show, whether accredited or non-accredited, should find this a valuable aid to their judges paraphernalia, since it will



broaden our own horizon to learn how the British garden clubs judge their Shows, and, who can tell, since we fly back and forth so nonchalantly, it will be well to be prepared to act as an honorary judge if one is invited,—by some exuberant garden-clubber you may be visiting,—and have at least a reading acquaintance with the helpful advice outlined in her book, should you meet Mrs. Soutar who is president and founder of their Harrow and District Flower Group.

The book is indeed a modern approach to British flower arrangement, including ikebana, and shows us that the only sure thing in life is change,—even in the tradition-bound way with flowers of our British cousins. Most interesting and informative.

KAREN FOSS

### ***An Easy Guide to Artificial Light-Gardening for Pleasure and Profit***

By Vernon Johnston & Winifred Carriere. Hearthsides Press, Inc., 118 E. 28th St., N.Y. 16, N.Y. 192 pages, copyright 1964, 6 insert pages of photographs—drawings. \$4.50. Members price \$3.83. (Library)

The authors have written in non-technical language a book that should appeal especially to the "inquiring" amateur, that is, one who, with no real scientific training, is willing to experiment. The first part of the book is especially helpful in explaining the whys of light and darkness needed in plant growth; gives many ideas, with sketches, on construction, care and feeding, and increasing plants.

This reviewer was sorry to see emphasis put on light gardening for profit, for too many hobbyists are getting "into the act" and hurting the legitimate grower who has to make a living from growing plants.

In the second part of the book, there is much information on compatible light-garden plants, divided into three categories: plants for maximum light; less intense light; and plants for the Gourmet. You will not find all of your favorite plants listed in alphabetical order, but you can judge requirements from similar plants. You may not agree with the Author's findings on all plants, but there again, is your chance to experiment, as we hobbyists are continually doing.

GRACE P. WILSON

### ***Pleasures of Herbs***

By Audrey Wynne Hatfield. Illustrations by the author. St. Martin's Press, Inc., 175 Fifth Avenue, New York 10, N.Y. 1964, 186 pages. Price \$3.95 (Library) Members \$3.35.

Compacted into 185 pages, plus a page of Bibliography, the author has done a tremen-

dous amount of research, covering herbs from alecost to violet, and writing with such fluid ease that she carries the reader right along with her.

The book is filled with fact, fiction (and by the latter, I mean old wives' tales which she tracks down) origin which sometimes is lost in antiquity, and how to properly grow each herb.

It is grand reading for a quiet relaxation, for pure enjoyment, and is a grand little concise guide book for reference use, not to mention the exquisite illustrations of every herb mentioned, which adorn and add charm to the book.

There is a section called "Flavours—herbs in the kitchen" where you learn how our English and Continental cousins use their herbs in culinary ways, new cooks may find a bit of difficulty with the use of oz. instead of t. or Tb., but, whether you care to try out the "receipts" just reading them is a "fragrant" and delightful pastime. And, of course, how to use scents for bath and potpourri.

Whether you get the urge or have it, to grow a pot of chives on your kitchen window sill or tackle a knot garden, the author gives most helpful instructions, which are not useful only in her own country, England, but here, too.

Come to think of it, now that there is a new elderberry with heavier yield, maybe I'll try that elderberry jelly!

KAREN FOSS

### ***Peacock Manure and Marigolds***

By Janet Gillespie. The Viking Press, Inc., 625 Madison Ave., N.Y. 22. 1964, Illustrated, 184 pages. Price \$3.95. (Library)

With two books already published, titled 'Joy of a small Garden' and 'Bedlam in the back seat' Mrs. Gillespie's title for her third book, which is amusing and controversial implies a no poison guide to gardening. She states that she is not trained as a biologist tho she has been involved-not in the laboratory, but in the field, raising babies, puppies, chickens, and other domestic fauna—She declares she has no ax to grind, except the one common to us all—A safe world for people and wild creatures to live in.

Brought up from childhood with the practice of companionate planting, she discusses and lists combinations of vegetables, flowers, and kitchen herbs which are held to be mutually beneficial (the bad companions), usually plants from the same vegetable family or plants from the same family planted in the same ground the following year, can be very troublesome.

Apparently marigolds if planted in the rose bed are beneficial to the roses, there is na excretion from the roots of the marigolds which will kill soil nematodes.

The author's directions for building a compost pile reads like a cecepe for a chocolate



layer cake, (read manure in place of frosting!)

A delightful chapter deals with Perils . . . Acts of God, Acts of Men (including gardeners) . . . the Acts of God include such perils as sun and wind burn, drought and the like, while the acts of men are listed as disturbance of the water table by construction, disturbance of drainage, etc., etc.

Some observations noted include the following . . . the companionship of nature is a scientific fact . . . the environment in which we live is shared by foxes, chickadees, bees, and toads . . . birds that love to be near people check in and build near by . . . the phoebe nests in the garage, the wrens and bluebirds take over the bird houses.

The last chapter entitled good guys bad guys and some ammunition lists and describes the pests and controls. Controls both chemical and natural, the natural being the insect enemies of the pests. For some of the hard to describe pests there are portraits . . . and Mrs. Gillespie has made up a medicine chest, which she assures us should take care of most normal garden problems.

This Book should be a MUST for the average gardener to read, and own, for there is much enjoyment to be had from leafing through the pages.

F. P. K.

### **Sort Guide to the Perennial Garden Flowers**

By George W. Kelly, Crown Publishers, 419 Park Avenue South, New York, N. Y. 10016. 152 illustrated punched sort cards. 1964. \$4.95. (Library), Member's price, \$420.

Here is the horticulturist's answer to data processing, complete for home use. This compact set of more than 150 indexed cards covers well over 150 perennials but not true-bulb perennials such as lilies. This sort-index is far superior to plant lists given in books because it presents immediately the plants with the several characteristics in which you are interested, and at the same time includes all other pertinent information concerning these plants. For example, one can select easy-to-grow blue-flowered perennials for acid soil in full sun; or summer-flowering perennials with spiked flowers for moist locations; or many other perennials with combinations of desired attributes. The number of combinations of two or more characteristics could be well over a hundred, a fact which indicates the versatility of the index. The horticultural plant characters on the cards can be sorted with relative ease by simply inserting the sorting pin through the desired sections of the cards. Those cards that are notched for the character in question fall gently from the rest. Practice in handling and sorting the cards increases the speed and accuracy of separation.

