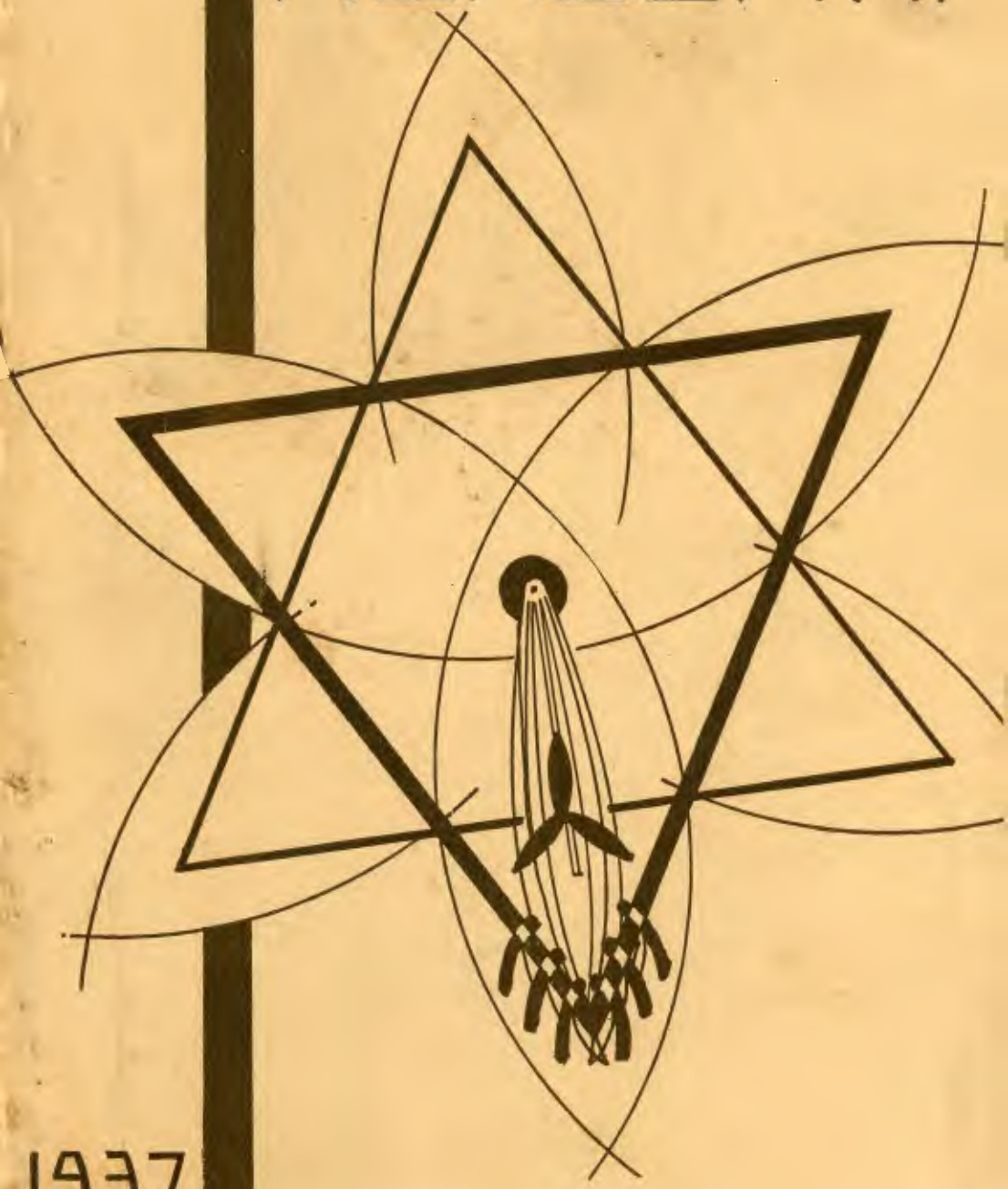
HERBERTIA



1937

HERBERTIA

VOLUME 4

DEDICATED TO THE MEMORY OF

WILLIAM HERBERT,

1778-1847

EDITED BY

HAMILTON P. TRAUB

Mira Flores, Orlando, Florida

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THE AMERICAN AMARYLLIS SOCIETY

1937

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INTRODUCTION

The dedication of the present volume of HERBERTIA to the memory of the Hon. & Rev. William Herbert is very appropriate since this year marks the centenary of the publication of his AMARYLLIDACEAE, a work that needs no introduction to anyone interested in this fascinating family of flowering plants.

Although Herbert devoted a great deal of his time to the study of the Amaryllidaceae, he also gave a considerable amount of attention to the subject of plant-hybridisation, and recorded his experiences and conclusions in three papers published at intervals over a period of twenty-five years, (*Trans. Hort. Soc. London,* IV. 15-50 : 1822 ; AMARYLLIDACEAE, 335-380 : 1837 ; and *Journ. Hort. Soc. London,* II. 81-107 : 1847), the last one appearing just before his death.

Herbert's work on hybridisation is now of little more than historical interest, so greatly has our knowledge of heredity and plant-breeding advanced since the re-discovery of Mendel's work in 1900, but in his own day Herbert did much, no less by his example than by his writings, to encourage and popularise the practice of hybridisation, with the result that many beautiful hybrids were added to the number of garden-plants.

It may also be mentioned that Herbert was one of the few biologists of his time to combat the doctrine of special creation, and to favour the suggestion that the species within a genus, and even allied genera themselves, might be descendants from a common ancestor, views that affected to no small degree his treatment of taxonomic problems.

It is chiefly for his work on the taxonomy of the *Amaryllidaceae* that Herbert is remembered today, for this work is still of practical importance. Until Herbert's time the classification of the family was in a state bordering on chaos, as may be seen from the fact that no fewer than twelve distinct genera were included within the limits of the one genus *Amaryllis,* and we owe a great debt to Herbert for his work in clearing up the confusion and setting the classification of the family on a sound basis. Herbert took the view that the genus was the most important unit in classification, and he took great care, not only that the plants he referred to any one genus should have characters in common, but also that each genus should be sharply distinguished from other genera by some constant feature or features.

How well he did this work may be judged from a comparison of the genera recognised by Herbert with those accepted in the second edition of Engler's PFLANZENFAMILIEN, volume XVa, which appeared in 1930. Of the eighty-three genera enumerated by Herbert in his AMARYLLIDACEAE, fifty-six are maintained in the PFLANZENFAMILIEN, and of the remaining twenty-seven, no fewer than twenty rank as distinct sections of the genera to which they are reduced. It may be added that more recent research has led to the resuscitation of three of the genera recog-

nised by Herbert which were reduced in the PFLANZENFAMILIEN. It is also interesting to note that eighteen of the genera which Herbert himself established are maintained in the PFLANZENFAMILIEN, and that all of them belong to the subfamily *Amaryllidoideae,* which consists of some fifty-five genera. If to these are added two of the recently resuscitated genera which were first proposed by Herbert, we find that Herbert was responsible for twenty genera out of the fifty-seven now recognised in the subfamily *Amaryllidoideae.*

As to Herbert's concepts of the limits of the family, this is still followed for the most part in the PFLANZENFAMILIEN, the only alterations being that the three genera which formed Herbert's suborder *Xerophyteae* have been segregated as a distinct family the *Velloziaceae,* and that the four genera which Herbert had as section *Dioscoreaeformes* of suborder *Agaveae* are now made a separate family *Dioscoreaceae.*

The excellence of Herbert's work may perhaps be traced to two circumstances. Firstly he had the incomparable advantage of working to a great extent with living plants, most of them grown in his own garden at Spofforth under his personal supervision. He was thus in a position to study the plants through all stages of their life-histories—a circumstance of which he took full advantage, as his writings show. Secondly Herbert was an artist of considerable merit and constantly employed his talent in depicting his plants, and in making drawings to elucidate their structure—an occupation that entailed, as a matter of course, close and critical examination of the material before him. To this circumstance may be traced the accuracy and minuteness of observation which is one of the leading characteristics of Herbert's work.

Many of his paintings and his observations enrich the pages of the *Botanical Magazine* and the *Botanical Register,* whilst all the forty-eight plates in his AMARYLLIDACEAE are the work of his own hand. It has been computed that in all Herbert drew some hundred and eighty-five plates, many of them crowded with figures.

Herbert's AMARYLLIDACEAE embodies much of the wide knowledge he had gained of this interesting family, and the fact that a hundred years later this book should still be indispensable to any serious student, is, in itself, a high tribute to the botanical prowess of its talented author.

August 27, 1937,
Royal Botanic Gardens,
Kew, Surrey.

ARTHUR W. HILL.

PREFACE

The biography of William Herbert is long overdue.
—ARTHINGTON WORSLEY.

At long last we have an interesting and authentic biography of Herbert, and we are fortunate in having it from the pen of Arthington Worsley. In addition one of Herbert's essays on plant breeding, written in a charming style and published in 1837, is reprinted in full in this issue. The place of Herbert in the history of science is discussed in a most valuable paper by Dr. Darlington of the John Innes Horticultural Institution, London. We cannot thank Dr. Darlington too much for this outstanding favor to the members of the Amaryllis Society.

The present issue of HERBERTIA represents a rich harvest, so rich indeed that in this short preface reference can be made to only part of even the most important contributions. The excellent article by Dr. Darlington has just been referred to, but it represents more than fixing the place of Herbert in the history of science for it throws new light on the gradual growth of the concept of evolution and the science of genetics. We will all read and reread this important paper. Many will be interested in the review of chromozome numbers, as far as determined at present for the Amaryllidaceae, by Doctors Flory and Yarnell of the Texas Agricultural Experiment Station. It will provide food for thought for those interested in the interrelationship of the species and genera in this plant family.

There are also important articles by Dr. Stout, on daylilies, and by Mr. James, especially those on the culture of Leucocoryne, and the control of the Lesser Narcissus Fly. We are also most grateful to the contributors in South Africa, Kenya Colony, Australia, England and Germany. We wish to call particular attention to the articles, by Doctors Dyer and Creasey of South Africa, which contain some important information about cultural requirements of amaryllids.

Special note should be taken of the article on forcing bulbs by Mr. de Graaff, and also the paper by Mr. Heaton on the same theme, for this subject will be more thoroughly explored in the 1938 HERBERTIA. Dr. Grainger, Curator of the Tolson Memorial Museum, Ravensknowle, England, will contribute a review of the whole subject, and Prof. Dr. E. van Slogteren, Director of the Laboratorium voor Bloembollenonderzoek, Lisse, Holland, will furnish a paper on his interesting experiments in this field.

The breeder of hybrid amaryllis (Hippeastrums) should note carefully the hybridization method followed by Mr. Pierre S. du Pont. The general recognition and application of the principle underlying this procedure marks a genuine advance in this field. Others are also using this method but he was evidently the first to use it on a major scale in producing finer and more delicately colored hybrid amaryllis, and he was first to achieve important practical results.

The first award of the Herbert Medal was unanimously voted to Mr. Worsley, and soon nominations will be received for the award in 1938. There are a number of amaryllid enthusiasts who have rendered distinguished service in the field of the Society, and the Board of Directors

has voted to award at least three medals each year for a short period, at least until overdue honors have been bestowed. Thereafter, the medal will be awarded to only one person annually.

Mr. Wyndham Hayward, the brilliant, wide-awake and efficient Secretary of the Society, has now carried on his duties faithfully for four years and during that period the organization has been built up largely through his efforts into a thriving and efficient unit for the advancement of the amaryllids. The task of Secretary for such an organization is not an easy one, but it has been lightened somewhat on account of his great enthusiasm. However, lately he has been ill at times, and on orders from his physician, he must curtail his many activities in order to conserve his nervous energy. The Board of Directors has accordingly appointed an Executive Secretary, Dr. A. E. Hughes, to assist the Secretary. Dr. Hughes is a soil scientist in the Bureau of Plant Industry, United States Department of Agriculture, and amaryllid culture is his avocation. He is a talented and indefatigable worker, and his experiments with amaryllids at his Orlando home are important in that they break new ground.

The 1938 HERBERTIA will be dedicated to Mr. Ernst H. Krelage. The special feature of this issue will be the Krelage autobiography which is now in preparation. He will also contribute some notes on the history of amaryllid culture in Holland. As far as possible, the history of amaryllid culture in the rest of Europe will also be included. An appeal for amaryllid histories is here made to those interested in France, Italy, Germany and other European countries.

HERBERTIA for 1939 will be dedicated to South Africa. The leading features of this issue will be supervised by Doctors Dyer and Compton. The 1940 volume will be devoted to Latin America; the 1941 issue to Australia, and the 1942 number to Major Albert Pam.

The tenth anniversary issue, in 1943, will be dedicated to those who have been active in reviving interest in the amaryllids during the preceding ten years. It will constitute a comprehensive review of the advances made since the Society was organized in 1933.

—HAMILTON P. TRAUB,
Editor.

Mira Flores,
Orlando, Florida,
July 20, 1937.

CONTENTS

PAGE

William Herbert Memorial Edition cover design, by Edward Steichen
Introduction, Sir Arthur W. Hill ---- 3
Preface ---- 5
Dedication ---- 12
Biography of the Hon. and Rev. William Herbert, 1778-1847, Arthington Worsley ---- 13
On Crosses and Hybrid Intermixtures in Vegetables, The Hon. and Rev. William Herbert (Reprinted from Herbert's Amaryllidaceae, 1837) ---- 29
The Early Hybridizers and the Origins of Genetics, C. D. Darlington ---- 63
Wilder's Adventures with Hardy Bulbs, Hamilton P. Traub ---- 69
Coombs' South African Plants for American Gardens, Wyndham Hayward ---- 70
Mr. Worsley Honored—First award of William Herbert Medal ---- 71

1. REGIONAL ACTIVITIES AND EXHIBITIONS

Amaryllids in Kenya Colony, The Lady Muriel Jex-Blake ---- 73
News Note from Germany, Dr. Camillo Schneider ---- 77
Announcements—
The 4th. National Amaryllis Show, Los Angeles, Calif., Sept. 23, 1937 ---- 78
First William Herbert Medal Award ---- 79
The 5th. National Amaryllis Show, 1938 ---- 79
The 6th. National Amaryllis Show, 1939 ---- 79
The Southeastern Regional Amaryllis Show, 1938 ---- 79
Amaryllids at the 24th. Annual International Flower Show, I. W. Heaton ---- 80
The 1937 Amaryllis Show of the Bureau of Plant Industry, U. S. Department of Agriculture ---- 81
Amaryllids at the Philadelphia Flower Show, John R. Ruckman 81
Amaryllids at the 1937 Jacksonville (Fla.) Flower Show, Mrs. W. E. MacArthur ---- 82
Daffodil Notes 1937, Miss Mary McD. Beirne ---- 83
Daylily Meeting in Providence, Rhode Island ---- 84

2. COLOR DESCRIPTION

Photographing Flowers in Color, George W. Hesse ---- 87
Meinhard on Color Prints ---- 88
Color Description of Hemerocallis fulva rosea, Hamilton P. Traub ---- 89
The R. H. S. Color Chart ---- 89

3. DESCRIPTION AND PHYLOGENY

On a manuscript by the younger Linnaeus dealing with certain genera now included in the Amaryllidaceae, Spencer Savage 91
A Checklist of the Bulbous Amaryllidaceae of Mexico, C. V. Morton 101
Additional Amaryllidaceae of Peru, J. Francis Macbride 109
Australian Amaryllidaceae, G. K. Cowlishaw 111
The Genus Zephyranthes in Texas, H. B. Parks and V. L. Cory 117
Additional Notes on South African Amaryllidaceae, R. A. Dyer 121
The Flowering Habit of Cooperia Traubii, Ausker E. Hughes 123
The Generic Name Amaryllis according to William Herbert 123
Lycoris radiata and Nerine sarniensis, Russell S. Wolfe 124
Nerine-Lycoris error disclosed, Wyndham Hayward 127
Notes on Florida Hymenocallis, Mary W. Diddel 129
The Horticultural Status of Daylilies, A. B. Stout 130
Classification of Amaryllis (Hippeastrum) Flower Types 137
Classes and Awards (Prize Schedule) 137
Registration of New Varieties—
New Hybrid Amaryllis (Hippeastrum) Varieties 142
A List of the New Clones of Daylilies, A. R. Stout 144
Narcissus 161
Awards to species and horticultural varieties in 1937 161

4. CYTOLOGY, GENETICS AND BREEDING

A Review of Chromozome Numbers in the Hemerocallideae, Alstroemeriales and Amaryllidales, W. S. Flory and S. H. Yarnell 163
A Daffodil Mutation—Narcissus schizocoronatus, Friedrich Meyer 182
New Double Hybrid Amaryllis, J. J. McCann 185
Amaryllis in Germany, Max Loebner 186
Hybrid Amaryllis in the du Pont Collection 187
Cyrtanthus-Vallota Hybrid, T. A. Weston 188
Hybrid Crinum Sophia Nehrling, Wyndham Hayward 188
The Howard and Smith Hybrid Amaryllis Strain, Fred H. Howard 189
Hastening Blooming of Seedling Hybrid Amaryllis (Hippeastrum) Bulbs, Ausker E. Hughes 191

5. PHYSIOLOGY OF REPRODUCTION

Propagation of Zephyranthes, H. H. Hume 195
The Effect of Growth Substances in Hippeastrum, Hemerocallis and Alstroemeria, Hamilton P. Traub 199
Propagation of Ismene Sulphur Queen, Hamilton P. Traub 200
New Daylily Propagation Methods, Wyndham Hayward 201
Methods of Propagating Daylilies (Hemerocallis) Vegetatively, Hamilton P. Traub 205

6. AMARYLLID CULTURE

Alstroemerias in the Northwest, Harry L. Stinson ---- 211
Alstromeria pelegrina, H. P. T. ---- 217
Alstroemeria pulchella, Wyndham Hayward ---- 218
Alstroemerias in Rhode Island, Mrs. Mary H. Campbell ---- 218
Amaryllids at Kirstenbosch, L. B. Creasey ---- 222
Hybrid Amaryllis Naturalized in Kenya, East Africa, Mrs. Frank Joyce ---- 226
Haemanthus Katherinae, Mrs. W. E. MacArthur ---- 226
Hosta in Florida, Frank Vasku ---- 227
Hybrid Amaryllis in Maryland, George E. Waters ---- 228
Hybrid Nerine-Minerva ---- 228
Cyrtanthus as a House Plant, John F. Ruckman ---- 229
Cyrtanthus, W. M. James ---- 230
Nerine Culture, W. M. James ---- 233
William Herbert on Plant Markers ---- 234
Hippeastrum rutilum var. crocatun, Frank Vasku ---- 235
Nothoscordum bivalve, Wyndham Hayward ---- 235
The Use of Lycoris Aurea in the Landscape, John R. Heist ---- 236
Lycoris squamigera and aurea, E. O. Orpet ---- 236
Agapanthus umbellatus, Mrs. W. E. MacArthur ---- 237
The Miniature Hippeastrums, Wyndham Hayward ---- 237
Hippeastrum pratense, W. M. James ---- 238
Amaryllis Culture by an Amateur, E. N. Blake ---- 241
Flowering Leucocoryne ixioides odorata in two years from seeds, W. M. James ---- 242
Amaryllis Nutrition Problems, John R. Springer ---- 243
Amaryllis belladonna, E. O. Orpet ---- 244
Daylilies in New York and Florida, John V. Watkins ---- 245
Lesser Narcissus Fly Control, W. M. James ---- 249
Daylilies—Dependable Perennials, Mrs. W. E. MacArthur ---- 250
Acidulated Fertilizers ---- 251
Growing Daylilies on Muck, R. P. Lord ---- 251
Nematode on Hemerocallis, Wyndham Hayward ---- 252

7. HARVESTING, STORAGE AND FORCING

A Winter Show Season in Holland, Jan de Graff ---- 255
Forcing Amaryllis without Drainage, Wyndham Hayward ---- 257
Harvesting, Storage and Forcing Hybrid Amaryllis, I. W. Heaton ---- 259
Griffiths' Speeding up Flowering in the Daffodil and Bulbous Iris, Wyndham Hayward ---- 260

8. THE SOCIETY'S PROGRESS

The Secretary's Mail Bag ---- 261
Report of the Secretary ---- 264
Notice of 1938 Nominations ---- 266
Report of Trial Collections Committee ---- 267

Officers and Directors ---- 269
William Herbert Medalist ---- 269
Corresponding Members ---- 269
Standing Committees ---- 270
Special Committees ---- 270
Publications of the American Amaryllis Society ---- 271
Buyers' Guide ---- 273

Year Book Correspondence. Correspondence regarding articles and illustrations for **Herbertia,** the Year Book of the American Amaryllis Society, is cordially invited. The annual news-letter or articles from Corresponding Members and Regional Chairmen of Trial Collections should be forwarded, if at all possible, by April of each year, or earlier, depending upon the distance, so as to reach the editor in ample time for publication.

Manuscripts should be typewritten if at all possible and double spaced; photographs should have the **name of the owner** to whom credit should be given, and the **name and size of the subject,** written on the back.

LIST OF ILLUSTRATIONS

PAGE

Plate 44 Frontispiece Portrait, William Herbert, reproduced from the portrait by Sir William Beechey---Facing page 12
Plate 45 Spofforth Rectory and Garden ---- 15
Plate 46 Spofforth Church ---- 16
Plate 47 Magnolia planted by William Herbert and still living ---- 21
Plate 48 Habranthus cardinalis ---- 72
Plate 49 Hybrid Amaryllis in the collection of the U. S. Dept. of Agric. ---- 75
Plate 50 Hybrid Amaryllis in the collection of the U. S. Dept. of Agric. ---- 76
Plate 51 Carl Linnaeus, the Younger ---- 85
Plate 52 Specimen Pages, Manuscript on Amaryllidaceae by the Younger Linnaeus ---- 86
Plate 53 Crinum Forbesianum and Buphane disticha ---- 90
Plate 54 Cyrtanthus contractus ---- 95
Plate 55 Nerine sarniensis (Plate from Curtis's Bot. Mag.) ---- 96
Plate 56 Lycoris radiata ---- 105
Plate 57 Pure White Hybrid Amaryllis, Mary Davis ---- 106
Plate 58 Hybrid Amaryllis, Ernestine ---- 115
Plate 59 Hybrid Amaryllis, Ethel Duckworth ---- 116
Plate 60 Pure White Giant Leedsii Narcissus, Mary Beirne ---- 125
Plate 61 Flower of Aloma Daylily ---- 126
Plate 62 Narcissus schizocoronatus, "Buttonhole", etc. ---- 134
Plate 63 Narcissus schizocoronatus, "Vorstin", etc. ---- 135
Plate 64 Narcissus schizocoronatus, other hybrids ---- 145
Plate 65 McCann Hybrid Double Amaryllis ---- 146
Plate 66 Hybrid Amaryllis, Aulicum X Vittatum ---- 157
Plate 67 Hybrid Amaryllid—Probably Vallota-Cyrtanthus Cross ---- 158

Plate 68 Hybrid Amaryllis in the Collection of Pierre S. du Pont ... 162
Plate 69 Other Hybrid Amaryllis in the Collection of Pierre S. du Pont ... 173
Plate 70 Hybrid Crinum, Sophia Nehrling ... 174
Plate 71 Howard & Smith Hybrid Hippeastrum Breeding stock ... 183
Plate 72 Propagation of Zephyranthes, Z. Atamasco and Simpsonii 184
Plate 73 Propagation of Zephyranthes, Z. grandiflora and rosea ... 194
Plate 74 Effect of Hormones on Amaryllis and Hemerocallis ... 202
Plate 75 Vegetative Propagation of Ismene Sulphur Queen ... 203
Plate 76 Vegetative Propagation of Hemerocallis ... 206
Plate 77 Vegetative Propagation of Hemerocallis, growth responses following tip pruning ... 209
Plate 78 Alstroemeria pulchella ... 210
Plate 79 Hybrid Amaryllis in the Garden of Mary Early Joyce, Kenya ... 219
Plate 80 Hippeastrum rutilum var. crocatum ... 220
Plate 81 Nothoscordum bivalve ... 231
Plate 82 Hybrid Nerine, Minerva ... 232
Plate 83 Nerine Bowdeni, and Nerine corsuca major ... 239
Plate 84 Hybrid Nerines Hera and Ingens ... 240
Plate 85 Lycoris aurea naturalized in the Garden of Mr. John R. Heist ... 247
Plate 86 Hippeastrum advenum—Pink ... 248
Plate 87 Hippeastrum advenum—Ox-blood Red ... 253
Plate 88 Hybrid Amaryllis in the Garden of Mr. E. N. Blake ... 254
Plate 89 Forcing Hybrid Amaryllis without drainage ... 258

Figure 30 Cyrtanthus lutescens ... 230
Figure 31 Agapanthus umbellatus ... 237
Figure 32 Two year Leucocoryne Seedlings ... 242

This volume of Herbertia
is dedicated to the memory of
The Hon. and Very Rev. William Herbert, 1778-1847
Dean of Manchester
in celebration of
the 100th anniversary of the publication of
his enduring work—
Amaryllidaceae
in 1837

From the Painting by Sir William Beechey

William Herbert

Plate 44

THE BIOGRAPHY OF THE HON. AND REV. WILLIAM HERBERT, 1778-1847

ARTHINGTON WORSLEY, *England*

The biography of William Herbert is long overdue. It is a record of amazing intellectual vigor which, not to be contained within boundaries, broke out in all directions.

Great men are often held up as exemplars to future generations. In this case there are few, indeed, who could compete on the wide field over which his thought and work ranged. Of him to whom many talents are given, much is required, and he gave his best to the world, good measure, pressed down and running over.

No great man in modern times has left fewer personal records that may be easily traced than has William Herbert. I could find only a single portrait, painted when Herbert was seventeen years of age, at Eton, by Sir William Beechey, and which is reproduced, with the kind permission of Lord Hugh Cecil, Provost of Eton, in this volume of *Herbertia* (Plate 44). At the Spofforth Rectory where he lived for more than three decades there is no memorial to him.[1] Even his place of burial has been forgotten. One magnolia (Plate 47) planted by him is still alive in the old rectory garden of Spofforth which he planned and laid out, and of the "host of crocuses" planted there by him, the inhospitable climate has allowed many to survive to this day.

Pictures of the Rectory and Church have been secured by the kind collaboration of the present Rector, the Rev. Nelson O. Butler and are reproduced in this volume (Plates 45 and 46). The photographic copy of Herbert's signature, appearing under his portrait (Plate 44), was taken from the Spofforth Church register. But his work lives and enlightens past and present generations. This is the real test of greatness.

In this brief outline biography, we can do no more than touch on the varied activities of William Herbert. He acquired mastery of languages early in life, and became a creative literary artist during his college and university days. Following graduation he was briefly occupied as a lawyer and parliamentarian, but he finally found anchorage as an ordained minister. His boundless energy was more than sufficient to do full justice to his vocation and overflowed mainly into science—chiefly plant science and to a lesser extent into animal biology, particularly ornithology.

The valuable paper by Dr. Darlington of the John Innes Horticultural Institution, also appearing in this volume gives a critical estimate of Herbert's place in the history of science, and it is also very fortunate that Herbert's essay, *On Crosses and Hybrid Intermixtures in Vegetables*

[1] The Rev. Nelson O. Butler, present Rector of Spofforth, writes under date of April 25, 1937,—"I wonder whether the Society (American Amaryllis Society) . . . would consider placing a tablet or window in the chancel of the Church to the Dean's memory. There is no memorial to him here where he lived for, I think, 33 years."

is reprinted in its entirety in this volume. This will serve as an excellent sample of his scientific writing.

William Herbert was born on January 12, 1778. He was the third son of Henry Herbert, first Earl of Carnarvon, by Lady Elizabeth Alicia Maria, eldest daughter of Charles Wyndham, Earl of Egremont.

His formal education began at Eton. He showed his brilliancy early in life for he edited a volume of poetry in 1795 while still at Eton, and on finishing his preparatory education, he obtained a prize for a Latin poem.

On July 16, 1795, Herbert matriculated from Christ Church, Oxford, but soon migrated to Exeter College where he took his B.A. degree on June 9, 1798. Later he moved on to Merton College, Oxford, and received his M.A. degree on Nov. 23, 1802; the B.C.L. on May 27, 1808; and the D.C.L. degree on June 2, 1808.

At first he inclined to a political career, and he was elected member of Parliament for Hampshire in 1806 and for Crockledale in 1811, and he appears at some time to have practiced at the Bar.

But soon after retiring from political life in 1812, he completely changed his plans, and entered the ministry. He was ordained in 1814 and was presented in that year with the important rectorship of Spofforth in the West Riding of Yorkshire, which was in the gift of Lord Egremont. It appears that previous memoranda about Dean Herbert, to the effect that he was promoted to the deanery of Manchester in 1840, demand emendation, for the Diocese of Manchester was not created until 1847, previous to which date he held since 1840[2] the wardenship of the Manchester Parish Church, to which he drove from Spofforth Rectory by means of post horses. He was, in 1847, made the first Dean of Manchester, but it is doubtful if he actually officiated as Dean of Manchester for more than a short time for he died suddenly in his own house in Hereford Street, Park Lane, London, on May 28, 1847.

On May 17, 1806, Herbert married the Hon. Letitia Emily Dorothea, second daughter of Joshua, fifth Viscount Allen, and was the father of Henry William Herbert and three other children.

Some particulars of his family at Spofforth may be of interest. His wife delighted in gymnastics and Herbert caused a high wall to be built to screen a part of the garden from the observation of the neighbors. Some state was observed on ceremonial occasions, and when his daughters went from the 30-room rectory (Plate 45)[3] to the Spofforth Church for Divine Service, pages followed them carrying their books, saw them into their pew and shut them in. The Rectory was always known locally as "The Doctor's", probably for the reason that he lived there for 33 years before he became Dean. It is somewhat remarkable that a world-wide reputation should have clung to this latter title.

[2] It was in 1840 that he received the B.D. degree from Merton College, Oxford.

[3] The Rev. Nelson O. Butler writes under date of Apr. 25, 1937,—"The house (Rectory) has been reduced in size. When I came here it had 30 rooms—now there are 20, but what is left is exactly as it was in his day . . . . . The Church has been rebuilt since his day (in 1854) except the tower which is 15th Century and the Norman ascades in the nave."

Spofforth Rectory and Garden

Plate 45

Spofforth Church

Plate 46

BROAD INTERESTS OF DEAN HERBERT

Herbert achieved eminence as a classical scholar, linguist, and naturalist. In this section we will take a glance at Herbert's achievements as a scholar and linguist, and this will be followed by brief separate sections on his religious work and avocation of naturalist.

While still at Eton he published, in 1795, a book entitled *Musae Etonensis,* and in the same year he won a prize, on leaving Eton, for a Latin poem entitled *Rhenus.* In 1801 he published a small volume of Greek and Latin poetry,—*Ossiani Darthala,* and this was followed in 1804 by part one of *Select Icelandic Poetry* translated from the originals with notes. The second part appeared in 1806. These two works are important since they constitute the first adequate rendition of ancient Scandinavian literature in English. Herbert's translations from the Icelandic were considered of such importance by Byron that he wrote, in his *English Bards and Scotch Reviewers* (1809),—

> *Herbert shall wield Thor's Hammer, and sometimes*
> *In gratitude thou'lt praise his rugged rhymes.*

His exceptional command of languages is attested by other translations of German, Danish, and Portuguese poetry in 1804. He continued his literary work with articles of a non-political nature in the *Edinburgh Review.*

In 1815 followed *Helga,* a poem in seven cantos, and in 1820 he published *Hedin, or the Spectre of the Tomb,* a tale in verse from Danish history, and also *Pia della Pietra,* and *Iris,* a Latin ode. In 1820-21 appeared *Wizard Wanderer of Jutland.*

Beyond his religious work for the Anglican Church and for his own flock, his books and studies on horticulture and botany (of which a fairly complete list is given in the bibliography), he had a great interest in the Sagas, in Norse epic poetry and tradition, much of which he rendered in poems and allegorical works in English, Greek and Latin. Such works antidated the reawakening of the Germanic and Scandinavian races to their ancient religious beliefs. The substratum of this movement lies in the assumed intellectual superiority of the Indo-Germanic races as delineated in the works of the Comte de Gobineau and of Richard Wagner, reinforced by the "rediscovery" of the old Nordic gods. Civilization proceeds in this way, and we see the long ignored and forgotten efforts of individuals finally built up into great national movements.

It should not be said that by writing on the Sagas and on Norse divinities Herbert unwittingly did something to deflect Christian beliefs into other channels. The Old Testament Divinities had already been pushed to one side by the churches of Europe, and the Christology of St. Paul established in its place. But still we find, outside Christendom, the worship of ancient racial heroes is practiced. In Japan, the Holy Emperor, whose ancestors are considered as descended from heaven many thousands of years ago, retains his ancestral status, and Tennyson was not accused of derogating Christian beliefs by bringing into public

prominence such legendary characters as King Arthur and Merlin, although he granted to both his heroes at least semi-divine status.

These great men of the past are all divine in one sense, they are all Sons of God, as all Christians and all Greeks have ever claimed and as every man that ever existed must be. Some may have "scoured off the dust from the mirror of the mind." Some may have "Swept out the chamber of the heart and made it a fitting place for the dwelling of the Beloved." Let them all be honoured that deserve honour, however far we may be taken back through the mists of history or legend to that "first ray of golden Light."

HERBERT'S RELIGIOUS WORK

Herbert did much work in the religious field, mostly from a historical standpoint and as a defender of the faith embosomed in Christianity. As will be realized by reference to the bibliography of Herbert's works, a great portion of his life's work lay outside the sphere of botany and horticulture. One cannot omit some reference to his theological views and work, although such references must be rigidly curtailed, as it would require a volume of some size to deal with his work outside the proper limits of the publications of the American Amaryllis Society. However, *Herbertia* must deal with Herbert from all points of view. There is no doubt but that in his *Amaryllidaceae* we possess his master work but much light is thrown upon his life and times by his ecclesiastical and classical writings.

These take us back into a world of religious thought so far removed from the ideals of today that the whole panorama disclosed before Herbert's eyes seems to have now vanished. To recover this vision we must picture to ourselves that the great engine of Torquemada had back-fired into the very foundations of the Anglican Church. Real live devils sought to undermine Christian traditionary worship and to upset faith, and unbelief in what one was told was a crime and not merely an error of judgement. This was the world in which Herbert lived and taught. He was severely orthodox. Like Socrates, he knew the Good, and he wished to make everyone good. The pictures of Martin, which at one time hung on the wall of every devout Anglican churchman's home, depict the unrighteous going down quick into the pit, among whom are prominently shown many mitered bishops and ladies of obese tendencies —after the style of the pictures of Rubens. Let us hope that the juxtaposition of these two classes of the damned was purely fortuitous on the part of the artist.

The prevailing orthodoxy of the day is clearly traceable in Herbert's discourses, combined with an element of reciprocity which suggested to his flock that they should get what was possible out of religion, and obtain in a future beatific state what most of them had missed in this life here below. With dogmatic certainty he clearly expounded his credo, but fresh crusades against the unbeliever formed no part of his teaching. He inculcated the need for progressive improvement in the morals of his flock based upon the unwavering belief in his teachings. Perhaps the rural congregation at Spofforth may have been terrified by his denuncia-

tions, but as good countrymen in daily touch with nature, took it all in good grace.

Those interested in this phase of Herbert's many sided career should refer to his religious writings. In 1820 he published a volume of *Sermons* which was reviewed in *Gentleman's Magazine* in 1843 (Part I, p. 115). This was followed in 1838 by an epic poem, *Attila, or the Triumph of Christianity.* Subsequently he advertised *Attila and his Predecessors,* an historical treatise, but this may not have been published. A final volume of poems, *The Christian,* appeared in 1846.

HERBERT, ORNITHOLOGIST, SYSTEMATIC BOTANIST, AND PLANT BREEDER

As a naturalist Herbert devoted most of his energy to systematic botany and plant breeding. However, he was a good hunter, and contributed many closely printed pages of ornithological notes to *White's Selbourne,* published in 1832 by Prof. Rennie; and later, in 1837, Bennett's edition of the same work contains many of Herbert's notes on ornithology. Herbert also drew the title-page illustration for Rennie's edition.

We come now to the climax of Herbert's career, the publication of his *Amaryllidaceae* in 1837. With the lapse of a century, all of his other works have become secondary to his exceptional masterpiece on systematic botany. No one can study this treatise without realizing his great constructive and analytical talent, although here and there one may detect signs of dogmatism, this is on the whole a very minor note.[4]

He must be placed among those favored few, whom a fairy has touched at birth, and who did everything well that he took in hand. The wide field of work over which his labors extended shows conclusively the universality of his genius and in no way eclipses, as has already been pointed out, his best known work—*Amaryllidaceae*—to which, even after the passing of a century, all men turn for information on this subject.

What is most worthy of admiration is the remarkable thoroughness of his work, and the foresight shown in his arrangement. For he brought an ordered sequence out of the confused and often contradictory matter which his precursors had left for him and which they had only studied piecemeal.

He had given years of study to the amaryllids and study of a kind which previous authors had not given. He was what we moderns call a "liaison" man between the worker on dried specimens in the herbarium and the gardener. For he lived with his plants, watched them growing and only used dried specimens to fill in the lacunae left by the absence or inaccessibility of certain plants in a live condition. Even in so doing he was doubtful if some monkey-trick had not been played upon him, and "the inflorescence mismatched with the foliage." Sometimes his doubts were well founded, for the anthropologist who seeks for confirmation for his theories by examining a mummy may be unaware that it has been squashed and contorted out of all recognition of what

[4] See Herbert's remarks on the genus **Eustephia; Amaryllidaceae,** 1937, p. 156.

the living man had been like. In the case of a mummy of a great king who had lost his head in battle, some doubt might arise as to head and corpse being subsequently mis-matched; and as to any mummy which might have been made of Harold or of Cromwell, this doubt would have become a certainty.

During the progress of his great work he was in a position which no previous writer had been able to occupy. Until the development of heated glass house structures it had been impossible to examine, or even to grow the classes of exotic amaryllids which flower or grow in the winter season.[5] In Herbert's time this hindrance was in the process of being overcome. Moreover, he was a gardener as well as a botanist and methodologist. He wrote about what he had grown and watched and therefore his resulting observations are incomparably more valuable than those made by a systematic botanist in his study.

One can surmize, without having definite proofs, what first turned Herbert's mind to the love of amaryllids. His published works on this subject belong to the latter part of his career but if we allow 12 years for study of the subject and for the preparation, correction and publication of his *Amaryllidaceae* we are taken back to 1825. Now his father personally introduced several species of Hippeastrum into cultivation in 1820 — notably *Harbanthus bifidus* (Herb.) and *Hippeastrum stylosum* (Herb.) and the Geneva Botanic Gardens (A. DC. Pl. Rar. Hort. Gener., t.9) named as *Carnarvonia* a garden form, near *H. reginae,* but thought to be a hybrid. All this looks as though, (long before 1825, perhaps), his father had been a cultivator of amaryllids. Herbert's life when at home, at *Highclere,* may have been passed among these plants and he may have fallen a not unwilling victim to this form of beauty-worship when a young man. It is worthy of record that he described both of his father's specific introductions. At least we know that he followed up a line of horticulture in which his father already excelled. Once started on this line the utter confusion then existing in the whole Order must certainly have led an ardent methodologist to gird on his armor for the fray—from which he emerged victorious. That was one thing done and we have been saying "thanks" ever since.

A perusal of Herbert's *Amaryllidaceae* shows that he was a systematist of the first order. He was not satisfied to look at his task in a fragmentary way in the manner of the ordinary taxonomist. He proposed a phylogenetic arrangement of the monocotyledons in which he sought for natural groupings. The philosophy expressed in the introduction is quite modern, but the facts available in his day were meager as compared with those now at hand. On the basis of the available facts his arrangement is admirable. Lindley's work on systematic botany appeared in 1836, and Herbert includes a critical estimate of this work. Having satisfied himself as to the probable relationship of the group in which he was interested to the rest of the monocotyledons, he proceeds with his phylogenetic arrangement of the amaryllids.

[5] Excepting in the case of some hardier kinds, such as **Amaryllis.**

C. Maurice Steevens, Harrogate *See page 13*

Magnolia planted by William Herbert and still living

Plate 47

His arrangement of the Amaryllidaceae is based on such sure insight that even today, for instance as recently as May of the present year (Sealey, Jour. Royal Hort. Soc.) the genera *Habranthus* and *Pyrolirion* which had been erased since 1888 by Baker, have been reinstated.

The text is not after the fashion of the hack taxonomist for interesting notes on culture, and on contemporary workers are liberally dispersed among the necessarily formal descriptions of genera and species.

Herbert's botanical and genetic work is especially exemplified in his essay entitled *On Crosses and Hybrid Intermixtures in Vegetables* which is appended. In this he shows himself a cosmopolitan plantsman and eminent pioneer plant breeder. Since Dr. Darlington's valuable paper concerns this phase of Herbert's career, all that need be said here is that Herbert not only was a pioneer breeder of amaryllids but also of gladioli, azaleas, camellias, calceolarias, camellias, azaleas and many other plants.

Among nerines he raised the following hybrids—*Mitchamiae (curvifolia* x *undulata), Haylocki (curvifolia* x *pulchella), pulchella* x *undulata, pulchella* x *humilis, humulis* x *undulata, curvifolia* x *venusta* and *Spofforthiae (venusta* x *undulata).*

Baker states that "A large number of crinums were artificially hybridized by Dean Herbert, *C. longifolium, Americanum, erubescens, asiaticum, scabrum* and *zelanicum* being principally used by him."

In the *Amaryllidaceae* Herbert enumerates a large number of hybrid Hippeastrums raised by himself at Spofforth, and also many varieties raised at his ancestral estate, Highclere.

Herbert contributed articles about amaryllids and other horticultural and botanical subjects to the *Journal of the Royal Horticultural Society,* the *Botanical Register* and *Curtis's Botanical Magazine.* Among the most notable of his later horticultural works is the series of papers on *Crocus* species *(Crocus Synopsis),* which appeared in the Botanical Register between 1843 and 1845. He had just finished revising this series of articles when he passed away, and the work was published separately as the *History of the Species of Crocus,* after his death in 1847, under the editorship of Lindley.

HERBERT'S CONTEMPORARIES

Mrs. Bury in her *Hexandrian Plants* published in 1831-34, hand-painted with scrupulous care her illustrations and gave us the best illustrated work on the amaryllids that exists. She refers to Herbert's Genus Hippeastrum. Her work was put together in Liverpool and she records the help she received in the donation of specimens from Richard Harrison of Liverpool, J. R. Gowers, Prof. Lindley, Mr. Griffin of South Lambeth and from the Liverpool Botanic Garden. During those years Mr. Harrison was receiving many hippeastrums from Brazil and in his honor Prof. Lindley named *H. Harrisoni* (which is probably the same species as the one which is now called *H. ambiguum* and is as hardy as *H. vittatum).*

She figures several interesting hippeastrums which are now unobtainable, particularly *H. crocatum*[7] which is the only really yellow hippeastrum that is known. The segments are remarkably attenuated towards their long tapered tips. The leaves are very dark, very glaucous on the back and 3 inches wide. It cannot be difficult to cultivate for her drawing was made in 1826 from a bulb said to have been imported from Sao Paulo (together with *H. psittacinum)* 16 years previously. In my experience very few bulbs of hippeastrum have an individual life of 16 years in our hothouses, but offsets or seedlings may have carried on the life history without much change. But there are many other possibilities, such as that the comparative absence of brilliant light in old-fashioned hot-houses may have admitted of a pure yellow coloration in a plant that in full sunlight may have been orange colored. Still, quite apart from color, the plant drawn by Mrs. Bury is distinct from all others seen by myself, and the accurate coloration in all her other portraits gives credence to accuracy in this instance also.

Among her illustrations is the alleged hybrid *Hippeastrum Johnsoni.* Around this plant myths have arisen and it is puzzling to reflect how one scientific book after another has accepted these myths in sincere and perfect faith. It is very interesting but unscientific for investigation at the source has been possible ever since 1831-34. Mrs. Bury figured the original plant, *the Johnsoni,* given by the original Johnson himself to Edward Faulkner of Liverpool, guaranteed by the giver to be the original *Johnsoni* and drawn by Mrs. Bury herself. One feels inclined to ask "If this is not *Johnsoni,* what is?" But the alleged parentage of this plant is guess work and very bad at that. Let us grant to Johnson the mantle of a prophet who foresaw in a vision what might be done.

Among the hippeastrums figured by Mrs. Bury it is worthy of note that some bore umbels of 8 flowers to the scape. This was specially the case in those plants nearest to *Hippeastrum rutilum fulgidum.* I have seen crosses of this type with 10 flowers to the scape. This was half a century ago in a greenhouse in York. Of late years we only see the regulation 4 flowers, with an occasional atrophied fifth bud.

Miss Rosenburg's work, the *Corona Amaryllidaceae,* published in Bath in 1839, contains colored plates of five reported hybrid hippeastrums. Mrs. Loudon's *Ladies' Garden of Ornamental Bulbous Plants,* published in 1841, contains many colored plates of amaryllids and refers to Herbert.

P. J. Redoute's *Les Liliaces* published in Paris, in parts, contains portraits of the highest merit of amaryllids and other hexandrian plants. The cost was, and remains, very high. It was slightly pre-Herbertian in date.

During his life-time several cultivators assisted independently in the description of amaryllids. Notably Messrs. Garraway of Bristol, the Liverpool Botanic Gardens, and Messrs. Van Houtte in Belgium. The latter published many excellent colored plates in *Les fleurs des Serres et des jardins de l'Europe,* and stood all by themselves for many years in the culture of these plants.

[7] **Hippeastrum rutilum** var. **citrinum** Baker.

Rather later good work was done by many, amongst whom Sir Charles Strickland (at Malton), H. J. Elwes (Cheltenham) and Messrs. Van Tubergen (Haarlem) were prominent, and so also were Messrs. Veitch (Chelsea) and Messrs. Bull (Chelsea). The Royal Botanic Gardens, Kew, and the Austrian Royal Gardens at Schoenbrunn both continued to do inestimable work of the same kind especially among amaryllids whose stature was beyond the economic limits of most growers. Nor must the name of the Messrs. Krelage, to whom the 1938 *Herbertia* is to be dedicated, be omitted from this list, for this was one of the oldest firms of bulb growers in Holland to whose efforts no one can say how much is due. The present Mr. Ernst H. Krelage has kindly sent me extracts from accounts of bulbs furnished by various other firms to E. H. Krelage in or about 1837, and also extracts from bulb catalogs published in Holland about 1837, including the catalog of the Krelage firm. The following list[8] has been made on the basis of this information and will give some concrete idea of the material generally available during Herbert's time—

Hippeastrum reginae
H. Reginae d'Hollande
H. rutilum crocatum
H. equestre
H. equestre (double)
H. acuminatum
H. recticulatum
H. vittatum
H. vittatum major
H. vittatum rubrum
H. vittatum grandiflorum
H. aulicum
H. braziliense
H. miniatum
H. altissima
H. crocea-vitallina
H. vittelina
H. Krelagii
H. Johnsoni
H. Johnsoni sternianum
H. Johnsoni flore stricta
H. Johnsoni varitaete

Sprekelia formosissima

Sternbergia lutea

Lycoris aurea

Vallota purpurea

Zephyranthes atamasco

Amaryllis belladonna (new)
A. belladonna major
A. belladonna purpurea

Nerine sarniensis
N. undulata

Brunsvigia gigantea

Crinum longifolium album
C. longifolium roseum
C. amabile
C. americanum
C. giganteum
C. augustifolium
C. lineare

Pancratium maritimum

Haemanthus ciliaris
H. coccineus
H. puniceus

Ammocharis falcata

Stenomesson sp.

Hessea crispa

Alstroemeria pelegrina
A. pulchella
A. aurantiaca
A. Ligtu

Polianthes tuberosa fl. pl.

[8] Nomenclature of the present day is given where there is no question as to the identity; those which cannot be referred to present nomenclature and hybrids are designated as they appear in the 1837 catalogs.

IN RETROSPECT—AMARYLLID CULTURE IN BRITAIN

The culture of exotic amaryllids in Britain has been subject to remarkable changes of taste. Round about 1837 to 1842 a sudden rage for exotic amaryllids broke out. Herbert's great book made its appearance together with the finely illustrated work of Mrs. Bury at Liverpool, of Miss Rosenberg at Bristol, and of Mrs. Loudon in London. At the same time improved methods in the construction and heating of glass houses enabled a host of tender amaryllids to be cultivated. But were they cultivated, or were they merely made the butts of injudicious experiments? One must not be surprised at ignorance, for experience was lacking in the case of bulbs never previously grown or even seen. Even the great Herbert admits the loss of many of his bulbs through attempting to grow them in the wrong soil medium. It is natural therefore that lack of success in the early attempts should put a damper upon the rage for attempting to grow exotic amaryllids.

There is an old Eastern saying—"Art is a thousand men deep"—and to *grow* in heated structures a mixed assortment of amaryllids from various continents and climates demanded a numerous class of trained gardeners. Such a class did not exist then, and is only now being slowly called into being. The first foundation for success had not been provided. No training establishment existed and the gardeners blundered along as best they could. Some successes were obtained; bulbs which contained, when imported, an embryo flower, by some lucky chance carried the inflorescence and were duly figured in various publications. But the great bulk of importations died, or lingered on as wrecks of their former selves. The discouragements encountered led many to give up the culture of exotic amaryllids in Britain by the 80's, but there has never ceased to be a rather limited class of amateur enthusiasts who cultivate these plants in spite of any handicaps. It is important to note in this connection that during the period when exotic amaryllids were being grown to a lesser extent the culture of hardy amaryllids, such as narcissi and galanthus, increased out of all knowledge in Britain.

A similar course of events has been reported from the United States of North America, but in this vast area the wide range of climatic conditions must dictate what class of plants can be cultivated with success, and in what localities. In the subtropical climate of central and south Florida most of the tender amaryllids are hardy out of doors and many of the earlier introductions which reached there in a round about way, mostly via England and continental Europe, have persisted, especially *Crinums, Lycoris aurea, Haemanthus multiflorus, Hippeastrum equestre major* and others. In Southern California also many of the tender amaryllids have found a congenial home. While the glass house culture in the north of tender forms declined to a great extent between the 90's and the 1930's, the interest in these lingered on and they were championed by such enthusiasts as Theodore L. Mead and Henry Nehrling in Florida; Fred H. Howard, Richard Diener, Cecil Houdyshel, Gordon Ainsley and E. O. Orpet in California; Al. G. Ulrich in Missouri, and J. L. Gebert in Louisiana. It was natural therefore that the recent

revival of interest in these tender forms should find its beginning in these regions. The revival of interest in tender amaryllids in Australia, South Africa and Kenya should also be noted.

In England economic causes have also operated since the Great War. The load of taxation has dealt severely with the grower of expensive exotics for in many cases he must now limit his purchases to standard types and varieties which can be produced in great quantities and which are in consequence more reasonable in price. These are often excellent for quality cannot be measured in cost. However, this condition has changed the character of the amaryllid grower from an experimenter with varied forms from many parts of the world to a grower of forms that are standardized and which are grown over a wide area in Europe and the United States.

The situation however is not without hope since the recent demonstration that the tender amaryllids can be rapidly propagated vegetatively may lead to a revival in this class, for, with rapid increase, the prices may be much reduced so that tender varieties can be purchased for forcing without the necessity of carrying over the plants from year to year.

TENTATIVE BIBLIOGRAPHY OF THE WORKS OF WILLIAM HERBERT, 1778-1847, AND HERBERTIANA

I. Main Published Works:

Musae etonenses: seu, Carminum delectus nunc primum in lucem editus. Londini, excudit G. Stafford, 1795. 2nd ed. Etonae, T. Ingalton, 1817.

Ossiani Darthala (Greek and Latin poetry). 1801.

Translations from the German, Danish, etc. To which is added misc. poetry. London. 1804.

Miscellaneous Poetry. London. 1806.

Hybrid Crinums. In Jour. Royal Hort. Soc. II, p. 14; III, p. 187; 189 of Part 2.

On Hippeastrum. In Jour. Royal Hort. Soc. II, p. 19; III, p. 196; IV, p. 42.

Helga, a poem, 1815; 2nd. ed. 1816; *Hedin, or the Spectre of the Tomb,* London, 1820; *Pia della Pietra,* 1820; *Isis, a Latin Ode.* York, 1820.

Sermons. 1820.

A Treatise on Amaryllis, Crinum, Pancratium, Cyrtanthus, 1821. (This reported work could not be traced.)

Amaryllidaceae; preceded by an attempt to arrange the monocotyledonous orders, and followed by a treatise on cross-bred vegetables, and a supplement. London. J. Ridgway and Sons, 1837.

Attila, King of Huns. London. 1838. 2nd ed. London. 1841.

Attila and his Predecessors. (Date of publication not known).

Ornithological Observations. In White's Selbourne, publ. by Prof. Rennie. 1832.

Works of the Hon. and Very Rev. William Herbert, Dean of Manchester, etc., excepting those on botany and natural history; with additions and corrections by the author. London. 1842.

Supplement to the works of the Hon. and Very Rev. William Herbert. London. 1846.

The Christian. (Poems) 1846.

Sylvae recentiores: London. 1846.

Hybridization Amongst Vegetables. In Jour. Royal Hort. Soc. II, p. 11, (1847)

A History of the species of Crocus. 1847.

2. HERBERTIANA:

The Genus Herbertia (Named for Herbert by Sweet).

The Genus Haylockia (Named for one of his gardeners).

Drawings and descriptions of plants contributed to Botanical Magazine, 2121, 2607, etc.

In the Kew Herbarium Library some of Herbert's works are to be found under Hooker, Lindley and Sims correspondence.

Some of Herbert's drawings are at the Royal Horticultural Society (London), and also under Pritzel. 141., Jacks. 558, R.S. C. III. 305.

Biographical notices of Herbert may be consulted in Gard. Chron. June 5, 1847, 371-372 (notice of death); Jour. R. Hort. Soc. II, 249; also II p. 14; The Garden XXVIII. 400; Proc. Manchester Lit. Phil. Soc. XXV. 43; Gentleman's Mag. VI. 531; Dict. Nat. Biog. XXVI. 234 (1847); Ann. Register, 1847 p. 234.

See also misc. non-political articles in Edinburgh Review.

ON CROSSES AND HYBRID INTERMIXTURES IN VEGETABLES[1]

THE HON. AND REV. WILLIAM HERBERT

THE first experiments, with a view to ascertain the possibility of producing hybrid vegetables, appears to have been made in Germany, by Kolreuter, who published reports of his proceedings in the Acts of the Petersburgh Academy between 50 and 60 years ago. Lycium, digitalis, nicotiana, datura, and lobelia, were the chief plants with which he worked successfully, and as I have found nothing in his reports to the best of my recollection opposed to my own general observations, it is unnecessary to state more concerning his mules than the fact, that he was the father of such experiments. They do not seem to have been at all followed up by others, or to have attracted the attention of cultivators or botanists as they ought to have done; and nothing else material on the subject has fallen under my notice of earlier date than Mr. Knight's report of his crosses of fruit-trees, and my own of ornamental flowers, in the Transactions of the Horticultural Society of London. Those papers attracted the public notice, and appear to have excited many persons both in this country and abroad to similar experiments.

In the year 1819, having for some years previous paid attention to the production of hybrid vegetables, but ignorant of the experiments of Kolreuter, I was induced, rather against my own inclination, to address some detailed observations on the subject to the Horticultural Society, which were published in the transactions of that body. It was, I say, against my inclination, because I was fully aware, that a much longer course of experiments was necessary, in order to obtain any results sufficiently certain to give stability to my views. It is, however, satisfactory to find at the present day, after the attention of botanists and cultivators has been fully called to the subject during the space of many years, and a multitude of experiments carried on by a variety of persons, that, although our knowledge of its mysteries is still very limited, my general views have been fully verified, and my anticipations confirmed in a manner which I was scarcely sanguine enough to have expected. Soon after the publication of that communication to the Society, I was accosted by more than one botanist in the words, "I do not thank you for your mules," and other expressions of like import, under an impression that the intermixture of species which had been commenced, and was earnestly recommended to cultivators, would confuse the labours of botanists, and force them to work their way through a wilderness of uncertainty; whereas it was evident to myself, that it would on the contrary afford a test whereby the accuracy of their distinctions might be more satisfactorily investigated, many of the errors of their system eradicated, and its details established upon a more solid foundation, and less upon the judgment or caprice of individuals. The alarm, which some botanists had taken inconsiderately, appears to have subsided, and admissions have been already made by some of the most distinguished, which, if the con-

[1] Reprinted from "Amaryllidaceae," 1837, pp. 335-380. References to pages and plates are to "Amaryllidaceae," 1837.—Ed.

sequences that flow from them are considered without prejudice, must lead to much more extensive avowals, and a final assent to the principle of my statements concerning specific and generic distinctions. A number of attempts had been made by the President of the Horticultural Society to produce new varieties of fruit,* by impregnating the flowers with the pollen of other individuals, and the success of his proceedings was communicated to the public, both by his letters to the Society, and by the more substantial production of the fruits he had raised; but it must be evident, that less could be expected in the raising of new fruit-bearing plants by intermixture, because the hybridising process is to a certain degree inimical to fertility in the offspring; and that the flower-garden was more likely to be adorned, than the kitchen-garden replenished, by the intermixture of species. The President adopted in his writings a principle or dogma, which seemed to be then much relied upon by botanists, that the production of a fertile cross was proof direct that the two parents were of the same species, and he assumed as a consequence, that a sterile offspring was nearly conclusive evidence that they were of different species; and this dictum was advanced without suggesting any alteration in the definition of the term species, but leaving it to imply what it had before universally signified in the language of botanists. Having, in fact, the same fundamental opinion, that the production of a fertile intermixture, designated the common origin of the parents, I held also, what experience has since in a great measure confirmed, that the production of any intermixture amongst vegetables, whether fertile or not, gave reason to suspect that the parents were descended from one common stock, and shewed that they were referable to one genus; but that there was no substantial and natural difference between what botanists had called species, and what they had termed varieties; the distinction being merely in degree, and not absolute; so that, without first reforming the terms used in botany, and ascertaining more precisely what was meant by a species, those who argued on the subject were fighting the air; and I suggested, as my view, that the birth of an intermixture afforded presumptive evidence that the parents were of one genus, meaning thereby kind or descent, and implying such an affinity as to enable them to breed together, and to induce a probability that they had diverged from one original created type. The real point in discussion at that period was, whether there did exist a positive and invariable line of fertility or sterility in all mixed vegetable productions, founded upon an original identity or diversity in the parental stocks; and whether it was possible for two plants, which were considered according to the general system of botanists to be distinct species, to produce a fertile cross, without proving an error of the subdivision in that particular case. Further experiments have shewn, that the sterility or fertility of the offspring does not depend upon original diversity of stock; and that, if two species are to be united in a scientific arrangement on account of a fertile issue, the botanist must give up his specific distinctions generally, and entrench himself within the genera. It has been objected that if any plants, now different, had

* There is a paper in the Philos. Transact. concerning the production of apples, by crossing the pollen, by Benj. Cooke.

descended from one original type, we might expect to find new forms and combinations daily arising round us by the process of nature, as well as by artificial agency; whereas the catalogue of European vegetables does not appear to be increased by the production of new plants in a wild* state; but it is most probable, that if the Almighty created the original types capable of permanent variations under different circumstances, perhaps of soil or climate, those variations were worked at a very early period, on the first diffusion of seeds into every different portion of the world, especially by the operation of the flood, and may have in part resulted from the changes of climate which accompanied it and shortened the life of man. We must recollect, that although the different races of dogs, which all freely interbreed, are universally admitted to have come from one type, though now outwardly more unlike to each other than numberless distinct species of other animals, we know not what the similitude of that type was; we have no record concerning the original wild dog, nor whether there existed immediately before or after the deluge any dogs in an undomesticated state; nor have we any knowledge of the time or place when any one of the several races, as greyhound, terrier, spaniel, bull-dog, &c. took its birth; nor is there a single known instance of two parent dogs of the same race, giving birth to individuals of a new race, or materially dissimilar to themselves, except where they are mongrels, and one of the ancestral types reappears more strongly than the other. Neither have we any information concerning the origin of the different races of mankind, which are as different in appearance as the species of vegetables; we have not seen any new race arise within the period of historical certainty; and whatever we do know concerning them, refers the time of their branching out from the common stock to very remote antiquity, at a period antecedent to or coeval with the dispersion of mankind over the globe. If it had been otherwise, the various races would have been blended, instead of occupying different localities. It is probable that the various races of dogs owe their origin to a very early period; to the days, when the effects arising from change of situation, were first experienced by the several created members of the animal and vegetable kingdom: and it is no more essential to believe that individuals of every one of the present species of fox, or antelope, or finch (many of which are more like to each other than the greyhound is to the terrier, though they do not intermingle), entered with their present respective aspects into the ark, than that all the calceolaries on the mountains of Chili, or all the mezembryanthemums on the wastes of Southern Africa, exhibited their present peculiarities in the days of the patriarch. It was perhaps part of the wise scheme of Providence, for the purpose of peopling the world with the immense diversity of forms that occupy it, to give each created race a disposition to branch into diversities, acquiring constitutional peculiarities, which should keep them more or less separated; and the same phænomenon is observable in the languages of man, which are infinitely numerous; yet there

* Ranunculus, Anemone, Hypericum, Scleranthus, Drosera, Potentilla, Geum, Medicago, Galium, Centaurea, Stachys, Rhinanthus, Digitalis, Verbascum, Gentiana, Mentha, Quercus, Salix, and Narcissus, are however a long list of Genera enumerated by Schiede, 1825, and Lasch Linn., 1829, as having produced spontaneous hybrids, to which Crinum may be added.

is no reason to believe that many languages were given to man on the confusion of tongues; on the contrary, the cloven tongues that gave back the power of universal speech, imply that they were few; but from these have branched out innumerable languages, which cannot be reunited, and no person can show when or how any one of them arose, though we may trace the mingling of one with another in the later years of the world. One thing seems pretty certain, amongst the mysteries in which this subject is enveloped, that the differences worked, whether in plants or animals, in a state of domesticity, do not effect so great a constitutional separation inducing an indisposition to reunite and produce a prolific offspring, as the changes which have been wrought by nature in the wilderness.

I have said in the preliminary observations on Amaryllidacæ, that a perfect analogy between animals and vegetables in their generations is not apparent; but I do not mean to assert, that, if this subject can ever be thoroughly bottomed, it may not be found to exist. A reformation of Zoology is in progress; for example, in Ornithology, the Linnæan genus Motacilla was after a time confined to the wagtails, a large group being detached as Silviæ, but later observers found that group to consist of several families, and have since correctly distinguished at least the robins, the redstarts, the nightingales, the hedge warblers, the fruit-eating warblers, the sedge warblers, the chats, the troglodyte wrens, and the greenish wrens, as separate genera with their respective diversities; and within those generic limits I suspect that the power of crossing may be confined, and their several species, however now immutably distinct, may have respectively branched out from one stock since the period of the deluge. I have lately had under my observation a dog, whose father was a fox in an innyard at Ripon, and it has singularly the manners as well as the voice of a fox, but it is the parent of many families of puppies: and I feel satisfied that the fox and the dog are of one origin, and suspect the wolf and jackall to be of the same; nor could I ever contemplate the black line down the back of a dun pony without entertaining a suspicion that the horse, unknown in a wild state except where it has escaped from domesticity, may be a magnificent improvement of the wild ass in the very earliest age of the world: bearing in mind, that both in the animal and vegetable creation, the diversities arising from inscrutable causes in the wild races of the forest, are of a more unalterable character than those which spring up under the care and cultivation of man. With respect to animals in their wild state, their union with their own species seems to be mainly guided by voice and smell, and in domesticity that instinctive preference is evidently much weaker, and the will to keep themselves distinct is therefore lessened. The various species of greenish wrens are so similar in plumage, that it requires nice examination to distinguish them, yet they have different notes, manners, and habits of building their nests, even when in the same locality; but we have no certainty that if their predilection for the voice and smell of their own race was weakened, they would not be capable of producing a fertile cross; and we draw our conclusions from a few instances of domestic

mules between species which happen to be widely removed from each other, as the pheasant and fowl, the goldfinch and canary bird; whereas we should apply to this subject, concerning which our knowledge is very limited, the consideration of the fact ascertained concerning vegetables, which have no will to interfere with our experiments, that some crosses are sterile and some quite fertile, without any apparent reason, except the greater or less approximation of constitution in the parents: and that the cross-bred plant, which has seemed for a long course of years to be absolutely sterile, becomes under some circumstances productive.

In accordance with the principle above stated, when it was shown that the botanic subdivisions of Rhododendron, Azalea, and Rhodora, comprehended plants which were capable of intermixing, I asserted that the botanist must reconsider and alter his subdivisions, and acknowledge that, notwithstanding their peculiarities, they constituted but one genus or kind. Conformably with this suggestion, Mr. Sweet, in the second edition of his Hortus Britannicus, has since wisely added to Rhododendron the genera Rhodora and Azalea, with the exception of Azalea procumbens, though in his subdivision of the pelargoniums he has not kept in view sufficiently that certain and unalterable guide. The true meaning of species, not as the word used to be explained by botanists, but as it is in fact used in all botanical arrangements, appears to be, the subdivision of the genera or kinds into branches, which naturally maintain themselves distinct even when approximated, though they may be more or less capable of artificial or accidental intermixture; while a local variety will reproduce itself when isolated under particular circumstances of soil and climate; and a seminal variety will not with equal certainty reproduce itself in the same form anywhere, being more ready to intermingle with others of like origin. In fact, there is no real or natural line of difference between species and permanent or descendible variety, as the terms have been applied by all botanists; nor do there exist any features on which reliance can be placed to pronounce whether two plants are distinguishable as species or varieties. Any person, who attends to the subject, will perceive that no botanist has laid down any precise rules by which that point of inquiry can be solved, and that the most variable, contradictory, and unsubstantial features have been taken by different persons, and by the same person on different occasions, to uphold the distinctions they proposed to establish; the truth being that such distinctions are quite arbitrary, and that, if two plants are found capable of interbreeding, when approached by the hand of man, they are as much one as if they were made to intermix more readily and frequently by the mere agency of the wind, or assiduity of insects; and are not separable with more truth by any positive difference, than the varieties which cannot be prevented from crossing with each other when in the same vicinity. It remained to be ascertained whether there did exist a real, natural, and indefeasible difference between plants which could produce a fertile and those which could produce only a sterile offspring by blending their races. It was my opinion that fertility depended much upon circumstances of climate, soil, and situation, and that there did not exist any

decided line of absolute sterility in hybrid vegetables, though from reasons, which I did not pretend to be able to develop, but undoubtedly depending upon certain affinities either of structure or constitution, there was a greater disposition to fertility in some than in others. Subsequent experiments have confirmed this view to such a degree as to make it almost certain that the fertility of the hybrid or mixed offspring depends more upon the constitutional than the closer botanical affinities of the parents. The most striking and unanswerable proof of this fact was afforded by the genus Crinum, which is spread round the whole belt of the globe, within the tropics and within a certain distance from them, under a great variety of circumstances affecting the constitution of individuals, which nevertheless readily intermix, when brought together by human agency. The plant called Crinum Capense (formerly Amaryllis longifolia), impregnated by either Crinum Zeylanicum or scabrum, both at that time also called Amaryllis, produced offspring, which during sixteen years proved sterile, probably because, notwithstanding their botanical affinity, the first is an extra-tropical aquatic plant, and the two latter tropical plants which affect drier habitations and readily rot, at least in this climate, in a wet situation. The same C. Capense, impregnated by Crinum pedunculatum, canaliculatum, or defixum, produces a fertile cross, though they are so dissimilar as to have been placed in different genera, and the author was formerly reproached by botanists as having committed an absurdity when he insisted upon uniting them. The reason of the fertility of their joint produce seems to be, that they are all aquatic or swamp plants; and it may be further observed that the crosses with the two former, the plants being all extra-tropical, are much more fertile than that between C. Capense and defixum, because the latter is a tropical plant. The mules between Scabrum and Capense having continued so many years with every appearance of absolute sterility, without any change of situation or treatment, at last produced one good seed in 1834 and another in 1835. These facts were of such an overbearing nature, that it became impossible for those, who had charged the author with absurdity for uniting the parents under the genus Crinum (to which even certain other plants were then asserted to be more nearly allied than the species at that time called Amaryllis,) to contend any longer that they, producing a fertile offspring, were of different genera, and they will probably be never again disunited in any botanical work; but the facts furnish much ground for the serious consideration of men of science. It happens (as if expressly designed to overthrow the theory, that the identity of species is proved by fertility or sterility in the mixed issue), that, while C. Capense, Zeylanicum, and scabrum, are very similar in their general appearance, and yield an offspring which has been found quite sterile except in the case of the two seeds above mentioned, C. Capense and pedunculatum are as unlike as perhaps any two species of any known genus; and if it were asserted that C. Capense and pedunculatum are one species, and C. Capense and scabrum two species, the assertion would appear, to any person looking at the plants, too preposterous to require a serious answer.

In further confirmation of the fact that the sterility depends on constitutional discrepancy, or difference of what medical men call idiosyncrasy, may be adduced the curious plant figured in the Botanical Magazine under the name of Crinum submersum, which was found by my collector in a pond or flooded spot not far from Rio Janeiro, in company with a small variety of C. erubescens, and appeared to be exactly intermediate between that aquatic plant and C. scabrum, which grows on high ground amongst the woods. It is absolutely sterile, the anthers being always shrivelled and the pollen dry, and it is not materially different from the mules raised in our stoves between C. scabrum and a larger variety of C. erubescens, the latter being of course a finer mule, but with exactly the same barrenness of the anthers. C. submersum is certainly a natural cross, in consequence of the pollen of C. scabrum having been brought to the lake by some humming-bird or insect which touched the stigma of the aquatic species. The same sterility has been found in C. amabile and C. augustum, which are undoubtedly mules accidentally produced between dry-land and swamp-species, the former probably between C. Zeylanicum and procerum, the latter between C. Zeylanicum and bracteatum; as also C. longiflorum (Amaryllis longiflora of the Botanical Register), which is an accidental cross between C. Capense and erubescens, one variety of it having been produced at Demerara, the other in Jamaica. The fact being established with respect to one genus, that the species which have most botanical affinity and general likeness, if they delight in a different state of soil or of atmosphere, produce a barren cross, while the most dissimilar, if they possess the same constitutional predilections, give birth to a fertile plant, cannot remain as an isolated circumstance, but must be considered by every unprejudiced and philosophical mind with reference to the whole vegetable creation. I have lately heard it admitted in conversation by an eminent botanist, that he had almost arrived at the conviction that there was but one rose, meaning that there seemed to be no natural impediment to the fertile intercourse of the great variety of plants which constitute the known species of that extensive genus. Let it be observed, if the fact is so, the reason is apparent enough; that, although some roses will endure a little more cold than others, there is a sameness of constitution throughout the genus, which affects a dry soil and a temperate atmosphere. The genus Calceolaria embraces plants very dissimilar to the eye of the botanist, as well as of the unlearned observer, of which some are absolutely stemless, and bear only leaves and flower-stalks, while others are shrubby, and acquire a strong woody stem some feet in height; yet there appears to be no limit whatsoever to their intermixture, and their produce may be crossed again indefinitely. Are we, then, to come to the result that there is but one Calceolaria, oversetting not only the nicer distinctions of botanical science, but the difference between herb and shrub? The African Gladioli, excepting those which, like the European, present their flowers in front of the stalk, have been intermixed by me without any difficulty occurring, and the crosses of the most dissimilar have proved abundantly fertile, and four or five sorts have been blended in successive generations. Some of the complicated crosses have produced seed

less freely, and one treble cross (Hirsuto-Cardinali-blandus) has as yet produced none that has vegetated, probably because the last male, G. hirsutus, is of a constitution much less suited to our climate than the other two. Are we then to come to the result, that these dissimilar species are all one natural Gladiolus? There is no outward sign of barrenness in G. hirsuto-Cardinali-blandus, which will probably bear seed under favorable circumstances; that there is no insurmountable natural impediment may be proved thus; the offspring of G. versicolor by hirsutus, of blandus by versicolor, and of Cardinali-blandus by tristis, have all borne seed, shewing that G. hirsutus is not of a separate race, and that the triple cross is not an impediment. I have crosses raised by me between the yellow Linaria genistifolia and the purple purpurea, and also between Penstemon angustifolium and pulchellum, both perfectly fertile and sowing themselves about the garden, and, from my having given them many years ago to more than one nurseryman, become common. It is scarcely possible to assert that these very unlike plants are respectively one, and at the same time to distinguish them from the rest of their own genera, especially the former. That whole portion of Amaryllideæ which constitutes the genus Hippeastrum, and was confounded by botanists with a portion of the genus Crinum, not only interbreed freely, but produce offspring invariably fertile, because they are all of like constitution, and impatient of excessive moisture, though some will bear more cold than others. Amongst the Pelargoniums a similar convertibility has been found to exist within certain limits, which, if duly observed, will be sure guides to ascertain the genera, into which they ought to be subdivided, and by which the botanist, who is desirous that his labours should not be overturned hereafter, must be in a great measure ruled in classing them. Amongst the Cacti or Cerei the prickly angular speciosissimus, the flexible flagelliformis or whip-plant, and the flat unarmed phyllanthocides, are nearly the most dissimilar, yet they have produced mixed offspring, which readily bears eatable fruit of intermediate appearance, colour, and flavour. The fruit of the speciosissimus is large, green, and well-flavoured, round oblong; that of phyllanthocides small, purple, and very inferior; the mule from the former has purple fruit of a medium size and taste. The cross from the former by flagelliformis is now ripening here a short angular fruit, quite unlike that of the mother plant. The fertility of these crosses, and readiness to vary the appearance and taste of the fruit, though derived from such very dissimilar parents, is one of the most striking results of our experiments. I have had no opportunity of attempting to cross them with the plants called echino-cacti, but I do not see a single point in the generic character given of those plants which can uphold it, and I believe them to be of one genus with Cereus, and capable of intermixing; but I have had no opportunity of examining the flower of any of the plants called Echinocactus myself. Amongst melons I have had the Cucumis osmocarpus from Mexico, bearing a small egg-shaped white fruit and a small flower and leaf, very different from the Cucumis melo, fertilized accidentally by its pollen, thus occasionally producing fruit of twice

the natural size with red flesh. Lobelia speciosa is a cross between L. siphylitica and fulgens, yet it reproduces itself abundantly.

