PLANT LIFE

1951

THE AMERICAN PLANT LIFE SOCIETY

THE AMERICAN PLANT LIFE SOCIETY is organized for the "increase and diffusion of knowledge concerning plant life," and to carry out its objectives the main emphasis is placed on the publication of PLANT LIFE, the periodical devoted to plant life, incl., HERBERTIA, the issue devoted exclusively to the amaryllids. The publications are international in scope. All paid up members are privileged to receive the current issues of PLANT LIFE, incl., HERBERTIA.

NOTE FOR PLANT LIFE AND HERBERTIA CONTRIBUTORS

Correspondence regarding articles and illustrations for PLANT LIFE, incl. HERBERTIA, is cordially invited.

STYLE. Manuscripts *must* be *typewritten* and *double-spaced* throughout [using a new heavy black ribbon]. Calculations, figures, tables, names, quotations and literature citations should be carefully verified.

MANUSCRIPTS AND PHOTOGRAPHS. To insure against loss in the mails, authors should *retain copies* of manuscripts and the *original negative or extra prints* of photographs sent for publication in PLANT LIFE, incl., HERBERTIA. Photographs should have the *name and address* of the owner to whom credit should be given, and the *name and size* of the subject, written on the back.

Address correspondence and send membership dues to:
E. FREDERICK SMITH, *Membership Secretary*
The American Plant Life Society
Box 2398, Stanford, California

PLANT LIFE

VOLUME 7

[Nos. 1-4, Jan., Apr., Jul. & Oct.]

1951

EDITED BY

HAMILTON P. TRAUB

HAROLD N. MOLDENKE

THE AMERICAN PLANT LIFE SOCIETY

Box 2398, Stanford, California

Printed in the United States of America

Published January, 1951

Citations to this issue of PLANT LIFE should read as follows: PLANT LIFE *7:* —— — ——, 1951.

Address correspondence and send membership dues to:

Mr. E. Frederick Smith, Membership Secretary,

The American Plant Life Society,

Box 2398, Stanford, California

TABLE OF CONTENTS

Cover design, by Mulford B. Foster, based on *Amaryllis fosteri* Traub, *sp. nov.* (see page 27 of this issue for type description).

PLANT LIFE, VOLUME 7, NO. 1. 1951—HERBERTIA: LATIN AMERICAN AMARYLLID EXPLORATION EDITION

PLANT LIFE, VOLUME 7, NO. 2. 1951—GLORIOSA LILY EDITION

PLANT LIFE, VOLUME 7, NO. 3. 1951—THE AMERICAN PLANT LIFE SOCIETY

PLANT LIFE, VOLUME 7, NO. 4. 1951—SEEDS AND PLANTS DIRECTORY

ILLUSTRATIONS

PLATES

TEXT FIGURES

[TABLE OF CONTENTS—continued on page 174.]

PLANT LIFE, VOL. 7, NO. 1, JANUARY, 1951

HERBERTIA

1951

LATIN AMERICAN AMARYLLID
EXPLORATION EDITION

EDITED BY

HAMILTON P. TRAUB

HAROLD N. MOLDENKE

THE AMERICAN PLANT LIFE SOCIETY

Box 2398, Stanford, California

[Moldenke—AMARYLLID GENERA AND SPECIES, continued from page 82.]

Eustephia armifera Macbr., Publ. Field Mus. Bot. 11: 47. 1931.—Conspicuously very leafy; bulb ovoid, 4 cm. in diameter, attenuate into a neck almost 1.5 dm. long; leaves about 8, oblong-linear, 2—3 dm. long, almost everywhere 12—14 mm. wide, lax or apparently sometimes prostrate; peduncles about 1.5 dm. long, more or less compressed; bracts 2 or 3, rather large, almost 4 cm. long, about 1 cm. wide, subtruncate; flowers about 5, subsessile; perigonium 2.5—3 cm. long, the tube scarcely spotted, quite ampliate at the throat, the segments definitely unequal, ovate, subacute, 6—8 mm. long; free filaments 5 mm. long, narrowly winged, conspicuously dentate on both sides at the apex; anthers about 7 mm. long; style slightly surpassing the stamens but included; stigma irregularly discoid-foliose. Peru.

Hymenocallis repanda Otto & Dietr., Allg. Gartenz. 11: 123. 1843.—Bulb subglobose; leaves suberect, broadly lanceolate-lorate, flat, slender; umbel about 10-flowered; tube green, the segments linear, adnate at the base of the corona, equaling the tube; sinuses of the corona repand. Mexico.

Zephyranthes filifolia Kraenzl.; Herb. ex Baker, Amaryll. 33, nom. nud. 1888.—It differs from *Z. despauperata* Herb. in its smaller stature, all its leaves being capillary (not linear), the peduncle rather thick and quite firm, the pedicel and sheath shorter, and the segments of the perigonium lanceolate to oblong.

Bulb not seen; the lower part of the stem covered with a few brown cataphylls; leaves filiform or more often capillaceous, to 10 cm long, scarcely 0.5 mm. wide; scape without the flower to 8 cm. tall, rather thick, sometimes slightly thickened at the middle (always?), very slightly widened at the apex itself, always 1-flowered (at least in the 12 specimens seen), sheath including the pedicel, ovary, and even the basal part of the perigonium, pellucid, lightly pergamaceous, acuminate, 2.2 cm. long; pedicel about 1 cm. long; flowers yellow, almost like those of our *Gagea pratensis;* tube of the perigonium very short, scarcely 2 mm. long; sepals lanceolate, acute, 1.8—2 cm. long, 3 mm. wide; petals oblong-lanceolate, equally long, acute, 1.8—2 cm. long, 5—6 mm. wide; stamens inserted at the base of the tube, 4 mm. long; ovary 7 mm. long, 4 mm thick; stigmas 3, greatly twisted. Patagonia.

Zephyranthes (*Zephyrites*) *longipes* Baker, differs from the remaining species in this section by its very long pedicel.

Bulb ovoid, 1 inch in diameter, the exterior tunics membranaceous, brown; leaves linear, glabrous; peduncle slender, fragile, almost a foot long; spathe 30 mm. long, cylindric toward the base, bifid toward the apex, the valves convolute; pedicel 3—4 inches long; ovary oblong, oblique, 6 mm. long; perianth pale-red, 3 inches long, the tube short, narrowly funnel-form, the segments of the limb lanceolate; stamens one-third as long as the perianth; anthers linear-oblong; style deeply trifid; capsule globose, 12 mm. long. Uruguay.

[Moldenke—AMARYLLID GENERA AND SPECIES, continued on page 8.]

PREFACE

This LATIN-AMERICAN AMARYLLID EXPLORATION EDITION is appropriately dedicated to Mr. Mulford B. Foster, who received the 1951 HERBERT MEDAL award for his outstanding contributions toward the advancement of the amaryllids.

Mr. Foster contributes to this issue an autobiographical sketch and an interesting article with map about his eight plant exploration trips. In connection with these trips, it is of interest to note that he brought back alive many amaryllids. Part of these have already been described; part are proposed as new species in this issue, and the rest are still to be identified. Some of these amaryllids are of the greatest importance to the plant breeder, particularly such species as the pink *Amaryllis espiritensis* Traub, *sp. nov.*, a smaller statured large-flowered species, described for the first time in this issue; some are excellent pot plants without further breeding; and all are of interest in adding to the sum total of human knowledge.

The cover design by Mr. Foster, shows the ornamental qualities of one of Mr. Foster's discoveries—*Amaryllis fosteri* Traub. *sp. nov.*, described in section II of this issue.

Among the other important contributions appearing in this issue are the following:

The outstanding pink miniature *xAmaryllis henryae* Traub, *hybr. nov.*, is described. It was synthesized by Mrs. Henry by crossing the pink *Amaryllis belladonna* var. *haywardii* and the pink *Amaryllis espiritensis*, already mentioned. The fine *xHabranthus floryi* is named for Dr. Flory; Mrs. Henry proposes the fine new hybrid, *xAmaryllis gladwynensis* M. C. Henry, sp nov. An article is devoted to the technique of producing colchicine-induced polyploid *Hemerocallis*.

Dr. Corliss writes about his garden visits in 1950; Mr. Manley reports on the 1950 Cleveland *Amaryllis* trials; Mrs. Morton writes of the 1950 New Orleans Amaryllis Show, and Mr. Hayward favors us with notes on the 1950 Orlando-Winter Park Hemerocallis Show.

Mr. Hayward writes about *xAmaryllis johnsonii;* Dr. Dyer concludes his fine review of the genus *Brunsvigia*; Miss Ficker reports on somatic chromosome numbers in *Amaryllis species;* Mr. Mitsch comments on the new Narcissus classification; Mr. Manley summarizes the Valleevue *Amaryllis* trials; and Dr. Moldenke makes available some more amaryllid generic and species descriptions in English.

Mrs. Strout and Sir Henry Lynch write about the BLUE AMARYLLIS; Mr. Culpepper writes of outdoor culture of *xCrinum* clone CECIL HOUDYSHEL in Virginia; Dr. Cooley and Mr. Lenington write on daylily culture; Mr. Mitsch and Dr. Cooley report on the 1950 Narcissus season; and Mrs. Henry describes an amaryllid birthday cake.

The 1952 HERBETIA, the 2ND ALSTROEMERIA EDITION (closing date for articles July 1, 1951) will be dedicated to Dr. J. C. Th. Uphof, the noted botanist, who has made valuable contributions toward the advancement of the amaryllids. He will contribute a systematic article on

Alstroemeria to this issue.

The 1953 HERBERTIA, the 2ND NARCISSUS EDITION (closing date for articles July 1, 1952) will feature *Narcissus.*

November 15, 1950

Hamilton P. Traub
Harold N. Moldenke

CORRIGENDA

PLANT LIFE, VOL. 6, 1950

Page 50, 1st line, insert "tentatively" between "has" and "identified."
Page 51, line 11 from top, for "Epple" read "Eppel."
Page 53, line 7 from top, for "fairy-ilke" read "fairy-like."
line 17 from bottom, for "*MacKenni*" read "*MacKeni.*"
line 6 from bottom, for "Exemplus" read "Exemplum."
Page 60, line 15 from bottom, for "1950" read "1850."
line 8 from bottom, for "*Hessleriana*" read "*Hassleriana.*"
Page 62, line 4 from top, for "Hera" read "Herba."
Page 83, line 18 from top, for "*notalensis*" read "*natalensis.*"
Page 90, 4th paragraph, 2nd line, for "Net" read "Not."
5th paragraph, 1st line, after "Doubtful species" insert "[Herb. Amaryll. 266. 1837]"
Page 110, 3rd paragraph, 9th line, for "Hearld Brand" read "Herald Brand."
Page 111, 5th line from bottom, for "litle" read "little."
Page 114, 3rd paragraph, 1st line, for "specie" read "species."
Page 130, 7th line from bottom, for "6" read "5."

[Moldenke—AMARYLLID GENERA AND SPECIES, continued from page 6.]

Hippeastrum marginatum R. E. Fries, Act. Soc. Upsal., ser. 4, 1 (1) : 161. 1905.—*Habranthus,* completely glabrous; leaves many, linear, flat, rounded at the apex, white-margined, the margin dentate; scape elevated, more or less equaling the leaves in length; the two exterior bracts linear-lanceolate, the interior ones numerous, linear; flowers numerous, long-pedunculate, purple, the tube long, narrow; segments of the perigonium oblong, acute. Argentina.

Haylockia andina R. E. Fries, Nov. Act. Soc. Sci. Upsal., ser. 4, 1 (1) : 160—161, pl. 9, figs. 1 & 2. 1905.—Bulb round or pyriform, the long neck including the short scape; leaves unknown; spathe hyaline, bifid at the apex; ovary sessile; segments of the perianth oblong, acute, whitish above, rosy beneath; stamens long, situated within the long tube and more than twice as long as it; stigmas very shortly trifid. Argentina.

Dedicated to
Mulford Bateman Foster

Herbert Medalist—Mulford Bateman Foster

Plate 1

MULFORD BATEMAN FOSTER

An autobiographical sketch

On December the 26th, 1888, there appeared in the weekly paper "The Elmer Times," at Elmer, N. J., a two line item in the local happenings column that read like this: "'Christmas present arrived at the editor's on the 25th, ahem. Ask him! ???"

This sudden bit of publicity surprised my father as much as it did me. He generally wrote all the copy for that column, but this time one of the men in the composing room got the scoop on him.

It was rather a disappointment to me to have been born on Christmas as that was a very poor time for birthday parties.

It must have been two or three years before it dawned on me that my mother had a green thumb. This gave me a new interest and hope for the future. I soon began to realize that our diningroom was also used for dining, that is, the part that was not filled up with plants.

When I first heard the old saying "A rolling stone gathers no moss," this somewhat cramped my plans for the future because I loved to make miniature gardens with all sorts of mosses and wild plants from the woods just outside of town.

At the age of six I started attending public school. I suppose it was a good idea but it left only Friday afternoons, Saturdays, holidays and vacations for garden making, ditch riding and hunting snakes.

When I finished High School I toyed with that old "moss" saying again, but father thought I should have a business education, so I finished Business College. Then I worked for nearly five years in two of Philadelphia's largest banks. By this time I was afraid that if I did not do a bit of rolling around I would gather too much "moss."

Then I tried being associate editor on my father's newspaper. He wrote as easily and interestingly as the clear running brook that rushed through our little town. It was definitely not easy for me to write. I was the "babbling brook" type.

I still toyed with that rolling stone idea and in 1912 I made my first trip to Florida and the Deep South looking for snakes. I found them, plenty of them. In fact, so many of them that Elbert Hubbard wrote a chapter "Snakes and Sich" in one of his books, "Pig Pen Pete," just about my snakes.

While I was in Florida on that trip I found something else besides snakes, the crackers called it "Spanish Moss." It was festooned in the trees. It fascinated me so much that I took some back north with me (just like a tourist), but it was soon apparent that it preferred to live in the South judging from its behavior in the trial habitat for a few summer months at the Boys' Camp in my new Kittatimy Mountain home in Pennsylvania which I had recently acquired.

That trip to Florida was fatal, as I found sand in my shoes and moss in my hair. In 1923 I made my second trip to Florida, this time to stay as I soon learned that Spanish Moss wasn't moss at all, it was

a bromeliad! That settled the rolling stone idea. So, I've been rolling all over Central and South America for the past eighteen years gathering no moss, but plenty of bromeliads, amaryllids, cacti, orchids, aroids and other tropical plants.

If there has been any spare time I have filled in by doing botanical drawings and painting plant portraits with philosophical interpretations of plant life.

Ever since the first amaryllid I found in the wild in Virginia, *Zephyranthes atamasco,* some forty years ago, they have had a fascination for me, so I've continued to collect the different species of this family to place somewhere in my garden.

On our first cacti collecting trip to Mexico, Racine and I included amaryllids, bromeliads and orchids. On our second trip to Mexico we found the new species *Zephyranthes fosteri* (see HERBERTIA 7: 65-66, 1941). This whetted my appetite. From that time on, even though our trips have been principally for collecting bromeliads, I have continuously collected amaryllids.

Of the more than sixty species of amaryllids representing a dozen different genera that have been collected on our many trips throughout the Americas, the new *Amaryllis Fosteri* Traub, sp. nov. (see page 116 of this issue of PLANT LIFE for type description), which I found in Brazil in 1948, is the most spectacular.

My profession being that of a landscape architect for the past twenty-seven years, my great interest has been a continued effort to find both new and old species of plants that could be used to increase our southern landscape material as well as to add new house plants and cut flowers for use in our homes.

And I am not through yet even though I do not gather moss.

COLLECTING AMARYLLIDS IN LATIN AMERICA

MULFORD B. FOSTER

My eight plant hunting expeditions throughout the Americas have added up to over 50,000 miles. (Plate 2). The first three trips were by automobile into Mexico in 1935-1936 and in 1937. In the first one I was accompanied by an artist friend, and the second two by my wife, Racine, who also accompanied me on all my subsequent collecting trips except the last one.

Cacti was my greatest plant hobby at that time. Bromeliads and orchids came next while amaryllids were incidental. Those three trips in Mexico covered over 15,000 miles, much of it rather hard going especially on the first trip. At that time the highway to Mexico City was not open, so we had to cross the Huasteca Mountains to San Luis Potosi via the OLD SPANISH TRAIL which I'm sure had not been improved

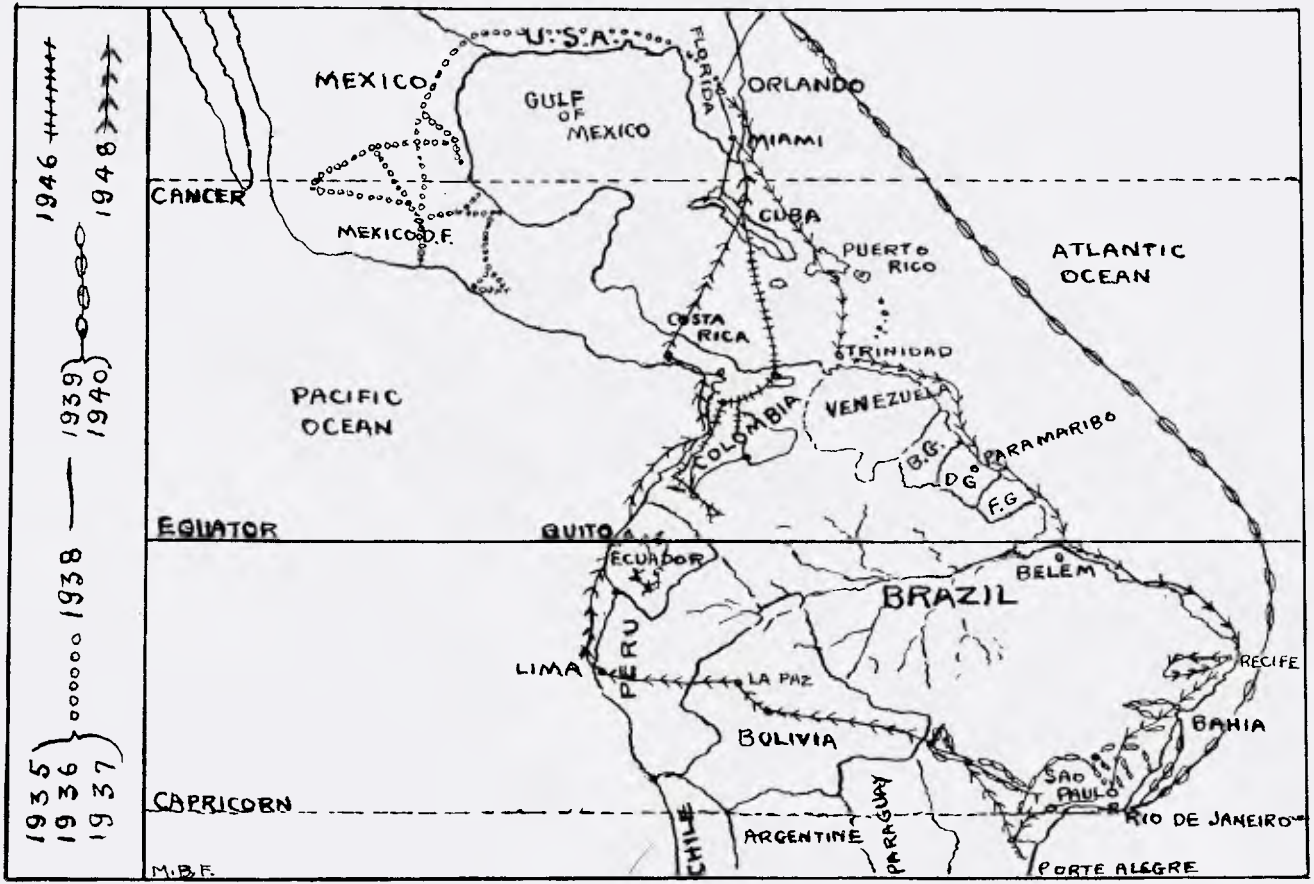


Plate 2

Map showing routes of the eight Mulford B. Foster plant hunting expeditions.

since the time of Montezuma. In 1935 we were told that ours was the first Florida auto license to enter Mexico City. We covered considerable territory including Mexico City and Acapulco, and then by train to Salina Cruz and Tehuantepec, at the Guatemalan border.

Mexico yielded my first discovery of a new species of bromeliad, *Hechtia melanocarpa.* And one new cactus, *Peniocereus Fosterianus.* Although it was eleven years after collection that these two new species first flowered in my garden and were later described. The only amaryllids I collected were *Zephyranthes macrosiphon* and *Z. grandiflora,* as well as *Cooperia pedunculata.*

The second trip of 1936 had fewer hardships; roads were much better. Collecting was good but we were gone only six weeks; no new species were found that year.

The third Mexican trip of 1937 covered a greater area. On our way to Guadalajara in the northwest, just before reaching Morelos, I collected a nice glaucous leaved phase of *Sprekelia* and discovered the new species later described as *Zephranthes fosteri* Traub [See HERBERTIA 7: 65-66. 1941, for type description.], a beautiful Bengal rose in color. I found a fine *Hymenocallis* too, not yet identified. After this trip, Dr. Hamilton P. Traub and the late Dr. Ausker Hughes, both then of the U. S. AGRICULTURE EXPERIMENT STATION here in Orlando, visited my garden. By their enthusiasm my amaryllid temperature started to rise.

Our trip to Cuba, in 1938, was successful in bromeliads and orchids but somehow we neglected amaryllids although we motored the entire length of that beautiful island. The palms, bromeliads and orchids occupied our attention.

Our first really big expedition was in 1939 to Brazil. This expedition lasted six months. Bromeliads came first and we found more than fifty new species that year. But I began taking amaryllids on this trip. On Mt. Itatiaia, Brazil's second highest mountain, to my surprise, I saw my first epiphytic *Amaryllis;* then again we found these bulbous members growing in trees in the state of Espirito Santo, north of Rio, and also to the south in the state of Santa Catharina. However, to this date I do not have them identified. Unfortunately, they bloom only when I am away from the garden, generally, when I am back in South America! In the state of Parana I discovered the new species, *Cooperia brasiliensis* Traub [see HERBERTIA 12: 38—40. 1945, for the type description.]; this proved to be the first species of this genus to be found in Brazil.

On this same trip I first found the charming *Alstroemeria caryophyllaea* but it was three years later before Mr. Harry Stinson of Seattle, Washington, identified it for me. It was the lovely, long lost fragrant *Alstroemeria.* Ever since, this dainty, winter blooming flower has been a very welcome addition to our garden. Now that I have six successful generations of crosses with this and other Brazilian species, most of them fragrant, I feel that it was one of the most outstanding horticultural finds of all my plant hunting trips.

During the 1939 expedition we collected in the states of São Paulo, Rio de Janeiro, Espirito Santo, Bahia and Parãna, traveling by canoe,

coastwise steamer, horse, oxcart, narrow gauge wood-burning and electric railroads, trucks, private cars, shank's mare and pigaback.

This expedition, in spite of all its hardships had its thrills and was only an invitation to return again in 1940, much against all advice of family and friends. The war clouds in Europe were darkening but this might be the only chance for several years—and it was.

This 1940 expedition was a memorable one. We covered much new territory such as in the states of Minas Geraes and Matto Grosso and retraced some of our 1939 grounds in Espirito Santo, Rio and São Paulo.

I will never forget the late afternoon in July, just at dusk, when I found fruiting capsules of *Amaryllis reticulata* var. *striatifolia*. The brilliant golden-orange inner walls of the wide open capsules contrasted sharply with the shining black globular seeds tied securely in the three sectional cells. As if that was not enough for any amaryllis to display, mother nature included in the bargain on the deep, dark, green leaves a central milk-white stripe as contrast to this splendid fruiting display. I said to myself as I started picking fruit and digging a few bulbs, "the flower will no doubt be an insignificant little affair, but because this 'last act' is so dramatic I'll take a few bulbs anyhow." I rather expected it to be a liliaceous plant rather than an amaryllid. The surprise I received when the first bulb flowered in our Orlando garden, was indeed a thrilling one, and the contrast of those round shining succulent black seeds in an orange setting to the four delicately reticulated pink and white flowers on each stem was far more than I had ever dreamed of. Pandora's Box surely held no greater surprises. There was still one more surprise coming, for I found that every seed which sprouted produced bulbs with those same striking striated leaves.

I found one other colony more than a hundred miles from that first collection, and here, too, all leaves were marked with the milk-white central line. And a few days later, miles from either of those two collections I found still another colony, but one having plain green leaves. Not one of these had a center stripe.

In southern Brazil I found *Habranthus robustus* growing among the plants of *Laelia pupurata alba* down near the sea on great granite boulders. Far out in Matto Grosso I held up a train (but not as a bandit) for several minutes while I dug up another *Habranthus* along the tracks. A few days later, nearer the Bolivian border, I found an *Amaryllis* species with the most perfectly shaped flower I have ever seen. I have its blood in a cross but my one and only surviving bulb is hovering between life and death, as yet unidentified botanically, but I still have hopes of its recovery.

It was on this same expedition that I first saw *Worsleya rayneri*, the striking blue amaryllid, growing in the rich humus filled crevices out on the sunny steep rocks of the Organ Mountains high above Rio. My collected plants did not live long in Florida.

An *Amaryllis* species, determined as new to science by Dr. Traub (see type description of *Amaryllis espiritensis* Traub, *sp. nov.* in section II of this issue); a variety of a recognized species (see description

of *Amaryllis organensis* var. *compressa* (Herb.) Traub, comb. nov. in section II of this issue) ; and *Amaryllis aulica,* were interesting additions to our collection as well as a few other species as yet unidentified.

Incidentally, I discovered one new piper, *Peperomia fosteri,* and about seventy-five new species of bromeliads in those two memorable years of collecting in Brazil. There still remains much of the material that has not yet been described.

Then came the second World War. For six years I stayed home and, among other occupations, worked with my vast collection, still discovering new species right here in my own garden from plants that bloomed long after I had gathered them in the jungles of South America. This is where I had an advantage over the average botanical collector. I brought the living plants back home, many of them without having first seen their flower or fruit, in fact, not more than ten percent of the amaryllids I collected were in flower when I first found them.

I still have at least twenty-five species of bromeliads and amaryllids, collected in Brazil in 1939-40 that have not yet flowered. A plant lover's explorations never cease nor does his interest ever die.

By the year 1946 the war clouds had blown over, at least that is what we thought then, so it was time for another trip, this one to Colombia, the Gateway to South America. One day in June we enjoyed breakfast in Palm Beach and a late lunch in Barranquilla, Colombia. It was the old magic carpet stuff which had been outdated by fast air travel. One really should spend a lifetime collecting in Brazil and then fold up into chrysalis form ready to emerge the very next day with another life time occupation studying and collecting in Colombia. This should give one an embryonic start to do a bit of plant collecting in some of the other South American countries while enjoying a few additional reincarnations as the same old "plant hound."

The scenery changes much more often and in much greater contrast in Colombia, thanks to the three great cordilleras of the Andes, than it does in Brazil where the mountains are older, but fewer and lower. When anyone asks the question "which country do you like best, Brazil or Colombia," I can only answer "Quien sabe?"

The famous French botanist Eduard André had a head start on me seventy years before. He was greatly interested in bromeliads and his fabulous collecting score was something like this; he collected about one hundred and two species of bromeliads in Colombia and about eighty-four of them were new species! That is an unbeatable record. (See PLANT LIFE 1: 33-39. 1945.) It's lots of fun, though, to follow the "top man." It either discourages you or sharpens your eye sight. We followed much of André's route and found a great majority of his species in addition to about fifty new species as well as many others that he did not collect. I do not know André's record on amaryllids and other families of plants, but I do know that his record in bromels was astonishing.

Here and there, between bromeliads and palms (about 8,000 palm seeds were collected for the Fairchild Tropical Garden in Coconut Grove), I found an *Eucharis* species, determined as new to science by

Dr. Traub (see type description of *Eucharis fosteri* Traub, sp. nov. in section II of this issue) ; the old species *Phaedranassa lehmannii,* and the low altitude *Bomarea* spp. *B. gloriosa* and *B. moritziana.* It seems that anywhere in the Colombian Andes, as soon as you reach nine to eleven thousand feet above sea level you are almost sure to find some of the showy, vining bomareas. They are lovely and colorful but they prefer the high, cool altitudes; they will rarely spend more than one winter in Florida and never a full length summer. This same dislike for Florida is held by the altromerias of Chile and Peru. So far, not one of them has been happy in my Florida garden. Unlike the Brazilian alstromerias they do not tolerate our summer rainy season. If the Pacific Coast plants ever do get any rain it is generally in the cool of the year.

I had several missions in mind for my 1948 trip and they were in such wide-spread locations that it was necessary to make this trip almost entirely by air. However, no matter what means of travel you use to reach any of the South American countries, when you start collecting plants in the wild, you immediately resort to the primitive ways of traveling.

While Puerto Rico was my first stop, I did little collecting outside of the Caribbean Rain Forest.

My next collecting stop was in Dutch Guiana and although I did not go any great distance into the interior I did find the beautiful *Amaryllis belladonna* var. *barbata.* It was refreshing to see the white counterpart of our common Florida door-yeard "equestre," which is the true *Amaryllis belladonna* L.

Unexpectedly I came upon an interesting area of shell mounds, (acres of fine shells very much like the finely broken coquina shells of the Florida East Coast) where I found an *Amaryllis* species, which Dr. Traub determined as new (see type description of *Amaryllis vanleestenii* Traub sp. nov. in section II of this issue). I found two interesting color phases of this species. In that country I added a few new bromeliad species to my "plant bag" and then I flew on to Brazil, that famous mecca for botanists.

After the northern states of Paraiba and Pernambuco in Brazil I flew on to Bahia. This state of Bahia with her old worn out granite mountains is still good collecting ground. Some interesting amaryllids were to be found there. An *Amaryllis* species, determined as new by Dr. Traub (see type description of *Amaryllis fosteri* Traub, sp. nov. in section II of this issue) is certainly a spectacular sight (Cover Design and Plate 5). With its six orchid shaped flowers topping a three to four foot scape this beautiful amaryllid is really a striking member of the family and I can assure you that it was thrilling to find it even though I wore a fine lot of blisters on my hands in digging these bulbs from tough unwilling soil in a semi-arid area.

Two *Habranthus* species taken in this area may prove of some interest when they flower this coming spring.

On this trip I collected still farther south in Brazil than I had done previously. This time I went on to the state of Santa Catharina

and not far from Blumenau I collected the beautiful little *Amaryllis blumenavia.* This is really a meadow flower as lovely as any species in the family. I brought back both bulbs and seeds and have had them bloom since my return. The seeds are semi-succulent, not as globular as those of *A. reticulata* var. *striatifolia,* but very different from the flat wafer seeds of the usual *Amaryllis* species. Several attempts have been made to grow *A. blumenavia* in this country and apparently with but little success. My experience has been that it desires much water in a loose rather spongy soil and it will thrive best on the shady side.

In Bolivia, not far from La Paz, when I found *Lepidopharynx deflexa,* it reminded me of *Sprekelia.* It is definitely more interesting than beautiful. A few other amaryllids from this high Andean country will have to wait for identification.

In Ecuador, Phaedranassas were numerous and in the high *paramo* regions I found a few very interesting bomareas, but as yet I have not been able to get any identifications. One in particular that I found at an elevation of 13,000 feet, south of Guenca, was a stiff upright plant and the leaves were not resupinate as they are in most of the species of *Bomarea* and *Alstroemeria.*

One *Stenomesson* was the only amaryllid I "bagged" in Peru but I spent very little time there on this trip. That land of the Incas is rich in amaryllids, yet so few of them are happy in Florida.

For several years to come, I hope, I will still look for bromeliads, and doubtless will continue to find a few amaryllids. Who knows? The time may come when I can no longer climb trees, possibly this will give me more time to examine the flora on the ground floor and I might even devote more time in looking for amaryllids, but until that time they will continue to be beautiful incidentals.

I. REGIONAL ACTIVITY AND EXHIBITIONS

EXHIBITION OF AMARYLLIS IN CLEVELAND

THOMAS R. MANLEY, *Horticulturist*
The Garden Center of Greater Cleveland

Amaryllis grown for varietal observation in the Valleevue *Amaryllis* Trials were exhibited to form three displays. Public response to the beauty and charm of this flower was beyond all expectations. Cleveland is *Amaryllis* conscious as a result of these displays and local sources selling the named Dutch Hybrids are swamped with requests to obtain certain varieties depending on the taste of the purchaser.

In planning the test garden Mr. Arnold M. Davis, Director of the Garden Center of Greater Cleveland, stated that "Once Clevelanders became aware of the beauty of these new giant flowered Dutch Hybrids, *Amaryllis* would be found in most flower loving homes." The displays plus the excellent educational program set up by Mr. Davis has acquainted the public with the culture of amaryllis. Newspaper articles, radio talks, and television demonstrations of potting and caring for amaryllis reached thousands. Garden Center staff members gave illustrated lectures to many garden clubs. Result, several garden clubs held *Amaryllis* shows while others held flower arrangement shows using amaryllis to perfection.

CLEVELAND HOME AND GARDEN SHOW

This show was visited by over 286,000. The *Amaryllis* were exhibited in a 1000 sq. ft. rectangular display (see Plate 3), featuring over 200 8" pots of named varieties of Dutch Hybrids and Species, *A. belladonna* L., *xA. johnsonii,* and *A striata.* Background material consisted of *Ilex opaca, Ilex crenata microphylla, Cahamaedaphne calyculata* and *Taxus cuspidata nana.* Bordering the planting were *Primula malacoides* and *Hedera helix baltica,* accenting plants consisting of *Clivia minata* and *Veltheimia viridiflora.* The display was divided into four sections each featuring varieties of the leading Dutch hybridizers: Ludwig, Warmenhoven, DeGraaff and one of Species and American Mead Hybrids. This display was by public opinion the feature display of the Show.

Not only did the *Amaryllis* increase in number of bloom open per scape during the show but those open at the beginning of the show remained open during the entire eight days. The photograph of the exhibits (Plate 3) was taken on the opening day of the show.

Plate 3

Amaryllis exhibits at the Cleveland Home and Garden Show, 1950.