The margins of the cards are notched for appropriate characteristics of flowering form, use, fragrance, color, and season; plant height, foliage

color, fragrance and texture; growth habits, relative ease of care, suitability for special gardens or effects, expected life length, cultural requirements relating to water, soil, light exposure, and pests; areas of adaptability in the U. S. and several other useful characteristics. One side of each card contains a paragraph or two of more precise horticultural information on a single kind of perennial or group of similar perennials of a single genus. Common and botanical names are given, and the plants are pictured, some in color but most in excellent sketches with accompanying size and scale. These drawings are by Joyce Thode.

The cards have few defects, but two were noted that should be mentioned: (a) Goldenrod (*Solidago*) is blamed heavily for causing hay fever, yet it is actually no more important in this respect than a number of other plants such as Dahlia; and (b) the Delphinium card is properly notched for susceptibility to pests, but a statement on the card incorrectly indicates relative freedom from pests.

Properly, for an index such as this, little is left to the imagination except perhaps the beauty of the plant. One might be inclined to say that this clever index is the last word in organized ornamental horticulture. The accompanying booklet indicates that other similar "soft guides" are in the making, with Ornamental Shrubs and Vines scheduled to appear soon. These would be welcome for you will find that it is great fun to use the index even if you never intend to sow a seed.

WILLIAM H. PRESTON

### **Shell Art (A Handbook for Making Shell Flowers, Mosaics, Jewelry and Other Ornaments)**

By Helen K. Krauss, Hearthside Press, Inc., 381 Park Ave., South, New York, N. Y. 10016. (Library). Price \$6.95—Members—\$5.90. 128 pages, clothbound, illustrated.

Shell Art invites all gardeners, flower arrangers, and shell collectors to duplicate nature in constructing realistic flowers from sea shells. It is possible to make at least 130 accurate replicas of natural flowers from shells of countless colors, from directions in this book.

After telling the interesting story of sea shells from the time of primitive man to the present, the author guides the reader through the collection and preparation of shells; the basic steps of flower making, the material and tools needed and arranging the bouquet. Shell Art is not limited to artistic flower arrangements. Instructions are given for using shells in mosaics, underwater pictures, montages, the making of shell animals, dolls and jewelry. Fourteen beautiful color-plate illustrations of artistic arrangements, mosaics and pictures should inspire those who seek a diversion from the intense participation in which most horticulturists indulge.

MARIE W. LEE



***The Azalea Book (2nd Edition)***

By Frederic P. Lee. Publ. by D. Van Nostrand Co., Inc., 120 Alexander Street, Princeton, New Jersey, 1965. Illustrated. Clothbound—435 pages. Price \$12.00. AHS members—\$8.50.

When the first edition of *The Azalea Book* was published as a project of The American Horticultural Society in 1958 it was welcomed as a major contribution to horticultural literature. In fact, at that time this reviewer was at work on his own book on Rhododendrons and the Azaleas were excluded from it solely because *The Azalea Book* had already provided an up-to-date, comprehensive and vastly competent treatment of this part of the Rhododendron genus. The newly published second edition is even better than the first.

The changes in the second edition result principally from new information developed by research or exploration in the last seven years. The classification and description of the Oriental Azaleas reflect the recent observations of Dr. John Creech in Japan. The account of the derivation of the popular Kurume hybrids now seems much more plausible. The Satsuki Azaleas receive a timely new treatment which is of special interest because of the giant flowered clones recently introduced by the U. S. D. A.

The hardiness ratings of the Azaleas are now usefully keyed to the U. S. D. A. Plant Hardiness Zone Map which is reproduced on the front endpaper. The quality ratings of deciduous Azalea hybrids published by The American Rhododendron Society would have been equally welcome additions, had the author chosen to include them. A new blooming period chart for both deciduous and persistent leaved Azaleas will be helpful to anyone planning garden color effects.

The second edition of *The Azalea Book* includes other changes, perhaps not extensive but important to anyone with more than a casual interest in the subject. The use of artificial light supplement, critical in the propagation of deciduous Azaleas, is described, and there is instruction on the role of the new growth retardants as they affect flowering. The current projects of the country's leading Azalea hybridists have been updated, and the list of commercial sources has been expanded and revised.

The latter would be more useful still if the nurseries which sell exclusively at wholesale had been so marked.

Any reviewer plucking peevishly at the pages of another specialist's work can always find some cause for discontent, and *The Azalea Book* is no exception. The omission of a separate list of species synonyms is, in my view, a fault of consequence which I had hoped would be remedied in this second edition. The section on Azalea diseases has a particularly good discussion on the control of the devastating flower blight but the help it provides for those seeking information on dieback, damping off and some other afflictions is not adequate. There is no mention of mildew, perhaps the most common of all the diseases affecting deciduous Azalea foliage.

After the research that has been done on nutrition it is disappointing to see nitrate nitrogen and chloride suggested in the section on fertilizers, when ammonium nitrogen and sulfates are known to be so much more congenial to Azaleas. There are a few scattered errors of fact, too. The distribution of *R. roseum* extends westward to Missouri, and *R. reticulatum* occurs in Korea, despite the author's contrary indication. *R. oblongifolium* has thriven and bloomed regularly in my climatic zone 5a garden for at least ten years where as the author gives it a useful hardiness rating of zone 7a.

Finally, a hefty swing at the publisher, Van Nostrand, for the wasteful design of the book. The first edition had 324 pages with margins of normal width. The new edition, with 435 pages, has bottom margins of two and a quarter inches and the text covers only about seventy percent of the page area, surely unnecessary even for this age of conspicuous consumption. The prodigality is presumably reflected in the price.

But the criticisms are niggardly in contrast to the massive authority and affectionate scholarship which mark *The Azalea Book*. The only possible summary is that Frederic Lee's second generous contribution to The American Horticultural Society is the preeminent work on the subject, the best ever published, and its status as a classic has only been made more secure by the revisions in the present edition. The first edition has been exhausted for some time, in itself a tribute by the horticultural community to the author's competence in writing so effectively on every conceivable aspect of the Azaleas.

BY DAVID LEACH



## Notes for Manuscript Contributors

The Editorial Committee of the American Horticultural Society, which reviews all material contributed for publication, makes the following suggestions with respect to manuscripts submitted for consideration in the Society's journal, the American Horticultural Magazine.