The more these facts are considered, and the more they are multiplied, as they will be by the daily experiments of cultivators in other genera, the more strongly will my original suggestions impress themselves upon every botanist, who will look on the subject without prejudice, that the genera of plants are the real natural divisions; that no plants which interbreed can belong to separate genera; that any arrangement, which shall have parted such plants, must be revised; that any discrimination between species and permanent varieties of plants is artificial, capricious, and insignificant; that the question which is perpetually agitated, whether such a wild plant is a new species or a variety of a known species, is waste of intellect on a point which is capable of no precise definition, and that the only thing to be decided by the botanist in such cases is whether the plant is other than an accidental seedling, and whether there are features of sufficient dissimilarity to warrant a belief that they will be reproduced, and to make the plant deserve on that account to be distinguished by name amongst its fellows. The effect, therefore, of the system of crossing, as pursued by the cultivator, instead of confusing the labours of the botanist, will be to force him to study the truth, and take care that his arrangement and subdivisions are conformable to the secret laws of nature; and will only confound him when his views shall appear to have been superficial and inaccurate; while on the other hand it will furnish him an irrefragable confirmation when they are based upon reality. To the cultivators of ornamental plants the facility of raising hybrid varieties affords an endless source of interest and amusement. He sees in the several species of each genus that he possesses the materials with which he must work, and he considers in what manner he can blend them to the best advantage, looking to the several gifts in which each excels, whether of hardiness to endure our seasons, of brilliancy in its colours, of delicacy in its markings, of fragrance, or stature, or profusion of blossom, and he may anticipate with tolerable accuracy the probable aspect of the intermediate plant which he is permitted to create; for that term may be figuratively applied to the introduction into the world of a natural form which has probably never before existed in it. In constitution the mixed offspring appears to partake of the habits of both parents; that is to say, it will be less hardy than the one of its parents which bears the greatest exposure, and not so delicate as the other; but if one of the parents is quite hardy and the other not quite able to support our winters, the probability is that the offspring will support them, though it may suffer from a very unusual depression of the thermometer or excess of moisture, which would not destroy its hardier parent. Such is the case with the beautiful mule Rhododendron Altaclaræ, of which the mother was a cross between Ponticum and Catawbiense, and the father the Nepal scarlet arboreum. We now possess a further cross by the impregnation of Altaclaræ by arboreum, which will probably come so near the father in its colour, that if, as expected, it should be able to endure our winters, we shall have nearly attained the result, which

would be otherwise most likely impracticable, of acclimating the magnificent Nepal plant; for it does not appear that in reality any plant becomes acclimated under our observation, except by crossing with a hardier variety, or by the accidental alteration of constitution in some particular seedling; nor that any period of time does in fact work an alteration in the constitution of an individual plant, so as to make it endure a climate which it was originally unable to bear; and, although we are told that laurels were at first kept in hothouses in this country, it was not that they were less capable of supporting our seasons than at present, but that the cultivators had not made full trial of their powers of endurance. The notion of Mr. Sweet that the roots produced by cuttings are hardier than those of seedling plants is probably fanciful, if he meant permanently so, which alone would be of importance. They may be tougher at the first period of propagation, while the seedling is in its infancy, but that, if not permanent, could have no effect in acclimating a plant. In truth it is not the root that is tougher, but the nucleus or base of the cutting from which the roots issue, and in which the life resides, which is tougher than in a young seedling at the first. All his other experiments only tended to show that some half-hardy plants would live through an English winter in very dry and sheltered situations, or during two or three years, till a more inclement season cut them off, but not that by any process of his they had become hardier; the word acclimating seems, therefore, to have been misapplied in his paper in the Transactions of the Horticultural Society. For the purpose of obtaining a large or a brilliant corolla, it will be probably found in the long run best to use the pollen of the species which excels in those points, because the corolla, in truth, belongs to the male portion of the flower, the anthers being usually either borne upon it, or in some manner connected with it by a membrane; but upon the whole an intermediate appearance may be generally expected, but with a great disposition to sport, especially in the seminal produce of the fertile crosses, as in plants which are apt to break into cultivated varieties.

Before I proceed to consider the various cross-bred productions of late introduction, which at present embellish our collections, I will enter into a short detail of the reports which I have seen of experiments on this subject, made on the Continent, together with my view of the opinions which have been advanced in them, and in a little work by Professor Rennie, the matter of which is chiefly extracted from the writings of Mons. De Candolle. Kolreuter's experiments* are detailed in the transactions of the Petersburg Acad. in 1777, and the five or six following years. I do not find any further reports of experiments made in Germany, previous to that of Gaertner, concerning the observations he had made in 1825, subsequent to the publication of those of the President of the Horticultural Society of London, and of myself, in

* Relating to Lychnis and cucubalus, N. C. ac. Petr. t. 20. p. 431—448. Hybrid digitalis Act. Ac. Petr. 1777. Do. Journ. de physique t. 21. p. 285—299. Other hybrid digitalis, Act. Ac. Petr. 1778. Continuation of experiments on hybrid foxgloves, J. de phys. t. 21. 209—306. Hybrid lobeliæ, Act. Ac. Petr. 1777.—J. de phys. t. 23. 100—105. Hybrid lycia, Act. Ac. Petr. 1778. Verbasca, 1781. Daturæ, 1781. Malvaceous plants, 1782. Flaxes, Nov. Act. A. P. t. 1. 339—346. Pinks, ib. t. 3. 177—284. There may perhaps be some other reports by Kolreuter, of which I may have neglected to make a memorandum. I believe one concerning Nicotiana.

its Transactions. He gave an account of the number of impregnations he attempted to effect, the particular subjects of his several experiments, and the failure or success of each. I cannot learn that he has since published any report of the germination of the seeds which he had obtained by those experiments, and no later statement was known to Mons. De Candolle, in 1832. I have no hesitation in saying that this report, which seems to have been accepted as proof of what Gaertner had done, is utterly fallacious. He has entirely overlooked the difficulty, and, in many cases, the impracticability with the utmost care of excluding the natural pollen; the insufficiency of a bag to shut it out, and the probability of its having been admitted even before the bag was placed over the flower. I have learned by endless disappointments to know, that no attempt to obtain a cross-bred plant can be looked upon as successful, till the seedlings raised shall have advanced in growth sufficiently to exhibit the type of both parents united in themselves; and I consider Gaertner's report of the cross-bred seeds he *has obtained,* to be nothing but a mere enumeration of the crosses he *has tried to obtain;* and I believe some of his supposed intermixtures to be impossible. The fact is, that in this country, where the passion for horticulture is great, and the attempts to produce hybrid intermixtures have been very extensive during the last fifteen years, not one truly bigeneric mule has been seen; and, although I by no means presume to assert that such a production is impossible, experience shews it to be improbable; and those, who fancy they have obtained one, must forgive my wishing to see it forthcoming, and to examine whether it is certainly of such descent as they suppose. Gaertner details his mode of proceeding, which is pretty similar to my own; but he does not seem aware, that, in spite of all possible precautions, the pollen will often escape unobserved, and will penetrate the coverings that may be used. He asserts that the moist juice of the pollen combines with that of the stigma, to fecundate the germen, a questionable point, that need not here be considered. The superabundant viscous juice on the stigma of Rhododendron appears to me to obstruct the fecundation, which I think takes place more readily when it subsides. Gaertner could not decide whether the fecundation is slow as Kolreuter imagined, or rapid as Hedwig asserted; but in microscopical observations the particles of pollen seemed not to be emptied in less than an hour and a half; and he found that, when the fecundation was as he thought complete, the particles afterwards superadded did not change form or color; but that in hybridizing applications a greater quantity of pollen seemed requisite, in proportion to the distance of affinity, and that it was repeatedly consumed; and he fancied that its successive applications in such cases made the seeds more numerous and perfect, which is very probable; but he says that only in kinds very closely allied did he obtain the full complement of seeds, as for instance in the genus Datura, of which Metel and Lævis mix freely. He found the life of the stigma more prolonged, when it was not fertilized by its own pollen; which might be expected, because the complete saturation of the stigma had not taken place, after which it no longer receives the influence of the pollen.

He states that in natural fecundations the change of the stigma took place sometimes in 85 or 100 minutes, usually in a few hours, at most in 24; but neither he nor any other person seems to have thought of ascertaining whether the influence of the pollen really fertilizes the germen within that period, or merely saturates the stigma; and, although I have not pursued a course of experiments to make that fact sure, I have some reason to believe that the truth is not yet ascertained. If the fertilization was complete, and the office of the stigma defunct, it might be cut off without any detriment; unless necessary to the mere nourishment of the ovules, whether fertilized or not, which does not seem probable; but I have repeatedly cut it off a few days after I had applied pollen to Rhododendron, and the result has been that no seed has been formed. The whole of my observations has led me to think, that at any period before the decay of the stigma the access of the natural pollen may supersede the influence of the foreign that may have been previously applied, if not from a closely allied species or variety; but that on the other hand no foreign pollen can act upon the germen after the stigma has been fertilized naturally. The incomplete saturation of the stigma in the first case enables the natural pollen to gain access; but, if the absorption of the pollen first applied causes immediate fecundation, it cannot be explained how the subsequent access of the natural dust should supersede it; and it has seemed to me that the natural pollen could supersede that of an Azalea on the stigma of an evergreen Rhododendron even after the flower had fallen off. This point, which I have not sufficiently investigated, might be elucidated by cutting off the stigma with portions of the style of various lengths at different periods after the application of pollen, and seeing in what manner the operation interferes with the fructification of the plant. Gaertner thinks it doubtful whether the corolla is essential to the fertilization of the stigma; my observation is, that its early destruction is very prejudicial to the growth of the germen and stigma, but that after their development it is not usually essential. He observes that the corolla perishes more quickly and completely after fecundation, and is more persistent and sometimes withers instead of falling off, in cases of hybrid impregnation, as it does where impregnation is prevented; but he seems not to have distinguished the cases of successful and abortive hybrid impregnation. I observe that he admits that the viscous juice remains on the stigma of Datura and Nicotiana two or three days after fecundation, which does not exactly agree with his theory, and seems to mark that the stigma has not become quite inoperative. Some days elapse before any other signs of fecundation appear after the fall of the corolla, such as the enlargement of the peduncle, or strengthening of its articulation, and that period seems to him longer in hybrid impregnation, and the interval longer before the seeds are vivified. Both he and Kolreuter observe instances, such as I have found, of false hybrid fecundation, producing an enlargement of the germen, or even seeds with an imperfect embryo or without any. They remarked, that they did not usually obtain the full complement of seeds from a hybrid impregnation, unless the affinity was very close. My own observation

is that this circumstance depends rather on the similarity of constitution, and is by no means universal, for I had a pod from Crinum Capense fertilized by revolutum, in which every ovule produced a seedling plant, which I never saw to occur in a case of its natural fecundation. He cites from Kolreuter that Datura metel and lævis have each about 600 seeds in a capsule; he found that a capsule from one of them fertilized by the other contained 640, and in another case 284; but that Datura lævis by Nicotiana rustica produced only 108 seeds, which were however apparently perfect and provided with an embryo; but I utterly repudiate the probability of that impregnation, of which he has not published the ultimate result. In Gaertner's list, I find Convolvulus sepium by Ipomœa purpurea (the Convolvulus major of nurserymen) 8 experiments failed; the converse 10 failed. Ipom. purpurea by Convolvulus tricolor 6 failed; 1 successful, which I greatly doubt. Datura lævis by Metel, 4 failed and 4 succeeded; by Hyoscyamus all failed; by Nicotiana macrophylla 3 failed; 1 succeeded; by Nicot. rustica 1 failed, 1 succeeded. Datura metel by lævis all succeeded; by Hyoscyamus failed; by Nicot. macoph. failed. Glaucium by Papaver failed. I make no doubt that when the seeds vegetated, the supposed crosses of improbable origin manifested themselves to be natural seedlings of the mother plant, or produced by the intrusion of some kindred pollen. Kolreuter raised mules (Act. Ac. Pet. 1780) between Lobelia siphylitica and Cardinalis both ways. He found them fertile by the pollen of either parent, and their pollen fertilized the parents, but he obtained no seed from the mule by its own pollen. Lobelia speciosa, or more properly Lowii, Bot. Reg. 17. 1455, was found in a border where siphylitica and fulgens grew; it was a mule from siphylitica, which seeds freely. That mule, intermediate and purple-flowered like those of Kolreuter, seeded abundantly with me standing in a border between the two parents, but the seedlings with one or two exceptions, did not approximate to either, but reproduced the mule with some variability of colour. Dr. Wiegman, in a tract published in the German language, has given an account of some interesting experiments. By sowing Allium porrum and Cepa in one bed, and tying the flower-stems together, he obtained plants intermediate between the leek and onion, which were fertile. By tying together Vicia faba hortensis (the garden bean) and Vicia sativa (the common vetch), he obtained crossbred seed; the seedlings from the bean had flowers more purple, smaller pods and seeds, which when sown again, yielded plants that appeared to him not distinguishable from what he calls the known red-seeded variety. Those from the vetch shewed also a difference of blossom. In 1823 he sowed Pisum sativum (the field pea) and Vicia sativa (the common vetch) together; the seedlings showed a departure from the natural colour, and yielded grey seeds. From the twining Phaseolus vulgaris albus, and Phaseolus nanus which does not twine, he obtained crosses; some seedlings of the latter twining, and of the former bent and crooked, but not twining. From Vicia sativa (the common vetch) and ervum lens (the lentil) he also obtained a fertile cross. If these facts are correct, it is clear that the closely allied genera Faba, pisum, vicia, and ervum cannot be up-

held as distinct; but, although it is a very common practice in England to sow peas and tares mixed with beans, I have questioned many intelligent farmers on the subject, and not one had ever heard of any adulteration in the seed in consequence of the mixed cultivation, which, according to Dr. Wiegman's statement, ought to be of constant occurrence in such cases. On the other hand, I have seen cultivated in Yorkshire a plant having the growth of a vigorous field pea (Pisum), which produces seeds that no man would hesitate to call beans, and which when boiled have, I understand, more the flavour of beans than of peas; and the plant, though very fertile, has every appearance of being a mixed production between the two. The most extraordinary mule, however, that is asserted to have been produced on the Continent, is a cross between the cabbage and horse-radish, which Monsieur Sageret reports that he has obtained, and that it has produced seed-pods, some of which resemble the short pod or silicula of the Cochlearia or horse-radish, and some the long pod or siliqua of the Brassica or cabbage. Strange it is, that asserting such a result, he appears quite unaware of its importance, and does not state whether those singular and various pods contained seeds or proved abortive. He does not even state whether the plants so obtained were annual, like the cabbage, or perennial, like the horse-radish, nor does he describe them. I must therefore, without any offence to him, be allowed to consider the actual generation of such a mule questionable, till the mule plants are produced before the public, so that their conformation may be examined to see whether it is agreeable to their supposed origin, or at least their peculiarities accurately detailed, and the impossibility of a mistake rendered manifest. I have, however, always considered the separation of siliquosæ and siliculosæ to be very unsatisfactory, and have entertained great doubts of the established distinctions amongst Cruciferæ. In consequence of M. Sageret's statement, I tried in 1835 to impregnate a plant of Brassica with the horse-radish, and with the pollen of two or three other genera of Cruciferæ; but I did not obtain a single seed from at least fifty flowers, on which the experiments were tried, all other flowers being cut off from the plant. I beg to be understood as not denying M. Sageret's assertion, but requiring better proof of the accuracy of a fact so important to science, in which he may be mistaken, and more detailed particulars, and especially the production of the plants; and I invite M. Sageret to communicate one of them to the Horticultural Society of London, that opportunities may be afforded of examining it carefully.

Experiments have also been made on the Continent to establish within what limits the cucurbitaceous plants (melons, &c.), can be intermingled; but, the names used not being of general currency, I cannot state accurately the result. Dr. Wiegman extended his experiments to varieties of oats. The accuracy of his observations and those of Sageret ought to be thoroughly investigated, and the results produced before the public; and a more useful office, connected with its pursuits, could not be undertaken by the Horticultural Society of London, than to pursue those enquiries and extend them to other vegetables. An

observation made by Gaertner and Wiegman (Berlin, 1828) as well as by Mr. Knight, that the offspring of hybrids revert to the maternal and not to the paternal type, is certainly erroneous, and Wiegman admits that tobacco (Nicotiana) and oats may be made by crossing again either to revert to that of the mother, or advance to that of the father. The offspring of the mule Passiflora cœruleâracemosa, both in Mr. Milne's garden and in mine, have notoriously approximated to the type of the father, and lost altogether the red colour of the original mother. It is certainly not correct as a general law, though some have stated it, that the number of seeds in one pericarp is smaller in hybrid, than in cases of natural, impregnation; it is true in some cases, and the reverse occurs in others. With respect to the conditions stated by Professor Rennie, as necessary to ensure success in crossing vegetables, it must be observed that the first, namely, that the blossoms should be nearly in the same state of advancement, is not accurate; for in some kinds, as for instance, Calceolaria, that which is to bear the seed should be much less advanced than that from which the dust is taken; and in others, as Pelargonium and Alstrœmeria, it should be much more advanced. In truth, the moment should be seized, when the stigma in the flower which is to bear the seed, and the pollen in the other, is in perfection. The second condition stated, that the anthers should be cut out early in the morning, is equally liable to objection, and cannot be applicable to all flowers, some of which blow in the morning, and others in the afternoon or evening. The necessary condition is, that the anthers be removed from the flower that is to produce the seed before the dust can escape from them; for which purpose in many cases, as for instance in Crocus, Erica tetralix, and others, the flower must be opened with great difficulty at a very early stage. The plant must be then placed in a situation where no natural dust can reach it, brought either by the wind or by insects; and the pollen from another flower, which is in perfection and not beginning to wither, must be applied to the stigma as soon as it is quite developed and mature, or rather sooner. The success of such experiments is always most probable when the plant, which is to be fertilized, has been forced, and no natural pollen can be brought to it accidentally from other plants, and, by forcing one of the intended parents, those, which flower at different seasons, may be made to intermix. But it should be always remembered that, except in cases where the anthers are very accessible, and not mature till after the expansion of the flower, it is almost impossible to be quite certain that no particle shall escape from them in the operation. It is incorrectly stated that we cannot cross plants which do not ripen seeds with us, for their dust may be used to fertilize one that will ripen its seed; for instance, the pollen of Zephyranthes carinata, which I have never known to bear seed in England, has fertilized Z. tubíspatha. It is also very possible, if the fruit of one species is apt to perish immaturely from the unsuitableness of the climate, and the germen of another is not usually fertilized with us, in consequence of an imperfect formation of its pollen, that it may be effectually fecundated by the pollen of the other species, though neither would have borne seed separately. The deficiency of pollen is of fre-

quent occurrence in the American Azaleas from the fault of our climate; but the pollen of Sprekelia and of Z. carinata is abundant, and their sterility does not arise from its defect, but from the temperature or exposure in which they are placed not being exactly adapted to the growth of their fruit.

The first hybrid amongst our liliaceous plants that appeared in our gardens was the mule between Hippeastrum vittatum and regium, which was circulated under the name of Amaryllis Johnsoni, having been raised by a nurseryman named Johnson. It was, perhaps, an accidental production, for it was offered to the public with an incorrect statement, that it had been raised by impregnating H. vittatum with the pollen of Sprekelia formosissima. He might, however, have made various trials, and have been deceived as to which of them had been successful. That statement has been since disproved by the failure of every attempt to fecundate any species of Hippeastrum by the pollen of Sprekelia, of which the separate generic character is thereby confirmed, and also by the facility with which plants exactly similar have been raised between H. vittatum and regium. The next hybrid of that order, that flowered amongst us, was the Crinum Goweni, which was raised from seed of C. Capense, impregnated with the pollen of C. Zeylanicum in the greenhouse of the Earl of Carnarvon, at Highclere, in 1813, by R. J. Gowen, Esq., and blossomed in my possession at Spoffroth; and soon after the mules between C. Capense and Canaliculatum, which had been first raised by me at Mitcham about the same time, came into flower with other crosses at Spoffroth. All the hybrid Crinums raised between Capense and tropical species, which are now very numerous, are hardy enough to stand out of doors against the front wall of a stove, where, if a mat is thrown over them in sharp frosts, they preserve much of their leaves through the winter, and from May to November continue throwing up a succession of flower-stems in great perfection. C. scabro-Capense bears the most beautiful flower; C. pedunculato-Capense is of the largest stature. The only other hybrids of much note in our gardens at that period were, to the best of my recollection, as follows:—The Rhododendron Azaleoides, obtained by the accidental impregnation of an Azalea by Rhododendron Ponticum, in the nursery of Mr. Thompson at Mile-End; the Rhododendron glaucum hybridum figured in the Botanical Register, and Azalea enneandra figured in the Botanical Magazine, which had both been raised by me at Mitcham and removed to Spoffroth. Since that time we have had the Rhododendron fragrans of Mr. Chandler, and a very great number of similar crosses from American white Azaleas by Rhododendron Ponticum at Highclere. I am not aware at what period the beautiful mule pink which is common in our gardens made its first appearance, nor through whom, or in what manner it was obtained; but it was probably the produce of an accidental intermixture of a florist's pink with a crimson sweet-william. Mr. Sweet gives no date to the hybrid pinks. Several most beautiful mule Gladioli and Ericæ, which had been raised at Mitcham between the years 1808 and 1814, and removed from thence to Spoffroth, had also flowered there, but had not been made known to the public till the year 1819, when an engraving

of Crinum Goweni was published in the Horticultural Transactions, and a figure of two or three crosses of Gladioli appeared soon after in the same work. Those who raised pelargoniums from seed had found amongst the produce of certain species a great disposition to intermix and sport, which was occasioned by the accidental transmission of the pollen from one plant to another by the bees, which occurs perpetually in that genus, because many of its flowers are occasionally without anthers, or lose them before the stigma comes to maturity, which causes them to be fertilized by another flower; and in the year 1812 (taking the date from Sweet's Hortus Britannicus) the beautiful cross between Pelargonium Citronodorum and fulgidum was obtained from seed, and afterwards produced under the name ignescens; and, being fertile, it has become the parent of an innumerable variety of the most beautiful plants that adorn our greenhouses. P. ardens had been raised two years before between fulgidum and lobatum, and had first pointed out to cultivators that it was possible, through the pollen of P. fulgidum, to introduce its brilliant tint of scarlet under a variety of modifications, in union with the superior qualities of other species in which it was deficient; but a long course of experiments has shewn the impracticability of blending the plants allied to zonale (which are properly detached by Mr. Sweet under the name Ciconia) with the true Pelargoniums, which are however certainly of one genus with the bulbous rooted sorts that are found to interbreed with them, and have been improperly detached. Such plants as fulgidum and echinatum, which have a stem of a semi-tuberous nature and capable of enduring a long period of drought, form a curious link between the tuberous and fibrous-rooted species. The practicability of obtaining a cross between the hardy Passiflora cœrulea and its more splendid but tenderer congeners had been suggested in my communication to the Horticultural Society; and not long after Mr. Milne verified the suggestion by the production of three fine varieties by seed from the scarlet racemosa fertilized by cœrulea. These mules, though not absolutely sterile, are indisposed to fruit, but seedlings were obtained from them by Mr. Milne, which are approximated more in colour to the male parent cœrulea, and laboured under a suspicion on that account of having been the fruit of a second cross by cœrulea, which was flowering in the immediate vicinity. Some time after a solitary fruit was borne by one of Mr. Milne's plants in the conservatory at Spofforth, and although there certainly was a plant of cœrulea in another greenhouse in the garden, at a considerable distance from the plant, there was no probability of its pollen having reached the conservatory, though it certainly was possible that it might have done so. Twelve seedlings were raised from the fruit, which was small, shrivelled, and quite deficient in juice, and those which have flowered not only approximated in colour to cœrulea, having no tinge of the red of its female progenitor, but were inferior to cœrulea in the beauty of the flower, and tenderer than that plant; neither of which circumstances were likely to have occurred, if they had been derived from a second cross with cœrulea. In the same manner I have found that the seedlings from the crosses, between the scarlet G. cardinalis and the white or purplish G. blandus, are always disposed to

degenerate from the colour of the more brilliant parent and approximate themselves to G. blandus, whether the scarlet cardinalis was the male or the female ancestor. It appears probable that this seeming disposition in fertile crosses to produce seedlings approaching to the least splendid of their parents, may arise from the effects of our climate upon them, which is more congenial to the duller coloured than to the brighter species; in which case it would follow, that if the crosses were planted in the native soil and atmosphere of their more splendid parent, the same degeneration of colour would not take place. This is, however, a conjecture which I have no opportunity of verifying. I was led in some measure to form it, by having once observed the flowers of the hardy Nymphæa alba of a pale rose-colour, after a fortnight of unusual and intense heat in July, which appeared to point out why the genus Nymphæa, which is white in our latitudes, is found blue nearer the tropics, and red under their influence. This suggestion does not, however, account satisfactorily for the mule offspring, being inferior to the mules themselves generated in a similar situation; but I have observed the seedlings from Hippeastrum Johnsoni or Regio-vittatum by its own pollen to have often a corolla both smaller and less brilliant than the mule plant itself, and this deterioration of the descendants may perhaps be in part attributable to the fertility of the mule being less vigorous and perfect than that of the original parents, when there exists some constitutional difference between them, which is the case in these three instances, Passiflora cœrulea being hardier than racemosa, Hippeastrum vittatum than regium, and Gladiolus cardinalis much more thirsty than blandus.

I have already spoken of hybrid cactaceous plants of the genus Cereus. Grandiflorus is also said to have been crossed with speciosissimus at Colvill's, and Ackermannius has bred with both phyllanthocides and speciosissimus at Spofforth, and I have been told that some of them have been also crossed with the very dissimilar truncatus. There is, therefore, every reason to suppose that the whole genus Cereus will intermingle, and the fertility of the existing crosses seems to open an unlimited field to the expectations of the cultivator. I entertain such doubt of the truth of the separation of Echinocactus that I would urge cultivators to try whether it will cross with Cereus. In no genus, however, are more valuable results to be obtained than in that magnificent ornament of our shrubberies, the Rhododendron, including the subordinate family of Azaleas, which together with Rhodora form part of the same genus. I had entertained an idea that the dwarf Alpine species would be found distinct from the rest of the genus, but I am satisfied the suspicion was unfounded, and I believe all the species to be capable of intermixing, though I have failed as yet in blending Az. Indica with any but its own immediate kindred. There is a strong plant at Spofforth from Rhodora Canadensis by Azalea Pontica (of which cross a great number were raised, but being very delicate when young most of them perished, as well as another cross from Rhodora by Rhododendron Ponticum), and small plants were raised from Rhodora by Azalea triumphans and Rhod. Ponticum. That by Az. Pontica will flower next spring for the first time. Four evergreen seedlings obtained from the seed of Rhod.

Ponticum, which I had fertilized at Spofforth with pollen of Az. Pontica, have flowered at Highclere. Two produced yellow fragrant flowers nearly of the colour of Az. Pontica, one had flowers of a paler yellow or lemon colour, and the fourth of an intermediate chestnut. I have raised many weak plants from the seed of Rhododendron by yellow and orange Azaleas, but I have found extreme difficulty in rearing them, and have lost them at an early age. I had the same bad success in trying to rear to maturity a pot full of mules between the white Australian Nicotiana suaveolens and the red Virginian Tabacum. The American Azaleas have intermixed with the Nepal Rhododendron aboreum at Spofforth, and under the care of Mr. Smith of Norbiton, at that time the gardener of the Earl of Liverpool, who also succeeded in obtaining seedlings from Rhododendron Dauricum sempervirens by the scarlet aboreum. The latter, which were curious little plants, are probably all dead, in consequence of his injudicious perseverance in exposing them at an early age in the open ground. I vainly endeavoured to rescue the last survivor from his hard treatment. It is remarkable that the difference of constitution between the Rhododendrons and the American Azaleas seems to render the mules more impatient of wet than either of the parents, which is manifested by a sickly variegation of the leaf, rendering it often difficult to rear them, and indicating the want of a more sandy and drier soil. This may be the consequence of crossing a deciduous with an evergreen species. It is probably on account of that discrepancy that no seed has been yet obtained from any Rhododendron-Azalea, though the crosses of evergreen Rhododendra are sufficiently fertile, and I have raised seedlings from Azalea Pontica-viscosa v. alba, and Calendulaceâ-viscosa v. rubescens, though neither are disposed to seed freely. The intermixture of the white Rhododendron maximum, which is not an accidental variety, but a widely-spread and permanent kind on the mountains of Jersey in America, with Ponticum, has afforded a beautiful white cross, which reproduces itself in perfection by seed, and from that, or the American white itself, with Azalea Pontica or the yellow Sinensis, or the still more splendid orange varieties of calendulacea, we may expect to obtain various Rhododendrons with more decidedly yellow flowers, hardier constitution, and larger stature than R. Chrysanthum. Seedlings from the white American Rhododendron, and also from a cross between Maximum and Ponticum, impregnated by me with pollen from Az. calendulacea v. chrysolectra, were in cultivation at Highclere, but they have been mislaid and perhaps lost. The fragrance of the Azaleas had been communicated to the Rhododendron, both by the Mitcham crosses and that of Mr. Chandler. The Indian Azaleas are probably capable of intermixing with the rest of the genus Rhododendron, and the beautiful lilac cross obtained by Mr. Smith abundantly between phœnicea and the white or ledifolia is very fertile, and has produced a great number of vigorous seedlings at Spofforth. Rhododendron Ponticum and Catawbiense have produced a cross which far excels the natural sorts in the size and complication of the umbels of flowers, and is amazingly florid, and the further cross Altaclaræ between that and the scarlet aboreum is of a colour beautiful in the extreme, and quite hardy enough to bear our winters, though more impatient of wet than the

Pontic and American plants, more fragile, and from its inheriting the early habits of arboreum, very obnoxious to spring frosts. A profusion of seedlings, now of large size and flowering, were reared at Highclere from the American blush-coloured aborescent Rhododendron, probably the maximum v. purpureum altissimum of Pursh, which is more like to Ponticum than to maximum, and requires a specific name (I suggest Aborescens), impregnated by the scarlet aboreum of Nepal, and this cross will probably be of great stature and magnificence. The plants of that American species or local variety have broad oval leaves. I have another permanent variety of American Rhododendron raised from seed gathered by Fraser from a tree in Pennsylvania, which he stated to have been the largest he ever saw, and capable of being sawed into large planks. It has the leaf narrower than Ponticum, and unlike any of the three kinds which are ranged under the name maximum. I should include it under the name aborescens. The white Nepal aboreum, with a feruginous underside to the leaf, and the beautiful but still rare campanulatum, are hardier than the red aboreum; and Dr. Wallich saw in one situation the red growing at a much higher elevation than it usually occupies, from which hardier variety he has given us hopes of obtaining seed; and from these sources, as well as from the bristly Rhododendron barbatum, when it shall flower with us, and the beautiful Rhododendron venustum of Silhet, which we hope soon to possess, our means of increasing the varieties of this desirable family will be multiplied. It is to be hoped that the seedlings which I have raised from the white Rh. maximum by aboreum, will not move so early in the spring and will suit our variable climate better. An intermixture between the white aboreum and the yellow or orange Azaleas will yield a plant of great beauty. The cross between Aboreum and Caucasicum has flowered and been duly appreciated. The mule Altaclaræ has been crossed again with a large red Azalea at Highclere, and Azalea Sinensis has yielded a most beautiful intermixture with the same red Azalea. The finest flowered cross I have seen is one that I possess between Arboreum and Catawbiense, and having forced this plant more than one season I have obtained seed from it, no other Rhododendron having been in flower at that time. The result is important, namely, that it requires no label to distinguish the offspring, which are as uniform and unlike all others in foliage as if they were a separate species; and so in fact they are, and, if planted by themselves in a congenial situation and climate, would be the parents of a distinct race. This cross I call Haylocki. The great complaint against the mules raised by the impregnation of the Nepal aboreum, is that they all partake of its irritability, and move so early that they are very frequently damaged by spring frosts. Finding them all as irritable as the male parent, I have lately raised from it crosses by R. maximum and others, hoping that such may inherit the tardier habits of the hardy male parent, which would greatly increase their value. They are as yet but two years old, and their constitution has not yet been sufficiently proved. In the lovely genus Rosa, I believe, little has been done except by the hand of accident, and the necessary consequences of cultivation and the approximation of species in gardens. Much re-

mains to be accomplished, but our climate is not very favourable to the seeding of the more delicate sorts, and the continental cultivators do not as yet take pains to obtain the results that might be expected from a judicious combination of the species, when rosa lutea, sulphurea, and bicolor shall be brought into union with the fragrant, the double, and the ever-blowing individuals of other species. The first decided original cross that we know was brought by Fraser from America, where it had been raised between the musk cluster and the ever-blooming Chinese, probably by accident; and, having been sold to Mr. Noisette, it has been made to bear his name, and, being more fertile in France than in this country, it has become the parent of an extensive family of beautiful varieties. From this plant Mr. Smith raised by impregnation with the yellowish Indian rose a variety of some merit, but not a good flowerer under general circumstances; and Rosa ruga is understood to have been raised in Italy from the Ayrshire rose by the pollen of the Chinese odorata, but the fact is not authenticated, and, if I am rightly informed, the great variety of cultivated roses, is owing rather to accidental than artificial intermixture. It is particularly desirable that those, who reside in quarters congenial to the seeding of roses, should exert themselves to intermix the qualities of the most estimable species. Many have been lately introduced of which I know not the origin. The honeysuckles also offer an easy opportunity of improvement, by intermixing the fragrant and more vigorous with the yellow and the scarlet. Fruit has been grown at Spofforth from the common garden honeysuckle by Fraser's scarlet, but it was plundered, when on the point of ripening, by robins. I have plants which I have raised from an early pale honeysuckle crossed with hirsutum, and with flavum. The French have favoured us with some desirable magnolias from M. Yulan, fertilized by obovata and gracilis, but the admixture of the Chinese species with the magnificent grandiflora, and with the very hardy tripetala is probably still in expectation. One of the most interesting genera, on which the process of intermixture has been successfully attempted, is that of Calceolaria, because it embraces plants of a decidedly shrubby and tender habit, and others which are completely stemless, and capable of retiring to rest under ground in the temperature of a British winter, and colours very dissimilar, the yellow and the brownish purple; and because most of the numerous species which have been imported appear to intermix with the greatest readiness, producing an endless variety of forms. The natural effect of crossing a yellow with a purple flower should be to produce various shades passing from the intermediate coppery tinge to the two extremities of purple and yellow, and such is the case in the mixtures between arachnoeides and the different varieties of integrifolia; but the cultivators of this genus were surprised by the breaking of the intermixture of the purple arachnoeides with Corymbosa, which has some purple specks on the corolla, so as to produce yellow flowers, broadly blotched with dark and even blackish purple; but the subsequent discovery of a Chilian biennial species which has not yet been figured, and which I call C. discolor, blotched with a reddish purple in a manner somewhat similar, shewed that such an arrangement of colour was a

natural variation of the genus, which the cultivator might therefore have expected, if all the natural species thereof had been previously brought to his knowledge. C. integrifolia in all its varieties, including the closely allied viscosa, is a woody shrub, attaining, if protected, the height of several feet (I have had viscosa ten feet high), but incapable of resisting many degrees of frost, while C. plantaginea is absolutely stemless, and so hardy, that although it loses its leaves in the open border, and disappears in the winter out of doors, yet even in the north of England it pushes again in the spring, and is only liable to be lost by drought in summer, or too great a superabundance of wet in the winter season. The application of the pollen of the latter to the shrubby integrifolia at once reduces the stature of the offspring from that of a shrub to a low semiherbaceous plant, not absolutely stemless, yet capable of retiring into winter quarters like C. plantaginea, and not exceeding a few inches in elevation. C. Herbertiana, though shrubby, has more affinity to the herbaceous species, being rather intermediate between integrifolia and corymbosa in its general appearance, and the effect of the application of its dust to C. plantaginea is to afford an offspring more absolutely herbaceous, and of which the leaves are partly radical and partly borne on recumbent sprouts. The same is the case with the cross between C. plantaginea and arachnoeides, which, though it pushes out a number of herbaceous branches, that die back in the winter out of doors, is perfectly hardy and spreads under ground, so as to form a large clump. The cross from C. plantaginea by rugosa (figured in the Botanical Register first under the name ascendens which is to be struck out, and afterwards a second time under the right name rugosa) grows but a few inches high, and is marvellously florid. It is further remarkable, that although the natural species in this genus have such diversity of habits, the crosses, as far as has been seen, are all fertile and able to intermix, ad infinitum, though they will not bear seed as readily as some of the natural sorts. Unfortunately C. corymbosa which has given us a cross with the most beautiful broken colours by intermixture with arachnoeides, called C. Youngi, from the nurseryman who first flowered it, is one of the most delicate species that have been introduced. C. plantaginea is covered with minute specks underneath, and the cross between it and arachnoeides is inclined to continue speckled, and not to receive the ornamental blotch, but to change the whole tint of the corolla. The cross of plantaginea with the annual crenatiflora is a hardy biennial one, but it has perished with me after flowering. C. floribunda, which endures a Yorkshire winter, may afford the means of elevating a conspicuous branching scape from an herbaceous stemless plant, and produce some very desirable crosses with species that have a more ornamental flower. One very singular monstrosity has shewn itself, though not permanently, yet frequently amongst the mules from C. plantaginea; the flower has assumed a form totally different from its natural shape, being like a bag or purse two inches long, widest in the middle, and gradually tapering almost to a point at the two extremities. Sometimes one or two such are on a stalk amongst the natural flowers, and sometimes nearly a whole head has consisted of them. This may authorize an expectation of very

curious garden varieties being hereafter produced in this genus. The whole genus agrees in constitution, liking a clear air, and a very moist soil. The hybrid Gladioli, of which a large portion are sufficiently hardy, flower about the same time as the roses, and contribute quite as much in general effect to the embellishment of the garden by their fine colours and profusion of blossom. They succeed very well in the natural soil of the garden at Spofforth, which is a good yellowish light loam, suitable for barley, and also in the artificial borders of peat and sand, where, however, in a dry summer they stand more in need of water. These hardy crosses are between G. Cardinalis, blandus, carneus, inflatus, angustus, and tristis, and they vary with every shade of colour from white to scarlet, rose, coppery, and blackish purple, and some are exquisitely speckled in consequence of the cross with tristis. They succeed best when grown into a thick tuft, in which state the profusion of blossom is admirable, the cluster of bulbs and the old skins of decayed bulbs permitting the wet to drain away, and preventing the earth from lying too close and heavy on the bulbs in autumn and winter. Clusters have now stood undisturbed at Spofforth above twenty years, with the precaution of covering them with leaves from November to March or April. There is danger in disturbing and parting them, for numbers will rot if re-set separately; and, if they must be divided, it is best to do so in April, or, if it be done in the autumn, the roots taken up should be potted, and turned out again in the spring. The beautiful crosses with hirsutus, recurvus, and versicolor are more delicate plants, and do not succeed well in the border. I have not succeeded in obtaining any cross, on the correctness of which I can depend, by admixture with Gladiolus psittacinus (Nathalensis), and I do not believe that it will breed with any of the above. Like all the European species, it presents its flowers in front of the stem, which is erect; and repeated experiments have shewn that every flower of G. tristis which was touched with the pollen of G. Byzantinus only, failed of making seed, while every flower to which the natural pollen had access produced it, and I consider the union of Byzantinus with any of the species above enumerated, except Psittacinus, to be impracticable. I consider Alatus to belong to the same family as Psittacinus, and also a beautiful species imported, likewise, as I understood, from the neighbourhood of the Nathal river, which I propose to call G. oppositiflorus. It is now sold by the Dutch nurserymen under the name floribundus, which has been long preoccupied. Its flowers, twenty-four or more in number, present themselves alternately from the two sides of a robust erect stalk. Blandus, Cardinalis, &c. have the flowers rising upwards from the back of a bent stalk, and seem to constitute a family distinct from those which present themselves in front. G. oppositiflorus has the flower much undulated, white, dashed with pinkish purple. The genus Gladiolus ought to be divided into at least two sections or sub-genera. I consider a sub-genus to be such a portion of any genus as will not intermingle with the rest, and has some distinctive appearance, but insufficient to induce a belief of their original diversity. Seedling Gladioli will flower often the first autumn; the best treatment is to sow the seed in pots, and give them shelter till the seed-

lings are pretty strong, and then turn out the ball unbroken into the border, where they will produce a crowded nosegay of flowers of various shades of colour.

It is not, however, by crossing different species or local varieties of plants only, that the cultivator may add to the beauty of his collection. Much may be done undoubtedly by crossing judiciously the finest seminal varieties of such plants as have been already improved in our gardens, and are disposed to break into a multiplicity of forms or colours.

It is to be observed, that in some cases the seminal varieties of plants preserve themselves almost as distinct in their generations as if they were separate species: for instance, the cultivated double holyoaks, of which at least the orange, the yellow, the white, the black, the red, and the pink, may be raised with certainty by seed from plants of the several colours, although planted near together in the garden; and it is probable that if gardeners were to take the trouble of crossing them with the pollen of plants of a different colour, a greater multiplicity of hues would be procured. In carnations also the seedlings have a great disposition to follow the colour of the parent plant. I have had greater success than any other person in raising from seed double camellias of various tints and appearance, and some of the best have been produced either from single flowers or plants raised from single ones, impregnated by the pollen of double flowers, preferring, where it can be got, the pollen that is borne on a petal. The new seedlings that flowered with me in one spring for the first time were nine full double; three semidouble, of which one was very fine, and only three single; but such an unusual result is not to be obtained without particular attention to the mode of treating the mother plant while in flower and seeding: the method which I have adopted being to keep it in confined air, with a superabundance of water, even to the detriment of its health, and to prevent it from making young shoots, in a great measure, if not entirely, by which means an exuberant degree of nutriment is forced to the seed vessel. The reason that the seedlings raised by some nurserymen are so very inferior is, that their plants are in the most luxuriant growth; and it cannot be expected that seed gathered from individuals growing with freedom and vigour, should not be more disposed to reproduce the natural form of the plant, than to yield the fine cultivated varieties, which are to be obtained from them when almost diseased by repletion. The finest double varieties of Camellia Japonica which I have so raised are as follows:—

From the single white by the pollen of the Pompone, 1. var. Spofforthiæ, or *Spofforth striped,* very large and very double, white, with a few pink stripes, and occasionally one or two anthers.—2. v. Maculósa, or *Calypso,* do.—3. v. Haylocki, or *Haylock's white;* pure white, rarely a few anthers.—4. v. Ebúrnea, or *Ebur;* very vigorous, pure white; somewhat waratah shaped.—5. v. Nivósa, or *Nitor;* double white, variable in form.—6. v. Fortuita, or *Fortúna;* very like var. 1.—7. v. Lactescens, or *Luna;* double white. From seedlings impregnated by the Pompone, which had been raised from the common single red by the striped.—8. v. Púmila, or *Circe;* regularly formed double white dwarf myrtle-leaved.—9. v. Ulantha, or *Hylas;* white striped with pink; flowers in four uni-

form compartments.—10. v. Lysantha, or *Lysimachus;* flowers if possible more regular than the buff or old double white, red with a watery white line and margin to each petal. A very erect plant of rapid growth with flowers of first-rate merit.—11. v. Victric, or *Victoria;* own sister to Lysimachus, equally regular, of the colour of a full-blown cabbage rose, paler near the edges. From the Chinese semidouble by Pompone.—12. v. Picta, or *Alcméne;* very regular in general; with a pink stripe usually on each petal, the white changing after some days to blush, sometimes less regular, with one or two anthers; very beautiful. From the Pompone.—13. v. Spofforthiana rosea, or *Idúna;* superior to the Peony-flowered in form and colour; the flower has always some anthers like its parent. From the waratah by the striped.—14. v. Foliolósa, or *Amalthéa;* flower-shaped like the rose-scented peonia edulis, v. rosea, red, with about 350 petals.—15. v. Conferta, or *Odin;* fine double red, not regular. I have never seen any anthers in either this or the preceding.—16. v. Porrecta, or *Bellóna;* fine crimson; branches horizontal or weeping. From waratah by Pompone.—17. v. Modesta, or *Hebe;* flower nearly regular, of a delicate purplish pink. From waratah by 13. Iduna.—18. v. Rosígena, or *Penélope;* double red. From a seedling from single red by striped, fecundated again by striped.—19. v. Molesta, or *Némesis;* very double red, but a delicate plant.—20. v. *Venósa,* or Venus; flower regular, but not sufficiently full, red veined with white. This has produced but one flower yet, and I am not sure of its permanent superiority. Many others of much merit I have not thought worthy of being named; and amongst them is one full-double red, raised immediately from the common small-flowered single red. I have a great multitude of seedlings which have not flowered yet, from which I anticipate much beauty and variety. I scarcely entertain a doubt that the double pink Camellia Sesanqua (Maliformis of Lindley) is a cross-bred plant between C. Japonica and Sesanqua; and, from its seeming sterility, I cannot but suspect that C. reticulata is not a genuine species, but a cross, perhaps obtained from some species still unknown to us.

Mr. Chandler obtained some very fine varieties from the waratah, impregnated by the striped, one season, but those which he has raised since have not proved good. It is, therefore, probable that there was some difference in the treatment of the plant or plants which bore seed for him that season, though accidental and unnoticed by him. His finest productions are eximia, somewhat like imbricata, Bironi, one-while called concinna, a very remarkable flower, regular and oddly flattened, but very beautiful; Woodsi, a large rose-coloured flower, quite double, but cup-shaped and hollow in the centre, requiring a little warmth to flower it in perfection; Chandleri, striped, sometimes very fine, but not always equally so. His élegans, rosa sinensis, and flórida, are handsome also; corallína and althæiflora sometimes, but often producing poor semi-double flowers. His anemoneflora alba comes very near in flower to its parent the Pompone, with a much less hardy constitution. Mr. Gray produced three cross-bred seedlings, of which Press's eclipse is the best, and Colvill's nursery two speckled seedlings of considerable merit, though very irregular, and too muddy in the colour. I have seen no

other seedling Camellia that deserves to be preserved, but I have been told that Mr. Gray has since raised a good red one. His former plants were said to have been crosses between the single white and Chinese semi-double. These observations may perhaps tend to the raising still finer varieties, when the mode of obtaining them is rightly understood. I have no difficulty in obtaining seed from any given flower of the Pompone or Middlemist's Camellia, by putting it in a house rather warmer, and with less admission of air, than suits greenhouse plants in general; impregnating the stigma, and taking off the corolla before it begins to decay, and cutting away the petals that adhere to the germen or young seed-vessel, that the air may have free admission to it; without which precaution it will perish in most cases from damp. The striped sorts have usually more white in their flowers when they flower early in the spring, and it seems that the seed ripened earliest in the year is the most apt to yield white or pied seedlings. There is a strange mutability in the flowering of Camellias, of which the Pompone, which has been called on that account variabilis, furnishes a striking instance. It has four distinguishable kinds of flower, the pure white and the red-eyed, which appear promiscuously, the brindled pink, and the rose-coloured, which may be kept separate with tolerable certainty by grafting from the branch that bears them, the rose-coloured form being the Peony-flowered of the nurserymen. There is a branch on my oldest plant of the peony-flowered, which has reverted to the pure white colour, an occurrence less common than the departure from it. Carnations, which have run to red, very seldom revert to the white-stripe. I have been informed that the Chinese do not reckon seedling Camellias confirmed in their habit, till they have flowered six or seven seasons without becoming less double. I have not found any of mine, thus raised several years ago, degenerate from their first appearance. Of the Chinese, the double white, the buff, the fringed white, and, as far as we know, the red variety, called imbricata, are the only sorts that never bear anthers. Having cultivated the myrtle-leaved above twenty-five years, I never saw that variety bear an anther in my collection, except one season, when all the flowers on every plant of the kind had them, and they were found in two or three late flowers last year; but the seedlings reared from its pollen, of which great expectations were entertained, proved to be the worst I had ever raised, and it seemed that whatever peculiarity of the season inclined the flowers to deviate from their usual double form, and approach nearer to the fertile single-flowered original, disposed also the pollen to generate single seedlings. I have seen the myrtle-leaved with anthers at Mr. Knight's nursery, though the circumstance has been so rare in my own collection; perhaps it may be connected with the more or less luxuriant growth of the plant.

It is to be lamented that more experiments have not been tried to improve the races of agricultural vegetables by crossing. I impregnated in 1834 with great care the Swedish turnip (ruta-baga) with pollen of the white, and another branch thereof with that of the red-rooted turnip, which produces perhaps a greater tonnage than the white, bearing both frosts and unfavourable summers better, and thriving in soils where the

white does not succeed. The seed was sown immediately, and the plants of both crosses, though late, formed pretty good roots. The leaves differed in appearance from those of the Swedes, and did not, like them, retain the rainwater on their surface. In the following spring they were set for seed in two different situations where no extraneous pollen might have access. The flowers of the greater part were of the bright yellow of the two male parents; a smaller portion in each lot produced straw-colour blossom, like that of the Swede: but not one shewed the least disposition to an intermediate tint; and it seemed as if those two colours were incapable of blending, or modifying each other. I have a crop from their seed this year, but the season has been particularly unfavourable for all turnips; the fly destroyed the first sown, and the plants being again too backward, I do not think their value will be fully ascertained from the present crop.

There seems no reason to doubt that better varieties of wheat, oats, and barley may yet be obtained by combining the hardiness of one, with the productiveness of another sort, and the finer skin or greater weight of a third. I am inclined to think that I have derived advantage from impregnating the flower, from which I wished to obtain seed, with pollen from another individual of the same variety, or at least from another flower, rather than with its own; and as races of animals are known to degenerate, if they are perpetuated by the union of near kindred, it seems not unlikely that vigour may be given also to any race of vegetables by introducing a cross, though of the same kind, and especially from an individual grown in a different soil or aspect. To illustrate this, I will state a circumstance which occurred last summer in my stove. Nine very fine crosses of Hippeastrum were flowering there at the same time; one a natural seedling from Johnsoni or Regio-vittatum, two Johnsoni-pulverulentum, one Johnsoni-vittatum, one Psittacino-Johnsoni, one from Psittacino-Johnsoni crossed again by Vittato-Johnsoni, one from Johnsoni by Solandriflorum, and two from Vittato-Johnsoni by the same. Being desirous of blending again these plants which were all cross-bred, different flowers were touched with pollen from their several neighbours and ticketed, and other flowers were touched with their own pollen. Almost every flower that was touched with pollen from another cross produced seed abundantly, and those which were touched with their own either failed entirely or formed slowly a pod of inferior size with fewer seeds, the cross impregnation decidedly taking the lead. It appears to me that this circumstance may be analogous to the introduction of a male from another flock or herd, which has been found advantageous to the breed of domestic animals; and I would advise gardeners to try the effect of setting flowers with the dust from another individual in preference to their own, with a view to obtain an improved breed.

It is only from the superior efficacy of the pollen of another plant, that we can account for the circumstance of some hybrid plants, which breed freely with plants of either parental stock and fecundate them, not producing seed readily when left to themselves; for if their pollen is able to fertilize, and their ovary to be fertilized, there can be no positive

sterility in the plant, though there may be a want of sufficient energy under certain, or perhaps under ordinary, circumstances. Many centuries of experimental cultivation must elapse before the subject can be, if ever, fully understood; and I cannot suppose that my present view of it will not require to be modified by the results of future investigation. For instance, there seems little prospect of being able to answer why the hybridizing process is so easy in some genera and so difficult in others, if equally facile of access, unless it shall be found to arise from greater or less constitutional conformity.

The genus Calceolaria affords greater facility than most others, because its stigma is nearly obsolete before the pollen of the flower is ready, and, in the earliest stage of the bud, it is easy to lift up the corolla, and take out the anthers, which are then comparatively large and exposed, and the stigma may be fertilized at that early period, when it is defended by the covering of the corolla from any accidental intrusion. Amongst the Amaryllideæ there is for the most part much facility of performing the operation in the several genera, the anthers not being reversed to display the pollen till a little while after the expansion of the flower; yet in the genus Hippeastrum there is a complete readiness of all the species to intermix when crossed artificially, and in the genus Crinum nearly so, while in Zephyranthes it is extremely difficult to obtain hybrid seed, and repeated disappointments occur from the escape of some particles of the natural pollen in taking out the anthers. In the genus Crinum one unintelligible impediment appeared for a long time to exist. C. Capense, which bred freely with every other species, refused to be fertilized by the tropical Cape-coast kinds, Broussonetianum, and petiolatum or spectabile. A seedling has, however, at last been obtained at Spofforth from C. Capense by the latter, which I believe to be correct, and it can scarcely be doubted that the difficulty arises from some constitutional peculiarities in those plants. In general hybrid plants have been found to be excessively florid, but sometimes the contrary has been the case, and there appears to be some impediment to the perfection of their blossom. The mule between Hymenocallis disticha and rotata, which was raised many years ago, whether it be in the stove or in the open air, where it grew against the front wall of the stove, throws up, after its proper time of flowering, an abortive scape, on which the buds are dead and discoloured, as Amaryllis Belladonna does at the time its leaves push in the spring, when the previous autumn has been unfavourable to its flowering. In the course of above fourteen years since it was raised, it has only once attempted to expand its flowers, and that in a very unsatisfactory manner in the stove; but I have lately had reason to suspect that more wet is necessary to it than to either of its parents, and perhaps absolute immersion at the time of flowering. I may take this opportunity of stating that the plant which I fancied many years ago to have been obtained from C. Capense by Hymenocallis (then Pancratium) disticha, proved, as it advanced, to have been by C. Canaliculatum. There had been an error in the memorandum made concerning it, or the flower had been touched by the pollen of both plants. A very interesting Crinum, of which only one plant was raised, from C. defixum

by speciosum for several years put forth abortive scapes, but it has flowered well the two or three last seasons, though it has yielded no increase in any manner; neither has the fine plant which was raised from Scabrum by Canaliculatum. One of the handsomest white sorts, from C. brevifolium by the larger variety of erubescens, having a strong red root-stem, somewhat like Amabile, has afforded many offsets but no seed. The only genus in which I had observed barrenness of the offspring appearing to arise from the botanical difference of parents, whose constitution seemed very similar, was Nerine, of which the crosses between the division with regular and that with distorted filaments had borne no seed; but in that case the discrepancy was so important that it might have been almost supposed to afford a generic distinction, and Mr. Salisbury had named the Distortæ Loxanthus. In the article Nerine, p. 283, I have given an account of a mule from the distorted N. pulchella by the regular curvifolia, of which the flowers are exceedingly similar to those of the cross between undulata and curvifolia, plate 45, but more healthful and free. The last-mentioned cross, as far as I have seen, is quite sterile, the parents having differed not only in regularity of perianth, but in the mode of flowering; for the inflorescence of undulata is centrifugal—that of pulchella, as well as curvifolia, centripetal; from which conformity I anticipated the more probable fertility of the mule. That conjecture has been verified, since the former pages were sent to the press, by the production of healthy seed from the mule curvifolia-pulchella, and an abundant crop from two plants of curvifolia by the pollen of the mule, no other Nerine having been permitted to develop its anthers on the premises. Here, then, is a feature which had been overlooked, which seems, nevertheless, to have a powerful influence over the fertility of the offspring. The seeding of this mule is fatal to Salisbury's genus Loxanthus, if any doubt could have remained after the production of the former intermixture. In the tubular African heaths the pollen remains confined, unless the anthers are touched by something inserted, as the point of a pin or the proboscis of an insect, when they spring asunder and discharge it. This genus, therefore, affords greater facility of intermixing, and it is probable that some of the native species, which are said to be quite local, have been produced by accidental intermixture of two other kinds. There is a natural species of Goodia, quite permanent by seed, which I had many years ago named intermedia, but which appears in Sweet's Hortus Britannicus under the name subpubescens, which is so exactly intermediate between lotifolia and pubescens in all points, that it can scarcely be doubted that it might be produced by crossing those two species. Amongst other crosses of Ericæ, I obtained at Mitcham many plants from two very dissimilar, namely, from Jasminiflora by vestita coccinea, which had the foliage slender and near an inch long. The late Mr. Salisbury had conceived that those two species, being distinguished by a shorter and a longer and more pointed pod, were referable to two distinct genera to which he had accordingly assigned names, and he told me that I should fail in my attempt to cross them; which was answered by shewing him the seedlings then several inches high. They were all lost on, or soon after, removing to Spofforth before they had flowered, though one of them was above a foot high. The

disposition to sterility which had been stated to exist especially in the offspring of parents of different constitutions, offers a great impediment to the unlimited use of crossing in the fruit-garden, but it is certain that great advantage may be derived by the cultivator, who will strive to bring together the various good qualities of the sorts between which no such obstacle exists; and the complete fertility of the fruit-bearing Cerei makes it very uncertain where such obstacles will be found to interfere, before the experiment is made. I have already mentioned that Crinum scabro-capense, though the pollen of different species was applied to it had continued about sixteen years perfectly sterile. In 1834 a plant of it which had been growing the greater part of that time out of doors in front of the stove, produced one small seed. It vegetated, but the leaf was from the first of a yellowish white, and the plant did not live many weeks. In 1835 it produced another and larger seed, the early part of the summer having been very hot both those seasons. This seed was sown in white sand to try to save it from perishing like the former, and a thriving young plant has been obtained from it. Whether they are the produce of its own pollen, or that of Pedunculato-capense, which grew beside it, cannot yet be judged with certainty; but the seedling now growing vigorously, has deep green leaves, and does not shew any approximation to the glaucous hue* of C. Capense, of which a large bed was not far off; and that hue would probably have been very apparent, if it had been so crossed again. I had often attempted to fertilize C. Capense by the pollen of this beautiful mule unsuccessfully, but the circumstance of the two seeds it has borne shews that it is possible to obtain such a second cross, which would be a great acquisition, as it would certainly yield a plant of hardier constitution, and able to bloom in our open gardens, with much greater beauty of flower than Capense itself.

I have not found as yet the results which might perhaps have been expected, and which Mr. Knight seems to have obtained, from carefully blending the pollen of more than one species before its application. I attempted to fecundate calceolaria plantaginea with the pollen of twelve species, most industriously mixed together, but very few seeds were ripened, and the produce differed very little from those which had been procured by the pollen of one of the twelve species. Further experiments are necessary to establish how far the influence of different males can act simultaneously, by admixture of the dust. I have obtained mule seed and natural seed from the same capsule, but they were probably formed in different cells. Experiments should be made to ascertain whether, in cases of partial and imperfect fecundation, the pollen of another species, and even of nearly allied genus which could not alone fertilize the ovary, can act in conjunction with a single grain, or at least with an insufficient quantity of the natural dust to effect the fertilization,

* Since these pages were prepared for the press, the supposed seedling from C. Capense by Spectabile, which had grown very slowly, having been immersed in water in the stove has pushed vigorously, and my present opinion is that it will prove to be a natural Capense produced by the escape of some particle of maternal pollen, notwithstanding all the precautions which had been taken. This seedling had been glaucous from an early age. The refusal of the W. African species, Spectabile and Broussonetianum, to breed with Capense is therefore not yet overcome.

and occasion the seed to produce a variety, not actually hybrid, but in some degree departing from the natural form. See, above, the account of Hymenocallis amœna, var. lorata, p. 211. It is certain, by the result of many experiments, made at Spofforth, that the pollen of a nearly allied genus, which cannot effect the production of seed that will vegetate, will often cause some of the ovules to swell to a large, and occasionally to a preposterous, size, and become seed-like masses without an embryo, and the same circumstance has been observed in Germany; and, as it can act so far, I do not see the impossibility of its influencing the character of the produce, where the access of natural pollen is insufficient; and it seems to me questionable whether some of the singular varieties which occur among vegetables may not have been so produced.

A very singular occurrence in the history of cross-bred plants took place last year in the garden of my brother (Hon. Algernon Herbert), at Ickleton, in Cambridgeshire, which deserves the attention of naturalists. In 1834 he purchased a plant, grafted from a hybrid Cytisus, known to have been raised in France between C. laburnum and purpureus, of which the leaves are as large as those of laburnum, though a little different in form, the flowers of a dingy and rather coppery purple in long racemes. The plant purchased consisted of a strong laburnum stock about 8 inches, and a grafted scion about 16, high. Its growth that year was vigorous. In 1835, from a strong branch, which was not in existence when the plant was purchased, proceeded a small shoot a foot and half long, covered with small leaves of the exact size and very nearly of the form of those of the little C. purpureus, while the rest of the tree, having reached the height of 8 feet, had the usual large foliage, approaching in appearance to that of the laburnum. This extraordinary branch, which has in a great measure, though not exactly, assimilated itself to the structure and habits of that one of the two parents to which the mule had originally the least resemblance, has this year, like that parent, produced small flowers, four at each joint, from the axills of the leaves, in the same manner as C. purpureus, and of a colour more purple than the pendulous racemes on the other branches, which had about 16 flowers on a spike. This fact is scarcely less wonderful than if a mule, between a mare and an ass, were at three years old to acquire an ass's tail. It was positively stated to me, 30 years ago, by a nurseryman, that Spong's rose was not a seedling, but an accidental sucker from the rose de Meaux, which had assumed a different character of leaf and flower, and maintained its diversity: a phenomenon which, if true, appears to be in some degree analogous. I have also seen the flower of the yellow Austrian rosa lutea borne upon a branch of the two-coloured var. bicolor, improperly called a Persian species, purpurea, by Sweet; but certainly a garden cross from lutea. Jacquin had observed, also, that this two-coloured plant sometimes bore flowers entirely yellow.

I am not informed which was the female parent of the hybrid cytisus, but I entertain no doubt that it was the laburnum, because the foliage approximates to it, and the flower follows rather the colour of purpureus; as the mule Rhododendrons by Azalea Pontica have the evergreen leaf of the former, and are more disposed to follow the yellow col-

our of the latter. The natural leaves of the hybrid cytisus are about four times as long, and four times as broad, that is, sixteen times as large as those of the curious branch on which the leaves are as crowded as on C. purpureus; the general foliage of the tree, though altered from the exact shape of the laburnum, being little, if at all, reduced in size. I have been told, but cannot verify the fact, that a like circumstance has occurred in France to a plant of the same mule. Grafts or layers from the anomalous branch will in all probability preserve their acquired character, and be so propagated as a distinct plant.

It was apparent to me that no botanist had been able to distinguish Nicotiana, Salpiglossis, and Petunia, except by features which I knew to be unsupported by the fact, though Salpiglossis, in my humble opinion, has been erroneously placed in a different order and alliance from the others, plants with five stamina being considered Solaneæ, and those in which the fifth is wanting Scrophularineæ. I had ascertained the utter invalidity of that feature, having seen flowers of the same Salpiglossis with only four stamens, with five fertile stamens, and with four fertile stamens and one abortive; and, as in Nicotiana the fifth stamen is always of a different power and inserted differently from the other four, I was inclined to believe them to be one genus, and I made a great many attempts to cross them, but in vain. On further examination of those plants I find a diversity of the seeds, which are very small, and must be examined with a magnifier. Those of Salpiglossis are angular; see pl. 43. f. 50. In other respects, although its aspect is easily recognized, it is not so easily separated by any decided distinction from Nicotiana; and it has been incorrectly characterized by one of the stamina barren, since the fifth is sometimes entirely wanting, and sometimes fertile. The character of Nicotiana in the Bot. Mag. is quite untrue; founded on one species, and inapplicable to others. That genus affords an instance of the unimportance of the more or less continued adhesion of decurrent filaments, the adhesion varying greatly in the different species. See the seeds of Nicotiana, pl. 43. f. 51 and 52. They are not angular, but more oblong and reniform than those of Petunia, which are nearly round, and pitted all over. See Pet. linearis, pl. 43. f. 48. I never doubted the diversity of Nierenbergia, but it stands yet undefined. Dr. Lindley characterised it by the reflex uneate lobes of the stigma, but the stigma will prove often a treacherous feature in botanical characters; and Professor Don, having found in N. aristata a stigma of which the lobes are very little more reflex than in Petunia, at once assumed that they were one genus. They are, I doubt not, substantially distinct, but the generic character of Nierenbergia must be, *Tube slender cylindrical, limb wide-funnel-shaped, stamina adhesive to the style and stigma.* I have never seen more than one seed perfected in a pod of Nierenbergia, the rest of the ovules proving abortive, and the capsule so small that it is often overlooked when ripe; the seed of filifolia is oval with the back rounded. See pl. 43. f. 47. I see nothing in N. aristata to reconcile it to Petunia. The lovely N. calýcina has a much greater affinity to Petunia from its trailing inflorescence and general aspect; but, if petunia can be shewn to be one with Nierenbergia, there will remain

nothing to separate them from Nicotiana. I am, however, now almost satisfied of the diversity of Petunia and Nicotiana, wishing, however, cultivators to persevere awhile in the attempt to cross them; for Petunia and Nicotiana have much closer affinity than the others, and their distinction is more questionable. I am, however, by no means satisfied that, if they are distinct, Petunia linearis (Salpiglossis integrifolia, Bot. Mag. Nierenbergia, Sweet's B. f. g.) may not belong to a fifth genus. It is certainly neither a Salpiglossis nor a Nierenbergia, and its seeds conform with Petunia, but it has a different aspect, and I cannot cross it with the other sorts of Petunia. It will belong at least to a separate section of Petunia with linear leaves. It is very remarkable that, although there is a great difference in the form of the flower, especially of the tube, of P. nyctanigenæflora and phœnicea, the mules between them are not only fertile, but I have found them seed much more freely with me than either parent. The mules I had raised from the former by the latter, having been forced early in the spring of 1835, set their seed before any other petunia was in flower on the premises, and must therefore have been fructified by its own pollen. The white impregnated by the dust of the mule, and the mule by it, produce a great deal of sporting, but from a pod of the abovementioned mule to which no pollen but its own had access, I had a large batch of seedlings in which there was no variability or difference from itself; and it is evident that the mule planted by itself, in a congenial climate, would reproduce itself as a species; at least as much deserving to be so considered, as the various Calceolarias of different districts in South America.

I have little to add to this treatise, but my regret that it is necessarily so imperfect; and, from the nature of the subject and the additions made to it since it was first written, of somewhat too desultory a character. I hope, however, that it may have the effect of removing some erroneous impressions, and contribute its humble mite towards the elucidation of truth; and that, by giving the public a clearer view of what has been effected, it may enable those, who are disposed to pursue experiments on this subject, to conduct them with greater advantage. I have by no means enumerated all the genera in which crosses have been lately introduced, as for instance, Potentilla and Anagallis, in the last of which I have seen a remarkable result in the production of a reddish purple flower, by the union of the orange with the bright blue. I have an hybrid from the little Hibiscus ficulneus by manihot, which, with leaves that preserve the form of those of ficulneus, has the vigor and statute of manihot with its terminal spike, but with small axillary flowering branches also. I had likewise a cross from H. palustris by speciosus, but the plants were so delicate that all died before they had made a fourth leaf. I apprehend that several genera are comprehended under the name Hibiscus, which shews a great diversity of fruit, and an interesting course of experiments might be conducted to ascertain whether any cross can be obtained between those which differ in that respect, and whether they are all convertible within certain demarcations. Cultivators are too apt to believe they have obtained the cross they have been desirous of producing, when they have really a natural seedling variety. I can

have no doubt in saying that the plant figured under the name Azalea Rawsoni, (Paxton, p. 123.) which Mr. Rawson's gardener fancied to be a cross between Az. Indica and Rh. Dauricum, is not allied to the latter plant, but a genuine Az. Indica, perhaps from a cross between two varieties of that plant. In speaking of the varieties of Camellia, I should have noticed Ford's handsome variety in Paxton's work, but I never saw it, and am ignorant of its orgin.

THE EARLY HYBRIDISERS AND THE ORIGINS OF GENETICS

C. D. Darlington,

John Innes Horticultural Institute, London

The importance of the early hybridisers, Kölreuter and Gärtner, Knight and Herbert, lies in what their work did to lay the foundations of genetics as we know it to-day, and in order to understand what this means we have to enquire what those foundations are.

The Greek philosophers who first speculated about the nature of things paid more attention than is generally realised to problems of heredity. And what they said is worth considering, because they disputed about questions that we still dispute about. Their problems are still alive. They were mainly concerned with animals so far as sexual reproduction was concerned, although they, or at least some of them, realised that a differentiation of sexes occurred in plants. They had already learnt what some primitive people have not yet learnt, that the male as well as the female are necessary for reproduction. Some even considered the male the most important, a view still expressed in our social usage. It was generally held that evolution of some kind had taken place, though its comprehensive nature was not generally grasped. In regard to its mechanism a wide cleavage of opinion arose between two schools. There were on the one hand those who like Aristotle supposed that a purpose, divine or natural, worked by the inheritance of acquired characters to produce conformity with an imagined harmony of nature. On the other hand there were those who saw no purpose or design in the order of things, and conceived of living organisms as growing and changing according to deterministic laws, laws which equally governed non-living beings. Such a cleavage still persists to-day.

These disputes did not rest on the strict experimental evidence that can now be adduced but merely on observations of a world which clearly provides by its ordinary changes the means of testing many fundamental hypotheses as it still does in astronomy and cytology. From such observations emerged one theory which we ought to keep in mind because it agrees in so many respects with the views underlying modern genetics. This was the theory developed with closely reasoned argument by the atomic and materialistic philosophers and preserved for us largely in the great poem of Lucretius. It may be summarised under five heads—(1) Material bodies handed down from one generation to the next determined heredity both of body and mind. Matter being atomic, inheritance was atomic or particulate as we now call it; (2) The offspring were derived from materials of both parents, sometimes more of one than of the other, the two being therefore merely statistically equal; (3) Separation and recombination of these bodies in the course of sexual reproduction was responsible for the separation, recombination and reversion of characters; (4) Evolution occurred in the sense that some species became extint while others changed. Man for example had developed from brutish ancestors without law or language. There was no all-embracing scheme of evolutionary change and there was equally no

conception of species being fixed; and (5) New structures arose by chance and survived if they were useful. Nature eliminated unprofitable types. They did not come into being for a purpose or in response to use. Aristotle thought this was leaving too much to chance, an argument that was equally to be used against Darwin.