CLEVELAND MUSEUM OF ART DISPLAY

One of the weekly feature displays in the court of the Cleveland Museum of Art was devoted to *Amaryllis*. Many plants were displayed among leafy ferns and oriental pottery and handicraft of the 12th century. Not only did the *Amaryllis* enhance these priceless museum pieces but gave a bizarre touch which met with public approval. Thousands viewed the displays each week, many paused to comment on the *Amaryllis* believing them to be a plant of yesterday, not the ultra modern flower of today. This display will be enlarged and repeated in 1950.

EASTER DISPLAY AT THE GARDEN CENTER OF GREATER CLEVELAND

Amid live rabbits and ducklings, the *Amaryllis* formed the background of the Garden Center Easter display. Attendances of 10,000 or more per day are common at Easter time and displays are superb in the Garden Center. Mrs. A. F. Burkett, Flower Arranger, and Miss Viola Briner, Educational Consultant of the Garden Center, planned and arranged many of the pots of *Amaryllis* in the Easter garden. Many arrangements by Mrs. Burkett featuring *Amaryllis* were on the tables and stands in the Garden Center. As a cut flower it holds well, and buds out of water remained fresh for days. Like the other displays, *Amaryllis* will be used next Easter and a number will be forced for Christmas.

HIGHLIGHTS OF 1950 GARDEN VISITS

PHILIP G. CORLISS, M. D., *Southwest Regional Vice-President, A. P. L. S., Somerton, Arizona*

During the past season my visits to growers of the amaryllids was chiefly limited to the southwest region, of which I am vice-president. My annual swing around the country was again pointed at growers of daylilies, so I feel that this report naturally falls into two parts:

AMARYLLIS IN THE SOUTHWEST

There seems to be a great increase in the interest of gardeners in the southwest in the *Amaryllis* family. This is naturally reflected in greater activity on the part of those commercial growers who list these bulbs and who hybridize them.

The spectacular *Sprekelia* always causes a sensation, whether blooming in the garden or when displayed at flower shows. It was effectively used in an arrangement with tall bearded iris at the 1950 Southern Iris Show. It does well in full sun on the Arizona desert and blooms better than when protected by some shade. In this respect it is like all others of its family which I have been growing in the southwest.

One of the most pleasant stops on my trips this year was at the Santa

Barbara garden of Mr. and Mrs. E. O. Orpet. They had a wealth of interesting material to show me, even though they were quite tired from spending the hot afternoon with an enthusiastic young customer.

At the fields of Mr. Hermon Brown, hybridizer of *Amaryllis* in Gilroy, California, I saw the last blooms of some of his interesting flowers.

In the warm valley behind the coastal mountains of the San Francisco Bay area, Mr. Frank Leach has extensive plantings of most of the principal varieties of *Alstroemeria.* I enjoyed a visit with him in the distinguished company of Professor Sidney Mitchell and his charming wife. The alstroemerias were at peak bloom.

I wonder how many of our members are familiar with the fabulous collection of flora to be found in the Arboretum of San Francisco's Golden Gate Park? I had a wonderful visit with Mr. Eric Walther, superintendent of the gardens, and spent several days studying and photographing the flowers which have been brought here from all parts of the world, and are planted in sections according to the continent of their origination.

Like that of San Francisco, the new "Arboretum" of Los Angeles County is really going to be a Botanical Garden. Mr. Quinn Buck is now on its staff, and I have had several pleasant contacts with him.

Dr. A. B. Stout lectured on *Hemerocallis* to the Southern California Institute of Horticulture early in September, and at that meeting I not only won a wonderful Rex Begonia on a raffle, but met many of our members who were in attendance.

DAYLILIES ACROSS THE COUNTRY

In the final tour to gather information for my forthcoming book on daylilies, I drove another seventeen thousand miles around the nation, visiting as many important daylily growers and gardens as possible. The annual meeting of The Hemerocallis Society in Cleveland was well attended by prominent daylily enthusiasts, and I was honored by being asked to show some of my Kodachromes at the annual banquet, sharing the program with Dr. Samuel Emsweller, the principal speaker of the meeting.

The following weekend I attended the luncheons and garden tours of the New England Regional meeting, where the Nesmith, Fraim, Knowlton, Howe, Merry, and Plouf gardens were visited. On the way to these meetings I saw the daylily bloom at Sarcoxie, Missouri (Gilbert Wild & Son), LaFontaine, Kansas (Hill-son), Bartlesville, Oklahoma (Rice and McKeithan gardens), Kansas City (Lenington garden), St. Louis, Mo. (Dill and Rudy gardens), and Columbus, Ohio (Stephan garden). On the return trip, I visited the David Hall, Elmer Claar, and Hubert Fischer gardens in Illinois, the Joseph Wood gardens in Yakima, Washington, and the California gardens of Professor Mitchell, Harold Johnson, and Carl Milliken.

The finest public planting of daylilies I have seen is in the Missouri Botanical Garden at St. Louis, where large clumps of the Stout daylilies are magnificently displayed with other perennials. The three runners-

up, in my opinion and experience, are at Swan Lake, South Carolina; Whitnall Park, near Milwaukee; and at the Waltham (Massachusetts) State Experimental Station.

As a result of my travels, I have concluded that form, size, and color have too often been emphasized by our hybridizers to the exclusion of recurrent bloom, ability to remain open in the evening, and to resist fading and wilting. Four varieties are available which are almost continuous bloomers in mild climates. These should be used as parents; and as they are different from one another, should produce many varieties of repeat bloomers. They are: Amur Valley (yellow); Constance (bicolor); Blanche Hooker (red); Oneita (rose).

I think the appearance of daylilies in the late afternoon is very important—can they hold their beauty through the day? If I cannot spend an entire day in a garden, I try to arrive at five in the afternoon, and return at ten o'clock in the evening, with flashlight, if necessary, to see whether they have closed or remained open. Regional performance varies greatly, and cannot be over-emphasized in evaluating daylilies.

EDITORIAL NOTE.—Daylily seeds offered. Our vice-president for the Southwest Region, Dr. Philip G. Corliss of Somerton, Arizona, has offered to give twenty seeds from crosses of the best new daylily hybrids for all NEW memberships which are sent to him. If you know someone who might be interested, tell Dr. Corliss what daylily characteristics are wanted in the parentage.

ORLANDO-WINTER PARK HEMEROCALLIS SHOW, 1950

WYNDHAM HAYWARD, *Florida*

The Mead Botanical Garden at Orlando-Winter Park, Fla., held its annual Hemerocallis Show on Sunday, May 21, 1950, with good attendance of daylily enthusiasts from all parts of the state.

Among the daylily breeders showing their creations at the Mead Gardens guest house were Ralph W. Wheeler of Winter Park, Mrs. Bright Taylor of Ocala, Wyndham Hayward, Winter Park, Mrs. Gerald Knight, Orlando, and a large selection of fine hybrids, many of them of Russell origin, were exhibited by Soper's Gardens, Orlando. Frank Vasku, Winter Park, showed unnamed seedling selections. The show is held on a non-competitive display basis.

Wheeler showed his own hybrids exclusively, with a number of named varieties, principally in the dark red and maroon tones, including one which attracted much attention, nearly midnight black in shade, named "Raven."

A newly introduced variety named PAULA WAGNER, with pleasingly compact flower and recurved petals, golden yellow in color, was shown by Wyndham Hayward as his latest novelty. It is named after the wife of the new president of Rollins College, Winter Park.

Wheeler showed 28 of his varieties, including BRACKEL, SCARLET

1950 Amaryllis Queen of New Orleans

Plate 4 (See bottom of opposite page for additional legend.)

SUNSET, ROYAL LADY, PAUL IHRIG, BACCHUS, MING TOY, DEMI-TASSE, VEGA, BERCEUSE, BOBOLINK, AMHERST, LADY FRANKLIN, MIRAGE, SHOW GIRL, PSYCHE, NARANJA, TARRYTOWN, SABRINA, BRANDYWINE, BALLET GIRL, BILLIE BURKE, MARTHA WASHINGTON, VICTORIA and GANYMEDE. The Knight group showed one of their named varieties, LENA TYSON.

In the Hayward collection were his own EMPEROR JONES, BABETTE, RAMONA, TAHITI BELLE, OLD ROSE, CLEO, MINNIE, ARABY, DELIA, CLARENCE, ANTOINETTE, ORLANDO, FLORIDA, IRENE, ZULU BOY, SALMON ROSE and E. W. YANDRE. Besides these he displayed choice flowers of several other prominent hybridizers, including Dr. A. B. Stout, Mrs. Thomas Nesmith, etc.

Mrs. Taylor's group, picked in Ocala, 80 miles away before the dawn and brought by motor to Winter Park in the early morning, included numerous examples of her interesting and showy new seedlings and some of her named varieties, as PENELOPE, H. HAROLD HUME, MAN O'WAR, SALLY O'NEAL, SHALIMAR, FLORIDA GOLD, PINK BOWKNOT, SPICE, SUNSET GLOW, SAN FRANCISCO, RUBAIYAT, PRIMA DONNA, etc.

One of the most remarkable flowers in the show was the giant lemon yellow MIDWEST STAR, of the Sass strain from Nebraska, in the Hayward collection.

NEW ORLEANS AMARYLLIS SHOW, 1950

MRS. W. D. MORTON, JR., *Pres. Garden Circle, New Orleans, La.*

The second Official Amaryllis Show, sponsored by the Garden Circle, was held on March 11th-12th, 1950. The lower floor of the Jewish Community Center, 5342 St. Charles Ave., was a mass of loveliness. Beautiful arrangements made by the Garden Clubs, and lovely specimens exhibited by individuals filled the rooms and spacious halls. Ribbons, Sweepstakes and APLS awards were given, and six accredited Judges had charge of the awards.

Miss Marilyn Favret, daughter of Mr. and Mrs. B. A. Favret, Jr., was crowned the 1950 Amaryllis Queen by Safety Commissioner Bernard J. McCloskey (Plate 4). Miss Rosemary Wingrave last year's Queen presented Miss Favret and her Court of maids. Miss Favret's Court included Miss Greta Le Blanc, Miss Joyce Gilthrope, Miss Annette Ruckstuhl, Miss Clementine Doskey, last year's Queen—Miss Rosemary Wingrave, Miss Betty Jane Keating, Miss Joan Harrison, Miss Elsie Blanchard and Miss Sue Maynard.

Plate 4. (See opposite page.) The queen of the New Orleans Amaryllis Show, 1950, Miss Marilyn Favret, center, is crowned by Safety Commissioner Bernard J. McCloskey at ceremonies at the Jewish Community Center. Others, from left, are (left side) Miss Greta Le Blanc, Miss Joyce Gilthrope, Miss Annette Ruckstuhl, Miss Clementine Doskey, last year's Queen—Miss Rosemary Wingrave; (right side) Miss Betty Jane Keating, Miss Joan Harrison, Miss Elsie Blanchard and Miss Sue Maynard.

Amaryllis fosteri Traub, *sp. nov.*

Plate 5

2. SPECIOLOGY

[EVOLUTION, DESCRIPTION, CLASSIFICATION AND PHYLOGENY]

NEW SOUTH AMERICAN AMARYLLIDS

HAMILTON P. TRAUB, *Maryland*

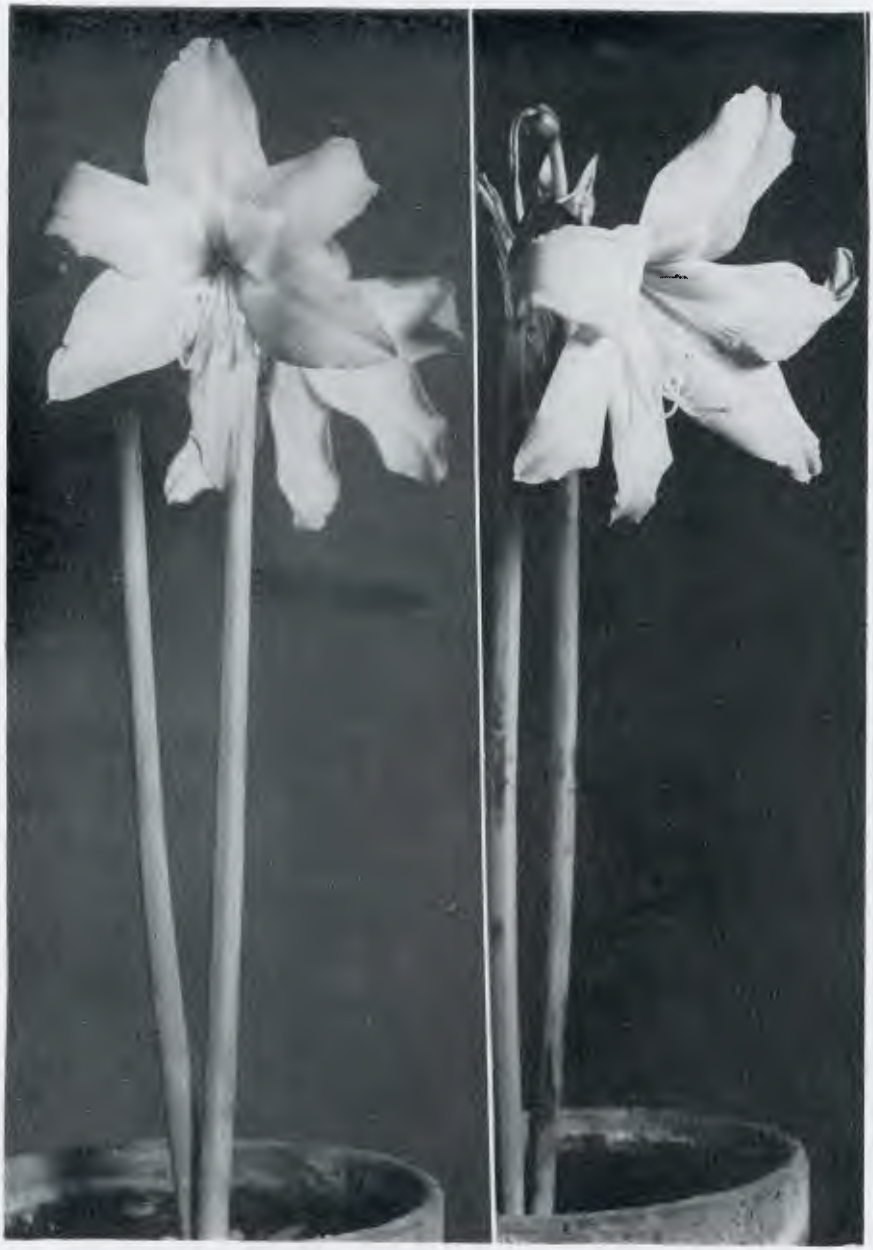
We are indebted to Mr. Mulford B. Foster, Mr. M. A. Carriker, Jr. (through Dr. Rodolphe M. de Schauensee), Dr. H. F. Winters, Dr. Harold N. Moldenke, and Dr. Ramón Ferreyra, for the amaryllids here described. Among these are included some very fine *Amaryllis* species for the breeder, and the first *Zephyranthes* species from Puerto Rico.

Amaryllis fosteri Traub, **sp. nov.**—Planta bulbosa; bulbo parvo; foliis 2-6, aestate post anthesim prolatis 31—37 cm. longis, longe oblanceolatis 2.2—3 cm. latis obtusis; scapo verno prolato, sub anthesis 50 cm. alto, sub fructu non elongato; spatha bivalvata, valvis lanceolatis 4.7 cm. longis; umbella 5-flora; pedicellis 3.2 cm. longis; ovario 1.1 cm. longo; segmentis tepalorum perigonii valde recurvatis; tubo tepalorum 1.5 cm. longo; paraperigonio fauces operto; segmentis tepalorum 8—8.5 cm. longis 1—1.6 cm. latis, angustis lineari-lanceolatis obtusis, rubellis, intus linea lactea ornatis; staminibus styloque fasciculatis valde exsertis; stigmate obscure 3-lobato.

DESCRIPTION.—Bulb small; leaves 2—6, produced after the flowers in summer, 31—37 cm. long, long-oblanceolate, 2.2—3 cm. wide, obtuse; scape produced in spring, 50 cm. tall at anthesis, not elongating in fruit; spathe 2-valved, valves lanceolate, 4.7 cm. long; umbel 5-flowered; pedicels 3.2 cm. long; ovary 1.1 cm. long; perigone with tepalsegs much recurved; tepaltube 1.5 cm. long; paraperigone closing in the throat; tepalsegs 8—8.5 cm. long, 1—1.6 cm. wide, narrow linear-lanceolate, blunt, shell pink (RHS, 516/1) with 5 mm. wide cream band in center; stamens and style fascisculate, very much exserted; stigma obscurely 3-lobed. Type: Traub nos. 101, 149 and 153, in the Traub Herbarium; type illustrations Plate 5; and Plant Life 6: Figs. 7 and 8. 1950.

RANGE.—Brasil; Bahia, near Amargosa, 305 m. (M. B. Foster, 1948), "in the caatinga along with the bromeliads and cacti in a wild, harsa section with acid soil."

NOTES.—On the basis of kodachromes furnished by Mr. Foster, this species was tentatively identified (PLANT LIFE 6:49-50. 1950) as *Amaryllis muesseriana* (L. Lind. et J. de Barr.) Traub & Uphof, in Herbertia 5: 129. 1938, *anglice;* (syn.—*Hippeastrum muesserianum* L. Lind. et J. de Barr., L'Illus. Hort. 43: 376, pl. LXXII. 1896, *nomen subnudum*), in the hope that this name could thus be validated. However, when L'Illus. Hort. illustration was compared with the living plant in flower, it was not possible to maintain the tentative identification due to the extreme difference in the width of the tepalsegs which are only 1—1.6 cm. wide in *Amaryllis fosteri.*



Amaryllis espiritensis Traub, *sp. nov.*

Plate 6

This very fine species has been appropriately named for Mr. Mulford B. Foster, the 1951 Herbert Medalist, who brought it back alive so that we may all enjoy it.

Fig. 1. *Amaryllis espiritensis* Traub, *sp. nov.*

Amaryllis espiritensis Traub, **sp. nov.**—Planta bulbosa; bulbo parvo; foliis usque ad 6 obovatis 15—22 cm. longis, 3—4.7 cm. latis, aestate productis; scapo hieme producto 30 cm. alto; spatha bivalvata, valvis lanceolatis usque ad 4 cm. longis; pedicellis 2.5 cm. longis; ovario 5 mm. longo; perigonio roseo, gula subviridi-albida; tubo tepalorum 3 cm.

longo; paraperigonio in gula fimbriis composito; segmentis tepalorum 7 cm. longis, 2.5—3.1 cm. latis lanceolatis; staminibus styloque faesciculatis declinato-adscendentibus; stigmate obscurissime 3-lobato.

DESCRIPTION.—Bulb small; leaves up to 6, obovate, 15—22 cm. long,

Fig. 2. *Amaryllis vanleestenii* Traub, *sp. nov.*

3—4.7 cm. wide, produced in summer; scape produced in winter, 30 cm. tall; spathe 2-valved, valves lanceolate, up to 4 cm. long; pedicels 2.5 cm. long, ovary 5 mm. long; perigone Porcelain Rose, (RHS Color Chart 620), greenish-whitish throat; tepaltube 3 cm. long; paraperigone of fimbriae at the throat; tepalsegs 7 cm. long, 2.5—3.1 cm. wide, lanceolate;

stamens and style fascisculate, declinate-ascending; stigma very obscurely 3-lobed. Type: Traub nos. 31 and 126, in the Traub Herbarium; type illustrations, Plate 6 and Fig. 1.

RANGE.—Brasil; Espirito Santo, near Santa Thereza, alt. 900 m., partial shade; Foster, Aug. 7, 1940.

NOTES.—This species was collected by Mr. Mulford B. Foster in 1940. It should be noted that this species is one of the parents of the outstanding hybrid, *xAmaryllis henryae* Traub, sp. nov., produced by Mrs. Mary G. Henry, which is described in the following section (see Fig. 22).

Amaryllis vanleestenii Traub, **sp. nov.**—Planta bulbosa; bulbo parvo 4 cm. diametro; foliis late obovatis 19—21 cm. longis, 4—4.8 cm. latis, ad apicem rotundatis, deorsum versus angustatis, post anthesim aestate productis; scapo 36 cm. alto, extremo hiemis vel initio veris producto; umbella biflora; spatha vivalvata, valvis anguste lanceolatis usque ad 5 cm. longis; pedicellis 2.5—3.5 cm. longis; ovario 1.2 cm. longo; tubo tepalorum 2.2 cm. longo; segmentis tepalorum lanceolato-acutis vel accuminatis 9 cm. longis, 2.9—3.4 cm. latis; paraperiginio in gula fimbriis composito; staminibus styloque segmentis tepalorum brevioribus; stigmate obscurissime 3-lobato, lobis globosis minus quam 1 mm. longis.

DESCRIPTION.—Bulb small, 4 cm. in diam.; leaves 2, broadly obovate, 19—21 cm. long, 4—4.8 cm. broad, rounded at apex, narrowed below; produced after the flowers in summer; scape 36 cm. tall, produced in late winter or early spring; umbel 2-flowered; spathe 2-valved, valves narrow-lanceolate, up to 5 cm. long; pedicels 2.5—3.5 cm. long; ovary 1.2 cm. long; perigone scarlet (RHS Color Chart 19/1), whitish-yellow throat, tepaltube 2.2 cm. long; tepalsegs lanceolate-acute or pointed, 9 cm. long, 2.9—3.4 cm. wide; paraperigone of fimbriae at the throat; stamens and style shorter than the tepalsegs; stigma very obscurely 3-lobed, lobes less than 1 mm. long, globose. Type: Traub no. 165, in Traub Herbarium; type illustration, Fig. 2.

RANGE.—Surinam; near Paramaribo; in shell mounds, in full sun; alt. about 25 ft.; Foster, Oct. 3, 1948.

NOTES.—Collected by Mr. Mulford B. Foster in Surinam in 1946. At the suggestion of Mr. Foster this species has been named for Mr. H. N. Van Leesten, of Paramaribo, who assisted Mr. Foster considerably in all of his collecting in Surinam.

Amaryllis viridorchida Traub, **sp. nov.**—Planta bulbosa; bulbo globoso 8 cm. diametro 6 cm. alto; collo 4—4.5 cm. diametro 6 cm. longo; radicibus crassis 6.5 mm. diametro; foliis usque ad 9 sempervivis oblanceolatis 41—51 cm. longis, supra medium 3.5—4.5 cm. latis, attenuato-acutis; pedunculo usque ad 30 cm. alto; spatha bivalvata, valvis 8.5 cm. longis; umbella biflora; pedicellis 3.5—4 cm. longis; ovario 1.7—2 cm. longo subtriangulari; tubo tepalorum 1.9 cm. longo; paraperigonio fauces operto; segmentis tepalorum secus costam profunde viridibus, adversus margines diluto-viridibus, oblanceolatis 6—7.5 cm. longis, 1.6-2.4 cm. latis; staminibus declinato-adscendentibus, eorum longissimis paullo exsertis; stylo exserto; stigmate trifido, lobis ca. 2 mm. longis.

DESCRIPTION. — GREEN ORCHID-FLOWERING AMARYLLIS. Bulb globose, 8 cm. in diam., 6 cm. long, tapering into a neck, 4 x 4.5 cm. in diam., 6 cm. long; roots thick, up to 6.5 mm. in diam., some growing on the surface of the ground; leaves up to 9, evergreen, oblanceolate, 41—51 cm. long, 1.8 cm. wide at the base, 3.5—4.5 cm. wide above the middle, tapering to an acute point; peduncle dull green, slightly tinged reddish at the base, hollow, somewhat flattened, edges rounded, up to 30 cm. tall, 1.4 x 2.1 cm. at the base, tapering to 0.7—1.2 cm. at the

Fig. 3. *Amaryllis viridorchida* Traub, *sp. nov.*

apex; spathe 2-valved, valves green, 1.9—2 cm. wide at the base, 8.5 cm. long, apexes acute, edges infolded after anthesis; umbel 2-flowered; pedicels green, 3.5—4 cm. long; ovary green, 1.7—2 cm. long, triangular with rounded edges; ovules many per locule; perigone green in general aspect, any other coloration is barely perceptible except on very close inspection; tepaltube green, 1.9 cm. long, 9 mm. in diam. at the base, 1.4 cm. at the apex, triangular with rounded edges; tepalsegs of four different lengths, darker green in mid-rib region, becoming lighter green

toward the edges; sepsegs oblanceolate, 7—7.5 cm. long, 1.6—1.8 cm. wide where widest, connivent, cuspidate at apex, very slightly light brownish on the outer upper part of keel; petsegs oblanceolate, 6—7 cm. long, 1.6—2.4 cm. wide where widest, entirely green, recurved; paraperigone (corona) closing in the throat, whitish-green, 3—4 mm. long, membranous, margins undulate; stamens, 2 in one, 4 in the other flower, aborted; the longest of the 2 or 4 fertile ones exserted about 1 cm., of four sets of lengths, declinate-ascending; anthers about 2 cm. long, 3 mm. wide, before pollen is shed, whitish with deep bluish line on narrow edges of anther; pollen yellowish-greenish; style exserted; stigma trifid, very light pinkish; capsule and seeds unknown. Type: Traub nos. 182 and 183, in the Traub Herbarium; type illustration, Fig. 3.

Fig. 4. *Amaryllis oconequensis* Traub, *sp. nov.*

RANGE.—Brasil; State of Rio de Janeiro, slopes of Serra dos Orgaos

NOTES.—Collected by Dr. Harold N. Moldenke, (no. 19611) Sept. 17, 1948, on the slopes of Serra dos Orgaos, State of Rio de Janeiro.

The flowers open very slowly, and last for several days. They seem to mimic a green orchid, with sepsegs connivent and petsegs recurved [see Fig. 3]. This species should be a very valuable addition to the *Amaryllis* breeding collection.

Amaryllis oconequensis Traub, **sp. nov.**—Planta bulbosa; bulbo globoso-subuplano, collo brevi; foliis sempervivis usque ad 8, usque ad 20 cm. longis, 5.3—5.6 cm. latis, oblanceolatis acutis; scapo sub anthesi 9 cm. alto, sub fructu usque ad 24 cm. elongato; umbella 4-flora; spatha

Amaryllis organensis var. *compressa* (Herb.) Traub, *comb. nov.*
Plate 7

bivalvata, valvis 5 cm. longis; pedicellis 1.2—6.5 cm. longis; ovario 1.7 cm. longo; tubo tepalorum viridi subtriangulari 2 cm. longo; paraperigonio viridi 2 mm. longo, setis filiformibus fauces opertis; segmentis tepalorum oblanceolato-acutis 11—12.5 cm. longis, 2.5—5 cm. latis, intus rubris, parte inferiore rubello-brunnea, parte superiore extus rubra, faucibus astro flavido-subviridi notatis; staminibus styloque exsertis fasciculatis declinato-adscendentibus; stigmate subtriangulari, lobis globosis.

DESCRIPTION.—Plant evergreen, bulb globose-flattish, with a short neck, the globose part 7.7 x 8.7 cm. in diam., neck 4.3 cm. long, 3.9 x 4.4 cm. in diam.; leaves sheathing below, up to 8, up to 20 cm. long, 2.4—2.8 cm. wide at the base, 5.3—5.6 cm. wide at widest area above middle, oblanceolate, acute, but final point is rounded; scape 9 cm. tall, flattish with rounded edges, 1.5 x 2.4 cm. at the base, 1 x 1.7 cm. at the apex, elongating to 24 cm. in fruit; umbel 4-flowered; spathe 2-valved, whitish, valves about 2.2 cm. wide at the base, 5 cm. long, acuminate pointed; bracteoles 4, whitish, similar to spathe-valves but much smaller; pedicels variable in length, 1.2—6.5 cm. long; ovary 6-ribbed, 1.7 cm. long, 1.2 cm. in diam.; perigone bilaterally symmetrical, about 10.5 cm. long with tepalseg tips horizontal or slightly reflexed, 10.6 cm. across face, light yellowish-green star in throat, near Sap Green (RHS Chart 62/1), the upper portion Delft Rose (RHS o20/1), tepaltube green, 2 cm. long, 8 mm. at base, 1.1 cm. at apex, triangularish; paraperigone green, 2 mm. long, with filiform bristles, closing in the throat; tepalsegs oblanceolate-acute, 11—12.5 cm. long, 2.5—5 cm. wide, red on inside; lower portion reddish-brownish, upper portion red on outside; yellowish-greenish star in the throat; stamens and style exserted, fascisculate, declinate-ascending; style exserted; stigma triangularish, lobes globose. Type: Traub nos. 184 to 188, incl., in the Traub Herbarium; type illustration: Fig. 4.

RANGE.—Southeastern Peru; Oconeque, Prov. Puno, Eastern Cordillera.

NOTES.—Collected by Mr. M. A. Carriker, Jr., between May 22—June 5, 1931, at Oconeque, Puno, Peru. According to Dr. R. M. de Schauensee, "Oconeque is a village situated at an altitude of 8,000 ft., on the Eastern Cordillera. The plant could have been collected either above or below this altitude for Oconeque is situated in a deep valley." The plant was sent by the collector to Dr. de Schauensee, Vice-Pres., The Academy of Natural Sciences, Phila., who sent it to the writer for identification.

Amaryllis organensis var. **compressa** (Herb.) Traub, **comb. nov.**, syn.—*Hippeastrum organense* var. *compressum* Herb., Bot. Reg. Lond. 28: misc. 39. 1842. According to Herbert (1842) this appears among Gardner's specimens of *Amaryllis psittacina* to which it approximates in color but *A. psittacina* has a strong screen (corona) and the upper tepalseg is depressed.

Mr. Mulford B. Foster again collected this plant in the Organ Mountains, Brasil, in 1940. It flowered for Mrs. Mary G. Henry in early January, 1950, under greenhouse culture, who contributed the illustration (Plate 7).

Eucharis fosteri Traub, **sp. nov.**—Planta bulbosa; bulbo parvo, viis vegetabilibus rapide augmento; foliis usque ad 5; petiolo 7—10 cm. longo; lamina late elliptica 13 cm. longa, 6—6.5 cm. lata; scapo usque ad 29 cm. alto; umbella 8-flora; pedicellis 1.5—3 cm. longis; ovario 4 mm. longo; tubo tepalorum 1.8 cm. longo, dimidio inferiore viridi, dimidio superiore albo; segmentis tepalorum albis lanceolatis usque ad oblongis 1.6 cm. longis, 6—8 mm. latis; staminibus albis, quam segementis tepalorum dimidio brevioribus, ad basim vix vel non connatis; antheris versatilibus subalbidis; stylo albo, limbum perianthii expansum circiter aequanti; stigmate albo trifido, lobis globosis 1 mm. longis.

Description.—Bulb small, increasing rapidly by offsets; leaves about 5, 20—23 cm. long; petiole 7—10 cm. long, 4—5 mm. wide, blade broadly-elliptic, 13 cm. long, 6—6.5 cm. broad; scape 27—29 cm. tall; spathe valves lanceolate; umbel 8-flowered, flowers somewhat pendulous; pedicels 1.5—3 cm. long, 1.5 mm. wide; ovary 4 mm. long, 3-celled; tepaltube 1.8 cm. long, green in lower half, white in upper half, 2 mm. at the base, 6 mm. at the apex; tepalsegs oblong to lanceolate, white; perigone-limb 2.6 cm. wide; sepsegs lanceolate, 1.6 cm. long, 6 mm. wide; petsegs oblong, 1.6 cm. long, 8 mm. wide; stamens white, half as long as the tepalsegs, barely if at all united at the base; anthers 5 mm. long, versatile, whitish, pollen whitish; style white, about as long as the expanded limb; stigma white, trifid, lobes globose, 1 mm. long. Type: Traub no. 17, in the Traub Herbarium.

Range.—Colombia; Valle de Cauca; above Cali on road to Buenaventura; in moist shade; alt. 2,000 ft., Foster, Dec. 5, 1946.

Notes.—Collected by Mr. Mulford B. Foster in 1946.

Stenomesson peruvianum Traub, **sp. nov.**—Herba bulbosa; bulba 3 x 2.8 cm., collo 4.5 x 1 cm.; foliis ignotis; pedunculo usque ad 29 cm. alto; umbella plerumque 5-flora; floribus rectis; spatha 2-valvata, valvis lanceolatis usque ad 3.5 cm. longis; bracteolis parvioribus; pedicellis rectis usque ad 4 cm. longis, vulgo aliquantulum parvioribus, inter se longitudine variis; ovario 5—6 mm. longo; perigonio rubro 3—3.5 cm. longo; tubo tepalorum 1.6—2.3 com. longo, in parte inferiore gracili, e medio sursum aprupte dilatato; segmentis tepalorum lanceolato-acutis 1.4—1.5 x 5—7 mm.; poculo staminorum 7 mm. longo, dento uno acuto 2 mm. longo inter filamenta posito; staminibus segmentis tepalorum subaequilongis; stylo paulo exserto; stigmata capitato. Exemplum typicum: Ferreyra 3777, in herbario Traubii access. no. 145.

Description.—Bulb almost round, 3 x 2.8 cm. with neck 4.5 x 1 cm.; leaves unknown (not present on type specimen), apparently produced after the flowers; peduncle slender, up to 29 cm. tall; umbel usually 5-flowered; flowers upright; spathe 2-valved, valves lanceolate, 8—10 mm. at the base, up to 3.5 cm. long; bracteoles smaller; pedicels upright, variable in length, up to 4 cm. long, usually somewhat shorter; ovary 5—6 mm. long; perigone red, 3—3.8 cm. long; tepaltube 1.6—2.3 cm. long, slender in lower half, suddenly dilated from the middle upwards; tepalsegs lanceolate-acute, 1.4—1.5 cm. long. 5—7 mm. broad; staminal cup 7 mm. long, with a single pointed tooth, 2 mm. long, be-

tween the filaments (the tooth is microscopically irregularly notched, which can be seen only under the low power microscope); filaments filiform, 6 mm. long; stamens 8 mm. long, versatile, attached at the middle; stamens about as long as the tepalsegs, style slightly exserted; stigma capitate, rounded. Type: Ferreyra no. 3777; accession no. 145 in Traub Herbarium.

RANGE.—Peru; between Tarma and Oroya, Dept. of Junin; stony habitat; alt. 3300—3400 m., June 29, 1948 (Ferreyra no. 3777).