1. Place *full name* and *address* in the upper right-hand corner of your manuscript.
2. Manuscripts should be written at the level of the serious amateur gardener. For examples of the style desired refer to recent issues of the American Horticultural Magazine. An article about a particular plant or group of plants should emphasize cultural and descriptive phases of ornamental horticulture. When uncommon plants are discussed it is advisable to mention sources. Some botany and history in terms clear to a gardener are useful; also, the text should be taxonomically sound. Taxonomy can be checked by the Editorial Committee. Avoid if possible, footnotes and lengthy citations of literature.
3. Accompanying photographs are highly desirable. They should be sharp, black-and-white prints preferably four by five inches in size or larger. Captions for photographs should be on a separate sheet and enumerated with corresponding number on the back of the photograph, carefully so as not to emboss the reverse side, together with the name of the contributor for purposes of identification. It is advisable to *write out* numbers.
4. The length of an article or note should be based primarily on adequate treatment of the topic. The average article is about seven pages, including photographs, and notes are about a half page to a page excluding photographs. There are about 750 words to the page of text in the American Horticultural Magazine.
5. Manuscripts should be neatly typewritten and double-spaced throughout with a 1-1½" left-hand margin. Copy of manuscript and photographs should be retained by the author.
6. One set of galley proofs of articles will be sent for corrections, which should be held to a minimum. Proofs should be returned immediately.
7. Include, in the case of articles, an "author note" of about four lines giving name, address, occupation, and particular horticultural interests and achievements.
8. Send your manuscript to The American Horticultural Society, 1600 Bladensburg Road, N.E., Washington, D. C. 20002.



# The Gardeners' Pocketbook

## Belgium—Some Features of Its Horticulture and Gardens

Belgium long has maintained an enviable position in the production of ornamental plant crops, dating back to the early years of the 19th century when Louis van Houtte, Ambroise Verschaffelt, and J. J. Linden were leading names in the horticulture of this country with headquarters in Ghent. Belgium still ranks among the most important centers on the Continent for the commercial production of ornamental plants, producing for example, nearly 60 percent of the tuberous begonias imported into the United States. Vast quantities of Indian azaleas from Belgium yearly supply the European market. The city of Ghent ranks high among the flower capitals of Europe, for it was here that the first floral exhibition on the Continent was held in 1809. The Ghent Floralties, held every 5 years, is an exhibition of first importance in the great tradition established 142 years ago by this city.

Old gardens of the classical period of the 17th and 18th centuries are located in various parts of the country. The great park of Beloeil is an outstanding example of a classical garden in the Italian style. Peter Paul Rubens, the painter, built a garden around his villa in Antwerp about 1620. Part of the estate still exists much as the master designed it in the 17th century.

Modern private gardens skillfully incorporate features of the classical period with aspects of the modern era, abound

in Belgium. Indeed, this country is highly sensitive to gardening in the tradition we learn to associate with European horticultural institutions.

*Nursery of Sander and Fils, Bruges*—The nursery of Sander & Fils is an old nursery long known for the production of orchids and other greenhouse plants, especially bromeliads (Bromeliaceae). Laurel trees (*Laurus nobilis*) are grown in the conventional way as globes on straight standards for use in hotel doorways and in bizarre shapes, with spirally coiled stems or with stems twisted in the form of a heart. A considerable demand still exists for these plants on the European market.

*Horticulture Flandria, Bruges*—Horticulture Flandria is a nursery devoted mostly to greenhouse plants, especially bromeliads (Bromeliaceae), ferns, various aroids (Araceae), and other foliage plants. Of special interest are *Dracaena deremensis* 'Flandria', a selection of the species with pink-variegated leaves; *Ficus elastica* 'Decora Variegata', a color mutant of *F. elastica* 'Decora' with pink and white-variegated leaves; and *Aristolochia arborea*, a shrubby erect species from Guatemala.

*Royal Botanic Garden of Belgium, Meise*—The new national botanic garden of Belgium under development at Meise is located about 5 miles north of Bruxelles. It replaces the old botanic garden located in the heart of the Belgian capital for over 100 years. When completed, the new garden with its many expanded facilities will become one of





FREDERICK G. MEYER

**Portion of the pinetum. Groenendaal Arboretum, Brabant, Belgium.**

the most elaborate botanic institutions of Europe. The spacious grounds at Meise covering 225 acres were given by the Royal family of Belgium for a national botanic garden. It is an imposing site where large specimen trees abound and verdant lawns provide sweeping vistas for some distance. An avenue of towering old beech trees (*Fagus sylvatica*) greets the visitor at the garden entrance. An ancient chateau dating from the year 1130 stands on a small peninsula in the lake. At another part of the lake stands a fine group of cypress trees (*Taxodium distichum*) with well-developed knees. An extensive range of tropical conservatories called the Palais des Plantes includes separate departments for plants of Africa, Asia, America, and Australia, and a large house for aquatics includes a mangrove swamp and plants of *Victoria amazonica*, the water-platter lily of the Amazon river.

The collections under glass are rich in species from the Congo, and in ornamentals developed long ago in Belgium,

many of which have all but disappeared elsewhere from cultivation. Plants of special merit were a collection of croton (*Codiaeum variegatum* var. *pictum*) cultivars; *Chlorophytum alismaefolium*, *C. mannii*, *C. orchidastrum*, *C. macrophyllum*, *C. ukambense*—all species from the Congo region; *Eugenia guilleminiana*, a handsome foliage plant of the Myrtaceae; *Eulophia horsfallii*, a giant orchid from Mt. Ruwenzori in Africa; and *Bignonia unca* 'Rodigasiana', a handsome foliage climber with pewter-colored leaves with green edges.

The new garden at Meise is being developed by Dr. Walter Robyns, authority on the flora of the Congo and director of the garden.

*Groenendaal Arboretum, Brabant*—The Groenendaal Arboretum located in pleasant countryside at Brabant about 10 miles south of Bruxelles was established in 1897. Here the Belgian government maintains a forest research station for investigations in silvicultural practices and breeding of forest trees. The



arboretum is administered through the Ministry of Water and Forests of the Department of Agriculture.

Much of the research work concerns conifers, although soft-wood deciduous trees are studied for use in pulpwood, matches, and for other domestic purposes. The arboretum of about 26 acres

is planted with a diversified collection of North Temperate Zone deciduous trees; the conifers are grouped together in an attractive pinetum; a smaller fruticetum (for shrubs) was created in 1916. A nursery of several acres is used for experimental work by the research staff. The publication entitled "Catalogue de

**Avenue of conifers originally planted as a nursery row about 80 years ago. Kalmthout Arboretum, Kalmthout, Belgium.**

L. O. SEVERIN





l'Aboretum de Groenendaal," by A. Galoux, published in 1955, gives a short history of this institution with climatic and meteorological data of the area. Trees listed in the inventory are accompanied by notes that indicate the rate of growth and other characteristics for each introduction as a potential forest tree for Belgium.