There is no doubt that with the coming of Christianity the unpalatable views of the atomists were suppressed. Divine purpose and the inheritance of the effects of sin are part and parcel of revealed religion as well as of popular prejudice. When philosophical support was needed by the mediaeval church to satisfy the growth of intellectual enquiry, Aristole was established as the authority and the materialistic explanations of heredity, if they had not already been forgotten, were left unheeded. Just as the flat earth and geocentric theories already rejected by Greek mathematicians had to be disproved again by modern astronomy, so the fixity of species and the inheritance of acquired characters rejected by the atomists had to be unlearnt again by modern genetics. In both cases the new discovery seems to have disregarded the old. The traditional opposition to it has also been deeper and the proof therefore has had to be more rigorous.

Modern science is not derived from Greek atomism but it is in harmony with it. Modern science is philosophically inarticulate. Its philosophical method has been expressed by Bacon, but it was intuitive in Bacon's contemporaries and has remained so in most of their successors. The complexity and specialisation of recent science has aggravated this fault and has led to special errors that we shall see later. Modern biology has therefore developed in complete ignorance of Greek materialism. It has had to start from the beginning again. Indeed, worse than that, it has had to start with the special incubus of the dogma of special creation, a dogma which has taken 100 years to destroy. One effect of this dogma was probably to attach greater interest to the precise determination of species than would otherwise have arisen. Since species were as they always had been, they would likewise remain as they always had been. Their describers borrowed an eponymous immorality from the dogma of fixity they religiously applied. The vastly increased flora and fauna thrown open to our study by the great navigations have occupied systematists ever since. But it would be a mistake to imagine that the founders of systematics considered species in the formal way that has been adopted by most of their imitators. John Ray in 1686 gave us a definition of a species which cannot be improved upon to-day. It is not a definition generally used by systematists. No more certain criterion of a species exists, he says, than that it breeds true within its own limits ("nulla certior occurrit quam distincta propagatio ex semine"). In other words the species of convenience is also the species of descent.

Ray's definition, like Linnaeus's which followed it, was genetic. It was with them a working hypothesis and no dogma at all. The need of testing it was to a great extent the stimulus of the early hybridisers. During the lifetime of Linnaeus it became gradually realised that species of plants as well as animals would cross and even give fertile hybrids. The foundations of the notion of fixity were being undermined. And

Linnaeus realised it although again his disciples did not. In his essay on the sexes of plants in 1760 we find him asking himself whether all the members of a genus cannot be supposed to have a common ancestor, and bravely advocating the study of hybrids to his fellow botanists.

Linnaeus's advice had been anticipated by the work of Kőlreuter, who published the first extensive treatment of artificial hybrids in the following year. Kőlreuter's book marks an important advance in two ways. He not only made controlled crosses between species; he attempted to find out what the physical means of reproduction was at the same time. He examined pollen-grains and he tried to see whether individual pollen grains would succeed in fertilisation. His observations showed the lines on which future progress would be made, but he was not very successful. The microscope was still inadequate. Consequently Kőlreuter spoke of mass effects where we would now speak of individual combinations. Kőlreuter, unlike Linnaeus, did not consider that hybridisation made possible the production of new species or could be held to account for the origin of old ones. To him and to his contemporaries the sterility of hybrids proved the fixity of species, and if a hybrid was not sterile its parents were not different species. The important evolutionary bearings of hybridisation were therefore lost until the question was taken up by Herbert in 1819.

William Herbert was at once a practical systematist and a practical hybridiser. He knew that he could "create" (as he called it) new forms by hybridisation within genera. He knew that in some genera all the species would cross. He believed that organisms had been created by the Almighty at a relatively recent date. He therefore concluded (as Linnaeus had done but with more evidence and more conviction) that the genera had been created and that the species were derived from them by later change. With his religious convictions no more was possible. It was however the thin edge of the wedge that Darwin drove home.

At the same time Herbert reaffirmed the genetic definition of species as groups which "naturally maintain themselves distinct" (almost the words of Ray) while there was "no real or natural line of difference between species and permanent or descendible variety" (almost the words of Darwin).

Herbert bridges the gap not only between Ray and Darwin but also between Kőlreuter and Mendel. In his early years men spoke of forces of heredity (perhaps they still do), others spoke of essences and fluids and others still of tinctures and tendencies. The ancient notion popularised by Linnaeus that the outside was derived from the mother, the inside from the father, was still prevalent. But when Herbert writes in 1847 a change has taken place. Pollen tubes have been seen to grow down the style and enter the ovule. It is no longer necessary to cut off the styles to prove as he had done that fertilisation is not instantaneous. The structure of the plant has been reduced to cells as units. Nuclei have been observed in these cells. Herbert concludes that "the fecundation of the ovules is not a simple but a complicated process." Nevertheless he concludes also that "we are utterly in the dark as to the mystery of fertilisation."

Herbert was evidently born too soon to appreciate the later cytological discoveries. His industry led him to try innumerable experiments many of which would have been unnecessary in the light of microscopic observation, and often with results which were bound to be confusing, working as he was with species of various kinds whose nature he could not possibly tell. When for example he produced true-breeding hybrids in *Amaryllis* and *Oenothera* he could not know that he might be dealing with polyploids in the one case and permanent interchange hybrids in the other, from whose behaviour no general rule could be drawn. Others have been less discreet. Again in the absence of cytological observation the distinction between self-sterility and cross-sterility was a baffling one. Only later was Darwin able to distinguish between the failure of the pollen-tube and the failure of the embryo. Microscopic observation showed the way to genetic analysis.

A younger man was bound to look at the matter differently. The discovery between 1840 and 1860 of the unitary and cellular character of the processes of fertilisation naturally made it possible to look at the whole of heredity from a new point of view. At the same time Darwin had been collecting the diverse evidence of variation and hybridisation, palaeontology and stratigraphy into one consistent and deterministic account of evolution. These two advances brought men back to the materialistic way of thinking that had been lost in biology for so long. The one who profited by this was Mendel. In a sense he did nothing that had not been done before. He crossed different varieties of peas and discovered dominance of the characters of one parent in the first generation, as Knight had done. He discovered segregation of their differences in the second generation, as Goss and Seton had done. He explained the properties of the cotyledons as properties of the seedling generation, as Knight had also done. He proved, according to a letter of 1870, that single pollen grains effected fertilisation, as Kőlreuter had at least attempted to do.

The difference between Mendel and his predecessors was that he knew the material processes underlying heredity and had the kind of mind that could explain their results in a material way. He understood that the simplest assumptions always had to be used until they were disproved. The cell-theory and the evolution theory displayed to him "the unity in the developmental plan of organic life." The importance of studies of the fusion of cells in the fertilisation of fishes and algae would not therefore escape him. We find also that he rejects continuity in variation. Darwin had invented continuity in biology just when discontinuity had been established in chemistry, a mistake the Greeks looking at science as a whole could never have made. We also find that Mendel rejected the improvement of plants by cultivation and the general Lamarckian theory into which Darwin lapsed only a few years later. In view of all these things we cannot even be surprised when we learn from the convincing argument of Fisher that Mendel knew what he was going to get before he began his critical experiments in hybridisation. He did not draw his bow at a venture.

Mendel directed his enquiries with a rigorous determinism. He assumed that every property of every seedling was determined by something that happened in its two parents. He had therefore to consider all the progeny from a cross and all their characters. In order to do so and find out the law governing what happened in the parents he had to take their characters individually and he had to take their progeny individually. He had to count them. None of his predecessors had the audacity and conviction in determinism to make such a task seem worth while. De Vilmorin, who recognised the importance of individuals, worked only on inbred stocks. Goss and Seton began counting, but they were baulked by not realising that an exact equality at segregation will not necessarily give an exact equality in the progeny because every germ cell will not act. A conviction of determinism and uniformity led Mendel to the view that the same rules applied to all organisms; nevertheless the great majority of biologists were then (and still are now) too faint-hearted to use such bold assumptions in their work. They are continually afraid of being swept off their feet by a revolutionary hypothesis.

Mendel's theory therefore meant a release from prejudice that was as important to purely scientific thought as Darwin's theory had been. Together they undid the superstitions of two thousand years and brought us back to the principles enunciated by Lucretius.

The inevitable relationship between the practice of breeding and the observation of the reproductive structures—sperm, eggs, and nowadays, chromosomes and genes—is made doubly clear owing to the freak of history by which Mendel's work was lost for 30 years, overshadowed by Darwinism. Mendel knew of cells and nuclei. He went further to something inside the nuclei. We may say that he predicted the genes. While his paper was still unknown Weismann arrived in 1892 at precisely the same conclusion on entirely different evidence, on the evidence in fact that the microscope had only just brought to light. Fertilisation had been found in 1875 to consist in the fusion of nuclei. The division of nuclei had been found to perpetuate a constant number of chromosomes. Weismann predicted the occurrence of a reduction to compensate for the addition of chromosomes in the nuclei at fertilisation. The chromosomes consisted of units or particles responsible for heredity. Variation must therefore be discontinuous and the differences responsible must separate and recombine as the chromosomes are observed to do. The chromosomes being handed down from generation to generation unchanged, except in their combinations, the inheritance of acquired characters was excluded. We now know from a consideration of plants that the distinction between body cells and germ cells is not, as Weismann thought, the basis of this separation, but rather the distinction between changing cells and their permanent nuclei.

This great parallelism of independent discovery is matched by smaller parallels at the same time. The atomism implicit in both Weismann's and Mendel's theories was independently proclaimed, again on quite different grounds, by Bateson as discontinuity and by de Vries as mutation. The distinction made between germ and body on cytological grounds was immediately paralleled by Johannsen's distinction, on

breeding evidence, between genotype and phenotype. In defining a genotype as that internal and hereditary character which reacted with the environment to produce the external and observed character or phenotype, Johannsen established the primary and operative axiom of genetics. He thus defined, as Weismann had done, the contrast between the static system of the permanent chromosomes which is responsible for heredity and the dynamic system of reactions they set in motion, which is responsible for development. In the experiments on which he based his definition he established the independence of genotype and environment and abolished all the loose and slippery arguments on which Lamarckian doctrines have always depended.

Never before in the history of science had the same theories been arrived at independently on such entirely different evidence. In such circumstances we might expect that the new discipline would be readily embraced. In fact however the process of conversion, in spite of the powerful advocacy of Johannsen and Bateson, has been gradual and is still incomplete. There are many who still find it difficult to separate the character from the individual who bears it. There are many who dare not follow Mendel's analytical way and think of gametes in breeding instead of zygotes, many who consequently cannot face Mendel's definition of a hybrid without misgiving. They will still imagine that they can recognise a hybrid by its appearance, by its mere phenotype. And there are many who refuse to believe that visible agents are sufficient to effect visible results and that there is not something else behind the chromosomes which will permit mystical definitions of heredity and species. The reformation has been too profound to be accepted by those brought up in the old tenets. They prefer to halt between two opinions.

The most immediately obvious and direct conclusion from Mendel's work was that a new individual or zygote produced by fertilisation owes its directly and predictably constitution to the germ cells or gametes which go to make it, and not to the parents which provide those gametes. A hybrid is therefore the product of the union of dissimilar gametes and not necessarily of dissimilar zygotes. Yet this definition is scarcely recognised outside experimental genetics to-day.

In learning the properties of hybrids we have not merely discovered the general laws of heredity and variation, we have come to understand the nature of particular species. The troubled history of *Oenothera* has been a struggle for fifty years between those who considered its forms as species and those who objected to them as hybrids. The solution came when it was realised that they were both. The paradox of the permanent hybrid then revealed how sex-chromosomes came about and sex-determination developed in its multifarious ways.

It must not be supposed therefore that the earlier development of genetics was smooth. The separation of breeding work and cytology led to many unfortunate results. Each technique has its own vices. Just as experimental breeding unrelated with cytology led de Vries and Bateson up several false trails, so cytology unrelated with experimental breeding led Roux to the struggle of the parts and Weismann to a theory of germinal selection, as he called it, in which all differentiation depended

on a sorting out of determinants within the body during development. We find as late as 1911 Johannsen saying that "The question of chromosomes as the presumed 'bearers of hereditary qualities' seems to be an idle one." And Bateson later maintains much the same view. Genetics, we see, as indeed other sciences, has been like a drawer that we pull out by uneasy jerks, first one side, then the other.

All this shows the prejudices with which present-day genetics is struggling in establishing itself in a proper relationship to other branches of biology. But the weapons with which it is now equipped make its task much easier than it was in the time of Herbert and Darwin. The immediate consequence of the union of breeding and cytology was the development of exact genetics in *Drosophila* on extremely mechanistic lines. It was assumed that since heredity is particulate, variation is also particulate, and by the combination of these particles or genes evolution resulted. Gradually however it was realised that variation is not necessarily particulate. Changes of proportion and position in the genes make a direct and mechanical description of variation impossible. Variation and likewise hybridisation are of many kinds, depending on the many kinds of change that can take place in genes and in their arrangement. Simplicity has again given place to complexity, but it is a complexity within the reach of our understanding, a complexity we can use in showing the forms and processes of living things as parts of a single system.

The refined technique of breeding, the high power of magnification of chromosomes, the X-ray method of producing mutations and also of analysing molecular structure are bringing nearer the time when we shall be able to say that genetics has demonstrated the unity not merely of biology but of science itself.

WILDER'S ADVENTURES WITH HARDY BULBS[1]

There are not enough bulbous plants grown in this country; there is not enough proemial curiosity concerning them. There are plenty of big tulips grown, many daffodils, a good many crocuses, some snowdrops, and a few others, but there is a vast reservoir of beauty and interest that is seldom tapped by any save the gardener with an explorative or adventurous turn of mind.

—Louise Beebe Wilder

This delightful book of 363 pages is packed with interesting observations on bulbous plants based mainly on the author's experience with bulbs over a long period of years in two locations in New York State, one "a cold garden, snow-blanketed as a rule in winter, brilliantly sunny in summer, the soil well on the sandy side with a good deal of lime in it; the second subject to muggish summers, freeze and thaw winters, having a clay subsoil, and a good deal of shade."

It is written in the charming informal style characteristic of the author's other works on gardening. The book is divided into two parts—

[1] Adventures with Hardy Bulbs, by Louise Beebe Wilder. Macmillan Co., New York. 1936.

the first is concerned with general observations on the use of little bulbs in the rock garden, naturalizing bulbs, and tender bulbs in the rock garden. Those interested primarily in amaryllids will find here references to daffodils, *Brodiaeas, Milla, Allium, Leucojum, Lycoris squamigera,* various species of *Zephyranthes, Cooperia, Clidanthus fragrans,* and *Sprekelia.*

In the second part, forty genera are considered separately, including the following in which the amaryllid enthusiast is particularly interested —*Allium, Brodiaea, Galanthus, Leucocrinum, Leucojum, Lycoris* and *Nothoscordum.*

The book is illustrated with excellent drawings and photographs by Walter Beebe Wilder.

—Hamilton P. Traub.

COOMBS' SOUTH AFRICAN PLANTS FOR AMERICAN GARDENS[2]

Mrs. Coombs, a charter member of the American Amaryllis Society, and a prominent worker in national Garden Club activities, has written a useful and interesting handbook for the beginner about these absorbing and exotic plant novelties. She covers the field quite categorically, with much helpful botanical data and all too few of her own personal comments on the habits and culture of the numerous noteworthy items under consideration.

The book will serve as a valuable fundamental text for those desiring a handy reference volume, in this newly opened field of the South African natives. While advanced students will still need to go to the original sources for fuller information, there is a world of good garden reading and stimulating material to add to the reader's knowledge.

The whole field of South African plants is only just beginning to be opened to the American garden lovers and Mrs. Coombs' book should do much to increase the popularity of the worthwhile types of bulbous plants, succulents, herbaceous plants, shrubs, etc. which abound in the Union of South Africa. The volume is reasonably well illustrated, although some of the pictures leave much to be desired and others are too small to do justice to the subjects. The Amaryllis family comes in for 25 pages or so, including such well known and little known genera as *Agapanthus, Amaryllis, Ammocharis, Buphane, Clivia, Crinum, Crytanthus, Haemanthus, Nerine, Tulbaghia* and *Vallota.*

The book is the product of a number of years intensive investigation of the wealth of Cape flora by the author, who made a trip to South Africa two years ago to round out her studies. There are entertaining introductory chapters on "Native Conditions," "Types and General Cultivation," and "Plans and Suggestions," besides a glossary and indexes.

—Wyndham Hayward.

[2] South African Plants, for American Gardens, by Sarah V. Coombs. F. A. Stokes Co. New York. 1936.

MR. WORSLEY HONORED—FIRST AWARD OF WILLIAM HERBERT MEDAL

The highest honor which can be bestowed by the Society is the William Herbert Medal, founded by the Society in 1936, and awarded for the first time in 1937.

As was expected, the William Herbert Medal Committee, by unanimous vote, made the award to Mr. Arthington Worsley, the Dean of the amaryllid fraternity. He has been and is now a faithful worker with amaryllids and became the torch bearer in this field during the time when interest therein began to decline in the later 19th and first quarter of the 20th centuries. Because of his unselfish devotion to highest principles of conduct, he has inspired the younger workers in the field so that the coming generation can build on the foundation laid by past and present workers.

The sketches for the design of the medal were made by the HERBERTIA editor, Dr. Traub, who writes as follows concerning them,*—

> The award of such a medal should represent a dramatic event, the culmination of faithful service, and it should therefore convey its message effectively but without excessive verbiage or crowded sculpturing. Accordingly, the obverse should consist of the sculptured likeness of the first great amaryllid enthusiast, William Herbert, and since as a man of science and letters he belongs to the world, it is not necessary to indicate dates of birth or death, or even his given name. The very simplicity of the obverse therefore conveys a forceful message.
>
> On the reverse a typical amaryllid, in this case a *Hippeastrum*, should be the motif, and the sculptured likeness should be encircled by the names of the great groups in the field of the Society—Hemerocallideae, Amaryllidales, and Alstroemeriales. The award is given "for eminent service" and no more words need be used.

The members of the Society will be interested to know that the original of the portrait on the obverse is the painting of William Herbert by Sir William Beechey, which is at Eton College, Windsor, England. The original of the amaryllid on the reverse is the fine old plate of *Hippeastrum vittatum* from *Thesaurus Botanicus* of Leopold Trattinnick, published in Vienna in 1819. This excellent old text is well worth looking up just for a glimpse at its numerous color plates of amaryllids and other interesting botanical subjects.

Lakemont Gardens,
Winter Park, Florida,
July 15, 1937.

—WYNDHAM HAYWARD.

* The sculpturing was executed by L. G. Balfour Company.

Wyndham Hayward *See page 263*

Habranthus cardinalis

Plate 48

1. REGIONAL ACTIVITIES AND EXHIBITIONS

AMARYLLIDS IN KENYA COLONY

THE LADY MURIEL JEX-BLAKE,

Kenya Colony, British East Africa

It is not really very easy to write a second note on the Amaryllidaceae in Kenya, for no great change has taken place in the last year, no new finds have been made among the indigenous plants, and no one has yet got sufficient time or money to specialize in these beautiful, but expensive, bulbs. Our flower shows are still "general purpose" shows, and it will be a long while yet before we can have special shows for any one type of flower. After all, the Colony of Kenya is not forty years old yet, and the gardening spirit is only now beginning to be wider spread and gaining in enthusiasm.

Rereading the excellent and interesting Year Book of the Amaryllis Society for 1935, I have studied, with particular interest Dr. Hutchinson's article.

The botanical revision of any natural order of plants is always rather a worry to the amateur gardener, who has managed to get some family into his head, but in this case at least Dr. Hutchinson has given us as good plants as he has taken from us in his alterations; for the inclusion of the Genera *Agapanthus, Allium,* and *Gilliesieae* in the Amaryllideae enriches the family more perhaps than the exclusion of the *Hypoxis, Alstroemeria,* and *Agarve;* because the first and the last of this trio are not really of very great garden interest, while the new entrants are of considerable decorative value.

I note that the Amaryllis Society has not abandoned the Alstroemeriales in spite of the fact that they now rank as a plant family. The members may be interested to know that *Alstroemeria psittacina,* (or is it *braziliensis* now?) becomes a rather difficult weed in our gardens, while *A. aurantiaca* grows well and flowers luxuriantly only at an altitude of over 7000 ft. Hybrids of *A. chilensis* have flowered with me here, under 6000 ft., but were not happy enough to stay.

Another lovely plant that we grew very well is also an exile from the amaryllids, in which tribe it was included by John Weathers in his "The Bulb Book", published in 1911 (Is this most invaluable book well known in America I wonder?), *Polianthes tuberosa,* more popularly known as the Tuberose, a thoroughly misleading "englishising" of a Latin name. This is a very great "stand by" in this country, for both single and double varieties flower magnificently, and when happily placed go on flowering over very long periods of time.

Having allowed these two outcasts to trespass on your pages, we must go on to the newly legitimised additions, and *Agapanthus,* being an African genus, comes first. Although agapanthus species grow and flower at the comparatively low level of Nairobi (5,500 ft.) it undoubtedly prefers the higher cooler conditions, and to see agapanthus

at its best in Kenya one should go to the gardens at about 7000 to 8000 ft. where it flowers magnificently and increases rapidly. In one garden of my acquaintance it is particularly beautiful in a huge informal group of mixed blue and white, growing under the light shade of *Juniperus procera,* called here the "pencil cedar", and with a foreground of scarlet flowered *Phyllocactus* plants, making a picture long to be remembered. At lower altitudes agapanthus needs rather more moisture if it is to flower well, and does best if planted near water unless the plants can be well drenched by hand watering at intervals. But it will grow anywhere, and give occasional flowers even when unkindly treated.

A dwarf species, *Agapanthus umbellatus minor,* which I brought out from Kew Gardens two years ago, is proving itself very amenable, and is a charming little plant, with narrow foliage only about 8-14 inches long, and masses of 12 inch stems with good sized heads of a deep blue colour and lasting in bloom for many weeks, even in a dry spot.

Hemerocallis does exceedingly well in Kenya, and, to quote the book, *Gardening in East Africa,* "is easily grown in all districts, by the water side, or in any part of the garden, either in sun or in shade." It flowers freely during the greater part of the year, and many species and varieties are grown. Personally I have so far had no success with *Hemerocallis minor,* which refuses to flower at present; but as many plants take a year or two to acclimatize themselves to our conditions, I still hope for success.

The Alliums, so useful in European, and probably in American gardens, are so far not much grown in Kenya, and it is only in the higher, cooler places that these hardy bulbs are likely to flower successfully. But we should be very grateful for hints from gardeners in the Southern States of America, and news of any species which do well in the American tropics and the subtropics of Florida, Southern California, and Texas.

A very nearly allied plant from South Africa, closely or allied to agapanthus, is the *Tulbaghia violacea,* one of a genus of about a dozen species of garlic-smelling herbaceous plants with rhizomatous root-stocks, narrow strap shaped leaves and more or less urn shaped flowers in umbels. *T. violacea* is a charming plant to look at, with green foliage, and clear light violet flowers, from eight to twenty of them in an umbel. In Kenya it never dies down, and flowers almost continually throughout the year, but it smells rankly of garlic if picked or bruised.

The Gilliesieae have not come our way, and I can find very little about them in my reference books, except that they *were* nearly allied to *Lilium!* Are they of garden value at all? The description of *G. graminea* sounds merely dull.

I had hoped to be able to write of new finds on a recent "safari" we have just returned from, when we travelled North, by car, for about three hundred miles from Nairobi into the low, hot, dry country which lies between the White settled area of Kenya, and the Abyssinian border; a country populated only by nomad tribes which wander over it with large herds of cattle and flocks of goats and sheep. The farther North one gets, the lower, dryer and more nearly desolate does the country become, till near Lake Rudolph it is a desert of lava rocks and dust, and

U. S. Department of Agriculture See page 81

Hybrid Amaryllis in the collection of the United States Department of Agriculture

Plate 49 *Flower uniformly colored red.*

U. S. Department of Agriculture *See page 81*

Hybrid Amaryllis in the collection of the United States Department of Agriculture

Plate 50 *White finely penciled with pink; flower 11" diameter.*

only for a month or so each year is there any vegetation or water. And up from this grim country on the edge of the lake, which lies at about 1250 ft., stands a miniature range of mountains named Nyiro running up to 9,200 ft., with the upper 2000 ft. covered with a dense forest of beautiful Podocarpus and Juniper trees interpersed with many other species, and a lush vegetation and a rich flora. We climbed up precipitous tracks to the top, but unluckily we were too late in the year for the bulbous plants, and found no single amaryllid in flower.

At the foot of the mountain I found dried foliage of what may have been *Crinum ammocharioides,* and dug down to the necks of big bulbs, but they were too big and too deep and we had not enough time to excavate (the only word suitable to the task!) deeply enough to get them out. Higher on the mountain we saw another *Crinum,* larger with very wide leaves, possibly *C. giganteum,* rather than the ubiquitous *C. Kirkii.* These were in a rather difficult place, and feeling sure we should meet others we left them, but alas! never another did we see.

Higher up the bulbous plants were many, but all of the Irideae, such as *Gladiolus, Dierema, Aristea* and *Kniphofia* in great quantity; also many ground orchids, but no amaryllids.

The seeds so kindly sent me by the Amaryllis Society last year have all germinated wonderfully—Hippeastrum hybrids, a small "Hippeastrum species, pink", *Zephyranthes citrina,* and *Cooperia,* also the Ragioneri strain of Freesias—and are all growing well.

Nairobi,
August 13, 1936

NEWS-NOTES FROM GERMANY

To the members of the American Amaryllis Society:—

I tried to get an account of the history of the Bornemann strain. I wrote several people about it. As far as I know now most of Bornemann's plants were sold after his death to a certain Mr. Schumacher at Naumburg who at that time was one of the best breeders of amaryllis in Germany. From this man Mr. Kunert, formerly director of the Imperial Gardens at Sans Souci, bought some plants, and formed quite a good collection. Unfortunately after the Great War these plants were sold and apparently are now lost. They were bought by the firm Kayssner at Zossen which shortly after went bankrupt. Mr. Weigel (of Weigel & Co., Erfurt) secured a few plants too from Mr. Kunert of the Bornemann strain. He raised a great number of plants, and to-day has one of the best collections of such hybrids in Germany. Mr. Gude at Berlin-Britz and Mr. Winter at Mariendorf near Berlin have some good amaryllis too but so far as I know their plants cannot rival those that I have seen in England and Holland, and what, I suppose, you have in the U. S. A.

With my best wishes for the American Amaryllis Society, I am,
very sincerely yours

Berlin—Charlbg. 9, (Signed) CAMILLO SCHNEIDER
May 8, 1937.

THE 4TH NATIONAL AMARYLLIS SHOW, LOS ANGELES, CALIF., SEPTEMBER 23, 1937

On account of the frost damage to the above ground parts of amaryllids during January 1937 in California the scheduled National Amaryllis Show in April at Montebello, California, has been postponed for one year. This Show will be held in 1938 as the 5th. National Amaryllis Show.

Later in the season, arrangements were made to hold the 4th. National Amaryllis Show in the fall on September 23, 1937, in cooperation and in conjunction with the Los Angeles County Fair (Sept. 17 to Oct. 3, incl.).

Inquiries concerning entries should be addressed to Cecil Houdyshel, La Verne, Calif., who has been designated as the Society's official representative for the Show. Class 14 has been created for amaryllid exhibits, including the lot numbers as indicated below,—

Class 14—Amaryllids

Awards to be 1st., 2nd., and 3rd prize ribbons, and a special certificate. If required, assistance will be given in classifying as to species, etc., upon arrival at the fairgrounds.

Lot No.
1542—Habranthus species and Dwarf Hippeastrums
1543—Habranthus and Dwarf Hippeastrum hybrids
1544—Lycoris aurea
1545—Lycoris radiata
1546—Lycoris squamigera
1547—Zephyranthes candida
1548—Zephyranthes carinata
1549—Zephyranthes citrina
1550—Zephyranthes robusta
1551—Zephyranthes rosea
1552—Zephyranthes ajax
1553—Hymenocallis species
1554—Crinum asiaticum

Lot No.
1555—Crinum capense (longifolium)
1556—Crinum Moorei
1557—Crinum Powellii
1558—Amaryllis belladonna
1559—Alstroemerias
1560—Bomareas
1561—Hemerocallis (Daylilies) species
1562—Hemerocallis hybrids
1563—Nerine species
1564—Nerine hybrids
1565—Any other amaryllid not otherwise specified

Sweepstakes—For the largest and most varied display as part of the exhibit, including only lots within the division . . . . . Special American Amaryllis Society Certificate.

FIRST WILLIAM HERBERT MEDAL AWARD

During the 4th. National Amaryllis Show, at 11 a. m., on September 23, 1937, the first award of the William Herbert Medal, illustrated in Plate 48, will be officially made. The committee was unanimous in making the first award to Mr. Arthington Worsley, of Ventnor, Isle of Wight, England, in recognition of his outstanding contributions to the advancement of the amaryllids. The presentation will be made by the Society's official representative, Mr. Cecil Houdyshel, and in the absence of Mr. Worsley, the medal will be received by the British Consul at Los Angeles, for forwarding to Mr. Worsley.

THE 5TH NATIONAL AMARYLLIS SHOW 1938

The Board of Directors has awarded the 5th. National Amaryllis Show to Southern California to be held in the Spring of 1938. The arrangements will be made by Mr. Fred H. Howard, Vice-President of the Society. For details about the show write to Mr. Howard at Montebello, California.

THE 6TH NATIONAL AMARYLLIS SHOW, 1939

The 6th. National Amaryllis Show has been awarded to New York City, and plans are being made to hold it in cooperation with the International Flower Show in New York City during the World's Fair.

SOUTHEASTERN REGIONAL AMARYLLIS SHOW IN 1938

The Southeastern Regional Amaryllis Show will be held in early April in Florida. Further announcements will be made through the local and horticultural press.

AMARYLLIDS AT THE 24TH ANNUAL INTERNATIONAL FLOWER SHOW, NEW YORK, MARCH 15-20, 1937

I. W. Heaton, *Florida*

The International Flower Show held at the Grand Central Palace, New York, March 15th to 20th contained many items of interest for the amaryllis enthusiast during the entire week. In the competitive classes, staged Monday to Wednesday there were a few really outstanding types. Mr. S. A. Savage, Glen Head, L. I., was awarded *First Prize* in the 12 plant class, his exhibit containing imported bulbs, included two of the three best amaryllis shown during the week. One a nine inch compact Leopoldi Salmon, the other of the same type in medium red, were the best among the private exhibits. These two plants had substance and remained in good condition until Saturday. The *Second Prize* went to Mr. and Mrs. John M. Schiff, Oyster Bay, L. I. This exhibit was also composed of imported bulbs.

In the 6 plant class, Mr. and Mrs. Marshall Field of Huntington, L. I. was *First;* with Mr. J. P. Morgan placing *Second.*

On Wednesday night after the close of the show for the evening Mr. Galliss and Mr. Chadburn staged the displays in the 50 foot classes. Mr. Galliss, Supt. for Mr. and Mrs. Marshall Field was awarded *First* and Mr. Chadburn, grower for Mr. S. A. Savage was *Second.* Mr. and Mrs. John M. Schiff had the best collection in this class but it was very poorly staged.

Mr. Marshall Field's collection is of English origin, and his varieties *Rose Velvet* together with the crosses,—*Daphne* x *Defience* and *Admiral Drake* x *Rose Velvet* introduced some pleasing shades of light rose.

It was my good fortune to be able to spend an afternoon at Longwood, Mr. Pierre S. du Pont's estate, in company with Mr. Wm. Mullis, Supt. This collection must include nearly 10,000 plants, which as they flower are transferred from the growing house and beautifully staged among the other plants in the display houses. Mr. Mullis by departing from the standard practice of amaryllis breeding—crossing flowers of similar color—has produced some wonderful results by using pure white pollen on the lighter shaded solid color types. Space does not permit me to describe the many worthwhile varieties but one interested me so much, in fact I think it is the best Amaryllis I have ever seen. Mr. Mullis produced this variety by crossing pure white on light red. The flower was good size, at least nine inches, very flat Leopoldi type, the petals pointed and slightly twisted at the tips, color pure white, very faintly shaded with minute specks of light pink. The coloring extended only from the corona to the break of the throat, appearing as a dusting of color on a white base, giving the flower a faint blush pink.

This collection is without doubt the finest in the world today, and Mr. du Pont cannot be praised too highly for his judgment in assembling stock and the breeding methods adopted which have produced these noteworthy color variations.

THE 1937 AMARYLLIS SHOW OF THE BUREAU OF PLANT INDUSTRY, U. S. DEPARTMENT OF AGRICULTURE

The twenty-fourth annual Amaryllis Show of the U. S. Department of Agriculture was held at the Department Greenhouses, Fourteenth Street and Constitution Avenue, N. W., Washington, D. C., from March 27, to April 4, 1937, inclusive, being open each day from 9:00 a. m. to 9:00 p. m. The display was viewed by 21,027 people, including classes from public and private schools, members of garden clubs, and out-of-town as well as local florists and commercial growers.

The exhibition comprised 1,260 amaryllis bulbs, each of which bore two or three flower stems, some more than two feet long, with from two to seven flowers on each stem, making a display of several thousand flowers ranging in color from dark velvety red through various shades of red, pink, orange, yellow-orange and striped types to pure white. A number of the blooms measured eleven inches from tip to tip.

The plants were arranged in the exhibition house on two side benches and on a center elongated pyramidal staging. Small pots of *Vinca major* with rounded grey-green leaves edged with white were placed between the pots of amaryllis to form a pleasing combination with the pointed dark green leaves, thick silvery green flower stems and clear bright blossoms of the amaryllis. Several large pots, each containing a group of bulbs in flower, were placed along the ridge of the center staging to provide accent notes.

There were suspended from the roof of the exhibition house twenty-five baskets of *Streptosolen Jamesonii*, whose small, orange, trumpet flowers added to the general appearance of the exhibition.

The bulbs in the Department's collection of amaryllis are hybrids resulting from many years of breeding conducted by Department of Agriculture experimenters since 1909 when twelve varieties were imported from England. The Amaryllis Shows are exhibitions of the results achieved by the Department in one of the many phases of its work to produce improved forms. Department workers with amaryllis have successfully endeavored to obtain longer stems, new shades and larger flowers. The white amaryllis was produced through successive selection and cross-pollination of striped flowers showing the most white. A group of seedlings, flowering for the first time this spring, revealed new subtleties of color, particularly in the orange and red shades. Two seedling varieties included in the collection are illustrated in Plates 49 and 50.

The Department has held an Amaryllis Show each year since 1912 with the exception of the years 1914 and 1915.

AMARYLLIDS AT PHILADELPHIA FLOWER SHOW

JOHN F. RUCKMAN, *Pennsylvania*

The following report of awards in the amaryllid classes at the Philadelphia Flower Show, March 8 to 14, 1937, has been prepared with the assistance of the Pennsylvania Horticultural Society and B. B. Starkey, Secretary of The Philadelphia Flower Show, Inc.,—

In the class of hybrid amaryllis, *six plants,* there were three entries: Mr. Arthur H. Lea, Chestnut Hill, Pa., Gardener William H. Starke, Jr., *First Prize;* Mrs. Bruce Ford, Chestnut Hill, Pa., Gardener William Monroe, *Second Prize.* Only two prizes were offered in this class. The third entry was that of Mrs. Ernest du Pont, Wilmington, Delaware, Gardener Samuel Allison.

In the class for cut amaryllis, twelve spikes, Mrs. Bruce Ford, Chestnut Hill, Pa., Gardener William Monroe, was the only entry and was awarded *First Prize.*

Mr. Robert H. Jewell's amaryllis seedling was a special entry and was not in competition, but was awarded a *Certificate of Merit.*

In the Class for narcissus, three pots, three varieties, Mrs. William M. Potts, Wyebrooke, Pa., Gardener Alexander Handling, was awarded *First Prize* and Mrs. Ernest du Pont, Wilmington, Delaware, Gardener Samuel Allison, *Second Prize.*

In the Group of narcissus covering twenty-five equare feet, Mrs. William M. Potts, Wyebrooke, Pa., Gardener Alexander Handling, was awarded *First Prize* and was the only entrant.

Mrs. J. Emmot Caldwell of Bryn Mawr, Pa., gardener John W. L. Gatenby, was awarded a *Certificate of Merit* for a *Clivia miniata* which was not in competition. This was an unusually well grown specimen, the main plant and two offsets each with an enormous cluster of bloom. Mr. Jewell's seedling amaryllis, a large dark red, was also very fine. A few *Eucharis grandiflora* were shown both as cut flowers and growing plants in various decorative displays. The outstanding hybrid amaryllis at the show was used as a decoration in the commercial display of Hosea Waterer of Philadelphia. This was a fine large flowered bright pink, somewhere between watermelon and begonia in shade, a clear, even color with no markings of any kind, as striking as it was unusual.

AMARYLLIDS AT THE 1937 JACKSONVILLE (FLA.) FLOWER SHOW

Mrs. W. E. MacArthur, *Florida*

The display of hybrid amaryllis at the Jacksonville Flower Show was very creditable considering that most of the choicest varieties in this area were forced into bloom before the scheduled date of the Show, April 15th and 16th, 1937 by the unusually warm weather conditions of the past winter.

Mrs. W. G. Tilghman, Palatka, Florida, contributed a colorful display of choice blooms which were appreciated by hundreds of interested spectators during the two days of the Show.

The first prize went to a lovely specimen of six bells of white with pink markings exhibited by Mrs. Millar Wilson.

A wonderful dark red hybrid amaryllis of four bells grown by Mrs. J. H. Churchwell was awarded the second prize.

Many varieties of early blooming hemerocallis were exhibited showing an increasing interest in this versatile garden plant. Another amaryllid noted at the show was *Crinum Powellii album.*

DAFFODIL NOTES 1937

MARY MCD. BEIRNE, *Virginia*

To one who has fallen victim to the habit of attending Spring Daffodil Shows, there is an absorbing interest in watching the gradual ascent to popularity of varieties one has grown. Likewise, it is equally diverting to observe these same flowers give place to others of obvious superiority, and to study the reasons why.

For the past several seasons de Graaff's *Aerolite* has been steadily climbing to first place among the class of Yellow Trumpets. There are other flowers of very high quality in this class which as yet are unavailable to the gardening public. Brodie's *Hebron* is one of these—bred from *White Emperor* by *King Alfred.* It has inherited the best quality of each parent, taking fine form from one and pure deep *King Alfred* yellow color from the other.

Lord Antrim is another Yellow of superb stature and clean bright color. Van Tubergen's *Apotheosis* and *Dawson City* continue in popular favor, bringing quiet beauty to the Show table, as well as providing lovely spots of clear soft yellow for the garden.

Beersheba has for the moment yielded first place in the White Trumpet class to *Tain* and *Slemish.* The former flower is a pure white of very great beauty, bred from *Beersheba.* As yet it is prohibitive except for the collector. *Slemish,* another child of *Beersheba,* is making its presence felt not only for Show, but as a garden decorative of high quality. The flower is tall and straight; of good form and a clear, pure two-toned white which is cool and captivating.

The universally popular *Mrs. Krelage* and its running mate, *Mrs. Robert Sydenham,* two good garden whites, continue to make their annual appearance. *Driven Snow* is always amazing in its snowy whiteness. Other glistening whites, of high quality, are *Corinth* (which perfects its color indoors) and *Everest.*

Bicolor Trumpets were represented mainly by those varieties which have proven as hardy as they are lovely. *Sylvanite* and *Moira O'Neill* have withstood this test. *Tapin* and *Halfa* are still Trump cards for the Star exhibitor.

Among Bicolor Incomparabilis, several fine specimens of P. D. Williams' bright colored *Afghanistan* were conspicuous in several blue ribbon Collection classes. This flower is slightly drooping, with wingy perianth of soft creamy yellow; and a long glowing crown of deep orange color.

Bodilly is always in evidence, a good flower of fine form and clear-cut white and yellow color. But specimens exhibited on this side of the Atlantic are pigmies compared with plants grown overseas. This variety makes little effort to conceal its displeasure at being transplanted to American soil.

Two charming Yellow Barriis noted were *Alcida* and *Red Sea.* The former has a telling citron-yellow cup with orange frill. Additional fine qualities of good height and vigorous increase contribute to the

growing popularity of this splendid show and garden variety. *Red Sea* is an excellent example of the brillance of clear yellow, set off by a crown of solid deep red.

Mr. P. D. William's *Kennegie* was outstanding among the class of Bicolor Barriis. The broad white pointed petals and perfectly flat crown with wide margin of deep red, was a glowing spot of color, even among other highly colored flowers of its class.

Rosebud, another seedling of Mr. P. D. Williams raising was especially lovely; purest white with a deep orange eye.

Tenedos, as usual, took first place among the class of Giant Leedsii with *Irish Pearl, Gracious* and *White Sentinel* clamoring for a share in the honors. Mr. Engleheart's *Still Waters* was enchantingly lovely; a flower of icy whiteness, with just the faintest suspicion of rosy pink in its crown.

In the Poeticus group, *Actea* is still a prime favorite, possibly because of its large size and bright scarlet eye. *Dinton Red* was a brilliant bit of glowing color; while *Ace of Diamonds* is still unsurpassed as the gem of its class with eye of blazing hot scarlet throughout.

DAYLILY MEETING IN PROVIDENCE, RHODE ISLAND

Miss Mary E. Davis, *Rhode Island*

On June, the nineteenth, a group of hemerocallis enthusiasts met in Providence, Rhode Island, by invitation of Mr. George DeWitt Kelso. After a luncheon, the daylily beds at Roger Williams Park which are under the care of Mr. Kelso were visited and a list of daylily varieties in the collection was distributed to those present.

A round table discussion on "Evaluation" was held in the Park Museum Building, presided over by Mr. Kelso who showed pictures of his blooms and described his recent visit to Dr. Stout of the New York Botanical Garden. Letters and articles were read and various phases of the subject considered. The consensus of opinion was that there were too many new varieties of insignificant value.

Growers and others interested are urged to score hemerocallis plants using the designations adopted last year—

discard
poor
x *good*
xx *very good*
xxx *excellent*

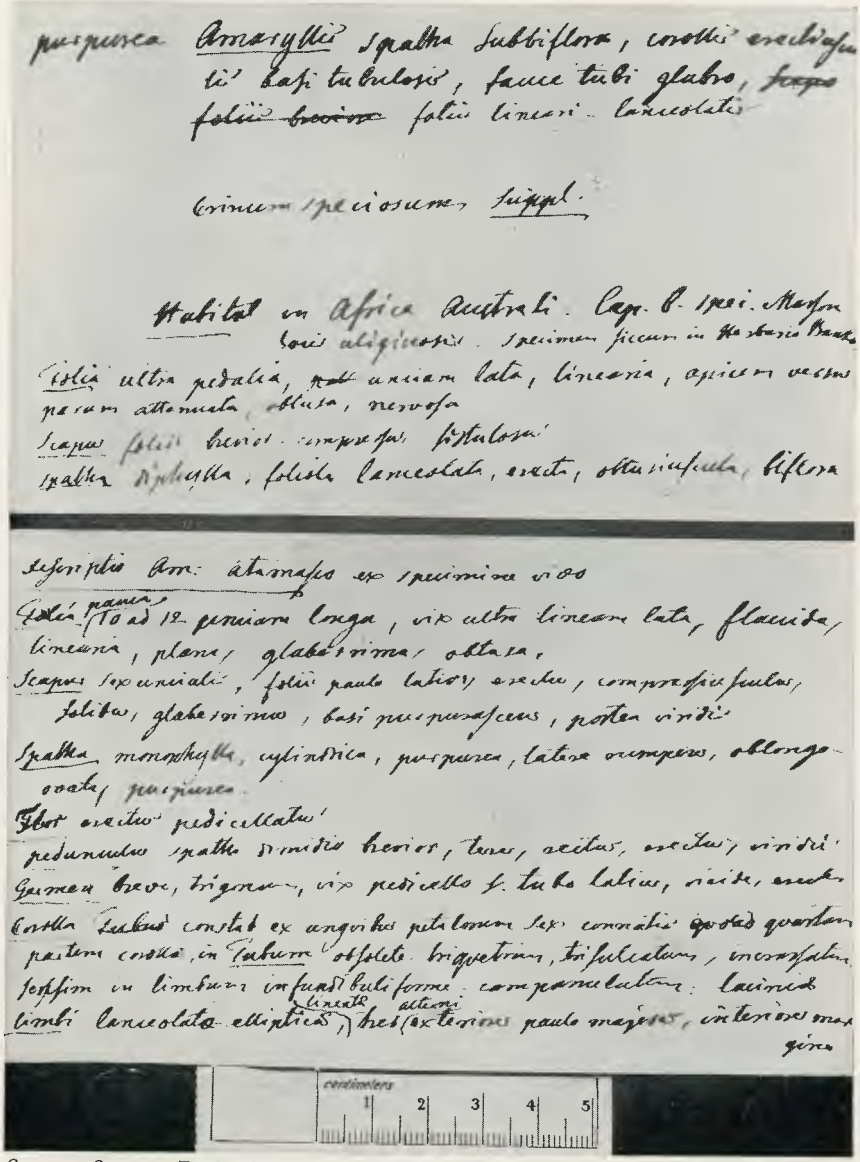
All data should be sent to Mr. Kelso, 184 Washington Street, Providence, R. I., by September.

The results of some experiments concerning fragrance of daylilies were presented and a tentative classification of hybrid daylilies was proposed.

From Hedin's Minne af von Linné, Fader och Son, 1808. See pp. 91 and 100

Carl Linnaeus, the Younger

Plate 51



purpurea Amaryllis spatha subbiflora, corollis erectis
tri basi tubulosis, fauce tubi glabro, scapo
foliis ~~brevior~~ foliis lineari-lanceolatis

Crinum speciosum Suppl.

Habitat in Africa Australi. Capt. B. 1791. Masson
locis aliginosis. Specimen siccum in Herbario Banks

Folia ultra pedalia, ~~pollicem~~ uncian lata, linearia, apicem versus
parum attenuata, obtusa, nervosa
Scapus foliis brevior. compressus fistulosus
spatha diphylla, foliola lanceolata, erecta, obtusiuscula, bifera

Descriptio Am: staminosa ex specimine vivo

Folia (pauca) 10 ad 12 pollicem longa, vix ultra lineam lata, flaccida,
linearia, plana, glaberrima, obtusa,
Scapus sesquicialis, foliis paulo latior, erectus, compressus sulcatus,
foliis, glaberrimus, basi purpurascens, postea viridis
Spatha monophylla, cylindrica, purpurea, latere rumpens, oblongo-
ovata, acuminata.
Flor erectus pedicellatus
pedunculus spatha dimidio brevior, teres, rectus, erectus, viridis
Germen breve, trigonum, vix pedicello suo tubo latius, viride, erectum
Corolla tubulosa constat ex unguibus petalorum sex connatis quoad quartam
partem corollae, in tubum obsoletum triquetrum, trisulcatum, incrassatum
versus in limbum infundibuliformem companulatum. Laciniis
limbi lanceolato-ellipticis, linearibus alternis, tres exteriores paulo majores, interiores mar-
gine

See page 94

Spencer Savage, England

Specimen pages, manuscript by the Younger Linnaeus dealing with certain genera now included in the Amaryllidaceae; approximate date of composition, September 1782 to November 1783

Plate 52

2. COLOR DESCRIPTION

PHOTOGRAPHING FLOWERS IN COLOR

GEORGE W. HESSE,

E. Leitz, Inc., New York, N. Y.

Flowers and other parts of plants never look so well in print as when natural color processes are used to reproduce every delicate nuance of hue inherent in the original. Natural color photography has made many advances in recent months, methods and procedures having been improved to a remarkable degree. In the newest film available, Kodachrome, there is little to be desired so far as color rendition, emulsion speed, and range of uses are concerned. For still work, this film is at present available only in the 35 mm. size for cameras such as the Leica.

Unlike previous natural color processes, neither a geometical screen nor special taking filters are required in order to produce the colors. The separation of colors is brought about within the body of the emulsion itself, being accomplished by coating the film support five times; consisting of three coats of color sensitive emulsions, which are separated by two coats of plain gelatin. Each of the three coatings of emulsion is selectively sensitized—that adjoining the film support is red sensitive; the center coating is green sensitive; and the outer, top, coat is sensitive to blue-violet. The two layers of plain gelatin prevent the sentitizers of emulsions from straying away from their respective coatings. The overall thickness of these five layers is no more than that of the emulsion of ordinary black and white negative material.

When an image is focused upon Kodachrome film, some part of the picture is formed in each of these three layers, depending upon the color of the subject: red colored objects in the picture are recorded by the bottom, red-sensitive layer; green colored objects by the center, green sensitive layer; and blue colored objects by the top, blue-violet sensitive layer. After the film is processed by the reversal method, each of the three coats of selectively sensitized emulsions is dyed with color complementary to its original sensitivity. The bottom, red-sensitive emulsion is dyed blue-green. The center, green-sensitive coat is dyed red (magenta). And the top, or blue-violet sensitive layer is dyed yellow.

During the processing the metallic silver image is dissolved and thus removed, leaving a pure dye image reproducing beautifully all colors of the original. Because the three emulsion coatings can be sensitized selectively it is possible to balance the film for either daylight or artificial light.

The Kodachrome Regular (K135) is prepared so as to give a correct color rendition under daylight conditions. In the mountains at high altitudes and under certain other conditions there may be a preponderance of ultra-violet light which may photograph on the Kodachrome film as violet. To correct this, the Kodachrome haze filter (requiring no increase in exposure) should be used. If necessary, the same film may be used for photography under artificial light by the use of a blue Koda-

chrome filter. This filter, however, necessitates an increase in exposure of 4 times over normal.

For photographs in artificial light the Kodachrome Film Type A (K135A) has an emulsion specially corrected for use with photoflood and photoflash bulbs. It should be used only with this type of illumination for high wattage tungsten bulbs will make the picture too red while the so-called blue daylight bulbs will make the picture too blue. For use in daylight it is necessary that a reddish-yellow Type A Kodachrome filter for daylight be used so as to change the quality of daylight to that of artificial light.

It should be borne in mind that the scene itself produces its own color contrast and when photographing a picture the scene should be illuminated by flash light. Under artificial light the best results will be secured by so arranging the lights that 60 per cent of the illumination will come from one side with about 40 per cent from the other.

The entire range of Leica accessories can be used for making color pictures for the Kodachrome emulsion is the most sensitive color film which has yet been produced. Color macro-photographs can easily be made of portions of plants by using the Leica in conjunction with either the sliding focusing copy device or .the rotating focusing stage. When examined by projection these pictures reveal unsuspected hidden beauty.

While the usual method is to project color transparencies by means of a Udimo or Umena Projector, the aim of all natural color photographers is to reproduce their color pictures on paper. Though Kodachrome produces a colored transparency it is possible to use this positive as a master from which to make separation negatives by means of filters L-50, N-61 and F-29. These negatives can then be used to make the prints by one of the color printing processes such as Chromatone, Eastman Wash-Off Relief, Trichrome Carbro, Bellcolor, Duxochrome, Colorstill and the like.

MEINHARD ON "COLOR PRINTS"

Under date of February 15, 1937, Mr. P. R. Meinhard of the Eastman Kodak Company, Rochester, N. Y., writes as follows,—

> Kodachrome transparencies can be used as a source for color separation negatives, from which, in turn, prints can be made on Eastman Wash-Off Relief Film. The three-color negatives are made through red, green, and blue Wratten filters (Nos. F-29, N-61, C4-49). Exposure may be made by contact or projection on a panchromatic material such as Wratten Panchromatic Plates or Eastman Portrait Panchromatic Film.
>
> If the lens in the enlarger is not sufficiently color-corrected to make satisfactory separations, it might be advisable to make the original three negatives by contact. Exposure may then be made by projection from these negatives onto wash-off relief film.
>
> In printing from these negatives, it will be necessary to expose through the No. 35 violet filter. Exposure may be made through the tri-color filters mentioned above, with either tungsten or photoflood illumination. We would not recommend the argon tube illumination for either making the separation or for printing on Eastman Wash-Off Relief Film. We see no reason why satisfactory enlargements up to 11x14 cannot be made by the above means.

COLOR DESCRIPTION OF HEMEROCALLIS FULVA ROSEA

The value of a color chart in the description of flower colors is illustrated in the case of Hemerocallis fulva rosea. The color differences are so subtle that a simple color chart is not sufficient and Marez and Paul "A Dictionary of Color" was used—

> The general aspect of the flower is brighter than that of the type, and the other fulvous varieties. The eye zone is near to Red Cross Red (4-L-6), and the portion of the petaline segments above this zone is a red between Old Coral or Jasper Red (3-J-10) and Mephisto Red (3-K-10) with a very narrow pink band in the center of the segment. This is a delicate pink (3-K-7) between Laurel Pink and Carnival Red. The portion below the eye zone is light-greenish very near to Chalcedony Yellow (18-J-1). The lower one-third of the sepaline segments is similar to the description just given. The color then begins with Raspberry Red (3-K-9) changing gradually to Ibis Pink (1-B-10) and finally to Honey Dew (9-B-8) at the extreme edges of the tip.
>
> The style is Chalcedony Yellow at the base changing to very light pink and then to light Mephisto Red and finally again to Chalcedony Yellow at the tip. The filaments are Chalcedony Yellow at the base changing to Mephisto Red, and the unopened anthers are fulvous brownish-red.

Mira Flores,
May 29, 1937

HAMILTON P. TRAUB

THE R. H. S. COLOR CHART

As announced in the 1936 Herbertia, the Royal Horticultural Society has in preparation a color chart for horticultural purposes. This promises to be the most adequate and convenient color chart that will be available for some time, and it is also quite inexpensive. For these reasons the Board of Directors of the Society is taking steps for its official adoption as soon as issued. Further details will be supplied in the 1938 Herbertia.

R. A. Dyer, Pretoria

See page 121

UPPER, *Crinum Forbesianum;* LOWER, *Buphane disticha*

Plate 53

3. DESCRIPTION AND PHYLOGENY

ON A MANUSCRIPT BY THE YOUNGER LINNAEUS DEALING WITH CERTAIN GENERA NOW INCLUDED IN THE AMARYLLIDACEAE

SPENCER SAVAGE, F. L. S. *England*

Carl Linnaeus the younger—known to botanists by the abbreviation *Linn. fil.*,—was born on 20 January 1741 at the home of his maternal grandfather at Falun, in the province of Dalecarlia, Sweden. He was only twelve years of age when his father published his most important book, the "Species Plantarum"; and as the only son of the most celebrated living botanist it might be thought that his happiness and success in life would have been well assured. Nevertheless, in spite of his father's care and encouragement of his education; placing him under the tuition of some of his best university students and giving him copies of his own and others works, (the inscriptions in some of which still bear witness to his paternal love), the younger Linnaeus grew up to a somewhat unhappy manhood. Several factors contributed to this unhappiness. His father's overshadowing greatness was undoubtedly one; the comparisons that were all too readily made by those who resented his advancement just because he was Linnaeus's son (he was called by some "the young Dauphin") was another; but above all was the extraordinary dislike, amounting to hatred, shown to him by his mother. (See portrait, Plate 51).

Unhappiness, however, did not prevent his becoming a good naturalist. When eighteen years of age he was appointed demonstrator in the University Botanic Garden, Uppsala; and in a few years had published his "Decas prima (secunda) plantarum rariorum horti Upsaliensis" (1762-63), illustrating the work from his own drawings. In 1763 he was appointed adjunct-professor of botany in Uppsala University; and in 1765 the degree of doctor of physic was conferred on him. Although not inheriting his father's great genius he became a very competent naturalist, as his published works and the considerable amount of surviving unpublished MS. material amply prove. During the last year of the elder Linnaeus's life, the son was made professor of botany at Uppsala, as the father was then through illness unable to do any real work. After his father's death on 10 January 1778 he inherited the title of von Linné, but was compelled to purchase from his mother and sisters the valuable collections of animals, plants and minerals made by his father. On obtaining these, which together with a library of printed books and manuscripts became known as the Linnaean Collections, he worked very hard to preserve them and to carry on his father's work. In botany, that work resulted in the publication of the "Supplementum Plantarum" in 1781, a book containing new descriptions by both father and son.

In the spring of 1781, the younger Linnaeus left Sweden for a visit to England. On reaching Newcastle-upon-Tyne he was made welcome by an old friend, John Rotheram[1], the only English student of the elder Linnaeus and one of the two persons present when he died. Reaching London about May, the son of Linnaeus was given a warm welcome by Sir Joseph Banks, Daniel Solander and others, who did all they could to help him. It was in London that he began the MS. dealt with here, as well as one on the genera of palms. Whilst in this country he visited many of the famous gardens in or near London, including the Royal Garden at Kew.

In the English translation of Stoever's life of Linnaeus and also in Sir James Edward Smith's article on the younger Linnaeus in Rees's Cyclopaedia the statement is made that this English visit lasted only four and half months, but from documents found among the Linnaean MSS. it seems certain that the younger Linnaeus remained here for about sixteen months, although he may have visited France for a short time in 1781. Unfortunately, although a strong and vigorous young man he had a bad attack of jaundice after reaching London, which incapacitated him for about two months. It is stated that Sir Joseph Bank's botanist and librarian, Daniel Solander, nursed his fellow-countryman during that illness.

On leaving England, he visited France, Holland, Germany and Denmark, returning to Uppsala in February 1783. After resuming his duties at the University, he became ill with a bilious fever, which culminated in an apoplectic stroke from which he died on 1 November 1783 in his forty-third year. He was buried in Uppsala Cathedral at the side of his father; and, being the last male heir to the title, the family coat-of-arms was broken over his grave.

The younger Linnaeus is stated to have been a man of agreeable and unassuming manners and to have been much liked by his contemporaries. He is also credited with an excellent memory, and his keen and penetrating eyes are said to have resembled those of the great Linnaeus. Unlike his father, he knew English well enough to speak and write it fairly well; and probably for that he had to thank his friend John Rotheram, who had spent quite a long time at Uppsala, had learned Swedish, and was a frequent visitor at Linnaeus's house.

The MS. which is the subject of this paper came into the possession of The Linnean Society of London with the Linnaean Collections when they were purchased in 1829 from the executor of Sir James Edward Smith, its first president. (In 1783 Smith had purchased the Collections from Linnaeus's widow, to whom they had reverted on the death of the younger Linnaeus.) In size the MS. measures 16 x 9.5 cm. and comprises 150 leaves, out of which only 196 pages have been written upon. Sir James Edward Smith wrote the following title on the outer wrapper: *Linn. fil. MSS. de Liliaceis et affinibus plantis.* From internal evidence the MS. can be roughly dated as between 1 September 1782 and 1 November 1783, as on fol. 65 the author states that he saw 'Pancratium fulvum' in flower at the Paris Garden on the former date. It is prob-

[1] He became professor of physic at the University of St. Andrews, Scotland.

able, however, that the MS., which would have been a gradual compilation, was commenced during his stay in England and laid aside before his return to Uppsala. Therefore, it may be dated 1781-82.

The following genera are dealt with:—*Haemanthus, Narcissus, Pancratium, Crinum, Agapanthus, Amaryllis* and *Eucomea;* followed by generic diagnoses only of *Aletris, Veltheimia, Hyacinthus* and *Lachenalia;* ending with a specific diagnosis of *Lilium longiflorum.* The MS. is obviously incomplete, and it is now impossible to tell how much more the author intended to include, as he left no plan for the complete work and no title that might have given a clue.[2] It will be at once noticed that here are included three genera that were not published until after the younger Linnaeus's death,—*Agapanthus,* by L'Héritier in 1788; *Eucomea,* by R. A. Salisbury in 1796 (L'Héritier's *Eucomis* in the 'Sertum Anglicum', 1788, is the same genus); and *Lachenalia,* by Jacquin in 1787. The explanation of this is simple: the source from which these authors derived the names was Solander's MSS., where much of Solander's work remained unpublished. Charles Louis L'Héritier published his 'Sertum Anglicum' after a visit to England; and Salisbury not only had access to the Solander MSS. but through Sir James E. Smith was able to examine and cite in his 'Prodromus stirpium in horto ad Chapel Allerton vigentium', Londini, 1796, this MS. of the younger Linnaeus, which, however, he does only for five species.

Another work, Aiton's 'Hortus Kewensis', 1789, has a more important bearing on this MS., as the following passage shows:—

> 'When the younger Linnæus was in England, in 1781 and 1782, he composed a treatise on the Palms and Liliaceous Plants, extracts of which, as far as was thought likely to be useful to this Catalogue, he communicated to the Author; this Manuscript is quoted under the abbreviation of *Linn. fil.*' (Vol. 1, p. vi).

I find that twenty-seven of the specific diagnoses in the MS. under consideration were printed with the authority *Linn. fil.* in the first edition of the 'Hortus Kewensis', as well as generic diagnoses of *Crinum, Agapanthus* (though not marked *Linn. fil.),* and *Amaryllis.* (These have been noted in the following list.) Nevertheless, in the second edition of 'Hortus Kewensis' (1810-13) all reference to the younger Linnaeus disappears from the preface, and instead of his authority against certain genera and species Willdenow's name has been substituted. In nearly all cases the diagnoses remain verbally the same.

Fortunately, the history of the 'Hortus Kewensis' was dealt with in some detail by the late James Britten, F.L.S.[3]; and from his account it is clear that Jonas Dryander, Sir Joseph Bank's librarian, was the editor of the first edition and of the earlier portion of the second edition. Dryander would have made full use of the Solander MSS., connected with the Banksian herbarium, in preparing the book for the press; and without doubt he must have accepted the authorship for the twenty-seven

[2] See page 94, ftnote.

[3] J. Britten, 'The history of Aiton's Hortus Kewensis', Journal of Botany (London), vol. 50, Suppl. 3, 1912.

species mentioned here. Nevertheless, in 1803, in a reply to a letter from W. T. Aiton, son of the nominal author, asking for help in preparing the proposed second edition, Dryander wrote:

> 'I shall be very ready to give you all the assistance in my power in publishing a new edition . . . But before we proceed to put it in execution it will be necessary to have a conference with Sir Joseph Banks, to determine upon what alterations the edition of Willdenow's Species Plantarum and other new books may make expedient particularly in regard to synonyms and differentiæ specificæ—'[4]

What passed at that conference is not recorded, but one feels a great regret that this MS. of the unfortunate younger Linnaeus was not published as a complete work before his death. At any rate, the citations to Willdenow's 'Species Plantarum' in the second edition of the 'Hortus Kewensis' are manifestly incorrect, because in Willdenow's book these species are ascribed to *Ait. Hort. Kew.* They should in every instance be credited to the younger Linnaeus.

The general plan of this work by the younger Linnaeus is a usual one in systematic botany: first, a Latin generic diagnosis, sometimes with added observations; secondly a Latin specific diagnosis, followed in many cases by a detailed description, for each species, with in some cases a copious synonymy. In one instance thirteen synonyms are given, referring in the main to illustrations with an added note as to whether they are good or bad ones. (See Plate 52). In addition, some species have interesting notes (one of which is in Swedish) added to the diagnoses. An unfinished work, the MS. has additional items such as the one shown in the lower portion of Plate 52.

In the following list of species dealt with in the MS., the manuscript name given by the author is placed first, followed, in round brackets by any important synonym or reference to a good figure cited by him. The habitats and sources of specimens are given in full as being of historical interest. My own notes on the MS. are placed in square brackets. A list explaining the abbreviations used is placed at the end of the article; taken partly from Dryander's excellent list in 'Hortus Kewensis'.[5]

Hæmanthus multiflorus. (Seb. Thes. 1, p. 20, t. 12, f. 1, 2, 3.) Habitat in Africa prope Serram Leonem. [Salisbury, Prodr., p. 217 cites this MS. name as a synonym of *H. colchicifolius*.]

H. puniceus. (Dill. Elth. 1, p. 167, t. 140.) Habitat in Africa Australi: Cap: b: spei. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 404.]

H. coccineus. (Comm. hort. 2, p. 127, t. 64.) Habitat in Africa Australi: Promont: Bon: spei. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 403.]

H. pubescens. (Suppl. Plant.) Habitat in Africa Australi: Promont: Bon: spei campis arenosis. [The name *H. hirsutus* was first given to the diagnosis, but has been deleted for the already published *H. pubescens.* Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 404.]

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[4] l. c., p. 6.

[5] Since writing the above, a search amongst the uncalendered MSS. of the younger Linnaeus has brought to light another MS. which, so far as investigated, appears to contain some of the first drafts for the MS. considered in this article. This earlier MS. is a paper-covered notebook, 19.5 x 16 cm., 18 leaves. On its cover the younger Linnaeus has written LILIACEA, which may be translated 'Liliaceous Plants.'

H. King, Pretoria

See page 122

Cyrtanthus contractus

Plate 54

Curtis's Botanical Magazine *See page 127*

Nerine sarniensis

Plate 55

H. pulchellus. [Name deleted; no synonym cited.] Habitat in Africa Australi: Promont: Bon: spei. Masson. Specimen in Herbar: Dni Banks pro descriptione inservuit.

H. ciliaris. *(Amaryllis ciliaris* Suppl.) Habitat in Africa Australi: Promont: Bon: spei. Mas(s)on. Descripsi specimen in Herb: Dni Banks. [Specific diagnosis printed in Aiton, Hort. Kew. I, p. 404; Salisbury, Prodr., p. 217, has this species and cites *Amaryllis ciliaris* Suppl. as a synonym.]

H. distichus. *(Amaryllis disticha* Suppl.) Habitat in Africa Australi: Promont: Bon: spei. Masson. Descript: ex specimine sicci in Herb: Dni Banksi. E MSca Banks: Nomen Holland Vergift Boll. Hottentotti extracto radicis aroma intoxicant, et inde venenum præparare quibus Antilopes occidantas. Masson. [Specific diagnosis printed in Aiton, Hort. Kew. I, p. 405, but for *H. toxicarius.*]

H. spiralis. *(Crinum tenellum* Suppl.) Habitat in Africa Australi: prope Promontor: Bon: spei. [Specific diagnosis printed in Aiton, Hort. Kew. I, p. 405.]

Narcissus Pseudo-Narcissus. (Rob. icon. t. 242: *Narcissus sylvestris.)*

N. bicolor. (Rudb. Elys. 2, p. 70, f. 7, p. 71, f. 9.)

N. minor. (Rudb. Elys. [2,] p. 72, f. 11.)

N. Tazetta, α polyanthos, β vitellina. [Note in Swedish on the 'common Tazetta,' which translated* reads: 'I observed when in London that the pistil is very often so short in *orientalis* that it is not visible between the anthers as is the case in the common Tazettas. I wonder if this is correct.']

N. calathinus. (Park. Par. p. 68.) Obs: synonyma patris vix huc pertinent.

N. papyraceus. (Barr. icon. t. 916.) Vulgo Paper-White.

N. concinnus. (Barrel. f. 956.) [Salisbury, Prodr., p. 225, cites this MS. name as a synonym of *N. radiiflorus,* but with a query.]

N. stellatus. [Name deleted.] (Barrel. f. 957, 958; etc.)

N. angustifolius. (Hort. Eyst., Vern. IV, fol. 10, f. 3.) Habitat in Europa Australi.

N. Bulbocodium. (Hort. Eyst., Vern. 3, t. 13, f. 4.)

N. odorus. Fig: mihi nulla visa, huic simile nisi Park. parad. t. 89, f. 5 ?; fig: certe mala.

N. reflexus. (Swert. Flor. 27, n. 4) Habitat in Europa Australi: in Lusitania prope Oporto.

N. Jonquilla. (Fl. Arag. No. 293.)

Pancratium excisum. Ex horto Marquis of Rockingham sub nomine *Pancratium caribæum commune.* Forte varietas *Pancr: charibæi.* Variet: *charibæi* Hortul: accepti. [Salisbury, Prodr., p. 226, cites this MS. name as a synonym of *P. amœnum.*]

P. caribæum. (Comm. Hort. 2, p. 173, t. 87.) Habitat in India Occidentali: Jamaica, Barbados. Vidi at [sic] Duchess of Portland.

P. declinatum. (Jacqu: amer., p. 99; hort. 3, p. 10, t. 11, *Pancratium declinatum.)* Habui ex horto Marquis of Rockingham in Wimblington [Wimbledon] sub nomine *Pancratium amboinense commune.*

P. speciosum. [The names *augustum* and *Rockinghamni* have been deleted.] (Raji Hist. III, p. 554, n. 4.) In Hort: Lord Rockingham in Wimbleton [Wimbledon]. Florentem vidi in mense Julii et in Martii. Obs: nullum hujus reperire potui figuram, nec patriam inquiere. Forte varietas *charibæi;* sed diverso tempore florens, et magnitudine omnium partium speciosior. Regina Plantarum Coronariarum, saltem nullæ in qualitatibus ab his nobis desideratis cedens. [Salisbury, Prodr., p. 227, cites this MS. name under the same name, *P. speciosum.*]

P. expansum. *(Pancratium amboinense* β, Syst. Nat.) Habitat in America? Vidi in Hort: Marqu: of Rockingham.

P. amboinense. (Comm. Hort. 1, p. 77, t. 39.) Habitat in Amboina? Nec specimen vel vivam vidi!

P. littorale. (Jacqu: amer: p. 95, t. 179, f. 94, floris; hort. 3. p. 41, t. 75). In Hort: Dni Pitcairn. Habui ex horto Marquis of Rockingham sub nomine *Pancratium caribæum verum.* [Salisbury, Prodr., p. 227, has this species under the same name and cites the same synonyms and the second source.]

* Lt. Col. A. Uggla, F.L.S., has kindly made this translation.

P. carolinianum. (Catesb. Carol. 3, p. 5, t. 5.) Habitat in America Septentrionali: Georgia. Ex Horto Lee.

P. verecundum. [The name *suaveolens* has been deleted.] (Rudb. Elys. 2, p. 88, f. 7.) Specimen siccum hujus vidi in Herb: Dni Banks a Koenig missum. Descriptionem secundum vivum specimen communicavit Dr Solander.

P. fulvum. [The name *tubulosum* has been deleted.] Habitat in Lima unde ad Hortum Parisinum missa ubi florentem vidi anno 1782 primo Septembris.

P. zeylanicum. (Comm. Hort. 1, t. 38.) Habitat in India Orientali. Specimen siccum in collectione Sloanea Mus: Britt:

P. longiflorum. (Forsk. desc. Plant. Arab. p. 72 *? Pancratium maximum.)* Habitat in Ceylona. Specim: sicc: in Musae: Banksii. Obs: plantam quam describit Forsk: l. c. certe huic maxime affinie si non eadem. In specimine sicco, marginem Nectarii observare non potui.

P. Ornithogaloides. Habitat in Perou. In Herbario Dni Jos: de Jussieu. [Rough sketch of the flower.]

P. clavatum. Habitat in Perou. In Herbar: Dni Joseph. de Jussieu. Facie *Amaryll(id)is cernui.* [Rough sketch of the flower.]

P. maritimum. (du Bry Floril. t. 26, *Hemerocallis valentina.)* Specimen siccum unicum mihi visum in Musaeo Brittanico: Herb. Sloan: vol. 57, fol. 18. Varietas flore rubro vide du Bry Florileg: t. 59, *Narcissus major s. Pancratium floribus rubris.*

P. illyricum. *(Pancratium maritimum,* Sp. Pl. ed. 1.)

P. mexicanum. (Dill. Elth. p. 299, t. 222, f. 289). Figuram vidi Millerii in Museo Banksii ex planta in Horto Fothergill: factam. Obs: Hæc differt a Dillenii figura . . .

Crinum. [Generic diagnosis printed in Aiton, Hort. Kew. 1, p. 413.]