Fig. 4a. *Zephyranthes puertoricensis* Traub, *sp. nov.*

Zephyranthes puertoricensis Traub, **sp. nov.** Planta bulbosa; bulbo mediocriter magno; foliis linearibus 30—34 cm. longis, 7—9 mm. latis, versus basim apicemque usque ad 4 mm. angustatis; pedunculo sub anthesi 9 cm. alto, post anthesim usque ad 10.7 cm. elongato; umbella uniflora; spatha 2.5—3 cm. longa, dimidio inferiore in tubo connato, ad apicem bifida; ovario 4 mm. longo; pedicello sub anthesi 3.5 cm. longo, post anthesim usque ad 4.5 cm. elongato; perigonio albo, gula subviridi; tubo tepalorum 3 mm. longo; segmentis tepalorum 2-seriatis oblanceolatis 3.8—4 cm. longis, 1.5 et 1.8 cm. latis, segmentis sepalorum quam segmentis petalorum amplioribus; staminibus 2-seriatis 1.3 et 2 cm.

longis; stylo 2.9 cm. longo; stigmate trifido, lobis filiformibus 3 mm. longis; capsula ca. 1 x 7 cm. 3-loculata; seminibus 4 x 6 mm. nigris non alatis.

DESCRIPTION.—PUERTO RICAN ZEPHYRANTHES. Bulb medium sized to large for the genus; leaves linear, 30—34 cm. long, 7—9 mm. wide, narrowed to 4 mm. toward the base and apex; peduncle 9 cm. tall at anthesis, elongating to 10.7 cm in fruit; umbel 1-flowered; spathe 2.5—3 cm. long, united into a tube in lower half, apex bifid; pedicel 3.5 cm. long at anthesis, elongating to 4.5 cm. in fruit; ovary 4 mm. long; perigone white, greenish in throat; tepaltube 3 mm. long; tepalsegs of two different sizes; 3.8—4 cm. long, 1.5—1.8 cm. wide, sepsegs larger than petsegs; stamens of two different lengths, 1.3 and 2 cm. long; style 2.9 cm. long; stigma trifid, lobes filiform, 3 mm. long; capsule about 1 x .7 cm., 3-celled; seeds 4 x 6 mm., black, not winged. Type: Traub no. 151, in the Traub Herbarium; type illustration, Fig. 4a.

RANGE.—Puerto Rico; northwestern corner of the Island.

NOTES.—Collected by Dr. H. F. Winters, of the Federal Experiment Station, Mayaquez, Puerto Rico, several years ago in northwestern Puerto Rico, and sent to the writer for identification in 1949. It is fine species, the first ever described from Puerto Rico, and belongs to the group with filiform stigmatic lobes. It is moderately self-fertile, and can be rapidly increased from seeds.

LOUISIANA'S ST. JOSEPH LILY—xAMARYLLIS JOHNSONII

WYNDHAM HAYWARD, *Florida*

Common in the lower South, especially in Louisiana, where it is even found in flower beds of the State Capitol Grounds, the bulb known popularly as St. Joseph's Lily (Fig. 5) provides one of the puzzles of American horticulture. Like *Lycoris radiata* and *Lycoris aurea,* found in parts of the South, the origin of the plantings of this bulb is lost in the mysterious goings and comings of plants during the colonial period.

This bulb is usually defined botanically as *xAmaryllis johnsonii,* and said to be the first hybrid *Amaryllis.* Dean William Herbert says in his "Amaryllidaceae," page 142, of *xA. johnsonii* that it was first raised by one Johnson, "who had a small garden in Lancashire in 1810," as a cross between the species *A. reginae* and *A. vittata.* Herbert, a great botanist and the greatest amaryllid authority of the first half of the 19th Century, should know his business. He was writing only 27 years after the date he cites.

Herbert also states that he produced the same hybrid at Mitcham in 1811, and at Highclere later, presumably places where he maintained gardens during his ecclesiastical career. He indicates that the bulb is represented by the plate in Redouté's "Liliacées," entitled *A. braziliensis.* Just how Redouté, the court flower painter to the Empress Josephine, could have given the name *A. braziliensis* to *Amaryllis xJohnsonii* is not clear.

Arthington Worsley in his writings on William Herbert in the 1937 Herbertia, (Vol. 4) page 20, shows that Highclere was the estate of Dean Herbert's father, Henry Herbert, the first Earl of Carnarvon, of whom William Herbert was the third son. Worsley also states, in explaining influences which early gave William Herbert his interest in Amaryllids, that "the Geneva Botanic Gardens (A. DC. Pl. Rar. Hort. Genev. t.9) named as *A. carnarvonia* a garden form of *Amaryllis,* near *A. reginae,* but thought to be a hybrid." Herbert cites the name *Amaryllis carnarvoni* (De Candolle) as a synonym of *A. johnsonii,* mentioning that the name *carnarvoni* was improper "since the name *John-*

Fig. 5. *xAmaryllis johnsonii* Johnson ex Herb.

sonii had been previously published in the Hort. Trans., and was in general use."

Herbert also makes this additional statement, which we give for what it is worth: "Johnson's cross was probably accidental, for he thought it a mule between *Vittatum* and *Sprekelia formosissima,* and it passed for such during several years."

Worsley also has something to say about *xA. johnsonii* on page 23 of Herbertia, vol. 4, when writing of Mrs. Bury's famous illustrated work on "Hexandrian Plants." He remarks, "among her illustrations is the alleged hybrid *Hippeastrum Johnsonii.* 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." Worsley says Mrs. Bury figured "the original plant, *the Johnsonii,* given by the original Johnson himself to Edward Faulkner of Liverpool, guaranteed by the giver to be the original *Johnsonii* and drawn by Mrs. Bury herself. One feels inclined to ask 'If this is not Johnsonii, what is?' But the alleged parentage of this plant is guess work, and very bad at that."

There is an illustration of *xAmaryllis johnsonii* in Dr. Henry Nehrling's German monograph "Die Amaryllis," 1909. It has wider open type flowers than the common type (Fig. 5) found in Louisiana and neighboring states. Possibly the Louisiana form is a sixth or seventh generation seedling of the original *johnsonii.* Or it may be a good species by itself, which has been long thought to be a hybrid by some classic error.

The plant sets seeds, and by that means we may solve the problem. It has almost lost the power to seed, however, and seldom does this without hand pollenization. In the South it is universally propagated and distributed by offsets, the bulbs being divided from time to time.

Actually it is a slow grower, and prefers heavier types of soils than the usual sandy loams of Central Florida, which may explain its scarcity in that area. In Louisiana and Mississippi it is often found in old gardens in rather heavy clayish types of soil and thrives there, growing to twice the size it will make in Florida. It also must have a steady moisture supply to do well, and multiply. It thrives without attention in Louisiana just as *Amaryllis belladonna* Linn., does in the thinner sandy loams of central Florida.

The scapes are dark colored, reddish-glaucous, and the flowers usually four to the umbel. A large bulb will have two scapes. It grows well in pots, several to a large pot, in a heavy mixture, although seldom seen thus. A striking sight is a clump of a dozen or two in full bloom in a street-side garden, the bulbs growing so close they touch each other. It is one of the sights of the Lower South in springtime.

Just how the bulb came to have its name of St. Joseph's Lily is not understood at this time, so far as the writer knows. Some plant detective with a systematic bent can earn a new pair of spurs by looking up all the old and recent plates and printed descriptions of *xA. johnsonii* and its synonyms to see what can be learned as to its real identity.

[Traub—AMARYLLID NOTES, continued from page 43.]

sensis Traub.

Genus *Zephyranthes* Herb., Sect. **Parandranthes** Traub, sect. nov.; filaments deltoid, slightly united near the base.

Filamenta deltoidea prope basim parum connata. Typus: *Zephyranthes albicans* (Herb.) Baker

Eucharis bonplandii (Kunth) Traub, **comb. nov.**; syn.—*Hymenocallis bonplandii* Kunth, Enum. Pl. 5: 666. 1850.

Amaryllis bagnoldii (Herb.) Dietr. var. minor (Speg.) Traub, **comb. nov.**; syn.—*Hippeastrum bagnoldii* var. *minor* Speg., in Anal. Mus. Buenos Aires, Ser. II. 7: 170-171. 1902.

AMARYLLID NOTES

HAMILTON P. TRAUB, *Maryland*

Genus **MOLDENKEA** Traub, **gen. nov.** (*Amaryllidaceae*). Rhizoma bulbosa. Folia sessiles. Scapus nudus. Umbella biflora. Spatha bivalva. Ovarium petaloideum. Flores horizontales. Perigonium tubuloso-infundibulare. Tubus sepalorum (in typo 3.8 cm. longus) angustissimus trigonus basim versus leviter arcuatus incurvatusque limbo perigonii 6-partito brevior (segmentis tepalorum in typo 7.6 cm. longis). Stamina 6 erecta limbo perigonii breviores. Stylus staminaque aequilonga. Stigma minutum obscure 3-lobatum. Typus: **Moldenkea lateritia** (Dietr.) Traub, **comb. nov.** (syn.—*Amaryllis lateritia* Dietr., Allg. Gartenz. *18*: 65—66. 1850; Plant Life *6*: 60. 1950.)

Rootstock bulbous; leaves sessile; scape leafless; umbel 2-flowered; spathe 2-valved; ovary petioled; flowers horizontal; perigone tubular-funnel-shaped; *tepaltube* (3.8 cm. long in type), *very narrow, three-sided,* slightly arched and incurved toward the apex; *shorter than the 6-parted perigone limb;* style as long as the stamens, stigma minute, obscurely 3-lobed.

This new genus which apparently belongs in the Tribe *Cyrtantheae* is named in honor of Dr. Harold N. Moldenke, Curator & Administrator of the Herbarium, The New York Botanical Garden, in recognition of his valuable contributions toward the advancement of the amaryllids.

Genus **SANMARTINA** Traub, **gen. nov.** (*Amaryllidaceae*). Planta glabra perennis; bulbo tunicato, in collum subaequilongum attenuato; foliis linearibus planis ad apicem rotundatis, marginibus albis hyalinis microscopice irregulariterque dentatis; pedunculo nudo; umbella circiter 10-flora; spatha ad basim breviter tubulosa, superne bifida; tubo tepalorum apicem versus subattenuato quam limbo infundibuliformi perigonii paullo minus dimidio breviore; segmentis tepalorum 6; staminibus in fauce tubi tepalorum affixis liberis 3 aequalibus vel subaequalibus brevioribus, 3 etiam aequalibus vel subaequalibus longioribus; filamentis rectis, ad basim complanatis, sursum attenuatis, prope apicem filiformibus; stigmate trifido. Typus: **Sanmartina marginata** (R. E. Fries) Traub, **comb. nov.** (syn.—*Hippeastrum marginatum* R. E. Fries, Act. Soc. Upsal. ser. 4, 1(1) : 161, pl. 9, figs. 3 & 4. 1905.).

Glabrous perennial plant with tunicated bulb, attenuated into a neck about as long as the bulb; leaves linear, flat, rounded at the apex, with white hyaline margins which are miscroscopically irregularly dentate; peduncle leafless; umbel about 10-flowered; spathe shortly tubular at the base, bifid above; tepaltube slightly longer than half the length of the funnel-shaped perigone limb of 6 tepalsegs, tepaltube attenuated slightly toward the apex; stamens attached at the throat of the tepaltube, free, three equal or subequal, shorter than the other three which are also equal or subequal; filaments straight, flattened at the base, attenuated upwards, becoming filiform near the apex; stigma trifid.

This genus, native to the Argentine, is appropriately named in honor of the great South American Liberator, San Martin.

This new genus is apparently intermediate between the genus *Zephyranthes* Herb. and *Eustephia* Cav. The straight stamens of two equal to subequal lengths rule it out of *Amaryllis* L., where it was originally placed by R. E. Fries in 1905, and where it was tentatively retained by Traub and Moldenke, Tribe Amaryll. p. 94. 1949.

Habranthus reedii Traub, **nom. nov.** (syn.—*Zephyranthes mendocensis* Baker, Amaryll. 36. 1888; *Habranthus mendocensis* (Baker) Sealy, in Jour. Roy. Hort. Soc. lxii: 208. 1937, non *Habranthus mendocinus* R. Phil., 1862.)

Habranthus tubispathus (L'Herit.) Traub, **comb. nov.** (syn.—*Amaryllis tubispatha* L'Herit., Sert. Angl. 9. 1788, non Ker-Gawl.; *Habranthus robustus* Herb. ex Lodd., Cat. 18: pl. 1761. 1831.)

Habranthus viridiluteus (Kraenzl.) Traub, **comb. nov.** (syn.—*Zephyranthes viridilutea* Kraenzl., in Fedde, Repert, *13*: 118. 1914.)

Habranthus argentinus Traub, **nom. nov.** (syn.—*Zephyranthes lilacina* Speg., in Physis *2*: 40. 1917, non Liebm. 1844.)

Habranthus jujuyensis (Holmb.) Traub, **comb. nov.** (syn.—*Zephyranthes jujuyensis* Holmb., in Anal. Mus. Buenos Aires, Ser. III. *4*: 523. 1905.)

Habranthus holmbergii (Hicken) Traub, **comb. nov.** (syn. *Hippeastrum Holmbergii* Hicken, in Anal. Soc. Ci. Argent. *55*: 235—236, fig. on page 236. 1903.)

Zephyranthes aurantiaca (Lem.) Traub, **comb. nov.** (syn.—*Pyrolirion aurantiacum* Lemaire, in Jardin Fl. pl. 317. 1854; Uphof, Herbertia *13*: 82—83. 1947.)

Zephyranthes smallii (Alexander) Traub, **comb. nov.**, (syn. *Cooperia smallii* Alexander in Addisonia *21*: 1—8, pl. 676. 1939.)

Zephyranthes jonesii (Cory) Traub, **comb. nov.**, (syn.—*Cooperia jonesii* Cory, in Field & Laboratory *18*: 43—46. 1950.)

Zephyranthes brazosensis Traub, **nom. nov.**, (syn.—*Cooperia drummondii* Herb., in Bot. Reg. Lond. pl. 1835. 1836.)

Zephyranthes brasiliensis (Traub) Traub, comb. nov., (syn.—*Cooperia brasiliensis* Traub, in Herbertia *12(1945)*: 38—40. 1947.)

Zephyranthes kansensis (Stevens) Traub, **comb. nov.**, (syn.—*Cooperia kanensis* Stevens, in Trans. Kansas Acad. Sci. *40*: 95, 96, pl. 1, figs. 1—4. 1938.)

Zephyranthes andina (R. E. Fries) Traub, **comb. nov.**, (syn.—*Haylockia andina* R. E. Fries, Act. Soc. Sci. Upsal. 4, *1*: 160—161, figs. 1 & 2. 1905.)

Habranthus unifolius (Arech.) Traub, **comb. nov.**, (syn.—*Zephyranthes* unifolia Arech., in Anal. Mus. Montevideo *2*: 290. 1900, in adnot.)

Zephyranthes pseudocrocus (Solms-Laubach) Traub, **comb. nov.**, (syn.—*Haylockia pseudocrocus* Solms-Laubach, in Bot. Zeit. *65*: 135—136. 1907.)

Tribe *Zephyranthese* (Pax) Hutchinson, subtribe **Zephyranthinae** Traub, **subtr. nov.**; perigone-limb radially symmetrical; stamens subequal

or of 2 different lengths; stamens and style erect, suberect or horizontal; tepalsegs subsimilar.

Limbus perigonii radialiter symmetricus; stamina subaequales vel biseriata; stamina stylusque erecta vel suberecta vel horizontales; segmenta tepalorum subsimiles. Genus typicus: *Zephyranthes* Herb.

Tribe *Zephyrantheae* (Pax) Hutchinson, subtribe **Habranthinae** Traub, subtr. nov.; perigone-limb bilaterally symmetrical; tepalsegs of 4 different sizes; style and stamens fasciculate, decinate-ascending; stamens of 4 sets of lengths.

Limbus perigonii bilateraliter symmetricus; segmenta tepalorus 4-seriata; stylus staminaque fasciculata declinato-adscendentes; stamina 4-seriata. Genus typicus: *Habranthus* Herb.

Genus *Zephyranthes* Herb., subgenus Haylockia (Herb.) Traub, **subg. nov.** (Syn.—Genus *Haylockia* Herb., Bot. Reg Lond. *16*: pl. 1371. 1830. Type: *Zephyranthes pusilla* Dietr.)

Genus *Zephyranthes* Herb., subgenus Cooperia (Herb.) Traub, **subg. nov.** (Syn.—Genus *Cooperia* Herb., Bot. Reg. Lond. pl. 1835. 1836. Type: *Zephyranthes brazosensis* Traub.)

Genus *Zephyranthes* Herb., Sect. Atamasco (Adanson ex Greene) Traub, **Sect. nov.**, (Syn.—Genus *Atamasco* Adanson ex Greene. Type: *Zephyranthes atamasco* (L.) Herb.)

Genus *Zephyranthes* Herb., Sect. **Eupyrolirion** Traub, **sect. nov.**; stamens subequal; style straight; peduncle longer than the neck of the bulb.

Stamina subaequales; stylus rectus; pedunculus collo bulbi longior. Typus: *Zephyranthes tubiflora* (L'Hérit.) Schinz

Genus *Zephyranthes* Herb., Sect. **Brachylirion** Traub, **sect. nov.**; stamens subequal; style straight; peduncle included in the neck of the bulb.

Stamina subaequales; stylus rectus; pedunculus in collo bulbi inclusus. Typus: *Zephyranthes pseudocolchicum* Kraenzl.

Genus *Zephyranthes* Herb., Sect. **Tristemanthes** Traub, **sect. nov.**; perigone erect or suberect; style variously curved; functional stamens 3, erect-spreading.

Perigonium erectum vel suberectum; stylus multimodis curvatus; stamina pollinifera 3 erecto-patentes. Typus: *Zephyranthes minima* Herb.

Genus *Zephyranthes* Herb., Sect. **Sibonaya** Traub, **sect. nov.**; stamens of 2 sets of lengths; perigone and style horizontal.

Stamina biseriata; perigonium stylusque horizontales. Typus: *Zephyranthes bifolia* (Aublet) Roem.

Genus *Zephyranthes* Herb., Sect. Eucooperia Traub, **sect. nov.**; filaments not united near the base.

Filamenta prope basim non connata. Typus: *Zephyranthes brazo-*

[Traub—AMARYLLID NOTES, continued on page 40.]

Brunsvigia radulosa Herb., summer rainfall form with leaves contemporaneous with the inflorescence, collected near Carolina, Eastern Transvaal. Photo by G. W. Reynolds.

Plate 8

A REVIEW OF THE GENUS **BRUNSVIGIA** HEIST.

R. A. DYER

[CONTINUED FROM PAGE 83, PLANT LIFE, VOL. 6, 1950, HERBERTIA EDITION.]

The first part of this review, including the introduction and the description of nine species of *Brunsvigia*, was published in PLANT LIFE (HERBERTIA EDITION) *6*: 63—83, 1950. The review is concluded in this second part with the description of eight additional species of *Brunsvigia*, nos. 10 to 17, inclusive.

10. B. RADULOSA *Herb.* Amaryllid. 281 (1937). *B. burchelliana* Herb. Amaryllid. t. 22, fig. 2 (1837). *B. cooperi* Baker in Fl. Cap. 6: 207 (1896) in part, not of Saund. Ref. Bot. 5: t. 330 (1872).

Description:—[Plate 8 and Fig. 6] *Bulb* underground, with short neck, up to 10 cm. tall and 6-10 cm. in diam. with a hard cartilaginous tunic and sometimes (plants from Karoo) with linear cartilaginous bristle-like strips persisting on the sides of the neck. *Leaves* 4-6, absent or present at time of flowering (depending on environment) spreading on ground, developing up to 25-50 cm. long and 10-20 cm. broad, thick and tough, with asperities on upper or both surfaces, very rarely smooth, margin scabrous. *Peduncle* red-brown or green with pink tinge, compressed, 30-50 cm. tall, 2.5-3.5 cm. broad. *Spathe-valves* ovate-lanceolate or ovate, 5-7 cm. long. *Umbel* 30-60-flowered. *Pedicels* reddish-green or reddish-brown, somewhat glacous, 20-30 cm. long, 6-10 mm. thick near the base, tapered above, obscurely 3-angled or slightly 6-ribbed. *Perianth* red or pink, fairly regular in shape, 4.5-5.5 cm. long, with tube 2.5-5 mm. long; lobes oblong-lanceolate, 1-1.5 cm. broad. *Stamens* declinate about equal to perianth in length; the filaments attached in the throat of the perianth tube, slightly shouldered towards base; anthers 1-1.2 cm. long. *Style* becoming slightly longer than the stamens. *Ovary* acutely 3-angled, 1.5-4 cm. long, 1-1.75 cm. broad; capsule up to about 4 cm. broad.

Distribution:—The type locality is near Colesburg in the Orange Free State. Specimens are included from Bechuanaland, the central Karoo of the Cape and O.F.S., Basutoland, Natal and Transvaal. It is the only species—and a variable one—from the Great Karoo.

Notes:—Herbert, in 1837, based the 2 names *B. radulosa* and *B. burchelliana* on one and the same leaf specimen collected by Burchell, 2703, near Hondeblats River in the Colesburg division. From the leaf character alone it would have been impossible to identify other plants with it with certainty, but in view of the fact that only one species is recognised from the Karoo area where Burchell collected his plant, there is some justification for not discarding the name. The fact that Baker adopted the name *radulosa* in preference to *burchelliana* in Fl. Cap. 1896, is reason enough for it to be followed here. It is a pity, though, that a distinct species bears such a similar name as *B. radula* which may cause some confusion.

Specimens collected in the same area by Cooper were first identified by Baker as *B. radulosa* and were only later reidentified by him as *B. cooperi.* This was an incorrect identification in Miss Leighton's and my opinion and the name *C. cooperi* has been placed in the synonomy of *B. orientalis.* In addition, I am assuming that other specimens from the central area cited by Baker under *B. gigantea* (*B. orientalis*) and *B.*

Fig. 6. ***Brunsvigia radulosa*** Herb. Lower left, bulb cut to expose cartilaginous thickening of leaf bases; and upper left, the dry persistent bristle-like strips; collected by L. Meyer from Fauresmith, somewhat north of the Burchell type locality. Right, showing cartilaginous cover of bulb and the persistent bristles of the old leaf bases; plant collected by Dr. Henrici near Jagersfontein in the Orange Free State, some miles north of the Burchell type locality. Photo by H. King.

josephinae are also conspecific with the Burchell specimen named *B. radulosa.* I have gone further and have included plants from Bechuanaland, Transvaal and Natal.

These plants seem to hold together in a natural group, but at the same time show a fairly wide range in time of leaf production, in their

surface and also in the size and shade of flower. Out of this assemblage one could quite conceivably have sorted out a number of specimens and given them specific rank, but this would not for long have successfully masked our ignorance.

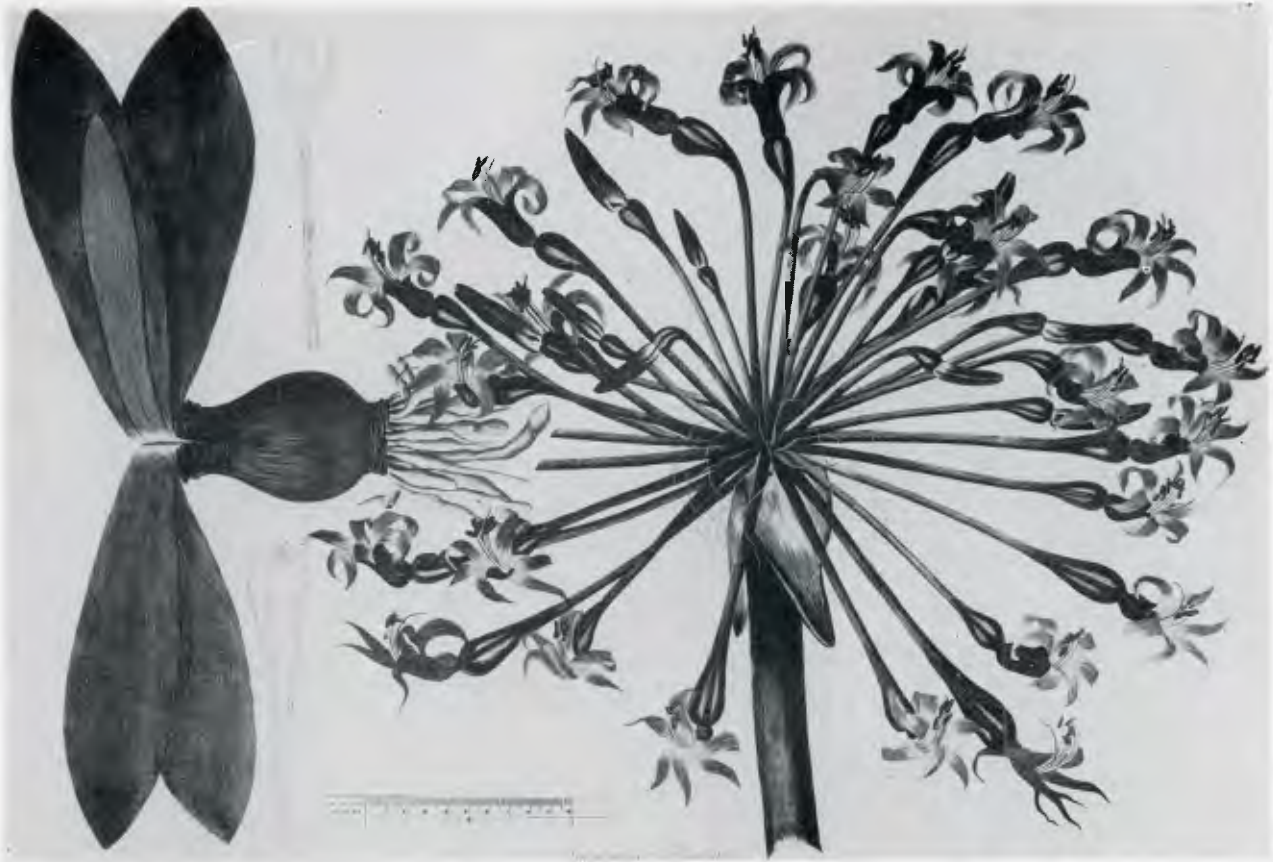
In the Orange Free State with low and late summer rainfall the leaves are absent at the time of flowering, whereas in Natal, with medium rainfall, they are produced with the inflorescence (the peduncle arising outside the new leaves). This difference in time of leaf production is probably due to habitat conditions and is referred to in the introductory notes on the genus.

Some specimens have the leaves rough-granular on both surfaces, others are rough on the upper surface alone, but very rarely smooth on both surfaces. There are many other variations; for instance, concerning specimens from the neighbourhood of Fauresmith in the Orange Free State, a collector recorded: "I am sending you today another *Brunsvigia*. The bracts are quite different from all I have seen up to now. In this plant they are red and fleshy, not pink or membranous. The colour of the perianth is more red than the previous specimens."

Several other similar examples of variation could be cited.

11. B. ORIENTALIS *(L.) Ait* ex *Eckl.* Trop. Verz. 7 (1827); Leighton in Journ. S.A. Bot. 14: 83 (1948); Dyer, PLANT LIFE 6: 63-65, Fig. 10. 1950; *Amaryllis orientalis* L. Sp. Pl. 293 (1753); Jacq. Hort Schoenbr. 1: 38, t. 74 (1797); *Brunsvigia* Heist. Monogr. 1753 and 1755; *Haemanthus orientalis* Thunb. Prod. 1: 59 (1794); Fl. Cap. ed. Schult. 298 (1823); *Brunsvigia multiflora* Ait. Hort. Kew ed. 2, 2: 230 (1811); Gawl. in Bot. Mag. t. 1619 (1814) excl. syn.; Herb. Amaryll 280 t.36 fig. 1 (1837); *Brunsvigia gigantea* Heist. ex Schult. f. Syst. 7: 844 (1830); Baker Handb. Amaryllid. 98 (1888); Fl. Cap. 6: 206 (1896) Marloth Flora S.Afr. 4: 123 (1915); *Coburgia multiflora* Herb. in Bot. Mag. sub. t 2213 (1820); *Brunsvigia cooperi* Baker in Saund. Refugium Bot. t 330 (1872) in part; Fl. Cap. 6: 207 (1896) in part, excl. specimens.

Description:—[Plate 9; see also PLANT LIFE, vol. 6, 1950, Fig. 10.] *Bulb* oval or subglobose, subterranean, with a short neck, up to 10-15 cm. tall and broad, covered with a dense membranous tunic. *Leaves*, absent at time of flowering, 2-6, spreading flat on ground, 30-45 cm. long, 7-12 cm. broad, rarely up to 19 cm., obtuse, thickish, with very short pubescence on upper surface, velvety when fresh, sometimes becoming slightly roughish on drying, closely veined. *Peduncle* red-green, 30-50 cm. tall, compressed, 2-3 cm. broad. *Spathe-valves* 2, deltoid, 10 cm. long. *Umbel* 20-40-flowered, rarely up to 80-flowered, spreading into a spherical head in large plants. *Pedicels* 10-20 cm. long, about 7 mm. in diameter near the base, tapering slightly to apex, strongly 6-ribbed, strengthening in fruit. *Perianth* bright red or pink, 5.5-7 cm. long, recurved from the 5 mm. long tube; lobes linear-lanceolate, 5-6.5 cm. long, and about 8-9 mm. broad, recurving towards apex. *Stamens* shorter than the perianth, and filaments inserted in the throat of the perianth tube; anthers dark red, oblong, about 8 mm. long, versatile. *Style* finally slightly longer than the filaments. *Ovary* 3-angled, 2-3 cm. long, 1.5-2



Brunsvigia orientalis (L.) Ait. ex Eckl., reproduced from Jacquin (1797), a typical example of the type of species of the genus. Photo by H. King. (See also PLANT LIFE, vol. 6, 1950, Fig. 10).

Plate 9

cm. broad; *capsule* prominently 3-angled, 4.5-9 cm. long and up to 3 cm. across the angles.

Distribution:—No exact locality for type: Cape Province; western area, including Divisions of Cape Peninsula, Malmesbury, Caledon, Stellenbosch, Robertson, Swellendam and Riversdale, in sandy soil.

Notes:—The original description by Linnaeus does not get us very far. It reads *spatha multiflora corollis inaequalibus foliis linguiformibus* and is supported by a few references to previous literature. There is little doubt that Linnaeus took his specific epithet from the phrase of Swert: *Narcissus indicus orientalis,* which is accompanied by an illustration of a bulb in leaf. Swert's Florilegium was published in 1611-12, forty years before van Riebeeck landed at the Cape to establish a "refreshment centre" for vessels of the Dutch East India Company on their way to and from the East Indies.

There is only one species of *Brunsvigia* recorded from the Cape Peninsula and consensus of opinion identifies it with *Amaryllis orientalis* L. 1753. In 1753 also, Heister described a plant in detail under the generic name *Brunsvigia,* but gave no specific epithet and it was only in 1830 that the epithet *gigantea* was added, and it persisted in use for over 100 years. Here again consensus of opinion has it that Linnaeus and Heister were dealing with the same species, and according to the Rules of Nomenclature, *orientalis* has priority. Jacquin's figure and description of *Amaryllis orientalis* 1797, seem to confirm the identity of the plant fairly soundly with the Cape Peninsula species.

But there is one peculiar feature of previous descriptions of *B. orientalis.* The leaves are usually described as glabrous. It is well recognised now that the Cape Peninsula plant has velvety leaves when fresh. Professor R. H. Compton writes:

"*B. orientalis,* the Cape Peninsula species, with velvety leaves, normally has the bulbs completely (or almost so) below the surface of the sandy ground in which it grows, and the leaves spread out flat on the surface."

The leaves may be slightly roughish on the upper surface when dry.

There has been quite a degree of confusion at various times between the names *B. orientalis* and *B. josephinae,* perhaps because of the general similarity in the irregular flowers, but there are marked differences in detail and the bulbs and leaves are also very different. It seems that Baker included citations in the Flora Capensis, 1896, to not less than 2 distinct species under the name *B. gigantea* (=*B. orientalis*) and 3 under *B. josephinae.* The specimen collected by Shaw in the central eastern Cape and cited by Baker under *B. gigantea* is probably specifically equal to specimens cited by him under *B. cooperi.* His type of *B. cooperi* is probably also equal to *B. orientalis.*

The name *B. cooperi* is based on Ref. Bot. t. 330 (1872), the inflorescence of which shows no distinguishing features from *B. orientalis,* nor does the description indicate any distinction. The leaves, which would not have been present with the infloresence are described as granular on the face. This could apply to the dry leaves of *B. orientalis,*

although perhaps better to *B. radulosa.* Cooper, who collected mainly in the eastern Cape and Orange Free State, where *B. orientalis* is absent, is given as the collector, but it was a number of years later than the original description that Baker actually cited Cooper numbers under the name. (Previously, he had named them *B. radulosa* Herb.) They do not, however, agree with the type illustration, and the name *B. cooperi* must be regarded as a synonym of *B. orientalis.* The plants named *B. cooperi* by Baker in the Flora Capensis thus require a new name. By taking a liberal outlook we may fall back on *B. radulosa* Herb., which was Baker's identification of *Cooper* 881, before he identified it with his *B. cooperi.*

In view of my difficulty as regards the identity of Baker's *B. cooperi,* I feel it pertinent to quote a letter preserved in the Kew herbarium, written in 1902 by Mr. A. Worsley to Mr. Elwes:

"Dear Mr. Elwes,

B. cooperi or *gigantea?*

"Perhaps this may be only one sp. certainly Baker's descriptions would place them very close together. You will see that he only makes *cooperi* differ from *gigantea* in having 12 to 16 flowers in place of 20 to 30; in having prostrate leaves, granulated and scabrous edged; and in *not* having exserted stamens. I have examined as many as a dozen different bulbs of my *cooperi* in flower at once, and altogether quite 40 different specimens, so that I did not judge by one individual plant. (These were directly imported from the wilds). I found an average of 19 flowers to the umbel (ex. 10 to 28), the leaves 4 to 6, prostrate, scabrous edged and surface granulated. The stamens = limb of perianth.