*Kalmthout Arboretum, Kalmthout*—The Kalmthout Arboretum, located along the main rail route about 20 miles north of Antwerp, is one of the most important private establishments of its kind in Europe. The older part of the collection dates from 1857, when Charles van Geert acquired the property for nursery purposes. For nearly a half century thereafter, this nursery was renowned in Europe as a source of exotic trees, shrubs, and selections of Indian azaleas (*Rhododendron indicum* Sweet), known as van Geert azaleas. From 1900 to 1951 the nursery was administered by the Société Horticole under the management of Antoine Kort.

In 1951, the de Belder family acquired the property, and quickly restored the derelict nursery of about 20 acres into an attractive garden. Many old specimen trees exist throughout the property; around these, new introductions are constantly being added. A fine avenue of tall conifers, originally planted as a nursery row dates from the days of van Geert. Some of the woody plants reputedly were brought from Japan, about 1860, by the German-Dutch botanist and plant explorer, Philipp Franz von Siebold. There is a good collection of hardy bamboo at Kalmthout. A rare conifer is *Pinus nigra* 'Aurea', a selection of the Austrian pine with yellow-tipped leaves. A picturesque specimen of *Stewartia koreana*, about 15 feet tall, is divided into six large stems near the base. A seedling selection of Japanese maple, *Acer palmatum* 'Autumn Glory', originally raised at Kalmthout, is known for its brilliant yellow autumn leaves. Two selections of witch-hazel, *Hamamelis* × *intermedia* 'Jelena', a hybrid with dull orange and yellow-edged petals, and *H.*

× *intermedia* 'Ruby Glow', with dark orange-red flowers, originated at Kalmthout. A printed seed list is sent each year to persons in Europe and abroad interested in exchanging plants with the de Belders.

—FREDERICK G. MEYER  
U.S. National Arboretum  
Washington, D. C.

### Borers Can Cause Rhododendron Dieback

Wilting and drying of leaves and dieback of the tops of rhododendrons may be caused by stem borers. These insect pests enter the stems many months before the dieback becomes evident. The borers in the stem are the larvae of a clear-winged moth that lays its eggs in May or June. The young caterpillars bore into the stem, feed during the summer, and are mature by mid-autumn. They live over the winter in the damaged stems. Stems attacked by the borers eventually have rough, furrowed bark, often with vertical cracking that exposes the wood. The striking symptoms of wilting, drying, and browning of leaves and death of the upper stems, or a whole branch represent the last stages of damage.

Control of the borers by pruning and destroying infested parts in autumn or late winter and by spraying with DDT in May and again in June before the moths appear. The time to spray will vary with latitude. Examine stems in summer and autumn for evidence of borer work. Lightly infested stems may sometimes be saved by inserting a soft copper wire into the borer gallery and puncturing the larvae. A drop or two of carbon disulphide placed in the hole, which is then sealed with wet clay or putty, is also effective.

Dieback caused by borers is often mistaken for disease. Indeed, fungi may be present on the dead parts but the presence of borer tunnels lower on the stems is the telltale work that fixes the blame on the insect.

—THE EDITORIAL COMMITTEE



### A Famous Flowering Cherry of Japan

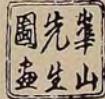
During my several years of contact with Japanese horticulture, I have continually enjoyed the pleasure of encounters with new ideas in plant culture or new depths of understanding and appreciation for plants. So many of the practices employed by Japanese gardeners reflect stability and patience. One only has to consider bonsai, preservation of famous natural landscapes, maintenance of ancient gardens in their original design, and perpetuation of famous trees in kind for centuries. How widespread the last named practice is, I am not certain, but at least it figures in the history of one cherry tree growing in Ueno Park, Tokyo. This is the "Shushiki-

In the upper right hand corner is the original poem to this cherry tree written by Shushiki. The poem in the left hand corner is the first generation poem to the same tree.

Present flowering cherry commemorating the original event of "Shushiki-zakura" in 1681. At left is the stone slab with the Haiku written by Shushiki, then a wooden board notice of the tree, a smaller stone slab carved with "Shushiki-zakura," and a young weeping cherry that is the sixth replacement.

秋の瑞乃より此の瑞生也  
秋色女遣吟四世晴色女筆

秋色江都人餅果舖女也以寸色初於世其家貧不能蓄好僕  
 育王侯之召必伴父而到婦途賜智則竊勸之登之自著  
 於茶室後其孝順類如坎能諧  
 一晋子門侍間與名阿亞吉  
 穠色其號也  
 浩齋主人



一世菊后亭秋色女遣想

此は此の瑞生也  
 瑞生也  
 瑞生也



K. KATO



zakura," a tree of *Prunus serrulata*. Legend has that a child poet of the 17th Century composed such remarkable "Haiku" that she was the marvel of the day. In 1681, at age 13, she hung on the branches of a cherry tree in Ueno Park, a "tonzaku" on which she had written a poem. The incident came to the attention of the Lord Abbott of the Kwan-si Temple in the park. Although she was but a commoner, he received her "in audience" and she became a member of the court poetry group. In commemoration, the tree was named Shushiki-zakura, for the child poetess.

A tree still stands on this spot, not the original, of course, but the *sixth* replacement. The current tree, "Sendai-shidare" was planted in 1958. My good friend Mr. Kaname Kato, reports that replacement trees were also planted in 1826, 1885, 1923, 1929, and 1941. Judging from the average length of life of

each, there probably was one more between 1681 and 1826. The point is, that the idea was continued and with each replacement tree, a new poem commemorating the occasion was prepared. A postcard of 1929 vintage shows the original "haiku" at the upper right corner and a subsequent one in the left corner.

—JOHN L. CREECH  
Hyattsville, Md.

### Butterfly Weed

One of the most successful plants in my garden is the Butterfly Weed, *Asclepias tuberosa*, a member of the milkweed family. It can be found growing wild along railroad banks and highways. It has a long, vertical root which makes it difficult to remove from the soil, but it transplants easily, even if part of the root breaks off.

It grows from two to three feet tall and has clusters of bright orange flowers.

*Asclepias tuberosa*, the butterfly Weed.

PHOTO BY AUTHOR





Butterflies and bees are attracted to the blossoms. The plant does not seem to be affected by disease or insect damage and requires very little care. It grows best in full sunlight where the planting increases in size each year. In the fall the long slender pods are full of the typical milkweed silk to which the seeds are attached. The pods can be dried and used effectively in dried flower arrangements.

Although there is supposed to be a range of color from light lemon yellow to dark red, I have only been able to locate the orange-colored plant. The blossoms appear in July at about the same time as the day-lilies and adds a spot of color to a garden when very little else is in bloom.