Crinum americanum. (Comm. plant. rar., t. 14.) Habitat in America?; Asia, Banks & Soland. In Caldariis Anglorum vulgaris. Pericarpiam hæc descripsit Solander in Java. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 413.]

C. erubescens. *(Crinum americanum* β, Sp. Pl. p. 419.) Habitat in America; Java, Thunberg. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 413. Salisbury, Prodr., p. 230, cites *C. erubescens* Linn. fil. in Ait. Hort. Kew. as a synonym of *Amaryllis procera.*]

C. asiaticum. (Rhed. Hort. Malab. XI, p. 75, t. 38.) Habitat in Ceylona.

Agapanthus. [Generic diagnosis printed in Aiton, Hort. Kew. 1, p. 414, but the authority *Linn. fil.* omitted.]

Agapanthus africanus. *(Crinum africanum* Syst. Nat.) Habitat in Africa Australi: prope Prom: b: spei in monte tabulari et montibus adjacentibus. Variet in loco natalia α) flore saturate cæruleo β) flore dilute cæruleo.

Amaryllis. [Generic diagnosis printed in Aiton, Hort. Kew. 1, p. 415.]

Amaryllis ornata. (Rumph. Amb. V, p. 306, t. 105. *Tulipa Javana.)* Habitat in Africa: Guinea. Vulgo Cap-Coast-Lilly. Ex horto in Wimblington [Wimbledon], Lord Rockingham. Obs: figuram coloratam hujus vidi in Musaeo Dni Banks in patriae cura Smeathmanni facta. Plantam vivam ex horto Dni Rockingham habui. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 418.]

A. latifolia. *(Crinum latifolium,* Syst. Nat.)

A. Equestris. (Merian. Surin. p. 22, t. 22.) Angl: Martinique Lilly s. Barbados Lilly. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 417.]

A. cernua. (Plukn. Alm. t. 195, f. 3.) Habitat in Africa Australi locis paludosis prope Breed-Rivier. Fr. Masson. Descr. Soland.

A. radiata. (Trew. Seligmann. t. 35.) Figura Seligmanni facta Londini ab Ehret, sed ex minuto specimine. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 421.]

A. obliqua. Habitat in Africa Australi, circa Promont. Bon. spei, prope Chamtours Rivier in campis graminosis. Fr. Masson.

A. fucata. Ex horto Marquis of Rockingham in Wimblington [Wimbledon]. Obs: longissimo tubo, et coarctito limbo differt a *A. longifolia* facile.

A. longifolia. (Comm. hort. 1, p. 71, t. 36.) Habitat in Africa Australi. Amaryllis descr: ex fig: picta Mill: Hæc forte planta varietas *A. latifoliæ,* cujus figuram dedit Rheed, a qua differt maxime numero florum, flores mi-

nores, rubri, lacinias non acutas sed obtusiores in reliquis conveniunt. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 419.]

A. revoluta. *(? Crinum lineare* Suppl.) Habitat in Africa Australi. Vivam vidi ex Horto Kewensi, cura Dni Aiton. Obs: Flos odore *Gardeniae floridae.* [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 419.]

A. zeylanica. (Comm. hort. 1, p. 73, t. 37.) Patriam suae Africam dicit Erhet [i. e. Ehret.]

A. purpurea. *(Crinum speciosum* Suppl.) Habitat in Africa Australi: Cap. b. spei, locis, uliginosis. Masson. Specimen siccum in Herbario Banks. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 417.]

A. miniata. Habitat in India occidentali: insulis Caribæis. Horto Dni Lee ad Hammarschmidt [Hammersmith] prope London. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 417, but for *A. reticulata;* Salisbury, Prodr., p. 233, cites this MS. name as a synonym of *A. reticulata.*]

A. falcata. *(Crinum falcatum,* Jacqu. hort. 3, p. 34, t. 60.) Habitat in Africa australi: Cap. b. spei. Thunb[erg.] [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 418.]

A. falcata. Ex Sched: Solandri. Descriptio Massonii non Solandri. Habitat in locis sabulosis ad Promontor. b. spei.

A. Atamasco. (Trew. Seligmann, t. 37.) Habitat in America Septentrionali: Carolina. [Specific diagnosis, with the final word 'aequalibus' added, printed in Aiton, Hort. Kew. 1, p. 416.]

A. Atamasco. Descriptio *Am: Atamasco* ex specimine vivo. [See Plate 52, lower portion.]

A. aurea. Ex China allata . . . vivam vidi ex horto Regio Kew. Angliae cura Dni Aiton. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 419.]

A. lutea. *(Amaryllis lutea,* Syst. Nat.) [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 415.]

A. Belladonna. (Trew. Seligmann, t. 12.) Habitat in Africa Australi: Cap: Bona Spei. Obs: Cornutii figura videtur aliam exprimere plantam, sed quam ignoro; facies potius *Amaryllid: falcatae.* [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 417.]

A. Reginae. (Trew. Seligmann. t. 18.) Habitat in America Meridionali. Vulgo Mexican-Lilly. Floret in Januarii vulgatissime in hortis Anglorum. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 416.]

A. vittata. (Ferr. Flor. 166, t. 119 ?) In fine mense Aprilis florentem vidi in selecto [?] Horto Dni Dris Pitcairn in Islington; in Caldario ubi per 14 dies fere floruit speciosissima planta. [Specific diagnosis, slightly corrected, printed in Aiton, Hort. Kew. 1, p. 418.]

A. undulata. *(Amaryllis undulata,* Hill. Hort. Kew. p. 352, t. 14.) Habitat in Africa Australi. Vulgaris in Hortis Anglorum. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 420.]

A. formosissima. *(Sprekelia Heisterii,* Trew. Seligmann, t. 24.) Habitat in America Meridionali. Rarissime biflora. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 416.]

A. sarniensis. (Trew. Seligmann. t. 30) Habitat in Japonia . . . in Africa Australi: Cap: B: spei. (Masson.) [Note on its introduction into Guernsey. Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 420.]

A. orientalis. *(Amaryllis orientalis,* Sp. Pl. 422.) Habitat in India. [Specific diagnosis printed in Aiton, Hort. Kew. 1, p. 420, but the last four words omitted.]

Eucomea regia. *(Fritillaria regia,* Syst. Nat.) Habitat in Africa Australi: Cap. b. spei.

E. clavata. *(? Fritillaria nana* Syst. Nat.; Mant. p. 223) Habitat in Africa Australi: Cap. b. spei.

E. undulata. *(Asphodelus comosus,* Houtt. Hist. Nat. XII, p. 336, t. 83; *Fritillaria longifolia,* Hill. Hort. Kew. p. 354, t. 15.) Habitat in Africa Australi: Cap. b. spei.

Lilium longiflorum. Habitat in Japonia. In collect: Burmanniana.

LIST OF ABBREVIATIONS USED IN THE CITATIONS.

Aiton, Hort. Kew. W. Aiton: Hortus Kewensis. London, 1789. 3 vols. 8vo; ed. 2, London, 1810-13. 5 vols. 8vo.
Barr. icon.; Barrel. J. Barrelier: Plantae per Galliam, Hispanian et Italiam observata. Parisiis, 1714. 3 vols. fol.
Catesb. Carol. M. Catesby: The natural history of Carolina, Florida, and the Bahamas Islands. London, 1731, 1743. 2 vols. fol.
Comm. hort. J. & C. Commelin: Horti medici Amstelodamensis rariorum plantarum descriptio et icones, auctore Jo. Commelino. Amstelodami, 1697. Pars altera, auctore Casp. Commelino. 1701. fol.
Comm. plant. rar. C. Commelin: Plantae rariores et exocticae horti medici Amstelodamensis. Lugduni Batavorum, 1706. 4to.
Dill. Elth. J. J. Dillenius: Hortus Elthamensis. Londini, 1732. 2 vols. fol.
du Bry Floril. J. T. de Bry: Florilegium novum. [Oppenheim,] 1612(-14). fol.
Ferr. Flor. J. B. Ferrarius: Flora s. florum cultura. Romae, 1633; Amstelodami, 1646. 4to.
Fl. Arag. I. J. d'Asso y del Rio: Synopsis stirpium indigenarum Aragoniæ. Massileæ, 1779. 8vo.
Forsk. desc. Plant. Arab. P. Forskal: Flora Ægyptiaco-Arabica, sive descriptiones plantarum quas per Ægyptum inferiorem et Arabiam Felicem detexit Pet. Forskal. Havniæ, 1775. 4to.
Hill, Hort. Kew. John Hill: Hortus Kewensis . . Londini, 1768. 8vo.; ed. 2, 1769.
Hort. Eyst. B. Besler: Hortus Eystettensis. [Norimbergae,] 1613. fol. max.
Houtt. Hist. Nat. M. Houttuyn: Natuurlyke historie . . . Tweede Deel. Amsterdam, 1773-83. 14 vols. 8vo.
Jacqu. amer. N. J. Jacquin: Selectarum stirpium americanarum historia. Vindobonae, 1763. fol.
Jacqu. hort. N. J. Jacquin: Hortus botanicus Vindobonensis. Viennae, 1770-76. 3 vols. fol.
Mant. C. Linnaeus: Mantissa plantarum [prima]. Holmiae, 1767; . . . altera. Holmiae, 1771. 8vo.
Merian. Surin. M. S. Merian: De generatione et metamorphosibus Insectorum Surinamensium. Hagae Comitum, 1726. fol.
Park. Par(ad). J. Parkinson: Paradisi in Sole Paradisus terrestris. London, 1629. fol.
Plukn. Alm. L. Plukenet: Almagestum botanicum. Londini, 1696. 4to.
Plukn. phyt. L. Plukenet: Phytographia. Londoni, 1691-96.
Raji Hist. John Ray: Historia Plantarum. Londini, 1686-1704. 3 vols. fol.
Rhed. Hort. Malab. H. A. van Rheede tot Draakestein: Hortus Indicus Malabaricus. Amstelodami, 1678-1703. 12 vols. fol.
Rob. icon. [319 plates of plants engraved by Nic. Robert, A. Bosse et Lud. de Chastillon.] fol.
Hudb. Elys. Olof Rudbeck, **father and son:** Campi Eylsii liber secundus. Upsaliæ, 1701. fol. [A very scarce book, on account of the fact that most of the copies of this volume, as well as those of Vol. 1, published in 1702, were destroyed in a great fire at Uppsala in 1702. The second volume had been published first as likely to be more attractive on account of its woodcut illustrations of garden plants. In 1789 Sir James E. Smith published 'Reliquiæ Rudbeckianae,' using some of the surviving unpublished woodblocks, still in the Linnaean Collections, for illustrations.]
Rumph. Amb. G. E. Rumphius: Herbarium Amboinense. Partes VI et Auctarium. Amstelædami, 1750-55. fol.
Salisbury. Prodr. R. A. Salisbury: Prodromus stirpium in horto ad Chapel Allerton vigentium. Londini, 1796. 8vo.
Seb. Thes. Albertus Seba: Thesaurus rerum naturalium. Amstelædami, 1734-65. 4 vols. fol.
Sp. Pl. C. Linnaeus: Species plantarum. Holmiae, 1753. 2 vols. 8vo; ed. 2, Holmiae, 1762, 1763. 2 vols. 8vo.
Suppl. (Plant.) C. Linnaeus **the younger:** Supplementum plantarum. Brunsvigae, 1781. 8vo
Swert, Flor. E. Sweert: Florilegium. Amstelodami, 1612-14; and later editions.
Syst. Nat. C. Linnaeus: Systema Naturae. Ed. 12. Holmiae, 1767-68. 3 vols. 8vo.
Trew. Seligmann. J. M. Seligmann: Hortus nitidissimus, sive amœnissimorum florum imagines, quas collegit Chr. Jac. Trew, in æs incisis vivisque coloribus pictas edidit Joh. Mich. Seligmann. Norimbergae, 1750-73.

EDITORIAL NOTE—Under date of August 26, 1937, Dr. Spencer Savage writes, from the headquarters of The Linnean Society of London, Burlington House, Piccadilly, London, W. 1,—"The title of the book from which the portrait of the younger Linnaeus was photographed is as follows: *Minne af von Linné, Fader och Son. Af Sv. Hedin, M. D. Stockholm, 1808. 8vo.* The book is really in two parts, with separate title pages, one part dealing with the elder Linnaeus and the other with the younger Linnaeus. There are two plates, a portrait of Linn. patr. at the beginning, and the Linn. fil. portrait at the beginning of the second part."

A CHECKLIST OF THE BULBOUS AMARYLLIDACEAE OF MEXICO[1]

C. V. MORTON, *U. S. National Museum*

The following list is intended to include all species of bulbous Amaryllidaceae that have been reported as native to Mexico. A critical estimate of the group is hardly possible from the limited material now available, and consequently the present treatment is little more than a compilation of published data. It is likely that further study would result in a reduction of the number of species recognized in *Hymenocallis*. *Zephyranthes* is under critical study by Prof. H. H. Hume at the present time.

Tribe ALLIEAE

I. ALLIUM L.

1. ALLIUM CALIFORNICUM Rose, Contr. U. S. Nat. Herb. 1: 12. 1890.
   RANGE: Northern Lower California.
2. ALLIUM DRUMMONDII Regel, Acta Hort. Petrop. 3, pt. 2: 112. 1875.
   RANGE: Coahuila. United States.
3. ALLIUM EUROTOPHILUM Wiggins, Contr. Dudl. Herb. 1: 164. pl. 12, fig. 1. 1933.
   RANGE: Northern Lower California.
4. ALLIUM GLANDULOSUM Link & Otto, Ic. Pl. Rar. Hort. Berol. 1: 33. pl. 17. 1841.
   RANGE: Central and northern Mexico. Closely related to *Allium Kunthii*, but differing in its dark purple perianth segments and two-edged scapes, the margins of which are bordered with granular papillae.
5. ALLIUM HAEMATOCHITON Wats. Proc. Amer. Acad. 14: 227. 1879.
   RANGE: Northern Lower California. California.
6. ALLIUM KUNTHII Don, Mem. Wern. Soc. 6: 82. 1827.
   Schoenoprasum lineare HBK. Nov. Gen. et Sp. 1: 277. 1815. Not *Allium lineare* L. (1753).
   Allium scaposum Benth. Pl. Hartw. 26. 1840.
   RANGE: Almost throughout Mexico. Southwestern United States.
7. ALLIUM PENINSULARE Lemmon, Pittonia 1: 165. 1888.
   RANGE: Northern Lower California. California.
8. ALLIUM PLUMMERAE Wats. Proc. Amer. Acad. 18: 195. 1883.
   RANGE: Northern Mexico. Arizona.
9. ALLIUM PRAECOX Brandeg. Zoe 5: 228. 1906.
   RANGE: Northern Lower California. California.
10. ALLIUM UNIFOLIUM Kell. Proc. Calif. Acad. 2: 112. pl. 35. 1863.
    RANGE: Northern Lower California. California.

II. BEHRIA Greene

1. BEHRIA TENUIFLORA GREENE, Bull. Calif. Acad. 2: 143. 1886.
   Bessera tenuiflora Macbr. Contr. Gray Herb. n. ser. 56: 11. 1918.
   RANGE: Lower California.

III. BLOOMERIA Kell.

1. BLOOMERIA CROCEA (Torr.) Coville, Contr. U. S. Nat. Herb. 4: 203. 1893.
   Allium croceum Torr. Bot. Mex. Bound. 218. 1859.
   Bloomeria aurea Kell. Hesperian 3: 437. 1859.
   RANGE: Northern Lower California. California.

[1] Published by permission of the Secretary of the Smithsonian Institution.

IV. BRODIAEA J. E. Sm.

1. Brodiaea capitata Benth. Pl. Hartw. 339. 1857.
   Range: Northern Lower California. California.
2. Brodiaea Palmeri Wats. Proc. Amer. Acad. 24: 78. 1889.
   Triteleia Palmeri Greene, Pittonia 1: 292. 1889.
   Range: Lower California.

V. MILLA Cav.

1. Milla biflora Cav. Icon. Pl. 2: 76. pl. 196. 1793.
   Askolame biflora Raf. Fl. Tell. 2: 11. 1837.
   ? Diphalangium graminifolium Schauer, Linnaea 19: 703. 1847.
   Range: Central and northern Mexico. Southwestern United States.

VI. MUILLA Wats.

1. Muilla Purpusii Brandeg. Univ. Calif. Publ. Bot. 4: 177. 1911.
   Bloomeria Purpusii Macbr. Contr. Gray Herb. n. ser. 56: 9. 1918.
   Range: Central Mexico. An insufficiently known species.
2. Muilla serotina Greene, Erythea 1: 152. 1893.
   Range: Northern Lower California. California.

VII. NOTHOSCORDUM Kunth

Note: The name *Geboscon* Raf. (1824), taken up for this genus by House, is a *nomen nudum*. *Geboscon* Raf. (Fl. Tell. 2: 19. 1837) is different and is a synonym of *Allium*. *Pseudoscordum* Herb. (1837) is a *nomen nudum*. *Periloba* Raf. (1838), cited as a synonym at the time of the conservation of *Nothoscordum* by the International Congress at Brussels, is not of this family, but belongs to the Nolanaceae, even though as recently as 1930 Krause has given it as a synonym of *Nothoscordum*. The first validly published name is therefore *Nothoscordum* Kunth (1843), and it is here suggested that this be removed from the list of *nomina conservanda*.

1. Nothoscordum bivalve (L.) Britt. in Britt. & Brown, Ill. Fl. N. U. S. 1: 415. 1896.
   Ornithogalum bivalve L. Sp. Pl. 306. 1753.
   Allium striatum Jacq. Coll. Suppl. 51. 1796.
   ? Schoenoprasum longifolium HBK. Nov. Gen. & Sp. 1: 277. 1815.
   ? Allium longifolium Spreng. Syst. 2: 38. 1825.
   ? Praskoinon longifolium Raf. Fl. Tell. 4: 29. 1838.
   Range: Mexico and Guatemala. Eastern and southern United States.
2. **Nothoscordum inodorum** (Ait.) Morton, comb. nov.
   Allium inodorum Ait. Hort. Kew. 1: 427. 1789.
   Allium gracile Ait. op. cit. 429.
   Allium fragrans Vent. Hort. Cels. pl. 26. 1800.
   Maligia gracilis Raf. Fl. Tell. 2:19. 1837.
   Nothoscordum fragrans Kunth, Enum. 4: 461. 1843.
   Range: Mexico to Costa Rica. Jamaica. Southern United States.

VIII. PHARIUM Herb.

1. Pharium elegans (Schult.) Steud. Nom. ed. 2, 2: 316. 1841.
   Bessera elegans Schult. f. Linnaea 4: 121. 1829.
   Pharium fistulosm Herb. Bot. Reg. 18: pl. 1546. 1832.
   Pharium Herberti Steud. Nom. ed. 2, 2: 316. 1841.
   Bessera multiflora Mart. & Gal. Bull. Acad. Brux. 9²: 385. 1842.
   Bessera miniata Lem. Fl. des Serres 4: pl. 424. 1848.
   Bessera fistulosa Lindl. ex Pritz. Icon. Ind. 149. 1855.
   Bessera Herberti G. Don ex Sweet, Hort. Brit. ed. 3, 694. 1839.

RANGE: Central and northern Mexico.

NOTE: The name *Bessera*[2] has been proposed for conservation, but such a course appears highly undesirable. There is only a single valid species, which is neither widely known nor of any economic importance. . Furthermore, there is a valid name available *(Pharium),* so that no new name or combination is necessary. The genus *Behria,* considered a synonym by Macbride, appears sufficiently distinct. *Androstephium,* also, has been considered a synonym, but that seems more closely related to *Brodiaea* than to *Bessera.*

Tribe CRINEAE

IX. CHLIDANTHUS Herb.

1. CHLIDANTHUS EHRENBERGII (Klotzsch) Kunth, Enum. 5: 654. 1850.
   Coleophyllum Ehrenbergii Klotzsch in Otto & Dietr. Allg. Gart. Zeit. 8: 185. 1840.
   RANGE: Described from Mexico.

NOTE: A wholly dubious plant. Nothing resembling it has since been found.

X. CRINUM L.

1. CRINUM AMERICANUM L. Sp. Pl. 292. 1753.

NOTE: Recorded from Veracruz by Kunth and from San Blas by Hemsley. The reports are perhaps erroneous.

2. CRINUM ERUBESCENS Sol. in Ait. Hort. Kew. 1: 413. 1789.
   Crinum cruentum Ker. Bot. Reg. 2: pl. 171. 1816.
   Crinum Loddigesianum Herb. Amaryll. 253. 1837.
   Crinum erubescens var. *mexicanum* M. J. Roem. Syn. 4: 79. 1847.
   Crinum cruentum var. *albidum* Kunth, Enum. 5: 555. 1850.
   RANGE: Jalisco, Nayarit, Puebla and Oaxaca. Guatemala, Honduras and Nicaragua. Naturalized or cultivated in El Salvador and Costa Rica.

NOTE: Baker (Handbook of Amaryllidaceae) placed *C. erubescens* in the subgenus *Platyaster,* characterized by lanceolate perianth segments. On the other hand *Crinum cruentum* is put into *Stenaster,* which includes those species with linear segments. The original plate of *C. cruentum* shows the segments to be lanceolate, exactly as in *C. erubescens,* and even Dean Herbert, whose specific concept was extremely narrow and who moreover had first-hand acquaintance with living plants of both species, was unable to find any difference between them, except that *C. cruentum* had more erect leaves of a darker green color and somewhat darker-colored flowers. I therefore have no hesitancy in reducing *C. cruentum* to synonymy. There does, however, actually exist a plant having truly linear perianth segments. This is from the Nicoya Peninsula, Costa Rica. It has been identified as *C. cruentum,* but doubtless represents an undescribed species.

The only other native *Crinum* of continental North America is *C. Kunthianum* M. J. Roem., which has been found on Barro Colorado Island, Panama Canal Zone.

Tribe ZEPHYRANTHEAE

XI. COOPERIA Herb.

1. COOPERIA DRUMMONDII Herb. Bot. Reg. 22: pl. 1835. 1836.
   Cooperia mexicana Herb. Amaryll. 182. 1837.
   RANGE: Tamaulipas, Nuevo Leon, San Luis Potosi, and Oaxaca. United States.

[2] **Bessera** Schult. f. Linnaea 4: 121. 1829. Not Schult. (1809).

2. Cooperia miradorensis Kränzl. Repert. Sp. Nov. Fedde 21: 75. 1925.
   Range: Mirador, Veracruz.
3. Cooperia pedunculata Herb. Amaryll. 179. pl. 42, fig. 3-5. 1837.
   Range: Coahuila, Tamaulipas, and Nuevo Leon. Texas.

XII. ZEPHYRANTHES Herb.

1. Zephyranthes arenicola T. S. Brandeg. Proc. Calif. Acad. II. 2: 205. 1889.
   Range: Mexico.
2. Zephyranthes citrina Baker, Bot. Mag. 108: pl. 6605. 1882.
   Range: Yucatan.
3. Zephyranthes concolor (Lindl.) Benth. & Hook. Gen. Plant. 3: 724. 1883, in note.
   Habranthus concolor Lindl. Proc. Hort. Soc. Lond. 1838: 8. 1838.
   Hippeastrum concolor Baker, Journ. Bot. 16: 82. 1878.
   Range: Mexican plateau.
4. Zephyranthes Conzattii Greenm. Proc. Amer. Acad. 33: 473. 1898.
   Range: Described from Oaxaca.
5. Zephyranthes erubescens Wats. Proc. Amer. Acad. 25: 162. 1890.
   Range: Not known definitely.
6. Zephyranthes grandiflora Lindl. Bot. Reg. 11: pl. 902. 1825.
   Zephyranthes carinata Herb. Bot. Mag. 52: pl. 2594. 1825.
   Amaryllis carinata Spreng. Syst. 4, pt. 2: 152. 1827.
   Amaryllis Lindleyana Schult. Syst. 7, pt. 2: 802. 1830.
   Pogonema carinata Raf. Fl. Tell. 4: 10. 1838.
   Atamosco carinata Wils. Sci. Surv. Porto Rico 5: 159. 1924.
   Range: Mexican plateau.

   Note: *Zephyranthes grandiflora* Lindl. was based on a mixture, the leaves and fruits described belonging to *Z. Lindleyana* Herb. The name *grandiflora* must naturally go with the floral element figured, which is *Amaryllis Lindleyana* Schult. and is the same as *Z. carinata*, under which name it has usually been known.

7. Zephyranthes lilacina Liebm. Ind. Sem. Hort. Haun. 1844: 7. 1844.
   Range: Mexico.
8. Zephyranthes Lindleyana Herb. Amaryll. 174. pl. 35, fig. 5. 1837.
   Atamosco Lindleyana Standl. in Standl. & Cald. Lista Prelim. Pl. El Salv. 31. 1925.
   Range: Mexico.
9. Zephyranthes longifolia Hemsl. Diagn. Pl. Nov. 3: 55. 1880.
   Atamosco longifolia Cockerell, Canad. Ent. 33: 283. 1901.
   Range: Northern Mexico. Southwestern United States.
10. Zephyranthes macrosiphon Baker, Gard. Chr. III. 16, pt. 2: 70. 1881.
    Range: Mexico.
11. Zephyranthes Nelsoni Greenm. Proc. Amer. Acad. 33: 473. 1898.
    Range: Oaxaca and Chiapas.
12. Zephyranthes nervosa (HBK.) Herb. Amaryll. 172. 1837.
    Amaryllis nervosa HBK. Nov. Gen. et Sp. 1: 278. 1815.
    Range: Tropical Mexico. Venezuela. West Indies.

    Note: This species has been considered the same as *Z. tubispatha* (L'Her.) Herb., of Argentina.

13. Zephyranthes verecunda Herb. Bot. Mag. 52: pl. 2583. 1825.
    ? *Amaryllis minuta* HBK. Nov. Gen. et Sp. 1: 278. 1815.
    Zephyranthes striata Herb. Bot. Mag. 52: pl. 2593. 1825.
    Amaryllis verecunda Schult. Syst. 7, pt. 2: 800. 1830.
    Amaryllis striatula Schult. op. cit. 801.
    Zephyranthes sessilis Herb. Amaryll. 175. 1837.
    Zephyranthes sessilis var. *verecunda* Herb. loc. cit.
    Zephyranthes sessilis var. *verecunda* Herb. loc. cit.
    Zephyranthes Grahamiana Herb. loc. cit.
    Range: Mexico and Guatemala.

Wyndham Hayward *See page 127*

Lycoris radiata

Plate 56

Wyndham Hayward

See page 142

Pure white Hybrid Amaryllis, Mary Davis

Plate 57

NOTE: The oldest name is very likely *Amaryllis minuta* H. B. K., but a proper combination under *Zephyranthes* has never been published. An additional synonym is probably *Amaryllis pallida* Willd. ex Schult. Syst. 7, pt. 2: 801. 1830 in synonymy = *Zephyranthes pallida* M. J. Roem. Syn. 4: 124. 1847.

Tribe EUCHARIDEAE

XIII. HYMENOCALLIS

1. HYMENOCALLIS BISTUBATA Herb. Bot. Reg. 30: Misc. 43. 1844.
   RANGE: Not known.
2. HYMENOCALLIS CHORETIS Hemsl. Biol. Centr. Amer. Bot. 3: 335. 1882.
   Choretis glauca Herb. Amaryll. 220. pl. 35, fig. 1. 1837.
   Hymenocallis glauca Baker ex Benth. & Hook. Gen. Plant. 3: 734. 1883, in note. Not M. J. Roem. (1847).
   RANGE: Not known.
3. HYMENOCALLIS CONCINNA Baker, Gard. Chr. III. 14, pt. 2: 150. 1893.
   RANGE: Not known.
4. HYMENOCALLIS CORDIFOLIA Micheli, Rev. Hort. 71: 444. 1899.
   RANGE: Guerrero.

   NOTE: From the description and figure this must be one of the most distinct species of the genus.

5. HYMENOCALLIS EUCHARIDIFOLIA Baker, Gard. Chr. 1884, pt. 1: 700. 1884.
   RANGE: Sinaloa and Nayarit.

   NOTE: Described from material of uncertain origin. The Mexican specimens which I have tentatively so identified are fragmentary but agree with the description.
6. HYMENOCALLIS GALVESTONENSIS (Herb.) Baker, Handb. Amaryll. 126. 1888.
   Choretis galvestonensis Herb. Amaryll. 219. fig. 35. 1837.
   Hymenocallis jaliscensis M. E. Jones, Extr. from Contr. West. Bot. 18: 33. 1933.
   RANGE: Jalisco, Colima, Nayarit, and Sinaloa. Texas.
7. HYMENOCALLIS GLAUCA (Zucc.) M. J. Roem. Syn. 4: 173. 1847.
   Pancratium glaucum Zucc. Abh. Baier. Akad. Wiss. 2: 317. 1837.
   RANGE: Oaxaca and Guerrero.
8. HYMENOCALLIS GRAMINIFOLIA Greenm. Proc. Amer. Acad. 39: 74. 1903.
   RANGE: Morelos.
9. HYMENOCALLIS HARRISIANA Herb. Bot. Reg. 26: Misc. 35. 1840.
   RANGE: Morelos and Nayarit.
10. HYMENOCALLIS HORSMANNI Baker, Handb. Amaryll. 125. 1888.
    RANGE: Nayarit.
11. HYMENOCALLIS LITTORALIS (Jacq.) Salisb. Trans. Hort. Soc. London 1: 338. 1812.
    Pancratium littorale Jacq. Sel. Amer. 99. pl. 179, fig. 94. 1763.
    Pancratium americanum Mill. Gard. Dict. ed. 8, No. 7. 1768.
    Pancratium Dryandri Ker, Quart. Journ. Sci. 3: 326. 1817.
    Pancratium distichum Sims, Bot. Mag. 44: pl. 1879. 1817.
    Hymenocallis littoralis var. *longituba* Herb. Bot. Mag. 53: under pl. 2621. 1826.
    Hymenocallis littoralis var. *Dryandri* Herb. loc. cit.
    Hymenocallis littoralis var. *disticha* Herb. loc. cit.
    Hymenocallis littoralis var. *acutifolia* Herb. op. cit. pl. 2621.
    Hymenocallis acutifolia M. J. Roem. Syn. 4: 174. 1847.
    Hymenocallis americana M. J. Roem. op. cit. 176.
    Hymenocallis arenaria M. J. Roem. loc. cit.
    Hymenocallis Dryandri M. J. Roem. op. cit. 175.
    Hymenocallis Staplesiana M. J. Roem. loc. cit.
    RANGE: Yucatan Peninsula. Throughout Ceneral America.

    NOTE: Standley (Flora of Yucatan) takes up for this species the name *H. americana* (Jacq.) Salisb., a usage which I do not understand.

12. Hymenocallis longibracteata Hochr. Bull. N. Y. Bot. Gard. 6: 265. 1910.
    Range: Veracruz.
13. Hymenocallis Pringlei Greenm. Proc. Amer. Acad. 39: 74. 1903.
    Range: Hidalgo.
14. Hymenocallis repanda Otto & Dietr. Allg. Gart. Zeit. 11: 123. 1843.
    Range: Sinaloa and Nayarit (?).
15. Hymenocallis riparia Greenm. Proc. Amer. Acad. 41: 235. 1905.
    Range: Morelos and Michoacan.

Doubtful and Excluded Species

16. Hymenocallis mexicana (L.) Herb. Bot. Reg. Append. 44. 1821.
    Pancratium mexicanum L. Sp. Pl. 290. 1753.
    Range: Southern United States. Ascribed to Mexico in error, presumably.
17. Pancratium trichromum Cerv. in La Llave & Lex. Nov. Veg. Desc. 1: 20. 1824.

    Note: The description indicates a most unusual plant, perhaps not belonging to *Hymenocallis*.

Tribe HIPPEASTREAE

XIV. SPREKELIA Heist.

1. Sprekelia formosissima (L.) Herb. Bot. Reg. Append. 35. 1821.
   Amaryllis formosissima L. Sp. Pl. 293. 1753.
   Amaryllis Karwinskii Zucc. in Otto & Dietr. Allg. Gart. Zeit. 2: 245. 1834.
   Sprekelia glauca Lindl. Bot. Reg. 26: Misc. 65. 1840.
   Sprekelia ringens Morr. Ann. Soc. Hort. Gand. 2: 133. pl. 60. 1846.
   Sprekelia Karwinskii M. J. Roem. Syn. 4: 293. 1847.
   Range: Chihuahua, Durango, Mexico, Jalisco, Michoacan, and Guerrero.

ADDITIONAL AMARYLLIDACEAE OF PERU

J. Francis Macbride

Field Museum, Chicago, Ill.

BOMAREA

(All the determinations in this group were made by Mr. E. P. Killip, U. S. National Museum, who wrote the treatment of the genus for the Flora of Peru).

Bomarea involucrosa (Herb.) Baker. Departments of Lima, Junin, Cuzco, and Puno. Vernacular name Sulla-sulla.

Bomarea campanuliflora Killip. Quebrada de Toipata, Department of Puno.

Bomarea bracteata (R. & P.) Herb. Departments of Ancash and Junin.

Bomarea puberula (Herb.) Kraenzl. Andinamarca and Huánuco.

Bomarea Fiebrigiana Kraenzl. Santa Ana Valley, Cuzco. Also in Bolivia.

Bomarea porrecta Killip. Known only from Peru, the exact locality unknown.

Bomarea zosteraefolia Killip. Department of Ancash.

Bomarea dulcis (Hook.) Beauverd. Departments of Cajamarca, Ancash, Lima, Junin, Puno, Arequipa, Moquehua, and Cuzco.

Bomarea petraea Kraenzl. Puno. Also in Bolivia.

Bomarea uniflora (Mathews) Killip. Ancash and perhaps elsewhere. Also in Bolivia.

Bomarea phyllostachya Mast. Huánuco and perhaps elsewhere.

Bomarea crocea (R. & P.) Herb. Lima, Junin, and Cuzco. Called "Chocllopa."

Bomarea pumila Griseb. Cuzco, at 3000 meters. The smallest plant of the genus, the stems only 4-5 cm. long.

Bomarea secundiflora (R. & P.) Baker. Cajamarca and Huánuco.

Bomarea nervosa (Herb.) Baker. Department of Amazonas.

Bomarea cruenta Kraenzl. Department of Amazonas.

Bomarea coccinea (R. & P.) Baker. Huánuco and Junin.

Bomarea brevis (Herb.) Baker. Huánuco, Junin, and Cuzco. Also in Bolivia.

Bomarea distichophylla (R. & P.) Baker. Huánuco, Junin, and Cuzco.

Bomarea cornigera Herb. Probably from northern Peru.

Bomarea torta (HBK.) Herb. Cajamarca and Amazonas.

Bomarea Stuebelii Pax. Amazonas and Junin.

Bomarea Klugii Killip. Near Moyobamba, San Martin.

Bomarea rosea (R. & P.) Herb. Ancash, Huánuco, and Junin.

Bomarea anceps R. & P. Department of Junin.

Bomarea aurantiaca Herb. Departments of Ayacucho, and Cuzco, and perhaps elsewhere.

Bomarea filicaulis Kraenzl. Monzon, Huánuco.

Bomarea sclerophylla Kraenzl. Department of Huánuco.

Bomarea macranthera Kraenzl. Huacapistana, Junin.

Bomarea cernua Griseb. Huánuco and Cuzco.

Bomarea purpurea (R. & P.) Herb. Amazonas and Huánuco. Also in Colombia and Ecuador.

Bomarea setacea (R. & P.) Herb. Cajamarca, Huánuco, Junin, Cuzco, and Sandia. Also in Ecuador.

Bomarea densiflora Herb. Amazonas and perhaps elsewhere. Also in Ecuador.

Bomarea denticulata (R. & P.) Herb. Huánuco and perhaps elsewhere.

Bomarea caudata Killip. Choimacota Valley, Ayasucho.

Bomarea crinita Herb. Amazonas and perhaps elsewhere.

Bomarea loreti Kraenzl. Cerro de Ponasa, Loreto.

Bomarea formosissima (R. & P.) Herb. Huánuco and Ayacucho.

Bomarea superba Herb. Described from Peru, the exact locality unknown.

Bomarea sanguinea Kraenzl. Huánuco and Cuzco. Also in Bolivia. Local names Pachanca and Sullo-sullo.

Bomarea nematocaulon Killip. Playapampa, Huánuco, at 2800 meters.

Bomarea angustissima Killip. Tambo de Vaca, Huánuco, at 4000 meters.

Bomarea Engleriana Kraenzl. Monzon, Huánuco, at 3500-3700 meters.

Bomarea praeusta Kraenzl. Arequipa and probably elsewhere.

Bomerea parvifolia Baker. Type from Huantanga.
Bomarea campylophylla Killip. Type from Vilcabamba, Huánuco.
Bomarea cornuta Herb. Huánuco and perhaps elsewhere.
Bomarea ayavacensis Kraenzl. Above Ayavaca, Piura, at 2900 meters.
Bomarea tarmensis Kraenzl. Huánuco and Ayacucho.
Bomarea ovata (Cav.) Mirb. Cajamarca, Ancash, Huánuco, Lima, Junin, Moquehua, and Cuzco. Also in Bolivia but, as here restricted, unknown farther north. Local name, Ulubaya. The sweet tubers are eaten.
Bomarea cordifolia (R. & P.) Herb. Posuso, Department of Huánuco.
Bomarea latifolia (R. & P.) Herb. Antiquipa, Arequipa.
Bomarea Hookeriana Herb. Amazonas and Junin.
Bomarea dolichocarpa Killip. Huánuco, San Martin, Loreto, and Junin.
Bomerea speciosa Killip. Huánuco.
Bomarea lyncina Herb. Junin and perhaps elsewhere.
Bomarea declinata (Poepp. & Endl.) Klotzsch. San Martin and Junin, and possibly elsewhere.
(N. B. The species are listed here in the order in which they are treated in the Flora of Peru).

ALSTROEMERIA

Alstroemeria chorillensis Herb. Department of Lima.
Alstroemeria Ligtu L. Lima.
Alstroemeria peleggrina L. Ancash, Lima, and Huánuco. Called Peregrina and Azucenda de Lima.
Alstroemeria pygmaea Herb. Junin. Also in Bolivia and Patagonia.
Alstroemeria recumbens Herb. Lima.
Alstroemeria violacea Phillippi. Arequipa. Also in Chile.

HYPOXIS

Hypoxis decumbens L. San Martin and Huánuco. A species of wide distribution.

DISTREPTA

Distrepta vaginata Miers. Lima. Also in Chile.

AUSTRALIAN AMARYLLIDACEAE[1]

G. K. Cowlishaw, F. R. H. S.
New South Wales, Australia

This world wide Order is found most abundantly in the warm and temperate regions of the world, and particularly in those parts where the climate is characterized by decided wet and dry seasons. Such conditions exist in most parts of Australia, and it is therefore remarkable that but thirteen genera of this order have been recorded from this island continent. Nine are endemic, and of these, six are confined to Western Australia. Since the climatic conditions of so much of Australia are so suitable for the growth of exotic species which respond so well to cultivation here, one is led to wonder why a far larger number of such genera and species have not been found. Possibly the explanation lies in the fact that the *Amaryllideae* are but a recent link in evolutions chain. The Australian Flora and Fauna are on the whole, a survival of the past—living fossils they are often called—or have evolved from primitive forms, which have disappeared without leaving living survivors elsewhere in the world. We are therefore not surprised to find that it is only the older forms of the *Amaryllideae* or such species that owing to the nature of their seeds could have been transported to these shores by wind and waves of the sea, which are found in Australia. In the older genera of *Amaryllideae* we have something different and exclusively Australian. This is a subject I would like to go into at some length, but it hardly comes within the scope of the present paper.

Australian botanists have grouped the five tribes *Hæmodoreae* (2 genera), *Conostyleae* (5 genera), *Hypoxideae* (2 genera), *Agaveae* (1 genera) and *Euamaryllideae* (3 genera), (often ranked as separate orders) together to form the *Amaryllideae.* Thus they obtain a well defined group such as we possess in the *Irideae,* and the *Orchideae,* without leaving any misfits.

Each of these groups or tribes, comprising the *Amaryllideae* so constituted, have definite characteristics, which separate them individually, but collectively they agree in having important characteristics in common, such as are sufficient to clearly separate them from other Orders. It is not my intention to consider in detail the characteristics above referred to, nor to those of the individual tribes, or divisions comprising the *Amaryllideae,* other than the *Euamaryllideae.* I would refer the reader to Bentham's "Flora Australiense", should he or she desire any further information. With the exception of Western Australia, well written "Floras" of the different states have been written from time to time since Bentham's monumental work appeared, nearly sixty years ago. These may be consulted with advantage. In particular I would refer those interested in the *Amaryllideae* to Bailey's "Queensland Flora" in which much information on the *Crinums,* etc., may be obtained, and moreover many excellent illustrations of these plants may be studied.

[1] Mr. Cowlishaw follows the classification of Bentham's "Flora Australiense."

Key to the Australian Euamaryllideae

Perianth glabrous, stigmas small; bulbous plants; leaves horizontally flat, channeled or terate; flowers umbellate or rarely solitary on leaflets scapes.

No Corona; flowers large; ovules several in 2 rows in each cell ---------- *1. Genus Crinum.*

Filaments connected below the middle by a corona; ovary 3-celled with 2 ovules in each cell; leaves broad with distinct veins ---------- *2. Genus Eurycles.*

Ovary 1-celled with 2 ovules; leaves narrow with close veins, or broad with distinct primary veins ---------- *3. Genus Calostemma.*

Many of the Australian *Amaryllideae* are inconspicuous plants, possessing no qualities whatsoever to recommend them to the horticulturalist. On the other hand we have many species, particularly among the *Crinums* and similar genera, which stand well among the first rank as garden subjects.

Of the thirteen genera which have been recorded from Australia, but three, *Crinum, Calostemma,* and *Eurycles,* possess bulbs; of the remainder *Haemodorum, Tribonathes, Curculigo* and *Hypoxis* possess rhizomes or tuberous rootstocks. The rest are fiberous rooted plants. No bulbous rooted *Amaryllideae* has been recorded from the West for they are confined to the Eastern portion of the continent, and are found within several hundreds of miles of the coast. One species of *Crinum* has followed the Murray-Murrimbidgee-Darling River System almost to its mouth—*C. flaccidum.* The bulbous rooted species are found growing in the districts of heavy rainfall periods or in close proximity to water. This does not mean that they do not grow in districts of long dry spells, but where the rainfall is most abundant in the wet season. They are often found growing in close proximity to rivers where they receive moisture at the roots during the year round. In comparison with the size of the plant, Australian *Crinums* make but small bulbs, and are often evergreen.

I. Crinum

From a horticultural point of view, the crinums are about the most important of all the Australian *Amaryllideae.* These plants are bulbous herbs, with long flat radical leaves, sometimes channeled; scape simple, leafless; flowers large, and in the Australian species, mostly white, in a terminal umbel surrounded by a few membranous slightly coloured bracts.

There are 10 species recorded from Australia, all of which are found in Queensland, two extending to N. S. W. and Victoria.

The genus falls naturally into two divisions, in the first of which the stems are perennial above ground, and includes two species. *C. pedunculatum* and *C. Douglasii.* The former has a very wide range, and possesses many regional varieties. It is apparently closely related to *C.*

asiaticum, and is the commonest of Australian crinums in cultivation. It forms a stately plant carrying its long broad leaves on a more or less extended column. The flowers are white, with narrow segments, and may number as many as 40 in an umbel. The seeds are large, and retain their power of germination for many months. It is found growing from North Queensland down the eastern coast to Victoria.

The other group possess no perennial stems above the ground. The best known of these is C. *flaccidum* which possesses white flowers, and forms large bulbs some considerable distance below the ground. This species has followed the Murray-Murrimbridgee-Darling River System to its mouth in South Australia and is found in all the Eastern States except Tasmania. It is confined to the inland regions and is seldom noted close to the sea coast.

GENUS CRINUM, 10 Australian species, 9 endemic.

1. *C. pedunculatum,* Eastern States; Fiji, New Caledonia, New Guinea, Lord Howe's Is.
2. *C. Douglasii,* Queensland
3. *C. venosum,* Queensland
4. *C. brachyandrum,* Queensland
5. *C. brevistylum,* Queensland
6. *C. uniflorum,* Queensland
7. *C. angustifolium,* Queensland
8. *C. pestilentis,* Queensland
9. *C. Brisbanicum,* Queensland
10. *C. flaccidum,* Eastern inland.

Australian crinums are for the most part found growing along the banks of rivers in tropical scrubs or swamps, where they can enjoy the maximum amount of moisture at certain periods of the year. All take kindly to garden conditions, and respond well to cultivation. Seeds are easily germinated and in most species seedlings reach flowering stage by the end of the fourth year.

II. EURYCLES

Next in importance from a horticultural point of view and more typically Australia is the Genus *Eurycles.* There are 2 species native in Australia, one of which is endemic, and the other extends to the Archipeligo. These plants possess radical petiolate leaves; the lamina are broad with longitudinal rather distinct veins, and transverse veinlets between them; the scape is leafless, and flowers are usually white, in a terminal umbel surrounded by 2 or 3 membraneous bracts.

These plants are bulbous, and the fruit is succulent as in the crinums. The larger of the two species which also extends its range beyond Australia, is *E. sylvestris* and is found in North Queensland. The other, *E. Cunninghami,* is found from Northern N. S. W. to Rockhampton, Queensland.

The latter species is often found growing in gardens about Sydney. It appreciates an abundance of water while growing. Seedlings will flower within 3 years. Both species have a decided resting period in the winter.

GENUS EURYCLES, 2 Australian species, 1 endemic

1. *E. sylvestris,* N. Queensland, Malay Peninsula and Philippine Is.
2. *E. Cunninghami,* North N. S. W. to Queensland.

III. CALOSTEMMA

Closely related to the Genus *Eurycles* is the Genus *Calostemma.* These plants possess variously coloured flowers, smaller than in *Eurycles.* The leaves are all radical, narrow, with close parallel veins, or broad with more distinct veins, and traverse veinlets. The outstanding characteristic of the Genus is the reduction of the ovary to a single cell. This appears to be due to the early abortion of two of the carpels.

Two species are fairly common, one in the north and the other in the south of Queensland. The latter extends to Northern N. S. W. and can be easily distinguished from the former by leaf characters. The first with yellow flowers possesses linear narrow leaves, and is known as *C. luteum,* and the other which has ovate leaves and white flowers is known as *C. album.* A third species with purplish pink flowers occurs and is known as *C. purpurea.*

The Calostemmas have been grown rather extensively in Southern Gardens for many years, though not nearly so commonly now as in former times. A number of hybrids were reputed to exist in the past but I have been unable to trace any of these. There is no doubt that they will cross with *Eurycles,* and it is possible that *C. album* is itself a natural hybrid.

The seeds are large, solitary and fleshy. They germinate freely, and seedlings flower in their third year.

GENUS CALOSTEMMA, 3 species endemic to Australia.

1. *C. purpureum,* S. Australia and N. S. W.
2. *C. luteum,* Queensland and N. S. W.
3. *C. album,* Gulf of Carpentaria.

Wyndham Hayward

See page 142

Hybrid Amaryllis, Ernestine

Plate 58

Wyndham Hayward

See page 142

Hybrid Amaryllis, Ethel Duckworth

Plate 59

THE GENUS ZEPHYRANTHES IN TEXAS[1]

H. B. Parks and V. L. Cory
Texas Agricultural Experiment Station

Imagine yourself one morning in mid-August standing at the edge of a landscape composed principally of a flat and almost barren terrain dotted sparingly with old crippled post oaks, the veterans of a two century war with Gulf storms. The foliage of these survivors of the war with weather and man seem torn and dry and so they are. You are looking at a bit of central south Texas in 1918. A three years' drought of great severity has practically eliminated grass and herbs. Shrubs and trees are nearing the limits of endurance. Wild animals and birds have moved and man giving up hope for rain is on the march toward water.

It is the afternoon of the same day. Welcome clouds come from nowhere and the almost forgotten rain begins, first gently, then in torrents and, as if to make up for lost time, keeps up the deluge for a night and a day. The long drought of 1914-1918 is no more. Two days later you stand in the same place and what a change, the much dejected oaks have assumed an air of arrogance in bright green leaves, still fresh from the wash. But, Oh the miracle! Where four days ago was only barren sand now hundreds of golden rain lilies rejoice in the return of rain. If you could have been with me on the two days pictured, you, too, would be a zephyranthes fan. About five years ago Mr. V. L. Cory, Range Botanist of the Texas Agricultural Experiment Station, made a remark as to his long interest in this genus. This paper is a popular account of our joint investigations.

To those who know the genus from one or two species growing in gardens where shade and moisture are plentiful and the plants bloom abundantly for a goodly length of time, it is necessary to recount the habits of this genus in a semi-arid country as an explanation as to why after two centuries of botanical exploration new species are being found. The species are very selective in their choice of a habitat. In fact so much so that given the habitat one can predict with much surety the species.

Z. texana is found only in loose friable soils. Often a colony will be found in black tight land. Investigation will show that these plants are growing in a friable soil that fills an old depression in the black soil.

Z. pulchella is even more selective. It grows only in shallow lake-beds located on the Gulf Coast near salt water, which contain rain water occasionally.

Z. species (not identified) has a similar habit but inhabits lake-beds far inland.

Z. longifolia is restricted to the Trans-Pecos and the High Plains where it grows in large colonies in former depressions which are now filled with wind blown soil.

The foliage of zephyranthes is so grass-like and exists for so short a

[1] Contribution, No. 390, to the Technical Series, Texas Agricultural Experiment Station, approved by the Director, March 5, 1937.

time that it is overlooked. As the blooming period is short and occurs during adverse weather conditions it is little wonder that few persons have seen this most wonderful display of bloom. After living for over twenty years in a land where these plants occur the writers are agreed that a species might exist in a thickly settled community, and yet be unknown to the residents.

Z. texana came under cultivation at the Apicultural Research Laboratory near San Antonio in 1926. That year there was an abundant bloom in late July and many of the flowers were doubles or triplets. Bulbs producing such flowers were dug and replanted. Strange to say while the bulbs are still alive and have bloomed every year since but few flowers were plenus. In the field, however, each year many abnormal flowers were seen. The following table shows the erratic behavior and at the same time the fixed habits of *Z. texana,* while blooming under conditions of intermittent rainfall. There were six periods of blooming, and the average period was 3.5 days duration.

FLOWERING DATA OF ZEPHYRANTHES TEXANA IN 1933 *

Period	Rainfall		Interval	Duration of Bloom		Length of Blooming
	Date	Amount		Start	End	Period
Second	May 4	.49	6	May 10	May 13	3
Third	May 26	2.75	7	June 2	June 6	4
Fourth	June 13	1.77	5	June 18	June 21	3
Fifth	July 30	7.05	6	Aug. 5	Aug. 10	5
Sixth	Aug. 16	1.54		No bloom		
Seventh	Aug. 31	1.06	4	Sept. 4	Sept. 7	3
Eighth	Sept. 17	.40		No bloom		
Ninth	Sept. 26	1.56	2	Sept. 28	Oct. 1	3
AVERAGE		2.44	5			3.5

* There were nine blooming periods in 1933.

During a meeting of the Texas Florists Association at San Antonio in 1932 a florist visited the Laboratory and saw *Z. texana* in bloom. He informed us that this was not *Z. texana* but *Z. citrina* and later sent bulbs which were indeed *Z. citrina.* A bulb dealer in the Eastern United States advertised a new rain lily with a red exterior. On growing here this plant proved to be *Z. texana.* His attention was called to this and he has since advertised just yellow rain lilies. He stated that he had selected the smaller bulbs from a lot of *Z. citrina* he purchased and was glad to know they were *Z. texana.*

About the same time there came to us several inquiries as to yellow rain lilies growing near the Spanish Missions in San Antonio and vicinity and asking for bulbs and specimens. The inquiries originated from a newspaper item stating that the Spanish Padres brought the bulbs to the Missions years ago and that the plants had gone wild. The only species found was *Z. texana* and it not even common.

Mr. Wyndham Hayward presented us with some bulbs of *Z. citrina* which were larger than those procured elsewhere, undoubtedly due to better growing conditions. These grown in the same plats with other *Z. citrina* showed a marked difference in shade of color and some in size.

The season of 1936 this species made the best showing. They bloomed at two periods about a month apart. Most bulbs produced two or more flowers at a time, a habit that is shared with *Z. candida*.

Z. pulchella and *Z. chrysantha* were only names to us until September 1936 when, on a long expedition covering the entire Gulf Coast, we happened on the right place and right weather conditions near Ingleside. Here in a number of small lake beds, containing water from a recent rain, were thousands of golden lilies. We had made every effort to find a yellow Rain Lily in the Corpus Christi country but without result and now we had stumbled upon them. While the authorities seem to agree that *Z. pulchella* and *Z. chrysantha* are the same, there is the record in many places of a zephyranthes growing in the sandy soils near Corpus Christi. Well, it may be there. It is something for which to look. Mr. Robert Runyon reports that he finds *Z. pulchella* only in these lake beds near the Gulf. The recorded localities are now, near Brownsville; sixteen miles southeast of Corpus Christi; and at Ingleside, eighteen miles northeast of Corpus Christi and all in lake beds.

Another Rain Lily, species unknown, occurs abundantly in lake beds of the central southern part of the state. Bulbs from there are now growing in our plats, which, when they flower, will reveal their identity.

Z. longifolia has been recorded from Trans-Pecos Texas for many years. Records speak of them as occurring sparingly in low places. On May 25, 1935 we camped at Odessa, Ector County, Texas. In a low lake bed like depression back of the camp were literally acres of *Z. longifolia* full grown and awaiting sunshine before the flowers opened. The day was cold and wet. We left without seeing an open flower. This species was seen in similar places for a hundred miles eastward but no open flowers. Many bulbs were brought home for propagation and from which to obtain herbarium specimens. Although put into the soil in June 1935, no open flowers have been obtained. The plants come to full bud at appropriate seasons and drop the bud before it opens. A nice plat still awaits the day of blooming.

Z. erubescens S. Wats. was an enigma. We finally obtained the original description from Prof. H. H. Hume and found that both Hayward and Hume were hunting for Pena Station the place where the species was supposed to have been found. It took very little writing to locate this place as the original railroad station at Hebbronville and the collector did not visit that section the year of the collection. Without a doubt this is a Mexican species.

Z. candida Herb. is common as an escape throughout Texas where soft moist soils occur. It was seen growing abundantly at Deweyville on the Sabine River; at High Island near Galveston; and at a point eighteen miles east of San Antonio.

The last story is the best. For years we have asked about Rain Lilies on all our trips. In the spring of 1936 a lady, a botanist of good standing, reported that purple Rain Lilies occurred in the sand hills of central Texas. She was instructed to get samples and she did. They were brought in by a C. C. C. boy. There was no doubt as to the genus but was this *Z. rosea?* How could it be so far back in the sand hills. A visit

was made to the Camp. The officer in charge was asked. Yes, he knew where there were red Rain Lilies and led the party to a beautiful bed of *Z. rosea* in bloom in a near-by farmer's yard, but this was not the same flower sent us from the sand hills. Returning to the C. C. C. headquarters the officer found the boy who obtained the first red flowers. He denied having secured them from the farmer's garden and drew a map showing the exact spot whence the flowers came. We went there, into a solitude of abandoned fields, weeds, and a few lonely live oaks. Beneath a huge oak as the boy had directed, we found where he had dug the two specimens. There were many plants but no bloom. We dug several and then moved a few feet so as not to hurt the stand. The first lick with the mattock hit rock. A little excavating and a tombstone marked 1869 was found lying face up under six inches of drifted sand. What a vision! Three quarters of a century ago the sorrowing relatives planted a rare imported bulb, a tribute to the memory of the departed. We undoubtedly had robbed a grave, but research must go on. Those bulbs will bloom this summer and we will know.

We still have a long list of rumors to investigate and some may lead to unknown species. When we began we found listed:

Atamosco-Habranthus-Zephyranthes
alba Hort.
Andersoni Herb. var. texanus Wright
aurea Watson
candida Lindl.
carinata Herb.
chrysantha G. & T.
citrina Baker
erubescens S. Wats.
longifolia Hemsl.
pulchella A. G. Smith
rosea Lindl.
texana Herb.
Treatiae S. Wats.

The present time we know the following occur growing wild:

Zephyranthes
candida Lindl.
longifolia Hemsl.
pulchella J. G. Smith
texana Herb.

Probably *Z. alba, Z. rosea, Z. carinata,* and others exist as escapes. It is also probable that there are three additional species in the list of suspects.

ADDITIONAL NOTES ON SOUTH AFRICAN AMARYLLIDACEAE

R. A. Dyer,

Botanist, Division of Plant Industry,[1] *Pretoria*

It was gratifying to learn through correspondence that my remarks on South African Amaryllidaceae in last year's number of *Herbertia* had been of interest to some readers, and I regret that, this year, I am unable to devote so much time to an article. This is partly explained by my nomination as botanist by the Union Government to join an expedition, during February and March, to the "Lonely Island," Tristan da Cunha. Incidentally there is no record of any amaryllid having been found wild on the island, nor does there appear to be any likelihood of such a record in the future.

A few days prior to leaving Pretoria for Simonstown, and thence on H. M. S. Carlisle to Tristan da Cunha, I had the opportunity of testing in the field a new camera which I intended using on the trip. It was during this trial in the vicinity of Pretoria that the accompanying photographs of *Crinum Forbesianum* Herb., and *Buphane disticha* Herb., were taken (Plate 53). *Crinum Forbesianum* is a species closely allied to the more widely known *C. longifolium* Thunb. It is distinguished from this mainly by the more open flowers with darker keeled segments and the shorter scape. Baker, in Flora Capensis, vol. 6, 199 (1896), points out that the leaves of *C. Forbesianum* are ciliated, whereas those of *C. longifolium* are scabrous on the margin. The former was figured in Curtis's Botanical Magazine t.6545 and the latter, in the same work, t.661. It was a piece of good fortune that the specimen photographed was in such perfect condition, for most of the others had already been considerably eaten by a swarm of black and yellow beetles, probably *Pachnoda sinuata* F. Owing to the damage done by this pest it was impossible to obtain seeds this season and it is hoped to increase our stock from a few large bulbs which were transplanted into the garden at the Division of Plant Industry, Pretoria. The colouring of the flowers in the veld was not constant, some being less crimson than others.

Buphane disticha Herb., was referred to in my notes last year. The photograph (Plate 53) illustrates very well the unique appearance of the opposite series of leaves and the comparatively large bulb which is mostly exposed above ground and at the same time is protected by a thick coating of the dry leaf-bases. Although the surrounding grass is burnt almost annually the bulbs are unharmed, not only unharmed, but apparently stimulated by the heat of the fire to flower in very early spring before the growth of the leaves. However, I am not in a position to say that there is a definite relationship between the firing of the grassveld and the flowering of the *Buphane disticha* bulbs.

In a letter to me early this year, your Editor mentioned the increasing interest in America in the cultivation of species of *Cyrtanthus*, and enquired what prospects there were of a comprehensive account of the

[1] Dept. of Agriculture and Forestry, Union of South Africa.

genus being prepared for publication in the near future. It would require a great deal of careful study to arrive at a satisfactory classification of species. At the present time botanists in South Africa, when attempting to apply the correct names to plants received for identification, are seriously handicapped by the absence of literature and type specimens. One of my colleagues, Miss I. C. Verdoorn, recently had occasion to investigate the identity of a specimen of *Cyrtanthus* from the Transvaal. It involved the true identity of *C. Tuckii* Baker, *C. contractus* N. E. Br., *C. angustifolius* Ait., and other closely related species in this most difficult group.

C. Tuckii was described by J. G. Baker from specimens collected in the eastern Cape Province by P. MacOwan. According to the description the type had 2 leaves ¼-1/3 ins. broad at the time of flowering. It appears from Miss Verdoorn's research (although I may not commit her positively at this stage) that this, somewhat imperfectly known species, is widely spread from its type locality into Natal and Transvaal. In the latter two regions, however, it is found in different forms which may prove worthy of varietal rank. As compared with the other species mentioned, which have spreading segments, *C. Tuckii* has smaller and somewhat connivent segments. The flowers are yellow at the base of the tube and shade into red towards the lobes. Those of the Transvaal form are unicoloured: the base of the tube is light red and the intensity of the colour increases toward the lobes. The leaves are narrow and are produced after or sometimes during the flowering period. The Natal form has a red tube and green lobes and leaves are apparently usually absent at the time of flowering.

The accompanying illustration of *C. contractus* (Plate 54) represents a group of plants collected in the vicinity of Pretoria during November 1935 and which flowered in October of the following year. It will be noted that one bulb produced a leaf at the same time as the inflorescence, which feature is apparently unusual in this species, also. On the other hand these facts indicate that, in classification, too much stress must not be placed on the presence or on the absence of leaves at the time of flowering, particularly if the plants are growing under abnormal conditions.

A coloured illustration of the Transvaal form of *C. Tuckii* has been prepared for publication in Flowering Plants of South Africa and, if it it is not included in this year's volume, it should certainly appear during 1938. It is possible also that one or two new species of *Nerine* will be described in the same work within the near future.

PRETORIA,
May 12, 1937.

THE FLOWERING HABIT OF COOPERIA TRAUBII

AUSKER E. HUGHES, *Florida*

Cooperia Traubii Hayward, described for the first time in 1936 Herbertia, is one of the most interesting and decorative of amaryllids. Aside from the attractive flowers, the flowering habit of this species is worthy of consideration. The flowers of most of the amaryllids open slowly, so slowly in fact, that one never notices the movements of the segments as they spread apart. In the case of *Cooperia Traubii*, however, the segments open more rapidly beginning at twilight. When blooming time arrives, it literally opens before one's eyes as if by magic. The movement of the segments is plainly visible as they adjust themselves to the various stages in the process of opening. The time required for complete opening varies from three quarters of an hour to one hour and thirty minutes depending upon the environmental conditions.

In the Summer of 1937 when our first specimen of this species was to flower, we arranged a supper party and the guests enjoyed with us the thrill of observing the opening of the flower. The flower began to open at about 6 p. m. and a pleasant fragrance reminiscent of crinums was outstanding from the very start of segment separation. At 6:30 p. m. the segments were about one-fourth open and the stigma and anthers were plainly visible. Fifteen minutes later the petaline segments were three-fourths open while the sepaline segments were expanded only one half. At this point the fragrance reached its maximum intensity. By 7:15 p. m. the petaline segments appeared to stand still while the sepaline segments opened very rapidly until they were in line. Then very rapid spread followed and the flower was completely open by 7:30 p. m. For a short time the segments drooped gracefully below the horizontal plane, but by 7:45 p. m. they had returned to the horizontal position which was retained during the life of the flower through the following day.

It is interesting to note that at 8 p. m. the stigma was apparently receptive and the anthers while still upright were curved slightly outward at the top. At this time an examination showed that pollen was beginning to shed. Since the tube of this species is 4½ inches in length early pollination might be essential in setting seeds. The flower was accordingly self-pollinated fifteen minutes after complete opening. In two days the ovary began to swell indicating that fertilization was successfully accomplished.

THE GENERIC NAME AMARYLLIS ACCORDING TO WILLIAM HERBERT

Questions concerning the generic name *Amaryllis* are perennial, and it seems advisable to reprint a passage from Herbert's Amaryllidaceae, 1837, pp. 144-145, in order to show how the Hippeastrum-Amaryllis mix-up happened,—

> Many years ago, when in a letter published in the Hort. Soc. Trans., I first distinguished this genus (Hippeastrum) from the plants with which it had been confounded, I retained for it the name Amaryllis, and proposed that of

Coburghia for Belladonna and Blanda. I was not then aware that Linnaeus had given the name Amaryllis to Belladonna, with a playful reason assigned; but as soon as I learnt it, I felt, besides the general law of priority, that the *Jeu d'esprit* of a distinguished man ought not to be superceded, and that no continental botanist would submit to the change. I therefore restored the name Amaryllis to Belladonna, and gave that of Hippeastrum or Equestrian star to this genus, following up the idea of Linnaeus when he named one of the original species equestre. Mr. Sweet has improperly given the name Amaryllis to these bulbs, and made Belladonna a generic name, to which he subjoined a new specific one. This was doubly wrong, for with his view he ought to have adopted the proposed name Coburghia, which has been since applied to another genus.

The first institution of the genus Amaryllis was by Linnaeus in Hort. Clifford. p. 135, published in 1737. The name was given expressly to supercede Tournefort's Lilio-narcissus, which he rejected as a compound word. It so happens that a few species enumerated there by Linnaeus are of different genera as Sprekelia, Zephyranthes, Nerine and Oporanthus; and it was meant to comprise every thing called Lilio-narcissus by Tournefort: but he says that he gives the title in allusion to the name Belladonna, by which several species were known, because Amaryllis was the bella donna of Virgil, and her name was become proverbial for loveliness; and he adds a further conceit, that some of the bulbs were said to be bitter, *amarellas.* Amaryllis belladonna is not one of the few species defined in that article, because, though he knew of its existance, he had it not to enumerate from the Clifford garden.

Mr. Sweet was perhaps misled by knowing that equestre, which is one of the plants described, was called belladonna by Merian; but Merian only called it *another belladonna,* with reference to the plant of the Italian gardens, thinking erroneously that it was of the same genus. Barrelius had previously, in the year 1714, described the pink and white belladonna, as cultivated by that name in the gardens of Italy, and to the plant of Barrelius both Merian and Linnaeus alluded. It was the exquisite blending of pink and white in that flower, as in the female complexion, that suggested the common name in Italy, and to those lovely tints Linnaeus referred, when he assigned to it the name of a beautiful woman. To suppose he could have alluded to a bright orange flower would be perfectly absurd.

LYCORIS RADIATA AND NERINE SARNIENSIS

RUSSELL S. WOLFE, *South Carolina*

For about thirty years that I can remember, and perhaps many years longer, there have been naturalized in my yard many bulbs of red "Spider Lily" or "Surprise Lily" that, I was told, were properly named *Nerine sarniensis;* and, it seems that many other people had accepted that name as the proper one.

During the fall of 1936, I had an opportunity to compare the naturalized bulbs and flowers of my *"Nerine sarniensis"* with those of *Lycoris radiata* just imported from Japan. The imported bulbs *(Lycoris radiata)* were small (probably due to import regulations) and had a decided "hip" next to the neck, and the necks were small. The naturalized bulbs (supposedly *Nerine sarniensis)* averaged much larger, with practically no "hip," the bulbs tapering smoothly into a long, strong neck. Perhaps this difference could be due to different cultural conditions.

The blooms appeared similar, except that the florets and flower stems of the imported *Lycoris radiata* were slightly smaller and the subsequent foliage growth not quite as vigorous which perhaps was due to

Miss Mary McD. Beirne *See page 161*

Pure White Giant Leedsii Narcissus—Mary Beirne

Plate 60

Wyndham Hayward

See page 144

Flower of Aloma Daylily
Natural size

Plate 61

the fact that these bulbs were planted when received during August 1936 and flowered a few weeks later, and, the bulbs were small.

These slight differences in the *Lycoris radiata* imported from Japan, and the naturalized supposedly *Nerine sarniensis* may entirely disappear in another season or so when the recently imported *Lycoris radiata* have become thoroughly acclimated.

NERINE—LYCORIS ERROR DISCLOSED

WYNDHAM HAYWARD, *Florida*

Through the cooperation of the Brooklyn Botanic Garden and Dr. Henry K. Svenson, Curator of the Herbarium at the institution, the American Amaryllis Society has been able to ascertain definitely that many thousands of bulbs which have been grown as *Nerine sarniensis,* the Guernsey Lily, (Plate 55) in the South and Southwest for many years, are in reality *Lycoris radiata* (Plate 56), an interesting amaryllid from Japan.

First indications of the mistake in nomenclature were published in 1936 by Mrs. Jerome W. Coombs in the Gardeners Chronicle (American) and by W. M. James and the writer in the 1936 *Herbertia. Nerine sarniensis* is a native of South Africa, and *Lycoris radiata,* while it has been termed horticulturally the "Japanese Nerine", is quite a different plant in growth, habit and appearance.

An appeal was made to the Brooklyn Botanic Garden in June, 1936 and bulbs from a number of plantings over the South and in California were submitted for identification. These were brought into flower and proved to be *Lycoris radiata* without exception. Dr. Svenson also supplied the writer with quotations from the literature. The original illustration of *Nerine sarniensis* in Curtis's Botanical magazine is reproduced for comparison (Plate 55). Careful examination of hundreds of the bulbs in bloom in the collections of various growers in Florida, likewise showed that beyond all doubt the bulbs were the genuine *Lycoris radiata* (Plate 56).

Main distinctions between the two species, besides the difference in natural habitat include the following—Seeds of *Nerine sarniensis* are green and those of *Lycoris* are black. The leaves of *Nerine sarniensis* are broad and flat, light green in color and those of *Lycoris radiata* are narrow, seldom more than ⅜ inch wide, and are channeled, with a lighter green-gray stripe down the upper side of the leaf. The petals and sepals of *Nerine sarniensis* are considerably wider than those of *L. radiata.* The flowers of *L. radiata* are erect, with protruding stamens, all on a single rotary plane; in other words, the flowers and projecting stamens "radiate" about the stem. The umbels of *Nerine sarniensis* are loose and irregular. The bulb scales of the true nerines have tiny silk-like fibers in them, which *L. radiata* lacks.

Both plants have the habit of going dormant in summer, and blooming in the late summer or early fall, without leaves, which are produced during the winter and spring. *Lycoris radiata* is quite hardy, as its sistership to *L. squamigera* might lead one to believe. Its outstanding

character, however, is its extreme vigor and ability to adapt itself to numerous soil types. The bulbs will grow and thrive in poor soil, next to shrubs and trees, along a stony walk, etc., where most bulbous plants would be a complete failure.

The original illustration of *Nerine sarniensis* (Amaryllis sarniensis) as published in Curtis's Botanic Magazine, Vol. IX, X, p. 294, shows the character of the Nerine. It can be readily seen that it is quite unlike the supposed "Guernsey Lily," now known to be *L. radiata,* which has been a bright decoration of so many Southern gardens for generations.

Disclosure of the identity of this amaryllid as *L. radiata* has been somewhat of a shock to numerous of the older botanists in the Southern states who have known and admired them for a lifetime as *Nerine sarniensis.* As previously recounted, the error in nomenclature was first noted on examination of foliage and flowers of bulbs of *Lycoris radiata* recently imported direct from Japan, in the belief that they were a very rare plant in the United States.

On the other hand it now appears that *Nerine sarniensis,* the genuine species, is practically non-existent in the United States, unless possibly in private collections. Diligent search has failed to reveal more than a few bulbs, while there are thousands upon thousands of bulbs of *L. radiata* naturalized throughout the South and Southwest.

Experience with small seedling bulbs of *Nerine sarniensis* furnished through the kindness of Mr. W. M. James indicates that the true *Nerine sarniensis* may be unsuited for such general popularity and use in garden planting in warm climates as the *L. radiata* now enjoys. It is less vigorous, slower growing, and more subject to damage from droughts, insects, sunlight, etc., although it may prove to be valuable as a pot plant or bedding bulb for sheltered locations in good soil.

The mystery of how such quantities of *L. radiata* came to be present over the southern part of the United States, and under the name of a South African plant, remains as puzzling as any in modern horticulture. Doubtless the bulbs were brought in from the Far East with early shipments of other plants a hundred or more years ago. On the other hand, the genuine *Nerine sarniensis* is a well known bulb with European collectors, and is frequently found listed in the specialty catalogues of dealers in Holland and England.

Regardless of the change of name, *Lycoris radiata* remains one of the most valuable bulbs of the Amaryllis Family for outdoor planting in the South. The plants are inconspicuous, when not in bloom, although the foliage is truly handsome in itself. Their blooms appear when other flowers are scarce, rising as if by magic from the dry sand or clay soil. The flowers are a bright rose-red, extraordinarily beautiful and last in good condition for many days, making an excellent cut flower. The bulbs will grow almost anywhere except in a sour, soggy soil.