In all these respects my plants fell in with Baker's *cooperi.* Certainly they had rather more flowers, but this generally happens in cultivated plants.

If now the Kew authorities expand *B. gigantea* to include my plants I cannot see how they leave anything of *B. cooperi.*

Perhaps they are right. In any case Mr. Baker is the one responsible for the existence of *cooperi* as a Sp. I have seen the plate in Ref. Bot. 330 but will see it again to clear up any doubts, and will write you again about it.

I wish those who make new sps. would state in their descriptions in what respects they differ from the older sps! I always do this, but the plan does not commend itself to most writers, evidently."

[Sgd.] *Worsley.*

"From a horticultural point of view, *B. cooperi* as sent to Kew is very distinct in bulb, leaf and habit from *B. gigantea* or *josephinae.*"

[Sgd.] *H. J. Elwes.*
(ISLEWORTH, 4/10/2.)

To cite another example of probable confusion of species, one may refer to *B. gigantea* as interpreted by Marloth in his Flora 1915. His description fits mainly *B. orientalis,* but contains elements of *B. josephinae* and the photo reproduced in his fig. 34c, gives the impression that it was growing mainly above ground as in *B. josephinae.* He adds an interesting note referring to *B. orientalis.* "When the seeds are

ripe, the umbel becomes detached and is easily rolled over the veld by the wind, like a St. Catherine's wheel, dropping the seeds here and there in its course. As this takes place during the winter the seeds are able to germinate the same season [winter rainfall area], in fact not rarely they do so even before they are liberated from the capsules. The young plantlets have thus ample time to store water and food materials in the newly formed bulb before the dry season arrives, and then to pass the first summer safely in a dormant state." (the words in brackets are mine, R. A. D.)

Fig 7. *Brunsvigia grandiflora* Lindl., type illustration, Bot. Reg. pl. 1335. Photo by H. King.

Writing about the leaves of *B. orientalis,* Miss Leighton stated that they persist throughout the winter and die down in summer.

12. B. GRANDIFLORA *Lindl.* Bot. Reg. 16:t.1335 (1830); Baker in Fl. Cap. 6:205 (1896) in part. *Amaryllis banksiana* Lindl. in Bot. Reg. 28:t.11 (1842). *A. slateriana* Herb. ex Lindl. Bot. Reg. 30: 76 (1844).

Brunsvigia slateriana Benth. Gen. Plant. 3:727 (1883). *B. banksiana* (Lindl.) Th. Dur. et Schinz. Consp. Fl. Afr. 5:253 (1893). *? Amaryllis grandiflora* var. *banksiana* Herb. Amaryll. 279. t. 32. f. 2 (1837). *? Brunsvigia sphaerocarpa* Baker in Fl. Cap. 6: 207 (1896).

Fig. 8. *Brunsvigia grandiflora* Lindl. (syn.—*Amaryllis banksiana* Lindl., Bot. Reg. 28: pl. 11. 1842). Photo by H. King.

Description:—[Figs. 7 and 8; Plates 10 and 11, left] (from Lindl. Bot. Reg.) *Bulb* oval, with no neck. *Leaves* lingulate, pale green, falcate, flat, erect, roughish at the margin. *Scape* ascending, compressed, some-

what glaucous, a foot and a half high (45 cm.). *Umbel* spreading with about 30 flowers. *Spathe-valves* 2, membranous, pale brown, acuminate. *Pedicels* tapering. *Perianth* 6-parted, nearly equally spreading, segments flesh-coloured, linear-oblong, wavy, bluntish, somewhat recurved; the inner the broadest; stamens inserted into the throat, declinate, rather shorter than the perianth. *Stamens* with subulate filaments. *Style* filiform, declinate, stigma small, obscurely 3-lobed, papillose. *Ovary* 3-celled, with numerous fleshy distichous ovules.

According to the view held this description may be amplified by saying: *Bulb* subterranean 8-20 cm. long, 6-14 cm. diam. with a thick membranous tunic. *Leaves* produced about the same time as the scape, ascending, 20-45 cm. long, 2.5-4.5 cm. broad, somewhat glaucous, flat or somewhat undulate and slightly twisted in the apical third. *Pedicels* about 15-25 cm. long. *Perianth* light to dark pink, 5-7 cm. long; tube 7-8 mm. long; lobes about 12 mm. broad. *Ovary* obtusely 3-angled; capsule scarcely angled.

Distribution:—It was recorded of the type specimen—"This noble addition to the genus *Brunsvigia* was sent us in August 1829, by Mr. Tate, of Sloane St., to whom we have on former occasions had to express our obligations for favours of the same description. It is no doubt a native of the Cape of Good Hope." ? Eastern Cape Province from Uitenhage and Alexandria divisions eastwards into Natal.

Notes:—In dealing with *B. grandiflora* and its allies *B. banksiana* (= *B. slateriana*), and *B. sphaerocarpa,* one is again in a quandary. The figure of *B. grandiflora* is matched among a group of plants with their centre of distribution in the eastern Cape Province where the plants are apparently rather scattered generally. Within the group there is a wide range in the size and colour shade of the perianths, yet no reliable characters for specific distinction have so far been noted. That there are specific distinctions within the group is fairly certain. There are at least three types of leaf which seem too different for normal specific variation, but more important than this, there are at least 2 types of bulb. One might be persuaded that the differences in the leaves are not specific, but in the case of the bulbs the differences seem more fundamental.

The two types of bulb are illustrated in figures Plate 11, left; and Plate 11, right. In Plate 11, left, the bulb is underground and covered with a tunic of membranous leaf bases, while in Plate 11, right, the bulb is mainly above ground and the tunic is partly cartilaginous hardened.

If all herbarium material were complete, one would have a fair foundation to work on, but in spite of a wealth of herbarium material, the specimens collected earlier than 1948 are generally lacking in information on the character of the bulbs, and in many instances the leaves also are absent or immature. In these circumstances the application of the old names is largely guesswork. On the other hand the position would not necessarily be improved by ignoring all the old names and establishing new ones.

While the name *B. grandiflora* has been retained, there is little

Brunsvigia sphaerocarpa Baker, type specimen, which is probably equal to *B. grandiflora* Lindl. Photo by H. King.

Plate 10

Left, *Brunsvigia grandiflora* Lindl., a form from Eastern Cape Province, Story no. 3456. Right, *B. sp. nov.* (No. 13 in text), closely allied to *B. grandiflora*, but the bulb is largely above ground. Photos by H. King.

Plate 11

reason to uphold *B. banksiana* which was based on Bot. Reg. 28: t. 11 (1842) (= *B. slateriana*) (our Fig. 8). It was said at the time to be very near *B. grandiflora,* but that the shorter (peduncles) pedicels seemed to distinguish it satisfactorily, independently of the different colour (dark pink) and the expansion of the flowers. It is now felt that the known variability of species would readily account for the differences mentioned.

The record of *Amaryllis grandiflora* var. *banksiana* Herb., is so vague that it is not worth discussing whether or not it represents the same plant as described later under the name *B. banksiana.*

A herbarium specimen, which matches the type figure of *B. grandiflora* closely, is Alice Pegler 398, collected in February 1901 in the Kentani district. Other closely allied plants from near East London were collected by Galpin 6553, 7813. It is guessed that they had underground bulbs covered by membranous tunics.

Specimens from further west in Alexandria, Albany and Uitenhage districts, collected by Galpin, Story and Holland, have the mature leaves undulate in the apical ⅓ (not flat) and sometimes with a spiral twist. Yet no specific difference has been detected in the flowers from the two areas.

At one time it was considered possible to exclude *B. sphaerocarpa* from the present conception of *B. grandiflora,* but the similarity of the inadequate type material of the former to the latter makes it impossible in the present state of our knowledge. A photograph of one of the type number sheets of *B. sphaerocarpa* (Tyson 1268 from near Mt. Currie at 6,000 ft.) is reproduced, Plate 10. Baker's original description runs on the following lines:

Leaves ligulate, obtuse, smooth, glabrous, 30 cm. long, up to 7.5 cm. broad, margin entire; *Pedicels* 20-25 cm. long; *Perianth* bright red, 6.5-7 cm. long, with a short tube and lanceolate segments about 6 mm. broad; stamens as long as the perianth segments; anthers oblong, 4 mm. long; ovary subglobose, 12-18 cm. in diameter, not at all acutely angled.

I do not find a record on the label of the type of the bright red colour of the flowers which Baker mentions, but Tyson collected a "white variety" of his 1268 under his No. 1711. The colour is relatively unimportant, but Baker's placing of the species in the key next to species with prostrate leaves was misleading. There is little doubt that the leaves are normally ascending.

But the story of *B. sphaerocarpa* is not complete. A study of the *Brunsvigia* population in the type locality of Mt. Currie might reveal hitherto unrecorded distinctive characters, such as the bulb being mainly above ground and covered by a somewhat cartilaginous thickened tunic. This would be sufficient to restore it to specific status.

13. B. sp. [Plate 11, right]. Specimens with bulbs mainly above ground and the bulbs with a somewhat cartilaginous tunic and flowers like those of *B. grandiflora* and *B. sphaerocarpa* have been collected in the King William's Town and Tarkastad districts. An example is shown in Plate 11, right, as mentioned before. The following collector's note

received through Mr. Everitt of Queenstown is of interest.

"We are 10 miles from Hogsback—altitude 5,500 ft. The bulbs grow from Rockford (the name of the farm) right through to within 10 miles of Cathcart. They are to be found in the open veld and also on the sides of the river bank and on the cliffs. The bulb does grow above ground level and the leaves are always undulated until they die off in June. The flowers vary in colour from a pale pink. Under cultivation the colourings seem to be much richer in shade."

A very similar plant has also been recorded from further west in the Somerset East district but specific epithets have not been applied to these pending a more thorough investigation of *B. sphaerocarpa.*

14. B. UNDULATA *Leighton* in Fl. Pl. S. Afr. 14: t. 552 (1934).

Description:—*Bulb* up to about 12 cm. tall and 7-8 cm. in diam.; the neck of old leaf bases rising slightly above ground level. *Leaves* arising with the inflorescence, about 15, up to 50 cm. long, 4-10 cm. broad, distichous, lorate, green, shining, glaucous, with undulate margins. *Peduncle* slightly compressed, 4-5.5 x 2-2.5 cm. broad, 30-45 cm. tall, glaucous, spathe-valves reddish, oblong, 9.5 cm. long, 5 cm. broad. *Umbel* 35-80 flowered. *Pedicels* up to about 30 cm. long, 7-8 mm. thick near the base, tapering above, with 6 ribs, glaucous. *Perianth* claret-coloured, 4.5-5.5 cm. long, united into a tube for 5-7 mm. at the base, lobes recurved; the three outer with few glandular hairs within apex, 5-7 mm. broad; inner lobes 6-9 mm. broad. *Filaments* red, inserted in the perianth tube, about equalling the perianth. *Ovary* green, inconspicuously triangular, 1.5 cm. long, 8-10 mm. diam. *Style* red, slightly shorter than the stamens.

Distribution:—Natal: type locality near Pietermaritzburg. Occasional in the mountainous grassveld of central Natal.

Notes:—In view of the near relationship of this species to *B. grandiflora* Lindl. and *B. sphaerocarpa* Baker, I shall quote from the author's remarks at the time of describing the species.

"Unlike other members of the genus, *B. undulata* Leighton, together with its ally, another Natal species, *B. sphaerocarpa,* has fully developed undulate leaves at the time of flowering and the number of leaves is larger than is usually the case. Our species differs from *B. sphaerocarpa* in the size and set of the flowers; the segments of the latter being longer and narrower and considerably recurved. The umbel in *B. undulata* is somewhat semi-globose, instead of the more usual globose form, and the ascending pedicels are remiscent of *Nerine* rather than *Brunsvigia.* The seep ruby-color of the flower, too, is unusual in the genus."

A large specimen collected near Nottingham Road by Mrs. J. L. Smith had an umbel with 80 flowers. Specimens from the Estcourt district collected by J. Acocks showed considerable variability in the leaves. The margin varied from slightly undulate to markedly crisped.

15. B. JOSEPHINAE (*Red.*) *Gawl.* in Bot. Reg. sub tt. 192-193 (1817); Baker in Fl. Cap. 6:205 (1896) in part. *Amaryllis gigantea* van Marum.

Brunsvigia josephinae (Red.) Ker-Gawl., habit of bulbs in a kloof near Worcester. Photo by H. King.

Plate 12

in Nat. Verh. Bat. Maats. Weetens. 3, 1: 345 (1805); Gard. Chron. 103:60 (1938). *Amaryllis josephinae* Red. Lit. 7. tt. 370-372 (1813). *Brunsvigia josephinae* var. *augustifolia* Gawl. in Bot. Reg. t. 192-3 (1817). *Coburgia josephinae* Herb. in Trans. Hort. Soc. 4:181 (1822). *Brunsvigia josephinae* var. *josephine* Herb. in Bot. Mag. 52: t. 2578 (1825). *Amaryllis josephiniana* and var. *griffiniana* Herb. Amaryll. 278 (1837). *Brunsvigia gigantea* (van Marum) Traub, in Herbertia 5: 132-5 (1938), non Heist. ex Schult. (1830).

Fig. 9. *Brunsvigia josephinae* (Red.) Ker-Gawl., type of the species from Redoute (1813). Photo by H. King.

Description:—[Fig. 9, and Fig. 10, left; and Plate 12]. Bulb exposed mostly above ground, oval, often without a distinct neck in the wild state, up to 30 cm. long and 20 cm. diam., with a dense covering of membranous tunics. *Leaves* (absent at time of flowering) 8-20, suberect, oblong, the largest up to 90 cm. long and 5-20 cm. broad, the younger inner ones smaller, glaucous, glabrous, smooth, entire, thick, closely veined, sometimes slightly undulate towards the tip, curved. *Peduncle* compressed usually up to about 45 cm. tall but even up to 90 cm., 2.5-5 cm. broad. *Spathe-valves* 2, tinged with red, 15 cm. long, keeled, drying as flowers develop. *Umbel* with 20-30 flowers or occasionally with up to 50 or 60 and the larger ones with flowers spreading almost into a full

circle with a diameter of nearly 1 m. *Pedicels* reddish-violet, 25 cm. long and up to 30-40 cm. on maturity, 1.25 cm. thick near the base and narrowing gradually to the ovary, 6-ribbed when fresh and 3-angled when dry. *Perianth* red with dull yellowish-orange on the outer surface towards the tube, 7-9 cm. long, with a subcylindric tube 1 cm. long but with the margins of the lobes free slightly further to the base; outer lobes linear-lanceolate, 11-12 mm. broad near the base; inner lobes linear, acuminate, 9-10 mm. broad, spreading and recurving towards apex to variable degree, 3 upper lobes often strongly recurved. *Stamens* shorter than the perianth with the bases of the filaments united to the perianth into a tube for 1 cm.; anthers oblong, violet-purple before dehiscence, 1.5-2 cm. long. *Style* finally slightly longer than the filaments. *Ovary* oblong or turbinate, not strongly angled, 2-2.5 cm. long, 1.25-1.5 cm. broad; capsule membranous, not strongly angled, up to 4 cm. long and 2.5 cm. broad across the angles, often splitting irregularly on dehiscence.

Distribution:—No exact locality for the type specimen: Worcester, Swellendam hills, Laingsburg, Uniondale, Somerset East.

Notes:—Redonté gives the original habitat of the bulb as the interior of Africa and this may be taken to mean inland from the Cape Peninsula.

It would be expected that with Redonté's magnificent figure and full description it would not be difficult to associate it correctly with plants now to be found in the wild state. While the flowers are matched closely the bulb is drawn rather diagramatically. Plants from Worcester district agree with the Redonté inflorescence in all its magnificence, but the bulbs are largely exposed above ground and have a thick covering of old leaf tunics. It seems probable, however, that these would have been removed from the bulb imported to Holland and their absence from Redonté's illustration should not be given too much weight.

Gawler established the variety *B. josephinae* var. *augustifolia* for a plant figured in Bot. Reg. 1817, based on the narrower leaves, but judged on the Worcester plants I agree with Mr. Griffin, the grower, that it is likely to be as much a question of age as any permanent distinction. The author gave the locality of the variety as Hantam district which is near Calvinia and not many miles north of Worcester. Herbert saw fit to alter the varietal name to *Griffiniana*.

Backhouse, writing of Amaryllids early in April 1840, while travelling from Piquetberg to Worcester, stated: "among them the beautiful *Brunsvigia josephinae*, called Marsbloem, March flower, with a large spreading head of deep crimson, lily-like flowers, was in blossom in some heathy places. The bulbs of some of these plants are almost as large as a child's head."

Professor Compton reported that the *Brunsvigia* in the kloofs at Worcester identified by Mrs. Isaac (Miss Leighton) as *B. josephinae*, has a very large bulb with great numbers of bifarious old tunics and the bulbs are often half or less embedded in soil. This, he says, is the case also with the same species from near van Rhynsdorp, where the plants grow on a steep surface of large shale fragments and often expose at least ¾ of the bulbs.

Mr. van Breda, Officer in Charge, Veld Reserve, Worcester, wrote on 11/6/48:

"You ask whether it is usual for the peduncle to remain attached to the bulb in the case of the large *Brunsvigia.* I have carefully noted this and can safely say that it is most unusual and that in most cases the peduncle is broken off at the base by the wind and blown away. However, it appears that if the plant grows in a place protected from the wind the peduncle comes out in much the same way as that of the Aloes. I have

Fig. 10. Left, *Brunsvigia josephinae* (Red.) Ker-Gawl.; an old bulb most likely not less than 100 years old; collected at Worcester by van Breda. Right, *Brunsvigia litoralis* R. A. Dyer, *sp. nov.*, the bulb for comparison with that of *B. josephinae,* left. Photo by H. King.

actually come across two plants thus protected. I could send you a few peduncles of last season for examination as there is a small valley into which they are blown."

The remarkable nature of the plant is shown in the accompanying photos [Fig. 9, and Fig. 10, left; and Plate 12].

By counting the leaf tunics on an old bulb and allowing for up to 20 leaves per annum, its age was estimated at not less than 60 years, and making allowance for the disintegration of the tunics from the nude butt of the bulb it is likely to have been in the neighborhood of 100

years. Herbert estimated the age of the Malmaison plant at about 100 years, which is probably no exaggeration.

Herbert retained *B. josephine* under the genus *Amaryllis* [= *Coburgia* Herb.] with the Cape belladonna, but changed the spelling of the epithet to *josephiniana* and also unnecessarily created the varietal name *griffiniana.*

In the notes on *B. orientalis,* I have mentioned possible confusion by Marloth of a plant of *B. josephinae* with that species. According to the present classification it seems that Baker in Fl. Capensis 1896, cites specimens belonging to 3 or 4 distinct species under the name *B. josephinae,* but this opinion is based on locality records and not on an examination of the actual specimens.

Having aligned *B. josephinae* with plants from inland localities, I have in the residue a plant from coastal districts with a very similar inflorescence, but which differs sufficiently for specific separation. I have examined living material from the coast near Port Elizabeth. The main points of difference are its generally smaller habit, its subterranean bulb, its slightly shorter perianth lobes and relatively longer perianth tube. This species has been given the name *B. litoralis.*

16. **B. litoralis** R. A. Dyer, **sp. nov.** affinis *B. josephinae* Gawl, bulbo minore subterraneo corollae tubo leviter longiore lobis angustioribus differt.

Bulbus ovoideus, usque 15 cm. longus, 10 cm. diam. in collum breve productus, *Folia* hysterantha, plus minusve 12, suberecta, disticha, oblonga, 30-40 cm. longa, 5-7 cm. lata, glauca, glabra, plana, apicem versus leviter torta. *Pedunculus* 15-30 cm. longus vel nonnunquam usque 60 cm. longus, 2.5-3 cm. latus, compressus. *Spathae-valvae* 2, carcinatae, 6-7 cm. latae. *Umbella* 14-40 flora. Pedicelli 15-20 cm. longi, vel raro usque 27 cm., basin versus 7-10 mm. lati, leviter angulati. *Perianthium* rubrum, 7-8.5 cm. longum; tubus 1.25-1.5 cm. longus; lobi 8-9 mm. lati, 3 superiores valde recurvi, 3 inferiores patentes vel leviter recurvi. *Stamina* biseriata, perianthio breviora; antherae 1.25 cm. longae. *Stylus* filamentis leviter longior. *Ovarium* oblongum plus minusve 1.5 cm. longum, 1 cm. latum; capsula usque 3.5 cm. longa, obtuse triangulata.

Distribution:—Cape Province: Port Elizabeth Division; 5-7 miles from Port Elizabeth near Schoenmakerskop, March, Story and Holland 3463 (type); Holland in Nat. Herb. Pretoria 28395; Aug. (leaves) 28396; Parsons Vlei, March, Long 527; 545; Port Elizabeth (cult. Pretoria) Mogg; also Cruden 463; Paterson 986; Holland, Knysna Division (cult. Kirstenbosch) March, Sibbert.

Description:—[Fig. 10, right; and Fig. 11]. *Bulb* completely subterranean, oval with a short stout neck, 15-20 cm. long and 10-13 cm. diam. with a brown tough tunic and a large butt at the base. *Leaves* (absent at time of flowering) about 12, suberect, oblong, 30-40 cm. long, 5-7 cm. broad, somewhat glaucous, glabrous, smooth on both surfaces, entire, thickish, closely veined, usually with a half twist near the apex. *Peduncle* reddish, 15-30 cm. tall, 2.5-3 cm. broad, flattened. *Spathe-*

valves 2, reddish, keeled, scarious. *Umbel* with 14-40 flowers, averaging about 20. *Pedicles* reddish, glaucous, spreading, 15-20 cm. long, rarely up to 30 cm. in fruit, 7-10 cm. thick near the base, narrowing gradually to the ovary, slightly angled. *Perianth* mainly deep red with small crystal-like yellow flecking, 7-8.5 cm. long; tube 1.25-1.5 cm. long; the lobes about 7 cm. long, linear, 8-9 mm. broad; the 3 inner slightly nar-

Fig. 11. *Brunsvigia litoralis* R. A. Dyer, *sp. nov.*; showing bulb and suberect leaves (photo taken a few days after plant had been collected and they are slightly withered). Photo by H. King.

rower than the outer; the 3 upper curled back; the 3 lower slightly recurved; the 3 outer slightly hooded and with few hairs within the tips. *Stamens* shorter than the perianth, those opposite the outer perianth lobes slightly longer than the others, with bases of filaments united to perianth into a tube 1.25-1.5 cm. long; anthers 1.25 cm. long. *Style* finally slightly longer than the filaments. *Ovary* oblong, more or less 1.5

cm. long and 1 cm. broad, not strongly angled; capsule membranous, up to 3.5 cm. long.

Notes:—Previously this species has been classified under *B. josephinae* Gawl., but as pointed out under that species it differs in its distribution in the underground bulb, in the proportions of the perianth, shorter anthers, and in its generally smaller habit and leaves with a half twist near the apex. The flowers are, however, very similar in general appearance. The name *litoralis* has been given because of the coastal habitat as opposed to the inland habitat of *B. josephinae*.

I am grateful to Mr. F. H. Holland and Mr. R. Story for providing notes and living specimens from near Port Elizabeth. To quote from Mr. Story's notes:

"Flowers 14-40 in a head, averaging 20; when seeds ripen the peduncle tissue breaks down to a wet pulpy mass about ground level. This allows the inflorescence to come away very easily. The plants occur 7½ miles from the Port Elizabeth Post Office on the road to Schoenmakerskop via Humewood, gray sand at roadside. The grass, *Cynodon* is dominant; surrounding bush now mainly exotic—*Acacia,* with a few relics of *Sideroxylon, Rhus, Cassine,* etc."

There is little doubt that the city of Port Elizabeth will eventually extend over this site and B. litoralis will gradualy give place to other less beautiful objects of habitation.

The information about the Knysna record is scanty. More exact information is desirable and it is probable that the plant occurs at different points on the coast between Knysna and Port Elizabeth. One may assume that the specimens from near Port Elizabeth, quoted by Baker under *B. josephinae,* belong here.

17. B. sp.

Distribution:—Namaqualand: Springbok.

Notes:—Specimens collected by H. Herre near Springbok, Namaqualand appear to require specific description. Fuller information is being sought. The bulb is partly exposed above ground and is covered by a cartilaginous tunic. It is said to produce a few ascending tough ovate-oblong leaves and has a medium sized inflorescence. The preliminary information on the bulb and leaf characters make it a particularly interesting species for further investigation. This is a fitting note on which to conclude my review.

COMMENTS ON THE NEW R. H. S. NARCISSUS CLASSIFICATION

GRANT E. MITSCH, *Chairman,*
Narcissus Committee, Canby, Oregon

I R. H. S. REVISED NARCISSUS CLASSIFICATION, EFFECTIVE AS OF JANUARY 1, 1950

(i) "Colored" means yellow or some other color than white. (ii) "White" means white or whitish. (iii) The length of a perianth segment is the extreme length measured on the inside from its junction with the corona along the midrib to the extreme tip, and the length of the corona is the extreme length measured from its junction with the perianth to the end of its furthest extension when the edge is flattened out.

Division 1. TRUMPET NARCISSI [of Garden Origin]

Distinguishing characters: one flower to a stem; trumpet or corona as long or longer than the perianth segments. (a) Perianth colored; corona colored, not paler than the Perianth. (b) Perianth white; corona colored. (c) Perianth white; corona white, not paler than the perianth. (d) Any color combination not falling into (a), (b), or (c).

Division 2. LARGE-CUPPED NARCISSI [of Garden Origin]

Distinguishing characters: One flower to a stem; cup or corona more than one-third, but less than equal to the length of the perianth segments. (a) Perianth colored; corona colored, not paler than the perianth. (b) Perianth white; corona colored. (c) Perianth white; corona white, not paler than the perianth. (d) Any color combination not falling into (a), (b), or (c).

Division 3. SMALL-CUPPED NARCISSI [of Garden Origin]

Distinguishing characters: one flower to a stem; cup or corona not more than one-third the length of the Perianth segments. (a) Perianth colored; corona colored, not paler than the perianth. (b) Perianth white; corona colored. (c) Perianth white; corona white, not paler than the perianth. (d) Any color combination not falling into (a), (b), or (c).

Division 4. DOUBLE NARCISSI [of Garden Origin]

Distinguishing character: double flowers.

Division 5. TRIANDRUS NARCISSI [of Garden Origin]

Distinguishing characters: Characteristics of *Narcissus triandrus* clearly evident. (a) Cup or corona not less than two-thirds the length of the perianth segments. (b) Cup or corona less than two-thirds the length of the perianth segments.

Division 6. CYCLAMINEUS NARCISSI [of Garden Origin]

Distinguishing characters: characteristics of *Narcissus cyclamineus* clearly evident. (a) Cup or corona not less than two-thirds the length of the perianth segments. (b) Cup or corona less than two-thirds the length of the perianth segments.

Division 7. JONQUILLA NARCISSI [of Garden Origin]

Distinguishing characters: characteristics of any of the *Narcissus Jonquilla* group clearly evident. (a) Cup or corona not less than two-thirds the length of the perianth segments. (b) Cup or corona less than two-thirds the length of the perianth segments.

Division 8. TAZETTA NARCISSI [of Garden Origin]

Distinguishing characters: characteristics of the *Narcissus Tazetta* group clearly evident.

Division 9. POETICUS NARCISSI [of Garden Origin]

Distinguishing characters: characteristics of the *Narcissus poeticus* group without admixture of any other.

Division 10. SPECIES AND WILD FORMS AND HYBRIDS

All species and wild, or reputedly wild, forms and hybrids.

Division 11. MISCELLANEOUS NARCISSI

All narcissi not falling into any of the foregoing divisions.

II. COMMENTS ON NEW R. H. S. CLASSIFICATION

The new Revised System for the Classification of Daffodils is given here for the benefit of those who may not be familiar with it; however, since it has been in use for a year, doubtless nearly all fanciers have familiarized themselves with the changes which have been made. Chief of these are as follows: Classes 1b and 1c have been reversed, the bicolor trumpets now preceding the whites. Class 1d has been added to take care of new colors such as reversed bicolors. The old Division 4 has been eliminated, Class 4a becoming 2c, and Class 4b is now 3c with some exceptions. Pink cupped varieties in 4a become 2b, and varieties formerly listed as 4b but having cups with colored edges become 3b. As with the trumpet class, there is an extra division (d) in both sections 2 and 3 to allow for reversed bicolors. The doubles in Class 10 now become Class 4, and Class 10 now includes the species. Classes 6 and 7 have been subdivided, and a new section, Division 11 has been added to care for any Daffodils not falling in the preceding groups.

On the whole it would seem that the new classification is better and simpler than the one which it supersedes, although it is not without defects and will not be approved by every one. Some of us who have had a sentimental attachment for the old leedsiis will somewhat regret their amalgamation with classes 2 and 3; not so much that they are not more appropriately placed here but that there seems some inconsistency in placing the pinks such as WILD ROSE and MRS. R. O. BACKHOUSE in the same class with FERMOY and HADES (comparative examples of recent

and older varieties). Then it does not seem that FAIRY CIRCLE and SYLVIA O'NEILL belong with CORONACH and LIMERICK. A perfect classification, would, of course, be impossible. Many varieties are border line flowers which might be listed in either of two classifications depending on which of a number of blooms were measured, or the weather conditions effecting color in the season the variety was placed.

At present there is little need for Divisions 6 and 7 being divided for differences in the length of the coronas. Future developments may well justify these allowances and may further merit a division in color here since we already have white and bicolor representatives in these groups in addition to the familiar yellows; also, yellow flowers belonging to Division 5 are appearing.

Criticism of the above mentioned groups would be of little consequence, but in view of the vastly greater number of Daffodils in Division 2, it would seem justifiable even at the expense of a more cumbersome classification to segregate the "pinks" from the "red cups," and perhaps likewise, the "red and yellows" from the "all yellows." It might be argued that some of the "red cups" are yellow selfs in certain areas and under some conditions, but it is as true that the "pinks" not infrequently become white flowers. Since one of the primary purposes of the classification is the guidance of exhibitors, and where one variety may be entered in each section of Divisions 5, 6 and 7, there are apt to be a dozen each of "red and yellow" flowers and "self yellow" competing in the same class. Could there not be two more subdivisions added to each of Divisions 2 and 3?

Some feel that since this is a horticultural rather than a botanical classification, the species should be left in the groups with the hybrids which are obviously derived from them. This might well be true but since some species have not been used extensively, if any, in breeding, a separate division for them may be in order. If I may be so bold as to suggest changes I would like to see incorporated in the classification, it would be to change Divisions 2 and 3 to read somewhat as follows:

(a) Perianth yellow; corona yellow, not paler than the perianth.

(b) Perianth yellow; corona orange or red.

(c) Perianth white; corona orange or red.

(d) Perianth white; corona pink, salmon or buff.

(e) Perianth white; corona white, not paler than the perianth.

(f) Any color combination not falling into (a), (b), (c), (d), or (e).

It may be easily seen that some difficulties might be encountered in deciding whether the corona should be classed as orange or salmon, for instance; but such a decision should not be more difficult than deciding if a cream perianth was white or yellow.

CHROMOSOMES OF TWO NARROW-LEAVED AMARYLLIS SPECIES, AND THE GENERIC TYPE SPECIES, AMARYLLIS BELLADONNA L.

THELMA FICKER,
The Blandy Experimental Farm, University of Virginia

In most systematic treatments of the genus *Amaryllis* Linn., the genus has been first subdivided into two groups by the character of the leaf. Traub and Moldenke (1949) have followed this natural grouping in their recent revision of the genus. They place three subgenera, *Chilanthe, Phycella,* and *Rhodophiala* in the narrow-leaved supra-group with leaves 3 to 13mm. broad, while five subgenera, *Lais, Aschamia, Macropodastrum, Omphalissa* and *Sealyana,* constitute the broad-leaved supra-group characterized by leaves 2.5 to 5.7 cm. broad.

A number of species in the broad-leaved supra-group have been studied cytologically by Inaryama (1937), Sato (1938), Neto (1945), and Baldwin and Speese (1947). The plants studied by these workers had, in every case, a basic chromosome number of eleven (x = 11) and included three diploid (2n = 22), one triploid (2n = 33), two tetraploid (2n = 44), and one septaploid (2n = 77) species and one tetraploid species hybrid. No cytological report has been made on any of the narrow-leaved species or on the type species of the genus, *Amaryllis belladonna* Linn.

This paper is a preliminary report on the karology of two species of the narrow-leaved subgenus *Chilanthe, Amaryllis advena* Ker-Gawler and *A. chilensis* L'Héritier, and on the type species of the genus, *A. belladonna* Linn. A bulb of each species was sent to the Blandy Experimental Farm by Dr. H. P. Traub. A second bulb of *A. advena* was secured from Mr. Wyndham Hayward. As yet none of these bulbs have flowered at the farm.

MATERIALS AND METHODS

The root tips used in this study were treated with 0.2% colchicine for two to three hours and were then fixed in acetic-alcohol (3 parts 95% ethanol : 1 part glacial acetic acid) for 12 to 24 hours. The tips were stained in aceto-carmine for periods up to 12 hours. This was followed by a five minute maceration in Warmke's solution (1935). When the growing region of the root tip became clearly differentiated, the rest of the root was cut away and a drop of 4% iron alum was added to the maceration fluid to prevent further destaining. After maceration the root section was washed with 95% ethanol, transferred to a drop of aceto-carmine on a clean slide and shredded with steel needles. Temporary preparations were sealed with a mixture of 50% wax and 50% gum arabic. Slides were made permanent by the schedule of either P. C. Burrell (1939) or L. P. Johnson (1945). Drawings were made with the aid of a Zeiss camera lucida at a magnification of X2,500.