—LUCILE FONDA  
Greenbelt, Maryland

#### More on *Montanoa*

Some time ago, I published, (*American Horticultural Magazine*, April, 1963), an article on the unusual genus of Tree-Daisies, *Montanoa*.

Since that time *Montanoa bipinnatifida* has become a reasonably frequent inhabitant of choice gardens in this almost tropical part of Florida. This is due, in large part, to the availability of the species from the Fairchild Tropical Garden, since the commercial nurseries hereabouts have thus far largely ignored it as a landscape item.

Within my immediate neighborhood of Coconut Grove, for instance, there are now three splendid specimens in full bloom, as I write these lines at the end of October. The tallest exceeds twelve feet in height, though it is partially supported by a trellis-like arrangement. The others exhibit the somewhat drooping appearance which seems to characterize this species in cultivation, unless it is kept very tightly pruned.

The flower heads of this composite, which previously I considered to be rather annoyingly short-lived, have since been found to last, when cut, for upwards of five days in water—providing one cuts them with some good woody

portions of the attending stem. Even during the warmest hours of the day, these lovely snow-white chrysanthemum-like heads give off a delicate scent, which I find most enticing.

*Montanoa bipinnatifida* is propagated with some ease by rooting woody cuttings in moist sand. Some bottom heat seems beneficial during the process, but some of my friends locally have succeeded without this. The bushy plants are very rapid growers, and in our humid climate tend to become very straggly without close attention. They delight in our limestone soils, hence I can recommend them very highly for comparable regions.

I have, since my earlier article, received word from *Sunset Magazine* that none of the *Montanoas* appear to be currently offered in the California trade. This is unfortunate, but it is also the case here in Florida. In the invaluable *Checklist of Woody Ornamental Plants of California*, by Mathias and McClintock, 1963, *Montanoa arborescens* and *M. grandiflora* are recorded. I believe that our regional nurserymen might seriously consider adding this remarkably attractive plant to their lists.

—ALEX D. HAWKES  
Coconut Grove 33, Florida

#### *Leucopogon fraseri* (White Beard)

When is a heath not a heath? When it is an epacrid. This little-known family of plants which is closely related to the Ericaceae or heath family has all of its members native to the tropics or the southern hemisphere. There are a few stray species in India and Hawaii but by and large the family is confined to Australia, Tasmania and New Zealand. The present genus is confined to these regions of the southern hemisphere and this species is found in dry, rocky soil in open situations such as frequently develop in heavily grazed fields. For this very reason it has tended to spread as more land has been cleared for pasturage in New Zealand. Grazing animals will not touch it, which is easily understandable if you try to grasp the small,





PHOTO BY AUTHOR

*Leucopogon fraseri* (White Beard)

sharp pointed, shiny leaves encircling the wiry stems.

The present species is quite easily grown in mild climates where temperatures rarely go below twenty degrees. It has the largest flowers in a genus which has uniformly small flowers and even in this species the half inch long flowers are more notable for their sweet perfume, reminiscent of the eastern trailing arbutus, rather than their size. The flowers appear here in June and buds open over a three to four week period, making quite a nice show on the prostrate plant which rarely gets over four inches in height. The following month the flowers are followed by bright orange, sweet tasting, edible berries about one quarter inch in diameter.

In cultivation the plant should be grown in a sunny location in acid, peaty soils and, as with heaths and heather, it should be sheered back after flowering or fruiting. New shoots come from the base or from underground stolons and soon replace the old growth.

The name of the genus refers to the beard-like growth at the mouth of the corolla.

—FREDERICK W. COE  
Ross, California

### The Southern Dew Flowers

Some years ago, Dr. Caroline Dormon, wrote me with great enthusiasm about her dearly loved *Commelina crispa* with its myriads of butterfly like blossoms of a very pure and brilliant blue. As the only commelina I had known was the very prolific and troublesome *C. communis* I reported no interest whatever. Later, in spite of my attitude, she sent me three roots with a note that if I lost them a dire punishment would follow. She recommended a good soil, a place with little early morning sun, and regular moisture. No comment was made as to seeding, but only the note that if trimmed back in summer, it would flower well into the autumn.

The roots were planted in one of my nursery beds for azaleas as then I would certainly be able to guard against any prolific seeding.

The results have more than justified Dr. Dormon's enthusiasm and as not one seedling has appeared, my own fear of undue spread, has been killed. In fact, it is now a matter of genuine regret that I do not find seedlings.

The plant is a little late in showing in the spring, but it sends up slender



branching stems that here are definitely prostrate, unless an azalea is in the way, in which case they manage to surmount it. The longest branches noted here, are about 16 inches long, each branching in turn, and with flowers terminal from each.

The blooms are about  $\frac{3}{4}$  of an inch wide, with the two upper petals, of the most brilliant pure blue, between *Salvia Blue* and *Spectrum Blue* of Ridgway. The lower petal, white, is barely visible. The blooms open much earlier than I ever rise and last well to noon, as there is some broken shade over the area.

Unlike the weedy species, this plant here, has shown no tendency to root as it goes, as does the weedy species. No effort has been made to take cuttings and force rooting as too many other "projects" have been on hand. But this should be done, as the weedy species roots, and the nearly related *Tradescantias* all root freely. If any reader has any idea as to why there are no seeds formed, it would be received gratefully.

The short note in *Small's Flora of South Eastern United States* gives a range that does not include Mississippi which Dr. Dormon notes in her book on Southern flowers. In that book she notes another species, *C. angustifolia* that is reported in this State. After interest was truly aroused by her plant, an eye was kept for any commelina native

here, and in the dry woods of this place, a species was found that has not yet been named, and no effort as yet has been made.

This plant, is lower in stature here, in the dry sites and is making a flat mat in the garden in the site to which it was transplanted. The flowers are smaller than those of the above mentioned species from Dr. Dormon, and have a distinct blue, paler in hue, *Mazarine Blue* of Ridgway. It is still too early to discover what its seeding habits may be but a few small seedlings were found near the mother plants in the wood. It is, however, the less splendid of the two.

As Small gives a total of seven other species omitting the weedy one, the writer would be interested to hear from others of any experience they may have had with plants from their areas.

—B. Y. MORRISON  
*Pass Christian, Mississippi*

#### A Correction

In the article "Peatmoss" by John M. Patek, in the July 1965 issue, the captions for figures 2 and 3 were inadvertently switched. Figure 2, page 134, should read "Reed-sedge peat, Michigan." Figure 3, page 135, "Acute-leaved type of spagnum moss peat, Canada."