Lycoris aurea is a well known bulb in Florida, being found in abundance in old gardens about St. Augustine. *Lycoris squamigera,* the "hardy amaryllis" is grown as far north as Massachusetts and Ohio. These are the only species of Lycoris commonly available in the United States.

NOTES ON FLORIDA HYMENOCALLIS

Mary W. Diddell, *Florida*

The Amaryllis family holds no more lovely genus than *Hymenocallis,* and we have in Florida nine species and perhaps ten belonging to this Subdivision. The name, *Hymenocallis,* means beautiful membrane, referring, of course, to the membranous stamineal cup which is the most conspicuous feature of the flower.

My first acquaintance with hymenocallis, in its native habitat, was several years ago, when I found *H. occidentalis* growing in mud-flats in the Satilla River, in south-east Georgia, where the natives call it "Easter Lily", because it usually blooms at Easter. As the Satilla River is only a few miles north of the St. Mary's River, I think it is very probable that this species will be found in northern Florida, though as yet I have not come across it.

For several years I have hoped to make a thorough study of all of our native *Hymenocallis* species, but for various reasons in past years I have been prevented from going out into the woods and river banks to collect them at their blooming season. For several months past, I have been on the lookout for the plants on every trip into the woods, and have collected the bulbs and brought them home and planted them, keeping them as wet as possible, but owing to a late and freakish season this year only one has come into bloom. This is *H. coronaria,* and Dr. Small gives it range from Florida to Alabama and South Carolina. This one bulb appeared sometime ago in some irises which I had brought in from the woods and I took it out of the iris bed and transferred it to a small pool in the fern garden, where it bloomed again this year. From the bloom alone it would be difficult to tell whether it is *H. coronaria* or *H. laciniata* as it fits the description of both in Dr. Small's Manual. The nine leaves, however, arising from a short, globose bulb, are about twenty-five inches long, rich, shining green and shallowly channeled, which places it as *H. coronaria* for he described *H. laciniata* as having few leaves. Dr. Small further states of H. coronaria,—"Bulbs said not to produce stolons." This one bulb, so far, has not produced stolons, but other bulbs, identical in appearance, which I recently found in a swamp, but which have not yet bloomed, are stoloniferous.

Our native *Crinum americanum* occurs in many places in Florida where it can find enough moisture in full sun or deep shade. I have seen, at low tide, swampy areas so covered with the seeds that it was impossible to walk without stepping on several at once, but hymenocallis are more "choosy." The swamp species are found on the edges of swamps, or near streams, back in the deep shade, usually in soft mud. They are scattered over a small area, in segregated colonies of not more than a few hundred plants of the same species, though I know one spot where there are two colonies, representing two species, a quarter of a mile or less, apart.

There is considerable difference in the appearance of the plants of the different species, so that as a rule one could not be mistaken for another. In addition to the variation in the number of leaves to the

(Continued on page 161)

THE HORTICULTURAL STATUS OF DAYLILIES

A. B. STOUT,[1] *The New York Botanical Garden*

It would seem that the main objectives in the efforts of the proposed *Hemerocallis* (Daylily) Committee of The American Amaryllis Society are rather clearly determined in the need which exists for the evaluation of the daylilies according to merit and class and for information regarding the cultural behavior of the different types and classes of daylilies in gardens in different climatic areas, especially of America.

I. THE EVALUATION OF DAYLILIES

The horticultural group of daylilies are now in that stage of development which is characterized by a somewhat rapid and indiscriminate increase of clonal varieties many of which have no distinctive merit. The first of the hybrid daylilies which were named for culture appeared about 1890 and the number of such clones steadily increased until in 1934 there were records for 174 different horticultural clones which were listed in the chapter "The Horticultural Clones of Daylilies" in the book "Daylilies", published in March 1934. Since that date, a span of only three years, according to letters and catalogs which have come to hand, *97 new clones have been named.*[2] Also a considerable number of persons who have not yet named any plants are growing seedlings in considerable numbers of which at least some are certain to be introduced into culture.

The situation in respect to daylilies may be viewed impersonally and in the light of the history of the more extended development of other groups of garden plants, such as the irises, the dahlias, and the roses. An increase in the popular interest in any plant, such as the group of daylilies is now experiencing, is reflected in a general increase in "breeding." In the case of plants propagated vegetatively, as irises, dahlias, roses, daylilies, etc., most of this breeding is merely obtaining seed from hybrid clones and if there is more or less cross-pollination this is usually uncontrolled. As a rule the seedlings thus obtained from plants that are themselves hybrids show considerable variation. Often no two are exactly alike but the differences may not be very distinctive. Frequently the seedlings are grown by persons who have seen few types of the plant in question and have little critical judgment of the relative merits of their seedlings. Also certain nurserymen may grow seedlings and introduce them in considerable number without much regard to their real merits or distinctions.

Thus it happens that numerous seedlings are propagated, named as horticultural clones, and listed for sale to a public that is interested. But some of these clones are very much alike; many are not much different from and no better than certain of the older varieties; many are outranked by certain clones which may not be widely known. The average gardener is unable to distinguish between various of the clonal varieties; and he is often disappointed with varieties for which he may pay a goodly price.

[1] Chairman, Hemerocallis Committee.
[2] See page 144.

Thus there arises a decided need for the critical evaluation of the different clonal varieties. Perhaps an organization, as for example the American Iris Society, officially establishes a code for the rating of varieties by a committee of judges. But, whether or not this is done, in time experience indicates what varieties thrive best in different climatic areas. Also gardeners become more fully acquainted not only with the many varieties but with the different classes in which varieties belong, and their preferences become somewhat crystallized into a public evaluation of what constitute the best classes and the best clones in each class. At this stage the situation provides a natural check on the introduction of mediocre plants from indiscriminate breeding. New varieties which receive much attention must possess merit and either be better than the older clones or of a somewhat distinctly new type. There will always be opportunity for breeders to develop such plants.

A survey of the 250 or so horticultural daylilies now in existence will reveal to anyone that numerous varieties have neither distinctive characters nor special merit for garden culture. This holds for a considerable number of the clones named during the past three years. But any adequate evaluation of the daylilies must recognize that the group of horticultural daylilies has now become so diverse that there are distinct classes in each of which there are outstanding plants of decided charm, merit, and individuality. In respect to the season of bloom at New York a selection of types may be made which will provide a succession of bloom from early May until late in September. In stature there is a range from less than a foot tall to as much as six feet. There are several distinct classes in respect to habits of growth and to size and shape of flowers. The new flower colors give various classes such as the bicolor pattern, the eyed pattern (as in the Mikado Daylily), a type with rich shades of crimson red, a very distinct class in dark mahogany red (as in the Theron Daylily), and others. The extensive use of the autumn-flowering small-flowered *H. multiflora* in hybridization followed by selective breeding has given small-flowered plants in a wide range in habits of growth, stature, season of bloom, and color of flowers. Selections of the best individuals in various of these new classes have been made for propagation and garden culture. In regard to the number of named varieties, and the number of somewhat distinct classes the group of horticultural daylilies is rapidly expanding. The limits in the development of new types are certainly not yet in sight.

Perhaps the writer may be allowed the comment that the development of new types of daylilies seems to have outdistanced the realization and appreciation of the general gardening public. Daylilies are to most people merely daylilies. "Will you name the best daylily?" is a frequent request.

At the New York Botanical Garden there is a display garden in which nearly all known species of daylilies are represented and at least one plant grown of most of the named clones. There is also an experimental garden in which are some 500 plants selected as the most outstanding of about 50,000 seedlings obtained by hybridizations and selective breeding. There are also several thousand seedlings of recent breeding.

Many gardeners and nurserymen visit these collections of living plants. With very few exceptions the selections which these visitors make are based on personal tastes and are limited to few classes or to one class. Certain persons will select only clear colors in yellow or orange. Others will prefer the newer dark red or crimson red colors. Some will not look at any type which has any shade of fulvous coloring. Some are attracted to dwarf plants of which there are a considerable number of seedlings but others will remark that it is a waste of time and effort to be breeding for dwarf clones no matter how fine their flowers may be. More persons are pleased with the pink-flowered type than with any other one class. The reactions of these numerous gardeners lead me to conclude that there has not yet developed in the general gardening public, or even in that portion of it that is interested in daylilies, a sense of the horticultural classes of daylilies and of their relative values. This it seems must necessarily be the basis for the evaluation of the various individual clones. The question now is not what is the best daylily, but what clone is to be ranked most highly in a certain class: as for example, in the *dwarf, early-flowering, and red-flowered class;* or in the class that is *semi-robust, summer-flowering, and mahogany red;* and in other specific classes.

The first step in the evaluation and selection of daylilies is, it seems to the writer, the recognition of the main horticultural classes which exist in respect to (1) stature and habits of growth, (2) flowering habits, and (3) characters of flowers. An attempt to outline the limits of these classes was made by the writer in the chapter on "The Evaluation of Daylilies" in the volume "Daylilies", and in an article published in Herbertia, volume 3, pages 99-103. Perhaps a more definite standardization of classes and the listing of varieties typical of each class could now be attempted.

II. The Cultural Behavior of Daylilies

The value of any daylily for garden culture in a given region depends primarily on its response or behavior to the enforced and fixed conditions of climate that exist. The plant must thrive reasonably well or it cannot be recommended for general garden culture.

The cultural responses of most species and clones of daylilies are fairly well known for the more northern states. However, more definite data for local conditions are being obtained in various test gardens recently established in various northern states. At The New York Botanical Garden special effort is made to test plants of all species and horticultural clones for their cultural reactions. Special studies of the behavior of daylilies are also in progress at the State Experiment Station at Gainesville, Florida, under the direction of Professor H. Harold Hume. For other and somewhat different climatic areas of the United States the information regarding the behavior of daylilies is less adequate. Few of the different species and clones have been widely grown and also the experiences which growers and nurserymen have had with daylilies have not been assembled.

The wild daylilies *(Hemerocallis)* are all native of the temperate regions of central and northern Asia. They are naturally plants of the temperate zone. Yet some of them also thrive in tropical lands. For example the *Hemerocallis fulva* clone Europa has become one of the most cosmopolitan of garden plants and it seems that this clone thrives anywhere in temperate and tropical lands wherever out-door gardens are a success. But it does not follow that all of the species of the genus and that all of the horticultural clones will also thrive under a similar range of diverse climatic conditions.

The species that are fully hardy at New York are the early-flowering *Hemerocallis minor, H. Dumortierii* and *H. Middendorffii,* the summer-flowering *H. Thunbergii, H. citrina* and *H. exaltata,* and the late-summer and autumn-flowering *H. multiflora.* The foliage of these dies early in autumn and new shoots are suppressed until early in the following spring. Many of the hybrid horticultural clones which have one or more of these species in their ancestry are also full hardy. It is known that some of these daylilies do not thrive in Florida. Possibly the habit of dormancy during winter is necessary to their well being.

The early-flowering clone which is the botanical type of the species *H. flava* is fully hardy over a considerable portion of the temperate zone. This clone produces seed to self-pollination and from such seed numerous seedlings have been grown at The New York Botanical Garden. Not one has been hardy; the main buds are killed each winter and the new shoots from dormant buds of stems buried in the soil make weak growth during the following summer and seldom produce flower scapes. In this instance a plant which is *hardy* produces selfed offspring which are *not hardy.*

Wild plants which are to be included in the species *H. fulva* have been obtained from widely separated localities in Japan, China, and northern India. Mostly the foliage of these, and also of the older cultivated clones of this species, remains green and lush until severe freezes occur. Some plants suffer from winter injury. Various of the fulvous seedlings obtained, and especially in breeding for the pink-flowered type *(H. fulva rosea),* have not been hardy at New York.

The so-called *H. aurantiaca* and the *H. aurantiaca* clone Major have what may be termed a fully evergreen habit. At New York these types remain more or less green throughout the winter. The type clone of *H. aurantiaca* survives and blooms well but the clone Major is often killed unless it is protected by a covering such as is provided with salt hay.

Numerous hybrids including many of the ones named as horticultural clones have an evergreen or semi-evergreen habit and the main buds suffer more or less injury at New York from winter killing. But often the new growth from lower buds is vigorous and the plants bloom well.

It is reported in semi-tropical regions that daylilies of the evergreen type thrive especially well, remain lush and green throughout the year, and may have a somewhat extended or continuous blooming.

Fr. Meyer, Hamburg, Germany

See page 182

Narcissus schizocoronatus—

Left, Narcissus pseudonarcissus schizocoronatus "Buttonhole";
Right, Narcissus "King Alfred" (pistillate parent) X "Gigantic Orchidflower" (pollen parent).

Plate 62

Fr. Meyer, Hamburg, Germany

See page 185

Narcissus schizocoronatus—

Left, Narcissus incomparabilis "Confidence" X "Gigantic Orchidflower";
Right, Narcissus schizocoronatus "Vorstin" ("Buttonhole" X "King Alfred").

Plate 63

Very little can be reported regarding the culture of the dwarf species *H. nana.* Its culture does not appear to be very successful or general in Europe and at New York plants of this species have grown poorly and soon died when grown in outdoor culture, or in cold frames or in pots in greenhouses. This species grows wild in the uplands of southwestern China but evidently it is only found below the snow line. It would seem that somewhere in United States the conditions will be favorable for the successful garden culture of this interesting and perhaps valuable species. It has, however, been hybridized with hardy types and seedlings obtained that are fully hardy at New York.

There is also limited information regarding the cultural requirements of *H. plicata* and *H. Forrestii.* These two species have been confused in both botanical and horticultural literature. Plants grown from seed collected in China and which appear to be the true *H. Forrestii* have lived in out-of-door plantings at The New York Botanical Garden.

Possibly a Daylily Committee operating in the American Amaryllis Society may be able to render a service to those gardeners who wish to grow daylilies in the various parts of America and especially in sections where few kinds of daylilies are now known. Perhaps there is some information of value which awaits compilation by such a committee. But it is somewhat evident that the needed information on the matters discussed above may be provided most fully and quickly from test gardens in which plants of some of the species and of the best clones of each of the various horticultural classes are grown and their behavior noted. Such gardens could be under private, semi-private, or public ownership, or under the auspices of garden clubs, horticultural departments of experiment stations, or otherwise. These gardens would not only be test gardens but objective display gardens in which gardeners would see numerous kinds of daylilies and make their own selections and evaluations.

CLASSIFICATION OF HYBRID AMARYLLIS (HIPPEASTRUM) FLOWER TYPES

Revised for 1938 and 1939 shows: Hybrid amaryllis shall be subdivided tentatively into the following types on the basis of the characters indicated below,—

FLOWER TYPES

A. Flowers distinctly drooping, tube long (over 3 inches long)
  B. Tube very long (over 4 inches) *Solandriflorum Type A*
  BB. Tube shorter (3 to 4 inches) *Solandriflorum Type B*
AA. Flowers slightly upright, horizontal or slightly drooping, tube short
  C. Tube narrow, (1 to 3 inches)
    D. flower compact, *Reginae Type A*
    DD. flower pointed, *Reginae Type B*
  CC. Tube open (to 1 inch)
    E. flower compact, *Leopoldi Type A*
    EE. flower pointed, *Leopoldi Type B*

EXHIBITION GROUPS

For exhibition purposes there shall be three major groups, (1) Grandiflora classes in which flower form and size standards are the important considerations; (2) Decorative classes in which the use of the plant—landscape, rock garden, forcing, etc., shall be the important considerations, and (3) Double flowering classes.

CLASSES AND AWARDS (PRIZE SCHEDULE)

At the annual National Amaryllis Show, and at other exhibitions, as voted by the Board of Directors, the Society will award its First Class Certificate for meritorious new and standard varieties; its award of merit; and its first, second, third and fourth prize ribbons, in the classes indicated below. Any money prizes offered shall be authorized by action of the Board of Directors.

Each species or varietal exhibit shall consist of one or more potted flowering plants, or one or more flower scapes up to and including 1945; after which date three potted flowering plants or three flower scapes shall be required in each case.

SECTION A. AMARYLLIS (GENUS HIPPEASTRUM)

Class 1. Single entries of Hippeastrum species.
Class 2. Best collection of botanical species and varieties.
Class 3. Best collection of 10 or more Grandiflora varieties.
Class 4. Best collection of 5 to 10 Grandiflora varieties.
Class 5. Best collection of 10 or more Decorative varieties.
Class 6. Best collection of 5 to 10 Decorative varieties.
Class 7. Best hybrid amaryllis floral arrangement.
Class 8. Best amaryllid floral arrangement.
Class 9. Best display.
Class 10. Best bloom in Show.

Standard Grandiflora and Decorative Varieties

The score card, and prize schedule are reproduced on the two following pages.

Classes of Grandiflora, Decorative and Double Varieties (Prize Schedule)

COLOR CLASSIFICATION (Fischer Color Chart)	Grandiflora Group						Decorative Group	Double Group
	Leopoldi Type A	Leopoldi Type B	Reginae Type A	Reginae Type B	Solandriflorum Type A	Solandriflorum Type B		
White without markings	101	151	201	251	301	351	401	451
White with slight pale red markings	102	152	202	252	302	352	402	452
White with lighter red markings	103	153	203	253	303	353	403	453
White with lighter red stripes, keels, stars, tips, etc.	104	154	204	254	304	354	404	454
White with red stripes, keels, stars, tips, etc.	105	155	205	255	305	355	405	455
Yellow without markings	106	156	206	256	306	356	406	456
Yellow with markings	107	157	207	257	307	357	407	457
Bronze without markings	108	158	208	258	308	358	408	458
Bronze with slight markings	109	159	209	259	309	359	409	459
Bronze with distinct markings	110	160	210	260	310	360	410	460
Orange without markings	111	161	211	261	311	361	411	461
Orange with slight markings	112	162	212	262	312	362	412	462
Orange with distinct markings	113	163	213	263	313	363	413	463
Pale red without markings	114	164	214	264	314	364	414	464
Pale red with slight markings	115	165	215	265	315	365	415	465
Pale red with distinct markings	116	166	216	266	316	366	416	466
Lighter red to light red without markings	117	167	217	267	317	367	417	467
Lighter red to light red with slight markings	118	168	218	268	318	368	418	468
Lighter red to light red with distinct markings	119	169	219	269	319	369	419	469
Red without markings	120	170	220	270	320	370	420	470
Red with slight markings	121	171	221	271	321	371	421	471
Red with distinct markings	122	172	222	272	322	372	422	472
Dark red	123	173	223	273	323	373	423	473
Darker red	124	174	224	274	324	374	424	474
Violet red	125	175	225	275	325	375	425	475
Rainbow and tri-color types, excluding green	126	176	226	276	326	376	426	476
Any other color	127	177	227	277	327	377	427	477
Best bloom of type	149	199	249	399	349	399	449	499

Score Card—Grandiflora group[1] *Hybrid Amaryllis (Hippeastrum)*

All flowers to be expanded in ½ or more direct sunlight.

Color Class No..... Exhibitor's No.....

Flower Type.....

Character to be Scored	Method of Rating	Possible Score
Color and texture	No flower of inferior color to be considered; the full 50 points to be deducted for major color defects; dark green in combination with medium and dark red is especially objectionable.	50
Form	Rating should be based on conformity to type.	15
Size	Except in the case of Solandriflorum types, the following shall rule (diameter across face): 6″ to 7″, allow 10 points; 7″ to 9″, allow 13 points; 9″ and above, allow 15 points.	15
Habit	For Solandriflorum types the drooping habit is normal; but for Reginae and Leopoldi types, horizontal and slightly erect carriage are to be favored, although slight drooping is allowable.	5
Number of flowers to scape	For less than 3 or more than 5 allow 2 points; for 3 to 5 allow 5 points.	5
Length of scape	The length should be considered in relation to size of flower; scapes too short or too long should be penalized	5
Character of scape	Scapes should not be so coarse as to be conspicuous, but should be sturdy enough to hold up flower well	3
Fragrance	Should not be too faint or too strong	2

[1] **NOTE: No entry is to receive first prize unless a rating of at least 86 points is merited; second and third prizes may be awarded to entries rating from 76 points up. A Score Card for the Decorative group is in preparation.**

SECTION B. HEMEROCALLIDS

Class 601 Best collection of *HEMEROCALLIS* species (Daylilies).
Class 602 Best collection of hybrid Hemerocallis varieties.
Cass 603 Best Display of hybrid Hemerocallis varieties.
Class 610 Best hybrid Hemerocallis bloom in show.
Class 621 Single entries of hybrid Hemerocallis varieties.

Class 651 *HOSTA* (Plantain Lilies)

Class 661 *LEUCOCRINUM*

Class 671 *HESPEROCALLIS*

SECTION C. AMARYLLIDS (EXCEPT GENUS HIPPEASTRUM; SEE SECTION A, ABOVE)

Class 701 Best collection of *AGAPANTHEAE*
Class 702 Agapanthus
Class 703 Tulbaghia

Class 751 Best collection of *ALLIEAE*
Class 752 Bloomeria
Class 753 Muilla
Class 754 Allium
Class 755 Nothoscordum
Class 756 Tristagma
Class 757 Steinmannia
Class 758 Brodiaea
Class 759 Diphalangium
Class 760 Milla
Class 761 Androstephium
Class 762 Behria
Class 763 Bessera
Class 764 Leucocoryne
Class 765 Stropholirion
Class 766 Brevoortia

Class 801 Best collection of *GILLIESIEAE*
Class 802 Erinna
Class 803 Solaria
Class 804 Speea
Class 805 Trichlora
Class 806 Miersia
Class 807 Gilliesia
Class 808 Gethyum
Class 809 Ancrumia

Class 851 Best collection of *GALANTHEAE*
Class 852 Galanthus
Class 853 Lapiedra
Class 854 Leucojum

Class 901 Best collection of *AMARYLLIDEAE*
Class 902 Amaryllis (Belladonna)
Class 903 Brunsvigia
Class 904 Ungernia
Class 905 Nerine

Class 951 Best collection of *CRINEAE*
Class 952 Chlidanthus
Class 953 Crinum
Class 954 Ammocharis
Class 955 Cyrtanthus
Class 956 Stenolirion
Class 957 Vallota

Class 1001 Best collection of *ZEPHYRANTHEAE*
Class 1002 Zephyranthes
Class 1003 Cooperia
Class 1004 Haylockia
Class 1005 Crocopsis
Class 1006 Apodolirion
Class 1007 Sternbergia
Class 1008 Gethyllis

Class 1051 Best collection of *HAEMANTHEAE*
Class 1052 Hessea
Class 1053 Carpolyza
Class 1054 Strumaria
Class 1055 Buphane
Class 1056 Griffinia
Class 1057 Clivia
Class 1058 Haemanthus
Class 1059 Choananthus

Class 1101 Best collection of *IXIOLIRION* species

Class 1151 Best collection of *EUCHARIDEAE*
Class 1152 Hyline
Class 1153 Stenomesson
Class 1154 Pamianthe
Class 1155 Pancratium
Class 1156 Elisena
Class 1157 Ismene
Class 1158 Hymenocallis
Class 1159 Calostemma
Class 1160 Calliphruria
Class 1161 Eucharis
Class 1162 Stricklandia
Class 1163 Eurycles
Class 1164 Klingia

Class 1201 Best collection of *EUSTEPHIEAE*
Class 1202 Urceolina
Class 1203 Hieronymiella
Class 1204 Eustephia
Class 1205 Eustephiopsis
Class 1206 Callipsyche
Class 1207 Eucrosia
Class 1208 Phaedranassa

Class 1251 Best collection of *HIPPEASTREAE* (Except Genus Hippeastrum)
Class 1252 Placea
Class 1253 Habranthus
Class 1254 Sprekelia
Class 1255 Lycoris
Class 1256 Vagaria

Class 1401 Best collection of *NARCISSEAE*
Class 1402 Cryptostephanus
Class 1403 Tapeinanthus
Class 1404 Best collection of Narcissus species
Class 1405 Trumpet Narcissi
Class 1406 Incomparabilis Narcissi
Class 1407 Barrii (also Burbridgi) Narcissi
Class 1408 Leedsii Narcissi
Class 1409 Triandrus Narcissi
Class 1410 Cyclamineus Narcissi
Class 1411 Jonquilla Narcissi
Class 1412 Tazetta and Tazetta Hybrid Narcissi
Class 1413 Poeticus Narcissi
Class 1414 Double Narcissi
Class 1415 Cleft-corona Narcissi

SECTION D. ALSTROEMERIALES

Class 1501 Best collection of *ALSTROEMERIACEAE*
Class 1502 Alstroemeria
Class 1503 Bomarea
Class 1504 Leontochir
Class 1505 Schickendantzia

Class 1551 *PETERMANNIA*

Class 1601 Best Collection of *PHILESIACEAE*
Class 1602 Luzuriaga
Class 1603 Philesia
Class 1604 Lapageria
Class 1605 Eustrephus
Class 1606 Elachanthera
Class 1607 Geitonoplesium
Class 1608 Behnia

REGISTRATION OF NEW VARIETIES

Descriptions of new varieties of hybrid amaryllids, hemerocallids, and alstroemerids for this section must reach the Secretary not later than June 1 to be included in the current issue of Herbertia. This information is published to avoid duplication of names, and to provide a place for the authentic recording of descriptions. Names should be as short as possible—one word is sufficient. It is suggested that in no case should more than two words be used.

NEW HYBRID AMARYLLIS (HIPPEASTRUM) VARIETIES

Introduced by John R. Springer, Orlando, Florida;—No. S-1, *Florence Springer,* Reginae type A, vigorous grower, bulb 3″; 7 leaves (evergreen), up to 20″ in length, ½″ to 2″ wide; Peduncle 24″ long, 13/16″ wide; two scapes with 4 to 5 flowers to the scape; flowers held horizontally, tube 1-2/16″ long, and 7″ across face; flower color—medium red (Maerz and Paul, 2-L-8), fine white penciling in throat and center of segments and a white hairline at rim of segments, sometimes this line is broken. Apparently mostly of *H. psittacinum* ancestry.

Introduced by the American Amaryllis Society, 1937, acting for the Garfield Park Conservatory, Chicago, Ill.,—

GARFIELDII, (Syn. *Hippecoris Garfieldii,* No. 30), Decorative type, bright orange red with darker star; normally two scapes per bulb, and four flowers to the scape; a most excellent forcing variety.

AUGUST KOCH, (Syn. *Hippecoris Garfieldii* No. 13), Decorative type, bright orange red with pale yellowish star; normally two scapes per bulb and four flowers to the scape; a most excellent forcing variety.

In addition, the following decorative varieties (formerly classed as *Hippecoris Garfieldii)* have been distributed to members for trial under numbers,—13, 17, 18, 19, 24, 27, 30, 39, 40, 56, 57 and 68.

Members receiving any of these should keep them properly labeled in their collections for some of these may be given names later on. The names tentatively considered for some of these numbered varieties are,—*Chicago, Robert Van Tress, Illinois.* Members receiving any of the numbered varieties, and also the two named varieties listed above should report their successes and failures in Herbertia.

Introduced by Wyndham Hayward, Lakemont Gardens, Winter Park, Fla.,

No. B-12, *Ernestine,* Leopoldi Type B, 9″ across face, compact structure; color, lavender rose-red with white keel (See Plate 58).

No. B-24, *Ethel Duckworth,* Leopoldi type B, compact, 8″ across face; color, clear velvet red, deeper color in throat, faint lighter shading at perianth segment tips (See Plate 59).

No. B-3, *Mary Davis,* Leopoldi type B, compact, 7″ to 8″ across face; color, pure white with light green throat; first prize at Central Florida Exposition, Orlando, Fla., Feb. 1937. (See Plate 57)

Introduced by Hamilton P. Traub and A. E. Hughes, Orlando, Fla. All of these were produced by crossing the 10½″ almost pure white variety *Marina* on various light shaded Mead hybrids.

No. TH-1, *Ella Maie Stevens,* Leopoldi type B; very vigorous grower bulb 4½″ in 18 months under excellent cultivation; 9 leaves, up to 32″ in length, 2½″ to 3″ wide; Peduncle 24″ long, 1-⅛″ wide; two scapes, and 4 to 6 flowers to the scape; flowers held horizontally, tube ⅞″ long; flower 3½″ long, and 8″ across face; flower color—upper three and upper half of lower side perianth segments white band in center, and red veins on white; lower half of lower side segments and lip, minutely dotted red on white; throat delicate light green, filaments pure white, style green changing to white toward stigma. A cross of *Marina* on a large flowered vittatum type. Variety shows vittatum, pardinum, psittacinum and reticulatum ancestry.

No. TH-2, *Lena B. Hughes,* Leopoldi type B; bulb 3″ in 18 months, and 2 offsets under excellent cultivation; 4 leaves, up to 30″ in length, 2½ to 2¾″ wide; peduncle 28″ long, ⅞″ wide; two scapes, each with 3 flowers; flowers held horizontally, tube 15/16″ and flower 3¾″ long, and 8″ across the face; flower color—General aspect is that of an exceedingly delicate shade of salmon-rose; white band in center of all segments, upper 3 and upper portion of lower side segments white veined salmon-rose, lower portion of lower 2 side segments and lip white veined salmon; filaments and style delicate light green in throat changing to white and then to pink toward tip; stigma white; segments gold-dusted. Variety shows pardinum, reticulatum and psittacinum parentage. Produced by crossing *Marina,* a 10½″ almost pure white on the variety Will Rogers.

No. TH-3. *Princess Elizabeth,* Reginae type B; bulb 3″ in 18 months, and 2 offsets, under excellent cultivation; 4 leaves, up to 31″ long, 2¼″ to 2½″ wide; two flower scapes, each with 3 flowers, peduncle 27″ long, ¾″ wide, flower held slightly upright, tube 1″ long, flower 3¾″ long, and 7″ across face; flower color—brilliant coronation red, delicate light greenish to whitish star, and brilliant royal purple penciling at the base of the segments, the flower as a whole has a cheerful aspect; filaments and style greenish in throat changing to white and coronation red, stigma white. A cross of *Marina* on a large flowered equestre type. Variety shows equestre, and psittacinum ancestry.

No. TH-4, *Emma Piper,* Leopoldi type B; very vigorous grower, bulb 3¾″ in 18 months, and 2 offsets, under excellent cultivation; 7 leaves, up to 29″ long, 2¼″ to 2½″ wide; two flower scapes, each with 5 flowers, peduncle 25″ long, 1-1/16″ wide, flower held slightly upright; tube 15/16″ long; 2½″ long, and 8″ across face; flower color—upper 3 segments banded white, these segments and upper part of lower 2 side segments veined deep rose on white, lower portions of lower 2 side segments and lip white; throat light greenish; filaments and style light greenish in throat changing to white; stigma white. A cross of *Marina* on a large flowered Vittatum type. Variety shows vittatum, psittacinum and reticulatum ancestry.

A LIST OF THE NEW CLONES OF DAYLILIES

A. B. Stout[1]

New York Botanical Garden

The following list of daylilies includes clonal varieties concerning which the writer has obtained information since the preparation of the volume Daylilies which was published in March, 1934.

For many of these daylilies the data available are somewhat meagre. In most cases mention is here made of the person who grew the seedling and of the first catalog offering. At the *first mention* of a person or firm the address is given. The writer cannot vouch for the accuracy of the descriptions obtained or quoted for various of these daylilies or for their merits as garden plants. Undoubtedly there are other clones tentatively named or possibly already listed for sale of which the writer has no data. Information regarding other daylilies that have already been named or that may be named in the near future for propagation and horticultural culture will be appreciated by the writer.

ALBA STRIATA. Amos Perry, Enfield, England; catalog 1934. Described as "Large open flowers, delightful shade of orange-yellow; as the flowers age half the petals are pure white; very effective; June-July; 2½-3 ft."

ALOMA. Wyndham Hayward, Lakemont Gardens, Winter Park, Florida. Reported by letter in March 1937, as a tentative selection and described as follows: "Flowers upright, full, with spreading pointed petals, marked by waved edges; color clear orange with faint fulvous eye zone; individual flowers 5″ across when fully expanded; blooms in April in Florida" (See Plate 61).

ARABY. Wyndham Hayword, Winter Park, Fla. Medium early variety flowering in May in Florida; flowers golden bronze or rich coffee color, with distinct fulvous "eye" zones and golden throat; petals broad and full and of pleasing texture; free flowering habit and quite vigorous. Secured by crossing Hemerocallis fulva Europa on one of the Stout varieties.

AUTUMN HAZE. Mrs. Thomas Nesmith, Fairmont Iris Gardens, Lowell, Massachusetts; catalog 1937. Described as "A beautiful open flower of pale apricot with slightly fluted petals and very firm wax-like finish. A late blooming variety that is excellent for front of border. 2½ ft. Aug.-Sept."

BAGDAD. A. B. Stout. Mentioned and flower illustrated in the Journal of The New York Botanical Garden, September 1935. Offered to the trade by Farr Nursery Company, Weiser Park, Pa., in autumn 1935. A robust stature of at least 40 inches and flowers with a combina-

[1] Chairman, Hemerocallis (Daylily) Committee.

Fr. Meyer, Hamburg, Germany *See page 182*

Narcissus schizocoronatus—

Upper, N. incomparabilis "Confidence" X "Gigantic Orchidflower";
Lower, N. "King Alfred" X "Gigantic Orchidflower."

Plate 64

Wyndham Hayward *See page 186*

McCann Hybrid Double Amaryllis

Plate 65

tion of several rich colors characterize this daylily. The flowers are of medium size, full, and widely open with segments somewhat recurving. In color the throat of flower is clear orange, the blades of the petals are fulvous red over orange giving a shade close to "vinaceous rufous" (of the Color Standards by Ridgway) and the veins and a rather narrow midzone are almost "maddar brown." The blades of the petals are paler and more uniformly of one color. The combination of several colors gives a gay and bold pattern that is both attractive and pleasing. The period of bloom is in July.

This seedling was obtained after several generations of selective breeding for the more sprightly shades of fulvous and orange coloring and it has in its ancestry the species *Hemerocallis flava,* the EUROPA Daylily, a wild plant of *H. fulva* from Japan and the MIKADO Daylily.

BEACON. C. Betscher, Dover, Ohio. Reported to writer by letter from R. V. Ashley, Battle Creek, Michigan. Not yet described or listed for sale.

BEAUTY OF KENT. R. Wallace & Co., Ltd., Tunbridge Wells, England; catalog 1937. Described as "Magnificent deep rich yellow flowers, 5″ across. A very fine new variety. June-July. 4 ft."

BERENICE. Perry; catalog autumn 1936. Described as "Large open flowers 5 inches across, tawny-orange-yellow, suffused maddar-red, bold yellow line through each division; free; early July; 2 ft."

BERNSTEIN. This clone has been listed for sale by Karl Foerster, Potsdam-Bornim, Germany, since the year 1929, but it first came to the notice of the writer through mention in Gartenschőenheit 14: 12, Dec. 1933. The following is a translation from a letter received from Mr. Foerster: The *Hemerocallis* Bernstein originated in the garden of Karl Foerster and was derived from *H. aurantiaca* Major. The pollen parent is not known. This variety was put into the market in 1929. In literature on this variety is only represented in the description in our catalogs since the year 1929. Except us, no one carries this variety at present. The color is very pretty light-brownish Bernstein-yellow.

A plant of this clone was obtained from Mr. Foerster for The New York Botanical Garden in 1936. Its flowers are clear orange, medium full, and medium large.

BRETWALDA. George Yeld, Orleton, Gerrards Cross, England. Reported to writer by letter. Not yet described or listed for sale.

BROWNIE. This seedling was one of the early selections made at The New York Botanical Garden for fulvous colors. Later the plant was discarded and propagation discontinued, but by error a division was sent in 1929 from the Farr Nursery Company to the Agricultural Experiment Station at Gainesville, Florida. There it has been used in breeding and tentatively has been named Brownie. Not yet described or listed. Of no special merit and far excelled by later selections.

BURGANDY. Nesmith; catalog 1936. Described as "Sepals and petals are an even tone of wine purple, with pale yellow lighting in the throat. A charming flower of most unusual coloring. 4 ft. July."

BURMAH. Nesmith; catalog 1937. "A very late blooming variety of orange overlaid with rose and copper. Many large well formed flowers in tall well branched stalks. A finer and more brilliant Cressida, and much later in time of bloom. 3½ ft. Aug-Sept."

CHENGTU. Mentioned and flower illustrated in the Journal of The New York Botanical Garden, August 1935. Illustrated and described in Horticulture, Sept. 1935. Offered to trade by the Farr Nursery Co., spring 1937. Plants of this clone were sent originally to The New York Botanical Garden by Mr. W. P. Hsieh of Chengtu University, who stated that the type is commonly cultivated in the Province of Szechuen, China, for the production of the flowers which are gathered and used as food.

In the essential botanical characters this clone is to be included in the species *Hemerocallis fulva,* but it is an unusual type with various individual features which make it an attractive plant for garden culture. It has a good habit of growth, attractive foliage, flowers of sprightly coloring, and its flowering period extends well into August. It is less coarse and has more attractive flower colors than any of the older fulvous daylilies, and it is also different from *H. fulva rosea.*

CHISCA. Hubert F. Fisher, Germantown, Tenn., who reported to writer by letter in 1936 that this is a seedling of MIKADO x SIR MICHAEL FOSTER and that the petals are dark reddish brown and the sepals deep yellow edged with the colors of the petals. Not yet listed for sale.

CIRCE. Stout. Listed by the Farr Nursery Company, Feb. 1937. Illustrated and described in the Journal of The New York Botanical Garden, March, 1937, as follows: "The Circe daylily has been selected as an especially attractive plant from a large number of somewhat similar seedlings which have yellow flowers and bloom in early and mid-July. The scapes stand from 3 to 4 feet tall, and they are stiffly erect and somewhat branched. The flowers are full, about 3½ inches in spread and light yellow or almost lemon-yellow in color. In its particular combination of characters the Circe daylily does not closely resemble any of the various yellow-flowered named clones in bloom at the same time. The ancestry comprises six generations of selective breeding with hybridizations that include *Hemerocallis flava, H. fulva* clone EUROPA, *H. Thunbergii* and *H. aurantiaca.*"

CURLYPATE. Mrs. Elizabeth Scheffey, West Mansfield, Mass., states that she received "this seedling from a southern garden in a mixed lot of H. citrina hybrids." Evidently distributed by Mrs. Scheffey in 1935. Listed by Nevill Primrose Farm, Poulsbo, Washington; catalog 1937, and described as "charming late golden with much curled-back tips, not large but very dainty; free bloomer."

DAINTY. Betscher. Reported by Mrs. Herbert H. Dewey, Schenectady, N. Y., who states she obtained the plant from Mr. Betscher. Said to be pale lemon. Not yet listed.

DAUNTLESS. Stout. Illustrated and briefly described in the Journal of The New York Botanical Garden, Sept., 1935. First offered to the trade by the Farr Nursery Company in autumn with following description: "July, August; 30. The flowers are very full and medium large with rather broad and somewhat spatulate petals. At the base, in the throat of the flower, the color is greenish; the blades of the petals and the sepals are pale yellowish-orange somewhat lighter than cadmium yellow; and in the petals there is an attractive mid-zone of delicate pale fulvous. The colors are in pastel shades that are subdued and delicately blended and the flowers have good texture. The erect branched scapes extend slightly above the upper reaches of the foliage."

DAZZLER. H. A. Dreer Inc., Riverton, New Jersey. First listed in wholesale catalog, 1937. "Flowers about July 1; deep gold; flowers 7 inches in diameter; 3 to 4 ft. tall."

DORA WYMAN. Reported in 1934 by letter for Mrs. Thomas Nesmith who states that this daylily was found in the collection of Mr. Franklin B. Mead. Not yet described or listed for sale.

DOVER. Betscher. First listed by Chas. F. Barber, Troutdale, Oregon, 1932-3. Described as large clear orange flower of heavy substance.

EARLIANA. Betscher. Mentioned in a letter from Mrs. Thomas Nesmith. Not yet described or listed.

EARLIEST LEMON. Betscher. The writer saw a plant with this name at the Bristol Nurseries, Bristol, Conn., in April 1936, and was informed that the plant came from Mr. Betscher.

ELIZABETH PYKE. Perry; catalog 1934. "Middendorfiana x fulva, a very pretty dwarf-growing variety, tufts of graceful foliage, slender stems terminating with loose heads of large open flowers 3 in. across, inner divisions orange-brown, lined sulphur-white, outer divisions pointed orange-yellow, tipped green, conspicuous orange base; very free; 18 in."

EOLA. Dr. Hamilton P. Traub, Mira Flores, Orlando, Florida. Reported by letter in May 1937. "Plant evergreen; foliage up to 24 inches; inflorescence up to 3½ feet with more than 12 flowers; flowers very light yellow in color, long lasting; petals slightly wavy and tips curled back; flowers 4½ inches across the face and modestly sweet-scented; blooms during the middle of April in Florida."

EVERBLOOMING. In 1935 Mrs. Mary G. Alley, Pine Grove, West Va., sent a daylily by this name to The New York Botanical Garden. The flower is full, clear cadmium yellow and of medium size. Mrs. Alley reports that this plant blooms early in spring but also flowers again in autumn.

FLAVIA. Perry; catalog 1936. "A very distinct break; flowers over 6 in. across, narrow spidery segments, rich golden yellow; July-August; 3 ft."

FLAVINA. Arthur Fewkes. Listed catalog 1934, Fairmount Iris Gardens. A plant from these gardens grown at The New York Botanical Garden is two feet tall; blooms in May; flowers lemon yellow. Not dwarf as first described.

FULVA SPECIOSA. Listed by R. Wallace & Co., in catalog of 1937. Described as "very vigorous, with erect branching flower stems and bright orange-brick flowers. June-August. 4 ft." Evidently a fulvous daylily. In the catalog the name is written *H. fulva speciosa,* as though the type is a botanical variety rather than a seedling propagated as a clone.

GAIETY. Betscher. Listed in 1932 and possibly earlier, catalog of Kenneth McDonald & Sons Ltd., Ottawa, Canada. "Pale yellow. Fragrant. Outstanding."

GARDEN GOLD. Mrs. Frances E. Cleveland, Sunnybrook Iris Gardens, Eatontown, N. J. Listed in 1936 catalog of Fairmount Iris Gardens. Described as: "Selected from many seedlings as being outstanding; clear yellow, 3 ft."

GELASMA. Yeld. Reported to the writer by letter as "like Winsome but three weeks or more later in blooming." Evidently not described or listed for sale.

GIANTESS. Betscher. Mentioned in a recent letter from Mrs. Thomas Nesmith. Not as yet described or listed for sale.

GIANT ORANGE. W. H. Henderson. First listed in 1934 autumn catalog Henderson's Experimental Farms, Fresno, Calif. "Flowers are very large deep orange covered with a gold sheen. Flowers are of a heavy substance and petals very wide. Comparable in width of petals and size to some of the Amaryllis hybrids. Plant is 30 inches in height."

GLOAMING. Paul C. Cook, Bluffton, Indiana. First listed 1936 catalog Fairmount Iris Gardens. "Large open blooms with yellow background, heavily overcast with reddish rose-purple. The whole flower has a brilliant and sparkling beauty that is most pleasing. 3½ ft. July-August."

GLORIANA. Betscher. A plant with this name was first listed in 1936 catalog, R. V. Ashley, Arvista Gardens, Battle Creek, Mich. Described as "New and very rare. A golden yellow of long season. One of largest and finest." A letter from Mr. Ashley in March 1937 indicates that the plant which he has listed as GLORIANA was also sent out by Mr. Betscher under the name DOVER and that a somewhat similar plant which has larger and more deeply colored flowers is to be distributed under the name GLORIANA.

GOLDEN EMPRESS. C. N. Dennett, Amesburg, Mass. First listed in 1936 catalog Fairmount Iris Gardens. "Many golden flowers borne on tall stately stalks; flowers are of good size and firm texture. One of the late blooming varieties. 5 ft. August-September."

GOLDEN FULVA. Betscher. First listed 1936 catalog Bristol Nurseries, Inc., Bristol, Conn. "Rich orange-yellow with just a trace of the fulva tawniness. Good-sized flowers, freely produced. Height 3 ft. July-August."

HARRIET MOORE. Carl Purdy, Ukiah, Calif. Reported to the writer in letter. Evidently not as yet described or listed for sale.

HELEN CAMPBELL. Perry; catalog 1936. Described as "Bold clumps of attractive foliage from which arise stout blackish-green stems, bearing a profusion of large, well-formed flowers 5 in. across, rich orange-yellow; July-Aug. 4 ft."

HERBERT SPENCER. Mentioned in a recent letter from Mrs. Thomas Nesmith. Obtained by her from Mrs. Franklin B. Mead for trial.

HIGHBOY. Gray & Cole, Ward Hill, Mass. First listed in catalog 1934 as Hemerocallis (late); first listed as Highboy in catalog 1936 with statement as follows:—"Highboy, 5 ft. August. We found this plant in our nursery, propagated and named it. It is a pale yellow, the latest and tallest variety we have."

JUNE BOISSIER. Perry; catalog 1934. "Stout branching stems towering well above its broad foliage, bearing many large well-expanded flowers over 6″ across, a brilliant shade of rich bronze-orange, with a pale crimson zone and sulphur-yellow base; July-Aug. 3½ ft."

KUNDRED, A. E. A. E. Kundred Inc., Goshen, Ind., 1934 catalog. Described as "A new seedling originated by A. E. Kundred. It is a beauty, the petals being elegantly waved and of the finest lemon yellow color. Flowers open in the evening. It is tall, medium late blooming, strong and vigorous."

LARGE GOLD. Mentioned in 1936 in a letter from R. V. Ashley, who states that he obtained a plant of this clone from Mrs. E. L. Scheffy who described it as "a very fine large flower." Not as yet described or listed for sale.

LEMONETTA. Betscher. Mentioned in a recent letter from Mrs. Thomas Nesmith. Not yet described or listed for sale.

LINDA. Stout. Described and illustrated in Herbertia 3: 92, 1936, as follows: "In respect to the ensemble of coloring, the flowers of the LINDA Daylily are somewhat bicolored, pale-fulvous, and eyed. The throat is a shade of yellow approaching apricot yellow with greenish tinges at its base; the sepals are more clearly yellowish with almost no traces of fulvous; the outer half of the petals is delicately overcast with pale fulvous and there is a conspicuous eye zone of Brazil red bisected by a strip of pale fulvous that extends along the midvein toward the throat. The open flowers have a spread of about 4½ or 5 inches, and they are spreading rather than recurving. A well-grown plant usually stands between 3 and 4 feet tall and the scapes are much branched and up-

standing. The season of bloom at New York is in early July. The ancestry of the LINDA Daylily includes the species *Hemerocallis Thunbergii, H. citrina* and two different seedlings of *H. flava* which came from the wild in central China."

First listed in 1937 in catalog of Farr Nursery Co.

LOW-GROWING. Burbank. Reported by letter from Frank A. Leach, Jr., Piedmont, Calif., who states that this plant is supposed to be a seedling reared by Luther Burbank about 20 years ago. Not yet described or listed for sale. Possibly same as the BURBANK Daylily.

MADCAP. Nesmith. First listed catalog 1935, Fairmount Iris Gardens. Described as: "A lovely rock garden variety with rosy bronze petals and yellow sepals; much admired by garden visitors. 1 ft. August."

MAGNIFICA. Yeld. Mentioned in 1935 in Journal of Royal Horticultural Society 60: cxxvi. Not yet described or listed for sale.

MARS. Perry; catalog of 1936. "Long trumpet-shape flowers, uniform shade of bright orange, narrow divisions, three inner segments crested; July; 2½ ft."

MARY FLORENCE. Betscher. First offered by Kenwood Iris Gardens, Cincinnati, Ohio, in 1934 list. Plant grown at The New York Botanical Gardens, has clear apricot yellow flowers of medium large size; about three feet tall; blooming in July.

MAY MORN. Nesmith. Fairmount Iris Gardens catalog 1937. "A glowing flower of orange yellow which blooms with the bearded irises. The flowers are medium in size with many blooms on each stalk, giving a mass of color that is most effective with the irises. 2½ ft. May-June."

MAY SADLER. Perry; catalog 1934. "This beautiful introduction is one of the most distinct of my many new varieties; the medium-large flowers are freely produced during July, a brilliant reddish-brown, lined and splashed orange, with orange-yellow throat; only 2 ft. high. July."

MERCIA. Perry; catalog of 1936. "Broad pendant foliage, stout stems terminating with crowded heads of large, flat, tubeless flowers nearly 6″ across, rich golden-yellow; a new break in this genus; July; 3 ft."

MIDAS. Stout. First listed by the Farr Nursery Co., August 1935. "June-July; 40." The flowers have a spread of about 5 in.; the segments are pointed at the apex and recurving; the color is a clear, glowing, golden orange with no trace of fulvous. The branched scapes bear as many as fifteen flowers which stand about 18 inches above the upper level of foliage. In the underground parts there is a compact habit of growth. This seedling is a hybrid of the LUTEOLA Daylily x *Hemerocallis aurantiaca.*"

MONA. Perry; catalog 1936. "Open stellate flowers, dark lemon-yellow; mid-July; 2½ ft."

MOONLIGHT. Yeld. Reported to the writer in letter and described as "tall; blooms a fortnight after *H. flava* has finished; more stout in the petals than *H. flava.*" Not yet listed for sale.

MOONSTONE. Perry; catalog 1932. By omission left out of the volume Daylilies. "A delightful flower of brilliant reddish-buff, with cream zone in cut of flower; very fluted petals; long season of bloom. 3½ ft. June-August."

MULTIFLORA ISIS. Perry; catalog 1936. "Rigid, branching stems bearing a profusion of small flowers, lemon-yellow; passing to rich yellow; seeds freely; July-August; 2½ ft."

MULTIFLORA LUNA. Perry; catalog, 1936. "Rigid, branching stems, medium-sized, bell-shaped flowers, rich yellow, reverse bronze-buff; remarkably free flowering; July-Aug. 2½ ft."

NILBIO. Mentioned in Gartenschőenheit, 14: 12, December 1933. A letter from Willy Müller, Naples, Italy, states that this is one of the fulcitrina hybrids raised by him and first listed in 1908. This plant has large flowers, medium dark fulvous in color with slightly darker eye zone.

OLIF. Origin not definitely known to writer. Catalog 1934, Fairmount Iris Gardens. This is evidently a clone of *H. Middendorffii.* Mrs. Nesmith states in a letter that this clone came from John Lewis Childs, Inc., and that it is being discarded from her gardens as "not much good."

ORANGE KING. Catalog 1934, Fairmount Iris Gardens. Described as: "This is well described by the name it bears. New and rare. 3 ft." Mrs. Nesmith informs the writer that she obtained this plant from John Lewis Childs, Inc., and that she does not have information regarding its origin.

ORIOLE. Nesmith; catalog 1936. "The brilliant orange plumage of the Baltimore oriole is the same color as this new and lovely *Hemerocallis.* Much admired by all garden visitors. July-August."

PALE MOON. Mrs. Frances E. Cleveland, Sunnybrook Iris Garden, Eatontown, N. J., has supplied the following information. She observed at the Lovett Nursery propagations of two different daylilies intermingled with nursery stock of Lovett's Orange Daylily and Lovett's Lemon Daylily and distinct from these. She purchased the stocks and named the darker of the two WOODLOT GOLD and the paler one PALE MOON. Evidently introduced by Mrs. Cleveland in 1934. Described as "large lemon yellow, similar to HYPERION but without greenish cast."

PANDORA. Perry; catalog 1936. "Stout branching stems bearing many loosely built flowers, narrow segments; delightful shade of reddish-brown, faint yellow line running through each segment; July; 2½-3 ft."

PATRICA. Stout. First offered in 1935 catalog of Farr Nursery Co. "Early to late July; 36." This daylily is a sister seedling of the Dauntless daylily and in habit of growth and season of bloom it is much the same; but the flowers are clear and even toned pale yellow, of shade near lemon chrome, with throat greenish at the base. The flowers are medium large, 5″ to 7″ across, with pronounced fragrance; the petals and sepals overlap and conform in outline to give a very full flower of a firm and waxy texture."

PEACH BLOW. Nesmith; catalog 1936 Fairmount Iris Gardens. "Large open flowers of yellow heavily brushed with deep coral. A yellow and coral-pink combination that is most appealing. 2½ ft."

PERFECTION. Perry; catalog 1936. "Slender much branched stems bearing a profusion of small open flowers, uniform shade of rich golden-yellow; one of the best for border decoration. Late June. 2½ ft."

PINK LUSTRE. Nesmith; catalog 1937. "Exquisite flesh-pink flowers with lustrous sheen. The petals are slightly ruffled and flaring with pale cream mid-rib. The sepals are flaring and slightly lighter in pink tone. The throat of the flower is pale canary yellow. July-Aug. 3 ft."

POLLYANNA. Reported to writer by Mrs. E. L. Scheffy who obtained this plant from Mrs. Thomas Nesmith. Mrs. Nesmith states that this plant is early flowering and has light yellow flowers.

PRINCESS ELIZABETH. Perry; catalog 1936. "Large open flowers 5 inches across, rich bronze-orange, crimson zone, orange base; July; 2½ ft."

RAJAH. Stout. Catalog 1935 Farr Nursery Co. "July-August; 40″. The flowers are large and gayly colored with a conspicuous eye zone. The throat is a pale orange with a greenish tinge. The blades are English red, traversed by darker colored veins and there is a conspicuous eye zone, as in Mikado, that is near the shade of garnet brown. The scapes are coarse branched, bearing as many as twenty flowers. The foliage is a good green, rather dark in shade, medium coarse and ascending; spreading to a level about 12 inches below the flowers. In summary, a darker and later Mikado of very robust stature." Illustration in *Journal of The New York Botanical Garden,* 36: 211. 1935.

RALPH SCHREIVE. Reported by Mrs. H. H. Dewey, Schenectady, N. Y., who states that this plant came to her from T. F. Donahue, Newton Lower Falls. Evidently has not been described or listed.

RAYON D'OR. Perry; catalog 1936. "Medium-sized flowers, broad over-lapping divisions, rich orange-yellow stained red, purple tipped buds; July; 2½-3 ft."

RHODOS. Perry; catalog 1936. "Erect, open flowers, reddish-bronze shaded maroon, yellow centre; July; 2½ ft."

ROBIN REDBREAST. Nesmith; catalog 1936. "Cherry-red flowers overcast toward the throat with velvety red-purple. Slender graceful stems with blooms well above the foliage. Very rich and pleasing in color harmony. 3 ft. July-August."

ROSA KELL. Reported to writer in a letter from John Scheepers, Paradou, Brookville, N. Y. Flowers rich orange, much like the GOLDENI Daylily. Not yet listed in catalogs.

SALEM DAYLILY. Listed in catalog 1934, Fairmount Iris Gardens. "A type which is similar to *H. flava,* but flowers a little later. This variety has been blooming at old Salem, Mass., in gardens for more than one hundred years and is a great addition to the early June flowering kinds."

SATURN. Stout. First listed 1934 by the Farr Nursery Co. Illustrated and described in *Journal of The New York Botanical Garden,* March 1937: "The *Saturn* daylily was obtained after several generations of selective hybridizations which involved as parents *Hemerocallis flava, H. fulva* clone Europa, a wild plant of *H. fulva* from Japan, and *H. multiflora.* The general habit of the plant is of an erect *H. multiflora,* only more robust and with larger flowers of delicate fulvous colors. At New York the period of blooming has been from about June 15 to July 15. The foliage is nearly dormant in winter. The scapes are much branched and stiffly erect to a height of from 3 to 4 feet. The flowers are numerous, about 3 inches across, widely spreading and full; the throat is apricot-yellow; the petals have an eye zone of vinaceous rufous, beyond which is an area of ochraceous orange, and there is a marginal border of almost clear apricot-yellow. The sepals are somewhat less strongly eyed and they are reddish fulvous on the back. The marginal band of paler color in the open flower is somewhat more noticeable than in other seedlings or named clones which the writer has thus far seen."

SAYDA. Yeld. Reported by letter as "dark orange with a halo around the center of the flower; a softer SIRIUS but quite distinct." Not yet listed for sale.

SEMERAMUS. Reported to the writer by letter from Amos Perry, who states this is not one of his seedlings but does not state origin. Not yet described or listed for sale.

SERENADE. Stout. First mentioned in *Journal of The New York Botanical Garden,* Sept., 1935. "A robust plant with slender bending scapes and flowers of crinkled and wavy petals and delicate and subdued shades of pale yellow and pale fulvous." First offered by Farr Nursery Co., catalog 1937.

SHARON. Cook. A letter from Mr. Cook received in March 1937 states that this seedling was grown by him, and he describes the plant as follows:—"Flowers during late June and first half of July; scapes 30-36 inches; flowers widely open, orange with flush of fulvous." First listed by Fairmount Iris Gardens, catalog spring 1937.

SICA. Reported in a letter from George Yeld in 1934 as "a little darker than HYPERION, is looser in the petals and has a distinct brown flush round the tips of its buds. The seed pods show the same brown tint."

SONNY. Stout. Catalog 1935, Farr Nursery Co. "July-August; 36". Ever since it first bloomed in 1925 this seedling has been considered to be a plant of unusual charm and beauty. The flowers have a spread of four to five inches. The perianth segments are thick and firm in texture and strongly recurving and the petals are somewhat twisted. The throat of the flower is greenish in color and the face is a clear uniform shade of light yellow. On hot sunny days the color gradually becomes paler but the texture remains firm and the surface waxy and the flowers do not wither. The flowers open about sundown and are widely open throughout the next day and well into the following night. During the evening there are two sets of flowers that are open. The foliage forms a loose dome of spreading-ascending leaves extending almost to the flowers. The scapes are still and loosely branched, and they bear as many as fifteen flowers. The SONNY Daylily is a hybrid of the second generation of the cross *Hemerocallis Thunbergii* x *H. aurantiaca.*" Illustrated in *Journal of The New York Botanical Garden,* Sept. 1935.

SPRINGTIME. Nesmith; catalog 1935. "A lovely rock garden subject. Clear medium orange with lighter midrib on petals; sepals a tone darker. Beautiful open flower of very smooth finish; petals slightly ruffled. 20". May-June."

STALWART. Cook. Catalog 1935 of Fairmount Iris Gardens. "A beautiful new hybrid of tawny reddish-bronze and orange tones. Large flowers with nicely recurved petals, borne on tall well-branched stems. A very free bloomer and does well in hot dry weather. Excellent in every way. 40 in. July-August."

A full flower with orange fulvous and slight trace of eye zone. Near Cinnabar in color. Mr. Cook states in a letter that this seedling is from Calypso x *H. aurantiaca.*

STARLIGHT. Nesmith; catalog 1936. "Tall well branched stalks bearing many flowers of palest yellow. The blooms are large, and the petals charmingly fluted. The nearest to white in color of any Hemerocallis that I have seen. Much admired by visitors to the garden. Very beautiful. 4 ft. July-August."

STAR OF GOLD. H. P. Sass, Midwest Gardens, Washington, Neb. Catalog 1934, Fairmount Iris Gardens. "Beautiful waxy flowers of palest yellow; large and star-like in form; the best of the delicate yellow Hemerocallis. 4 ft. July-August."

Max Hoeber, Bonn, Germany

See page 187

Hybrid amaryllis, H. aulicum X H. vittatum
First generation

Plate 66

T. A. Weston *See page 188*

Hybrid amaryllid—Probably Vallota-Cyrtanthus cross

Plate 67

SUMMER EVE. Nesmith; catalog 1934. "Cupped-shaped flowers of pinky-orange, which toward night change to peach-pink apricot, giving the effect of two different blooms on one plant. Greatly admired by garden visitors. 3 ft. July-August."

SUMMER MULTIFLORA HYBRIDS. Stout. First listed by the Farr Nursery Co., 1935. "July-August; 30. Multiflora Daylilies have the distinct and desirable characteristics of (a) long bloom period, (b) numerous flowers to a scape, (c) small to miniature blooms which are very effective in either mass or cut flowers display. The species is native to China and of recent importation by Dr. Stout for breeding purposes. Several striking developments have already resulted with BIJOU as the forerunner. Among the clear colors, a group of about fifty sister seedlings were found to be so identical, as well as distinct and desirable, that it was decided to propagate and introduce them as a group. The clear orange blooms are two to three inches across and scapes bear up to 50 blooms, successively, thruout mid-summer."

SUNBEAM. Fewkes. Reported in 1934 by letter from Mrs. Thomas Nesmith as a "dwarf variety." Evidently not yet described or listed for sale.

SUNGOLD. H. A. Dreer Inc. First listed in wholesale catalog 1937. Brief description supplied as follows:—"June 10; medium height; flowers 5 to 6 inches in diameter, deep gold, with broad petals."

SYLPHIDE. Perry; catalog 1936. "Slender stems terminating with crowded heads of medium-sized flowers, delicate shade of silvery-rose, nankeen centre; July; 2½ ft."

TODMORDEN. First listed in catalog Hildemer Gardens, Wawa, Pa., in 1934. Information supplied by Miss Hannah S. Pennell as follows: "This daylily was observed growing among others by Mrs. Arthur H. Scott, Todmorden Farm, Maylan, Pa., some ten years ago. The plant usually blooms throughout June into July with scattering bloom again in fall. Many flower stalks reach a height of 42 inches. The general color effect of the flower is clear rich orange. The individual flower has a spread of five inches and is delightfully fragrant."

VIESSEAUX, MRS. Perry; catalog 1936. "Slender stems terminating with crowded heads of small flowers, silver-apricot shaded silver grey, bold yellow line running through inner segments, faint yellow zone; new shade to this interesting genus; July; 2 ft."

WOLOF. Stout. First described and illustrated in Herbertia 3: 95 and 113, 1936. "The WOLOF Daylily has flowers of dark brownish-red-fulvous coloring, the stature of the plant is robust (from 3 to 4 feet), and the season of bloom at New York is in July. A more precise designation of the flower coloring according to Ridgway's "Color Standards and Nomenclature" is as follows: The throat is clear orange near the shade of light cadmium; the sepals are between Morocco red and garnet brown without either a mid-zone or a central stripe; the petals have a

mid-zone near garnet brown or maroon, which is somewhat darker than the sepals; the blade outside this zone is near Morocco red with darker veins; the stripe that extends through each petal tapers and is not sharply defined along its margins. The back of both the sepals and the petals is somewhat tinged with red. The general color effect is noticeably different from that of Theron and Vulcan, which are also of the dark red class, and all of these are much darker than Rajah. The flower is medium full, medium large (from 4 to 5 inches in spread), the petals and sepals are broadly recurving, and the form and color is well maintained during the day. The somewhat robust foliage and the erect, much branched scapes give a good habit of growth and the plant is fully hardy at New York.

This daylily has in its ancestry the species *Hemerocallis Thunbergii, H. aurantiaca,* and a certain plant of *H. fulva* from the wild and it was obtained after several generations of selective breeding. The name Wolof refers to a native tribe in Africa and is here applied to suggest that the plant in question is one of the dark-colored type of daylily."

First offered in special blue list by Farr Nursery Co., spring 1937.

WONDER GOLD. Betscher. Reported in 1937 by letter from Mrs. H. H. Dewey who described this clone as having "large wide open flowers."

WOODLOT GOLD. See notes on the Pale Moon Daylily. Evidently first listed by Sunnybrook Iris Garden in 1934. Described as "very large, soft cadmium yellow."

YELLOW WONDER. Reported to be a seedling grown by A. E. Kunderd, Inc. Evidently not yet described or listed.

ZARA. Perry; catalog 1936. "A beautiful variety of *H. Forrestii;* grass-like foliage, slender stems bearing several well-formed open flowers, delightful shade of rich orange; July-August; 12 in."

The New York Botanical Garden maintains a public display garden for daylilies and efforts are made to obtain a plant of each newly named clone for this garden. These are obtained by donations and are not propagated either for sale or distribution. Many of the clones listed above are in this display garden but mostly they have either not yet bloomed or the plants have not reached a size that admits of adequate description. *In this list, however, the writer does not attempt to evaluate these plants or to pass judgment on the statements quoted from catalogs.*

May 18, 1937.

NARCISSUS

NEW PURE WHITE GIANT LEEDSII NARCISSUS—MARY BEIRNE (V.TUB.)
BEIRNE, MISS M., 1937

We are fortunate to have the opportunity of reproducing in this issue of Herbertia, Plate 56, a likeness of the new pure white Giant Leedsii narcissus—*Mary Beirne,* which is briefly described as follows,—"A pure white Giant Leedsii of great individuality and distinction. There is unusual clarity and chaste beauty in the exquisite whiteness of a broad overlapping perianth, and a delicately fluted spreading cup of rare refinement." —*H. P. T.*

SPECIES AND VARIETIES TO WHICH AWARDS WERE MADE IN 1937

First class certificates were awarded to the following during 1937. The awards are based in practically all cases on observations made in the Society's Trial Collection.

Crinodonna (Amarcrinum) Howardii
Hybrid Crinum, *Ellen Bosanquet*
Hybrid Crinum, *Peachblow*
Hybrid Crinum, *Mrs. James Hendry*
Hybrid Crinum, *J. C. Harvey*
Hybrid Crinum, *Sophia Nehrling*
Hybrid Crinum, *Virginia Lee*
Hybrid Crinum, *Powellii Krelagei*
Hybrid Hippeastrum, *Garfieldii*
Hybrid Hippeastrum, *August Koch*
Hybrid Ismene, *Sulphur Queen*
Hymenocallis tenuiflora
Cyrtanthus lutescens
Lecocoryne ixioides odorata
Hemerocallis fulva rosea
Hybrid Hemerocallis, *George Yeld*
Hybrid Hemerocallis, *Dauntless*
Hybrid Hemerocallis, *Soudan*
Hybrid Hemerocallis, *Mikado*
Hybrid Hemerocallis, *Waubun*
Hybrid Hemerocallis, *Vulcan*
Hybrid Hemerocallis, *J. A. Crawford*
Habranthus cardinalis
H. robustus
Zephyranthes citrina
Z. rosea
Z. tubispatha
Z. macrosiphon
Hybrid Zephyranthes, Ajax
Argyropsis candida

(Continued from page 129)

bulb, some of them have leaves deeply channeled, others only slightly so and flattened at the bases. Some of the bulbs are thick and globose and one species has a cylindrical, very long-necked bulb with light-green leaves, narrowly linear at the base and the lower portion, broadens out in the upper third, so that the leaf is almost spatulate. There is also variation in the size of the plants—*H. coronaria* is the largest I have so far collected, with leaves over two feet long, while another species has leaves a foot long or less, very narrow, dark green and usually only two, occasionally three leaves, to the bulb.

Hymenocallis occidentalis seems to always grow with its feet in the water and its head in the sun. *H. palmeri,* in several respects, is in a class by itself. It grows in low, damp, open flats, in company with low

(Continued on page 221)

Pierre S. du Pont

See page 187

Hybrid Amaryllis in the collection of Pierre S. du Pont
Plate 68

4. CYTOLOGY, GENETICS AND BREEDING

A REVIEW OF CHROMOSOME NUMBERS IN THE HEMEROCALLIDEAE, ALSTROEMERIALES, AND AMARYLLIDALES [1]

W. S. Flory and S. H. Yarnell,
Texas Agricultural Experiment Station

The taxonomic grouping of plants according to their phylogenetic relationships rests on their evolutionary development, which in turn has a cytogenetic basis. The evidence used by taxonomists is largely morphological and is supplemented by a knowledge of geographic distribution. Evidence from a study of the chromosomes—their number, size, shape, and behavior is just beginning to be utilized in classification. Their role in determining heritable characters and in limiting evolutionary changes suggests the desirability of such studies in supplementing the usual methods. A knowledge of chromosome numbers and behavior may also be of use to the plant breeders, particularly in wide crosses.

The three groups under consideration total about 95 genera with over 700 species in addition to a number of botanical and horticultural varieties. Chromosome studies in about 240 species or botanical varieties from 28 genera have been reported. If horticultural varieties such as those in the genus *Narcissus* be included, the number of forms investigated cytologically is over 300. Because of the mass of available material, this review will be confined largely to listing the chromosome counts together with the literature sources.

Table 1 presents these data in some detail. The different forms are arranged in the first column according to Hutchinson's plan (39). Following this is given the n number of chromosomes (i.e. the number that occurs in each pollen mother cell during the development of the pollen) ; then the 2n number of chromosomes (i.e. the number that occurs in each somatic or body cell of the plant) ; and finally reference by number to the paper reporting the investigation. These correspond to the numbers under "Literature Cited."

This table was compiled for the most part from the chromosome number lists of Gaiser (25-28), and of Tischler (133, 134), and where possible from the original papers of the various workers. The authors are much indebted to Doctors T. W. Whitaker and Lula O. Gaiser for the loan of reprints and also to Dr. Gaiser for the supplying of much information not otherwise available to them. The table was nearing completion when Suto's papers (120) listing reported chromosome numbers in the Liliaceae and Amaryllidaceae were received. While there is much overlapping between our list and his, it seems advisable to make all of the material available in this publication.

If the n number of chromosomes is composed of a group, each one of which is different from every other in the nucleus, the set is said to

[1] Contribution No. 395, to the Technical Series, Texas Agricultural Experiment Station; approved by the Director, April 27, 1937.

represent the basic (x) number of chromosomes. Plants or species with two such sets (2x), one from the egg, the other from the pollen are called diploids. Others may have several such sets (3x—triploid, 4x—tetraploid, 5x—pentaploid, and so on). Such numbers, multiples of some basic number, are frequently found among the different species of a large genus. Most species, particularly those reproducing largely by seed have a balanced number of chromosome sets (2x, 4x, 6x, or 8x). Thus species may have the same basic chromosome number because of a common origin. Such considerations taken in conjunction with a study of chromosome size and shape are a help in tracing phylogenetic relationships.

Table 2 summarizes the information presented in Table 1. It will be noted that more than one basic chromosome number is sometimes suggested for a single genus. Ordinarily the lower number is considered basic and the higher number a later derivative, although both may give rise to a polyploid series. For example 7 and 10 are listed as basic numbers for *Narcissus*. A possible explanation is that a 3x (triploid) plant having 21 chromosomes gave rise to a plant with 20 chromosomes, which through mutation or otherwise was able to establish itself to give a new x number of 10. Through continued point mutation or other chromosomal change over an evolutionary period the three extra chromosomes duplicating three of the original set might become sufficiently different to give a new basic set, of 10, in the original sense.

This genus *(Narcissus)* has been the subject of more cytological work than any other in the Amaryllidaceae. Three men, de Mol (70, 71, 73, 74), Fernandes (17-24), and Nagao (80-84) have each made outstanding contributions here. The somatic numbers reported for the genus are 14, 15, 16, 17, 20, 21, 22, 24, 25, 26, 28, 30, 32, 35, and 42. While these form a meaningless string of numbers as just arranged, they can be grouped according to the two basic numbers of the genus—14, 21, 28, 35, and 42 being multiples of 7, while 20 and 30 are multiples of 10. The rest presumably have chromosomal complements similar to one of these plus one or more additional chromosomes obtained through duplication, hybridization or fragmentation.

Fernandes in his monograph (24) has revised the previous classifications offered by various workers for the genus *Narcissus*. In this new classification the taxonomic placement according to subgenera and subgeneric sections coincides in general with the cytological relationships suggested not only by the basic numbers but also by external chromosome structure. It should be explained that in our table the chromosome numbers of several species of *Narcissus* have been changed as reported in one of his papers (22). This was done because of penciled notations on the margins of the reprint as received from this author.

In *Hemerocallis* the basic chromosome number is evidently 11. As Stout (112) points out *Hemerocallis,* with respect to this basic number, is an anomaly in the Liliaceae, the number occurring only in this genus. Its companion, *Hosta,* in the tribe Hemerocallideae has a basic number of 30. From this standpoint *Hemerocallis* would seem to be nearer a number of genera of the Amaryllidaceae. A further careful taxonomic

study coupled with a comparison of chromosome morphology of this genus and possibly *Nerine, Clivia,* and *Lycoris* might indicate a shift to the Amaryllidaceae. This case is mentioned as an instance where cytological findings may suggest problems for taxonomists working with these same plants.

Allium supplies the greatest number of species names investigated cytologically of any genus included. Levan (54-60) and others have shown that the basic numbers for the genus are 7, 8, and possibly 9. Since the number of species having 9 as a probable x number of chromosomes is relatively small, it is possible that they may have appeared later in the development of the genus.