An attempt was made to idiogram the chromosome complements of the three species but the differential action of the colchicine treatment made this unfeasible. However chromosome formulas could be determined by using the ratio of the short arm to the total length of the chromosome. The chromosomes were divided into long (L), medium (M), and short (S) on the basis of total length measurements. The

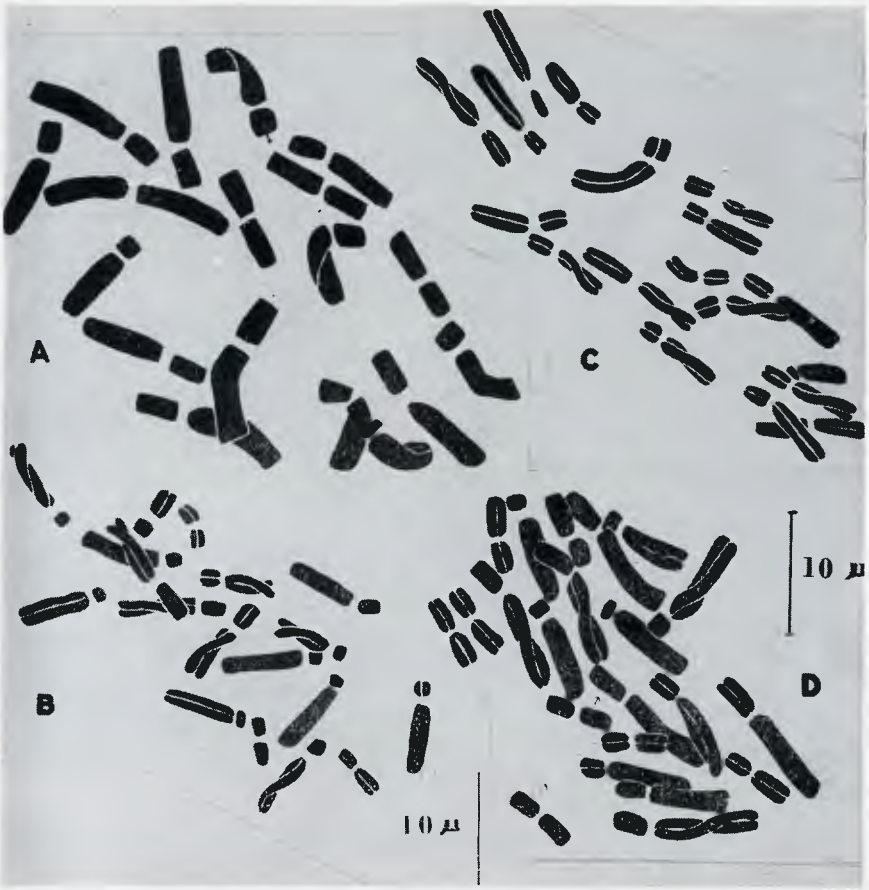


Fig. 12. Somatic chromosomes of *Amaryllis* species: A. & C, *Amaryllis advena* Ker-Gawl., B, *Amaryllis chilensis* L'Hérit., and D, *Amaryllis belladonna* Linn. Drawn at X2500.

position of the centromere region was determined by using the short arm/total length ratio. If this ratio closely approached .50 the centromere was called median (v); if the ratio was much less than .50 but greater than .25 the centromere was judged to be sub-median (l). Any chromosome with a ratio below .25 was classified as having a sub-terminal centromere (j).

CHROMOSOME OBSERVATIONS

Amaryllis advena. Fig. 12, A and C. 2n = 18 = 2:Sv, 1:Sj, 8:Ml, 6:Mj, 1:Ll. Four metaphase figures were measured.

Several chromosomes in the complement of this species have no apparent homologues. These are the Sj chromosome, the Ll chromosome, and one Ml chromosome whose centromere is distinctly more median than that of the other M chromosomes. The S chromosomes and the L chromosome are readily identified; the M chromosomes are too similar for easy individual identification within their respective groups.

Amaryllis chilensis. Fig 12, B. 2n = 18 = 2:Sv, 2:Sl, 2:Ml, 11:Mj, 1:Ll-j Three metaphase figures were measured.

This species also appears to have two unpaired chromosomes since only one L chromosome is found in the complement. However this chromosome may be merely a stretched or distorted Mj chromosome as its measurements approach the range of the M chromosomes. In one figure this chromosome was difficult to interpret because of folding. The other chromosome groups are easily distinguished.

Amaryllis belladonna Linn. Fig 12, D. 2n = 22 = 2:Sv, 6:Sl, 2:Ml, 6:Mj, 4:Ll, 2:Lj. Three metaphase figures were measured.

Like several other broad-leaved *Amaryllis* species, *A. stylosa, A. calyptrata,* and *A. elegans* Sprengel, which have been studied cytologically *A. belladonna* Linn., is an x = 11 type of plant. The two Sv chromosomes are quite readily identified. The rest of the chromosomes are too similar within their groups for individual identification although the Ml and Lj pairs can usually be distinguished.

DISCUSSION

In the light of these facts several hypotheses can be advanced:

1. The narrow-leaved and broad-leaved supra-groups of this genus are quite different cytologically. This may be due to a difference in origin or at least a divergent evolutionary history. The fact that no crosses between the two groups are known supports this belief.

2. The 2n = 18 species may have arisen from one or more of the 2n = 22 species by the loss of four chromosomes, not necessarily paired. If this is so *A. belladonna* Linn. does not appear to be the species that functioned in the development of the two narrow-leaved forms considered here as a comparison of the most easily distinguished chromosomes, i.e., the S ones, shows that the four chromosomes lost would always have to be S chromosomes. This does not agree with the cytological picture of these two narrow-leaved species. Likewise the opposite view, that an 18 chromosome species gave rise to a 22 chromosome species by the duplication of four chromosomes, does not seem plausible at this time from a comparison of the chromosome complements with 18 and 22 chromosomes respectively.

3. Chromosomes, in the narrow-leaved species, which have no homologues may be the result of natural dislocations or fragmentation in a clone.

Preliminary as this report is it demonstrates the need for further cytological work in this genus especially along the following lines: (1) a study of the karology of other narrow-leaved species especially those of the two uninvestigated subgenera *Rhodophiala* and *Phycella,* (2) cytological study of at least the type species of each of the broad-leaved subgenera, and (3) meiotic studies of both supra-groups when possible.

LITERATURE CITED

Baldwin, J. T. and B. M. Speese. 1947. *Hippeastrum solandriflorum* [= *Amaryllis elegans* Sprengel]: its chromosomes. Bull. Torrey Bot. Club. 74: 250-254.

Burrell, P. C. 1939. Root tip smear method for difficult material. Stain Tech. 14: 147-149.

Inariyama, S. 1937. Karyotype studies in *Amaryllidaceae* I. Sci. Repts. Tokyo Bunrike Daigaku. Sect. B. 3: 95-113.

Johnson, L. P. V. 1945. A rapid squash technique for stem and root tips. Canadian Jour. of Research. C23: 127-130.

Neto, E. 1948. Chromosome numbers in *Amaryllis* Linn. Herbertia. 15: 203-242.

Sato, D. 1938. Karotype alteration and phylogeny IV. Cytologia. 9: 203-242.

Traub, H. P. and H. N. Moldenke. 1949. *Amaryllidaceae*: Tribe *Amarylleae.* American Plant Life Soc.; Stanford, Calif. 194 pp.

Warmke, H. E. 1935. A permanent root tip smear method. Stain Tech. 10: 101-105.

VALLEEVUE AMARYLLIS TRIALS

THOMAS R. MANLEY, *Horticulturist,*
The Garden Center of Greater Cleveland

In order to determine the relative merits of the available strains of *Amaryllis* on the market today, the Garden Center of Greater Cleveland, in cooperation with Western Reserve University, established a series of comparative strains trial tests in its greenhouses at Valleevue Farm.

Varieties of Dutch origin were chosen because data previously collected indicated that these strains were superior to America's field grown strains. Collections were received from Ludwig & Co., Hillegom, Warmenhoven and Son, and H. deGraaff and Son, Lisse. These represent the principal sources of *Amaryllis* from Holland.

Five bulbs of each variety were received during early January and planted in 8″ pots with a uniform soil mixture of soil, sand, compost and cow manure. Due to the variation in bulb size, shipping condition, with possible injury from cold in transit, special treatment by the various growers and selection of bulbs by grower for shipment, a permanent rating will be issued after three years' testing.

This initial rating designated as Rating 1950 covers the performance of these varieties during the blooming season of spring 1950. Named varieties of *Amaryllis* vegetatively propagated represent the finest available sources on the American market. These varieties are grown in Hol-

land at great expense to the growers in greenhouse space and the necessary three year developmental period, naturally demand higher prices than the seed- or bulb-grown American hybrids.

It has been observed that certain named varieties appear to vary in color or throat marking suggesting that several varieties nearly identical in color and form might have been used as propagating stock. Wherever this condition existed those varieties were rated lower and further checking will be made to rogue the stock.

This initial rating designated as Rating 1950 covers the performance of these varieties during the blooming season of spring 1950:

The letter rating of AA—Superior; A—Excellent; B—Good; C—Fair, for discard, is based on clean color, floret size, number of scapes per bulb, number of florets per scape, floret substance, length of scape and vigor of foliage.

SALMON: Mona Lisa *(Ludwig)*. Salmon suffused pink. Color irregular and fades, 2 scapes 15″, 3 to 4 five and one half inch blooms. 1950 rating—C. Queen's Page *(Warmenhoven)*. Clean salmon orange. 3 scapes, 20″ tall with 4 eight inch blooms. Rating 1950—A. [Fig. 13, upper left.] Salmon Joy *(Ludwig)*. Salmon scarlet blending to deep red at base of petals—occasional scratchy white line on throat, heavily substanced floret, wide open. 3 scapes 22″ tall with 4 nine inch blooms. Rating 1950—A. [Fig 13, upper right.] Sweet Seventeen *(Warmenhoven)*. Frosty salmon rose on white giving a flesh pink tone to the floret. 3 scapes 20″, with 4 nine inch blooms. Rating 1950—B.

ORANGE SCARLET: Bordeaux *(Warmenhoven)*. Clean light orange scarlet blending to deep scarlet in throat. 2 scapes 26″ tall with 4 ten inch florets. Rating 1950—A. Caruso *(Ludwig)*. Orange scarlet intensifying at base of petals, slight striation at base of petals. 2—3 scapes 24″ tall with 4 eight inch blooms. Rating 1950—B. Invincible *(Ludwig)*. Smooth orange scarlet blending into deep red in throat. 2—3 scapes 22″ tall with 4 nine inch blooms. Rating 1950—A.

SCARLET: Fire King *(Ludwig)*. Scarlet deepening to medium red in throat, floret long tubed. 2—3 18″ scapes with 4 six inch florets. Rating 1950—B. Halley *(Ludwig)*. Clean, frosty scarlet with great substance and growth. 3 scapes 22″ tall with 3—4 eight and one half inch florets. Rating 1950—AA. Ludwigs Scarlet *(Ludwig)*. Glistening scarlet blending to deep red in throat, color breaks to yellow green at base of petals. 3 scapes 26″ tall with 4 seven and one half inch blooms. Rating 1950—B. Prince of Orange *(Warmenhoven)*. Clean scarlet blending deep in throat, fades as florets age. 3 scapes 19″ tall with 3—4 eight inch blooms. Rating 1950—B. Scarlet Beauty *(Warmenhoven)*. Scarlet blending to medium red to dark red in throat, possesses a velvety sheen that glistens. 3 scapes 24″ tall with 4 nine inch blooms. Rating 1950—A. Scarlet Leader *(Ludwig)*. Scarlet suffused with red, suffusion line intensifying in throat. 3 scapes 22″ tall with 4 seven inch florets. Rating 1950—B. De Graaff Scarlet Seedlings. Varying shades of scarlet, flat wide open florets. 2—3 scapes 20—24″ tall with 4 six to eight inch florets. Rating 1950—B.

PINK: Doris Lilium *(Ludwig)*. Light rose pink deepening to rose in throat, very heavy substance, 3 scapes 20″ tall with 4 six inch blooms. Rating 1950—A. Fidelity (*Ludwig*). Pale rose pink with green at base of petals, clean color. 3 scapes 14″ tall with 3 to 4 five inch blooms. Rating 1950—B. Liberator (*Ludwig*). Salmon rose with deep rose red throat, mid ribs of lower petals white. Color appears as a suffusion of rose salmon on white giving a netted appearance. 3 scapes 26″ tall with 3—4 seven inch bloom. Rating 1950—B.

Fig. 13. Valleevue *xAmaryllis* Trials—(upper left) Queen's Page (Warmenhoven); (upper right) Salmon Joy (Ludwig); (lower left) Queen of the Whites (Warmenhoven); and (lower right) Superiora White (van Meeuwen-de Graaff).

DEEP ROSE: Violetta *(Warmenhoven)*. Medium to deep rose with a light rose throat. Light rose midribs. 3 scapes 22″ tall with 3—4 eight inch florets. Rating 1950—B. De Graaff Rose Seedlings. Shades of rose with 2 scapes 20—24″ tall with 4 seven to eight inch florets. Rating 1950—A.

LIGHT AND MEDIUM RED: American Express *(Ludwig)*. Huge clean, medium red blending to deep red in throat, substance excellent for large floret. 2 to 3 scapes 28″ tall with ten inch florets. Rating 1950—AA. Anna Paulowna (*Warmenhoven*). Glistening light salmon red with deep red in throat, fades as it ages. 2 to 3 scapes 26″ tall with 4 eight inch florets. Rating 1950—B. Brilliant (*Ludwig*). Very thick, leathery light red with white deep in throat, occasional irregular white line on lip petal. 3 scapes 24″ with 4 six inch florets. Rating 1950—B. Mothers Day (*Ludwig*). Medium rose red deepening in throat to crimson red with white striping at base of petal. Irregular flecks of darker red to violet red appear in petals. 2—3 scapes 20″ tall with 3—4 six inch florets. Rating 1950—B. Orange King (*Warmenhoven*). Light red that loses its color as the florets age giving a blue gray sheen. 2—3 scapes 18″ tall with 4 eight inch florets. Rating 1950—B. Orange Wonder (*Ludwig*). Light red with light throat appearing dull pink. 3 scapes 18″ tall with 4 six inch florets. Rating 1950—B. Shakespeare (*Ludwig*). Glistening medium red blending to deeper red in throat, white line on some petals most prominent deep in throat. 3 scapes 18″ tall with 5—6 florets. Rating 1950—A.

DARK AND WINE RED: Lucifer *(Warmenhoven)*. Medium dark red of great substance. 2 scapes 19″ tall with 3 eight inch florets. Rating 1950—B. Moreno (*Warmenhoven*). Medium dark red with slight suffusion of rose red in the throat. 3 scapes 26″ tall with 4 eight inch florets. Rating 1950—AA. Mysterie (*Warmenhoven*). Rose red blending to deep red in throat. Midribs and tips of petals are rose. 2 scapes 20″ tall with 4 seven inch florets. Rating 1950—B. Red Master (*Warmenhoven*). Huge dark red of great substance with flat florets. 2 scapes 24″ tall with 2—3 eleven to twelve inch florets. Rating 1950—AA. De Graaff *dark reds*. Flat dark red with 2 scapes 24″ tall with 4 six to eight inch florets. Rating 1950—A.

WHITE: Casper Ludwig *(Ludwig)*. Pure white with yellow-green lines in throat. 3 to 4 scapes 16-20 inches tall with 4 five inch bloom. Rating 1950—B. Early White (*Ludwig*). Pure white with faint green tinge in throat, good substance, 3 scapes 22″ tall with 4 to 5 five and one half inch blooms. Rating 1950—A. Joan of Arc (*Warmenhoven*). Pure glistening white with green in throat. 2—3 scapes 24″ tall with 4 to 6 seven and one half inch blooms. Rating 1950—A. Leading Lady (*Warmenhoven*). Wide open pure white with green throat. 3 scapes 20″ tall with 3 to 4 seven inch blooms. Rating 1950—B. Mount Tacoma (*Warmenhoven*). Pure white with faint green tinge in throat. Petals are winged at base, 3 scapes 24″ tall, with seven inch blooms. Rating 1950—A. Queen of the Whites (*Warmenhoven*). Glistening, waxy pure white with faint tinge of green in throat, blooms flat with slight recurve at tip. Scapes 25″ tall with 4—5 nine inch blooms. Rating 1950—AA.

[Fig. 13, lower left.] SNOW QUEEN (*Ludwig*). Pure white with faint green tinge. 3 scapes 18″ tall with 4 five and one half inch blooms. Rating 1950—B. WHITE GIANT (*Ludwig*). Pure, frosty white with green tinge in throat, 3 scapes 24″ tall with 5 six inch blooms. Rating 1950—A. UNNAMED PURE WHITE SEEDLINGS (*Van Meeuwen-De Graaff Strain*). Pure frosty white with faint green tinge in throat, 2—3 scapes, 18—30 inches tall with 4 six inch blooms. Good substanced flowers that are very flat in form. Rating 1950—A. [Fig. 13, lower right, and Fig. 14, center.]

WHITE STRIPED: KING OF THE STRIPES *(Warmenhoven)*. Frosty

Fig. 14. Valleevue *xAmaryllis* Trials—Collection of Warmenhoven and van Meeuwen clones. SUPERIORA WHITE (van Meeuwen-de Graaff) in center.

pale pink with two broad undefined lines of carmine shading to vermilion in throat on each petal. 3 scapes 24″ tall with 3—4 five inch blooms. Rating 1950—A. STRIPED BEAUTY (*Warmenhoven*). Orange scarlet lines that cover a large part of the petal giving the appearance of a white border. 3 scapes 20″ with 3—4 six inch blooms. Rating 1950—B. UNNAMED STRIPED SEEDLINGS (*De Graaff*). Rose red lines on pure white, received as B. 2 scapes 15″ tall with 4 five inch blooms. Rating 1950—C.

NOTE.—Any hybridizer of *Amaryllis* who desires to have any named varieties rated and displayed in the Cleveland Flower Show may contact the writer in care of the Garden Center of Greater Cleveland, East Blvd. at Euclid, Cleveland 6, Ohio, for full particulars.

REGISTRATION OF NEW AMARYLLID CLONES

Registrars: Dr. J. B. S. Norton and Prof. W. R. Ballard

This information is published to avoid duplication of names, and to provide a space for recording brief descriptions of new Amaryllid clones. 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. *The descriptions must be prepared in the form as shown in the entries below, and must be typewritten and double-spaced.* The descriptive terms used should be in harmony with those given in the "Descriptive Catalog of Hemerocallis Clones, 1893-1948" by Norton, Stuntz and Ballard.

There is close liaison between the AMERICAN PLANT LIFE SOCIETY and the HEMEROCALLIS SOCIETY regarding the registration of new *xHemerocallis* clones. By cooperative arrangement with the HEMEROCALLIS SOCIETY, beginning with the 1951 HERBERTIA edition, descriptions of only such *xHemerocallis* clones for which the 50c registration fee has been paid to Registrar, Mr. Earl A. Holl, 3520 North Grant Ave., Indianapolis 18, Ind., will be registered, and numbered (example: 3322-R). The number "3322" indicating the number of the clone and the "R," the information that it is registered. The registration fee is required *only* in the case of *xHemerocallis* clones, and *not* for other amaryllids which are registered free of charge by the AMERICAN PLANT LIFE SOCIETY.

Correspondence regarding new amaryllid clones, including *Hemerocallis,* to appear in HERBERTIA should be addressed to Prof. J. B. S. Norton, 4922 40th Place, Hyattsville, Maryland, *enclosing self-addressed, stamped envelope, if reply is expected.*

For obvious reasons, there is a limit to the number of descriptions included from any one member in any one issue. Not more than six brief descriptions of clones under each generic heading will be published from any one member in any one issue of HERBERTIA. Descriptions of clones in excess of six brief descriptions, up to a total of 25, will be entered if the space required for each is limited to one line. In this case use should be made of the standard abbreviations already mentioned.

HYBRID AMARYLLIS CLONE

Introduced by Dr. & Mrs. J. S. B. Norton, Hyattsville, Md.

NARCISSA. Reginae Type B. Shows *Amaryllis pardina* parentage; 2-flowered; perigone 8" across; tepalsegs 1⅝" to 2⅜" wide; general coloe aspect medium red (M&P 42-L-1), minutely veined and dotted with darker red; stamens purplish; stigma trifid.

HYBRID HEMEROCALLIS CLONES

TRIAL GARDENS. Cooperative daylily trial gardens have been established at (1) *Cornell University, Dept. of Floriculture, Ithaca, N. Y.;* (2) *University of Florida, Dept. of Horticulture, Gainesville, Fla.* (3) *Southwestern Louisiana Institute, Dept. of Horticulture, La-*

fayette, La.; (4) *Whitnall Park Arboretum, Milwaukee City and County Park Board, Milwaukee, Wisc.;* (5) *Texas A. & M. College, Dept. of Horticulture, College Station, Texas;* (6) *Des Moines Park Board, Des Moines, Iowa.* [Complete addresses are given under *Officers and Committees, below.*]

Introducers should send complete collection of hybrids to these cooperating agencies in order that the new daylily clones may be impartially evaluated.

Introduced by Robert Schreiner, Salem, Oregon.

KIM, scape 38 inches; late mid-season; flower dark orange red. (3051)

Introduced by Mrs. Thomas J. Nesmith, Lowell, Mass.

BEATRICE, scape 39 inches; mid-season; flower deep cardinal red; semi-deciduous. (3052)

DANTE, scape 38 inches; mid-season; dahlia purple; semi-deciduous. (3053)

Introduced by H. M. Russell, Spring, Texas.

BLUE MIST, scape 3 feet; mid-season; wide segments ocean blue, deep purple eye zone; extended bloom; deciduous. (3054)

PEARL SHERWOOD, scape 4 feet; mid-season; wide segments pale greenish lemon; extended bloom; deciduous. (3055)

Introduced by R. W. Wheeler, Winter Park, Fla.

LILAC TIME, scape 40 inches; early mid-season, remontant; light yellow and polychrome. (3064)

WATERMARK, scape 24 inches; early, remontant; flower light red and light yellow bicolor. (3065)

Two typographical errors occur in Mr. Wheeler's registrations in Plant Life, 1949, page 90:—MERCEUSE should be BERCEUSE, and TOMAKA should be TOMOKA.

Introduced by Stanley E. Saxton, Saratoga Springs, N. Y.

BRIDESMAID, Scape 42 inches; mid-season; light red. (3056)

ESCORT, scape 45 inches; mid-season; light red, (3057)

EVALINA, scape 36 inches; mid-season; light yellow with halo. (3058)

FIRST PROM, scape 24 inches; mid-season; light red and light orange red bicolor with halo. (3059)

JACK-O'-LANTERN, scape 36 inches; early mid-season; orange red. (3060)

JUNE MOON, scape 32 inches; early mid-season; light red orange and light yellow bicolor. (3061)

LIBERTY BELL, scape 42 inches; early mid-season, remontant; dark orange. (3062)

TROPHY, scape 36 inches; early mid-season; light orange yellow with spot. (3063)

CORRIGENDA: Descriptive Catalogue of Hemerocallis Clones, 1893-1948, by Norton, Stuntz and Ballard. 1949.

The following corrections are here made in addition to those in PLANT LIFE 5:90, 133. The clones for which changes are to be made are

listed under their registration numbers or their names.

113, for "source unknown" read "Lester."
BRILLIANT, for "230" read "238."
330, see CHALICEA, page 85.
COVENT GARDEN, for "483" read "482."
FLAMANTE, for "739" read "738."
GLAMOUR, for "867" read "857."
GLORIANNA, add "(863)."
APOGEE, page 84, for "1045." read "1043."
1064, for "2704" in 1949 PLANT LIFE, page 89, read "1064."
nana, page 59, omit the number, "1506."
1533, for "MICKAJACK" read NICKAJACK."
RED DOT, for "1834" read "1398."
ROYAL LADY, for "1947" read "1944."
SATSUMA, for "2023" read "2029."
2320, for "TOREADOR" read "RUSSELL TOREADOR."
2344, for "ony" read "only."
VARIEGATED KWANSO, add "(1506)."
ONEONTA, page 87, for "2583" read "2582,"

AMARYLLID GENERA AND SPECIES

HAROLD N. MOLDENKE

[In this department the descriptions of amaryllid genera and species, particularly recent ones, translated from foreign languages, will be published from time to time so that these will be available to the readers.]

Demeusea De Wildeman & Durand, Bull. Soc. Bot Belg. 39: 77-79. 1900.—Perianth straight, erect, the tube cylindric, very short, the lobes shorter, narrow, equal; stamens equally attached in the throat, equaling the lobes, not longer; filaments filiform; anthers small, oblong, dorsally attached, straight; ovary 3-celled; style filiform; stigma entire; ovules solitary; rhizome thick, compact; leaves few, elongate, lorate; scape slender, articulate at the base; flowers umbellate, the pedicels slender, short; involuceral bracts indefinite, numerous, the interiors ones linear.

Demeusea longifolia De Wild. & Th. Dur. op. cit. 78-79. Rhizome thick, solid, about 12 mm. wide, brown on the outside, the roots numerous, densely pilose; leaves ending in a long petiole which is dilated at the base, reaching 40 cm. in length and 20 mm. in width, the leaves being acute, loriform, glabrous on both surfaces, with about 8 veins on each side, more or less crisped along the margin; scape central, pedunculate, 5 cm. long, increasing after anthesis to 20 cm. in length; umbel many-flowered, 2—3 cm. wide, bracteate, the exterior bracts 4, ovate-elliptic, the 2 larger ones about 14 mm. long and 8 mm. wide ,the 2 smaller ones 10—12 mm. long but 3—4 mm. wide, the interior ones filiform; pedicels about 7 mm. long, after enthesis reaching 20 mm.; the perianth articulate at the base, the tube cylindric, very short, about 0.8 mm. long, the seg-

ments linear-elliptic, subobtuse, 4.5—5.5 mm. long and 0.6 mm. wide, 3-nerved; filaments slender, about 2 mm. long; anthers yellow (?), about 2.5 mm. long; fruit unknown. Congo, without definite locality indicated, 1891 (F. Demeuse).

Zephyranthes melanopotamica Speg., Anal. Mus. Buenos Aires, ser. 2, 7: 169. 1902.—*Euzephyranthes;* the bulb ovoid, moderately large, dark-tunicate; leaves narrowly linear, very long, green, not synanthous; scape erect, more or less elongate, terete, glabrous; spathe elongate, bifid, more or less long-connate below the middle, becoming whitish; flowers solitary or paired, erect, borne on pedicels that are shorter than the spathe; periamth turbinate, moderately large, its segments oblanceolate, rather acute, white, twice as long as the unequally long glabrous stamens, shortly tubular-subconnate at the base, the scales small, pectinate-ciliate; the style rather long but included, trifid at the apex. It grows in dunes along the Rio Negro, February 1898 (C. S.)

The species is closely related to *Z. mesochloa* Herb., from which it differs in its non-synanthous and in its interstaminal scales being extremely ciliate-pectinate. The bulbs are ovoid, 30—35 mm. long, 20—25 mm. in diameter, often very deeply buried, clothed with many dark tunics, with an elongate neck, 10—30 cm. long, 1 cm. in diameter; leaves 2—5 from each bulb, erect, glabrous, 20—30 cm. long, 3 mm. wide, soon evanescent; scape becoming purplish downwards, green upwards, fistulose, 7—25 cm. long, 3—5 mm. in diameter; spathe acrogenous, solitary, membranous, subhvaline-whitish, 3:5—5.5 cm. long, its base more or less short-tubular, 5—20 mm. long, 6—7 mm. in diameter, the segments erect, narrow, acute; flowers inodorous, erect, the pedicels always (even after anthesis) short, 25—35 mm. long, 1.5 mm. thick, often becoming purplish, glabrous, terete; perigonium 4—5 cm. long, its base rather long obconic-tubular, 15—20 mm. long, more or less expanded above to 30—40 mm. in diameter, its segments oblanceolate, 8—10 mm. in diameter, more or less acutish toward the apex, gradually narrowed toward the base and subconnate into the tubular part of the perigonium, very lightly 11—13-nerved, white, reddish toward the base but the claw and the midrib greenish; interstaminal scales opposite the petals and adnate with them near the base, free for a short distance, white-greenish, pectinate-ciliate; stamens erect, the 3 longer ones 25 mm. long, the 3 shorter ones 18 mm. long; filaments slender, glabrous, free, lightly redish, inserted toward the base of the perigonium; anthers versatile, rather large, 7 mm. long, 1 mm. thick, subundulate, yellow; ovary elliptic-globose, 7—10 mm. long, 5—7 mm. in diameter, slightly purplish, glabrous, rather obtuse at both ends; style erect, 30—35 mm. long, slender, glabrous, terete, crowned at the apex with 3 stigmas which are rather broad, subcircinate, subcristate, 3—4 mm. long, and 1 mm. wide; capsule subtridymous-globose, 10—12 mm. in diameter and length, thin-membranous, loculicidal, glabrous, becoming purplish; seeds irregularly suborbicular, 4—5 mm. in diameter, lightly subfoliaceous, flaccid, black, rather shiny.

Zephyranthes traubii (Hayward) Moldenke, **comb nov.**; syn.—*Cooperia traubii* Hayward, in Herbertia *3*: 64. 1936.

Zephyranthes timida Holmb., Anal. Mus. Buenos Aires, ser. 3, 2:

77. 1903.—Roots thick, fibrous (about 8), gradually attenuate, to 9 or 10 cm. long; bulb oblong-ovate, 2.5 cm. long, 1.25 cm. in diameter, the tunics dark, the neck 1.5 cm. long and 3.5 mm. in diameter; leaves quite green, 3, caniliculate above, convex beneath, slightly keeled, 13 cm. long, 2 mm. wide, rather obtuse; scape precocious, compressed, 14 cm. long, attenuate from the base upwards, at the mid-point 3.25 x 2.5 mm. in diameter, green, becoming whitish at the base; spathe 3.5 cm. long, closed at the base (almost for the basal half), from there upwards unilaterally opened, the segments later bifid, albescent-sordid, marked with small rose-colored dots or small lines; pedicels 3.5 cm. long, 1.75 mm. in diameter, pale-green; ovary quite green or *Lagenaria*-green, 5 mm. long, at the base 2.5 mm. and at the apex 2 mm. in diameter; perianth with its tube very short, the segments acutely lanceolate-oblong, the exterior ones 40 mm. and the interior ones 38 mm. long, all 6 mm. wide, inside white, doubtfully reddish, outside with a pale-rose band (the color produced by the scattered or besprinkled little lines and dots), with 5 pale-green lines or veins running up and down from the middle, and yellowish-green in the lower third, with the margin of the segments finally white, almost 1 mm. wide; the filaments greenish, the smaller ones 12 mm., the larger ones 16 mm. long; the anthers retrorsely arcuate, that is, recurved, 4 mm. long, about 0.5 mm. wide; the pollen golden-yellow; the style pale-green, 17 mm. long, trifid, the segments 4—5 mm. long. A single flowering specimen I have seen in the Botanical Garden at Buenos Aires and sent to me very kindly by the illustrious Director Carolus Thays 2 days before the Ides of March [= March 13, H.N.M.]. The remaining specimens (not yet in flower) and the type collected by Rev. A. de Llamas at Santa Ana, Misiones.

Crinum uniflorum Sessé et Monciño, Fl. Mex. ed. 2. p. 88, 1894. The *Crinum* with a 1-flowered spathe, linear leaves, H. N. illustration. Root-bulb scaly, subrotund, covered with filiform fibers toward the base; stem-scape 23 cm. tall, terete-subcompressed, 1-flowered; leaves linear, entire, almost channeled, longer than the scape, erect; spathe united into one structure (monophyllous), membranous, striate, splitting longitudinally at the side; corolla gamopetalous, funnel-form, the tube obtusely triangular, the limb 6-parted, the divisions obovate, spreading, the exterior ones very slightly longer, mucronate, the mucro incurved; stamens-filaments 6, subulate, inserted at the mouth of the tube, half as long as the limb, erect, anthers linear, versatile; pistil-ovary inferior, obtusely 3-sided; style filiform, as long as the stamens; stigma trifid, the divisions obtuse, spreading-reflexed; pericarp-capsule subrotund, obtusely 3-sided, 3-celled, 3-valved, splitting at the apex; seeds very many, subovate, bifariously incumbent.

It grows in the gardens of St. Augustine, where it is called commonly "quiebra platos." It blooms in May. It varies in having white and rose flowers. Properties—the root is almost sweet and mucilaginous.

Amaryllis propinqua Salisb., Prod. Stirpium, etc. p. 230. 1796. The *Amaryllis* with the leaves broadly linear-lanceolate, crenulate, glabrous; peduncle 4—7-flowered, compressed; tube of the corolla 10 cm. long, the

divisions recurved, linear-lanceolate, almost equal; filaments incurved-spreading.

The *Crinum* with leaves, etc., of Philip Miller, Ic. p. 73, pl. 110. The Lilio-asphodelus Americanus, etc., of Commelyn Pl. Rar. p. 15, pl. 15.

Robert Millar collected it growing spontaneously near Panama. Very closely related to . . . . . [*A. procera* Salisb.] but differs in its lower stature, proportion, and the remarkable aspect of the herb, the leaves in this being more luxuriant green, more glabrous, not recurved as in the manner of that one.

Amaryllis capensis? Sessé et Monciño, Fl. Mex. ed. 2. p. 86. 1894. The *Amaryllis* with the spathe 1-flowered, the corolla equal, the pistil declined. Hort. Cliff. 135, pl. H.

It grows in gullies in the neighborhood of Guadalajara. Corollas red-purplish. *Amaryllis* with a many-flowered spathe; corollas campanulate, equal; genitalia declined; scape compressed, the same length as the umbel. Roy. Lugd. 72, 36; Ehret. pictum pl. 13.

The African lily that is low, with very long leaves, many-flowered, deep purplish. Herm. Parad. 190, pl. 195.

It grows in Aethiopa and is cultivated for ornament in bouquets at Guadalajara, Mexico, where it is called "flor de Lis." Herbaceous. Flowers 3 to 6, deep scarlet, issuing from a single spathe in the month of April.

Amaryllis Regina (sic) Sessé et Monciño, Fl. Mex. ed. 2. p. 86. 1894. The *Amaryllis* with many-flowered spathe, corollas equal, petals undulate, stamens declined, Fl. Mex. Scape terete, inflated at the center; spathe about 7-flowered; petals "dark-white" [dirty?], 3 red. It grows in Mexico. It blooms all spring.