—Editorial Committee, AHM



# Index to Volume 44

*Illustration references are set in italics*

- A**  
*Acer palmatum* 'Autumn Glory', 237  
Ackerman, William L. and others:  
Performance of three Privet Introductions  
in the Upper Midwest, 92  
A Famous Flowering Cherry of Japan, 238  
Allen, Paul H.:  
On transplanting Tree Ferns from the Wild  
(Panama), 116  
*Allium triquetrum*, 176  
*Alstroemeria pulchella*, 173, 173  
*Androstaphium caeruleum*, 176  
*Aphyllanthus monspeliensis*, 60  
Araceae, 234  
*Aralia spinosa*, 120  
*Ardisia japonica*, 120  
*Aristolochia arborea*, 234  
Arisumi, Toru:  
The African Violet Species, 154  
*Asclepias tuberosa*, 239, 239  
Ash, Mountain, A Search for Ornamental, 150
- B**  
Barker, Philip A.:  
A Visit with Lester Rowntree, 32  
Belgium:  
Some Features of its Horticulture and  
Gardens, 234  
Bellingrath Gardens: 14, 15, 16, 17, 18, 19,  
20, 21, 22  
Features of:  
Azaleas, 17  
Camellias, 17  
Chrysanthemums, 21  
Poinsettia, 21  
Roses, 19  
Bentgrass, Weeds in, 97  
*Bignonia uneata* 'Rodigasiana', 235  
Biological Control of Garden Insect Pests, 210  
Aphids, 213  
Balance of Nature, 210  
Biological Control Agents in the Garden,  
211  
Insect pathogens, 214  
Insect Parasites and Predators, 212  
Integrated Control, 217  
Other Insect Pests, 213  
Plant Resistance to Insect Attack, 215  
Research Needs in Biological Control, 217  
Sex Attractants, 217  
Sterility by Gamma Radiation, 215  
Summary, 219  
Blackburn, Benjamin:  
The Cornus Collection at Plainfield, N. J.,  
102  
Re-examination of *Magnolia stellata*  
Maxim., 56  
Borers can cause Rhododendron Dieback, 237  
Brewster, James L. and others:  
Plumerias in Hawaii, 125  
Bromeliaceae, 234  
Butterfly Weed, 239
- C**  
California Gardens, Plants from: 60  
*Calluna vulgaris*, 3  
'County Wicklow', 7, 9  
'Foxii Nana', 5  
'H. E. Beale', 9, 11  
'J. H. Hamilton', 13  
'Mrs. Ronald Gray', 2  
'Sister Anne', 6  
Canna, History, Breeding and Cultivation,  
84, 88, 89  
Pollinating, 88  
Cheney, Philip S.:  
*Iris japonica*, 118  
Chinn, James T. and others:  
Plumerias in Hawaii, 125  
Chrysanthemums, Garden, in the Northern  
Rockies, 202  
'Bannack', 204  
'Blackfoot', 204  
'Buffalo', 203  
'Chico', 204, 204  
'Custer', 204  
'Elkhorn', 204  
'Evelyn Mooney', 204  
'Monida', 204  
'Ravalli', 204  
'Salish', 204



- 'Sleeping Child', 204  
 'Spanish Peaks', 204  
 'Sun River', 204  
 Clay, Horace F. and others:  
 Plumerias in Hawaii, 125  
*Codiaeum variegatum* var. *pictum* cultivars, 235  
 Coe, Frederick W.:  
*Leucopogon fraseri*, 240  
 Plants from a California Garden, 60  
 Two Amaryllids, 171  
*Cholorophytum macrophyllum*, 235  
*mannii*, 235  
*orchidastrum*, 235  
*ukambense*, 235  
*Commelina augustifolia*, 242  
*communis*, 241  
*crispa*, 241  
 Copeland, Harold W.:  
 Plants for Winter Garden, Heathers and Heaths, 3  
 Corbett, Edward G.:  
 A Cold-Hardy Gingerlily, 129  
 Ornamental Kale, 67  
 Cornus Collection: Species List, Cedar Brook Park, Plainfield, N. J., 104  
 Correction: 242  
 Correction: Plate of *Diplarhena moraea* as *Magnolia stellata*, 120  
 Creech, John L.:  
 A Famous Flowering Cherry of Japan, 238  
 Two forms of Peking Willow, 181  
 Two Ground Covers native to Japan, 59  
 Crocus, The Versatile, 43  
 Crocus:  
 Culture, 48  
 Forcing, 51  
 Hybridization, 51  
 Pests, 49  
 Situations, use in, 50  
*Crocus biflorus*, 48  
*cartwrightianus*, 46  
*chrysanthus*, 46, 44, and vars. 47  
*etruscus*, 48  
*kotschyanus*, 44, 45  
*medius*, 45  
*ochroleucus*, 45  
*sativus*, 43, 46  
*sieberi*, 48  
*speciosus* and vars. 45, 45  
*tomasinianus*, 48  
*vernus*, 43  
 Croton cultivars: 235  
*Cucurbita maxima*, 197, 196, 198, 198  
*pepo*, 185, 184, 200  
*pepo* var. *ovifera*, 185  
*texana*, 185  
*Cyrtilla racemiflora*, 120  
**D**  
 Davidia, Culture of, 147  
*Davidia involucrata*, 142, 143, 144, 144, 145, 147, 148, 149  
 De Graaff, Jan:  
*Lilium* × *fialkovaja*, 112  
*Disa uniflora*, The Pride of Table Mountain, 205  
*Disa uniflora* (Orchidaceae) 205, 206, 206, 207, 209  
 Dodge, Albert F. and others:  
 Performance of three Privet Introductions in the Upper Midwest, 92  
 Donahue, Joseph W.:  
 History, Breeding, and Cultivation of the Canna, 84  
 Dove Tree, *Davidia*, The, 142  
*Dracaena deremensis* 'Flandria', 234  
**E**  
 Epimedium and Vancouveria, 220  
*Epimedium alpinum*, 222  
*chrysantha*, 225  
*diphylum*, 223  
*grandiflorum*, 222, 221, 225  
*grandiflorum* 'Album', 222, 225  
*lilacinum*, 225, 223  
*perralderianum*, 225  
*pinnatum* var. *colchicum*, 223  
*planipetala*, 225  
*pubigerum*, 224, 224, 225  
*roseum*, 223  
 'Rose Queen', 222, 225  
 × *rubrum*, 224, 221, 225  
*sagittatum*, 225  
 'Sulphureum,' 222, 223, 235  
 × *versicolor*, 223, 225  
*violaceum*, 223  
 × *warleyense*, 225  
*youngianum*, 223, 225  
*youngianum* 'Niveum', 223  
*Erica carnea* 'Springwood White', 3  
*vagans* 'Mrs. D. F. Maxwell', 8  
*Eugenia guilleminiana*, 235  
*Eulophia horsfallii*, 235  
 Evans, George E.:  
 A Search for Ornamental Mountain Ash in the Northern Rockies, 150  
**F**  
*Fagus sylvatica*, 235  
 Ferns, Tree, On transplanting from the Wild, Panama, 116  
 Fescue, Fine, Weeds in, 79  
*Ficus elastica* 'Decora Variegata', 234  
 Fonda, Lucile:  
 Butterfly Weed, 239  
**G**  
 Ginger Lily, A Cold-Hardy, 129  
*Gordonia lasianthus*, 120  
 Gourds, The Unpredictable, 185  
 Bicolor and Precocious Differentiation, 186  
 Classification and Relationships, 185  
 Genetics of Fruit Color, 187  
 Hold old are the Bicolor Gourds?, 199  
 Leaf Spotting, 194  
 Other Influences, 188  
 Plant Transformation, 196  
 Precocious-Yellow Inbreds, 190  
 Transmission of Gene B, 192  
 True-Breeding Bicolor Lines, 188