The positions of *Brevoortia, Hymenocallis,* and *Eucharis* need further investigation. Each is here represented by a single species, and in each case the number is out of harmony with other genera of the Amaryllidaceae. *Hymenocallis* includes around 30 species. It is quite possible that the cytological investigation of other species would bring this genus into general agreement.

The value of a knowledge of chromosome numbers to the plant breeder lies largely in the relation of chromosome behavior to fertility, in the reduplication of genes through polyploidy, and in the chance of gene linkage. In regard to fertility, related species with the same chromosome numbers are more apt to be interfertile than species with different numbers. Forms with unbalanced chromosome numbers (3x, 5x, 7x, 2x + 1, 4x + 1 etc.) are more apt to be sterile or nearly so than those with balanced numbers. Such unbalanced types frequently result from hybridizing, as in crossing plants with 2x and 4x chromosome numbers to give a triploid (3x) plant, or by self pollinating a triploid. Interspecific crosses between parents with different chromosome numbers are more apt to be successful if the species with the higher chromosome number is used as the seed parent than is the case of the reciprocal cross (Thompson, 130). In cases where the sterility of a first generation is due to chromosomal incompatability, techniques have been developed to double the chromosome numbers to give what is known as an amphidiploid, that is one having two sets of chromosomes from each parent. These usually have a nearly normal fertility. This same technique can be used to effect chromosome doubling of fertile plants to increase their size. The work of de Mol (72, 75) with hyacinths, tulips, and to a lesser extent with Narcissi has shown that the enormous size increase in Dutch bulbous plants is apparently due to such artificially induced polyploidy.

A further use of cytology to the taxonomist and plant breeder lies in the detection of interspecific hybrids. Five forms of *Narcissus* which have been described as distinct species have been found by cytological investigation to be interspecific hybrids. These are: *N. odorus* L., *N. intermedius* Lois., *N. biflorus* Curt., *N. incomparabilis* Mill., and *N. gracilis* Sabine (Table 1). Genera in which natural interspecific hybridization is common have been found to be very difficult from the taxonomic standpoint.

Perhaps, in conclusion, a word of caution, not to expect too much of a practical nature from cytological investigations, is desirable. The main source of inspiration for work in this field is still the hope of increasing our knowledge of pure science. Chromosomes are highly complicated organs with a great deal still unknown about them. To the horticulturist, information concerning the chromosomes of some favorite is an added item of interest, to the plant breeder, a tool for the further advancement of his work, and to the taxonomist, a substantial aid in establishing satisfactory relationships among the various forms.

TABLE 1.

REPORTED CHROMOSOME NUMBERS IN THE HEMEROCALLIDEAE, ALSTROEMERIALES AND AMARYLLIDALES.

(Arranged according to the system of Dr. J. Hutchinson)

Form	n	2n	Literature reference
LILIALES			
LILIACEAE			
HEMEROCALLIDEAE			
Hosta [1,2] **atropurpurea**		60	97
H. clausa Nakai	ca.30_{III}	90	146
H. coerulea	30		8, 139
H. Fortuni var. **gigantea** Bailey	30	60	146
H. japonica	30		1, 2, 63
H. japonica var. **augustifolia**	30		1, 2
H. lancifolia Engler		60	63
H. lancifolia Stern. var. longifolia Nakai		60	146
H. lancifolia Stern. f. **albomarginata** Mak.	30	60	146
H. plantaginea Asch.	30	60	146
H. rectifolia	30		1, 2
H. rupifraga	30		1, 2, 102
H. Sieboldiana Hosk.	30	60	61, 1, 2, 146
H. Sieboldiana var. **nigrescens**	30		1, 2
H. undullata Bailey	30		1, 2, 146
H. undullata green bud variation		60	146
H. undullata f. **albomarginata**		60	146
H. ventricosa	30	60	146, 102
H. venusta Maek.	30	60	146
H. sp.	30	60	1, 2, 63
H. sp.	30		1, 2
H. sp.	30		1, 2
H. sp.		60	146
Hemerocallis aurantiaca Bak.	11	22	123, 15, 112
H. citrina		24	129
		12	113
H. disticha Donn.	11	22	123
H. disticha var. **Kwanso Nakai**	11–20	33	123
H. disticha		33	86

[1] **Hosta,** Tratt. = **Funkia,** Spreng.

[2] Many investigators (115, 117, 118, 67, 122, 62, 40, 97, 102) reported 12 or 24 as the basic chromosome number, while Belling (8) found n=30, Lewitsky (61) 2n=60-62, Whitaker (139) n=30, D. Sato (102) n=30, 2n=60, and Akemine (1) observed a 30 basic number to be correct throughout the genus of **Hosta** investigated.

Form	n	2n	Literature reference
H. Dumortierii	11		63
		22	112
H. Elmusae	11		15
H. flava L.	11	22	123, 15, 112, 143
H. fulva L.	ca.12		115
	12		129
	11	22	7, 123, 112, 15
	16		132
	18		45
	24		105
	11_{III}	33	7, 112
	11–20	33	123
H. fulva clon. 'Europa'	6	12	123
H. fulva, var. **flora-pleno**	16		106
H. Forrestii		22	112
H. hippeastrioides		22	15
H. Kwanso	11_{III}	33	123
H. longituba Miq.	11	22	106
H. Middendorfii Trautv. et Mey.	11	22	106, 15, 97
H. minor Mill.	11	22	106
H. multiflora		22	112
H. nana		22	112
H. plicata		22	112
H. Thunbergii		22	112
H. vermusae	11	22	15
H. sp.		22	106
H. sp.	11_{III}	33	106
H. sp.		22	15
ALSTROEMERIALES			
ALSTROEMERIACEAE			
Alstroemeria aurantiaca	8	16	140
A. brasiliensis Spreng.	8		126
A. brasiliensis	8	16	140
A. chilensis Lood.	8		115
A. haemantha	8	16	140
A. pelegrina L.	8		31
A. psittacina	8		32, 33
A. psittacina (= **A. pulchella**)	9		108
A. pulchella	8	16	140
Alstroemeria (?)	8		116
Bomarea Caldasiana	9		108, 140
B. Banksii (**B. Caldasiana** x **B. patacocensis**)	9	18	140
B. cantabrigiensis (**B. Caldasiana** x **B. edulis**)	9	18	140
B. Matthewsii (**B. Carderi** x **B. edulis**)	9	18	140
B. Whittonii (**B. edulis** x **B. Carderi**)	9	18	140
AMARYLLIDALES			
AMARYLLIDACEAE			
AGAPANTHEAE			
Agapanthus excelsa	15		63
A. umbellatus	15		9, 16, 63
Tulbaghia violacea	6–8		110

Form	n	2n	Literature reference
ALLIEAE			
Allium albidium		16	55
A. albopilosum		16	55
A. aletianum		16	91
A. Allegheniense	7	14	56
A. alpinum	8		50
A. amblyophyllum	8	16	55, 60, 91
A. ammophilum	8		55, 60
A. amplectens	12–14		55
A. angulosum	8		55, 60
A. arinatum		24	91
A. ascalonicum	8	16	36, 55
A. atroviolaceum		16	55
A. azurem	8	16	55, 60
A. Bakeri		16	46, 47
A. baicalense	8		36
A. carinatum	8_{III}	24	55
A. Cepa	8	16	87, 67, 96, 125, 55, 60, 51, 91, 52, 103, *
	10_{IV}		78
	16		69
		30±	64
		24	10
A. Cepa L.		16	104, 37, 126
A. cernua	7		60
A. cernuum Roth.	8		77
A. ciliare		32	91
A. coeruleum		32	55
		16	88
A. Farreri	7		60
A. fistulosum	8	16	43, 46, 55, 56, 58, 91, *
A. fistulosum var. **caespitosum**		16	36, 91
A. fistulosum var. **viviparum**		16	91
A. flavescens		16	55
A. flavum	8		54, 55, 60
A. Forminii		16	55
A. Heldreichi	8		60
A. hymenorhizum	8	16	55, 60
A. karataviense Reg.	8		54
	9		127, 55, 60
A. latissimum	16	32	36, 97, 63
A. Ledebourianum	8		36, 55
A. lepidum var. **Rehamanni**		16	55
A. lepitans		16	55
A. leucanthum		16	55
A. macranthum		28	55, 56, 59, 60
A. middendorfianum	16		36
A. Moly L.	7	14	67, 68, 54, 55, 56, 99, 91
A. montanum	8		127
A. narcissiflorum	7		55, 56, 60
	8		36
A. neapolitanum	7		60
		28	55
A. nigrum	8		65, 66
A. nipponicum	8	16	46, 47, 91
		32	78

Form	n	2n	Literature reference
A. nutans [1]	8	16	55
	8_{III}	24	55
		32	55
	8_{VI}	48	55
		64	55
A. obliquum	8	16	55, 60, 29
A. odorum	8	16	34, 46, 47, 60 *
	16	32	68, 69, 60 *
A. "cf. odorum"	12		65
A. oleraceum	8_{IV}	32	55, 58
A. ophioscorodon Don.	14–16	ca.32	69
		40	91
A. Ostrowskianum Reg.	8		55, 60
A. pallyssium		16	91
A. paniculatum	ca.8		69, 55, 60
A. pendulinum	7		60
	9		60
A. ponticum		16	55
A. porrum	8_{IV}	32	55
A. proliferum		16	91
A. pulchellum Don.	8	16	54, 60, 91
A. pyrenaicum		16	91
R. Rosenbachianum	8		60
A. roseum	8		127
	16		55, 12
A. roseum var. bulbilliferum		32	56
	24		65
A. rotundatum	8		138
	8_{IV}		55
A. rubellum		16	55
A. rubens		34	91
A. sativum	8	16	135, 46, 55,95,91
A. sativum var. ophioscardon	ca.16		69
A. saxatile	8	16	54, 55, 60
A. Schoenoprasum	8	16	54, 55, 91
	8_{III}	24	60
A. Schoenoprasum var. sibericum	8_{IV}		55, 60
A. Schoenoprasum var. typicum		16	91, 63
A. Schoenoprasum var. viviparum		16	46, 97, 91
A. Scorodoprasum	8	16	46, 47, 138,55,60
A. senescens		32	91
A. sikkinensis		32	55
A. sphaerocephalum L.	8		54, 55, 60
A. splendens		32	97
A. stellatum	7		3
A. stellerianum	8		36
A. stipitatum	8	16	60, 98
A. striatum		18	91
A. subtillissimum Ledeb.	8		54
A. Suworowi	8		56, 60
A. tataricum	14–16		55
A. Thunbergii		16	91
A. torquetrum	8		127

[1] According to Levan (1931), **A. nutans** consists not only of euploid forms with 8 basic chromosomes but also of aneuploid forms which constitute 2n=42 and 68, and it was found by him that pollen grains with varying number of chromosomes occur in both polyploid and aneuploid forms.

Form	n	2n	Literature reference
A. tricoccum	8		90
A. triquetrum	9		56
A. ursinum L.	8		31
A. ursinum	7	14	13, 14, 55, 56
A. validum	14		55, 56
A. Victorialis L.	8		67, 55, 60
A. Victoriale	16		36
	8		55
A. Victoriale var. asiatic		32	97
A. vineale		32	55, 91
A. yunnanense Diels	8	16	55, 60
A. zebdanense	8		138
	9		60
A. sp.	8		32
Nothoscordum bivalve	9	18	49, 3, 5, 6
N. fragrans Kunth.	8		49
N. fragrans	12		66
	8_{IV}		63
	9	18	109, 60
N. striatum		16	66
Brodiaea californica (= Hookera californica)		10	44
B. stellaris (= H. stellaris)		12	44
B. minor (= H. minor)		14	44
B. coronaria (= H. coronaria)	21	42	44
B. "californica" (= Dichelostemma californicum)		36	44
B. multiflora (= D. multiflorum)		30	44
B. pulchella (= D. pulchellum)		36	44
B. capitata (= D. capitatum)		72	44
B. uniflora		12	144
B. grandiflora		36	144
B. lactea	21–24		107
B. sp. (Triteleia)		10–12	79
Brevoortia ida-maja	ca.20		44
GALANTHEAE			
Galanthus cilicicus		24	35
G. Elwesii		24	35
G. Elwesii robustus		24	35
G. Elwesii praecox		24	35
G. nivalis	12		108, 137, 94 *
		24	35
G. nivalis L.	10		137
Leucojum aestivum		20–24	35
	11	22	85, 53
L. autumnale		14	35
L. pulchellum		20–24	35
L. vernum	12	24	92
		20	35
AMARYLLIDEAE			
Amaryllis belladonna L.		20	19
Nerine Bowdeni		22	131
N. curvifolia		22– (24)	35

Form	n	2n	Literature reference
N. pusilla		ca.24	35
N. rosea Herb.		22	79
N. sarniensis		22– (24)	35
N. undulata		22	35
CRINEAE			
Crinum asiaticum L. var. **japonicum** BAK		22	85, 63
C. latifolium	ca.12		108
	12		136
C. maritimum		18	119
Cyrtanthus parviflorus		ca.16	125
Vallota purpurea		16	131
Ungernia Severzovii B. Fedtsch		24	4
ZEPHYRANTHEAE			
Zephyranthes candida		36	38, 145
	19	38	85
Z. carinata		46	85
Z. Lindleyana Herb.		48	18, 20
Z. texana	12	24	93
Sternbergia lutea Roem. et. Schult.		12	144, 145
HAEMANTHEAE			
Clivia miniata		18	11
C. miniata		22	131
Haemanthus sp.		16–18	79
H. albiflorus		16	35
H. Catherinae		16	35
H. coccineus var. **coarctatus**		(14)–16	35
H. fimbriatus		16–(18)	35
H. Katharinae	ca.12		108
	9	18	141
H. Katharinae Bak.	8		142
H. multiflorus		16–(18)	35
H. pubescens var. **hirsutus**		(14)–16	35
EUCHARIDEAE			
Pancratium ceylanicum		90–100	35
P. maritimum L.		18 or 20	19
P. maritimum L.	11	22	23
P. speciosum		ca.90	35
Hymenocallis rotata	40		85
Eucharis Amazonica	ca.45		108
HIPPEASTREAE			
Hippeastrum japonicum		(22)–24	35
H. rutilum fulgidum		(22)–24	35
H. vittatum		46	85
Lycoris albiflora		16, 17, (18)	42
L. aurea		12	42
L. radiata		33	42
L. radiata Herb.	11_{III}	33	89
L. sanguinea Maxim.	11	22	89, 42
L. squamigera		27	124, 42

Form	n	2n	Literature reference
NARCISSEAE			
Narcissus Barri (or Leedsii) (a variety)		14	84
N. biflorus Curt. (= **N. poeticus** x **N. tazetta**)			
N. biflorus (**N. poeticus gigas** x **N. tazetta**)		24	111
N. biflorus (a variety)	$7_{II}+10_{I}$		84
N. biflorus var. "Elvira"		24	84
N. biflorus Curt.		17	24
N. bulbocodium		42	35
N. bulbocodium var. "Androecium of Bulbocodium"		42	80
N. bulbocodium var. "Common Hooped Petticoat" (double fl'd)		14	80
N. bulbocodium var. "Conspicuous"		21	80
N. bulbocodium L. var. **genuinus**		14	17, 21, 22
N. bulbocodium L. var. **nivalis**		14	17, 21, 22
		15	24
N. bulbocodium L. polyploid forms from diff. localities		26	
		28	24
		35	
		42	
N. bulbocodium x **N. reflexus**		14	24
N. calcicola Mend.	7	—	18, 22
N. cyclamineus DC.		14	24
N. festalis (races)		14, 20, 21 22, 28	74
N. gaditanus Bss. et Reut. var. **minutiflorus** WK.	7		21, 22
N. incomparabilis Mill.		14	35
N. incomparabilis var. "Gloria Mundi"	7_{III}	21	80, 84
N. incomparabilis var. "Nelson Major"	7	14	80, 84
N. incomparabilis var. "Sir Watkin"		21	80, 84
N. incomparabilis var. **aurantus**		21	84
N. intermedius Lois.		17	84, 24
N. Jonquilla L.	7	14	80, 84
N. Jonquilla L. var. **Jonquilloides** WK.	7	14	18, 21, 22
N. minor L.		14	18
N. multiflorus "Ideal"		32	35
N. Odorus L.		14	84, 24
	7		22
N. Poetaz var. "Elvira?"		25	80
N. poeticus L.		16	111
N. poeticus ornatus		14 or 16	111
N. poeticus poetarum		14 or 16	111
	7_{III}	21	80, 81
N. poeticus var. "Albion"		14 or 16	111
	7	14	74
N. poeticus var. "Glory of Lisse"		14 or 16	111
N. poeticus var. "Glorie van Lisse"	7		74

Pierre S. du Pont *See page 187*

Hybrid Amaryllis in the collection of Pierre S. du Pont

Plate 69

Wyndham Hayward *See page 188*

Hybrid Crinum—Sophia Nehrling

Plate 70

Form	n	2n	Literature reference
N. poeticus x N. Psedonarcissus			
vars. "Lucifer"		14	71
"Lucifer" (bud variation)		ca.28	71
"Fuselier"		14	71
"Fuselier" (bud variation)		28	71
N. Pseudonarcissus L.		14	24
N. Pseudonarcissus minor		14	70
N. Pseudonarcissus minor cyclamineus		14	70
N. Pseudonarcissus nanus		14	70
N. Pseudonarcissus minimus		14	70
N. Pseudonarcissus muticus		14	70
N. Pseudonarcissus capex plenus		14	70
N. Pseudonarcissus Telamonius plenus		14	70
	7	14	74
N. Pseudonarcissus Johnstoni "Queen of Spain"		20	70
N. Pseudonarcissus Maximus		21	70
N. Pseudonarcissus var. "Bicolor Victoria"		22	70
N. Pseudonarcissus var. "Buttonhole"		22	70
N. Pseudonarcissus var. "Van Waveren's Giant"		28	70
N. Pseudonarcissus var. "Albicano"		14	80
N. Pseudonarcissus L. var. **bicolor** L.		28	21, 22, 24
N. Pseudonarcissus var. "Empress"		22	80
N. Pseudonarcissus var. "Golden Spur"		21	70
		30	80
N. Pseudonarcissus var. "Grandee"	$7_{III}+1_{I}$	22	82, 86
N. Pseudonarcissus var. "King Alfred"	7_{IV}	28	80, 84
N. Pseudonarcissus var. "Olympia"	7_{IV}	28	80, 84
N. Pseudonarcissus var. "Victoria"		14	80
N. Pseudonarcissus var. "Princeps Maxim"		14	80
N. Pseudonarcissus var. "Emperor"	7_{III}	21	84
N. Pseudonarcissus x N. poeticus		28	72, 73
		14	73
N. Pseudonarcissus x N. cyclamineus		14	24
N. reflexus Brot.		14	21, 22, 24
N. rupicola Duf.	7		22
N. scaberulus Henriq.	7		22
N. tazetta L.	11		22
N. tazetta L. var. A_{22} ("albae" type)	10, 11		83
	11	22	84
N. tazetta var. (an "albae" type)		22	80
N. tazetta var. of "albae" type	10, 11		82
N. tazetta var. (a "bicolores" type)		20	80

Form	n	2n	Literature reference
N. tazetta L. var. B_{20} (bicolores type)	11		83
	10	20	80, 83
N. tazetta L. var. B_{21} (bicolores type)	$10_{II}+1_{I}$	21	83, 84
N. tazetta L. var. B_{31} (bicolores type)	$10_{II}+11_{I}$	31	83, 84
N. tazetta L. var. ("Chinese Sacred Lily")	10_{III}	30	83
	7–14	30	84
N. tazetta L. var. "Franklin"	10	20	83, 84
N. tazetta var. "Luna"	$10_{II}+6_{II}$	ca.32	80
		32	83, 84
N. tazetta L. var. "Soleil d'Or"		30	83
N. tazetta L. var. "Yellow Prince"	10_{III}	30	83, 84
N. tazetta L. var. "L_{20}"	10	20	83, 84
N. tazetta L. (Wild growing form)		30	84
N. tazetta var. (albae type)	$10_{II}+7_{II}$	34	114
N. tazetta L. var. **Pannizzianus** (Parl.)		22	24
N. tazetta L. polyploid forms from diff. localities		21	
		22	24
		30	
N. trianderus L.		14	22

* Additional papers mentioning chromosome numbers incidentally might be cited.

TABLE 2. SUMMARY

Form	No. species studied	Basic chrom. no.	Range (2n)
LILIACEAE			
HEMEROCALLIDEAE			
Hosta	17	30	60, 90
Hemerocallis	20	11 (6)	12, 22, 33
ALSTROEMERIACEAE			
ALSTROEMERIEAE			
Alstroemeria	8	8	16
Bomarea	5	9	18
PETERMANNIACEAE	0	—	—
PHILESIACEAE	0	—	—
AMARYLLIDACEAE			
AGAPANTHEAE			
Agapanthus	2	15	—
Tulbaghia	1	6–8	—

Form	No. species studied	Basic chrom. no.	Range (2n)
GILLIESIEAE			
ALLIEAE			
Allium	98	7, 8, (9)	14, 16, 24, 28, 32, 48, 64
Nothoscordum	3	8, 9	16, 18, 24
Brodiaea	12	5, 6, 7	10, 12, 14, 30, 36, 42, 72
Brevoortia	1	20 (?)	—
GILLIESIEAE	0	—	—
Galanthus	5	12	24
Leucojum	4	7, 11, (12)	14, 20, 22, 24 (?)
AMARYLLIDEAE			
Nerine	6	11 (12)	22, 24 (?)
Amaryllis	1	10	20
CRINEAE			
Crinum	3	(8, 9, 11, 12)	16, 18, 22, 24
Cyrtanthus	1	(8)	
Vallota	1	8	16
Ungernia	1	12	24
ZEPHYRANTHEAE			
Zephyranthes	4	12, 19	24, 36, 38, 46, 48
Sternbergia	1	6	12
HAEMANTHEAE			
Clivia	1	9, 11	18, 22
Haemanthus	8	8, 9, (12)	14 (?), 16, 18, 24, (?)
IXIOLIRIEAE	0	—	—
EUCHARIDEAE			
Pancratium	3	11	22, 90+
Hymenocallis	1	40*	—
Eucharis	1	45 (?)*	—
EUSTEPHIEAE	0	—	—
HIPPEASTREAE			
Hippeastrum	2	11, 12, (23)	22–46
Lycoris	5	6, 9, 11	12, 18 (?), 22, 27, 33
NARCISSEAE			
Narcissus	22	7, 10	14, 15, 16, 17, 20, 21, 22 24, 25, 26, 28, 30, 31, 32 35, 42

( ) doubtful.
? exact number uncertain.
* such large **n** numbers probably do not represent the correct basic, or **x** number.

LITERATURE CITED

General chromosome lists are marked with an asterisk (*)

1. Akemine, T. 1935. On the chromosome number in genus **Hosta** (Japanese). Bot. Mag. Tokyo **49:** No. 580 (8).
2. Akemine, T. 1935. Chromosome studies on **Hosta.** I. The chromosome numbers in various species of **Hosta.** Jour. Fac. Sci. Hokkaido Imp. Univ. Ser. V, Bot. **5:** 25-32.
3. Anderson, E. 1931. The chromosome complements of **Allium stellatum** and **Nothoscordum bivalve.** Ann. Missouri Bot. Gard. **18:** 465-468.
4. Baranov, P. and V. Poddubnaja. 1925. Sur l'embryologie des Amaryllidacéas du Turkestan: **Ungernia Severzovii** B. Fedtsch. et **Ixioliron tataricum** (Pall.) Roem. et Schult. Bull. Univ. Asie Centr. Taschkent **11:** 1-15.

5. Beal, J. M. 1932. Chromosomes of **Nothoscordum bivalve.** Bot. Gaz. **93:** 105-106.
6. Beal, J. M. 1932. Microsporogenesis and chromosome behavior in **Nothoscordum bivalve.** Bot. Gaz. **93:** 278-295.
7. Belling, John. 1925. Chromosomes in **Canna** and **Hemerocallis.** Jour. Hered. **16:** 465-466.
8. Belling, J. 1927. The diminution in number of the nodes in the bivalents of **Lilium.** Nature **120:** 549.
9. Belling, John. 1928. Contraction of chromosomes during maturation divisions in **Lilium** and other plants. Univ. Calif. Publ. Bot. **14:** 335-343.
10. Bonnevie, K. 1908. Chromosomenstudien. Chromosomen von **Ascaris, Allium** und **Amphiuma.** Ein Beitrag zur Lehre der Chromosomen-Individualitat. Arch. Zellforsch. **1:** 450-514.
11. van Camp, G. M. 1924. Le role du nucléole daus la coryocinèse somatique **(Clivia miniata).** La Cellule **34:** 7-10.
12. Cappelletti, C. 1931. (Gives chromosome count in **Allium).** Annili di Bot. **19:** 1 ff.
13. Chodat, R. 1925. La chiasmatypie et la cinèse de maturation dans **l'Allium ursinum.** Bull. Soc. Botan. Geneve: 1-30.
14. Chodat, R. 1925. Sur la réalité de la chiasmatypie dans la cinèse de maturation de **l'Allium ursinum.** C. R. Soc. Phys. et. Hist. Nat. Geneve **42:** 4-8.
15. Dark, S. O. S. 1932. Meiosis in diploid and triploid **Hemerocallis.** New Phytol. **31:** 310-320.
16. Darlington, C. D. 1933. Meiosis in **Agapanthus** and **Kniphofia.** Cytologia **4:** 229-40.
17. Fernandes, A. 1930a. Observations anatomiques et cytologiques sur **Narcissus bulbocodium** L. C. R. Soc. Biol. **103:** 1267.
18. Fernandes, A. 1930b. Sur le nombre et la morphologie des chromosomes chez quelques especes du genre Narcissus L. C. R. Soc. Biol. **105:** 1935.
19. Fernandes, A. 1930c. Sur le nombre et la forme des chromosomes chez **Amaryllis belladonna** L, **Pancratium maritimum** L., et **Ruscus aculeatus** L. C. R. Soc. Biol. **105:** 139.
20. Fernandes, A. 1930d. Le nombre et la morphologie des chromosomes chez **Kniphofia aloides** Moench., **Zephyranthes Lindleyana** Herb. et quelques especes du genre **Aloe** L. C. R. Soc. Biol. **106:** 567-568.
21. Fernandes, A. 1931a. Etudes sur les chromosomes. Bol. Soc. Brot. **6** (2nd series): 294-308.
22. Fernandes, A. 1931b. Estudos nes cromosomas das Liliaceas e Amarylidaceas. Bol. Soc. Brot. **7:** 1-122.
23. Fernandes, A. 1933. Note sur les chromosomes de **Pancratium maritium** L. Bol. da Soc. Broteriana **8:** 1-10.
24. Fernandes, A. 1934. Nouvelles études caryologiques sur la genre "Narcissus" L. Bol. da Soc. Broteriana **11:** 1-204.
25. *Gaiser, L. O. 1926. A list of chromosome numbers in angiosperms. Genetica **8:** 401-484.
26. *Gaiser, L. O. 1930a. Chromosome numbers in angiosperms. II. Bibliographia Genetica **6:** 171-466.
27. *Gaiser, L. O. 1930b. Chromosome numbers in angiosperms. III. Genetica **12:** 159-256.
28. *Gaiser, L. O. 1933. Chromosome numbers in angiosperms. IV. Bibliographia Genetica **10:** 105-250.
29. Geitler, L. 1935. Der spiralbau somatischer chromosomen. Zellforsch. and Mikrosck. Anat. **23:** 514-521.
30. Guignard, L. 1882. Nouvelles recherches sur le noyau cellulaire et les phénomenès de la division communs aux végétaux et aux animaux. Ann. Sci. Nat. Bot. Ser. VI, **20:** 310-372.
31. Guignard, L. 1884. Recherches sur la structure et la division du noyau cellulaire. Ann. Sci. Nat. Bot. Ser. VI **17:** 5-59.
32. Guignard, L. 1889. Observations sur la structure et la division du noyau dans les cellules mères du pollen des cycadées. Bull. Soc. Bot. France **36:** 206-211.
33. Guignard, L. 1891. Nouvelles études sur la fécondation. Ann. Sci. Nat. Bot. Ser. VII, **14:** 163-296.
34. Haberlandt, G. 1922. Die Vorstufen und Ursachen der Adventivembryonie. Sitz. Ber. Akad. Wiss. Berlin: 386-406.
35. Heitz, E. 1926. Der Nachweis der Chromosomen. Zeit. Bot. **18:** 625-681.
36. Hirata, K. and K. Akihama. 1927. Ueber die Chromosomenzahl bei einigen **Allium**—Arten. Bot. Mag. Tokyo 41: 490, 597-600.
37. de Horne, A. 1911. Rechèrches sur la division de la cellule. I Le duplicisme constant du chromosome somatique chez **Salamandra maculosa** Lau. et **Allium cepa** L. Archiv. Zellforsch. **6:** 613-639.
38. Hosone, S. 1930. (cited by Kihara, Yamamoto, and Hosono, 1931—See reference 48).
39. Hutchinson, J. 1934. The families of flowering plants. II. Monocotyledons. Macmillan, London. XIII + 243 pp.
40. Imai, Y. and Kanna, B. 1934. A polyploid series in **Hosta.** Jap. Jour. Gen. **10:** 152-154.
41. Inariyama, S. 1928. On the spiral structure of chromosomes in **Hosta Sieboldiana** Engl. Bot. Mag. Tokyo **42:** 486-489.

42. Inariyama, S. 1932. Cytological studies in the genus **Lycoris** I. Conjugation of chromosomes in meiosis of **Lycoris albiflora** Koidz. Bot. Mag. Tokyo **46:** 426-434
43. Ishikawa, C. 1897. Studies of reproductive elements. III Die Entwicklung der Pollenkörner von **Allium fistulosm** L., ein Beitrag zur Chromosomen— Reduktion in Pflanzenreiche. Jour. Coll. Sci. Imp. Univ. Tokyo **10:** 193-225.
44. Johansen, D. A. 1932. The chromosomes of the Californian Liliaceae I. Amer. Jour. Bot. **19:** 779-783.
45. Juel, H. O. 1897. Die Kernteilungen in den Pollenmutterzellen von **Hemerocallis fulva** und die bei denselben auftreten Unregelmassigkeiten. Jahrb. Wiss. Bot. **30:** 205-26.
46. Katayama, Y. 1928. The chromosome number in **Phaseolus** and **Allium** and an observation on the size of stomata in different species of **Triticum.** Jour. Sci. Agr. Soc. Japan **303.** 52-54.
47. Katayama, Y. 1936. Chromosome studies in some alliums. Jour. Col. Agr. Imp. Univ. Tokyo **13:** 431-441.
48. *Kihara, H., S. Yamamoto and S. Hosono. 1931. A list of chromosome numbers of plants cultivated in Japan. Nakanishys Book Co., Tokyo.
49. Koerperich, J. 1930. Etude comparative du noyau, des chromosomes et de leurs relations avec le cytoplasme **(Nothoscordum, Eucomis, Beschorneria).** La Cellule **39:** 307-398.
50. Koshy, T. K. 1934. Chromosome studies in **Allium.** II. The meiotic chromosomes. Jour. Roy. Micro. Soc. **54:** 104-120.
51. Kotliarewskaja, M. 1932. (Gives chromosome number in **Allium Cepa).** Zeitschr. Zelliforsch. Mikr. Anat. **14:** 465-480.
52. Krivenko, A. A. 1935. Kariologicheskoe issledovanie repchatogo luka **(Allium cepa** L.) Bull. Appl. Bot. Gen., & Pl. breed. S. II, Gen. Pl. Breed. & Cytol. 8: 113-118. (Russian-English summary).
53. La Cour, L. 1931. Improvements in everyday technique in plant cytology. Journ. Roy. Micro. Soc. III, **51:** 119-126.
54. Levan, A. 1929. Zahl und anordung der chromosomes in der meiosis von **Allium.** Hereditas **13:** 80-86.
55. Levan, A. 1931. Cytological studies in **Allium.** A preliminary note. Hereditas **15:** 347-356.
56. Levan, A. 1932. Cytological studies in **Allium,** II. Chromosome morphological contributions. Hereditas **16:** 257-294.
57. Levan, A. 1933a. Cytological studies in **Allium.** III. **Allium carinatum** and **Allium oleraceum.** Hereditas **18:** 101-114.
58. Levan, A. 1933b. Cytological studies in **Allium.** IV. **Allium fistulosum.** Svensk. Bot. Tidskr. **27:** 211-232.
59. Levan, A. 1934. Cytological studies in **Allium.** V. **Allium macranthum.** Hereditas **18:** 349-359.
60. Levan, A. 1935. Cytological studies in **Allium,** VI. The chromosome morphology of some diploid species of **Allium.** Hereditas **20:** 289-330.
61. Lewitsky, G. A. 1931. The morphology of the chromosomes. — History. Methods. Facts. Theory. Bull. Appl. Bot. Genet. Plant-Breed. **27:** 103-174.
62. Li, J. 1929. The formation of four-stranded chromosomes in the amphinucleus of **Funkia Sieboldiana.** China Jour. Shanghai. **10:** 142-144.
63. Matsuura, H. and Suto, T. 1935. Contribution to the idiogram study in phanerogamous plants I. Jour. Fac. Sci., Hokkaido Imp. Univ., S. V, **5:** 33-75. 21 pls.
64. Merriman, M. L. 1904. Vegetative Cell division in **Allium.** Bot. Gaz. **37:** 178-207.
65. Messeri, A. N. 1930. Il numero dei cromosomi dell' **Allium roseum** v. **Bulbilliferum** e dell' **A.** confr. **odorum** e nuovi esempi di rapporti fra apomissia e poliploidismo. Nuovo Giorn. Ital. Bot. **37:** 276-277.
65. Messeri, A. N. 1930. Il numero dei cromosomi dell' **Allium roseum** v. **bulbilli-** "Allium" e "Nothoscordum." Nuov. Giorn. Bot. Ital. **38:** 409-441.
67. Miyake, K. 1905. Ueber Reduktionsteilung in den Pollenmutterzellen einiger Monokotylen. III. Johr. wiss. Bot. **42:** 83-120.
68. Modilewski, J. 1925. Zur Kenntnis der Polyembryonie von **Allium odorum** L. Bull. Jard. Bot. Kieff. II, 9-17.
69. Modilewski, J. 1928. Weitere Beitrage zur Embryologie und Cytologie von **Allium**—Arten. Bull. Jard. Bot. Kieff VII-VIII, 57-64.
70. de Mol, W. E. 1922. The disappearance of the diploid and triploid magnicoronate Narcissi from the larger cultures and the appearance in their place of tetraploid forms. Proc. Kgl. Ak. Wetensch. Amsterdam **25:** 1-5.
71. de Mol, W. E. 1925. Het celkundig-erfelijk onderzoek in dienst gesteld van de verdeling der Hyacinthen, Narcissen en Tulpen. (English summary). Genetica **7:** 111-118.
72. de Mol, W. E. 1926 Heteroploidy and somatic variation in the Dutch flowering bulbs. Amer. Nat. **60:** 334-339.
73. de Mol, W. E. 1927 Change of the number of chromosomes and its causes. X. Cong. Inter. de Zoo. Sect. II: 598-602.
74. de Mol, W. E. 1928. Ein nieuwe veredelingsmethode. Het doelbewust benutten van meerchromosomige bevruchtingskernen. Weekblad voor Bloemballencultur. July 20: 1-8.

75. de Mol, W. E. 1934. Näheres über das Vorfinden nebst dem experimentellen Hervorrufen mehrchromosomiger und embryosackartiger Pollenkörner bei diploiden und heteroploiden holländisshen Hyazinthenvarietaten. Cytologia: **5:** 204-229.
76. Moringa, T. and E. Fukushima. 1931. Chromosome numbers of cultivated plants. III. Bot. Mag. Tokyo **45:** 140-145.
77. Mottier, D. M. and M. Nothnagel. 1913. The development and behavior of the chromosomes in the first or heterotypic mitosis of the pollen—mother cells of **Allium cernuum** Roth. Bull. Torr. Bot. Club. **40:** 555-565.
78. Muhlmann, M. 1926. Die Neurogene Theorie der Caryokinese. Zeitschr. wiss. Biol. Abt. B. Zeitschr. Zellforsch. Mikrosc. Anat. **30:** 377-382.
79. Muller, C. 1912. Kernstudien an Pflanzen I, II. Arch. Zellforsch. **8:** 1-51.
80. Nagao, S. 1929a. Karyological studies of the Narcissus plant. I. Mem. Coll. Sci. Kyoto Imp. Univ. **4:** 175-179.
81. Nagao, S. 1929b. Chromosome arrangement. VIII. Mem. Col. Sci. Kyoto Imp. Univ. Ser. B, **4:** 347-352.
82. Nagao, S. 1930a. Chromosome arrangement in the heterotype division of pollen mother cells in **Narcissus tazetta** L. and **Lilium japonicum** Thumb. Mem. Coll. Sci. Kyoto Imp. Univ. **5:** 163-182.
83. Nagao, S. 1930b. On the meiosis in the polyanthus narcissus, **Narcissus tazetta** L. Jap. Jour. of Genet. **5:** 159-171.
84. Nagao, S. 1933. Number and behavior of chromosomes in the genus **Narcissus.** Mem. Coll. Sci. Kyoto Imp. Univ. **8:** 81-200.
85. Nagao, S. and Takusagawa. 1932. Ueber die chromosomen einiger amaryllidaceen. Bot. Mag. Tokyo **46:** 473-478.
86. Nakamura, M. 1934. On the triploidy of "kimchiamchahhi" **(Hemerocallis disticha** Donn). (Japanese with English Summary). Soc. Trop. Agr. Japan **6:** 7-11.
87. Nemec, B. 1898. Ueber abnorme Kernteilungen in der Wurzelspitze von **Allium Cepa.** Sitz. Ber. Böhm Ges. wiss. Prague. Math. Naturw. Kl; 1-10.
88. Nemec, B. 1931. (Chromosomes in **Allium)** Bull. Inter. Acad. Sci. Boheme.
89. Nishiyama, I. 1928. Reduction division in Lycoris. Bot. Mag. Tokyo **42:** 509-513.
90. Nothnagel, M. 1916. Reduction division in the pollen-mother-cells of **Allium tricoccum.** Bot. Gaz. 61: 453-476.
91. Ono, Y. 1935. Chromosome numbers in **Allium.** Jap. Jour. Gen. **11:** 238-240.
92. Overton, E. 1893. On the reduction of chromosomes in the nuclei of plants. Ann. Bot. **7:** 139-143.
93. Pace, L. 1913. Apogamy in **Atamosco.** Bot. Gaz. **56:** 376-394.
94. Perry, K. M. 1932. Mitosis in **Galanthus nivalis.** Jour. Roy. Micro. Soc. III. **52:** 344-356.
95. Raghaven, T. S. 1933. (Chromosomes in **Allium)** Jour. Annamalai Univ. **8:** 3-99.
96. Reed, T. 1914. The nature of the double spireme in **Allium Cepa.** Ann. Bot. **28:** 271-281.
97. Sakai, K. 1934. Studies on the chromosome number in alpine-plants I. (Jap.-English summary). Jap. Jour. Gen., **9:** 226-230.
98. Sakai, K. 1935. (Chromosomes in **Allium).** Jap. Jour. Gen. **11:** 68-73.
99. Sato, D. 1934a. Chiasma studies in plants. I. Chromosome pairing and Chiasma behavior in **Allium moly.** Jap. Jour. Gen. **10:** 155-159.
100. Sato, D. 1934b. Chiasma studies in plants. II. Chromosome pairing and chiasma behavior in **Yucca, Scilla** and **Urginea,** with especial reference to interference. Bot. Mag. Tokyo **48:** 823-846.
101. Sato, D. 1935a. Chiasma behaviour and interference. (Japanese). Shokubutsu oyobi Dobutsu **3:** 413-419.
102. Sato, D. 1935b. Karotypes in **Yucca** and **Hosta.** (Japanese). ibid., **3:** 1025-1026.
103. Sax, H. J. and K. Sax. 1935. Chromosome structure and behavior in mitosis and meiosis. Jour. Arnold. Arb. **16:** 423-439.
104. Schaffner, J. H. 1898. Karyokinesis in the root tips of **Allium Cepa.** Bot. Gaz. **24:** 225-238.
105. Schürhoff, P. N. 1926. Die Zytologie der Blütenpflanzen. Stuttgart.
106. Sienicka, A. 1929. Ueber den Blütenbau und die Pollenbildungsvorgange bei **Hemerocallis fulva fl. ploens.** Acta Soc. Bot. Poloniae **6:** 296-334.
107. Smith, F. H. 1933. Preliminary studies of chromosome rings in **Brodiaea lactea.** Proc. Nat. Acad. Sci. **19:** 605-609.
108. Stenar (S'on-) A. H. 1925. Embryologische Studien. I. Zur Embryologie einiger Columniferen. II. Die Embryologie der Amaryllideen. Akad. Abhand. Uppsala. 1-195.
109. Stenar (S'on-), A. H. 1932. **(Nothoscordum fragrans)** Svensk. Bot. Tido. **26:** 25-44.
110. Stenar (S'on-) A. H. 1933. (Chromosomes in Tulbaghia.) Bot. Notis. 520 ff.
111. Stomps, T. 1919. **Gigas** Mutation mit und ohne Verdoppelung der Chromosomenzahl. Zeitschr. Indukt. Abst. Vererb. Lehre **21:** 65-90.
112. Stout, A. B. 1932. Chromosome numbers in **Hemerocallis,** with reference to triploidy and secondary poplyploidy. Cytologia **3:** 250-259.
113. Stout, A. B. and T. Susa. 1929. Chromosome irregularities in relation to sterility in **Hemerocallis fulva** clon Europa. Ann. N. Y. Acad. Sci. **31:** 1-30.

114. Stow, I. (Mentioned by Nagao, S. 1933—See reference 86).
115. Strasburger, E. 1882. Ueber den Theilungsvorgang der Zellkerne und des Verhältniss der Kerntheilung zur Zelltheilung. Archiv. f. Mikr. Anat. **21:** 476-590.
116. Strasburger, E. 1888. Ueber Kern-und Zellteilung im Pflanzenreiche nebst einem Anhang über Befruchtung. Hist. Beitr. **1:** 1-258.
117. Strasburger, E. 1900. Ueber Reduktionsteilung, Spindelbindung, Centrosomen und Cilienbilder in Pflanzenreich. Hist. Beitr. **6:** 1-224.
118. Strasburger, E. 1905. Typische und allotypische Kernteilung. Jahb. wiss. Bot. **42:** 1-71.
119. Suguira, T. 1931. A list of chromosome numbers in angiospermous plants. Bot. Mag. Tokyo. **45:** 353-355.
120. *Suto, T. 1936. List of chromosome number and idiogram types in **Liliaceae** and **Amaryllidaceae.** I, II, III. Jap. Jour. Gen. **12:** 107-112; 157-162; 221-231.
121. Sykes, M. G. 1908a. Nuclear division in **Funkia** Archiv. Zellforsch. **1:** 381-398.
122. **Sykes, M. G.** 1908b. Note on the number of the somatic chromosomes in **Funkia.** Archiv. Zellforsch. **1:** 525-527.
123. Takenaka, Y. 1929. Karyological studies in **Hemerocallis.** Cytologia **1:** 76-83.
124. Takenaka, Y. 1930. On the chromosomes of **Lycoris squamigera.** Jour. Chosen Nat. Hist. Soc. No. 10.
125. Taylor, W. R. 1925. The chromosome morphology of **Veltheimia, Allium** and **Cyrtanthus.** Amer. Jour. Bot. **12:** 104-115.
126. Taylor, W. R. 1926. Chromosome morphology in **Fritillaria, Alstroemeria, Silphium,** and other genera. Amer. Jour. Bot. **13:** 179-193.
127. Telezynski, H. 1930. Le cycle du chromosome somatique I. Acta. Soc. Bot. Poloniae. **7:** 381-433.
128. Telezynski, H. 1931. Le cycle du chromosome somatique. II. Acta. Soc. Bot. Poloniae **8:** 109-132.
129. Timm, Herbert. 1928. Untersuchungen über die Sterilitat-sursachen von **Hemerocallis fulva und Citrina.** Planta **5:** 784-808.
130. Thompson, W. P. 1930. Causes of difference in success of reciprocal interspecific crosses. Am. Nat. **64:** 407-421.
131. Thornton, M. (Given by K. Blackburn with unpublished data concerning **Caryophylaceae, Primulaceae, Liliaceae,** and **Amaryllidaceae.** 1930).
132. Tischler, G. 1915. Chromosomenzahl,—Form und—Individualitat im pflanzenreiche. Prog. Rei. Bot. **5:** 164-284.
133. *Tischler, G. 1931. Pflanzliche Chromosomen—Zahlen. Tab. Biol. Period. **7:** 109-226.
134. *Tischler, G. 1935-36. Pflanzliche Chromosomen—Zahlen. Tab. Biol. Period. Nachtrag **2; 5** and **6:** 57-115; 281-304.
135. Toledo Piza, S. de., Jr. 1930. Cruzamento entre especies. Agronimia **1:** 201-209.
136. Tomita, K. 1931. (Gives chromosome count in **Crinum latifolium)** Sci. Rep. Tohoku Imp. Univ. **4** ser. Sendai **6:** 163 pp.
137. Transkowsky, D. A. 1930. Zytologische Beobachtungen über die Entwicklung der Pollenschläuche einiger Angiospermen. Planta **12:** 1-18.
139. Whitaker, T. W. 1934. Chromosome constitution in certain monocotyledons. Jour. Arnold Arbor. **15:** 135-144.
140. Whyte, R. O. 1929. Chromosome studies. I. Relationship of the genera **Alstroemeria** and **Bomarea.** II. Interspecific hybrids in the genus **Nolana.** New Phytol. **28:** 319-344.
141. Woycicki, Z. 1927. Grains de pollen, tubes polliniques et spermatogéneae chez **Haemanthus Katharinae** Bak. II. Bull. Int. Acad. Pol. Sci. et Lettres. Cl. Sc. Math. et Nat. Ser. B. 535-556.
142. Woycicki, Z. 1928. Ueber die Zahl und Form der Chromosomen bei **Haemanthus Katharinae.** Bull. Int. Acad. Pol. Sci. et Let. Cl. Sc. Math et. Nat. Ser. B: 611-629.
143. Wulff, H. D. 1933. (Gives chromosome number in **Hemerocallis flava).** Planta 21: 21pp.
144. Yamamoto, Y. 1930. (Cited by Tischler 1935-36, see reference 134).
145. Yamamoto, Y. and S. Hosono. 1931. (Cited by Tischler 1935-36, see reference 134).
146. Yasui, K. 1935. Cytological studies in diploid and triploid **Hosta.** Cytologia **6:** 484-491.

A DAFFODIL MUTATION—NARCISSUS SCHIZOCORONATUS

FRIEDRICH MEYER, *Hamburg, Germany*

During a visit to some of the Dutch bulb nurseries, I became acquainted with a new race of daffodils that is very promising as a garden subject. I shall try to give some preliminary remarks on their heredity, repeating in part my brief report in New Flora and Silva (Vol. 8, No. 4, July, 1936).

The mutation was discovered in connection with researches on some genera of Dutch bulbous plants begun by Dr. W. E. de Mol of Amsterdam, some 20 years ago, and continued since 1922 in collaboration with Mr. A. H. Nieuwenhuis, member of the bulb nurseries of Nieuwenhuis Bros., N. V., Lisse, Holland. The mutation consists of a cleft corona in *Narcissus.*

The united corona in *Narcissus* is apparently a phylogenetically young attribute, and species with naturally cleft coronas like *N. viridiflorus* and *N. serotinus* from the Mediterranean region of Europe and Africa may be regarded as old, primitive ones. Thus we may explain the cleft corona of the mutant as a reduction to former type by loss of an acquired character.

The collection of Dr. de Mol already includes several hundred varieties with the mutant character *(N. schizocoronatus),* which all trace back to only one mutation of the old and well known Bicolor variety, *Victoria.* This mutation, named *Buttonhole,* (See Plate 62), was distinguished by a regularly split-in-six corona with reflexed lobes.

Another mutation of the same origin with corona irregularly cleft, named *Semi-Buttonhole,* proved unfit for horticultural breeding work. Its descendants always had irregularly cleft coronas and could not be considered as an acquisition from the gardener's point of view.

The discovery of the mutant narcissus *Buttonhole* was a lucky chance. The new form was not at all perfect for its bulbs had the inclination to split up, and in addition both pollen and ovaries proved nearly fully sterile as in its ancestor, *Victoria.* The latter is known as an aneuploid, a hybrid containing in its body cells a multiplicity of chromozome sets with additional chromozomes. In this case there are 3 sets plus 1 additional (3n plus 1 or 22). Such plants usually are highly sterile.

For some years all attempts to use the mutant in breeding work proved unsuccessful, but finally a single seedling was obtained by crossing narcissus *Buttonhole* with *King Alfred.* This was named *Gigantic Orchidflower,* and it also was subject to bulb-splitting, had a short stem, but was an advance with regard to fertility.

After pollinating the Yellow Trumpet daffodil, *King Alfred,* and the robust Bicolor, *Van Waveren's Giant,* with pollen of *Gigantic Orchidflower,* a remarkably large number of fine seedlings were selected in both the self-colored and bicolored varieties. They differ more or less in color of the perianth as contrasted with the corona-lobes, in the direction of the corona parts, their length and the curling of their edges.

The illustrations, Plate 64, give an idea of this Schizocoronatus Trumpet daffodil in front view and in profile.

Howard & Smith

See page 190

Howard & Smith Hybrid Hippeastrum Breeding Stock

Plate 71

H. H. Hume

See pages 196 and 197

Propagation of Zephyranthes; UPPER, *Z. Atamasco;* LOWER, *Z. Simpsonii*

Plate 72

Later another hybrid, named *Vorstin (Princess)*, was secured (see Plate 63). Parts of its corona are alternately cleft and not-cleft, but it is valuable in breeding work on account of its robust constitution.

It should be noted that the more or less reflexed lobes of the cleft corona are laid opposite to the perianth-lobes, not alternate, as might be expected, if they were to be regarded as the next following independent circle of flower organs. This peculiarity is illuminating in connection with the problem of the origin of the corona which was discussed recently by Dr. W. E. de Mol (The Origin of Double Daffodils, R. H. S. Daffodil Year-Book, 1934, pp. 38-44.)

Since the cleft corona mutation behaves as a dominant factor in the preliminary trials, it is natural to expect that it could be bred into some of the other divisions of narcissi in addition to the Incomparabilis varieties.

The attempt was made in 1925, using narcissus *Confidence*, which was derived from *N. poeticus, Glory of Lisse* crossed on *N. pseudo-narcissus, King Alfred,* the mother parent. The variety *Confidence* proved exceptionally fertile, unlike other members of this division. Pollen was used from *Gigantic Orchidflower* and also from some of its descendants. This gave rise to a series of very fine seedlings with the split corona and also a shortened corona (See Plate 63).

In my opinion some of the class of Incomparabilis Narcissi with cleft coronas appear superior to the Trumpets. There is a more harmonious proportion between the reflexed and crisped corona and the smooth perianth lobes, and the color contrasts are usually pleasing.

Apparently the work will be carried still further and the cleft corona character will be bred into the Leedsii and Barri divisions.

Daffodil enthusiasts may expect the appearance of this new race in the trade in the not distant future.

NEW DOUBLE HYBRID AMARYLLIS

J. J. McCann, *Florida*

The strain of double hybrid Amaryllis which is being described in print for the first time was originated by me several years ago at my nursery in Punta Gorda, Florida as the result of a cross between the small double-flowered form of *Hippeastrum equestre,*[1] which is occasionally found in dooryard gardens over the state, and bulbs of ordinary large forms of hybrid amaryllis *(Hippeastrum).*

The double *H. equestre,* is an interesting orange-colored variety, but is not of vigorous constitution under cultivation. It produces no seeds, and is multiplied solely from offsets. Occasionally the blooms produce an abortive stamen or two, with a small amount of pollen. This pollen was used on the hybrid amaryllis.

The double hybrids have appeared in a variety of colors, mostly shades of red. They do not produce seeds, and hence their natural propa-

[1] Baker (Handbook of Amaryllideae, 1888), states that **"Amaryllis Alberti** Lemaire in Ill. Hort. t. 498, is probably a double-flowered form" of **Hippeastrum reginae.** Members of the Society have tentatively classed this double form as a variety of **Hippeastrum equestre.**

gation is usually slow. In a few cases, however, the bulbs will be found to multiply rapidly, so that I have had as many as 19 offsets from a single plant.

After the production of the first double hybrids, I used the pollen of these new doubles in making other crosses on ordinary hybrid amaryllis as the seed parents. The progeny of these later crosses, I regret to say, have not produced as good flowers of the double type as the first series.

I have not tried to make many of these interesting crosses because my facilities are limited, and I have only two city lots to grow the seedlings on. I have lived beyond my allotted time, and will leave some of the future developments of this new strain to others.

The new double hybrids have proved to be more vigorous than the old double *H. equestre,* which is a rather difficult subject under cultivation. The flowers are distinctive and strangely handsome, some of the colorings are very attractive. The bulbs make normal sizes as in the case of the ordinary hybrid amaryllis, and produce vigorous scapes with four blooms in most instances. Except for the doubling, the plants behave almost the same as the normal hybrids.

The illustration (Plate 65) shows a double flower of a bright orange red color. The photograph was taken in March of 1937. The flowers of this plant averaged about six inches in diameter when fully expanded.

AMARYLLIS IN GERMANY[1]

Max Löbner, *Bonn, Germany*

Species of *Hippeastrum* with a few exceptions are rare in Germany, and may only be found in botanical gardens. The so-called "amaryllis" of our nurseries are hybrids of *Hippeastrum vittatum,* sometimes with a little blood of *H. psittacinum.* Of those hybrids rather good forms with fine and large flowers can be met with. The plants are not difficult to grow if one allows them a rest period during the summer time when blooming is past.

Rarer than hybrids of *H. vittatum* are those of *H. psittacinum,* called *H. hybridum.* They are prevalent in English nurseries, and they can be seen on the continent in exhibitions in Belgium and Holland. I saw them in excellent condition in the spring flower show at Heemstede near Haarlem in 1935. From Holland a lot of flowers are sent to our German flower markets. The flowers of the hybrids of *H. psittacinum* are of a more open and noble type than those of *H. vittatum.* The former want some more care with regard to watering, and they produce few, if any, bulblets. We must propagate them by seeds as a rule.

H. aulicum var. *robustum,* in Germany commonly called "Amaryllis Tettaui", is one of the evergreen species of the genus. Formerly it has been cultivated quite extensively in Germany, and to-day it may be seen in many private gardens in the Rhineland as a window plant. Its culture is more like that of *Clivia,* and it does not require a rest period after

[1] Translated from the German by Dr. Camillo Schneider, Berlin, Germany.

blooming. Years ago *H. aulicum* was used quite extensively in hybridizing. The old *Amaryllis Ackermannii* and *A. Ackermanii* var. *pulcherrima* are hybrids of *H. aulicum.*

Among the seedlings of *H. vittatum* sometimes one or more may be found showing a marked influence of blood of *H. aulicum.* Such plants have three flowers to the scape—*H. aulicum* always produces only two large flowers. The throat of flowers with *H. aulicum* blood show the significant green with a red ring as shown in Plate 66. Its leaves do not die off entirely as in the hybrids of *vittatum* and *Psittacinum,* but they are half ever-green. The flowering plant therefore has a more pleasing aspect. Like *H. aulicum* it produces many bulblets.

Unfortunately hybrids of *H. aulicum* have so far not been used for breeding purposes in Germany. I do not know if this has been done in the U. S. A.. According to Mendel's laws of heredity it should be possible in the second generation to get an evergreen amaryllis which does not have the irregular flowers of *H. aulicum* with their narrow perianth-lobes but with fine regular roundish flowers like those of the *Psittacinum* hybrids. This would be a valuable goal to take aim at. I am trying to realize this ideal but my work is not yet completed.

Here and there in German botanical gardens the species *H. rutilum* and *H. reticulatum* are met with. The last one is more difficult to cultivate. During its resting period in winter it must not be kept too warm, but when in full growth during the summer it requires hot-house conditions. The watering must be done with great care. It too is evergreen, and it should be used, especially in its variety *striatifolium,* for breeding purposes with the evergreen and unpresuming *H. aulicum* to raise evergreen *reticulatum* hybrids of easy culture. In England *H. reticulatum* has already been used successfully for crossing with *Psittacinum* hybrids. The flowers of *H. reticulatum* are a delicate pink, reticulated with a deeper shade. *H. rutilum* is an easy growing and flowering species.

The oldest amaryllis hybrid raised in gardens is of course *H. Johnsonii,* but it is scarcely found to-day in German nurseries. It is only of historical interest being inferior to the modern hybrids of *vittatum* and *psittacinum.* Nevertheless it may be seen in some regions of Germany as a pot plant in the windows of farm-houses.

HYBRID AMARYLLIS IN THE DU PONT COLLECTION

The illustrations, Plates 68 and 69, show snapshots of hybrid amaryllis in the Pierre S. du Pont collection. Plate 68 shows a 10¾ inch diameter flower, semi-double white suffused pink. Plate 69 shows *upper left,* 1934 seedling, orange and salmon with deep salmon throat, flower 11″ diameter; *upper right,* 1932 seedling, amber suffused orange pink, flower 10¾″ diameter; *lower left,* 1934 seedling, clear salmon with dark salmon throat, flower 10¾″ diameter; and *lower right,* 1934 seedling, dark red; flower 9½″ diameter.

CYRTANTHUS-VALLOTA HYBRID

T. A. Weston, *New York*

A possible natural hybrid between *Vallota purpurea* and some species of *Cyrtanthus* appeared in 1936 among some bulbs imported from a grower on the Island of Guernsey in the English channel. Flower specimens shown in Plate 67 were submitted to Dr. H. K. Svenson, Curator of the Brooklyn Botanic Garden, Brooklyn, N. Y., and he gave the opinion that the plant was apparently a natural hybrid between *Vallota* and a *Cyrtanthus,* it having some of the botanical characters of both genera.

The bulb died after blooming the second time. There is a record of a hybrid between *Vallota purpurea* and *Cyrtanthus sanguineus,* as mentioned in Bailey's Standard Cyclopaedia of Horticulture. This hybrid is still in cultivation in England, and has been shown at an exhibition of the Royal Horticultural Society.

HYBRID CRINUM SOPHIA NEHRLING

Wyndham Hayward, *Florida*

The hybrid Crinum *Sophia Nehring,* which is pictured in this issue of *Herbertia* (Plate 70), apparently the first named variety of hybrid crinum produced by the late Henry Nehrling. It is very similar to Nehrling's last hybrid crinum, *Mrs. James Hendry,* which was illustrated on page 80 of 1936 *Herbertia.*

A brief comparison of the two hybrid crinums mentioned above was given in 1936 *Herbertia* on page 79. The flowers are slightly less full and rounded in the case of *Sophia Nehrling* than in the variety, *Mrs. James Hendry.* Nevertheless the umbel is large, the perfume strong and pleasant, and the general effect is striking and attractive. The color is white with delicate shadings of rose pink toward the outer tips of the petals.

The foliage is distinct, and handsome, practically identical with that of *Mrs. James Hendry.* The bulbs make offsets slowly, and are best propagated by cuttage. The flowers are borne on strong stems a foot and a half or two feet above the leaves, and several flowers open at once on succeeding afternoons, lasting in good condition throughout most of the next day, which is unusual in crinums. There are approximately ten flowers in the average umbel. The individual blooms may be five or six inches across the face when widely open. The possible parentage of this hybrid is not easy to guess.

THE HOWARD AND SMITH HYBRID AMARYLLLIS STRAIN

FRED H. HOWARD, *California*

Our firm took up the culture of hybrid Hippeastrums some forty odd years ago. Our interest in their culture was brought about by seeding a very fine collection for that period, grown on a considerable scale by an old French nurseryman of this section, Mr. George Compere. From him we obtained a few bulbs and by subsequent propagation carried on until a fair stock was produced. The information which I had from Mr. Compere at that particular period was to the effect that the original stock of these bulbs had been imported from France. In general, the flowers were of very large size, but with somewhat narrow petalage, more or less after the form to be noted in the variety *Hippeastrum reticulatum,* which blood I feel certain was preponderant in the strain.

About this same period we imported a large number of bulbs from various European sources, in order to obtain new types and colors. Carefully recorded crosses between the original Compere stock and these imports were made and a definite system of line breeding was carried on for several years.

During the year of 1907 I made a trip to England, the main purpose of which was to attend the International Genetic Conference held in London under the auspices of the Royal Horticultural Society at Vincent Square. One of the principal topics at this meeting was Mendel's law of heredity, resurrected and ably demonstrated by such leading experimentalists as Prof. Bateson, Miss Sander and Mr. Punnett and others of Cambridge University. I spent some time at Cambridge to become conversant with the practical demonstrations made there. The knowledge gained served well in after years.

One interesting bit of plant lore gained at Cambridge was to see the first hybrid Gerbera crosses raised by Mr. Lynch, curator of the Cambridge Botanical Gardens. These crosses were between the original *Gerbera Jamesoni* and one of its South African congeners. These Gerberas subsequently passed into the hands of Messrs. James Veitch and Sons for commercial distribution. I secured stock of these, probably among the first brought to the United States.

During this visit to England I had the pleasure of seeing in full perfection of bloom the magnificent hybrid Hippeastrums raised by Messrs. Ker and Son at Aigburth, a suburb of Liverpool. I also saw the collection of Messrs. James Veitch and Sons of Chelsea and Slough, and those of Mr. William Bull. These, besides several other fine collections, both commercial and private, were at their best. My firm conviction, formulated at that time, was to the effect that Messrs. Ker's strain, nearly all a uniform Leopoldii type, was the outstanding one in all England.

During this trip I made selections from some of the finer collections, purchasing a large number of bulbs, not only from the raisers noted above, but from certain sources in Holland and Belgium, where large collections were becoming a patent fact.

One principle which we have adhered to in all of our hybridizing efforts is to avoid indiscriminate crosses. Roses, for example, are a far more difficult subject than hybrid Hippeastrums to manipulate and grow from the initial stages to the time of flowering. The results we have obtained in many subjects, aside from Hippeastrums, more than justified the correctness of our applied efforts. A part of our breeding stock is shown in the illustration, Plate 71.

We have at the present time a series of crosses between the Hippeastrums and certain related genera which show some very interesting breaks and such as we anticipate will prove acquisitions to this glorious race of bulbous plants. More, however, of these crosses at a later date.

During the past season, through the courtesy of Mr. August Koch of the Chicago Parks, we obtained a few bulbs of Garfieldi hybrids which flowered a few weeks after potting. From all that I can judge, these remarkably beautiful hybrids will prove immensely valuable in the propagation of a graceful new race of these handsome bulbous plants.

We certainly need to break away from the constant inbreeding which has become a routine procedure in Hippeastrum breeding, and I am firmly of the opinion that the day is not far distant when yellows and hitherto unknown shades will be realized. Except by careful line breeding and gaining a fixity of type, the application of Mendel's law does not help to any great extent. The already inherent hybrid character of the hybrid Hippeastrums and the lack of sufficient data as to their true parentage leaves the plant breeder in more or less of a quandary as to how to proceed, unless it be, as stated above, a careful system of line breeding, plus the injection of the blood of new species for the purpose of securing a fresh start, at least to a limited extent.

Although the work prosecuted by our firm in various hybridizing efforts has been applied to many different subjects, there is nothing in the whole category which, in my opinion, offers a greater field of endeavor than that applicable to Hippeastrums and their improvement. I am positive that in the years to come it will be quite possible to have strains of these which will practically cover the twelve months of the year in time of bloom, and looking at the matter from the economic standpoint of view, they will eventually become one of the most important of florist's flowers.

HASTENING BLOOMING OF SEEDLING HYBRID AMARYLLIS (HIPPEASTRUM) BULBS

AUSKER E. HUGHES, *Florida*

A number of amaryllid growers have reported on blooming hybrid Hippeastrums from seeds in two years. A limited number have produced fair sized bulbs which have bloomed within 22 months. Still others are able to obtain blooming size bulbs only after 3 to 4 years from the time of seed planting. Because of the time required to grow hybrid Hippeastrums from seeds, some commercial growers, and also many amateurs, have resorted almost entirely to offsets for increasing their stocks.

The stem cuttage method of propagating amaryllids has gone a long way in reviving interest in this group. The faithful workers who are responsible for this landmark of progress are worthy of our highest regard. No longer does one need to wait and puzzle over the propagation of a prize variety. With this achievement we may well expect greater effort to be put forth in the development of hybrid Hippeastrums so that more bulbs worthy of being subjected to the stem cuttage process may be produced. Recent developments in the storage of pollens have made possible the holding of pollen from the first blooms of the spring flowering season for use in setting seeds upon blooms opening in June and July.

Late flowering bulbs when crossed with early blooming varieties may produce bulbs which flower in mid-spring. In such a case it would not be possible to bloom them the second spring from seeds unless the shortest time reported (22 months) should be reduced by 2 to 3 months, thus bringing the time down to 18 to 19 months. Seeds from plants blooming as late as June can be planted immediately and with proper treatment the seedlings will flower the second spring following the time of pollenation. However, many bulbs bloom in late June and July so that the seeds are not mature before August. To plant seeds in August and to have seedlings in flower the second following spring has apparently not met with success.

Once the hybridist has obtained the seeds from certain crosses it is his desire that they be germinated, grown into full sized bulbs and bloomed in the shortest time possible. Differences of three or four months in the collection of the seeds are quite likely to cost the hybridizer a delay of an additional year in obtaining blooms. Such a handicap would be overcome to a great extent were it possible to obtain blooms in 18 to 19 months. The experiment reported briefly here was undertaken at the writer's home in Orlando for the purpose of studying this problem of the amaryllis breeder.

Materials and Methods. The seeds used in this experiment were grown by Dr. Traub at Mira Flores in 1935. The anthers were removed from all the flowers in his collection before the flowers opened and only the pollen of the variety *Marina* (almost pure white, 10½ in. diameter flower) was cold stored and used throughout the season. He proceeded on the theory that the obvious and common colors usually found in the Mead strain are due to the usual practice of breeders who cross varieties with like colors, and that it would be possible to secure more subtle orchidaceous shades by always using one parent of a lighter color in mak-

ing crosses. To test out his theory he used only one light colored pollen parent on all his darker colored varieties.

The seeds were collected in June and July and planted in flats by the writer at his home in Orlando during the latter part of July and the first of August 1935. The soil in the flats was made up of two layers. A two inch layer, consisting of one-third Orlando Fine Sandy Loam, one-third crushed lime rock, and one-third peat, was placed in the bottom, and ample nutrient material, consisting mainly of poultry manure supplemented with commercial fertilizer of the analysis 4-5-5 was incorporated in this layer. Each flat was then watered with a solution containing ½ oz. maganese sulphate, ½ oz. magnesium sulphate, ¼ oz. ferrous sulphate, ¼ oz. copper sulphate, ⅛ oz. zinc sulphate, and 1/64 oz. borax per two gallons of water. A two inch layer of sand and crushed oyster shells containing a small amount of granulated peat was then placed on the surface and the seeds planted in this layer.

All watering was from the surface, regular applications being made as needed to keep the soil thoroughly moist. Good germination (85%) was obtained. Half shade was provided and under these conditions the seedlings developed rapidly. After three months, bulblets of ½ to ¾ inches had been produced. They were now ready to be planted directly in the nursery bed, also in half shade.

Two weeks before the time of planting two beds 4 by 8 feet were prepared in the following manner. Ten pounds of crushed oyster shells, 20 pounds of poultry manure, 5 pounds of a 4-5-5 fertilizer, and ¼ pound of combined rare elements in the ratio mentioned above, were worked into the first four inches of the soil of each bed.

In close planting of Hippeastrum bulbs it is impracticable to cultivate, so it is necessary to work into the soil as much plant food and soil conditioner as is possible before planting. Crushed oyster shells are flat and range in size from ⅛ to ½ inch in diameter. Ten pounds worked into the first 4 inches of a 32 square foot plot can be counted on to furnish sufficient calcium for the plants and keep the pH of the soil near 7 for a period of years.

Near the middle of November, 250 bulblets were taken at random and planted in the beds, previously prepared and located in half shade. The rows were 7 inches apart and the plants were set approximately 4 inches apart in the row. Regular applications of 2 pounds of a 4-5-5 fertilizer were made every 2 months and 10 pounds of poultry manure every 4 months, to each bed. When natural moisture was not sufficient, the beds were watered from the surface.

Results. Under the conditions outlined above, thrifty growth was obtained. Large bulbs were produced and the first flowers appeared on February 25, 1937. Practically all of the bulbs bloomed within 18 to 19 months from the time of planting of the seeds. Fully one fourth of the lot bloomed twice, while many produced three flower scapes.

The great majority of the seedlings produced flowers with subtle, lighter shades of pink, orange and red, and thus the desirability of crossing lighter colored varieties with darker flowered ones has been experimentally demonstrated. Many of the hybrids are first class and worthy of naming, and some of them have been registered with the Secretary

of the Society. With the general application of this principle in selecting parents for crossing, the complaint which we hear sometimes, and with justice, that amaryllis are too brilliantly colored, will entirely disappear for the varieties produced in this case, especially such varieties as *Lena B. Hughes,* are as delicate and refined as the orchids.

On April 10, 1937, 100 bulbs were taken at random, and were measured as to diameter by means of a caliper. The diameters of these bulbs in inches are given in Table 1, and the percentages of bulbs in the various size ranges are given in Table 2.

TABLE 1.

Showing sizes of bulbs at the end of 19 months from time of sowing seeds.

Bed No.	Row No.	Bulb number and size. (Sizes of bulbs indicated in inches) 1	2	3	4	5	6	7	8	9	10	Average
1	1	4.25	4.25	3.50	3.75	3.50	4.00	4.75	3.25	3.50	3.00	3.73
	2	4.75	2.75	3.00	2.50	3.75	4.25	4.00	3.25	3.00	3.50	3.48
	3	4.25	3.75	4.50	4.00	3.50	3.50	3.00	4.50	3.75	3.00	3.78
	4	3.50	3.00	3.50	4.00	3.75	4.00	4.25	3.00	3.50	3.25	3.58
	5	4.25	4.50	4.25	3.00	4.00	3.50	3.00	3.25	3.75	3.50	3.70
2	1	3.00	3.75	4.00	4.00	3.50	2.25	2.00	3.50	3.00	2.50	3.15
	2	4.50	4.75	3.50	3.75	3.25	4.00	3.75	4.00	3.25	4.00	3.93
	3	3.75	3.50	3.00	4.25	3.75	3.75	4.00	3.50	3.00	3.25	3.58
	4	3.00	2.75	3.75	3.50	3.25	3.50	3.75	4.00	3.50	4.00	3.50
	5	3.25	3.50	3.75	3.25	3.00	3.50	3.25	3.00	3.50	3.00	3.30
1 & 2												3.58

TABLE 2.

Showing percentages of total bulbs in the various size ranges.

Size Range in inches	Percentage	Remarks
2½ to 3	6	86% in range
3 to 3½	28	of 3 to 4½ in.
3½ to 4	37	94% in range
4 to 4½	21	of 3 in. and
4½ to 5	8	over.

The average for all the bulbs is 3½ inches in diameter,[1] and the extreme range is from 2 to 4¾ inches in diameter. It is interesting to note that 86 per cent of the bulbs averaged from 3 to 4½ inches in diameter, and 94 per cent, 3 inches and over.

Conclusions. From the facts presented above, we may conclude that under suitable conditions, hybrid Hippeastrums may be brought to the flowering stage in from 18 to 19 months from the time of seed planting, and that it is possible to produce large sized bulbs at the same time. Such a program may not be economical in ordinary commercial production of amaryllis bulbs, but is intended for consideration only in growing very valuable hybrids to the flowering stage in the shortest possible time.