Crinum americanum Sessé et Monciño, Fl. Mex. ed. 2. pp. 87—88. 1894. The *Crinum* with the apexes of the corollas inwardly hooked; scape lateral, flexuous, compressed, smooth, almost 91 cm. long; leaves 1½ "lengths of the forearm" long, ensiform, thick, very smooth, channeled, sessile, membranous and denticulate along the margin; umbels terminal, simple, about 6-flowered; flowers sessile, large, elegant, the tube 17.8 cm. long, or longer, obsoletely 3-sided, the divisions white within, almost violet outside, alternate, hooked inwardly; stamens divergent; filaments blood-red; pistil concolorous; bracts at the base of the individual flowers, binary, linear, membranaceous, shorter than the tube.

It grows at Cordoba; flowers in July; perennial.

Zephyranthes Andersonii (Herb.) Baker; Holmb., Anal. Mus. Buenos Aires, ser. 3, 2: 78—79. 1903.—I have examined some specimens collected by me in the first days of May, 1902, in the mountains and fields in Tandil. The first bloomed 4 days before the Ides of November, 1902 [= November 9, H.N.M.]; the rest at various times: December (1902), January, February, March (1903).

Five varieties are thus far known: (a) *aurea* Herb., Bot. Reg. pl. 1345a; (b) *cuprea* Herb., op. cit., pl. 1345b; (c) *obscura* Herb., loc. cit. (the bud very black on the outside); (d) *brevilimbus* Herb., loc. cit.

(with the leaves broader); (e) *parvula* Herb., Amaryll. pl. 26, fig. 4. A new one to be added is (f) *rosea* Holmb. [p. 79], var. nov.—part of the perianth yellow or golden, the remainder rose (Tandil, vol. 10, p. 902. H.). It flowered in the Zoological Garden in February 1903.

Zephyranthes gracilifolia (Herb.) Baker; Holm., Anal. Mus. Buenos Aires, ser. 3, 2: 78. 1903.—I actually collected very many specimens of this species in the first days of May, 1902, in fields and mountains of Tandil in the province of Buenos Aires.—(a) Conforming with the description, bloomed in the Zoological Garden in the months of February and March, 1903. (b) *Brothiana* Herb., Amaryll. 105; Bot. Reg. pl. 1967. not seen. (c) *Bulala Holmb.*, var. nov.—the perianth white, without red or rose, which is lacking also in the scape (H. Z., fl. 2, 1903). (d) *Bijou* Holmb., var. nov.—more robust in all parts and the scape longer; perianth white, the segments pale-rose on the ouside on their apical half; scape without rufescent color. (H.Z. fl. 2. 1903).

Zephyranthes oxitepala Speg., Physis 2: 41. 1917.—Euzephyranthes, synantherous, the scape rather elongate, 1-flowered, the spathe bifid laterally sometimes to the base, sometimes only to the middle, the flower erect, borne on a somewhat shorter pedicel, the tepals greenish, white above, narrow, acute, rather rigid, very shortly connate toward the base, scales and [thickenings?] distinctly none, the stamens shortly coalescent at the base, the 3 outer one-third, the 3 inner one-half as long as the tepals, flavescent; the anthers horseshoe-shaped, yellow; the style quite long—surpassing the stamens, trifid at the apex; the stigmas rather elongate, whitish, revolute. Argentina. Common after rains in meadows, Campina de Amerigo and Campina de San Pedro, Misiones, March 1907.

Haemanthus (*Melicho*) *Nelsonii* Baker, Kew Bull. Misc. Inf. 310. 1898.—It differs from the rest of the species in this subgenus by its large membranous leaves and long-exserted genitals.

Bulb oblong, compressed, 2 inches in diameter, the tunics thick, double, pink; leaves synanthous, sessile, oblong, membranous, a foot long, 4 inches wide at the middle, with soft scattered hairs on the front, the black glabrous; peduncle a foot long, pilose; umbel many-flowered, globose, 3 inches in diameter; pedicels 10—12 mm. long; bracts small, linear, reflexed; perianth scarlet, the tube cylindric, 6 mm. long, the segments linear, twice as long as the tube, the expanded flower spreading-erect; stamens long-exserted. Transvaal.

Eustephiopsis R. E. Fries, Act. Soc. Upsal., ser. 4, 1 (1): 162. 1905. —Bulb tunicate, produced into a neck; inflorescence pseudo-umbellate, 2- to many-flowered; flowers stipitate; perigonium funnel-form, its tube very short or short-cylindric, the lobes erect-spreading, subequal; stamens inserted in the throat of the perigonium, subequal, included, erect; filaments winged from the base to ⅔ their length or longer, free at the base, connate into a ring at the apex; anthers linear-oblong, dorsifixed; ovary 3-celled; ovules very numerous, in 2 series; style filiform; stigma capitate or trifid. Argentina.

[Moldenke—AMARYLLID GENERA AND SPECIES, continued on page 6.]

3. GENETICS AND BREEDING

COLCHICINE-INDUCED **HEMEROCALLIS** POLYPLOIDS AND THEIR BREEDING BEHAVIOR

HAMILTON P. TRAUB, *Principal Physiologist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Agricultural Research Administration, U. S. Department of Agriculture, Beltsville, Maryland.*

I. INTRODUCTION

The first great advance in the development of the genus *Hemerocallis* L. as an ornamental garden plant began in the early 1890's with the production of hybrids by Yeld in England. More extensive breeding experiments have been continued since then in Europe and the United States (Stout, 1934; Norton et al, 1949). Although this approach to the problem of improving *Hemerocallis* is not as yet yielding diminishing returns, the progress might be greatly accelerated with the added tool of induced polyploidy as reported previously by Traub (1949) and in the present paper, particularly when combined with hybridization.

Stout (1932) made a survey which showed ". . . (1) that a somatic number of 22 chromosomes is the rule for all species of the genus, (2) that triploidy exists in several of the cultivated clones of fulvous daylilies, and (3) that diploids, triploids, aneuploids and para-triploids are to be obtained among the seedlings of diploids crossed with triploids." He recorded that "offspring have been obtained by crossing triploids with certain diploids, and chromosome counts have been made for 44 of these seedlings. The majority of these seedlings are diploids, a few are triploids, and several are aneuploids with numbers that are fluctuating for various numbers between the diploid and triploid." He concluded that "As long as the seedlings obtained have one parent which is diploid there is little chance of advancing to higher levels of polyploidy."

It is apparent that speciation in *Hemerocallis,* once the typical amaryllid diploid, 2n = 22, was reached, under natural conditions, has been due to chromosome segmental rearrangement and/or gene mutation and not to polyploidy. If polyploidy could be brought in as an added factor, it is apparent that the evolutionary mechanism could be elaborated and this might speed up diversification. It was for this reason that experiments for inducing polyploidy in *Hemerocallis* were included in the larger program in 1940. These experiments were interrupted by war work but have been continued since 1945. Some interesting results have been obtained and part of these are reported in the present paper.

The main source of colchicine at present is *Colchicum autumnale* L. According to Blakeslee (1938), Levan (1938; 1940) and Levan & Steinegger (1947b), the roots of *Colchicum* species tested can grow in relatively concentrated colchicine solutions, up to 20% (Levan, 1940),

without any apparent poisoning effect. These workers used roots still attached to the plants. Cornman (1942), who used excised roots of *Colchicum* and the green flagellate, *Chlamydomonas,* which contains no colchicine, but shows resistance to colchicine poisoning, reported that "*Colchicum* . . . . . responds to high concentrations (up to 10%), with a typical colchicine effect. Accordingly, the immunity of *Colchicum* resides not in a difference in the mitotic process but in some extra-mitotic protective agency." The following compounds have been reported as antagonistic to colchicine: inositol (Chargaff et al, 1948; Cornman, in press, 1950); glucose (Cornman, in press, 1950), and cortical hormone (Tôrô, 1939; Lettre & Lettre, 1946). The following have been reported to synergize colchicine: NaF (Cornman, in press, 1950); chloroform (Levan & Steinegger, 1947a); and phenylurethan (Deysson, 1945). On the basis of the work quoted, Cornman (in press, 1950) concluded that these observations are compatible with the idea that cells can to some extent inactivate colchicine through a system which is inhibited by NaF, $CHCl_3$, or phenylurethan, or by mechanical interference with the source of nutrient, and is aided by glucose or cortical hormone.

Since Klein & Pollauf (1929) reported that colchicine had been demonstrated by micro-chemical analyses in *Hemerocallis fulva* L., it might be assumed that *Hemerocallis* species and hybrids would show immunity to colchicine poisoning, which causes induced polyploidy, according to the hypothesis of Blakeslee (1938) Levan (1938, 1940), and Levan & Steinegger (1947b). However. Traub (1949) reported on the basis of his experiments that *Hemerocallis* species and hybrids are very sensitive to colchicine, and concentrations in aqueous solution tested in the range from .025% to .1% with appropriate application techniques are quite effective in inducing polyploidy, and that concentrations much above .1% usually lead to the eventual death of the treated plants. If Klein & Pollauf's results as to colchicine content of *Hemerocallis* can be verified, then it would appear that this would be a case where a plant containing a relatively small amount of colchicine would be subject to colchicine poisoning on application of relatively greater amounts in harmony with the hypothesis of Cornman (1942). Only further experimentation can settle this question conclusively. However, the experiments as previously reported by Traub (1949) and in the present paper do show for all practical purposes that colchicine may be used as an effective mutagen to induce polyploidy in *Hemerocallis.*

II. PLANT MATERIALS AND METHODS

Plant Materials

The monocotyledonous genus *Hemerocallis* L. is restricted to herbaceous perennial species. The plants—seedlings or clones maintained under culture—increase by the production of multiple underground shoots, which are reduced stems or pseudo-bulbs sheathed by the basal leaf parts (Traub, 1936c). The shoots usually are formed in a compact group or crown (clump) of numerous more or less interwoven underground branches. In some cases, namely, *H. fulva,* etc., the shoots may be sep-

arated by the formation of longer rhizomatous (underground) stems, thus making a more or less ramifying group.

Extensive induced polyploidy experiments with *Hemerocallis* have been carried on, including material of four types: (a) seeds, (b) small seedlings, (c) single stem ramets obtained by division of the clump, and (d) small ramets obtained by fractional stem cuttage (Traub, 1936b; 1936c). Only some of the results from the last-named type, which are important from a practical as well as the theoretical standpoint, are included in this brief paper. The other work will be reported later.

Ramets of *Hemerocallis* species, varieties, natural clones, and hybrids clones were propagated by means of the vertical stem cuttage method of Traub (1936b; 1936c). The single stem divisions were quartered vertically and were then sprouted in a propagation medium before treating with the mutagen. The purpose of this procedure was threefold: (a) to increase the number of ramets; (b) to reduce the size of the ramets so as to facilitate handling, and also to reduce possible interference from any colchicine-antagonistic agents in the tissues as set forth by Chargaff et al (1948) and Cornman (in press, 1950); and (c) to throw the material back into a relatively more juvenile developmental stage similar to younger seedlings so as to take advantage of the "grand period of growth" during treatment as will be explained under the following section. A number of species and 18 hybrid clones were included in the experiments but on account of space limitations only three typical numbered experiments, involving the clones MAYOR STARZYNSKI, BERWYN, ROSALIND, and E. W. YANDRE, will be reported, but incidental mention will be made of some other work.

Mutagens used and method of treatment

A number of mutagens were used in the experiments with *Hemerocallis* but none equalled colchicine in effectiveness and therefore only the results with this compound are included.

The *Hemerocallis* plant increases by the addition of shoots, each covered with the basal portions of the leaves that are non-meristematic as in the great majority of the *Amaryllidaceae*. The shoots are slightly below or close to the ground and they are effectively protected from external stimuli. This applies also to many other monocotyledons. The objective in these experiments was to supply the mutagen in aqueous solution through the roots to the histogenic layers (Dermen, 1945) and core in the shoot apex when the plant was in active growth. The concentration is regulated so as to cause effective polyploidy but not to give the plant such a severe set-back that it may not resume growth during the alternate recovery period as explained in the next paragraph. The effect of too severe treatment is shown in Fig. 15. This shows that when plants B and C were dried at room temperature for 48 hours, then soaked for 48 hours in .05% and .2% colchicine solutions respectively, both died before the end of six weeks after removal from the mutagenic solutions and culture in a complete nutrient solution. In contrast, the control #1 given the recommended treatment (Fig. 15-A) resumed growth and

control #2, plants dried for 48 hours and placed in a nutrient solution, survived.

The second requirement, as will be explained more in detail under the discussion, is that the mutation (polyploidy) be caused not once but repeatedly so that numerous sectors are polyploidized in the apical histogenic layers (Dermen, 1945) and core. In this way the chances of obtaining dominance of polyploid tissues in the shoot apex are increased. The objective can best be attained by keeping the plant in active growth,

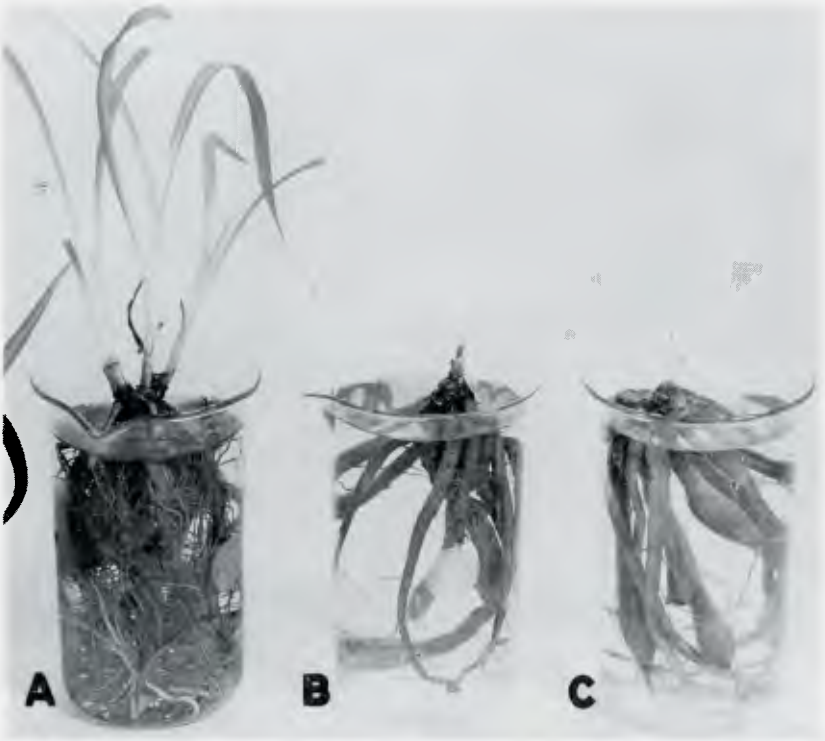


Fig. 15. *Hemerocallis multiflora* Stout, showing effect of severity of treatment: A, (Control #1), given six 4-hour treatments with .05% colchicine alternated with the same number of 16-hour recovery periods as described in text; B & C, dried at room temperature for 48 hours, then soaked for 48 hours (B) in .05% colchicine, and (C) in .2% colchicine. Control 2, not shown in figure, dried as in B & C, but not treated, developed normally. All grown subsequently in complete nutrient solution for 6 weeks. Note that ramets B & C have died.

and giving it alternate treatments punctuated by relatively longer recovery periods in a complete nutrient solution, although culture in tap water may be adequate in some cases. Wellensiek (1947) reported pioneer work with a similar method with wheat-rye hybrids as the test objects.

The procedure which gave best results with *Hemerocallis* is as fol-

lows: In late October—November, single stem cuttings are further divided by quartering vertically (Traub, 1936b; 1936c), and these cuttings are placed in flats in a growing medium of ½ sand and ½ granulated peat moss. They are allowed to sprout and after a few months (in mid-Feb.-Apr.) when the plants are in active growth, the ramets are treated. They are taken up, washed free of soil, and treated with roots immersed in aqueous solution of .05% colchicine—several ramets in each beaker—for a number of 8-hour periods, from 7 a. m. to 3 p. m. alternated with 16-hour recovery periods in tap water, or a complete nutrient solution (Hoagland & Arnon, 1938), from 3 p. m. to 7 a. m. the next morning. When the change is made from one treatment to another the roots of the plants are washed in running tap water. The number of treatment periods was varied from 4 to 16, but the best results were obtained as a rule with 4 to 6 treatments.

New .05% colchicine solutions may be used for each treatment, but such a practice will prove to be very expensive. As an alternative, the solutions may be re-used over a fairly long period by adding water to make up for evaporation (determined by allowing an equal volume of solution with the same surface area to stand without plants for an equal time), but not for the moisture absorption by the plant, and filtering between changes to remove any accumulated debris. If the alternative method is followed, it should be realized that the amount of colchicine taken up by the plant is unknown at present. Thus the solution may remain approximately constant, or become concentrated or diluted with each re-use and addition of water, depending on whether the plant absorbs colchicine from the solution at a rate as great as, or greater or less than, that originally present. The optimum concentration in these experiments has been indicated as .05%, but the mutagen is effective in the range of .025% to 1%, without too great injury to the plant at the higher concentration. Therefore, if the re-use program is not carried to the extreme, it should give satisfactory results, as shown by the present experiments.

The treated plants and controls were grown as pot plants in the greenhouse. Previous experiments had demonstrated that *Hemerocallis* can be successfully maintained under such conditions in 6″ to 8″ pots, the size depending on the stature of the species or clone. In most cases the plants improved with age over a period of 2—3 years, after which they were repotted, a single shoot division in each pot. However, some, especially such rapidly multiplying clones as BERWYN, need yearly repotting. The treated and control plants were grown in a potting medium of 1/3 loam, 1/3 sand and 1/3 peat (granulated). A complete fertilizer was used at least every two months during the active growing season. In the case of some clones, cold storage during the resting season is beneficial.

Methods of establishing polyploidy

Polyploidy was established on the basis of pollen grain size, stomate size, and chromosome numbers as shown by pollen tube mitoses (n number) and root-tip mitoses (2n number).

Pollen storage. The pollens required for the determination of pollen grain size and n chromosome numbers in pollen tube mitoses were collected in No. 000 gelatin capsules and were used in the fresh condition or after storage. In the latter case, the pollens were stored at 3° to 5° C., in a refrigerator, in closed containers over a saturated solution of zinc chloride, which provides a relative humidity of approximately 10% (Traub, 1936a; Traub & O'Rork, 1937). Under these conditions *Hemerocallis* pollens may be stored for 6 months or more and remain viable as shown by germination of pollen grains on artificial media. These results are in harmony with the recent work of Johnson & Griffiths (1950), who have shown that *Hemerocallis* pollens, as measured by the percentage of capsules set, remained viable for at least 3 months, when stored at a temperature of 3° C. and a relative humidity of 10%.

Pollen grain size. As the first measure of polyploidy, the comparative size of pollen grains of controls and treated plants was determined. For this purpose pollen grains were fixed, stained and permanently mounted directly in either Zirkle's gelatin-sorbitol-ferric-aceto-carmine (1940) or in Traub's uranyl- or other arabinate-sorbitol-ferric-aceto-carmine direct permanent mountant (Traub, 1951a; 1951b).

Stomate size. As added evidence of the extent of polyploidy, the stomate size was determined by stripping the epidermis from the under side of the leaves and mounting it in the manner indicated in the preceding paragraph. It was very difficult to obtain sufficient translucency for good photomicrographs, but they are clear enough to serve the intended purpose.

Pollen tube mitoses—n chromosome numbers. This beautiful tool has unfortunately been little used, but deserves more attention. The permanency of polyploidy is dependent on the effectiveness with which the apical histogenic layers have been polyploidized, but it is not possible to determine this by means of root-tip mitoses until the plant has grown for a sufficiently long period so that roots are produced from tissues developed from initially polyploidized histogenic layers in the shoot apex. This requires at least two regular flowering seasons in *Hemerocallis.* The process might be speeded up by removing the older roots after the treated plants have been well established. In the meantime, it is possible to determine the n chromosome numbers in pollen tube mitoses as shown by La Cour & Faberge (1943) and Darlington & La Cour (1947). Stout & Chandler (1933) have shown that in *Hemerocallis* the pollen tube begins to protrude from the germinal aperture only a few minutes after the pollen is scattered on the germinating medium; approximately two hours later the generative nucleus passes into the tube, and at the end of four hours early and late prophases, metaphases and anaphases can be studied.

The method of germinating pollen grains on cellophane (non-moisture proof) for later staining and mounting in euparal as originally described by La Cour & Faberge (1943) did not give reproducible results under our laboratory conditions. It was not possible to float the cellophane squares on a large drop of the germinating medium as recommended. In most cases too much moisture came through, and the pollen

tubes were not securely fastened to the cellophane and so they came off during the subsequent hydrolyzing and staining operations. After many substitutes had been tried the following modified procedure proved fairly successful with *Hemerocallis* pollen.

The germinating medium was supplied to the pollen as follows: single or double 2 mm. by 2 mm. filter paper squares were placed in a small petri dish bottom, 5 cm. inside diam., and the papers were wetted with 3 or 4 drops of sugar solution (germinating medium). A cellophane square, 1.5 mm. by 1.5 mm. was wetted in the same medium, blotted on filter paper, and then placed on top of the larger paper square. The small petri dish bottom assembly was then placed in a larger petri dish bottom, 9 cm. inside diam., and small amounts of acenaphthene and drierite, each in a tiny container, 2 cm. inside diam., were placed alongside the small petri dish bottom, and the larger dish bottom was then covered. The preparation was then ready for dusting the pollen on the cellophane square. The small petri dish bottom containing the cellophane with germinating pollen may be lifted out for convenient inspection of the pollen tubes under the low power (x20 ocular, x 10 objective) of the microscope since the wetted filter paper is sufficiently translucent.

Stout & Susa (1929) reported excellent germination of *Hemerocallis* pollen on a medium of 1% agar with 10% to 15% sucrose. Stout & Chandler (1933) reported similar results with 3/4% agar and 10% to 15% sucrose. In the present experiments, a medium containing 14% sucrose and 1% dextrose, dissolved in a complete nutrient solution (Hoagland & Arnon, 1938), gave best results.

The recommendation to combine colchicine with the germination medium (Darlington & La Cour, 1947) for the purpose of accumulating metaphases, could not be followed because its use caused great overstaining of the cytoplasm that could not be corrected during differentiation with ethanol. However, the use of acenaphthene as indicated above had no apparent effect on the staining of the cytoplasm. Since acenaphthene is poisonous, due caution should be exercised by keeping it in closed containers when not in use.

The use of a small quantity of drierite in the closed chamber to reduce excess humidity during germination was found advantageous in experiments with *Hemerocallis* pollen which were completed at the end of 4 hours or earlier. When it was not used there was occasionally moisture accumulation on top of the cellophane, causing the same difficulty as too great permeability of the cellophane at high temperature. In the case of experiments carried out over longer periods, the drying may be too severe.

In the case of Hemerocallis pollen, it is important to regulate the temperature between 21° and 25° C. for best results with the cellophane method. Apparently, the permeability of non-moisture proof cellophane (composed of cellulose acetate and glycerine) was increased to such an extent at temperatures above 25° C. under the conditions of these experiments that too much germinating medium came through. The pollen tubes therefore did not adhere sufficiently to the cellophane and came

off during subsequent manipulations. At temperatures somewhat below 21° C., the growth of the pollen tubes was much retarded.

Various thicknesses of non-moisture proof cellophanes were tested, but Du Pont grade 300 PT, .0009-inch thickness (approximately .023 mm.) proved most effective in these experiments.

The pollen tubes were fixed after 3 to 4 hours' growth. The fixing, hydrolyzing and staining procedure was adapted from La Cour & Faberge (1943) and Darlington & La Cour (1947). The pollen tubes on the cellophane squares, after being fixed in 1-3 aceto-ethanol over night, were stained in leuco-basic fuchsin for 2—3 hours after 6-min. hydrolysis in 1 N HCl at 60° C. The cellophane squares with pollen tubes were then passed through ethanols—50%, 2 sec., 80% 2 min., absolute ethanol, 2 changes of 2 min. each—and mounted on the object slide in euparal. Some of these preparations are now over 4 years old and are still perfect.

Root-tip mitoses—2n chromosome numbers. During the second blooming season after treatment, it was possible to determine chromosome numbers by means of root-tip mitoses in roots developed from initially polyploidized histogenic layers in the shoot apex that had been subjected to colchicine poisoning. The procedure has been described elsewhere (Traub, 1951b; 1951c; 1951d): root-tips taken at 12 noon to 1 p. m. were pretreated for chromosome shortening for 2 to 2½ hours in a saturated solution of acenaphthene in .5% ethanol, killed and fixed in 1—3 aceto ethanol over night; and stored in 70% ethanol. The root-tips were treated in 1 N HCl at 65° C. for 2—5 minutes, in 45% acetic acid for 2—5 minutes, and washed for 15 minutes to 1 hour in water before staining for 1—3 hours in Traub's bismuth arabinate-sorbitol-ferric-aceto-carmine (Traub, 1951b; 1951c; 1951d). They were then mounted permanently in the same mountant.

Photomicrographs. Photomicrographs of *Hemerocallis* n and 2n chromosome complements were made by means of the inexpensive Leitz Micam camera in combination with a Bausch & Lomb research microscope. When root-tip cells (2n = 22, 33/2 and 44) were flattened in the slide preparations by pressure according to the method of Traub (1951b; 1951d), it was possible to obtain photomicrographs with good detail by using the x20 ocular in combination with the x90 oil immersion objective. In the case of pollen tube mitoses mounted in euparal (La Cour & Faberge, 1943) fair detail was shown as a rule by the same combination for mitoses with n = 11 because the chromosomes were usually somewhat spread out. This was not the case, however, with n = 22 or polyploidized mitoses because the chromosomes were arranged in too great depth for focusing on a large percentage of those present.

III. PRESENTATION OF DATA

The results from typical experiments with colchicine-treated ramets of *Hemerocallis* clones—MAYOR STARZYNSKI, ROSALIND and E. W. YANDRE in this case—and their breeding behavior are summarized in Tables 1 and 2. Additional results with treated ramets of these clones and also the clone BERWYN will be included in the text presentation.

The development of the treated plants as compared with controls was relatively slower during the first 6 or 8 months after treatment. After that there appeared to be no great time lag with respect to time of flowering. For instance, in the case of MAYOR STARZYNSKI ramets treated in February, one control and one treated ramet bloomed in the following September, and all plants bloomed in March-April of the following year. Thus the first real opportunity of testing the treated plants presented itself 1-1/4 years after treatment, and the second testing took place 2-1/4 years after treatment. This report is being made 2-3/4 years after treatment in the cases of the clones MAYOR STARZYNSKI and BERWYN, and 1-1/4 years after treatment for ROSALIND and E. W. YANDRE.

The marked changes in the gross morphology of the treated plants as shown in Figs. 16 and 17, and Plates 13 and 15, are not in themselves sufficient proof of the exact genetic quantitative changes induced in the plants on the basis of increased chromosome numbers, but they offer a starting point for singling out plants that merit particular study on the basis of the recognized criteria for polyploidy. As already indicated, these concern the relative size of leaf stomates (Fig. 18), pollen grains (Plate 16 and Figs. 19 and 20), the n chromosome number determined by means of pollen tube mitoses (Fig. 21) and the 2n chromosome number in root-tip mitoses (Plate 17).

In order to avoid confusion in referring to the various polyploid types induced by colchicine treatments, it is necessary to adopt a simple broad classification with terminology. It is apparent that such a classification may be approached from different viewpoints, but in experimental work of this kind, the logical way is to proceed from the diploids (1A, see below), and colchicine-induced complete polyploids (2A), particularly the induced unitary complete polyploids (2B), to the more complex mixtures of tissues of different genetic constitution, or chimeras —complete polyploid chimeras (2C), and diplo-polyploid chimeras (3A). The diplo-unitary polyploid chimeras (3B), particularly of the diplo-tetraploid type, were most often encountered. This is apparently due to the optimal treatments with colchicine.

The conditions under 2C and 3A (and subdivisions) may be further subdivided. They may, for instance, be indicated on the basis of (a) mericlinal chimeras (discontinuous sectors of different genetic constitution—ploidy in this case) and (b) periclinal chimeras (tissues of one ploidy completely encircling the other). A subdivision of the mericlinal chimeric type was often met with in these experiments. In this variation, the plant was diploid on one side and diplo-polyploid or com-

pletely polyploid on the opposite side. This type is indicated as duoclinal in the text.

Classification and Terminology with symbols

1A. All tissues diploid (controls), 2x*	(1A) diploids
2A. All tissues polyploidized	(2A) complete polyploids
2B. Tissues of the same degree of polyploidy, 4x; 8x; 16x; etc	(2B) unitary complete polyploids
2C. Tissues of two or more degrees of polyploidy, 4x + 8x; 4x + 16x + 36x, etc.	(2C) complete polyploid chimeras
3A. Tissues partly diploid and partly polyploid	(3A) diplo-polyploid chimeras
3B. Tissues partly diploid and partly of the same degree of polyploidy, — 2x + 8x; 2x + 16x, etc.	(3B) diplo-unitary polyploid chimeras
3C. Tissues partly diploid and partly of two or more degrees of polyploidy, — 2x + 8x + 16x, etc.	(3C) diplo - multiple polyploid chimeras

*In this paper the definitions and symbols as given by Knight (1948) are followed, x denoting the basic number of chromosomes in a polyploid series; n and 2n referring to the gametic and somatic (zygotic) chromosome numbers respectively.

Clone Mayor Starzynski

From a total of ten colchicine-treated ramets of the clone Mayor Starzynski, one completely tetraploid plant (2B), Tetra Starzynski (Traub, 1949), the first reported tetraploid in the genus, was obtained. On the basis of stomate size and pollen grain size, it was possible to place the remaining treated plants in the broad classification of diplo-polyploid chimeras (3A) and to note that the diploid sectors are gradually gaining over the polyploid sectors so that during the second year the polyploid character had mostly disappeared. Eventually most of these may revert fully to the diploid state.

The complete tetraploid, Tetra Starzynski (the type of the synthetic tetraploid species, *Hemerocallis washingtonia* Traub, *sp. nov.*, described at the end of section IV), and one mericlinal diplo-tetraploid chimera of the duoclinal type, will be considered in detail, including the breeding behavior.

Complete colchicine-induced tetraploid. The tetraploid, Tetra

STARZYNSKI, represents 10% of the total of 10 treated plants. In this case apparently a sufficiently large proportion of the cells in the histogenic layers and core of the shoot apex were tetraploidized so that this portion assumed dominance over the remaining diploid portion. Such a

Fig. 16. A, Colchicine-induced tetraploid *Hemerocallis* TETRA STARZYNSKI, 2n = 44 (type of the synthetic tetraploid species, *Hemerocallis washingtonia* Traub, *sp. nov.*, described at end of section IV); and B control, MAYOR STARZYNSKI, 2n = 22, not treated. Grown in 7-inch pots.

result is of course very rare and difficult to achieve in material such as *Hemerocallis* by any method as yet reported. The percentage in this case is therefore unusual. In other experiments the percentage of complete polyploidy was usually nil, *but all of the treated plants were diplo-polyploid chimeras.*

The complete tetraploidy in this plant was established at the end

xHemerocallis: A, clone MAYOR STARZYNSKI, 2n = 22 (control); and B, colchicine-induced complete tetraploid, TETRA STARZYNSKI, 2n = 44.

Plate 13

of 1-1/4 years on the basis of significantly larger pollen grains (Plate 16-B), larger stomates (Fig. 18-B) and doubled chromosome complement, n = 22 in pollen tube mitoses (Fig. 21-B). At the end of 2-1/4 years, when roots were formed from tissues developed from initially tetraploidized histogenic layers in the shoot apex, it was possible to demonstrate complete tetraploidy also on the basis of root-tip mitoses, 2n = 44 (Plate 17-B).

This colchicine-induced tetraploid has now been maintained as a clone for over 2-3/4 years and has been divided into twelve ramets. It is

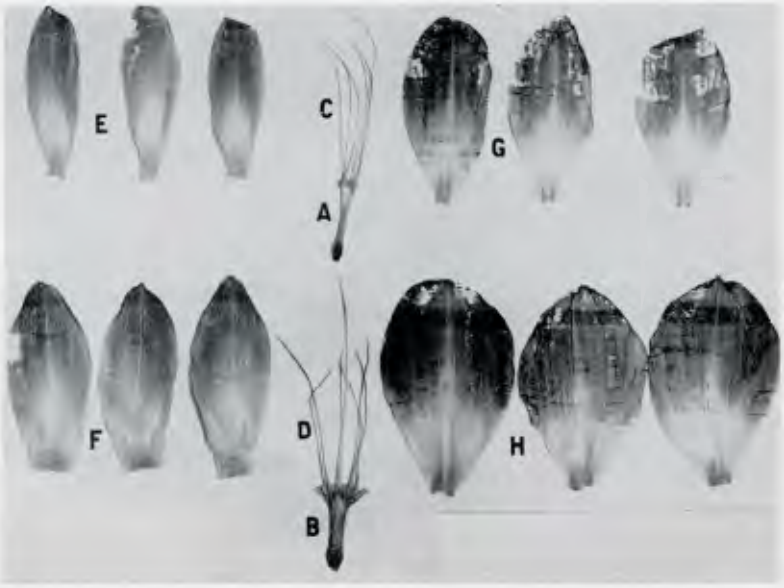


Fig. 17. Reproduction of herbarium specimens showing relative size of floral parts: upper row—*xHemerocallis* clone MAYOR STARZYNSKI, 2n = 22, control, A, tepaltube, C, filaments and style, E, sepsegs, G, petsegs; lower row—colchicine-induced complete tetraploid TETRA STARZYNSKI, 2n = 44, B, tepaltube, D, filaments and style, F, sepsegs, H, petsegs. Approx. .36 natural size.

self-fertile. As a rule only a limited number of seeds are produced per capsule, usually 3 to 8, rarely more. It is difficult to get a seed set until after about 2/3 of the flowers on the scape have been produced. The final flowers usually set seeds regularly when self-pollinated. It may be that the seed set can be increased by the application of growth hormone, but such trials are reserved for the future. The seeds are considerably larger than those produced by self-pollination of the controls. From 30% to 100%, an average of 55%, of the seeds obtained by self pollination of the tetraploid germinate. To date more than 25 seedlings have been obtained from such seeds, and two of these have flowered.