- Role of Genetic Backgrounds, 190  
 Table I: Fruit Color Variation, 194  
 Table II: The Inheritance of Genes, 194  
 Table III: Incidence of distinct yellow spots  
 on mature leaves of *Cucurbita pepo*, 196  
 Table IV: Yellow Spots on 'Fordhook Zuc-  
 chini', 196

## Gourds:

- 'Bicolor Pear', 195  
 'Bicolor Spoon', 188, 189, 190  
 'Big Tom', 186  
 'Early Pacific', 190, 191, 192  
 'Flat', 192, 193, 193  
 'Fordhook Zucchini', 190, 191, 192, 193, 197,  
 197, 199  
 'Precocious-1', 102, 193, 193  
 'Precocious-2', 192  
 'Precocious-4', 193  
 'Striped Pear', 185, 190, 191, 192, 193  
 'Summer Crookneck', 185

## Green, M. B.:

- Bellingrath Gardens, 15  
 Groundcovers, Native to Japan, Two, 59  
 Guernsey Lily, 171

## H

- Hammamelis* × *intermedia* 'Jelena', 237  
 'Ruby Glow', 237

## Hawkes, Alex D.:

- More on Montanoa, 240  
*Hedera helix* 'Arborescens', 177  
*Hedychium coronarium*, 129  
*gardnerianum*, 129  
*spicatum*, 129, 130, 130

## Hemlock, Canadian, Variants, 99

## Heaths and Heathers:

- Kinds and relatives, 3, 4  
 Newly Acquired, 13  
 Outstanding Varieties, 7, 8, 9, 10, 11, 12  
 Propagation, 6  
 Pruning, 5  
 Soils and Planting, 5  
 Uses, 4

## Hoffman, C. H.:

- Biological Control of Garden Insect Pests,  
 210

## I

- Illicium floridanum*, 120  
*Iris japonica*, 118

## J

- Jeffers, Walter F.:  
 The Wonderful Chugai Azaleas

## K

- Kale, Ornamental, 66, 67, 68, 69  
 Taxonomy of, 70  
 Kentucky Blue Grass, Weeds in Seeds, 77

## L

- Laurus nobilis*, 234  
 Lawder, Margaret:  
*Disa uniflora*, The Pride of Table Moun-  
 tain, 205  
 Lawn Seed and What's a Weed, 71

## Lawrence, Elizabeth:

- More Notes on Native Trees and Shrubs of  
 the S.E., 210

## Lee, Frederic P.:

- Epimedium* and *Vancouveria*, 202  
*Leucopogon fraseri*, 240  
*Ligustrum amurense* Carr., 92, 94  
*vulgare* P.I. 26767, 93, 94  
*vulgare* P.I. 107630, 93, 93, 98  
*Lilium brownii*, 175, 175, 176  
 × *fialkovaja*, 112, 112  
 inter-specific hybrids, 114  
 Rainbow Hybrids, 113  
*szovitzianum*, 115

Lily, An Unusual Hybrid from the Soviet  
 Union, 112

## Lowrey, Lynn:

- Texas Crabapple, 64  
 Two Native Trees of Texas, 111

## M

*Magnolia stellata*, Re-examination of, 56*Malus angustifolia*, 64

## May, Curtis:

- Rust of Junipers, Flowering Crabapple and  
 Hawthorne, 29

## Menninger, Edwin A.:

- Davidia*, The Dove Tree, 142

## Metcalf, H. N.:

- Garden Chrysanthemums in the Northern  
 Rockies, 202

## Meyer, Frederick G.:

- Belgium: Some Features of its Horticulture  
 and Gardens, 234  
 Nurseries of Boskoop, Netherlands, 177  
 Some Aspects of Horticulture and Garden-  
 ing in the West German Republic, 61

## Montanoa, More on, 240

*Montanoa arborescens*, 240*bipinnatifida*, 240*grandiflora*, 240

## Morrison, B. Y.:

- Allium triquetrum*, 176  
*Alstroemeria pulchella*, 173, 173  
*Androstaphium caeruleum*, 176  
*Lilium brownii*, 175, 175, 176,  
*Sandersonia aurantiaca*, 174, 174  
 Small Daffodils in the Garden, 23  
 Southern Dew Flowers, 241