The desirability of crossing lighter colored varieties on those possessing the common obvious darker color shades has been experimentally demonstrated. By the application of this principle in selecting parents for crossing, progeny can be secured that rival the orchids in delicacy and refinement of color shades.

[1] Mean: 3.58 plus or minus 0.35; coefficient of variability, 13.71.

H. H. Hume

See pages 197 and 198

Vegetative Propagation of Zephyranthes; UPPER, *Z. grandiflora;* LOWER, *Z. rosea*

Plate 73

5. PHYSIOLOGY OF REPRODUCTION

PROPAGATION OF ZEPHYRANTHES

H. Harold Hume and John V. Watkins

Florida Agricultural Experiment Station

Virtually all Zephyranthes now growing in gardens are wild species unmodified and unchanged. The sole exception to this statement, commonly known at this time, is Ajax, a hybrid by Sprenger[1] between *A. candida* and *Z. citrina.* Planting materials of some species still are secured to some extent from their native habitats, but in the main increases are obtained from offsets, from seeds or from both offsets and seeds.

Species in cultivation differ greatly in the freedom with which offset bulbs and seeds are produced. *Z. grandiflora* Lindley *(Z. carinata* Herbert) is a striking example of a species that so far as known produces no seed and under ordinary handling in the garden does not furnish many offsets. For instance, eighteen bulbs of this species planted out and dug up five years later furnished a total of only thirty bulbs. So long ago as 1837 Herbert[2] wrote of the behavior of this plant, "I have never seen it make any advance toward the formation of seed, though tried in various aspects and temperatures." Although several reports have come to hand of seed bearing by this species, it has not been possible to verify them and so far as known Herbert's statement is just as true today as it was when he made it. It may be that most of the bulbs of *Z. grandiflora* are direct asexual descendants of those that came out of Mexico in 1824[3]. To this time it has been increased only and but slowly from naturally formed offsets. *Z. rosea* produces offsets abundantly and seeds sparingly. Counts of seeds in a large number of capsules of this species have given an average of eight seeds each. *Z. citrina* seeds freely but naturally produces very few offsets and at times over long periods none at all. *Argyropsis candida (Z. candida)* produces seed well in Kew Gardens and other parts of England, but seldom has been found to do so in Florida. Among species studied under natural native conditions, *Z. Atamasco* forms offsets in large numbers, old clumps, started from a single bulb, often having a dozen in them and one clump has been counted that had twenty-eight apparently all produced in the same way. Mature bulbs of *Z. Treatiae* and *Z. Simpsonii* are seldom accompanied by offsets. All of the species native in Florida, viz., *Z. Atamasco, Z. Treatiae,* and *Z. Simpsonii,* produce seeds in considerable amounts and in about the same quantities.

The Zephyranthes discussed may be taken to be representative in their seed and offset production of all the species belonging to the group. Some increase rapidly by offsets, others bear seed abundantly, some develop no offsets of consequence, some produce no seed, and still others furnish both seeds and offsets in considerable numbers.

From what has been stated, it will be noted that Zephyranthes differ materially in seed and offset bulb production and, while both seeds

and offsets are satisfactory for reproduction, they are not always and in every species dependable sources of increase. For this reason it was decided to determine in how far propagation by bulb cuttings along the lines worked out by Luyten[4] and Traub[5] for hybrid Amaryllis would afford a satisfactory means of increase.

Five species were used, *Z. Atamasco, Z. Treatiae,* and *Z. Simpsonii,* all native in Florida, *Z. grandiflora* from Mexico, and *Z. rosea* from Cuba. Although other species were in hand the numbers were too small to make it possible to carry the work beyond these five. Bulbs in full leaf were used and cuttings made April 20, 23 and 24, 1936, and the results checked June 19, 1936. The time was not sufficient to secure final results, but was sufficient to indicate the value of asexual propagation for the Zephyranthes group. Because of the small size of the bulbs it was decided best not to make the pieces very small. All were planted in clean washed sand. Bulbs were *cross cut, scooped, oblique cut* and made into *halves, quarters* and *eighths* except in the case of *Z. Treatiae,* the bulbs of which were so small that it was exceedingly difficult to make parts smaller than *quarters.*

The following statements cover the methods of preparation:

Cross cut. These were cut with deep V-shaped incisions in the bases of the bulbs, with cuts forming a right angled cross.

Scooped. The stem or basal part of the bulb was scooped out partially. With very small bulbs this was difficult to do well.

Halves, Quarters, Eighths, refer to the cutting of the bulbs longitudinally into these portions, the number of parts depending upon the size of the bulbs.

Oblique cut bulbs had about one-half the basal stem cut away with a part of the upper portions.

The results of this work, when checked, were as follows:

Z. Atamasco.

Cross cut. Six bulbs, all well rooted. One has two bulbels, one has one bulbel and one has one bulbel well developed, with a second starting. Three have no bulbels.

Scooped. Four bulbs. Two well rooted, one slightly rooted, the remaining one without roots. One bulb has a small bulbel, no sign of bulbels on the remaining three.

Halves. Four bulbs, eight halves. All well rooted, six have bulbels and the other two show indications of bulbels starting.

Quarters. Two bulbs, eight quarters. All well rooted but without leaves. Seven have very small bulbels, one has no bulbel.

Oblique cut. Four bulbs. All well rooted without leaves and bulbels.

Typical results with **Z. Atamasco** (L) Herb. illustrated in upper half of Plate 72:—

Upper row: #1, cross cut, with one bulbel developed and a second starting from a single quarter. Remainder in row quartered, first one with bulb occupying whole center; #3 and #4 with single bulbel; #5 and #6 with two bulbels.

Second row: Halves. #1, point of bulbel starting from center; #2 and #3 with one bulbel each; #4 with two; #5 with bulbel starting; #6 with one bulbel.

Z. Treatiae.

Cross cut. Five bulbs, all bulbs in good condition, good root development, no multiplication.
Scooped. Four bulbs. Good root development; leaves started on all; no multiplication.
Halved. Five bulbs, ten pieces. Nine started with one bulbel each, the tenth piece still in good condition but without showing growth. Root development on all ten.
Quartered. Three bulbs, twelve pieces. All with root development, only one showing leaf development. Two pieces with two bulbels, eight with one bulbel and two with none. One or more roots on all pieces.

Z. Simpsonii.

Cross cut. Two bulbs, with both leaves and roots. One bulb with a small bulbel, the second bulb with one bulbel and one just starting.
Scooped. Three bulbs, all well rooted with leaves, two with one bulbel each, one with one bulbel and two others starting.
Halves. Two bulbs, four pieces, one lost. The remaining three are well rooted, one with small bulbel, one with well developed bulbel, one with two bulbels.
Quartered. Two bulbs, eight pieces, one lost. Seven remaining are all well rooted. Two have one bulbel each, four have two bulbels each, one has three bulbels.
Eighths. One bulb, eight pieces. All well rooted. Seven have one bulbel each, one has no bulbel but is rooted.
Oblique cut. Two bulbs. Parent bulbs are rooted. The two small pieces cut off are well rooted. Each of the small pieces shows the starting of a bulbel. One of the large pieces has produced two bulbels. The other one has none.

Typical results with **Z. Simpsonii** Chapman, illustrated in lower half of Plate 72:—

Upper row: First four, eighths, with one bulbel each; #5 and #6, quartered: #5 with two bulbels, #6 with three.
Second row: #1 and #2 halves: #1 has one bulbel, #2 has two bulbels. #3 and #4, two pieces, main large part and oblique cut, with two bulbels and oblique piece taken off with one starting.

Z. grandiflora.

Cross cut. Three bulbs. All well rooted with good foliage. No bulbels.
Scooped. Two bulbs, both bulbs with leaves and good roots. One bulb with bulbel.
Halved. Two bulbs, four pieces. One piece with large bulbel; one piece with three small bulbels and leaves; one piece with five bulbels; one piece with two bulbels, one of these bulbels with leaves.
Quartered. Two bulbs, eight pieces. Good roots on all. Two have one bulbel each, three have two bulbels each, one has four bulbels and two have five bulbels.
Eighths. Two bulbs, sixteen pieces, two of which were lost. The remaining fourteen pieces are all well rooted, four with one bulbel each, three with two bulbels each, and seven with three bulbels each. One or more bulbels on thirteen showed leaf growth.
Oblique cuts. Five bulbs, all with good roots and well developed leaves. One large part with one bulbel, one small piece cut off obliquely is well rooted with three bulbels; the other oblique pieces were lost.

Typical results with **Z. grandiflora** Lindley, illustrated in upper half of Plate 73:—

Upper row: Five eighths, #1 one bulbel; #2 two bulbels; #3 two developed and two or three more in process of developing; #4 has one bulbel; #5 has three. Green leaf tips showing on all.
Second row: #1 and #2, quarters; #1 with four bulbels; #2 with three. #3 and #4, halves: #3 with five bulbels, #4 with one.

Z. rosea.

Cross cut. Five bulbs, all well rooted, good leaf growth. One has one small bulbel, two have three small bulbels each, two have no signs of bulbels.
Scooped. Five bulbs, all well rooted, with leaves. None has produced bulbels.

Halved. Five bulbs, ten pieces. Eight well rooted with leaves, two well rooted but no leaves. Four pieces have growth from a part of the original growth point; three have produced two bulbels; one has five small bulbels; two have one small bulbel starting in each.
Quartered. Four bulbs, sixteen pieces, two pieces lost. The remaining fourteen have well rooted bulbels, five with leaves. Two have started growth from original growth point. Eight have one bulbel each, three have two bulbels each, one has three very small bulbels.
Eighths. One bulb, eight pieces, three pieces lost. The remaining five well rooted. Two have one bulbel each, two have two bulbels each, one has three bulbels.

Typical results with **Z. rosea Lindley,** illustrated in lower half of Plate 73:—

Upper row: #1, #2, and #3, halves, with one bulbel each. #4, #5, and #6, quarters, #4 with one, #5 with two. #6 with one.
Second row: #1 cross cut with two bulbels; #2, #3, #4, #5, and #6, eighths, #2 with one bulbel, #3 with two bulbels, #4 with two bulbels, #5 with one bulbel, #6 with one bulbel.

From the foregoing it will be seen that bulbs *cross cut* and *scooped,* in the manner indicated, produced very few bulbels and the methods have no particular value. It may be noted, however, if bulbs are in hand that are not doing well that these two methods will serve an excellent purpose in rejuvenating them. In practically all instances, bulbs so treated produced abundant root systems far in excess of what the bulbs had when they were lifted for use in the experiment. If *cross cut* or *scooped,* placed in sand for sixty days, then carefully lifted and replanted, there is assurance that the bulbs, in most instances, can be greatly improved in their growing condition. This may be of value in handling other amaryllids. *Oblique* cutting produced no practical results and the method is without value. Bulbs *halved, quartered* and cut into *eighths* perpendicularly serve all purposes of rapid multiplication. The exact size of the pieces will be governed in part by the diameters of the propagating material. If of large size they may be made into *eighths;* if of medium size, *quarters* only should be attempted; while if small, *halves* may be used.

LITERATURE CITED

(1) Sprenger, C. Zephyranthes Ajax Spr. Gartenflora Zeitschrift für Garten und Blumenkunde. T. 1469. 649-650. 1899.
(2) Herbert, Wm. Amaryllidaceae. 173, 1837.
(3) Nicholson, George. Dictionary of Gardening. Z. carinata. 239. Oct. 1887.
(4) Luyten, Ida. Vegetative Propagation of Hippeastrums. Yearbook, American Amaryllis Society, 115-122. 1935.
(5) Traub, Hamilton P. Propagation of Amaryllis by stem cuttage. Yearbook, American Amaryllis Society, 123-126. 1935.

THE EFFECT OF GROWTH SUBSTANCES ON HIPPEASTRUM, HEMEROCALLIS AND ALSTROEMERIA

HAMILTON P. TRAUB, *Florida*

During the present year the effect of growth substances or hormones on rooting and sprouting responses in Hippeastrum, Hemerocallis and Alstroemeria were studied in a preliminary way at Mira Flores. The synthetic growth substances used were indole acetic acid in 1 to 10,000 and 1 to 20,000 dilutions, and the commercial article called Hormodin which was used in the strength listed as so-called 40 B. T. I. units. The exact meaning of this terminology is not explained nor is the active ingredient indicated. The cuttings were soaked in these solutions either at the base, or at both ends, for 24 hours and were then rinsed and planted in a rooting or sprouting medium of equal parts of coarse sand and granulated German peat. The controls or untreated lots were soaked for an equal period in water.

Hippeastrum. The tests were carried out in the spring shortly after the flowering period which is considered the wrong time for cuttage experiments. The time was chosen on purpose in order to determine more clearly any favorable effect of the hormone applications. Typical results with Hippeastrum cuttings are shown in Plate 74. The variety, *Frank Wootten,* was used in this experiment, and 8 cuttings were utilized in each series from 1 to 4, inclusive. The number still living and the rooting response after six weeks is shown in the illustration. The controls (series 1) are not rooted and six of these are still alive. For the two concentrations of indole acetic acid (series 2 and 3), four cuttings are rooted in each case, but one more cutting is alive for the weaker concentration, 1 to 20,000 (series 3). The Hormodin treatment (series 4) did not give as good results as the indole acetic acid, but it may be that some other concentration might give better results. Further work with this preparation was discontinued because neither the exact strength nor the active ingredient was known.

Hemerocallis. The tests with Hemerocallis were confined to attempts to arrest the early senescence of the flower scape by means of hormone (indole acetic acid) applications in order to secure sprouts at the nodes when sections were then planted in the customary sprouting medium. Some species and varieties produce sprouts abundantly at the nodes on flower scapes but others almost invariably fail to do so. It was with the latter that these experiments were concerned. The sections of the flower scape with two nodes were cut after the flowering period was over, and the upper end was first treated for 8 hours, and then the lower end or base was treated for 16 hours. Controls were similarly treated with water. The experiments were successful only in a limited way for less than 10 per cent formed plantlets as contrasted with less than 5 per cent for the controls. Typical results with hormone treatment are shown in Fig. B, in Plate 74. The section of the flower scapes which formed sprouts remained green for a longer time than those which failed to do so. The scape then gradually turned yellow and died as the sprout with

a thick root or two was developed. Most likely better results could be secured with young flower scapes cut before the flowers open, and this type of material will be used in future work.

Alstroemeria. Mature vegetative shoots of *Alstroemeria pulchella* were treated at the base with 1 to 10,000 indole acetic acid for 24 hours, and then planted in the rooting medium. None rooted, but in many cases the hormone treated lots lived for a longer period than the controls. In future work only very immature sprouts will be used since these are presumably in a more meristematic condition and may respond to hormone treatment.

PROPAGATION OF ISMENE SULPHUR QUEEN BY STEM CUTTAGE

HAMILTON P. TRAUB, *Florida*

The beautiful hybrid Ismene, *Sulphur Queen (I. amanceas* X *I. calathina),* is quite rare, but is considered one of the best in this group. The flower is borne on a stout upright peduncle and is of an unusual yellow color. At Mira Flores it blooms faithfully each season, but has so far set no seeds and has made no offsets. This is a case where stem cuttage should be useful.

An experiment carried out during 1936 indicates that it can be very easily propagated by the stem cuttage method (2). On April 14 a large plump bulb was cut into 64 stem cuttings which were planted in the usual manner (2), and on July 26, 43 bulblets were harvested. The number and percentage of bulblets in each size class are indicated in Table 1. This represents bulblets formed for 67 per cent of the cuttings, and at this rate of propagation it should be possible to secure ample commercial stocks of this choice variety to meet all requirements in the not distant future.

TABLE 1.

Showing number and percentage of bulblets in each size class.

Description of size	Average diam. cm.	Number	Percentage	Remarks
Large	1.8	23	53.5	One cutting had also one leaf scale sprouted; one cutting made 3 bulblets.
Medium	1.2	15	34.9	
Small	0.4F	5	11.6	All were on cuttings from upper part of bulb.

The kind of growth responses secured following stem cuttage in this case are indicated in the accompanying illustrations, Plate 75. Figs. 1 to 5, inclusive, show the type of rooting responses and top growth and also the size range. Fig. 6A shows a small portion of leaf scale tissue almost detached from the main portion. It will be noted that this small fraction of leaf scale tissue has given rise to a tiny bulblet at the base. In Fig. 6B this small fraction is shown detached and enlarged—it is shown turned upward with bulblet in upper part of figure. This type of

growth response is similar to that reported by Miss Luyten for Hippeastrum (1). Fig. 7 shows a stem cutting with three bulblets.

The bulblets harvested were set out into the nursery row where they will be left until they reach blooming size.

LITERATURE CITED.

1. Luyten, Ida. Vegetative Propagation of Hippeastrums. Year Book Amer. Amaryllis Soc. (Herbertia), 1935. 2: 113-122.
2. Traub, Hamilton P. Growth Responses Following Stem Cuttage of Amaryllids. Herbertia, 1936. 3: 115-117.

NEW DAYLILY PROPAGATION METHODS

WYNDHAM HAYWARD, *Florida*

At last, as the result of researches published in the 1936 issue of HERBERTIA and in the December 15th, 1936 issue of *Horticulture*, the way has been opened for the amateur and professional grower to multiply his stock of choice and rare varieties almost at will.

These new methods are simple, effective and easy to perform, even in the hands of an unskilled operator. The first of these discoveries, published in last year's HERBERTIA, revealed that the Hemerocallis crown was amenable to vegetative propagation by cuttage as in case of the ordinary amaryllis (Hippeastrum) bulb. In this method the crown of the plant is sliced vertically into sections, with portions of the leaves and roots left adhering. These sections are then rooted in a sterile sand or sand-and-peat medium. As many as 32 sections have been made from a large single crown. Best results are obtained with ½ and ¼ sections.

The second method, as outlined in *Horticulture,* will probably take its place as the standard garden method of multiplying the daylily plant by artificial means. It possibly can be performed at any time of the year, but preferably in the spring before the blooming season, for northern climates, or in the spring and fall, in warm climates. These points however are not definitely settled.

The procedure is substantially as follows: the crown tip of a strong, single crown is cut off, preferably at a slant, just below the foliage, and the leafy crown, with the tip of the rhizome adhering, is treated as an ordinary tip cutting and rooted in sand. This tip cutting may be sliced vertically into several sections before rooting with fairly good results.

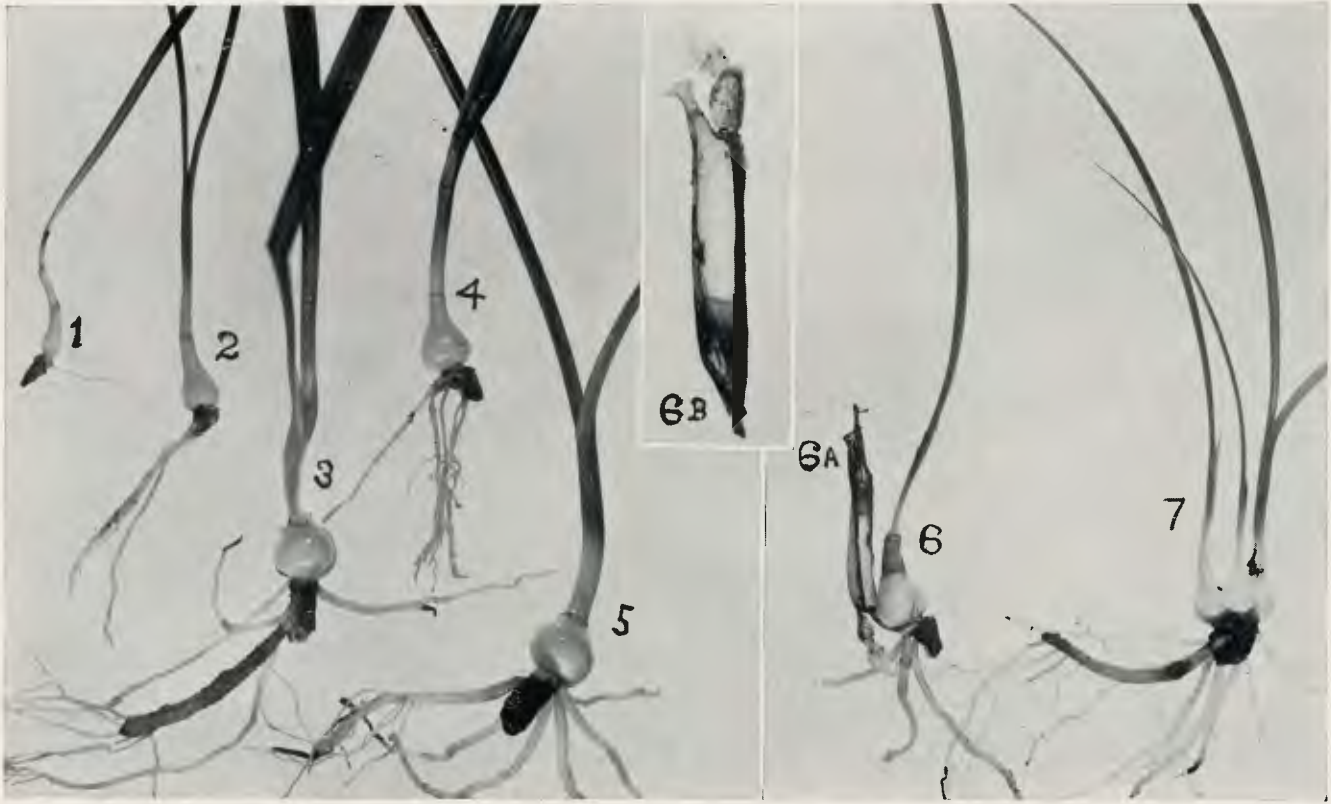
This rooting of the excised crown tip is definitely a contribution of Dr. Traub to scientific horticulture. The writer had already contemplated studies of the reaction of a mutilated rhizome or remainder of the plant in the ground, after the top was cut off, when Dr. Traub announced the results of his experiments, in which the emphasis was placed on the excised tip rather than the portion left in the ground.

As a result of these studies, the writer is able to show that this "excision of tender crown tips" of the daylilies, will bring about a surprising response from the mutilated plant left in the ground by the operation. Experiments conducted at Lakemont Gardens, Winter Park, Florida, by the writer, under the observation of Dr. Traub, have indicated that

See page 199

Effect of Hormones on Amaryllids and Hemerocallis

Plate 74



See page 200

Vegetative Propagation of Ismene Sulphur Queen, approximately natural size, except 6B, enlarged

Plate 75

strong single crown rhizomes of standard and new varieties of Hemerocallis hybrids will produce from three and four to as many as seven and eight new sprouts or crowns for the most part at the ends of small rhizomes coming out of the mutilated parent plant. These new sprouts are entirely apart from the plants obtained by cutting and rooting the crown tip, or top of the plant.

The initial studies were made in the Fall of 1936, the plants being cut in late September and October after the main flowering season. The following varieties were used: *Mikado* (Stout); *Soudan* (Stout); *Vesta* (Stout); *Bijou* (Stout); *Chengtu; Hemerocallis fulva var. rosea; Queen of May; Margaret Perry* (Perry); *J. A. Crawford,* (Betscher); *Mrs. W. H. Wyman* (Betscher). At least 20 plants in all were included in the trials. None of these failed to sprout. The crown tips rooted in a few weeks in every case, and when replanted in good garden soil, quickly became established and maintained themselves and the great majority flowered in the spring of 1937.

The average sprout production of the mutilated plants was between four and six after three months. Some of them produced as many as five to eight new plants, and a few gave only three or four. Semi-deciduous varieties were the slowest in response. It is evident that different species and varieties will give varying responses under this second method, due to the complex differences in genetical composition of the plants involved. Sufficient has been accomplished so that the method can be recommended for private or commercial growers with scarcely any reservation for the more rapid extension of their plantings of new and rare Hemerocallis varieties and species.

It is suggested that the newly sprouted plants be allowed to remain in position until they are well rooted and able to stand transplanting before the clumps are dug up and separated.

The plants obtained by rooting the excised leafy crowns, will bloom the following season, under good culture, as the writer has observed in the spring of 1937. Plants of *Soudan, Mikado* and others produced from rooted crown tip cuttings taken in October, 1936, were in full bloom with excellent flowers during April, 1937. In these cases the crown tip was not cut into sections, but rooted entire.

For a general review of the Hemerocallis vegetative propagation problem, with reference also to other phases such as the rooting of "proliferations," "dissection of the crown," etc., interested readers are referred to the article entitled "Vegetative Propagation of Daylilies" by Dr. A. B. Stout, of the New York Botanical Garden, in the January, 1937 issue of the *Journal* of the New York Botanical Garden, pages 13-17. There are also earlier discussions of the matter in Dr. Stout's book, *Daylilies,* New York, 1934, and in the United States Department of Agriculture Circular on Daylilies by Mr. B. Y. Morrison, issued several years ago.

METHODS OF PROPAGATING DAYLILIES (HEMEROCALLIS) VEGETATIVELY

HAMILTON P. TRAUB, *Florida*

In 1935 Mr. Wyndham Hayward, the Secretary of the Society, informed the writer that a more rapid method of vegetative propagation for daylilies was very urgently needed especially for the increase of new varieties. Although the increase by the generally recognized method is adequate when fair stocks are available, it is too slow in the case of new varieties, which in many instances remain rare collector's items for a considerable time after a variety is introduced.

The literature on the vegetative propagation of daylilies is apparently not very extensive. The ancient reliable method of dividing the compound rhizome has been described by Morrison (2), Bailey and Bailey (1) and Stout (3), and presumably by other writers on the subject in previous times. Stout (3) in 1934 also described the method of rooting aerial plantlets which develop on the flower scapes of some species and varieties.

A preliminary study by Traub (5) in 1936 showed that the hemerocallis crown is analogous to the bulb of the amaryllids. Most of the amaryllids do not have rhizomes, but some of them do—*Crinum americanum, Hippeastrum rutilum,* etc.—and in such cases the similarity is very striking. With this as a starting point efficient methods of vegetative propagation were rapidly worked out based mainly on the stem cuttage technique used with amaryllids.

It was shown that crowns cut vertically into halves, and quarters could be readily rooted and sprouted in appropriate media. Cuttage into a greater number of fractions than four was shown to decrease the sprouting percentages considerably. In the illustration, Plate 76, are shown typical growth responses following vertical cuttage of *Mikado* crowns into ¼ and ⅛ fractions, Figs. 1 and 2, inclusive, 30 days after planting.

The second report was published in Horticulture (Boston), December 15, 1936, Vol. 14, No. 24, and this is quoted here,—

> The method of hemerocallis propagation by means of excised tender crown tips is very simple and can be used by anyone, for all the equipment that is required is a flat of coarse sand and a shaded location.
>
> In practice, the tender crown tip of hemerocallis is cut off so that a small portion of the stem, consisting of the tip, is taken along together with the adhering leaves. Structurally, such a tender crown tip is equivalent to a tip cutting. The leaves are trimmed to about three inches and the cuttings are inserted into the sand to about one to one and one-half inches. The sand should be kept moist, but not too wet.
>
> When making the cut it is desirable but not necessary to slant it in order to have a little more of the stem on one side of the root base. This seems to hasten sprouting from the mutilated plant, which is left in place in the ground. The tender tip cuttings may also be cut vertically into halves and quarters if desired, but the percentage of sprouting will be cut slightly.
>
> In the initial experiments at Mira Flores, root growth began within a week and the leaves began to elongate within ten days. In three weeks roots were one and one-half inches long and plants had begun to grow. All of the ten tips used in the experiment rooted and formed plants. The rooted tip should be left in

See pages 205 and 207

Vegetative Propagation of Hemerocallis

Plate 76

the sand until the roots are three or more inches long before transplanting. Experience has shown that when tender crown tips are broken off in transplanting hemerocallis or are cut off as described above, one or more new side shoots appear on the mutilated crown. However, the tips should not be broken or cut off too frequently, otherwise the vigor of the plant may be unduly reduced.

Typical results secured by the method of tip cuttage, and tip division are illustrated in Plate 76. Figs. 4 to 6, inclusive, show rooting and sprouting responses after 15 days when whole (Figs. 4a and 4b), half (Fig. 5) and fourth (Fig. 6) tip cuttings are planted in appropriate media.

In connection with these new methods it should be emphasized that strong plants can be maintained if reasonable judgment is used in the frequency of dividing the plants, and if the plants propagated by this method are given a chance to grow strong before division is again attempted. It is of course wrong to merely sprout or root such cuttings and put them on the market. Actual experiments have shown that strong flowering plants can be developed in six months from the time of cutting if plants are put in a favorable environment for growth. Such plants are shown in Plate 76. Fig. 7, a flowering plant developed from a half vertical cutting, and Figs. 8 and 9, show plants grown from ¼ and ⅛ cuttings, made in November 1936. Plants were photographed in April 1937. Similar results have been secured with tip cuttings.

The growth responses following the cutting of the tips of daylily crowns is illustrated in Plate 77. The upper figure shows that 7 sprouts have formed on the decapitated crown of the variety *Bijou* after 6 months. Similarly the lower figure shows 5 rhizomes with crowns formed after six months when a single crown of *Margaret Perry* was decapitated. In Florida under favorable soil conditions, sprouts from crowns decapitated in the fall, and also the rooted tips planted at the same time, flower in the spring.

During the present year, 1937, Stout (4) published a short paper in which he described the method of dividing elongated rhizomes, and discussed the general subject of daylily propagation methods.

For the convenience of the daylily enthusiasts, the available information on daylily propagation methods has been summarized in Table 1.

TABLE 1.

Summary of Methods of Vegetative Propagation for Hemerocallis.

Portion of plant used	Method number.	Essential facts about method	Authority	Remarks
Division of Compound or single rhizome	1	Separation of compound rhizomes into sub- or simple rhizomes	Morrison, 1916	Ancient reliable method
	2	Division of elongated single rhizomes into parts	Stout, 1937	Very successful
	3	Separation of entire crowns with roots from single rhizomes	Morrison, 1916	Ancient reliable method
	4	Separation of sprouts on crowns after induced etiolation	Traub, 1937	Quite successful
Division of crown; also sprouting, decapitated crown bases	5	Vertical cuttage of entire crown into 2, 4, 8 or more fractions	Traub, 1936	½ and ¼ fractions very successful
	6	(a) crown tip, including portion of stem, cut off and rooted	Traub, 1936	Very successful
		(b) crown tip as in (a) may be cut vertically into 2 or 4 fractions and rooted	Traub, 1936	Fairly successful
	7	Crown base left from (a) and (b) above, makes one or more sprouts	Traub, 1936	Very successful
Sprouts from flower scapes	8	Utilization of aerial plantlets developed on flower scapes	Stout, 1934	Very successful
	9	Inducing sprouts on flower scapes not ordinarily producing such by planting portions with nodes treated or not treated with growth substances (hormones)	Traub, 1937	Only partly successful

All of the methods listed above have been previously described excepting Nos. 4 and 9. Etiolated sprouts are induced to grow on rhizomes by digging and packing in moist spaghnum and storing in the shade (Method No. 4). These sprouts are then cut from the crown and rooted in moist sand (See Plate 76, Fig. 3.) Method No. 9 is described in another brief paper appearing in this issue of HERBERTIA.

LITERATURE CITED

1. Bailey, L. H. and Ethel Zoe Bailey. Hortus, Macmillan Co. N. Y. 1930, page 188.
2. Morrison, B. Y. The Yellow Day Lilies. U. S. Dept. Agric. Circ. 42. 1928.
3. Stout, A. B. Daylilies. Macmillan Co., N. Y. 1934.
4. Stout, A. B. Vegetative Propagation of Daylilies. Jour. N. Y. Bot. Gard. 38:13-17. 1937.
5. Traub, Hamilton P. Propagation of Hemerocallis (Daylilies) by Crown Cuttage. Herbertia 3:123. 1936.
6. Traub, Hamilton P. Propagation of the Hemerocallis. Horticulture 14:478. 1936.

See page 207

Vegetative Propagation of Hemerocallis—Growth responses following tip pruning

Plate 77

Wyndham Hayward

See page 218

Alstroemeria pulchella

Plate 78

6. AMARYLLID CULTURE

REGIONAL ADAPTATION, SOILS, FERTILIZATION, IRRIGATION, USE IN LANDSCAPE, DISEASE AND INSECT CONTROL, ETC.

ALSTROEMERIAS IN THE NORTHWEST

HARRY L. STINSON, *Washington*
Northwest Regional Chairman, Trial Collections Committee

The alstroemerias are commonly known as the Peruvian Lilies. The first species were introduced into Europe about 1754 from Peru. The generic name, *Alstroemeria,* was given to them by Linnaeus in honor of a former pupil and friend, Baron Klas von Alstroemer.

Upon first introduction, botanists were inclined to place *Alstroemerias* in the Lily Family because of the leafy stem, lack of spathe valves, and tuberous-root system. Yet it did not entirely fit because of the epigynous character of the ovary. The final result was that systematic botanists broke into the family circle of the Amaryllidaceae and distorted it sufficiently to make it include the Alstroemerids. Even here it did not find a congenial home, for it was different from its neighbors with its leafy stem instead of a scape. Also it had tuberous roots instead of true bulbs. Again the inflorescense was not enclosed in spathe valves. Its leaves were not basal but distributed upon upright stems. So all in all, it did not fit, but since it had to be placed in a Family and as long as systematists did not offer any serious objection, it was left undisturbed.

Here it remained until Dr. J. Hutchinson, of the Royal Botanic Garden, Kew, England, after much study decided that it, together with three other genera, had sufficiently definite and distinctive characteristics to justify raising it to Family status. This he has done in his new book, "The Families of Flowering Plants." In the treatise he has taken four closely related genera, *Alstroemeria, Bomarea, Leontochir,* and *Schickendantzia,* and has placed them under the *Alstroemeriaceae.*

Whether this classification will be definitely final, only the passing of time and further scientific study and experimentation will determine. So far, it seems to be a happy solution to a vexing problem.

The root system of *Alstroemeria* is one of its peculiaristics. It has an under-ground fibro-tuberous rootstock, with terminal buds at the ends from which the stems arise. At or near these terminal buds are three to five long, round, whitish and very brittle tuberous roots, very much like those of the peony or dahlia, but more slender. In some species they are aggregated immediately at the terminal bud, while in others they are more or less scattered along the rootstock. The lengths of the tuberous-roots will vary from four to six inches and from one-quarter to one-half inch in diameter, depending upon the species and the general growth of the plants. At the outer or free ends of the tuberous-roots are the true and feeding roots.

These fascicled tuberous roots are not true tubers. Tubers are modified stems and have eyes (buds) like a potato from which new plants

sprout and grow. At various times broken segments of the enlarged roots have been placed in a propagating bed under various conditions to determine whether they would eventually develop adventitious buds and grow, but at no time have they ever shown any tendency to put forth new growth. They just pass away after lying dormant several months.

Deposits of starch, or farinaceous matter, constitute the thickening substance of the enlarged roots, and is stored up for the future use by the plant. From reports, some species are used for food by natives in South America.

As previously mentioned, the aerial stems rise from these terminal buds. From each bud there will develop two kinds of stems. The first kind to appear will be the sterile or vegetative one with leaves only. They come through the ground very early in the spring and grow to a height of one to three feet. Those that come up first do not attain the height of those that come later in the spring. When the weather has become settled, the floral stems will put in their appearance and will soon surpass and exceed the height of the sterile stems. They are stiff, slender, and wirey and may need staking if they are in an exposed position. Their height will range from one to four feet depending upon the species, the length of time the plants have been established, and the soil conditions. The stems do not have any roots attached to them directly, nor have they developed any when they have been detached with a heel and put in a propagating bed to see if they would "strike" root.

The leaves exhibit a very singular anomaly. They are borne upon a twisted petiole, so that what would ordinarily be the under side becomes the top surface of the leaf, with a resultant reversal of the internal anatomy of cells and stomata. The leaves are neither fleshy, coriaceous, lorate, nor linear like the majority of the amaryllids, but are rather thin and soft. In shape the leaves will vary from oblong-spatulate, obovate, or oblanceolate to almost linear with tips from acute to blunt in the several species. Some species show a tendency to be ciliate on some of the leaves with very short stiff cilia; however it does not seem to be constant thruout any species.

The leaves are petioled. Some species have very short petioles that vary from one-eighth inch to two to three inches in length. The leaf blade on the long ones gradually tapers down to the stems, in some cases almost parallel, giving the petiole a compressed or winged effect. The leaves are alternate and in some species are scattered along the stems, more on the sterile ones than on the floral stems. In others they are aggregated at the terminal end, with scarious bracts along the stem.

The inflorescense is in single or compound rayed umbels terminating the floral stems. The umbel will bear from three to nine rays with one to five flowers on each. Instead of the inflorescense being enclosed in spathe valves, it is subtended by a whorl of leaves, varying somewhat in the several species.

The individual flower is carried upon a pedicel two to three inches long. The flower is about two inches long and a little less in width, funnel shaped and flaring like a small lily. The flowers are epigynous, with the perianth cut almost to the ovary and the petals are arranged in two

circles of dissimilar segments. The outer circle of three segments is broad and inclined to be cuspidate, while the inner three are narrower. The upper two usually bear distinctive pencilings or dashes of contrasting color to the main color. The lower segment of the inner three is the narrowest of them all and is partially concealed by the six declined and recurved stamens.

The flowers are carried in an upright position, which sets them off to a much better advantage than if they were inclined to be pendulous. Each flower is open for a week to ten days, depending upon the weather and water supply available. The flowering period is extended over a long time, starting the latter part of June and in many instances continuing until September. In the compound rayed species the inside flower blooms first, and then the next adjacent flowers open in turn. The result is a continuous show of color.

Today much more consideration is being given to floral arrangement and color combinations than in previous times. This being the case, the decorator or florist may select from a wide range of colors the alstroemeria that fits any color scheme, for they come in colors ranging from pure white *(A. pelegrina alba)* thru mauve, pink, creamy yellow to pure yellow, orange, red tipped with green, lilac, and shades or combinations of these colors. All of the colors are soft and will harmonize with practically all other flowers.

When the flowers fade and drop away, the seed capsules develop with their geometric design and continue to give the plant a pleasing appearance. Externally they have a glistening sheen that continues until they are ripe. The capsules are three carpelled with the seed arranged around a central placenta. When the seeds are ripe and the capsule has lost sufficient moisture, it snaps open violently and throws the seeds several feet in all directions. So if the seeds are wanted, they must be gathered before they are dry enough to dehise.

The seed are spherical in shape, about the size of "bird shot," and thickly beset with minute nobby projections. In color they will vary from yellow to brown.

To all indications the alstroemerias prefer a well drained, loamy soil. Although they need abundant water during their growing season, they must not stand in it with wet feet nor dry out and bake hard in the summer. The soil must be worked to a depth of twelve to fourteen inches to accommodate the tuberous-roots which adjust themselves to a varying depth of eight to ten inches. Into this soil bed must be incorporated organic material, either leafmold or well decayed and disintegrated barnyard fertilizer.

At our latitude here at Seattle they seem to do equally well in full sun or partial shade, although those in more open and exposed positions seem to be inferior to those grown in the *sheltered locations.*

As yet no experiments have been made to determine what is the best effective acidity of the soil (pH) for alstroemerias, but to all appearances they are perfectly contented in a soil that tests about pH 6.5.

In English books on floriculture, reference is made quite frequently to growing alstroemerias in pots; however, no detailed instructions are

given as to the best methods of growing. At present no thorough trials have been conducted to determine the best cultural procedure with them in pots under our Northwest conditions. Some observations of a stray plant of *A. aurantiaca var. lutea* would seem to indicate that it could be forced in the greenhouse to bloom in January or February. If so, this would prove very fortunate to the florist as it would provide a yellow flower to the trade when such a color is scarce. Further experiments will be conducted along these lines this coming year, and the results reported later.

The question of hardiness is relative and is closely correlated with the latitude and climatic factors of the specific region under question. The Puget Sound area is somewhat peculiar in that it has, after the first fall frosts, a cool growing season in which many winter rooting plants put forth early vegetative growth, only to be destroyed when really cold weather comes in January. This would not be the case in a region where the cold was uniform and continuous after the first freeze.

Authorities differ as to what species are hardy and what degrees of frost they will stand under various conditions. Seattle can usually count on at least one cold snap in January or February, during which the thermometer will frequently fall and hover around six to sixteen degrees (Fahrenheit) above zero for several days. This happens usually when there is no snow on the ground to afford protection against the cold. Under these conditions both *A. chilensis,* hybrids and *A. aurantiaca* and its variety *lutea* have proven hardy when given a thin mulch of peat or straw to protect against heaving. Bailey also states that *A. brazilensis* is hardy. It has not been tried because no plants are available in this country. *A. haemantha* survived our usual winter in a seed flat in a sunken cold frame with only a lath frame covering. Otherwise the stock at hand has been too limited to risk losing any in experimenting, but as soon as sufficient stock is available, trials will be made to test their winter hardiness.

Two methods of propagation are available—seedage and division. At present seeds of alstroemeria are not in general trade in America nor in Europe, but when the seeds can be obtained, seedage is a fairly certain but slow way to increase stock to blooming size. Seeds of all species seem to germinate quite readily, some more quickly than others, but all eventually come up, perhaps not until the second year. *A. pulchella (psittacina)* germinated in about four weeks in a pot set in a warm location in the green-house, while *A. revoluta* has taken about six months when sown in a seed flat outside and later moved into a cool house at the approach of cold weather. Some seeds of *A. chilensis* sown in December a year ago are just now coming through the soil (Feb. 10)—a period of fourteen months. In all probability it was old seed as it was from an English source sold locally. If fresh seeds are sown, they sprout in forty to sixty days in a temperature of forty-five to seventy in a greenhouse. Last year seeds sown on November 25 under the same conditions produced plants which bloomed in May and June; after blooming, they were allowed to become dormant and were then set out in the open, where they were to remain permanently.

A trial is being conducted to determine whether they germinate better at high or low temperature. Lots of twenty-five seeds each of *A. aurantiaca and A. chilensis* were placed in pots in warm, cool, and cold situations, and these are being watched to see which will germinate first. Some seeds of *A. chilensis* shelled out on the ground last fall and have lain there all the fall and winter through twelve degrees freezing weather and then were sown in a pot in a sixty degree temperature. They are being watched to see if they will withstand such treatment and still germinate.

If seedage is employed, it is recommended that seeds be sown thinly about one inch deep and that the seedlings be permitted to remain in the seed bed for the first season without transplanting. There is seemingly one short period just before they start to form their tubercles when they can be transplanted without disastrous results. Thus it is safer to let them make their first year's growth before removing to the permanent beds.

Under our climatic conditions it seems best to plant the seeds in a greenhouse about December or January, or about September or even March, in a non-freezing cold frame. In a southern climate seeds should be planted as soon as ripe. The seedlings should bloom the next spring in May or June. As soon as the tops turn yellow, the plants may be taken up, separated, and set out in permanent beds, or they may be stored in a dormant condition, if desired, in dry sand or peat in a dry and cool place. I have some roots now (Feb. 12) that have been dormant since last June.

When planting it is best to set them out in rows or beds, five or six inches deep and eight or ten inches apart. August and September apparently are the optimum months for planting. They make late fall growth and show a tendency to come up during December. If they do so before spring weather has become settled, they should have a light mulch to protect them against frost and heaving.

In time the rows will become a crowded bed of roots. Then they should be dug as soon as the tops turn yellow. The soil should be shaken out and the clumps divided so that each plantlet has a terminal bud with each clumplet of tuberous roots. Care should be exercised not to mutilate them more than is necessary, for these fleshy roots contain the food for the succeeding year's growth. Experience here has shown that roots planted in August or September will bloom the following June and July, while in Southern California and Florida the blooming period will probably be in April and May. Their natural tendency is to spread somewhat and make a nice, colorful clump; however, if the master of the garden is geometrically inclined, he may preserve the outline by pulling up the wandering errants and confining them to the straight and narrow. In the main they are very well behaved and like Abou Ben Aben "may their tribe increase."

For decorative purposes they are excellent both as a cut flower for interior use or as a subject for the perennial border. When cut and placed in the house, they last from eight to ten days; the successive buds that come on make them last much longer than if they were single flowers.

Their colors—mellow, and in the pastel shades—lend themselves to various floral arrangements in almost every room. As a subject for the semi-hardy border they are unexcelled and may be used either as background for lower growing plants or as a foreground for the taller growing perennials like delphiniums. They will harmonize with almost all other colors, and with their long blooming season of six to eight weeks, they can be depended upon to give a good account of themselves.

There seems to be an erroneous impression among my Eastern friends that the alstroemerias are "galloping wild" over our countryside. Such a conception is not true, for in fact when it was suggested that some study and observation of their cultural requirements be made for the Society, it was with some difficulty that a source of supply of even the common ones was found near by. Since then, several small clumps have been located. They are not vulgarly common. An acquaintance had a plant of *A. aurantiaca,* and when she made inquiry of several of our local florists to indentify it for her, they were unable to do so. It must be said in all good faith that our florists are capable men, so it is apparent that the alstroemeria hereabouts is practically unknown. A few years ago, a float in a floral parade was observed to be decorated with *A. aurantiaca* var. *lutea.* Upon inquiry it was found that they had been sent to the florist who used them and that he did not know their name nor where they had been grown. At one time some were grown upon Vashon Island here in Puget Sound, but the grower abandoned them. The few strays he had left were purchased from him a year ago.

A nursery in Portland, Oregon lists the two varieties of *A. aurantiaca.* How large a stock he has is unknown. A wholesale florist of San Francisco listed "Peruvian Lilies" in a trade journal. In answer to my enquiry he was unable to give even the species name. From his general description of them they must be *A. aurantiaca.* They are grown at Colma, a city just south of the Golden Gate, in a region that is cooled during summer by the fogs that drift in from the Pacific Ocean. Aside from these plantings no large commercial growers have been located, with the exception of Mr. Orpet.

A search of available literature reveals that authorities differ as to the number of species known, but the number is between forty and fifty. Baker in his "Handbook on the Amaryllideae of 1888, gives forty-four, while Bailey in the *Cyclopedia of Horticulture* sets down the number as fifty, but describes only ten. From this it is apparent that many more are to be found and introduced into the horticultural world. Even in countries where other species are known to exist, they are practically unobtainable through ordinary trade channels. Efforts to secure seeds of plants indigenous to the Argentine and Chile have been fruitless. However, a correspondent in Paraguay has offered to supply four species previously unreported. These importations will be keenly watched.

Unfortunately many of the illustrations in the literature have, since publication, been found to be misnamed, and this fact has caused much of the present confusion. The *botanical key* used by Bailey, which is based upon purely vegetative characteristics, is inadequate to differen-

tiate the several species. Hopes are entertaind that when more species can be studied, a more definite key can be evolved.

The most complete collections listed in nursery catalogues are those of Van Tubergen, Haarlem, Holland; D. J. W. Chandler, Tecoma, Victoria, Australia; and Philip Montague, Frankston, Australia.

The following composite list, with synonyms, is taken from both English and American authorities:

1. *A. pulchella, (A. psitiacina)* dark red, tipped with green dashed with brown. Brazil.
2. *A. Chilensis,* Chilean Lily, pastel colors, pencilled lightly with maroon. Chile.
3. *A. pelegrina,* lilac pencilled with red purple. Chile
   A. pelegrina, var. alba, white.
4. *A. haemantha, (A. Simsii, A. barclayana)* red tipped green with red purple spots on a red-yellow. Chile.
5. *A. aurantiaca, (A. aurea),* orange-yellow pencilled brown. Chile.
   A. aurantiaca, var. lutea, bright yellow pencilled brown. Chile.
6. *A. brasilensis,* reddish yellow, spotted brown. Brazil.
7. *A. versicolor, (A. peruviana, A. sulphurea, A. tigrina)* yellow spotted purple. Chile.
   A. versicolor, var. niveo-marginata, (A. Hookeri, A. pallida, A. rosea).
8. *A. Ligtu,* whitish, lilac to pale red. Chile.
   A. Ligtu, var. pulchra, (A. Flos-Martini, A bicolor).
   A. Ligtu, var. caryophyllea, red and red striped. Brazil.
9. *A. violacea,* bright violet, spotted. Chile.
10. *A. revoluta,* yellowish and spotted. Chile.

For additional species indigenous to the Argentine, Chile, and other Andean regions, see reports on the amaryllids of those countries and regions in previous volumes of Herbertia.

These remarks on a little known Genus of the Alstroemeraceae are submitted to the members of the Society with the realization that they are only preliminary. I trust that the coming years will add to our knowledge of them.

ALSTROEMERIA PELEGRINA

Those interested in alstroemerias should consult the September 1937 issue of The Pacific Sunset Monthly. It features *Alstroemeria pelegrina* and *A. pelegrina alba* in color on the cover and includes an article about alstroemerias in which the work of W. M. James and E. O. Orpet is mentioned. The address of the Sunset publishers, Lane Publishing Co., is 376 Sacramento St., San Francisco, Calif.

—H. P. T.

ALSTROEMERIA PULCHELLA

WYNDHAM HAYWARD, *Florida*

This interesting species of *Alstroemeria,* which is known by both the names *A. pulchella* and *A. psittacina,* seems to be the only one which has made a home for itself in Florida gardens.

It is the species mentioned in the 1935 Year Book by the writer as having been found growing in the late Theodore L. Mead's garden at Oviedo, Fla., where Mr. Mead stated it had been established for more than 10 years, but could not recall the name.

Plants of this species have been received also from Mrs. John H. Churchwell of Jacksonville, where they likewise are thrifty garden specimens. It is reported in Jacksonville that the species was first introduced into that section from old gardens in lower Louisiana.

It is an easy species of Alstroemeria to grow, and produces tall vigorous bloom stems under best conditions, in early summer. The plants go practically dormant in mid-summer and are best transplanted at that time. The roots are a series of little tubers attached to a central crown, from which the sprouts come. These may be dried a day or two in the shade, and wrapped in tissue paper and shipped several thousand miles without loss of vitality.

Under good garden conditions, the plants multiply prodigiously. The foliage is typically alstroemeria-like and very attractive. The plants grow all winter in Florida. The flowers are dark red with brownish spots with a lighter green edging in the throat. The illustration, Plate 78, shows a typical flower stalk produced by Dr. Traub at Mira Flores, under good culture. The species is listed as a native of Brazil. Its hardiness is undetermined. It will set seeds readily in Florida. Unless kept in check the plant may almost become a weed in rich soil.

The best garden conditions suitable to its growth are a medium rich sandy loam, with steady moisture content, but excellent drainage conditions. It likes at least half shade for best results.

ALSTROEMERIAS IN RHODE ISLAND

MRS. MARY H. CAMPBELL,
President, Rhode Island Federation of Garden Clubs

Plants of *Alstroemeria aurantiaca* and *A. lutea* were imported some three years ago by my mother the late Mrs. R. G. Hazard of Peace Dale, R. I., from England. These were planted in a rich, friable soil, at the base of a twelve foot brick wall, with a southern exposure.

Peace Dale is a small town in Southern Rhode Island, in that part of the state known as the "South County," and having possibly a slightly milder climate than other parts of New England, being so close to the Atlantic Ocean and Narragansett Bay.

These imported plants grew thriftily, and have increased tremendously in their original location, so that now there are masses of the interesting yellow and orange flowers to be seen in that border during late July and August. It was with the purpose of helping to make this very worth while garden subject better known that some of the alstroe-

Mary Early Joyce, Kenya

See page 220

Hybrid Amaryllis (Hippeastrum) naturalized in the garden of Mrs Mary Early Joyce, Kenya, British East Africa

Plate 79

Frank Vasku *See page 235*

Hippeastrum rutilum var. crocatum

Plate 80

meria blooms were used by me in an oriental arrangement piece at the Newport, R. I., Flower Show during the summer of 1936. The flowers attracted wide attention in the press and with thousands of flower show visitors.

The culture of this tuberous rooted perennial has proved to be rather simple in Rhode Island, and the plants succeed remarkably well with good care. Winter protection is given to the alstroemeria beds in the form of a heavy mulch of oak leaves six or eight inches deep. The plants came through the severe winter of 1933-34 without serious injury, although the thermometer dropped to 30 degrees below zero, Farenheit.

Other alstroemeria plantings have been made on Mrs. Hazard's estate in open borders facing South, with the protection of an arbor vitae hedge on the north. A deep, rich soil has been provided and the ground is covered with a thick layer of oak leaves in winter. The result has been to produce very thrifty plants which are increasing in size from year to year. There are also plants of *A. aurantiaca* and *A. lutea* in cold frames and in the greenhouse, where they succeed equally well. Here also are specimens of *A. psittacina,* and *A. ligtu*—the latter from seed obtained in California during the winter of 1935, and which have not bloomed as yet.

Alstroemeria is a most welcome addition to our gardens—very decorative as to color and graceful in outline. The individual flowers come out from day to day in water which makes them last a long time when cut. Once established in the garden, the plants make a thick mass of lily-like stems which are very effective in the blooming season.

(Continued from page 161)

grasses, *Polygalas, Sabbatias,* etc. The bulb lies deep in the ground with a mat of thick, heavy roots below. The very long neck and upper part of the bulb have a dark, fibrous coating and the neck is very crooked. The leaves, usually three are twisted above; channeled, but flattened at the bases, and rounded on the back. The scape is flattened but not sharp-edged and is also slightly twisted. The tube of the flower is almost as long as the scape and it as well as the perianth are pale greenish-yellow, though the very large stamineal cup is snowy white. The scape is crowned by a single flower, which usually stands slightly above the surrounding vegetation and after anthesis the delicate cup fades and disappears, leaving the spreading perianth, three lobes of which always seem to tip down, the other three spreading upwards, giving a startlingly spidery effect. Dr. Small states that this species is only slightly fragrant, which it undoubtedly is in the daytime. At night however, it is intensely and overpoweringly fragrant. The buds burst suddenly into bloom, about sundown with barely perceptible odor and it is not until eight or nine o'clock that the odor is particularly noticeable and is diminished again next morning. It is probable that all the species are pollinated by night-flying insects.

I hope to ultimately secure a collection of all the Florida *Hymenocallis* species as well as many of the South American ones, and I plan to follow this up with further notes in future issues of Herbertia.

AMARYLLIDS AT KIRSTENBOSCH

L. B. Creasey,
National Botanic Gardens, Kirstenbosch, Union of South Africa

By far the largest portion of South Africa has a summer rainfall, but the extreme south-western corner of the Western Cape Province experiences a winter precipitation. As a general rule, the majority of summer rainfall plants make their leaf-growth during summer, while those from winter rainfall areas produce their foliage in winter and spring. There is some over-lapping and the exact period for growth depends upon the species, the locality and the date when the first rains fall.

These facts must be considered by all who grow South African plants and should be compared with the annual quantity of rain, altitude, rooting medium, situation, aspect and, in the case of bulbs, the depth at which they grow.

The National Botanic Gardens of South Africa lie on the eastern slopes of Table Mountain, but are reasonably well protected from the strong south-east winds. The cultivated portion extends from 500 to about 800 feet, thence rising rapidly to the great cliffs of the mountain itself. The average annual rainfall is 57 inches, practically all of which falls between May and the spring month of October. We may have occasional showers at the beginning and end of summer, but the hot months of November, December, January and February are dry. In winter, low temperatures are recorded, but no frost.

At Kirstenbosch we grow amaryllids under outdoor conditions, choosing good positions in preference to mixing special composts. The provision of water during summer has produced remarkably vigorous growth in certain *woody* plants from summer rainfall areas. Whilst bulbous subjects are not so visibly demonstrative, those accustomed to moist natural situations have benefited from such treatment.

We have no difficulty with *Amaryllis belladonna,* which is one of our local natives and essentially a winter rainfall plant. Apart from wild specimens on the mountain-side, there are patches and drifts planted amongst the cycad collection, where they have a light ground-cover of shrubs, ferns, asparagus and tussocky grass. This is a steep slope, so that only about one-third of the annual rainfall reaches the bulbs. The soil is a good deep loam, allowing us to sink the bulbs 9 to 12 inches deep, which they appreciate. We plant after the foliage has died in November and they usually miss flowering in the first season, but do extremely well thereafter. Seeds are freely produced and these must be sown as soon as ripe.

Ammocharis falcata and *A. coccinea* flourish in full sun, annually providing their umbels of pink or deep rose, fragrant flowers in January and February. At Kirstenbosch the leaves, which lie flat on the soil-surface, are borne at the same time as the flowers and continue for long afterwards. Ammocharis are principally summer rainfall plants, but enjoy our conditions and do not require a rich soil.

Anoiganthus brevifolius grows and multiplies in a perpetually moist position near a stream and partially shaded by tree ferns. Although from summer rainfall localities, it is naturally a wet-ground plant, and the nodding heads of yellow flowers are an annual delight in summer.

Burnsvigias are well-known overseas, particularly the very handsome *B. Josephinae*—a summer rainfall plant. In contrast we have *B. gigantea,* a winter rainfall species which makes its foliage at that season, and then has a long rest before producing its flowers in the following March. This has natural climatic conditions at Kirstenbosch and is happy in sandy soil, thrusting up its stout flower-stalk and from this, throwing out on long pedicels, the large head of blood-red, curiously curved flowers. Summer rainfall Brunsvigias also do well at Kirstenbosch, and the genus seems to be more amenable than most to conditions which are foreign to the natural habitat. We have *B. sphaerocarpa,* with enormous umbels of bright pink flowers on 14-inch pedicles, and broad, wavy-edged, semi-prostrate leaves that die off as the flowers open and are often immediately replaced with the first rains. We give all Brunsvigias full sun.

Clivias are troublesome. In a shady part of the garden they neither grew nor flowered, but are making good growth in tins under a shade-house. With perseverance and adequate summer watering, I believe we will yet grow them well, despite our wet and comparatively cold winters. I think the secret is to get *young* plants established and then leave them alone. Clivias are evergreen and must have shade, but they pass through a dormant season in their natural summer rainfall localities of the Transvaal, Natal and the Eastern Province. In Natal the rains commence lightly in October, become more heavy towards Christmas and gradually cease about May. Clivias, growing on rock-ledges where water runs in summer, are absolutely dried out in winter, but retain their leaves. They flower from spring or early summer till Christmas or soon after.

We have many species of *Crinum* at Kirstenbosch, and all take kindly to our climate, even though most are from the strictly summer rainfall regions of Natal and the Eastern Province. In moist and partially shaded positions *C. longifolium* makes enormous leaves, but flowers equally well in drier and sunnier places, although as a matter of course we supply Crinums with water in summer. *C. Macowani* and *C. Bainesii* do well in similar positions, but I fancy *C. Moorei* prefers shade. Crinums seed freely, but the seeds will not keep and must be sown immediately. This year *C. Forbesianum* showed how decorative it can be in the seed stage, when the pods are ripe and like brilliant red inverted onions. Since the stem normally collapses when the seeds are ripe (Nature's provision for bringing the latter in contact with the soil), the pods usually rot at Kirstenbosch before they attain full colour. Our Crinums are deciduous, although some have a very short resting season. *C. Moorei* may retain its leaves past the end of summer, but producing a new crop with the first rains and simultaneously discarding the old foliage. We do not plant Crinums deeply, especially species which form a definite trunk. We leave the papery crowns exposed.

We have had variable results with *Cyrtanthus* species, but are still experimenting with them. On a rather dry rockbank in shade, *C. angustifolius* flowers annually, but I think it would benefit by having a moister position. It has a wide natural range and occurs in both summer and winter rainfall areas. The remarkable *C. obliquus,* which comes from the Eastern Province, is definitely a summer rainfall plant. With an open position and deep soil, in various parts of the garden *C. obliquus* happily produces its stout, flat, twisted leaves, and the scapes of pendent, green and orange flowers. *C. parviflorus* flowers very well in a lightly shaded and constantly moist position alongside a stream. It is fully deciduous, but the bulb does not rot in winter.

Haemanthus Katherinae is well-known overseas and its culture is understood. It comes from Natal and the Transvaal, requires a complete rest when dormant, and at Kirstenbosch we have to start it in large tins, sinking these outside when the bulbs are in flower. *H. Katherinae* does not like strong sunlight. In open situations or amongst undergrowth we have *H. coccineus* wild in this district. It produces compact "brushes" of bright red on stems of 6 or 8 inches in March, the two flat leaves appearing later with the rains. It is satisfied with almost any type of soil, but is especially prevalent in the more sandy places, whether they be moist or dry. It has a fairly long dormant season. Among other species of *Haemanthus* we may dwell upon *H. Nortieri,* which comes from an area of late winter and strictly limited rainfall. It bears only one erect, flat leaf in its season of growth, the flowers being a compact reddish tuft on a red stalk. Seeds are freely produced here. It is satisfactory with shallow planting and a sunny aspect, and is naturally accustomed to a poor, stony soil, bone-dry over most of the year.

The genus *Hessea* is rather difficult in our locality of heavy and prolonged winter rainfall, but we give these also shallow planting in a light, stony soil in full sun. Like *Haemanthus Nortieri,* the Hesseas come from the semi-arid areas of the Western Cape where the winter rain does not fall till July or August, and even then is of short duration and small quantity. In cultivation, both *Haemanthus Nortieri* and *Hessea* species want sharp drainage. We have *Hessea karooica, H. unguiculata* and *H. Zeyheri.* The latter is a delightful species, the umbels of deep rose, starry flowers opening here in May, the leaves being half-developed at that time.

Nerines are well represented at Kirstenbosch. There are summer and winter flowering Nerines, and *N. undulata* extends to both areas. Some, such as *N. Masonorum,* germinate freely in outside seed-beds in sun and grow equally well in shade. *N. appendiculata,* from Natal, flourishes in a moist position by a stream and in full sunlight. Our own local *N. sarniensis* grows amongst the *Amaryllis* on the previously mentioned bank of deep soil with a light ground-cover. It is wholly deciduous, making leaf-growth in winter. All broad-leaved Nerines seem to be quite herbaceous, while many narrow-leaved species are more or less evergreen. Nerines grow under a wide range of natural conditions, and I am opposed to the wholesale drying-off of *all* species generally practiced under pot-culture. The species should be treated individually,

and any which show a tendency to retain their foliage should not be *completely* dried-off. Even when dealing with a species which requires a rest, some thought for the bulb is required. The old practice of growing the bulbs in the smallest possible pots which were dried-off close to a green-house roof under a hot sun, should be checked against a more moderate treatment.

We have *Vallota purpurea* in a moist position near a pond. This comes from the George district, where winter and summer rainfall areas meet, and where rain may fall any month in the year. Consequently, in cultivation *Vallota purpurea* must not be completely dried-off in winter. Neither should it be disturbed any more than is absolutely necessary, and when it *is* lifted or potted this should be done immediately after flowering. It likes a fairly rich peaty loam.

Since Dr. Hutchinson's classification now places *Agapanthus* and *Tulbaghia* in the Amaryllidaceae, I must refer briefly to them. Agapanthus needs no introduction, being well-known as a tub-plant. At Kirstenbosch the various species give a long season of flower from November till the end of March. This wide-spread genus is of easy culture. Blue flowers always appear to best advantage in shade (or by evening light), but Agapanthus thoroughly enjoys full sun. They like abundant water in summer, even though they will, when established, tolerate dry conditions under trees. In the latter position, seedlings appear round the old plants in spring at Kirstenbosch, but eventually die through drought. This explains why Agapanthus are often found naturally in moist situations. Certain species are generally regarded as deciduous. Experience at Kirstenbosch seems to indicate that this character is dependent upon the season and is not necessarily an annual habit of any species, except *A. campanulatus,* from Natal. All species, including those from summer rainfall areas, show no objection to our winter rains, and under cultivation overseas a reduction of the water supply in winter is all that is necessary; but *A. campanulatus,* being deciduous, would probably appreciate a more decided rest.

Of the many species of *Tulbaghia,* the most attractive we have are *T. violacea* and *T. pulchella,* plus the white form of the latter. *T. violacea* has been grown successfully outside in a warm position in England. At Kirstenbosch its flowers are nearly always with us, if the bulbs are kept in vigorous growth by summer watering. *T. pulchella* has larger flowers of a deeper mixture of lavender and lilac, and has broader leaves. This only flowers once in spring or early summer and the habit is not so good owing to the growth being exceptionally soft. The variety *alba* is a pure white edition. Tulbaghias ask for no special treatment, apart from watering while in growth.

In this short article it has been impossible to avoid generalities. I have referred only to genera of decorative horticultural merit, but it is hoped that this brief survey of amaryllids at Kirstenbosch will provide suggestions applicable to some of the reader's problems under American conditions.

HYBRID AMARYLLIS NATURALIZED IN KENYA, EAST AFRICA

Mrs. Frank Joyce,
Kenya, British East Africa

Mrs. Joyce writes under date of Febr. 2, 1937, "Here we were very short of rain the last 8 months of 1936; only 9.14 inches, but the hybrid Hippeastrums have never flowered so well—They began the end of August and the last two flowers scapes are only fading now" (See Plate 79).

HAEMANTHUS KATHERINAE

Mrs. W. E. MacArthur, *Florida*

In November, 1935 I obtained permission to import bulbs of the African Blood Lily for my amaryllid collection. This species might be more correctly styled the Tongaat Lily, as it was given to the world from the Tongaat District of South Africa.

Because of a prolonged growing season in South Africa, the bulbs were held until June, 1936 reaching me July 17, 1936 in splendid condition after a long journey from Natal.

The bulbs were immediately potted in a mixture of leaf mold, rotted dairy fertilizer and good garden soil and placed in semi-shade. They remained dormant until the latter part of September, 1936 when signs of life appeared. The growth was normal, the leaves were borne on a short stalk. The leaves are broad, pointed and deeply veined and each plant has from four to nine.

These plants remained out-doors all winter, sheltered from strong winds and protected by a canvas cover when temperature dropped to freezing. They showed no signs of wilting at any exposure proving themselves to be quite hardy. I believe they can be planted in suitable positions in the average Florida garden. They are free so far from insects and diseases.

As yet they show no signs of a bloom stalk, and probably they resent moving. However, a little white nose of a shoot is developing on the side of largest bulb which may be the beginning of a bloom scape, or it may be the formation of a new bulb as new leaves are coming out through center of new shoot.

In a Durban, South Africa newspaper Miss Mary Ritchie gives an interesting description of this species,—"Deep in the seclusion of the forest in the dim recesses of the glade grow the lovely *Haemanthus Katherinae* far out of sight where the fallen leaves of untold years have enriched the soil. Where no rough winds come, no scorching suns, she holds her court in the green aisles of the forests, guarded on one side by the deepest of bogs and on the other by the sea and high over head the birdlike flowers of the *Strelitzia* spread out to guard her bower."

HOSTA IN FLORIDA

FRANK VASKU, *Florida*

In the spring of 1935 I received from Indiana, among other plants two crowns with roots. There was no name attached and inquiry brought no information. Knowing nothing about them, I potted them in black mucky soil and placed them in shade. They soon started growth, one sent up narrow, pointed, lanceolate leaves of medium green, the other broad, somewhat cordate ones of a light yellowish-green color. They were kept well watered and occasionally fertilized either with liquid manure or nitrate dissolved in water. The small leaved one bloomed that summer and proved to be *Hosta,* probably *H. coerulea.* Its flower stalk gradually lengthened letting a few small bells of lavender open each day for weeks, but it refused to set seed. The other filled the pot with beautiful leaves, but did not bloom that summer.

During the following winter the foliage died down and it appeared that the plants were lost, but growth was vigorously resumed in the spring. No thought was given to reporting on them so no accurate data can be given, but about July *H. coerulea* sent up several flower spikes and soon its fairy bells delighted our eyes. A little later the other plant too began slowly to push up a flower spike. To our impatient eagerness it seemed weeks before the first snowwhite, fragrant, daylily-like bell opened. Then as day after day that flower stalk lengthened opening a few large bells each day I no longer wondered that it was so slow in pushing that spike up for it had a tremendous load to push. But, whatever *Hosta plantaginea,* which it proved to be, may be in other parts of the country, with us "Night Lily" would be far more appropriate name than "Day Lily" as it is sometimes listed in catalogs. It always opens its new bells about mid-afternoon and by mid-morning they were on the wane again. It set a little seed.

On account of being in the same pot for two years, the plants were very much pot-bound but each had a number of crowns so that it appeared each could be divided. Accordingly this spring I took them out of their containers and proceeded to divide them. *H. coerulea* was so matted that I took a knife and cut right through the mass making four pieces of it. *H. plantaginea* was not matted so badly and I could separate the roots without cutting. The divisions were set right out in the open ground in a shaded place. At the present time, April 15th, they are all growing and appear perfectly healthy. It seems, therefore, that *Hosta* can be successfully grown in Florida.

HYBRID AMARYLLIS IN MARYLAND

GEORGE E. WATERS, *Maryland*

To my way of thinking, the hybrid amaryllis is the easiest of all flowering bulbs to handle and the one which is most certain to give the best results with the least care and labor.

What I think I have found out after playing with them for about twenty-five years is that they need about seven months of growing time and about five months to rest. What I mean by growing time is that they should be kept growing and not standing around, neither growing or resting, and what I mean by resting is that they should be dried off completely without a drop of water while they are dormant.

The bulbs in my collection, which numbers about one hundred and thirty, are at this time (January 15th) dormant and are in pots under green house benches where they were placed last October. They will at any time now begin to show the flower stalks coming up. This will continue along for about a month before they all get started. As soon as the spathes appear I put them on top of the benches and keep them well watered and they make rapid growth and within a few weeks are in full bloom. This arrangement gives a long blooming season, from about March 1st to May.

About May 1st when all danger of frost is over and they are through blooming, I plunge them, pots and all outside in cold frames and pack soil or cinders around them up to the top of the pots. The cold frames are in full sun with good circulation of air all around them. When it doesn't rain they are thoroughly watered all through the summer. They need but little or no feeding but do need water all the time they are growing.

They remain in those cold frames until there is danger of frost—about October 1st here. They are then taken inside and dried off by withholding all water. It takes about three weeks to do this properly. They are then again put under green house benches to await the time for the next blooming. This completes the circle.

HYBRID NERINE—MINERVA

WYNDHAM HAYWARD, *Florida*

The hybrid nerine, *Minerva,* which is shown in the illustration, Plate 82, is one of the fine types of this charming group of plants which have been developed largely in England. The old English bulb firm of Barr & Sons has specialized in their culture for years. The color is a pleasing and unusual rich scarlet with minute overcast of glistening gold on the petals. The umbel when fully expanded is very showy. The culture of this variety is the same as that recommended for *Nerine Fothergilli major* and other well known varieties. It seems more vigorous and thrifty than many of the nerines and their hybrids, and may become an important horticultural specialty when increased stocks are available.

CYRTANTHUS AS A HOUSE PLANT

JOHN F. RUCKMAN, *Pennsylvania*

How such a choice and easily handled bulb as *Cyrtanthus* can have been neglected so long is a mystery. The only trouble seems to be to get the bulbs in the first place. The bulbs are small and should be potted up singly in three inch pots in the soil mixture used for hybrid amaryllis with the upper quarter of the bulb above ground. They start into growth early in November and bloom during January and February. After blooming a strong growth should be encouraged until the foliage ripens, usually about the middle of June. From then until November they should be kept dry or nearly so, as with other deciduous amaryllids in their dormant state. They form offsets rather freely and these should be kept growing with the old bulb until the pot becomes badly crowded as is the practice with *Vallota.* Occasional waterings with liquid manure both before and after blooming are beneficial and a little of the old surface soil may be removed from the pots and replaced with fresh just before growth begins.

So far I have grown three kinds. One, probably *C. parviflorus,* has not bloomed for me as yet but I have had it only a few months. *C. McKenii* bears an umbel of six narrowly tubular blossoms one and seven eighths inches long on 11½ inch stems. The flowers are a soft ivory white and have a faint perfume resembling that of *Amaryllis belladonna.* Unlike most Cyrtanthus the blossoms do not droop but are held in a horizontal position.