The gross morphology of the colchicine-induced tetraploid, TETRA

STARZYNSKI, is shown in Figs. 16 and 17, and Plate 13. It is interesting to note that tetraploidy in this case is characterized by the following phenotypic manifestations as contrasted with the diploid control: The plant (Fig. 16-A) is about as tall as the control, the leaves are somewhat wider, darker green, and thicker, the scape is thicker and has thicker branchlets, the tepaltube is thicker and shorter, the sepsegs and petsegs are thicker and wider, and the filaments and style are thicker (Fig. 17-B-D-F-H). The fragrance is slightly deeper, the flower texture is thicker, and the flower color is much brighter. However, the duration of the single opened flower is not lengthened. The flower opens slightly on

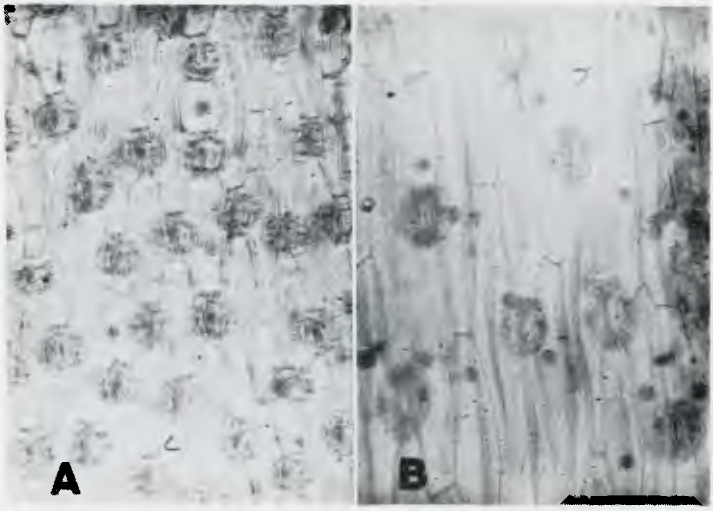


Fig. 18. Stomates of *xHemerocallis*: A, clone MAYOR STARZYNSKI, 2n = 22 (control); B, colchicine-induced complete tetraploid, TETRA STARZYNSKI, 2n = 44. Mounted in Zirkle's gelatine-sorbitol-ferric-aceto-carmine (Zirkle, 1940). x20x20.

the day before it fully opens showing the protruding style (Plate 13-B). On the following morning, the flower opens fully and fades at the end of the day. The flower duration in the F-1 progeny of TETRA STARZYNSKI is similar but as a rule the style does not protrude on the day before the flower fully opens.

F-1 progeny of Tetra Starzynski. As indicated above, up to the present more than 25 seedlings have been obtained by self-pollinating TETRA STARZYNSKI. About half of these have been examined cytologically, and in all cases the root-tip mitoses showed tetraploidy. Two of these, TETRA PEACH, 2n = 44 (Plate 17-E), and TETRA APRICOT, 2n = 44 (Plate 17-D), have flowered. The gross morphology of these, including flowers, is similar to that of the parent, but they differ particularly with regard to flower color as shown in Table 1. TETRA PEACH is near to peach-colored, and TETRA APRICOT is a very soft rich apricot. Both, in common with the parent, are outstandingly beautiful and of real horticultural merit.

Tetra Apricot x Tetra Starzynski. This cross gave progeny that are also tetraploids (Plate 17-G), but none of these have yet flowered.

Tetra Starzynski x various diploids. Some of these attempts were successful, giving rise to triploids, but others proved to be sterile. The cross TETRA STARZYNSKI (2n = 44) ♀ x STEPHEN FOSTER (2n = 22) ♂ was sterile, but the reverse cross gave rise to triploids, 2n = 33/2 (Plate 17-I). The cross TETRA STARZYNSKI (2n = 44) ♀ x IOWA (2n = 22) ♂ produced triploids as indicated in Table 2, and the reverse cross was sterile.

Diplo-unitary-polyploid chimeras. The diplo-unitary-polyploid chimeras (3B) obtained by colchicine treatment were of two general subclasses as shown by stomate and pollen grain size: (a) mericlinal chimeras which were diploid on one side and polyploid on the opposite side, or duoclinal, and (b) mericlinal chimeras with more than two discontinuous diploid and polyploid sectors.

Table 1. Comparison of colchicine-induced tetraploid *Hemerocallis* clone and segregates with the control clone, Mayor Starzynski.

Clone of segregate	tapaltube, cm. length	tapaltube, cm. width	tepalsegs sepsegs, cm. length	tepalsegs sepsegs, cm. width	tepalsegs petsegs, cm. length	tepalsegs petsegs, cm. width	Fragrance
Mayor Starzynski, 2n = 22; flower color bronzy-rose pastel	2.6	.55	7.5	2.1	7.7	3.3	very slight spicy
Tetra Starzynski[1], 2n = 44; flower color similar to diploid but deeper and richer colored	2.1	.65	8.3	2.8	8.5	4.8	slightly more spicy than diploid
Tetra Apricot, 2n = 44; segregate of Tetra Starzynski; flower color very rich apricot; eye zone very slightly reddish	2.2	.70	7.7	2.3	7.9	4.6	ditto

[1]Tetra Peach, 2n = 44; segregate of Tetra Starzynski, is similar to Tetra Starzynski, but the flower is deeper colored—near to a rich peach.

One duoclinal diplo-tetraploid chimera has been studied in some detail. The scapes produced during the first year after treatment were completely tetraploid on one side and diploid on the opposite side so that tetraploid flowers were produced on one side of the scape, and diploid flowers on the opposite side (Plate 14-A and B; Plate 16-C and D). In the second year, the diploid sector gained complete dominance over the tetraploid and no further scapes of this kind were produced. The seeds of selfs and crosses made with flowers on the diploid and tetraploid sides were stored for several months before they were planted, and they failed to germinate. Although it is the usual practice to store spring and summer outdoor-grown *Hemerocallis* seeds until late fall before they are planted, the greenhouse-grown seeds failed to germinate when similarly handled. This included diploid controls. Apparently, such greenhouse-grown seeds should be planted immediately or soon after maturity for satisfactory results.

Table 2. Breeding behavior of *Hemerocallis* diploids; colchicine-induced diplo-tetraploid chimeras, and complete unitary tetraploids; and seedling tetraploids.

Selfs or crosses	Chromosome ratio: pollen to style	Possible combinations	Expected pollen tube growth[1]	Progeny obtained
Mayor Starzynski self (style 2n = 22; pollen n = 11)	1:2	diploids	normal	diploids
Tetra Starzynski self (style 2n = 44; pollen n = 22)	1:2	tetraploids	normal	tetraploids[2]
Tetra Starzynski (style 2n = 44) ♀ x Stephen Foster (pollen n = 11) ♂	1:4	triploids	normal or reduced	nil (sterile?)
Stephen Foster (style 2n = 22) ♀ x Tetra Starzynski (pollen n = 22) ♂	1:1	triploids	much reduced	triploids
Tetra Starzynski (style 2n = 22) ♀ x Iowa (pollen n = 11) ♂	1:4	triploids	normal or reduced	triploids
Iowa (style 2n = 22) ♀ x Tetra Starzynski (pollen n = 22) ♂	1:1	triploids	much reduced	nil (sterile?)
Rosalind self (style 2n = 22; pollen n = 11)	1:2	diploids	normal (?)	nil (sterile) See Stout (1938).
Rosalind chimera[3] self (style 2n = ?; pollen n = 11 & 22)	See footnote[4]	diploids?, triploids?, tetraploids?	See footnote[4]	tetraploids
Rosalind chimera[3] (style 2n = ?) ♀ x Monterey (pollen n = 11) ♂	ditto	dipolids?, triploids	ditto	nil (sterile?)
Monterey (style 2n = 22) ♀ x Rosalind chimera[3] (pollen n = 11 & 22) ♂	1:2, 1:1	diploids, triploids	1:2, normal; 1:1, reduced or much reduced	diploids
E. W. Yandre chimera[3] (style 2n = ?) ♀ x Rosalind chimera[3] (pollen n = 11 & 22) ♂	See footnote[4]	diploids?, triploids?, tetraploids?	See footnote[4]	diploids
Reverse cross of above	ditto	ditto	ditto	nil (sterile?)
E. W. Yandre self (style 2n = 22; pollen n = 11)	1:2	diploids	normal	diploids
E. W. Yandre chimera[3] self (style 2n = ?; pollen n = 11 & 22)	See footnote[4]	diploids?, triploids?, tetraploids?	See footnote[4]	diploids
E. W. Yandre chimera[3] (style 2n = ?) ♀ x Berwyn (pollen n = 11) ♂	ditto	diploids, triploids?	ditto	diploids
Berwyn (style 2n = 22) ♀ x E. W. Yandre chimera[3] (pollen n = 11 & 22) ♂	1:2, 1:1	diploids, triploids	1:2, normal; 1:1, reduced or much reduced	diploids

[1]Expected on basis of work by Watkins (1932); Boyes & Thompson (1937); Jenkin (1933).—normal for ratio 1:2; normal or reduced for ratio 1:4; much reduced for ratio 1:1. According to Bucholz, as quoted by Blakeslee (1941), the ratio 1:1 causes bursting of pollen tubes on stylar tissue in *Datura*.

[2]F-1 tetraploid progeny are intra-fertile with Tetra Starzynski.

[3]Periclinal diplo-tetraploid chimera, with epidermis 2x and interior tissues 4 x.

[4]Ploidy of stylar tissue not investigated.

Flowers from ramet no. 12, colchicine-induced diplo-tetraploid chimeric scape of *xHemerocallis* clone MAYOR STARZYNSKI, diploid on one side and completely tetraploid on the opposite side: A, flower from diploid side of scape with pollen all n = 11; B, flower from tetraploid side of scape with pollen all n = 22. Approx. .85 natural size.

Plate 14

Flowers from colchicine-induced diplo-tetraploid chimeric scape of *xHemerocallis* clone BERWYN, A, flower from periclinal chimeric branchlet from mericlinal chimeric scape with n = 11 & 22 pollen in the same anther; and B, flower from diploid branchlet from mericlinal chimeric scape with n = 11 pollen. Approx. .85 natural size.

Plate 15

Clone BERWYN

The ten colchicine-treated ramets of the clone BERWYN were placed in two classes on the basis of stomate and pollen grain sizes at the end of 1-1/4 years after treatment.

(a) Nine plants are diplo-polyploid chimeras (3A) similar to those indicated for the clone MAYOR STARZYNSKI, above. The diploid sectors are gradually gaining dominance over the polyploid sectors during the second year.

(b) One plant is of the duoclinal type, diploid on one side and diplo-tetraploid chimeric (3B) on the opposite side. Thus the flowering scape is diploid on one side (Plate 15-B; Fig. 19-C.) and diplo-tetraploid on the other. On the latter side some periclinal branchlets were produced which had flowers with n = 11 & 22 pollen in the same anther (Plate 15-A; Fig. 19-B; Fig. 21-C, D & E).

It is of interest to note the gross morphology of the flowers produced on the diplo-tetraploid chimeric branchlet as shown in Plate 15-A. Apparently the floral parts have been affected in a manner similar to that of the complete tetraploid (Plate 13-B), but not to the same extent. In Plate 15-A, the thickness of the tepaltube is noteworthy. The thicker texture of the flower apparently prevents the tepalsegs from recurving markedly as in the control (Plate 15-B).

The record of the breeding behavior of this chimera is incomplete because the seed lots for selfs and crosses were stored for the late fall planting and did not germinate. Only the cross, DR. STOUT (2n = 22) ♀ x the diplo-tetraploid side of the chimera ♂, with pollen n = 11 & 22 in the same anther, from seeds planted immediately after maturity, is represented in the progeny. These are all diploids (Plate 17-C), although one might expect diploids and triploids from such a cross. This subject will be elaborated in connection with the discussion of the breeding behavior of colchicine-induced polyploids in section IV.

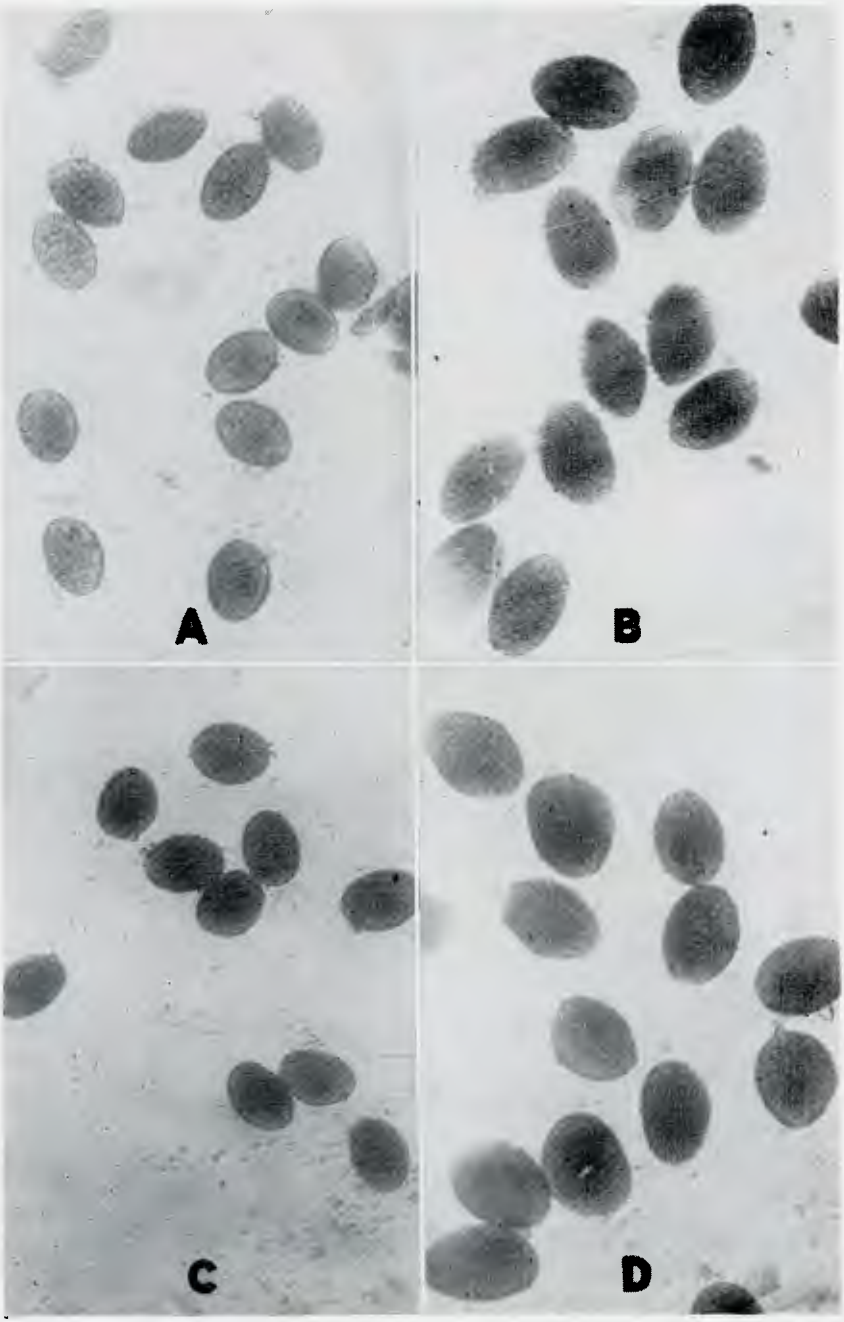
Clones ROSALIND and E. W. YANDRE

The colchicine-treated ramets of ROSALIND and E. W. YANDRE were placed in two broad classes on the basis of stomate size and pollen grain size, 1¼ years after treatment.

(a) Eight plants of ROSALIND and one plant of E. W. YANDRE are diplo-polyploid chimeras (3A) of the mericlinal type.

(b) Two plants of ROSALIND and one plant of E. W. YANDRE are diplo-tetraploid chimeras (3B) of the periclinal type (hereafter referred to as ROSALIND chimera and E. W. YANDRE chimera). In these chimeras the epidermis is diploid and the interior tissue is tetraploid. They produce flowers with n = 11 & 22 pollen in the same anther as shown for ROSALIND chimera in Fig. 20-B. In the absence of direct proof as to the ploidy of the female gametes, dependence has to be placed on any available indirect proof supplied by the breeding behavior.

ROSALIND (control, 2n = 22) is self-sterile but may be inter-fertile in some crosses (Stout, 1938). Since pollen of the diploid is ineffective



Pollen grains of *xHemerocallis* diploid and colchicine-induced unitary complete tetraploid and chimera (see bottom of opposite page for legend.)

Plate 16

on selfing, and the n = 11 & 22 pollen of ROSALIND chimera gave rise to tetraploids only (Plate 17-K), we have indirect proof of the presence of tetraploid female gametes in the ovules. Thus there seems to be no barrier to the growth of n = 22 pollen tubes in the stylar tissue.

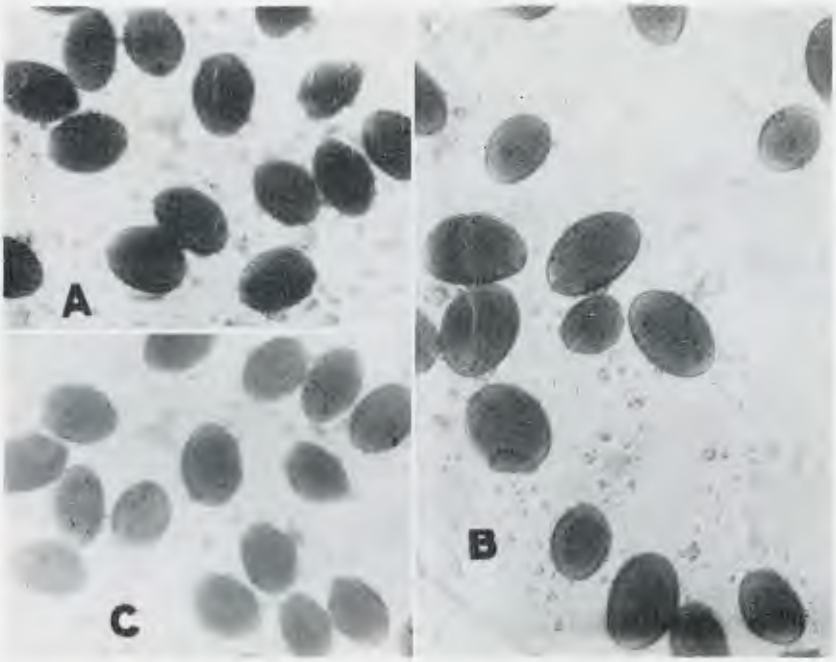


Fig. 19. *Hemerocallis* clone BERWYN, pollen grains in diploid and colchicine-induced diplo-tetraploid chimera: A, (control), n = 11; B and C, from opposite sides of same scape of colchicine-induced diplo-tetraploid mericlinal chimera; B, from periclinal branchlet of scape, n = 11 & 22 in the same anther; and C, diploid branchlet, n = 11. Mounted in Zirkle's gelatine-sorbitol-ferric-aceto-carmine (Zirkle, 1940). x10x10.

The 2n = 44 chromosome complement of one of the tetraploid seedlings, TETRA ROSALIND, the first studied, is shown in Plate 17-K. These tetraploids have not as yet flowered.

As indicated in Table 1, the cross of ROSALIND chimera (pollen n = 11 & 22) ♀ x MONTEREY, 2n = 22, ♂ was sterile, but the reverse cross gave rise to diploids only (Plate 17-L) although one might expect

---

Plate 16 (See opposite page for plate). Pollen grains of *xHemerocallis* diploid, colchicine-induced unitary complete tetraploid and diplo-tetraploid chimera: A, clone MAYOR STARZYNSKI, n = 11 (control); B, colchicine-induced unitary complete tetraploid, TETRA STARZYNSKI, n = 22; C & D, duoclinal diplo-tetraploid chimeric scape, Plant no. 12, C, diploid, n = 11, on one side, and D, colchicine-induced unitary complete tetraploid, n = 22, on the opposite side. All mounted in Zirkle's gelatine-sorbitol-ferric-aceto-carmine (Zirkle, 1940). x10x10.

to obtain triploids also. The reason for this behavior is at present unknown.

Previous experiments with pollen germination on artificial media have shown that in *Hemerocallis* the pollen tubes from the tetraploid grains grow at a relatively slower rate than those from the diploid grains, but so far no studies have been made of such growth rates in stylar tissues. Therefore further work is required before any positive statements can be made. In the meantime, the following hypothesis has been set up for testing.

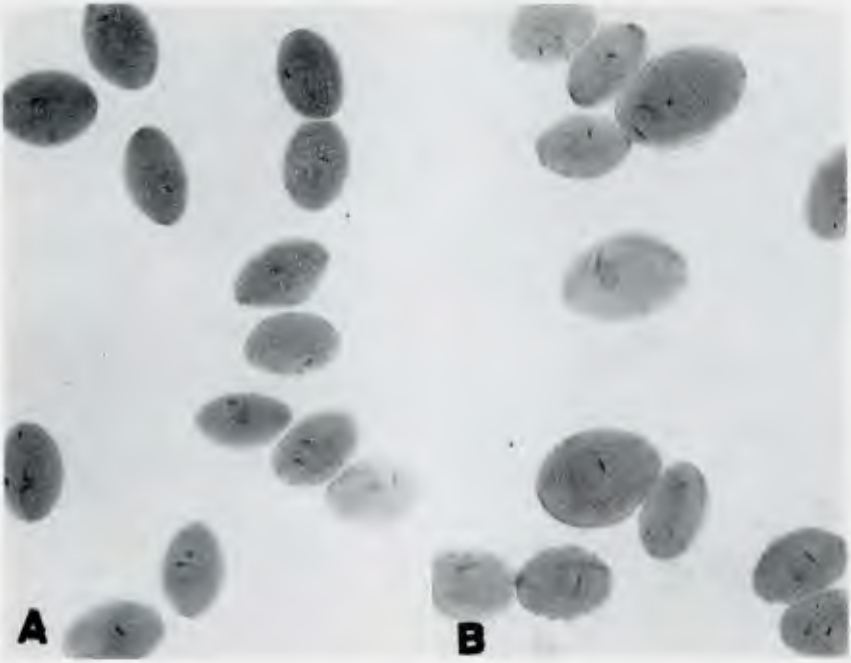


Fig. 20. Pollen grains of *Hemerocallis fulva* var. *rosea* clone ROSALIND Stout—A, control (not treated) n = 11; and B, ROSALIND conchicine-induced periclinal diplo-tetraploid chimera, n = 11 & 22 from the same anther. Mounted in Traub's uranyl-arabinate-sorbitol-ferric-aceto-carmine (Traub, 1951b). x20x10.

ROSALIND is self-sterile in the diploid state. Selfing of the ROSALIND chimera could then me equivalent to the selection of tetraploid pollen for application to the stigma in crossing with other clones since any growth rate differential in favor of n = 11 over n = 22 pollen on selfing ROSALIND chimera would be canceled out so long as the n = 22 male gametes arrived in time to fuse with the n = 22 female gametes. This growth rate differential might be of significance in such crosses as MONTEREY x ROSALIND chimera and E. W. YANDRE chimera x ROSALIND chimera when only diploids are obtained although triploids and/or

tetraploids might also be expected among the progeny.

E. W. YANDRE (2n = 22) is usually self- and inter-fertile as indicated in Table 1, but the cross of E. W. YANDRE chimera ♀ x ROSALIND chimera ♂ gave rise to diploids only. The reverse cross was sterile. This behavior is of interest in connection with the hypothesis outlined above. It should be noted that no seeds were obtained on ROSALIND diploid or ROSALIND chimera, except when the latter was selfed, and these were tetraploids.

E. W. YANDRE chimera (pollen n = 11 & 22) ♀ x BERWYN (pollen n = 11) ♂, and also the reverse cross gave rise to diploids, although triploids were also expected among the progeny.

The implication of the results presented will be considered further under the discussion in the following section.

IV. DISCUSSION

The breeding behavior of colchicine-induced *Hemerocallis* polyploids, the *Hemerocallis* breeding program, and the evolution of the chromosome complement in *Hemerocallis* will be briefly discussed.

Breeding Behavior

Tetra Starzynski selfs and crosses. The breeding behavior of the colchicine-induced tetraploid, TETRA STARZYNSKI, as indicated in Table 2, shows that chromosome ratios of pollen to style of 1:4 or 1:1, in these experiments involving diploids and tetraploids, are not always barriers to fertility. In 50% of the crossing attempts for each of these ratios fertility was observed. These results with *Hemerocallis* are in part contrary to the findings of Bucholz, as quoted by Blakeslee (1941), who reported that pollen tube growth in *Datura* is generally deleteriously affected by doubling chromosome number, and that 1x pollen tubes grow well in 4x conducting tissue of the style (chromosome ratio of pollen to style, 1:4), and 2x pollen tubes burst in the conducting tissue of 2x styles (chromosome ratio of pollen to style 1:1). The present results appear to be more in harmony with the findings of Watkins (1932) and Boyes and Thompson (1937), in specific wheat crosses, and Jenkin (1933) in herbiage crosses, who found that the optimum pollen tube growth was observed in styles of plants with the same chromosome number as the male parent, namely, if the chromosome ratio of pollen to style is 1:2. Pollen tube growth is normal or reduced in the style of a species with a higher chromosome number, whereas it is much reduced in the style with a lower chromosome number.

Selfs and crosses involving chimeras. When the periclinal diplotetraploid chimera of ROSALIND, which is self-sterile in the diploid state, was selfed, only tetraploids were obtained. When the periclinal diplotetraploid chimera of E. W. YANDRE, which is self-fertile in the diploid state, was selfed, only diploids were produced. According to the hypothesis outlined in the previous section, in the first case the n = 11 pollen tubes would apparently be ruled out from the beginning due to self-

sterility, and the n = 22 pollen tubes would have no competition, with the result that only tetraploids would be produced. In the second case, involving E. W. YANDRE chimera, the n = 11 pollen tubes apparently could compete actively with the n = 22 pollen tubes which might grow more slowly on the stylar tissue, and thus the former could win out, and diploids and triploids could be expected in the progeny if both n = 11

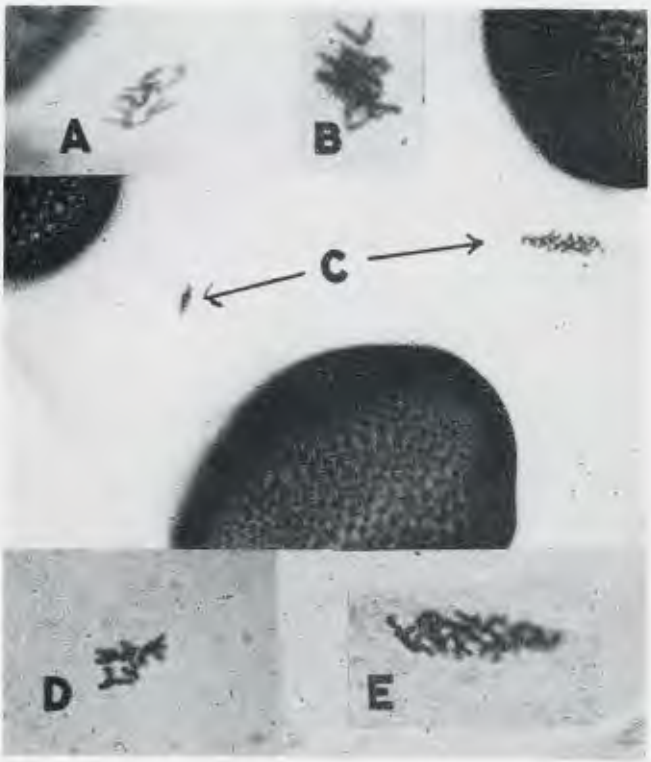


Fig. 21. Chromosomes in metaphase during pollen tube mitosis: A xHEMEROCALLIS clone MAYOR STARZYNSKI, n = 11 (x20x90); B, colchicine-induced complete tetraploid, TETRA STARZYNSKI, n = 22 (x20x90); C—E, incl., diplo-tetraploid chimera of clone Berwyn—C, metaphases of n = 11 (C-left) and n = 22 (C-right) pollen from same anther (x20x47.5); D & E, metaphases of n = 11 (D) and n = 22 (E) pollen from same anther (x20x90). Stained in leuco-basic fuchsin, and mounted in euparal.

and n = 22 female gametes were present in the ovules. However, only diploids were actually obtained. Only further work can fully explain the results.

In the case of ROSALIND chimera we have indirect proof that n = 22 female gametes were present in the ovules, and similarly we have indirect proof that n = 11 female gametes were present in the E. W. YANDRE chimera. It was not possible in the work so far to demonstrate

the presence of n = 11 and n = 22 female gametes in the same chimera. Since these chimeras are similar it is possible that both kinds of gametes were present in both, but only a more thorough investigation can settle this point conclusively.

In connection with these results, it is of interest to note that Emsweller and Stewart (1951) apparently selfed diplo-tetraploid *Lilium* chimeras and obtained only diploids. These workers concluded that "Evidently the gametes with 12 chromosomes have some advantage."

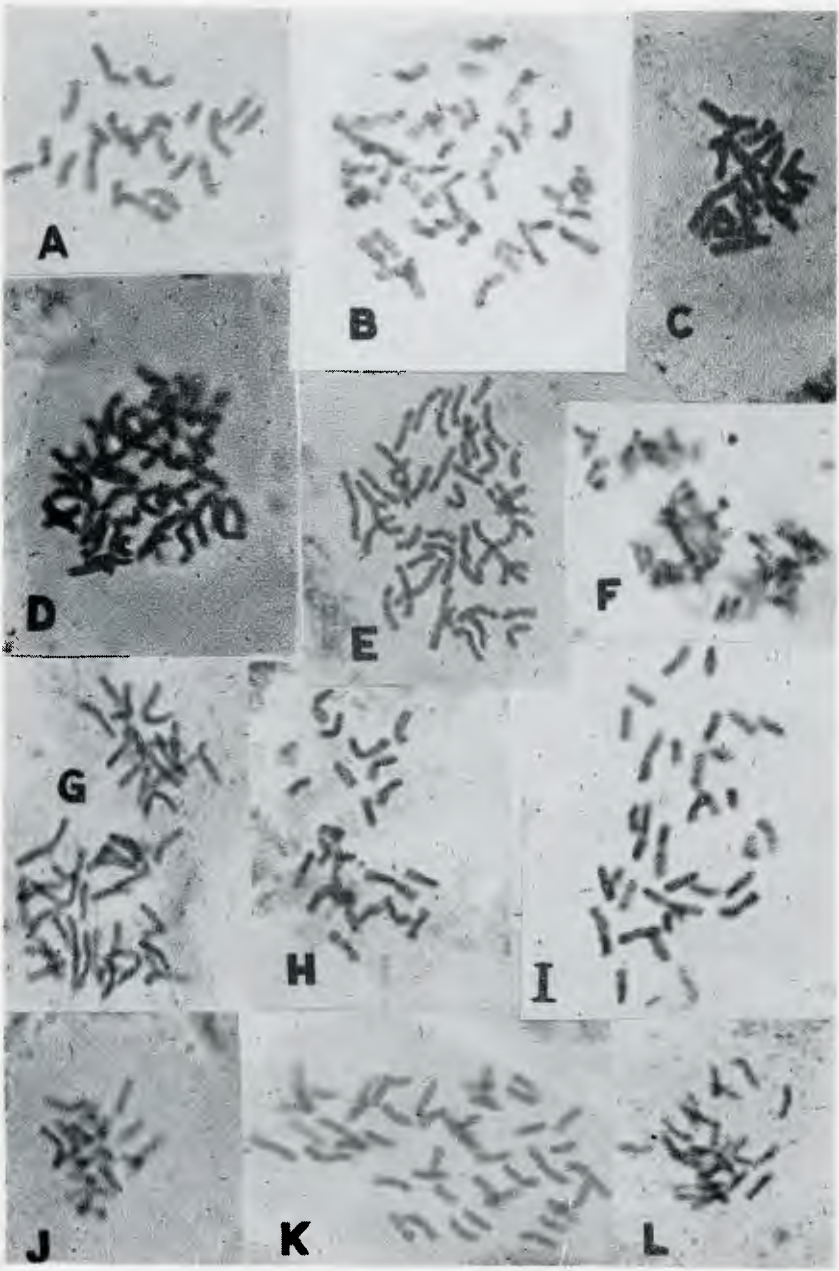
The *Hemerocallis* breeding program

The implications of the present results from the standpoint of the *Hemerocallis* breeding program will be briefly considered.

The results presented show above all that, contrary to the former belief, colchicine is an effective polyploidizing mutagen with *Hemerocallis* species and hybrids as previously reported by Traub (1949) and in the present paper if appropriate methods of application are employed.

In such genera as *Lilium* the procedure is relatively much more simple involving the soaking of the detached bulb-scales in .2% colchicine solution (Emsweller & Brierley, 1940; Emsweller, 1949). However, with most amaryllids, including *Hemerocallis*, which are characterized by a pseudo-bulb, the task is a very difficult one. In this case the non-meristematic leaf-bases—analagous to the meristematic bulb-scales in *Lilium*—are of no value with respect to the induction of polyploidy by colchicine poisoning. It is necessary to carry the colchicine solution into the apical histogenic layers and core while the plant is in active growth in order to induce polyploidy that may have any chance of permanency. Thus the external application of mutagenic solutions or pastes to the shoot apex in *Hemerocallis* after the leaf bases are sheared away, has proved ineffective in these experiments, and severe treatments by absorption or hypodermic injections of the mutagen have proved impracticable so far. Only when treatment was centered on the apical histogenic layers and core of the shoot in optimal repetitive doses punctuated by recovery periods was it possible to obtain a very small percentage of complete polyploids and a large number of diplo-polyploid chimeras in *Hemerocallis*. By using the latter class as parents, it is possible to achieve the objective of complete polyploidy indirectly by making use of appropriate breeding procedures.

The method for the induction of polyploidy in *Hemerocallis* is quite exacting. It should be emphasized that with plants such as *Hemerocallis* the following points must be observed: (a) the plants should be thrown back into a relatively more juvenile developmental stage by means of vertical stem cuttage (Traub, 1936b; 1936c) in order to take advantage of the more active growth thus induced. Another consideration also is important. Apparently the whole stem divisions of the clump present a relatively large mass of tissue that may contain relatively large amounts of colchicine-antagonistic substances (Cornman, in press 1950). For a similar reason large woody plants cannot be effectively treated by this method as shown by Traub (unpublished



xHemerocallis chromosomes in metaphase during root-tip mitosis (see bottom of opposite page for legend).