## N

## Narcissus:

- Jonquil species, 24  
 Bulbocodium species, 26  
*Nerine sarniensis*, 171, 172

Nurseries of Boskoop, Netherlands, 177, 178,  
 179

## O

*Orthosanthus multiflorus*, 63

## P

*Pachysandra terminalis*, 59

## Patek, John M.:

- Peatmoss, 132



- Pelargonium domesticum*, 36  
*hortorum*, 36  
*Pinus nigra* 'Aurea', 237  
*Pistacia texana*, 111, 182, 182  
 Plumeria in Hawaii, 125  
*Plumeria acuminata*, 126  
*alba* and cultivars, 126  
*bahamensis*, 126  
*obtusata*, 127  
*rubra* and cultivars, 127  
 Plumerias:  
 Classification by Color, 126  
 Cultivation of inter-specific hybrids, 124,  
 cover, 127  
 Existing species and major cultivars, 126  
 Keeping qualities of flowers, 127, 128  
 Privet Introduction, Performance in Upper  
 Midwest:  
 Tabulated Report on, 97  
*Prunus serrulata*, 239  
 Peatmoss:  
 Acids of, 134  
 Chemical composition of, 140  
 Classification, 132  
 Horticultural Qualities, desired, 132  
 Moisture holding, 139  
 Sphagnum moss, 133, 133, 134  
 Volume and weight, 139
- R**  
 Research at Penn State, Quality Geraniums  
 from:  
 Outline of problem and procedures, 36-37  
 Results of cooperative work, 40-42  
 Redtop, Weeds in, 81  
 Reed, Clyde F.:  
 Taxonomy of Ornamental Kale and Cab-  
 bage, 70  
 Restionaceae, 205  
*Rhododendron indicum*, 237  
 Rogers, Owen M.:  
 The Versatile Crocus, 43  
 Rowntree, Lester, 33, 34  
 Rust, Resistance, Crabapple, 31, 32  
 Junipers, 31, 32  
 Rye Grass, Weeds in, 80
- S**  
*Sabal louisiana*, 111, 111  
*Saintpaulia confusa*, 155  
*difficilis*, 156  
*diplotricha*, 156  
*grandiflora*, 158  
*grotei*, 158  
*intermedia*, 158  
*ionantha*, 155, 159  
*mangungensis*, 160  
*nitida*, 160  
*orbicularis*, 161  
*pendula*, 162  
*shumensis*, 162  
*tongwensis*, 163  
*velutina*, 164  
*Salix matsudana*, 181  
 'Tortuosa', 181, 181  
 'Umbraculifera', 180, 181  
 Scarborough Lily, 171  
 Schery, Robert W.:  
 Lawn Seed and What's a Weed, 71  
 Senior, Robert M.:  
 A new way of Raising Seedlings, 57  
 Shifriss, Oved:  
 The Unpredictable Gourds, 185  
 Solymosy, Sigmund L.:  
 Louisiana Violets, 62  
*Sorbus aucuparia*, 150  
*scopalina*, 150, 151  
*sitchensis*, 150, 152  
 Southern Dew Flowers, 241  
 Spingarn, Joel H.:  
 Canadian Hemlock Variants, 99  
*Stewartia koreana*, 237
- T**  
*Taxodium distichum*, 235  
*Tsuga canadensis* 'Armistice', 100  
 'Aurea', 100, 101  
 'Benet', 100  
 'Coles Prostrate', 99  
 'Fantana', 100  
 'Globosa', 100  
 'Green Spray', 100  
 'Horoford', 101  
 'Hussii', 100, 100  
 'Jervisi', 101  
 'Minima', 100  
 'Minuta', 111  
 'Palomina', 101  
 'Pendula', 99  
 'Pygmea', 101  
 'Ruggi', 101
- V**  
*Vallota speciosa*, 171, 172  
*Vancouveria*, 221, 224  
*Vancouveria hexandra*, 224, 225  
*Viburnum opulus* 'Roseum', 115, 116, 117  
*Victoria amazonica*, 235  
 Violet, African Species of, 154  
 Violet, African:  
 Breeding, 163  
 Cultural Methods, 157  
 Propagation, 159  
 Violets, Louisiana, 62
- W**  
 Walker, Durrell E. and others:  
 Quality Geraniums from Research at Penn  
 State, 35  
 Watson, Donald P. and others:  
 Plumerias in Hawaii, 125  
 Winters, Harold F. and Corbett, Edward G.:  
 A Cold-Hardy Ginger Lily, 129  
 Wyman, Donald:  
*Viburnum opulus* 'Roseum', 115





ANNOUNCING THE TWENTIETH DISTINGUISHED

# Williamsburg Garden Symposium

IN WILLIAMSBURG, VIRGINIA ★ MARCH 20-25, 1966

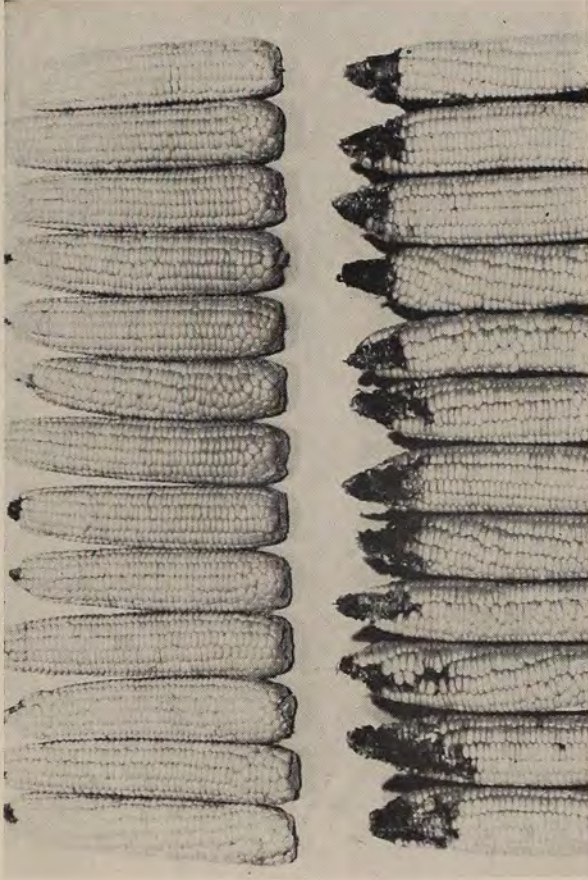
Colonial Williamsburg, in association with the American Horticultural Society, presents the twentieth anniversary session of this outstanding garden and horticultural conference. This year's theme will be *The World in Your Garden* and an outstanding panel of experts will explore this during five interesting days in Virginia's colonial capital. All the elements for a relaxed and productive conference are present: talks, special garden tours, social activities, and question-and-answer clinics. Tours of historic Carter's Grove Plantation, Colonial Williamsburg's

famous gardens, and a special program at the Norfolk Botanical Garden highlight the activities.

The Twentieth Williamsburg Garden Symposium is open to *all* gardeners.

Register now to insure desired accommodations at Williamsburg Inn, Williamsburg Lodge, or The Motor House. Write Mrs. Mary B. Deppe, Registrar, Post Office Box C, Williamsburg, Virginia 23185 for information and full program. Telephone (703) 229-1000.





*Top—Cauliflower plants protected from cabbage looper damage by two applications of polyhedrosis virus disease.*

*Bottom—Untreated cauliflower plants damaged by the cabbage looper (near other plants treated with virus disease.)*

*Left—Row of corn on the left is clean sweet ears from hybrid resistant to corn earworm. Row on the right is damaged ears from hybrid susceptible to corn earworm.*