Another Cyrtanthus whose name I do not know is, with the exception of *Zephyranthes carinata* and *Sprekelia,* quite the showiest small amaryllid I have seen. Its blossoms are much the shape and nearly the size of Freesias, borne in a characteristic drooping umbel of five or six on a 9½ inch stem. The color is an indescribably beautiful shade of glowing coral red, possibly the "sunrise color" ascribed to *C. sanguineus;* however its shape is not at all like *C. sanguineus* as illustrated on page 134 of the 1936 Year Book having much more the appearance, on a smaller scale, of *Clivia cyrtanthiflora.* The blossoms last a full two weeks in good condition and the foliage being short and rather stiff it is a good looking plant at all times. Easier to handle and much more permanent than most of the commonly grown winter forcing bulbs Cyrtanthus should become very popular once an adequate supply is available.

CYRTANTHUS

W. M. JAMES, *California*

This is a fairly large group (36 species), and the varied shape and colors of the flowers make it an interesting one.

C. lutescens has bright yellow, slightly funnel shaped (almost tubular) flowers which are 2 inches long with a short wide flare on the tip (See Fig. 30). They are borne in an umbel of 3-6 on a slender stem about 12 inches long. There are 4-6 bright green narrow leaves 10-12 inches long, persisting nearly all the year in Santa Barbara, especially

if they get a little water. The main flowering period is in early winter, but there are a few scattering flowers nearly all summer. A sandy loam is probably the best soil. It likes plenty of water and sun during the winter. Good drainage is absolutely essential. Although it will not stand many degrees of frost, it likes to be cool and probably should be kept at 40 to 50 degrees under glass. Present indications are that it will be desirable as a winter pot plant and fine out of doors in the milder climate. It is also useful for cutting.

C. Mackenii is very similar to C. lutescens, except that the flowers are a creamy white. The flower stems are a trifle thicker and straighter. The main flowering period is in late winter and early spring. Culture and use are as indicated for *C. lutescens.*

W. M. James

Fig. 30 Cyrtanthus lutescens

C. parvifolius has a small, bright red flower. Except for the color, it is doubtful if it deserves much attention. It may possibly be useful for hybridizing, I have also had *C. O'Brienii* and could see very little difference between it and *C. parvifolius* except that the flower is little different shade of red. Both bloom in early spring and require the same culture as *C. lutescens.*

C. obliquus is more showy than those already mentioned, although the flowers appear before the foliage is fully grown. It is not doing as well as it should. It seems to require a definite, dry, rest period and may have to be lifted and stored during the fall and winter. The flowers are more or less tubular, red with a yellowish base, 2-3 inches long and are borne in an umbel of 10-12 on a stem 1-2 feet long. The leaves are 1-2 inches broad, 1½ to 2 feet long and have a twist of one to two turns in

Wyndham Hayward

See page 236

Nothoscordum bivalve

Plate 81

Wyndham Hayward *See page 228*

Hybrid Nerine—Minerva

Plate 82

their length. Flowers appear in spring. This plant is apparently very desirable, but I haven't yet determined the best method of culture.

There are other species and some named hybrids. I have seedlings of *C. angustifolius* and *C. sanguineus.* Their descriptions sound interesting, and I am anticipating the first flowers with pleasure. Most of the seeds imported have been badly mixed and even yet I am not absolutely sure that I have all my plants correctly named. Apparently some of the species cross-pollinate very readily, making it difficult to name some of the seedlings from imported seed when we are not familiar with all of the species. My experience with Cyrtanthus has been interesting, and I think it will be a desirable addition to our list of useful plants.

NERINE CULTURE

W. M. James, *California*

When we consider that some of the better *Nerine* species were introduced to cultivation as long ago as 300 years, it is astounding that they are not more widely known at the present time. *N. sarniensis* has been so widely cultivated in the Channel Islands for some 200 years that it has acquired the name Guernsey Lily. They are grown rather extensively in England at the present time and the English have developed many fine hybrids. Outside of a few private collections, they are practically unknown in the United States. Bulbs offered here in fairly large quantities as *Nerine sarniensis* have mostly proven to be *Lycoris radiata.*

Very few of the known species are obtainable, even in their natural habitat in South Africa, and I will mention only a few of the hybrids. Descriptions of these will be found in catalogues and garden magazines as soon as the bulbs are available in sufficient quantities to supply the market.

Nerine filifolia is an evergreen with grasslike leaves and was described in the 1936 Year Book. It is hardier than the others and was not injured by the "freeze" we had this last winter. The first crosses to flower with this as a maternal parent indicate that it will pass on its free flowering habit and rapid increase of bulbs.

Nerine Bowdeni has a large pink flower and blooms with the foliage (See Plate 83). It would probably be evergreen in a warm enough climate. The leaves generally die down early in February and start again in June. This year the foliage was frosted in January and started again early in March. It is one of the hardiest and can be grown out of doors in the South and West of England. It propagates more rapidly than any of the others I have grown except *N. filifolia.* Two recent English hybrids with *N. Bowdeni* as one parent—*Aurora* and *Hera*—have the foliage with the flowers and seem to be about as hardy as it is. All three flower in September and October. *Hera* (See Plate 84) and *Aurora* have extra large pink flowers on long stems and are very fine appearing. I understand all the others flower before the foliage, although there are some species in the eastern part of South Africa that I know very little about. They flower from September to the last of November, and with most of them the foliage starts about the time the flower is nicely open. The main growth takes place during the winter months and

the foliage generally dies the last of April or first of May. They are quite tender and can be grown out of doors only in the mildest climates. *N. corusca major,* a variety of *N. sarniensis,* (See Plate 83) and *N. Fothergilli major* are two of the best reds in this group. There are thirty or forty named hybrids listed by English dealers. One striking characteristic of all the nerine flowers is the way they glisten in sunlight. The red shades look as if they had been sprinkled with gold dust and the pink shades with silver dust. The more that I see of them, the more I wonder why it has taken so long to get them into cultivation in this country.

The hybrid nerine *Ingens,* with deep salmon-pink flowers is shown in Plate 84.

The cultivation in general is very simple. They like the full sun, a medium loam with plenty of humus, and good drainage. In planting, the bulb should be covered to the neck only. They are rather exacting as to temperature requirements and must not be planted where it is too cold; neither will they stand too much heat.

They do very nicely under glass providing they get enough light and the temperature is 50 to 60 degrees F. They can be grown in the same pots for several years. The English recommend crowding pot plants a little. My experience with them in the field indicates that they will do as well or better if not crowded too much. Each year it is best to remove an inch or so of dirt from the pots and the offsets from the bulbs just before growth starts and add fresh top soil. Water should be given sparingly as soon as growth starts, plentifully while the leaves last, and gradually withdrawn when they start to die. After the foliage dies the pots should be kept dry until growth starts again. The English recommend that the roots be disturbed as little as possible and that the pots be kept on their sides and placed next to the glass while the plant is dormant. I think placing them next to the glass would "bake" them a little too much in most sections of the United States.

My experience in growing them in the field conflicts a little with the methods the English recommend. Because it is difficult to dry the soil out properly during the rest period, I always dig them as soon as they go dormant and store them under the same conditions as other bulbous plants. Naturally the digging more or less injures and breaks the roots and storage in dry air dries them out somewhat, but it does not seem to effect the way the bulbs grow and flower. When digging them, I have noticed that new roots have grown and that the old ones which were on the bulb when it was planted are all dead. If the old roots are not necessary it would be easier to handle the bulbs if the roots could be cut off when they are dug. As the bulbs become more widely distinguished, the experience of growers in different localities will help to determine the best method to use in growing and handling them.

WILLIAM HERBERT ON PLANT MARKERS[1]

Zinc is the only fit ingredient for labels whether to be used in the open ground or in pots. A sheet of zinc is easily cut by the gardener

[1] "Amaryllidaceae," 1837, page 411.

with strong scissors into labels of whatever size he may want. If the zinc is greasy, the labels should be steeped for a minute or two in diluted nitric acid. The following recipe for making ink for writing on the zinc was communicated to me by a gentleman who was in the habit of using it, and I have found it indelible. Take Verdigris in powder 3i. Sal Ammoniac ditto 3i. Lampblack 3fs. Water 3x. Mix carefully in a mortar. Keep the ink in a bottle well corked. It must be well shaken before the pen is dipped in it.

HIPPEASTRUM RUTILUM VAR. CROCATUM

FRANK VASKU, *Florida*

Our two bulbs of *H. rutilum* var. *crocatum* (See Plate 80) bloomed in time to be placed in the National Show held in Orlando in April 1936. Up to that time they were grown in a damp shady place, largely muck, along with other amaryllis. At the show they received a first class certificate as a species. As it seemed that this species is quite rare, we purchased more bulbs. We have found since that they are fairly common, in Orange County at least, but that they are often confused with the common *H. equestre* var. *major* and referred to by owners as "the common amaryllis."

This past year I gave the bulbs better care hoping to get some offsets and to carry them through the blooming period in better shape than I did last year. Ten of the bulbs flowered. From this limited experience I believe I am safe in making these deductions.

1. All of them are deciduous, or almost so. If they do have a leaf or two when they begin blooming, these die down before the plant gets through bloom.

2. There is quite a variation in size and coloring of flowers. Out of the ten bulbs blooming this spring, one was a beautiful delicate peach color, somewhat smaller than the rest, another was larger, coarser, with more red than our original ones and lacking in grace. Of course it is possible that these variations are due to cross pollination.

3. They all have one fault in common—They bloom themselves to death. They seem to put all their vitality and strength into the flower so that they have no strength left for making offsets. I have not tried propagation by cuttage as yet. They set seeds very readily but it is too early to say how true they come from seed.

NOTHOSCORDUM BIVALVE

WYNDHAM HAYWARD, *Florida*

The interesting little bulb known as *Northoscordum bivalve,* formerly spaced under *Allium* by some botanists, and closely related to the "onions," is widely distributed in nature in the South and midwest of the United States. It grows in rather moist, heavy soils, and adapts itself well to pot culture, blooming in the spring in Florida.

As might be expected from its wide range in habitat, there are found numerous varietal differences in the species, some with wider foliage and

larger flowers. The specimen shown in the illustration, Plate 81, was collected along the roadside near Lake City, Florida, where it was growing in a heavy clay soil in conjunction with bulbs of *Zephyranthes Treatiae*. The individual flowers are dainty and starlike, and have a delicate and pleasing fragrance.

THE USE OF LYCORIS AUREA IN THE LANDSCAPE

JOHN R. HEIST, *Florida*

Within its range, which has not been determined, *Lycoris aurea* has proved to be a most worth while and easily managed plant for naturalizing in the landscape.

Bloom and foliage is produced in late August or early September. The foliage grows until early June in full sun and a month longer in cool shady places. There is a period of about three weeks at this time that the ripening foliage is rather unsightly. For this reason it has proven more desirable for use when naturalized with other plants as shown in the illustration, Plate 85.

If left undisturbed it will make fine clumps showing a dozen or more bloom stalks. The golden yellow nerine-like flowers against the green of a border of shrubs or foliage plants is a sight to arrest the attention of every passerby.

LYCORIS SQUAMIGERA AND AUREA

E. O. ORPET, *California*

Since the days in New England, we have always been interested in the one amaryllid hardy there, then known as *Amaryllis Hallii*. This was introduced to Rhode Island by Hall with many other interesting plants from Japan, and for years this bulb, now recognised as *Lycoris squamigera*, was very scarce and highly valued in gardens. The original introduction seems to be the best form. There is a distinct bluish shade in the open flower and the name, "Blue Amaryllis", has sometimes been used.

We here have become possessed of another form with narrower foliage and much narrower petals to the flowers. Until recently, this was considered the same as the original introduction. We have been enabled to make comparisons and even now are not sure where our form originated, but probably from Japan as lycoris are commonly exported in quantity. Certain it is that the *Lycoris squamigera*, usually sold and grown in large numbers in the East and the Middle West, is the better one. We have never seen a tendency to seed production here on either one of the two kinds even with hand pollination. Both seem self-sterile which is usually suggestive of hybrid origin in other plants.

The one other species of this Genus—*Lycoris aurea*—is a total failure here. From an importation of 600 bulbs we have not one remaining. This is partly due perhaps to the "Fly," but more so to lack of warmth in our winter growing season. I am told this species does well in Florida. It is a glorious yellow when happy, but we have failed with it here.

In eastern gardens, we found that the bulbs of *L. aurea* were dormant in winter, flowered in autumn and make foliage with the spring weather and remained dormant throughout the summer.

AGAPANTHUS UMBELLATUS

Mrs. W. E. MacArthur, *Florida*

Mrs. W. E. MacArthur

Fig. 31. Agapanthus umbellatus

The Blue Lily of the Nile, which does not come from the region of the Nile but from South Africa, is a splendid decorative plant that should be freely planted in Florida gardens.

My plant, which must be three or four years of age, is in bloom for the first time bearing an umbel of ninety-two hyacinth blue perfect lilies and buds on a scape over three feet in height. (See Fig. 31). It continues to bloom over a long period of time because the flower buds unfold daily from the center of umbel. The straplike foliage is attractive and evergreen. The roots are hard to control and often grow out of the soil. They have bursted the pot in which they are growing.

Agapanthus makes a desirable pot plant for conservatories and for out-door planting as they are hardy in this area and are free from insects. There are both tall and dwarf varieties.

Agapanthus are apparently still rare. The white variety is lovely beyond description and suitable for a bridal bouquet.

THE MINIATURE HIPPEASTRUMS

Wyndham Hayward, *Florida*

The pink and red varieties of Hippeastrum advenum which are illustrated in this issue of Herbertia, Plates 86 and 87, are interesting bulbs for naturalizing in the Southern gardens. In habit they are similar to Lycoris and Nerines.

The red variety has been identified as *Hippeastrum advenum* var. *miniatum,* and the pink variety may be another variation of the same species. They are described in an article on page 133 of the 1935 Herbertia by Dr. C. W. Hall. They were introduced to the United States by Peter Oberwetter, pioneer amaryllid enthusiast of Texas. They are quite common in old gardens around Austin, Texas.

The pink variety makes a larger bulb in some cases than the red. The red variety has been termed the "Ox-Blood Lily" because of its distinctive coloring. The blooms come in the late summer as a surprise

when no leaves are showing, usually after a heavy rain. In a partly shaded place the stems will rise a foot and a half in height. The pink variety seeds readily and the red one sometimes. It would seem to require several years to grow blooming size bulbs from seeds, as they are very slow in growing and dormant all the summer months from May to October.

The culture is easy, as they require only fairly deep planting in a light, medium rich, well-drained loamy soil. Light frosts do not injure the foliage.

HIPPEASTRUM PRATENSE

W. M. JAMES, *California*

Four years ago Mr. Orpet, of Santa Barbara, had an exceptionally pretty flower show up in a corner in his garden. All record of what it was and where it came from had been lost. No one who saw it could identify it, and the flower was too valuable for seed to pick. He gave me the seed and I was fortunate enough to raise a few plants. The original plant died before flowering again. In the meantime a visitor told about seeing a red flower at the Chelsea Show. That was a definite clue, and the description was finally located in Baker's Amaryllideae, which I quote.

> Bulb ovoid, 1¼-1½ in. diameter; neck short; tunics brown. Leaves linear, contemporary with the flowers in spring, 1-1½ ft. long, ¼-½ in. broad. Peduncle moderately stout, 1-2 ft. long. Umbel 2-4 flowered; spathe-valves lanceolate, 2 in. long; pedicels 1-1½ in. long. Flowers bright red, ascending or horizontal; tube very short, appendiculate at the throat with minute linear scales; segments 2½ in. long, oblanceolate, ½ in. broad above the middle, subobtuse. Stamens declinate, more than half as long as the limb; anthers linear-oblong. Style declinate, as long as the limb; stigma capitate.

This bright orange-scarlet flower with a golden throat must be seen to be appreciated. It will be especially effective in masses. So far I know very little about its hardiness. English growers advise that it is hardy there if planted 5 to 6 in. deep in a sunny location. So probably it can be used out of doors in this country only in the milder sections. It is doing nicely here and generally flowers in April. It grows easily from seed and the bulbs increase fairly well. The stems are long enough, and it keeps well as a cut flower. It should prove a very welcome addition to our spring flowering bulbs.

W. M. James *See page 233*

***Nerine Bowdeni*, UPPER; *Nerine corusca major*, LOWER**

Plate 83

W. M. James

Hybrid Nerines, Hera, LEFT; *and Ingens,* RIGHT

See pages 233 and 234

Plate 84

AMARYLLIS CULTURE BY AN AMATEUR

E. N. Blake, *Texas*

First I wish to say that these observations are for the extreme south and they will have to be somewhat modified for colder regions. They are given in order to encourage the wider use of amaryllis in the gardens of the South.

My experience has been that fresh seed are the first requisite. Secure seeds from the current year's bloom and plant within three months after ripening. Prepare the beds by spading and then soak thoroughly, and when dried out so that they can be worked with a rake, pulverize the surface and open furrows about one inch apart and space the seed one inch apart in the furrow and cover lightly. Then give the bed a good wetting and cover with a slat screen to make a three-quarter shade. Keep the beds moist by watering through the screen. The plants should come up in about two weeks. Keep them growing where they are through the winter, but remove the shade when the weather gets cool, but keep the screen handy for a cover in case of a frost. If the leaves should freeze do not be uneasy as new ones will come out again unless the ground freezes too deeply.

In the spring transplant the seedlings to new beds and space them about four inches apart in rows about one foot apart where they can remain until they begin blooming which will be, as a rule, at the end of at least two years. If you wish to force a few into blooming earlier than that put some in pots so that they can be given more warmth.

Do not try to select your best plants until they have bloomed as you can not tell the best by the size of the growth they make, some of the largest flowers will come from the small or medium sized bulbs. When they have bloomed you will be able to decide which ones you want to keep. Take these and plant out in rows about eighteen inches apart and at least one foot apart in the row. They can be left here for two or three years if they do not multiply too much, in which case it will be better to thin them out again. If grown as closely together as indicated above, they will need lots of fertilizer and plenty of water.

The illustrations, Plate 88, show, *upper,* a clump of *Johnsonii* left undisturbed for eight years; forty-five flower scapes are shown, many of them with five or six flowers; *lower,* a group of two year old seedlings coming into bloom for the first time.

FLOWERING LEUCOCORYNE IXIOIDES ODORATA IN TWO YEARS FROM SEEDS

W. M. James, *California*

Experience gained over a period of years from growing several pounds of *Leucocoryne ixioides odorata* seeds indicates that only a very few plants bloom before the seedlings are 3 years old and that they go down below the ground surface 10 to 15 inches deep when planted in ordinary garden soil.

W. M. James

Fig. 32. Two year Leucocoryne seedlings

In the fall of 1935 two beds separately prepared with a rich mixture of different kinds of fertilizer and oak leaf compost were planted with seeds harvested the previous spring. A control bed was planted in unprepared soil at the same time. During the winter of 1936-37 two light applications of Amo-phos (11-48) were given all three beds, one soon after the leaves appeared and one just before the flowers opened. They are shown in the foreground of the illustration (Fig. 32). It shows very clearly the better results obtained in the prepared beds.

The leaves in all three beds were literally as thick as grass in a lawn. The control bed on the right had scarcely any flowers, while they were actually piled up in the center bed.

Very few of the bulbs in the control bed were over ⅜ inch in diameter and were in the ground 10 to 15 inches deep. In the other beds most of the bulbs were over ⅜ inch, with possibly 50 per cent of

them ½ to ⅝ inch, in diameter. Quite a few were up to 1 inch in diameter. Only a few of them were in the ground as deep as 15 inches and probably 50 per cent were less than 6 inches deep. Occasionally there was a large bulb only 2 inches below the ground surface. In 3-year old beds formerly raised, I have never found the bulbs over ⅝ inch in diameter and more than 50 per cent were under ½ inch and nearly all were 10 or more inches below the ground surface.

The bulbs from the prepared beds were as firm and nice looking as any I have ever seen. The largest bulbs in the top 3 inches of soils were separated when dug, and all the seeds from the 2 year old bulbs was separated from that of the older bulbs this year, in the hope that an earlier flowering, shallower growing strain might be developed.

AMARYLLIS NUTRITION PROBLEMS

JOHN R. SPRINGER, *Florida*

The apparently unresponsive nature of amaryllis bulbs (hybrid *Hippeastrums)* to various fertilization treatments under intensive lath-house culture, has been shown by an experiment undertaken during the growing season of 1935-36 near Orlando, Fla.

The bulbs used in the experiment were various mixed hybrids of the Mead strain, sorted into grades by size of the bulbs. They were under the minimum commercial size for a blooming size bulb (2½ inches diameter) and it was the purpose of the test to determine if possible what type of treatment would produce the greatest possible increase in size in the season's growth.

The bulbs were planted in beds in the lath-house between November 15 and December 15, 1935. The planting soil was the usual medium grade of Norfolk Fine Sand, which had been in active cultivation over a period of eight years but had been built up repeatedly during that time by the addition of organic roughage, manures, tankage, peat, leaf mold, etc. The bulbs were given adequate water by overhead irrigation when necessary during the experiment.

The beds are in approximate half shade, and the bulbs were planted in rows 12 inches apart, the individual bulbs four inches apart in the row. There were approximately 2,500 bulbs to each bed, and they were weeded and fertilized by hand entirely.

The fertilizer was applied to the beds in three equal applications, about February 1, May 1, and July 1, 1936. It was worked in by hand. The beds run north and south, and the north half of each bed was fertilized with organic materials only, the mixture being composed of ½ high grade tankage, and ½ ground tobacco stems. The south half of each bed was fertilized with inorganic materials exclusively, composed of nitrate of soda, sulphate of ammonia, super-phosphate, kainit, in the proportion of 4-5-5 (N-P-K).

In all there were four beds, and the bulbs were planted in them as follows: *Bed No. 1*—bulbs from ¾″ to 1¼″ in diameter; this bed received fertilizer throughout at the equivalent rate of 1,000 lbs. to the acre. This applied equally to the inorganic and organic materials.

Bed No. 2—bulbs from 1¼″ to 1¾″ in diameter; received fertilizer materials at the equivalent rate of 2,000 lbs. per acre. *Bed No. 3*—bulbs from 1¾″ to 2¼″ in diameter; received the equivalent of 3,000 lbs. of fertilizer to the acre. *Bed No. 4*—bulbs just short of 2½″ in diameter or commercial minimum size; received the equivalent of 4,000 lbs, of fertilizer to the acre.

All the bulbs were dug and sized about November 1st, 1936. There was practically no difference noted in the growth of bulbs in the same bed whether they had received the organic or inorganic fertilizer materials. The foliage on the half beds which received the organic materials was uniformly greener.

The bulbs on the entire four beds were found to have made a remarkably uniform increase in size, regardless of the quantity of the fertilizer materials applied to them during the experiment, and without reference as noted above, to the type of fertilizer materials used (organic or inorganic). The average increase of the bulbs was about ¾ inch per bulb in diameter for the growing season.

The writer presents these results with the feeling that while they are largely negative, they may be useful to other investigators in the important problem of commercial hybrid amaryllis culture. They will, it is hoped, help to point the way to further experiments of a similar nature along the same lines. It is realized, of course that a single year's results are not to be considered as conclusive in any way, as it is possible that weather, including temperatures, rainfalls, etc., and residually fertilizing elements in the soil may have influenced the results.

AMARYLLIS BELLADONNA

E. O. Orpet, *California*

For many years the Belladonna Lily, *Amaryllis belladonna* has been known and commonly grown, so much so that it is very much in the discard here. It thrives with no care, multiplies too rapidly and seeds freely. This is the supposedly original pink which seemed to be the type. We were much surprised to learn from Miss Stanford on her recent visit here at the time of flowering, that our kind was considered rare with her in South Africa, and that all those growing in her neighborhood were white and rarely pink tinged unless grown in the shade. Here is another puzzle in plant distribution. So much for the "type" as we know it here.

Some time ago a bulb of the white *Amaryllis belladonna* was brought in, distributed in a small way from offsets which was necessarily slow. However, seeds were produced and bulbs raised, which have not yet to our knowledge reached flowering age. Later, the source of these white forms was discovered to be in Australia, and more were introduced. The one we have flowered is called *A. belladonna multiflora alba,* and the plant when in bloom is well described by the name. There are from twenty to thirty flowers on each stem, pure white with a yellow center, and the succession of bloom lasts a long time. Another form, *A. belladonna Hathor,* is said to be the best. There are still others including

A. multiflora Harbord; some of these are white flowered and others are shaded pink. We are mostly interested in the white kinds here in California.

There is evidence of hybridity in all the above kinds. The very many flowered umbels do not obtain in the type as we know it and the question is, what did the Australians use to get these results? It would be interesting to know. Certain it is that they have been doing good work with this genus, and also with the watsonias. The series of watsonias sent here from Australia far surpass any of other origin that we know. The flowers are larger with better colors and the set we have had for years include the best to date. Some of the colors it is true are not desirable to some critics—"too much magenta" is the cry—but there are some who favor these, and we grow them. In a collection of varying shades in the garden there is harmony.

In returning to *Amaryllis bellanonna* it is of interest to note that there is no difficulty in importing them except that we have to change the season of growth. The bulbs arrive dormant and remain so through our summer, and only gradually become adapted to growing in our autumn. It takes about two years to acclimate such imported bulbs. We hope in another year to be able to report on more than this one variety, *A belladonna multiflora alba,* that has flowered in California for many years past.

DAYLILIES IN NEW YORK AND FLORIDA

JOHN V. WATKINS, *Assistant Horticulturist,*
College of Agriculture, University of Florida

A *Hemerocallis* enthusiast who visits the daylily plantings at the New York Botanical Garden is immediately and breath-takingly impressed with the scope of the work being done there with this responsive group of *Liliaceous* plants. Under the able direction of Dr. A. B. Stout, Director of Laboratories, the selective breeding of daylilies has been carried to remarkable lengths.

One of the most interesting groups to a Southern horticulturist, is the large collection of seedlings that contain the blood of *Hemerocallis multiflora.* These plants are characterized by wiry stems, small flowers that are borne in great profusion and lateness of flowering that has particular value in Florida. There is no doubt that a race of daylilies that will bloom for us in late October and in November will be developed to an unprecedented state of perfection by selection and breeding. One of the very attractive Stout hybrids of "multiflora" lineage bears numerous small flowers that resemble clear, butter-yellow freesias. These late autumn bloomers should be welcomed by the landscape designers and nurserymen who work in Florida tourist centers.

A Florida *Hemorocallis* enthusiast notices, upon close inspection of the individual clones, that there are differences in behavior between certain of the "fulvous" sorts growing in New York as compared with the same clone in peninsular Florida.

For instance, the old familiar fulvous daylily, *H. fulva,* known as Clone *Europa,* is the botanical type of the species. In the New York Botanical Garden, plants of this clone from the four corners of the world grow together and behave identically with their neighbors. There is not a trace of difference. Yet in Florida, plants of this clone, *Europa,* have distinctly shorter scapes, are much less robust, have less tendency to stool out into larger clumps. Several years' records show that in Gainesville, *Europa* scapes are a foot to a foot-and-a-half shorter than those growing in New York City and on Long Island. The well known variety *Bay State* is a semi-dwarf plant in Gainesville, sending its scapes to a height of twenty inches. In the New York Botanical Garden, *Bay State* scapes attain a height of 38 inches. There is a little hybrid that we like so well at the University that we call it *Brownie* and have known it for five or six years as a dwarf plant of distinct charm. In Dr. Stout's Collection *Brownie* bears its small dark brown flowers on scapes 34 inches above the ground! As a tall plant in the East its flowers are too small and dark for its stature, as a dwarf in Florida, *Brownie* has decided merit for certain uses.

Margaret Perry grows taller in the East than it does in peninsular Florida, as does *Kwanso,* the double flowered variety. *Cissy Guiseppi* is much smaller, much less at home in Florida than in New York.

The plants in the Gainesville collection that belong botanically to section *Dihemera,* such as *H. Dumortierii, H. Middendorffii* and their hybrids, are, for the most part, of little potential value to Florida gardeners. They are deciduous and their scapes are too short under our conditions to be capable of much show.

Our records show only an inch or two or three difference in stature for most of the 105 named varieties in the University collection as compared with Dr. Stout's records. The clones mentioned here certainly behave differently, react differently in our climate. Why most of the named sorts do not show greater discrepancies and why these particular ones do, presents a very interesting problem. Culture is identical for all plants in the University collection, none of them ever lack water or plant food, so we can be sure that they are not starved into their lesser statures.

During an unprecedented hot spell in New York last July, it was noted that the foliage on "fulvous" daylilies was injured much more seriously than were the leaves of many yellow-flowered clones. We have never noticed sun-scald on any *Hemerocallis* foliage in Florida, no matter how high the temperature.

Hemerocallis aurantiaca, if memory serves aright, seems much happier, grows much more lustily, produces flowers of better substance in Florida. It is an evergreen species that originally came from southern Japan and it seems to be one of our most excellent forms for Florida. Not always strictly hardy north of New York City, it is certainly at home in the lower South and is, without doubt, one of the best for mass planting.

In all fairness, it must be admitted that daylily blossoms are scalded by Florida's summer sun. All varieties definitely prefer after-

John R. Heist

See page 236

Lycoris aurea naturalized in the garden of Mr. John R. Heist, St. Augustine, Florida

Plate 85

Wyndham Hayward *See page 237*

Hippeastrum advenum—Pink

Plate 86

noon shade, the pale yellow sorts require it. In the New York Botanical Garden, the daylilies receive no shade and the flowers will go through most days without injury. The pale yellow varieties, the ones that have almost white perianths of very fine texture seem to have a great attraction for Dr. Stout and he is breeding and selecting with a view to the production of flowers that are extremely pale, but at the same time robust in petalage.

The long Florida growing season enables us to propagate salable stock from a single division much more quickly than can be done in the north. A given variety will grow a great many more divisions in twelve months in Florida than it will in New York and happily, we see no enervating tendency, no deterioration with the majority of clones.

As in Florida, the New York Botanical Garden daylilies, appear to have no serious diseases. In Florida there are no apparent insect pests that will prey upon *Hemerocallis,* but unfortunately, in the northern garden the unopened buds are badly injured by Japanese beetles toward the later part of July, and, as a result, the flowers are malformed.

It is a never ending thrill to see the same daylilies thriving on Long Island, in New York City, in South Carolina, in North Florida and in the Everglades. Truly this remarkable genus of plants exhibits a cosmopolitanism that is surpassed by few garden flowers that we know.

LESSER NARCISSUS FLY CONTROL

W. M. James, *California*

For several years I tried various methods in attempting to control Lesser Narcissus Fly with little or no success. They were especially bad on *Cyrtanthus* ssp. and *Vallota purpurea.* Study of all the literature available indicated that the fly preferred to deposit the eggs just where the leaves come out of the ground, especially if there were a few dead ones lying on the ground at that point. Then the thought occurred to me that the fly might not go down through a dense ground cover to deposit the eggs.

Dwarf Alyssum was tried because the seeds are not expensive, it grows quickly, is easy to control and will not choke the bulbous plants. It was planted so that the flowering plants completely covered the ground. A thorough trial with some ten different kinds of bulbous plants indicates this to be a very satisfactory control. Bulbs formerly alive with maggots when dug have shown no infestation at all for two years.

I do not think it is accidental and will be very interested in hearing if any one else can get similar results.

DAYLILIES—DEPENDABLE PERENNIALS

Mrs. W. E. MacArthur, *Florida*

A well known writer says that "God gave us memories that we might have roses in December" and through this gift of memory I am enabled to enter the gate of my grandmother's garden that has long since passed from the face of the earth and see perfectly my first daylilies—tawny daylilies that always seem to hold a fat bumble bee powdering himself with gold dust and the Lemon Lilies of wonderful color whose golden chalices of indescribable fragrance that lured the lovely iridescent humming bird many times a day for a feast of honied nectar.

These lilies I know now as *Hemerocallis fulva* and *Hemerocallis flava* and since the latter has advanced so much in style and form, I like to keep the Lemon Lily by its old name in my memory.

I have seen *Hemerocallis fulva* parading as wildlings by the roadsides in Ohio; as squatters on old abandoned homesteads in North Carolina, and as sentinels clustered about a cabin door high on a hillside in Kentucky and I felt that the hands that had carried, nourished and loved them had ceased from all toil and had left these rugged, persistent individuals to silently gladden the earth.

These dependable perennials have no rival as attractive garden plants for this area. They are easy to care for and increase into effective designs quickly and with the ever increasing work of plant breeding in developing color, size and form; its value as a landscape subject for the South is practically unlimited.

The recent discovery of the crown cuttage vegetative propagation method will aid very materially in increasing the recent hybrid creations.

This area has a creditable collection of some of the most sought after hybrids and some of our enterprising nurserymen have already produced some outstanding seedlings that are worthy of a name. However, with the ever increasing desire to create new forms and colors there will be a confusion of names such as now puzzles the camellia enthusiast.

There is a very fine hemerocallis in this section that has not been classified as to name,—the blooms are large amaryllis-like flowers of deep orange color, the texture is of heavy substance and glistens with a coating of gold dust; it begins to bloom in early April on a tall scape bearing four to five buds; it rarely develops seed pods but it does produce a fair percentage of proliferations on scapes that are easily rooted in sand if removed before the scape dies down.

This variety is known locally as *Lila White* because it was found in a collection of daylilies purchased by Miss White from the Glen St. Mary Nurseries, in Florida many years ago and its real name is unknown.

Chrome Orange, introduced by the late Theodore L. Mead, is one of the loveliest of medium sized daylilies and is a good bloomer. Mr. Burbank's *Calypso* is a treasure—even though a night bloomer, it carries over well into the next day. *Citrina* is another night bloomer that gives fragrance to moonlit gardens and is quite desirable.

The rare, gorgeous new hybrids produced by the plant breeders of Europe and America are legion and daylily admirers are collecting them for their own as quickly as means and time will permit.

ACIDULATED FERTILIZERS *

W. T. McGeorge, agricultural chemist, Arizona Experiment Station, writing in the California Citrograph (August) on "Acidulated Fertilizers for Alkaline Soils," reports that investigations at the University of California and more recently at the Arizona Experiment Station "emphasize the adverse influence of high pH values (alkalinity) on the normally balanced absorption of ions by crops. When salts under the influence of water separate into their component parts or ions, the ions carry either negative or positive charges of electricity. At high pH values, or in the presence of residually alkaline fertilizers in alkaline soils, the plant has considerable difficulty in absorbing sufficient of the negatively charged ions (nitrate, phosphate, sulphate) while at low pH values, and in the presence of residually acid fertilizers in acid soils, the plant experiences difficulty in absorbing sufficient of the positively charged ions (calcium, potassium, magnesium). A number of physiological disturbances are manifested by crops grown on alkaline soils and among these the several forms of chlorosis are most common. There is considerable evidence that these disturbances are fundamentally caused by small amounts of alkali in the soil. . . It is true that most of the physiological disturbances noted on these slightly alkaline soils respond favorably to dusting or spraying with salts of zinc, iron, manganese or copper, but it is equally true that the solubility of all these elements in the soil solution is reduced to a minimum by high pH values (alkalinity) and their absorption by the roots is thus reduced to a minimum. These facts are offered as evidence that a high soil pH is fundamentally associated with the major disturbances in crops of the southwest. Reasoning along this line, short growing crops should be least disturbed by these soil conditions and long growing crops such as fruit trees most affected, and this is confirmed by field observations. It is our experience that even the small amount of alkalinity arising from calcium carbonate or caliche in soils will often be manifested by a serious plant disturbance. This should not only discourage the use of residually alkaline fertilizers on calcareous or alkaline soils, but is rather convincing evidence that fertilizers for such soils should be fortified with acidulated organic matter and/or small amounts of finely ground sulphur.

GROWING DAYLILIES ON MUCK

R. P. Lord, *Florida*

In 1934, my father, Professor E. L. Lord, noticed the peculiar behavior of a plant of *Flamid* in his garden at Gainesville. This plant had been placed in the lower end of a rock garden in 1932, when the level of the lake was five or six feet below normal. In the summer of 1933 the lake rose so that the water was about two inches deep over the crown. The following summer the original single plant had developed to a solid clump of fifty odd crowns. It exhibited great vigor and a pro-

* Daily Digest, (U. S. Dept. Agric.) Vol. LXII, July 25, 1936.

fusion of bloom. Due to the impression that several of the species of *Hemerocallis* were native to flood plains, the writer has for some time wondered about the adaptibility of daylilies to bog gardens.

In 1935 a number of plants were set out in the Cypress Gardens at Winter Haven on muck where the water table was within a few inches of the surface. Very vigorous plants were the result. This year the author moved his whole collection of daylilies to a similar piece of muck a few miles away. Due to the difficulties of moving 2000 plants 200 miles in spare time, several interesting incidents happened. A group of 100 plants, 2-year seedlings, were dug on April 18 and allowed to dry out completely. On June 12 these plants were planted in muck and only one failed to grow vigorously. Thirty days later three of them were in bloom. Many, after planting, were later shifted while in bloom without the wilting of a single petal.

The author is completely satisfied that daylilies are very well adapted to muck or bog gardens. They make faster growth, larger clumps, have more continuous bloom and are more free from bleaching on unfertilized muck than on ordinary fertilized soils.

NEMATODE ON HEMEROCALLIS

WYNDHAM HAYWARD, *Florida*

The susceptibility of Hemerocallis to infestation by root-knot nematode, or eelworm, *Heterodera marioni*, is shown by the report from the Division of Nematology, Bureau of Plant Industry, United States Department of Agriculture, in a letter to the writer dated September 2, 1937. In this report Dr. G. Steiner, Principal Nematologist, states that the specimen of Hemerocallis hybrid which was sent in by the writer for examination on suspicion of infestation, "is indeed infested with the root knot nematode". The variety was Aureole, and was obtained from a nurseryman some time ago. Most varieties of Hemerocallis have previously seemed immune from infestation by root knot nematode, and this is apparently the first reported instance of Hemerocallis being infested by this pest. However, the literature has not been exhaustively searched and there may be earlier reported instances of nematode on Hemerocallis.

Wyndham Hayward *See page 237*

Hippeastrum advenum*—*Ox-blood Red

Plate 87

E. N. Blake *See page 241*

Hybrid Amaryllis in the garden of Mr. E. N. Blake, Laredo, Texas

Plate 88

7. HARVESTING, STORAGE AND FORCING

A WINTER SHOW SEASON IN HOLLAND

JAN DE GRAAFF

It was my good fortune to be in Holland during part of the past winter and to see some of the weekly shows of forced bulbs that are held under the auspices of the General Bulbgrowers Association and its branches.

Already on November 16th Professor van Slogteren, the eminent Dutch scientist, exhibited two perfect flats of Narcissus Barrii *Brilliancy* in full flower. These bulbs were grown under protection, then dug on July second, and after a short period of drying stored at a temperature of 48 degrees till September 18th. They were then planted in flats and held at the same temperature (48 degrees) until October 22nd. On that date the flats were brought into the greenhouse and kept at a temperature of about 59 degrees and on November 16th the narcissi were in full flower.

While this is not the first time Professor van Slogteren has surprised the Dutch growers, it really can be said now that his system has been so perfected that commercial growers can attempt the same thing with little fear of failure.

The next week no further daffodils were shown but Messrs. van Tubergen brought a very fine exhibit of *Hippeastrum aulicum* and a group of Naegelias in full flower. The Naegelias, now also called Smithianthas, were especially beautiful. Several hybrids were shown including *Rose Queen,* lilac-pink, flushed with salmon inside; *Golden King,* golden yellow with lighter shade inside and *Orange King,* clear orange. It was indeed a great collection.

On November 30th, while a real North Sea storm raged outside with hail and snow, I saw in a friend's small greenhouse several pots of narcissus *Fortune* in perfect condition. It is hard to describe the charm of these small greenhouses that one finds all over the bulb district in Holland. They are of very simple construction, heated with an ordinary coal-stove or a very small central heating plant. They are of immense value to the industry. It is here that new varieties are tested, it is here that new forcing methods can be tried out and it is here that growers, dealers, and exporters gather on these raw wintry days when no outside work can be done, to discuss the bulb business and the world conditions in general.

A week later my own firm had a very nice exhibit of narcissus *Fortune* with from two to three flowers per bulb, all in perfect form and with excellent coloring. The sensation of the day was however narcissus *Scarlet Leader,* one of our hybrids which received an Award of Merit in 1931. *Scarlet Leader* has a pure white perianth and a deep blood-red cup and the flowers here shown, three weeks before Christmas, were as good as any I have seen growing out of doors.

On December 14th we showed again *Fortune* and *Scarlet Leader* as well as some very nice pots of *February Gold,* the well-known cycla-

mineus seedling. Other daffodils at the show were Incomparabilis *Marion*, and *Helios;* Poetaz *Extase* and *Early Perfection.*

The big Christmas show of forced bulbs opened on December 22nd, in Sassenheim, the center of narcissus culture in Holland. It was a really magnificent show, a great tribute to Dr. van Slogteren whose research has made it possible to enjoy the beauty of spring flowers in mid-winter.

Besides many good tulips and very fine hyacinths there were so many daffodils of all types that it was hard to believe that Christmas had not yet come. Again *Fortune* was outstanding but I noted also a very fine flat of *Texas,* the fine double Backhouse seedling. Other good daffodils were *Lady Moore, Mrs. Barclay, Orange Glow, Indian Chief* and *Village Beauty.* Poeticus *Edwina* was the only one of that class and very fine. *Francisca Drake* claimed the attention of everyone. This variety is already well-known in the United States. The fiery orange cup on a pure white perianth was so outstanding that I predict a very good future for this variety. Yellow Trumpet *Alasnam* was extra good, also Poetaz *St. Agnes.*

I will not mention all other varieties shown in Sassenheim, nor those shown at the weekly shows in Haarlem on January 7th. and following weeks. The past winter has demonstrated very clearly that many daffodils of all types can be forced into flower from the middle of December to the middle of January and that with methods within the reach of any florist or even private estates. That this will bring with it a completely new evaluation of the varieties commercially available is evident.

No longer will mere earliness be an important factor in the valuation of a daffodil, since specially treated late daffodils can be made to flower in mid-winter. I believe that more and more we will judge the commercial value of a daffodil by its form and substance and coloring, trusting to the precooling methods to make it into a first class forcing variety as well. And it is here that the thousands of small experiments, carried on by practically all bulbgrowers in Holland will be of such immense value.

That the successful experiments with precooled daffodils opens up avenues of research for other bulbous crops is evident. Already at Christmas my firm had pots with crocus and muscari *Heavenly Blue* in full flower. Already enormous quantities of bulbous iris are forced commercially to flower at Christmas or shortly after. I believe the time is not far distant when the same thing will be done with many other bulbs such as amaryllis hybrids and that in the near future we will be able to time all these crops for special occasions.

FORCING HYBRID AMARYLLIS WITHOUT DRAINAGE

WYNDHAM HAYWARD, *Florida*

The forcing of hybrid amaryllis bulbs (Hippeastrum) into bloom in pots, bowls or other containers without drainage has been found practical in both experimental and commercial test planting during the last two years. This procedure possibly will open a large new field for the use of the bulbs, particularly in home floriculture.

The first experiment of this nature, so far as the writer is aware, was made in 1936 by Mr. Frank L. Bates, of the Bates Art Industries, Chicago, Illinois, who reports that his firm potted up 100 blooming size bulbs of hybrid amaryllis in the spring, using common granulated peat moss as the potting medium. The containers were art pottery bowls, such as are sold for the growing of Paper White narcissus in pebbles with water.

Mr. Bates writes under date of February 25, 1937, "The use of peat moss seems to give very satisfactory results—the idea of handling amaryllis in this way was, I think, original with us, as it followed our usual manner of handling Paper Whites. We have really had very good luck with blooming hybrid amaryllis in this fashion, and while we have had some complaints from customers, that the bulbs did not bloom, investigation has shown that the person attempting to grow the bulb did not wait long enough for it to develop."

Mr. Bates' commercial practice was to offer the bulbs for sale in retail stores together with an ornamental pottery container and sufficient peat moss for the potting.

In January, 1937, the writer undertook to repeat Mr. Bates' experiment with appropriate controls potted in a soil medium with drainage. Six bulbs of 2½ inch size, usually considered as blooming size, were potted up in glass pots and tin cans, the glass pots having been furnished by Prof. Alex Laurie of Ohio State University for amaryllis root studies. The bulbs were firmly packed in the containers, all of which, except the controls, were made water tight at the bottom. The peat moss was firmed around the bulbs which were buried to about one-half of their height. The peat moss was watered moderately for several weeks, just enough moisture being added to keep the peat thoroughly damp, never soggy. At no time was water enough given to the plants to allow any moisture to spill out, if the pots were tipped on their sides. This factor is most important in growing bulbs by the non-drainage method—careful moisture control.

The bulbs started growth in about three weeks, making a uniformly good root growth. This could be observed through the sides of the glass containers. All of them except one, produced flowers and about half of the bulbs produced leaf growth with the bloom scapes.

The illustration (plate 89) shows two of the bulbs in the glass pots, and was taken at seven weeks after the first potting. One of the bulbs is blooming in practically normal fashion without leaves. The other is sending up its bloom scape and also leaves. The root growth of the two bulbs in the potting medium is plainly visible through the glass.

Wyndham Hayward *See page 257*

Forcing Hybrid Amaryllis without drainage

Plate 89

As a matter of fact the root growth in the test cases was better than the average for hybrid amaryllis bulbs potted in ordinary soil for the same period, even when the latter were given the benefit of drainage. Flower production was approximately 80 per cent of normal for bulbs which are well established and pot bound, and was slightly better than the average results obtained the first season from bulbs newly potted in earth alone.

Of course it appears to be not practical to grow on the bulbs by this non-drainage method for the next blooming season. After flowering the bulbs can either be discarded as in the case of Paper Whites, or repotted in ordinary potting soil and grown on subsequently with good results. To attempt to grow them in the peat apparently would be difficult because of the problem of feeding them properly in the peat mixture and keeping this medium in a favorable condition, without drainage. This raises the interesting possibility of feeding each bulb with a proper nutrient solution in the undrained container. This matter would involve considerable additional research before any conclusive results could be secured, and what is mentioned here is only suggestive.

However, general use of the forcing method will undoubtedly lead to an additional and continuous. demand in the trade for new bulbs, which are becoming available in quantity at reasonable prices, for the ordinary grades.

The method is clean, neat and simple, and while not adapted to the growing of high priced or fanciers' specimens, or exhibition plants for displays, should prove a fascinating innovation for indoor bulb gardeners.

HARVESTING, STORAGE AND FORCING AMARYLLIDS

I. W. Heaton, *Florida*

It was my former opinion, that Amaryllis could be forced with more regularity, than now seems possible. This point has been forceably brought to my attention this past season in several instances. Here again we must consider the vast difference between greenhouse culture and our open air growing conditions in this state, where the bulbs are subject to rapid temperature changes and other abnormal conditions.

Forcing naturally interlocks with the subject of curing and storage and harvesting. From all available data it is apparent that the most opportune period for harvesting is the semi-dormant stage between the summer and fall growing season. In other words any time after the middle leaf has matured, ranging from August 1st to September 15th, before the fall flush of growth appears. If the bulbs cannot be dug at this time the next harvesting period follows the maturing of the fall flush of growth, generally December 1st to January 1st. It is not advisable to dig after this time. This past season we had three different control plots numbering 500 bulbs, all over four inches in diameter. Bulbs in plot No. 1 were dug in early September, cured only a few days, trimmed at the base and replanted. These flowered with normal size

blooms and thirty inch stems April 15th. The bulbs in plot No. 2 were dug in December and replanted. These also flowered in April. These bulbs apparently had made a normal root growth and had average foliage, and in spite of maturing seeds there was little shrinkage of the bulbs. The bulbs in plot No. 3 were dug on March 1st, replanted shortly after. In this case the bloom, produced May 1st, was not normal. The scapes were short, and no foliage was produced. The bulbs were badly shrivelled.

This clearly indicates that late harvesting and planting is not a good practice. While in New York this past spring I saw a planting of 500 imported bulbs, received in this country February 15th, and there was not a normal scape in the lot, while other plots of early shipped Florida bulbs had made nearly normal flowers.

Some indications point to a needed change in our methods of handling amaryllis bulbs, during the curing process. In some instances the bulbs have been cured too long, with devitalizing results. During the rush season we shipped this year bulbs which had not been cured a week and they carried perfectly, without heating or sweating. As this commercial strain is practically evergreen, there is no apparent reason for a long curing period, other than drying to permit safe transit.

Under greenhouse culture in the north there seems to be no standard practice, and each grower uses his own methods. From observation it appears that Mr. Jewell of New Rochelle, N. Y., Bobbink and Atkins, Rutherford, N. J., and Mr. William Mullias, Kenneth Square, Pa. are most successful in forcing amaryllis. The forcing methods used do not seem to be standardized. At one establishment I have noticed bulbs already under the benches, dried off, in July, and at others some still actively growing during September. My experience with greenhouse culture is limited to observation only and for this reason I do not feel qualified to suggest any changes in the methods used by the most successful growers. In checking the flowering dates of our named varieties grown in the north it appears that the bulbs can only be forced six weeks earlier than the normal flowering date here. Apparently this is partly due to even night temperature and partly to physical condition of the bulbs, from curing.

GRIFFITHS' SPEEDING UP FLOWERING IN DAFFODILS AND BULBOUS IRIS

WYNDHAM HAYWARD, *Florida*

Circular No. 367 of the United States Department of Agriculture, dated January 1936, is a posthumus publication of the late Dr. David Griffiths, Senior Horticulturist of the Bureau of Plant Industry, who died March 19, 1935. Its title is "Speeding up Flowering in the Daffodil and the Bulbous Iris." The text refers mainly to daffodils.

The pamphlet is an interesting and useful treatment of the subject

(Continued on page 272)

8. THE SOCIETY'S PROGRESS [1]

THE SECRETARY'S MAIL BAG

Describing the habits of *Zephyranthes pulchella,* an unusual and little known species from Lower Texas, Mr. Robert Runyon of Brownsville writes: "They grow in a low, clay soil of the gumbo type, and when the rains come in September they flower like magic by the tens of thousands." Mr. Runyon, a helpful cooperator, sent the Society a supply of the bulbs in the fall of 1936.

By an error of some boys engaged to make the collection, the bulbs recorded under A-33, Accessions of the Trial Collections Garden, page 23, 1936 "Herbertia," have proved to be *Cooperia Drummondii,* instead of *Zephyranthes pulchella* as originally listed. Further study of the bulbs leads to the opinion that they are the variety *chlorosolen* of *Cooperia Drummondii* as described by Baker. This is a more vigorous form than the type. A number of these bulbs of *Cooperia Drummondii* var. *chlorosolen* were distributed to members in 1936 as *Z. pulchella,* and recipients should note this correction.

The species of *Zephyranthes* imported from Argentina by the Society in 1934, listed under No. 22, Accessions of the Trial Collections Garden, page 31, 1935 Year Book, has been identified by Mr. H. Harold Hume, the *Zephyranthes* specialist of Gainesville, Florida, as *Z. mesochloa,* and the search for the genuine *Zephyranthes caerulea* (now classed as *Habranthus caerulea),* the "pale blue" flowered species, goes on. The *Z. mesochloa* bulbs were sent to the Society as *Z. caerulea,* but proved to be a fleeting, white-flowered form. The latest report of *Habranthus caerulea* has come from a collector in Asuncion, Paraguay, from whom it is hoped to obtain some bulbs of the true species so that ultimate distribution of this species may be made to the interested members.

Mr. R. A. Dyer, corresponding member for South Africa, writes under date of Feb. 10, 1937 that he has been nominated to go on a short botanical trip to Tristan da Cunha, for a few months. This trip to the lonely islands in the South Atlantic, about midway between South America and Africa, is the answer to a plant explorer's prayer. We wish the best of luck to Mr. Dyer on his trip, and hope his new species will be many. Perhaps there may be some unknown amaryllids to be found.

Mr. Hermon Brown, of Gilroy, Calif., sent the secretary a scape of a December-blooming Amaryllis which is probably a type of *Hippe-*

[1] Information in this section was furnished by Mr. Wyndham Hayward, Secretary of the Society.—Ed.

astrum aulicum. Mr. Henry Nehrling, in his book "Die Amaryllis," states that *Hippeastrum aulicum* "blooms about Christmas time" in the open in Florida. Mr. Brown's flowers were received on December 21, and the flowers were just starting to open. The secretary has had bulbs of *Hippeastrum aulicum* for several years in his garden, the same obtained from European dealers, but they have steadfastly refused to bloom, apparently being of rather delicate and temperamental habit. Mr. Gilroy is located about 80 miles south of San Francisco, possibly the "farthest north" in latitude of any amaryllis grower who raises his bulbs in the open ground.

Considerable disagreement has been noted in recent years regarding proper time to dig Amaryllis bulbs for shipment. In Holland the practice seems to be one of delaying this procedure until late November or even December. Some growers in Florida dig their bulbs as early as September. It is hoped that scientific study will be undertaken which will throw some light on this knotty problem for various areas.

Col. Stephenson R. Clark, of Sussex, England, a member of the Society for several years, was signally honored in 1936 by the Royal Horticultural Society which conferred on him the Victoria Medal of Honor in Horticulture. Under the provisions of this award there are only 63 Medallists in the United Kingdom. The medal was established in 1897 under the patronage of Queen Victoria "to enable the Council (of the R. H. S.) to confer conspicuous honor on those British Horticulturists resident in the United Kingdom, whom it might from time to time consider deserving of special honor at the hands of the Society."

A good list of the newer Hemerocallis varieties worthy of a place in any perennial planting would advisedly be made to include "Cressida," one of the Carl Betscher varieties, which the writer first saw in full perfection in April, 1937 in the interesting garden of Prof. E. L. Lord, of Orlando, Florida, a daylily enthusiast of many years standing. Mr. Lord has one of the most extensive collections of these plants in private hands in the state. "Cressida" is a rich, fulvous-on-orange type.

Prof. J. C. Th. Uphof, of the Botany Department, Rollins College, Winter Park, Florida, writes that he will prepare a revised systematic treatment of the Alstromerias for publication in a future issue of "Herbertia." It is hoped to include this in the number honoring Mr. E. H. Krelage, the noted Dutch bulb authority. Prof. Uphof, an internationally known writer on botanical and horticultural subjects, is also of Holland origin.

The amaryllis and related bulbs have been actively promoted in the Pacific Northwest area in recent years by Mr. Harry L. Stinson, of Seattle. Mr. Stinson has made numerous speaking appearances before clubs, educational groups and on the radio in this work.

Members of the Society and others interested in amaryllids will be pleased to learn that a comprehensive text on the phylogeny, classification, breeding, propagation and culture of the amaryllids has been in preparation since 1933 by Dr. Hamilton P. Traub, the editor of our Year Book "Herbertia," for publication in book form in 2 or 3 years. Dr. Traub, who is marked for his untiring perseverance and boundless energy in the pursuit of sub-tropical horticultural research, will devote his spare time beyond the needs of the "Herbertia" editorship to this task, including vacations, if any. The writer has forgotten the year in which Dr. Traub took his last vacation.

Mr. Fred H. Howard of Montebello, Calif., and Mr. Richard Diener, of Oxnard, Calif., leading amaryllis growers of the Pacific Coast states, write distressing accounts of the damage to bulbs and other nursery stock received in the freezing weather of January, 1937, which caused the postponement of the 1937 spring National Amaryllis Show for one year. It is hoped that favorable weather and growing conditions through the rest of the year will enable the amaryllis in the field plantings to recover sufficiently to assure an outstanding exhibition for 1938 at Montbello.

Especial emphasis is placed by the writer on the beauty and decorative quality of *Habranthus cardinalis,* a rare species from the West Indies, which has recently been introduced into the United States (See Plate 48). The only known source of the bulbs is from Miss Violet Brace, of Nassau, Bahamas Is. The native home of the bulbs is not known definitely. Miss Brace writes that her mother had the bulbs in cultivation for many years. The flowers are of a remarkable cardinal red, and tilted from the perpendicular, usually standing at an angle of about 90 degrees. Miss Brace writes that the bulbs do not seed with her, and they are very reluctant about this in cultivation. For color alone, the species is easily one of the outstanding *Habranthus species.* It requires some shade in cultivation for best results, and moderately rich soil.

For marking special bulbs and particular lots of seedlings and propagations a number of the members have found small strips of .030 in. thickness sheet celluloid, with a negative finish, very satisfactory when the writing is done in waterproof drawing (India) ink. These labels may be made with a hole in one end, and attached to one end of a one-foot galvanized steel wire of about No. 12 gauge with good results in field practice. They remain legible for long periods.

It is with the deepest regret that the secretary records the death, on July 31, 1936 at the age of 73 years, of a very good friend and charter member of the Society, Mr. Robert E. Morrison. Mr. Morrison was born at South Norwalk, Conn., and followed the florist's profession. He was a resident of Tavaree, Florida, for the past 15 years, and was among those who were most active in reawakening interest in the amaryllids.

Mrs. Sarah V. Coombs, author of "South African Plants for American Gardens" writes that "The identity of some of the flat-leaved bulbs which I brought home from South Africa belonging to the Haemanthus group has been determined as H. coccineus. Others have not bloomed as yet here. I do not know whether there are other species besides coccineus having leaves growing in that way, but there is one species of the genus growing at Kirstenbosch, probably a new species, which has one single leaf, which stands up stiffly, and flaps solemnly back and forth in the wind. I do not know why it should be amusing, but it is. The Rain Forest species which I brought back has not been identified, as its blossom was very imperfect this year (1935). It most closely approaches H. natalensis, but is not that species. When it blooms again, the flower will probably be better."

The horticulturally neglected but important members genus of *Bomarea,* sisters of the alstroemerias, and within the field of the American Amaryllis Society, is the subject of an unusually readable article in the April quarterly (1936) of the National Horticultural Magazine. (Mr. B. Y. Morrison, editor). The author is Mr. E. P. Killip of the Smithsonian Institution, who has made an extensive study of these plants both in the herbarium and in the field. The article is illustrated with pictures of a number of dried, pressed Herbarium specimens of various species of *Bomarea,* but with no photographs of the plants blooming in nature or in cultivation. Four of the plates are interesting as being the type specimens of the following species, *Bomarea campanuliflora; B. zosteraefolia; B. salicifolia* and *B. incana,* all named by Mr. Killip.

Dr. H. Harold Hume, the *Zephyranthes* specialist, is going to turn his attention to the genus *Hymenocallis* shortly, according to a recent letter. This is good news as there is no group of plants of horticultural importance which more urgently needs attention than the "Spider Lilies," as they are so grossly libeled. The genus *Hymenocallis* contains some of the most varied types imaginable, some being deciduous, others evergreen, some with strap leaves and others with leaves like *Eucharis.* One species, *H. Amancaes* is yellow-flowered.

REPORT OF THE SECRETARY

With the publication of the 1937 HERBERTIA, the American Amaryllis Society may well be said to have attained the first significant landmark of its early years of work and progress. This commemorative edition, issued on the 100th anniversary of Dean William Herbert's publication of his pioneer monograph on the *Amaryllidaceae,* marks the high point to date of the Society's efforts for a revival of interest in the amaryllids as a group.

Three previous year books have come and gone, the first, a slender hopeful volume and the two immediately following expanding successively in value and depth of content, quality of pictorial representations,

and breadth of the field covered. So too, has increased annually the world-wide renewed interest in amaryllids.

With this issue the Society, in behalf of horticulturists, botanists and flower lovers everywhere, pays a belated tribute to a great man, great in knowledge and foresight that was years ahead of his time. He was a man of amazing genius and intellectual powers, almost forgotten for a century, so that today scarce mention may be found of his name in the great encyclopaedias, who was fitted to take his place with the brilliant figures of his better known contemporaries, had he chosen to direct his energies in more popular paths. But Herbert's life was that of the quiet, modest and unassuming gentleman of science, literature and theology. In this fourth number of HERBERTIA, Mr. Worsley contributes an outline biography that will help us to appreciate more fully the problems and accomplishments of the first great amaryllid enthusiast.

The year of preparation for this William Herbert commemorative number of HERBERTIA has been distinguished by the increasing expressions of warm support and active cooperation on the part of members, cooperators and other friends of the Society. The members have been faithful in the payment of annual subscriptions, which are the life blood of the Society's treasury, and a number of additional garden lovers, horticulturists, plant scientists, etc., have joined our ranks.

While the vagaries of weather conditions during the early part of 1937 precluded the possibility of holding the usual national and regional spring Amaryllis shows, it was possible to arrange for a National Show in the fall at Los Angeles, Calif. under the supervision of Mr. Cecil Houdyshel of La Verne.

Amaryllids have been coming forward as increasingly popular and varied display features of the great American flower shows, and this happy tendency shows signs of further development. Only the warmest commendation has been expressed in writing and in published reviews by critics of the 1936 HERBERTIA. Particular praise has been accorded to the interest and quality of the numerous illustrations which are contributed through the kindness of cooperators.

The human and living side of the amaryllis picture will continue to be emphasized in future activities of the Society. A number of attractive and interesting species were made available to the old and new subscribers during 1937.

Dr. Hamilton P. Traub, editor and director, has outdone his past performances in the present HERBERTIA beyond all question, and *each* succeeding year of helpful association with him in his mighty task of research, supervision and coordination of amaryllid matters brings only greater astonishment at his unflagging zeal and vitality, inspiring enthusiasm and critical judgment, not to mention his marvelous capacity for editorial "punishment" and his really outstanding comprehension of the subject.

The Society and its officers express their sincere gratitude to all supporting members and advertisers who have made these splendid numbers of HERBERTIA possible. We solicit your continued financial aid and material cooperation. Our Society lives only for and through its mem-

bers. It needs and invites most cordially your good will, friendly criticism, and active help in every particular. The members are urged to send in good photographs, accounts of their experiences with amaryllids, and last but not least that very essential subscription renewal and nomination of new members.

A few suggestions for the betterment of your Society: send in your renewals promptly; give a membership for birthday or Christmas presents to flower-loving relatives and friends; show the Year Books to all possible prospects for membership in your acquaintance; donate copies to your local libraries, garden clubs and horticultural societies; spread abroad in every way the news of what is being done with the amaryllids today. HERBERTIA can be no better than the members help to make it. I can only repeat that it is *your* Society.

The impossibility of rendering proper acknowledgement to all the individuals, institutions and other organizations which have so kindly given of their time, attention and helpful cooperation in the past year is a matter of deep regret to your Secretary. He hopes that this final word will be taken in the spirit it is intended, one of humble thankfulness for all that has gone to make the Society's work so successful.

WYNDHAM HAYWARD,
Secretary.

May 3, 1937,
Lakemont Gardens,
Winter Park, Florida

NOTICE OF 1938 NOMINATIONS

To the Members of the American Amaryllis Society:—

As provided by Article 5, Section 1 of the By-Laws of the American Amaryllis Society, which specifies that the secretary shall send to all voting members, not less than 90 days before the date of the annual election, a list of the offices to be filled, and the names of those whose terms expire, this information is hereby incorporated below, as an official notice to the membership. This notice will take the place of a separate mailed announcement to the members to this effect for 1938 elections.

President	Mr. E. G. Duckworth, Florida
Vice Presidents	Mr. T. H. Everett, New York
	Mr. E. A. McIlhenny, Louisiana
	Mr. Fred H. Howard, California
Secretary	Mr. Wyndham Hayward, Florida
Treasurer	Mr. R. W. Wheeler, Florida

Director at large, for 3 years—Mr. Richard Diener, Oxnard, Calif.

Article 7, Section 1 of the Constitution, provides that any voting member may submit to the Secretary, not less than 60 days before the annual meeting, nominations for officers and directors. These shall be submitted to a nominating committee who shall select the candidates for the final ballot.

The annual meeting for 1938 will be held on April 13, being the second Wednesday of the month. Therefore the names of any suggested nominees must be submitted to the secretary before February 11, 1938.

WYNDHAM HAYWARD,
Secretary.

May 1, 1937,
Winter Park, Florida.

REPORT OF TRIAL COLLECTIONS COMMITTEE

Some unusually interesting Amaryllids have been added to the Society's Trial Collections garden during the past year. Some of the plant material in the garden has been made available for distribution during 1937 to certain classes of members.

ACCESSIONS, MAY 31, 1936 TO APRIL 30, 1937

A-81 to A-86—Contributed by Major Albert Pam of England
A-81 Seed of *Zephyranthes mesochloa*
A-82 Seed of *Griffinia Blumenavia*
A-83 Seed of *Hippeastrum phycelloides*
A-84 Seed of *Crinum Capense* (var. of *C. longifolium)*
A-85 Seed of *Hymenocallis speciosa*
A-86 Seed of *Crinum scabrum*

A-87—Seed of two *Cyrtanthus* species contributed by Mrs. W. E. MacArthur, Jacksonville, Florida, unidentified.

A-88 to A-89—Contributed by Robert Runyon, Brownsville, Texas. A-88 bulbs of Zephyranthes pulchella, rare yellow-flowered species. Collected within city limits of Brownsville, Texas. A-89 Seed of Zephyranthes pulchella.

A-90—Bulbs of *Zephyranthes pulchella,* contributed by Prof. H. B. Parks, San Antonio, Texas, "from a vacant half-block in the town of Ingleside in San Patricio county." Mr. Parks adds that the location is on the east side of Nueces Bay, and that the plants grew in heavy clay.

A-91—Seed of *Hymenocallis Amancaes,* the rare yellow-flowered Ismene type of *Hymenocallis,* from the Division of Plant Exploration and Introduction, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C. Collected in Peru.

A-92—Seeds of *Cyrtanthus* species, from Mrs. J. W. Archbell, Natal, South Africa; Several varieties identified only as to color.

A-93—Five bulbs, hybrid *Hippeastrum* received from Garfield Park Conservatory, Chicago, Ill.

A-94—*Hemerocallis* species, possibly *H. aurantiaca major,* from Mrs. J. H. Churchwell, Jacksonville, Fla. Plant is common in vicinity of Jacksonville but of unknown origin or identity.

A-95—*Haemanthus Natalensis;* seeds received from Mr. George F. Brockman, Louisville, Ky.

A-96 to A-103—Contributed by the Division of Plant Exploration and Introduction, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C. Bulbs collected in Brazil by Dr. W. A. Archer.

A-96 Three bulbs, *Hippeastrum sp.* P. I. No. 118776
A-97 One bulb, *Hippeastrum aulicum,* var. *robustum,* P. I. No. 118813
A-98 Five bulbs, *Hippeastrum breviflorum,* P. I. No. 118814
A-99 Two bulbs, *Hippeastrum calyptratum,* P. I. No. 118815
A-100 Two bulbs, *Hippeastrum psittacinum,* P. I. No. 118816
A-101 Three bulbs, *Hippeastrum puniceum* var. *barbatum,* P. I. No. 118817
A-102 Three bulbs, *Hippeastrum rutilum,* var. *crocatum,* P. I. No. 118818
A-103 Two bulbs, *Hippeastrum sp.,* P. I. No. 118819

A-104—*Zephyranthes Simpsonii,* bulbs collected in South Orange County, Florida, by R. W. Wheeler, Winter Park, Florida, on cultivated field.

A-105—*Hymenocallis species,* seed from bulbs collected by Dr. H. P. Traub in Lee County, Florida. The plant has a one flowered-scape, with rather inconspicuous bloom, found growing in wet flatwoods land.

A-106 to 207—*Cooperanthes* hybrids, 135 bulbs, received under number and name from Mr. S. Percy-Lancaster, Secretary, Royal Agri-Horticultural Society of India, Alipore, Calcutta, India. These are the interesting bi-generic hybrids between *Cooperia* and *Zephyranthes* species described on pages 108-110 of the 1936 "Herbertia."

A-106 King of Autumn (L-366)
A-107 Golden Drop (L-167)
A-108 Marguerite (L-233)
A-109 Hilda (L-224)
A-110 Ruby (L-398)
A-111 Bright Eyes (L-184)
A-112 Audrey (L-380)
A-113 Dove (L-378)
A-114 Nimrod (L-319)
A-115 Cygnet (L-379)
A-116 Hermione (L-310)
A-117 Donald (L-385)
A-118 Ethel (L-374)
A-119 Felix (L-322)
A-120 Eastern Star (L-314)
A-121 Hotspur (L-251)
A-122 Louisa (L-251a)
A-123 Goldfinch (L-312)
A-124 Star of Alipore (L-174)
A-125 Stella (L-187)
A-126 Midget (L-193)
A-127 Sydney (L-172)
A-128 Orange Queen (L-170)
A-129 Eva (L-226)
A-130 Nora (L-289)
A-131 Wanda (L-362)
A-132 Fireman (L-408)
A-133 Empress (L-205)
A-134 Albion (L-399)
A-135 Nymph (L-335)
A-136 Cora (L-356)
A-137 Jean (L-271)
A-138 Delta (L-235)
A-139 Triumph (L-425)
A-140 Crystal (L-476)
A-141 Karl (L-389)
A-142 Tea Rose (L-492)
A-143 Duchess (L-482)
A-144 Faith (L-474)
A-145 Duke of York (L-497)
A-146 Frank (L-526)
A-123 Goldfinch (L-312)
A-148 Gertrude (L-483)
A-149 Rene (L-472)
A-150 Madonna (L-103)
A-151 Fanny (L-105)
A-152 Morning Star (L-106)
A-153 The Governor (L-367)
A-154 Mrs. Lancaster (L-380)
A-155 Vesuvius (L-351)
A-156 Pride of Alipore (L-348)
A-157 Phoebe (L-293)
A-158 Arnold (L-340)
A-159 Penelope (L-347)
A-160 Beauty (L-283)
A-161 Queen Elizabeth (L-355)
A-162 Star (L-343)
A-163 Delia (L-604)
A-164 Prince Edward (L-152)
A-165 Model (L-401)
A-166 Olpheus (L-274)
A-167 Autumn Tints (L-400)
A-168 Apricot (L-163)
A-169 Sunkist (L-299)
A-170 Abundance (L-421)
A-171 Dog Star (L-477)
A-172 Claire (L-376)
A-173 Star of the East (L-328)
A-174 Murillo (L-202)
A-175 Maurean (L-206)
A-176 Alastor (L-194)
A-177 Nirvana (L-619)
A-178 Pine Love (L-331)
A-179 Troubador (L-371)
A-180 Gemma (L-173)
A-181 Bella (L-171)
A-182 Symbol (L-256)
A-183 Drummondii (L-253)
A-184 Ida (L-248)
A-185 Virginia (L-373)
A-186 Clara (L-627)
A-187 White Ensign (L-387)
A-188 White Queen (L-239)
A-189 Sabrina (L-556)
A-190 King Cup (L-557)
A-191 Emperor (L-554)
A-192 Libra (L-555)
A-193 Winnie (L-473)
A-194 White Pearl (L-431)
A-195 Irma (L-190)
A-196 Verecunda (L-241)
A-197 Hera (L-298)
A-198 Undine (L-280)
A-199 Eldorado (L-270)
A-200 Juno (L-417)
A-201 Moonlight (L-411)
A-202 Jane (L-302)
A-203 John (L-552)
A-204 Eden (L-451)
A-205 Templar (L-503)
A-206 Toreador (L-493)
A-207 Ajax (L-245)

A-208—*Crinum ammocharioides,* seeds contributed by the Lady Muriel Jex-Blake, Nairobi, Kenya Colony, East Africa. "Collected 23/11/36 at 6,000 feet altitude."

A-209—*Pamianthe peruviana,* pod of seed received from Major A. Pam, England.

A-210—*Zephyranthes* species, (probably *Z. texana)* seeds received from Dr. S. H. Yarnell, College Station, Texas.

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(Continued from page 260)

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Alphabetical Index to Advertisers

De Boer & Son, H. B. ---- 276
Diener, Richard, Nursery ---- 280
Farr Nursery Company ---- 276
Fisher Flowers ---- 273
Hall, C. W. ---- 274
Hayward, Wyndham ---- 277
Heaton Bulb Co. ---- 279
Heist, John R. ---- 278
Houdyshel, Cecil ---- 274
Howard & Smith ---- 275
John's ---- 278
Las Positas Nursery ---- 278
Martley, John ---- 273
Mc Ilhenny, E. A. ---- 276
Middlepen Plantation ---- 274
Oliver Mfg. Co., The W. W. ---- 278
Pearce, Rex D. ---- 276
Scheepers, John, Inc. ---- 277
Vasku, John ---- 278
Zandbergen Bros., Inc. ---- 275
Zimmerman, E. P. ---- 274

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