Plate 17

results) with *Malus sylvestris* (WINESAP and JONATHAN clones) where small root-grafts had to be utilized for effective results. With woody plants the optimum doses may have to be relatively greater (up to .1% or .2%) than for herbaceous plants like *Hemerocallis*. On the other hand, it is difficult to keep relatively small *Hemerocallis* seedlings growing effectively during the repetitive treatments as compared with plants propagated from single stem divisions by vertical stem cuttage. (b) The mutagen should be supplied to the apical histogenic layers and core of the shoot through the roots so that it is present in the entire apical region where it may come into contact with all of the cells that are dividing during any particular treatment period. (c) The treatment as to concentration (.025% to .05% colchicine), and times of treatment, should be optimal rather than maximal (.1% to .2% colchicine) as is the usual practice at present with most other plants. The concentration must be just sufficient, and the time of action just long enough to cause polyploidy, and never so severe as to give the plant a distinct set-back. (d) The colchicine treatment should be repetitive, namely 4 to 8, sometimes more, 8-hour periods, punctuated with relatively longer (16-hour) recovery periods in a complete nutrient solution, so that the plant will again be in active growth at the beginning of each successive treatment. In some cases it may be advisable to make the recovery periods longer, up to one or two days, but this is only necessary when a clone such as LIDICE, relatively more sensitive to colchicine, receives a decided set-back even by the optimal treatment. By repeating the polyploidizing process four or more times, the probability of producing relatively large and numerous polyploid sectors in the apical shoot tissues is increased.

This method is applicable to other plants as shown by the unpublished results obtained by the present writer on the basis of root-tip mitoses—particularly to monocotyledons such as the bulbous *Amaryllidaceae: Leucojum autumnale, Crinum asiaticum*, etc. and also dicotyledons: *Impatiens sultani, Phaseolus vulgaris, Arachis hypogaea, Raphanus sativus, Malus sylvestris* (WINESAP and JONATHAN clones), etc. The pioneer work of Wellensiek (1947), who reported success with wheat-rye hybrids by means of a similar method, should not be overlooked.

According to Popham & Chan (1950), Satina's layer-core terminology (Satina & Blakeslee, 1941) of the developing shoot apex is a

---

Plate 17. (See opposite page for plate.) *Hemerocallis* chromosomes in metaphase during root-tip mitosis: A, clone MAYOR STARZYNSKI (control), 2n = 22; B, colchicine-induced unitary complete tetraploid, TETRA STARZYNSKI, 2n = 44; C, diploid, 2n = 22, from cross, DR. STOUT (n = 11) ♀ x diplo-tetraploid chimera of clone BERWYN ♂ (n = 11 & 22); D to F, incl., seedlings obtained by selfing TETRA STARZYNSKI, D, 2n = 44, TETRA APRICOT, E, 2n = 44, TETRA PEACH, and F, 2n = 44, Seedling #583; G, TETRA APRICOT ♀ x TETRA STARZYNSKI, 2n = 44 ♂; H, clone STEPHEN FOSTER, 2n = 22; I, STEPHEN FOSTER, 2n = 22 ♀ x TETRA STARZYNSKI ♂, 2n = 33/2; J, clone ROSALIND, 2n = 22; K, complete tetraploid seedling TETRA ROSALIND, 2n = 44, obtained by selfing periclinal diplo-tetraploid chimera with n = 11 & 22 pollen in the same anther; L, Seedling, 2n = 22, obtained by crossing MONTEREY ♀ with ROSALIND periclinal diplo-tetraploid chimera (n = 11 & 22 pollen in the same anther). All shortened by pretreatment for 2½ hours in sat. solution of acenaphthene in .5% ethanol (Traub, 1951c), and mounted in Traub's bismuth-arabinate-sorbitol-ferric-aceto-carmine (Traub, 1951b). x20x90.

distinct improvement over the Schmidt (1924) and Buder (1928) tunica-corpus terminology because "it does not imply anything regarding the occurrence of periclinal cell divisions in the outer layers, thus permitting the worker to record his observations more accurately. In addition, the terminology is applicable to all gymnosperm and angiosperm apexes. The problem of determining the number of 'layers' in itself is not always an easy one."

It is of interest to note that the validity of this concept has been verified on the basis of sectorial polyploidy in *Datura* by Satina & Blakeslee (1941), and in cranberry and various bud sports by Dermen (1945; 1947a; 1947b). The developmental morphology of the shoot apex in *Hemerocallis* has not as yet been studied. Dr. Popham of the Department of Botany, Ohio State University, or one of his graduate students, will work out the problem in the future from material furnished by the writer. Therefore no statement about the number of apical histogenic layers, in addition to the core, of the shoot apex that are subject to colchicine-induced polyploidy in *Hemerocallis* can be made at present. In the meantime, the present results may be tentatively interpreted, without indicating the number of histogenic layers, on the broad basis of the layer-core terminology reference frame which is applicable to all gymnosperms and angiosperms as indicated by Popham & Chan (1950). Thus the histogenic layers, whatever their number, and core of the shoot apex in *Hemerocallis*, during colchicine treatment, may be polyploidized in toto, or one or more layers, including or not including the core, may be totally affected, or in part only to one or more degrees of ploidy. This would explain not only the small percentage of complete polyploids, but also the larger class of treated plants included under diplo-polyploid chimeras (3A) obtained, in which partial polyploidy was observed.

Since this report is written for readers that include enthusiastic practical gardeners, who may wish to try their hand at the very difficult task of producing polyploid *Hemerocallis,* a word of caution is in order with respect to reporting results obtained. Above all, the burden of proof is on the worker as in all scientific work. External appearances during the first growing season may be deceptive from the standpoint of the permanency of the changes induced. It is necessary to observe the treated plants for two or more years after treatment in order to be certain as to the permanency of the mutations. During the first flowering season, it is possible to determine tentatively the diploid or the polyploid state on the basis of pollen grain size and n chromosome numbers in pollen tube mitoses. If all of the pollen grains in the anther are polyploid (larger than in the control) in any particular plant, then there is promise that the changes may prove to be permanent. If the anther contains $n = 11$ and $n = 22$ pollen grains, for instance, then there is evidence of a chimeric condition, and the diploid tissues may gain dominance over the polyploid tissues later, or the reverse. The same is true when part of the plant produces flowers that are diploid and the other part polyploid flowers. After the treated *Hemerocallis* plant produces roots from tissues developed from initially polyploidized

histogenic layers in the shoot apex that were subjected to colchicine treatment, then it will be possible to obtain data on the 2n chromosome number from root-tip mitoses. If this shows polyploidy, one may conclude safely that polyploidy is permanent as far as these particular tissues are concerned. The criterion of stomate size is of secondary importance at the outset since it is not easy to examine all of the leaf surface, but if taken in conjunction with chromosome numbers as shown by pollen tube and root-tip mitoses two or more years after treatment, it should add to the completeness of the proof. If the plant is completely polyploid as is rarely the case, the task is finished, but that is not so if one is confronted with partly polyploid plants or chimeras. The next step is then to make an attempt to obtain completely polyploid plants through breeding of chimeric plants. This is briefly discussed in the following paragraphs.

Since it is very difficult to obtain complete unitary polyploids (Plate 17-B) directly—results being usually nil or less than 1%, very rarely as high as 10%—by colchicine treatment by methods devised so far, it is necessary above all to include a large number of treated plants so as to increase the chances of achieving the desired objective. When complete unitary polyploids are not obtained, and the treated plants consist of diplo-polyploid and/or polyploid chimeras, it may be possible to obtain complete unitary polyploids indirectly in some cases by further breeding as already briefly indicated. The present results show for instance that in the case of the colchicine-induced periclinal diplo-tetraploid chimera of *Hemerocallis fulva* var. *rosea* clone ROSALIND, complete tetraploids (Plate 17-K) were obtained by selfing. This was to be expected because this clone is self-sterile in the diploid state so that only the n = 22 gametes are functional. In cases where the periclinal chimera is self-fertile in the diploid state, it might be possible to obtain tetraploids and triploids by sorting out the n = 22 pollen with the aid of the microscope for use in selfing.

Triploids (Plate 17-I) may be obtained by crossing colchicine-induced tetraploids with diploids if the parents are inter-fertile in the diploid state. When the tetraploid and diploid are inter-sterile, and diploids only are produced by crossing the chimera and a diploid (Plate 17-L), triploids might be obtained by sorting out the tetraploid pollen for use in the cross. It should be realized that in cases where only diploids appear when triploids and/or tetraploids are also expected in the progeny, the mechanism involved is not known at present, and suggestions given are based on an hypothesis.

Finally, a brief reference to the meaning of the results from the standpoint of experimental evolution on the level of quantitative mutation in chromosomes is in order. The genus *Hemerocallis* is a relict, and is the only one in the tribe *Hemerocalleae* (Traub and Moldenke, 1949, p. 12). Stout (1932) pointed out that *Hemerocallis* species in nature are quite uniform from the standpoint of chromosome numbers, all having the basic n = 11, with the diploid 2n = 22, excepting in a few triploids. He also indicated that "As long as the seedlings obtained have one parent which is diploid there is little chance of advancing to higher levels of polyploidy." The hurdle has now been made with the production of such colchicine-induced tetraploids as TETRA STARZYNSKI (Traub, 1949) and the tetraploid segregates obtained by further breeding—TETRA ROSALIND, TETRA PEACH, TETRA APRICOT and other unnamed tetraploids.

So far no aneuploids have been observed in these experiments. Although more than 25 seedlings have been obtained by selfing TETRA STARZYNSKI, only half of these have been studied in detail as to chromosome numbers because of the press of other work. All of those examined are tetraploids. Thus the chromosome series now is 2n = 22, 33/2 and 44. If aneuploids should occasionally appear among the segregates of the tetraploids, then the series could be amplified by aneuploid 2n numbers intermediate between the 2n = 33/2 and 2n = 44 euploid numbers.

It has already been noted that the *Hemerocallis* shoot apex is effectively insulated from the effects of external stimuli such as low or high temperature that might affect ploidy stability, and this is probably the reason why polyploidy has not entered to any marked extent into the evolutionary mechanism in this genus. Ploidy is restricted to the 2n = 22 level, except for only a few sterile triploids. Thus the influence of polyploidy in the evolution of this genus in nature is apparently postponed indefinitely, and its operation, if at all, from the standpoint of our own time frame, is dependent on the intervention of man.

The diploid clone MAYOR STARZYNSKI (Traub, 1939, 1940), 2n = 22, is a complex moderately self-fertile hybrid of unknown parentage as far as the records are concerned, but the vegetative and floral characters (Fig. 16-B; Plate 13-A) indicate that *H. multiflora, H. aurantiaca,* and apparently also some other species were involved in its heredity. It is one individual selected from a breeding progeny of many thousands. The breeding procedure was carefully planned to greatly speed up diversification in *Hemerocallis* hybridization by making it possible to obtain various crosses in a single capsule as contrasted with the slower tempo when two parents only are represented in a single capsule with the usual practice. Mixed pollens from more than 100 different individuals (including several species and some hybrids) were applied to about 100 different pistillate species and hybrid parents through several generations. Apparently this made possible the survival of the most advantageous chromosomal combinations from the standpoint of fertility due to survival in competition. Part of the pistillate and

pollen parents were replaced by additions selected from a new generation of hybrids coming into flower in each year. After a few years of selective breeding, a large percentage of the progeny became moderately to highly self- and inter-fertile.

The colchicine-induced tetraploid of MAYOR STARZYNSKI is therefore an allopolyploid because several species apparently are represented in its make-up as shown by the gross morphology. It now remains to consider the systematic position of the group of which the tetraploid is the type.

(a) The allotetraploid is self-fertile and also intra-fertile with its progeny and thus these are being maintained as a distinct intrabreeding group in the same manner as is possible with other synthetic species (Clausen & Goodspeed, 1925; Clausen, 1928). This is aside from the intriguing experimental project of attempting to establish the group as a self-perpetuating one in the wild which remains for the future.

(b) When diploid pollen parents are crossed on individuals of the intrabreeding tetraploid group triploids only are produced if progeny are obtained. Thus the group is effectively isolated reproductively from all other similar groups in the genus due to this difference in ploidy level.

(c) On the basis of the gross morphological characters, the tetraploid group (Table 1) can be readily recognized as distinct from the diploid whence the group is descended and from all recorded species in the genus.

In harmony with the usual procedure of considering self-fertile allopolyploids of this kind as candidates for species rank (Clausen & Goodspeed, 1925; Clausen, 1928; Dobzhansky, 1941) on the level of such synthetic taxons as *Nicotiana digluta,* the group under consideration is proposed as a new species.

Hemerocallis washingtonia Traub, **sp. nov.**—Herbae perennes; foliis numerosis auguste lanceolatis usque ad 81 cm. longis, medio 2 cm. latis, ad apicem acutis, ad basim 1.5 cm. latis; scapo usque ad 102 cm. alto, ad basim 1 cm. lato, apicem versus paulo angustato, ulta 67 cm. altitudinis brachiato; ramis secundariis 8—18 cm. longis; floribus 35 per scapum; ovario superiore; tubo tepalorum 2.1—2.2 cm. longo, 0.65—0.7 cm. lato; segmentis sepalorum 7.7—8.3 cm. longis, 2.3—2.8 cm. latis, late lanceolatis obtusis; segmentis petalorum 7.9—8.5 cm. longis, 4.6—4.8 cm. latis, late oblanceolatis, ad apicem rotundatis; staminibus 6.7 cm. longis; stylo stamina 2.5 cm. excendenti.

DESCRIPTION.—Perennial herbs; leaves numerous, narrowly lanceolate, up to 81 cm. long, 2 cm wide at the middle, pointed at the apex and 1.5 cm. at the base; scape up to 102 cm. tall, 1 cm. in diam. at the base, narrowing somewhat upwards, branching at the height of 67 cm.; secondary branches 8—18 cm. long; up to 35 flowers to the scape; ovary superior; flowers wide open, brilliant bronzy-rose-, peach- or apricot-colored; modestly fragrant; tepaltube 2.1—2.2 cm. long, 0.65—0.7 cm. wide; sepsegs 7.7—8.3 cm. long, 2.3—2.8 cm. wide, broadly lanceolate, obtuse; petsegs 7.9—8.5 cm. long 4.6—4.8 cm. wide, broadly oblanceolate, rounded at the apex; stamens 6.7 cm long; style 2.5 cm. longer

than the stamens. Type: Traub nos. 196—198; type illus. Figs. 16-A, 17-B-D-F-H, 18-B; Plates 13-B, 16-B, 17-B-D-E-F.

V. SUMMARY

(1) The usual methods employed for the induction of polyploidy in herbaceous plants by maximal colchicine-poisoning (colchicine 1% to 2% concentration) are relatively ineffective in the case of *Hemerocallis* where the cells of the apical histogenic layers and core of the shoot apex must be effectively polyploidized by the poisoning mutagen while the plant is in active growth if satisfactory results are to be obtained.

(2) Therefore, the method of minimal application of colchicine (.05% solution) to the apical histogenic layers and core of the shoot apex by absorption through the roots in 4 to 8, or more, 8-hour repetitive treatments, alternated with 16-hour recovery periods, was used to induce polyploidy in *Hemerocallis* with the following results:

(a) One *complete* colchicine-induced tetraploid *Hemerocallis* clone, Tetra Starzynski (2n = 44), the first ever reported, was obtained directly, showing that it is most difficult to induce complete unitary polyploidy directly by any method of colchicine-poisoning as yet reported—usually nil, very rarel up to 10%.

(b) The rest of the treated plants were colchicine-induced diplo-polyploid chimeras, including the mericlinal and periclinal types, from some of which *complete unitary* polyploids may be obtained indirectly by breeding methods as indicated under (3b & c) below, although in most cases the diploid sectors in the chimeras are gradually gaining dominance over the polyploid sectors. Thus, in difficult material such as *Hemerocallis* it is not necessary to obtain *complete unitary* polyploids directly, a most difficult task at best, since these may be obtained more easily indirectly by breeding methods from the colchicine-induced chimeras.

(3 The breeding behavior of the colchicine-induced complete tetraploid and the diplo-tetraploid chimeras was tested with the following results:

(a) More than 25 F-1 complete tetraploid segregates (2n = 44) were obtained by selfing the colchicine-induced tetraploid, Tetra Starzynski (2n = 44), and by the cross between one of these segregates, Tetra Apricot (2n = 44) x Tetra Starzynski (2n = 44).

(b) Complete triploids (2n = 33/2) were obtained by crossing the colchicine-induced tetraploid, Tetra Starzynski, with diploids.

(c) Complete tetraploids (2n = 44) were obtained by selfing the colchicine-induced periclinal diplo-tetraploid chimera of Rosalind, which produces n = 11 & 22 pollen in the same anther. The production of only tetraploids in this case is apparently due to the fact that the clone Rosalind is normally self-sterile in the diploid state so that only the n = 22 pollen is functional with the n = 22 female gametes.

(4) The method described for *Hemerocallis* may be applied for the induction of polyploidy by colchicine-poisoning in other difficult plant material as shown by the unpublished results obtained by the writer.

(5) With the addition of tetraploids, the chromosome series in *Hemerocallis* is now 2n = 22, 33/2 and 44 from the standpoint of quantitative experimental evolution of the chromosome complement in this genus. If aneuploids should occasionally appear in the F-1 progeny of the colchicine-induced tetraploids, or could be obtained by crossing of triploids and tetraploids, then the series could be amplified by the addition of intermediate 2n numbers between 2n = 33/2 and 2n = 44.

(6) The synthetic species, *Hemerocallis washingtonia* Traub, *sp. nov.*, the first tetraploid species in the genus, is proposed.

LITERATURE CITED

Blakeslee, A. F. The present and potential service of chemistry to plant breeding. Carnegie Inst. Wash. Year Book 37: 35—40. 1938.

Blakeslee, A. F. Effects of induced polyploidy in plants. Biol. Symposia 4: 183—201. 1941.

Boyes, J. W. and W. P. Thompson. The development of the endosperm and embryo in reciprocal interspecific crosses in cereals. Jour. Genet. 34: 203—227. 1937.

Buder, J. Der bau des phanerogamen sprossvegetationspunktes und seine bedeutung fuer die chimaerentheorie. Ber deut. bot. ges. 46: (20)—(21). 1928.

Chargaff, Erwin, Robert N. Stewart and Boris Magasanik. Inhibition of mitotic poisoning by meso-inositol. Science 108: 556—558. 1948.

Clausen, R. E. Interspecific hybridization in *Nicotiana* VII. The cytology of hybrids of the synthetic species, *digluta*, with its parents, *glutinosa* and *tabacum*. Univ. Calif. Publ. Bot. 11: 117—211. 1928.

Clausen, R. E. & T. H. Goodspeed. Interspecific hybridization in *Nicotiana* II. a tetraploid glutinosa-tabacum hybrid, an experimental verification of Winge's hypothesis. Genetics 10: 278—284. 1925.

Cornman, Ivor. Susceptibility of *Colchicum* and *Chlamydomonas* to colchicine. Bot. Gaz. 104: 50—62. 1942.

Cornman, Ivor. Synergistic and antagonistic influence on colchicine-poisoned sea-urchin eggs. (Paper read at AAAS Meeting, Dec. 1949; in press, 1950.)

Darlington, C. D. and L. F. La Cour. The handling of chromosomes. rev. ed. London. 1947.

Dermen, Haig. The mechanism of colchicine-induced cytohistological changes in cranberry. Amer. Jour. Bot. 32: 387—394. 1945.

Dermen, Haig. Periclinal cytochimeras and histogenesis in cranberry. Amer. Jour. Bot. 34: 32—43, 1947a.

Dermen, Haig. Histogenesis of some bud sports and variegations. Proc. Amer. Soc. Hort. Sci. 50: 51—73. 1947b.

Deysson, Guy. Action simultanée du phenyluréthane dans la colchicine sur les méristèmes radiculaires d'*Allium cepa* L. Compt. Rend. Acad. Sci. Paris 220: 367—369. 1945.

Dobzhansky, Theodosius. Genetics and the origin of species. 2nd ed. New York, 1941.

Emsweller, S. L. Colchicine-induced polyploidy in *Lilium longiflorum*. Amer. Jour. Bot. 36: 135—144. 1949.

Emsweller, S. L. and P. Brierley. Colchicine induced tetraploidy in *Lilium*. Jour. Hered. 31: 223—230. 1940.

Emsweller, S. L. and R. N. Stewart. Diploid and tetraploid pollen mother cells in Lily chimeras. Proc. Amer. Soc. Hort. Sci. Vol. 56, in press 1951.

Hoagland, D. R. and D. I. Arnon. The water-culture method for growing plants without soil. Calif. Agr. Expt. Sta. Circ. 347. 1938.

Johnson, B. Lennart and Austin Griffiths, Jr. Effect of temperature and humidity on the longevity of *Hemerocallis* pollen as measured by its ability to effect capsule and seed set. Proc. Amer. Soc. Hort. Sci. 55: 507—512, 1950.

Jenkin, T. J. Interspecific and intergeneric hybrids in herbage grasses. Jour. Genet. 28: 205—264. 1933.

Klein, G. and G. Pollauf. Nachweis des colchicins. Oestrr. Bot. Ztschr. 78: 251. 1929.

Knight, R. L. Dictionary of genetics. Waltham, Mass. 1949.

La Cour, L. F. and A. C. Faberge. The use of cellophane in pollen tube technic. Stain. Tech. 18: 196. 1943.
Lettre, Hans and Renate Lettre. Aufhebung der Wirkung von Mitosegiften durch chemische Faktoren. Naturwiss. 33: 283—284. 1946.
Levan, Albert. The effect of colchicine on root mitoses in *Allium*. Hereditas 24: 471—486. 1938.
Levan, Albert. The effect of acenaphthene and colchicine on mitosis of *Allium* and *Colchicum*. Hereditas 26: 262—276. 1940.
Levan, Albert and Ernst Steinegger. The cytological effect of chloroform and colchicine on *Allium*. Hereditas 33: 515—525. 1947a.
Levan, Albert and Ernst Steinegger. The resistance of *Colchicum* and *Bulbocodium* to the c-mitotic action of molchicine. Hereditas 33: 552—556. 1947b.
Norton, J. B. S., M. Frederick Stuntz and W. R. Ballard. Descriptive Catalog of *Hemerocallis* Clones, 1893—1948. The American Plant Life Society. Stanford, Calif. 1949.
Popham, Richard A. and Allan P. Chan. Zonation in the vegetative stem tip of *Chrysanthemum morifolium* Bailey. Amer. Jour. Bot. 37: 476-484. 1950.
Satina, Sophie, and A. F. Blakeslee. Periclinal chimeras in *Datura stramonium* in relation to development of leaf and flower. Amer. Jour. Bot. 28: 862—871. 1941.
Schmidt, A. Histologische studien an phanerogamen vegetationspunkten. Bot. Arch. 345—404. 1924.
Stout, A. B. Chromosome numbers in *Hemerocallis* with reference to triploidy and secondary polyploidy. Cytologia 3: 250—259. 1932.
Stout, A. B. Daylilies. 1934.
Stout, A. B. and T. Susa. Chromosome irregularities in relation to sterility in *Hemerocallis fulva* clon Europa. Ann. N. Y. Acad. Sci. 31: 1—30. 1929.
Stout, A. B. & C. Chandler. Pollen-tube behavior in *Hemerocallis* with special reference to incompatibilities Bull. Torrey Bot. Club 60: 397—417. 1933.
Stout, A. B. Daylilies with rosy pink coloring. Hort. (Boston) 16: 226. 1938.
Tôrô, Imre. Neue untersuchungen zur wirkung des embryonalen herzextraktes. Arch. exp. zellf. 22: 201—216. 1939.
Traub, Hamilton P. A convenient desiccator for storing pollen. Herbertia 3: 104—106. 1936a.
Traub, Hamilton P. Propagation of *Hemerocallis*. Horticulture 14: 478. 1936b.
Traub, Hamilton P. Propagation of *Hemerocallis* (Daylilies) by crown Cuttage. Herbertia 3: 123. 1936c.
Traub, Hamilton P. (Hemerocallis clone Mayor Starzynski). Herbertia 6: 156. 1939.
Traub, Hamilton P. Daylily breeding in subtropical Florida. Herbertia 7: 151—155; 157. 1940.
Traub, Hamilton P. Colchicine poisoning in relation to *Hemerocallis* and some other plants. Science 110: 686—687. 1949.
Traub, Hamilton P. Pure arabinates as ingredients in direct stain-mountants. (To appear in Plant Life, vol. 7, no. 2. 1951a).
Traub, Hamilton P. Arabinate direct stain-mountants. (In press, 1951b).
Traub, Hamilton P. Comparison of some chromosome shorteners. (In press 1951c).
Traub, Hamilton P. The temperature factor with special reference to arabinate direct stain-mounts. (In press. 1951d).
Traub, Hamilton P. and Harold N. Moldenke. *Amaryllidaceae:* Tribe *Amarylleae*. Stanford, Calif. 1949.
Traub, Hamilton P. and C. T. O'Rork, Jr. Papaya pollen germination and storage. Proc. Amer. Soc. Hort. Sci. 34: 18. 1937 (an extract from the unpublished ms. dated Sept. 26, 1936, "Papaya pollen germination and storage; rate of pollen tube growth and duration of pistil receptivity.")
Watkins, A. E. Hybrid sterility and incompatibility. Jour. Genet. 25: 125—162. 1932.
Wellensiek, S. J. Methods for producing triticales. Jour. Hered. 38: 167—173. 1947.
Zirkle, C. Combined fixing, staining and mounting media. Stain Tech. 15: 139—153. 1940.

xAMARYLLIS HENRYAE—A MINIATURE PINK MARVEL

HAMILTON P. TRAUB, *Maryland*

In 1948, Mrs. Mary G. Henry, of Gladwyne, Penna., made the cross, *Amaryllis belladonna* var. *haywardii* ♀ x *Amaryllis espiritensis* ♂ (see Plate 6 and Fig. 1) and produced the miniature pink marvel shown in

Fig. 22. *xAmaryllis henryae* Traub, *hybr. nov.* (type); (*Amaryllis belladonna* var. *Haywardii* ♀ x *Amaryllis espiritensis* ♂). This hybrid, produced by Mrs. Mary G. Henry, represents a most outstanding achievement in *Amaryllis* breeding.

Fig. 22. This is without doubt the most outstanding achievement in the entire history of the genus *Amaryllis* under cultivation—

(a) The flower of the type (Fig. 22) is a most beautiful pink (=

carmine, R.H.S. Chart, 21/1). Two additional individuals that flowered for Mrs. Henry in December 1950, are even more beautiful pinks, if that should be possible.

(b) The plant is small in stature so that 3 or more bulbs can be grown in a 5-inch pot. This has been the objective of *Amaryllis* breeders for a long time past.

(c) The plant is vigorous and increases rapidly by offsets so that commercial growers will be able to work up large stocks in a relatively short time.

(d) The hybrid apparently blooms normally in December, and thus can be forced for the Christmas trade.

We are indebted to Mr. Mulford B. Foster, for bringing back the smaller statured species, *Amaryllis espiritensis,* from Brasil; to Mr. Carricker, Jr., Dr. de Schauensee and Mrs. Henry for giving us *Amaryllis belladonna* var. *haywardii* (native to Bolivia), the first real pink *Amaryllis,* and to Mrs. Henry for making the synthesis that now gives us the first real miniature pink grandiflora hybrid *Amaryllis.* The hybrid is appropriately named for its originator, Mrs. Henry.

xAmaryllis henryae Traub, **hybr. nov.**—(*Amaryllis belladonna* var. *haywardii* ♀ x *A. espiritensis* ♂) Planta bulbosa; bulbo parvo; foliis persistentibus spathulatis usque ad 31 cm. longis, usque ad 3 et 3.5 cm. latis vel paullo latioris; scapo 15—16 cm. alto; spatha bivalvata, valvis 5.5 cm. longis lanceolatis; umbella biflora; pedicellis sub anthesi 2.5—3.5 cm. longis; ovario ca. 8 mm. longo; tubo tepalorum 2.5 cm. longo; segmentis tepalorum carminio-roseis lanceolatis 7.5—8 cm. longis, 1.7—3.2 cm. latis; staminibus styloque exsertis.

Description.—Bulb small; leaves evergreen, spatulate, up to 31 cm. long, up to 3 and 3.5 cm. wide, or somewhat wider; scape 16—18 cm. tall; spathe 2-valved, valves 5.5 cm. long, lanceolate; umbel 2-flowered (in type); pedicels 2.5—3.5 cm. long at anthesis; ovary about 8 mm. long; tepaltube 2.5 cm. long; tepalsegs carmine, lanceolate, 7.5—8 cm. long, 1.7—3.2 cm. wide; stamens and style exserted. Type: Traub nos. 194 and 195, in the Traub Herbarium; type illustration, Fig. 22.

xAMARYLLIS GLADWYNENSIS

Mary G. Henry, *Pennsylvania*

The fact that there are 56 fine healthy bulbs, mostly of flowering size, of *xAmaryllis gladwynensis* is more owing to the prowess of the plants themselves than it is to any effort on my part.

The acquisition of my treasured bulb of *Amaryllis belladonna* var. *haywardii* occurred in 1944. This important and unorthodox event was duly chronicled on page 83 of Herbertia, 1949.

(Left) *xAmaryllis johnsonii* Johnson ex Herb., from Naga Hills, India; (right) **xAmaryllis gladwynensis** M. G. Henry, **hybr. nov.** [*Amaryllis belladonna* var. *Haywardii* ♀ x *xAmaryllis johnsonii* (Naga Hills, India clone) ♂]. Photo by Mary G. Henry.

Plate 18

At the same time that *A. belladonna* var. *haywardii* was in bloom, a handsome vigorous red-flowered *xAmaryllis* was also in bloom. This was identified by Dr. Traub as *xAmaryllis johnsonii* (Plate 18, left). The bulb was sent to me by my daughter Josephine in 1945. She was in Assam with the Red Cross at the time. An army truck driver had brought it to her saying, "Here is a red Lily I got in the Naga Hills."

It was about January 1st, 1948, when I made the crosses, *A. belladonna* var. *haywardii* X *xA. johnsonii* (= *xAmaryllis Gladwynensis;* Plate 18, right) and *A. belladonna* var. *haywardii* X *A. espiritensis* (= *xAmaryllis henryae;* Fig. 22). The little tags that registered the crosses can plainly be seen in the picture page 85, Herbertia 1949. The seeds ripened in about two months. I planted one 12 x 12 inch flat with seeds of the first mentioned cross. It was March. Spring was in the air, the outdoors called me and I answered with my trowel and spade. The remaining seeds stayed where they had fallen to the sand of the greenhouse bench below them and there they sprouted and remained until the following autumn.

The seed pod pollinated with *A. espiritensis* was a bit later in ripening. Every one of these fell to the sand March 20th, where they sprouted and survived the summer, when they were planted in a flat and numerous pots. There are 44 of these. The plants developed from the seeds that had fallen to the sand were completely neglected by me, but there were orchids hanging overhead and when I sprinkled them, the baby *xAmaryllis* received a share and doubtless, too, received nutrition from this source.

So it was as usual, except for a few minutes to water night and morning, that I spent my days outside tending my Liliums of which I have over 125 species and varieties, my numerous deciduous *Rhododendron* seedlings, etc., etc.

By Autumn the *xAmaryllis* had developed into stout little bulbs. I admired enormously their courage and their "will to live," took pity on them and from then on have tried to take care of them.

Early in January, at an age of 1 year and 10 months, a flower bud emerged from one of the pot grown bulbs of *Amaryllis belladonna* var. *haywardii* X *xA. johnsonii*. Little did I know of the treat that was in store for me.

Not long afterward, this, my first hybrid *Amaryllis* seedling, expanded its utterly beautiful and utterly gorgeous carmine-pink flowers (Plate 18, right). Even if I had dreams for my first one, the flowers when they came exceeded my highest hopes.

Before the season was over, and while still under two years of age, *xAmaryllis gladwynensis* had produced three stalks of its stunning flowers.

xAmaryllis gladwynensis M. G. Henry, **hybr. nov.**—[*Amaryllis belladonna* var. *haywardii* ♀ X *A. johnsonii* ♂]. Planta bulbosa; bulbo magno; foliis 6—8 lanceolatis usque ad 62 cm. longis, medio 3.5 cm. latis; umbella 2—4-flora; ovario 3 cm. longo; tubo tepalorum 3.5 cm.

longo; segmentis tepalorum lanceolatis 10 cm. longis, 2.2—4 cm. latis, in typo carminio-roseis; paraperigonio nullo; staminibus pistillo brevioribus; pistillo segmentis tepalorum 3 cm. breviore; stibmate obscure trilobato.

DESCRIPTION.—*Amaryllis belladonna* var. *haywardii* ♀ X *xAmaryllis johnsonii* ♂ ; bulb large; leaves 6—8, lanceolate, up to 62 cm. long, 3.5 cm. wide in the middle; umbel 2—4-flowered; ovary 3 cm. long; tepaltube 3.5 cm. long; tepalsegs lanceolate, 10 cm. long, 2.2—4 cm. wide, carmine in type, other shades of red may appear in other individuals; paraperigone absent; stamens shorter than than style, which is 3 cm. shorter than the tepalsegs; stigma obscurely trilobed. Type: nos. 108 and 109, in the Traub Herbarium; type illustration, Plate 18, right.

NOTES.—The individual of *xAmaryllis johnsonii* used in the cross is shown in Plate 18, left.

xHABRANTHUS FLORYI

HAMILTON P. TRAUB, *Maryland*

In 1940, the hybrid, *Habranthus brachyandrus*, 2n = 24, ♀ X *H. tubispathus* (syn. *robustus*), 2n = 12 ♂, was reported (HERBERTIA 7: 167—168. 1940.). Flory, in 1941 reported the somatic chromosome number of this hybrid as 2n = 18 (Ann. Rept. Tex. Agr. Expt. Sta. *54*: 54. 1941; Amer. Jour. Bot. *35*: 791—792. 1948). The reverse cross is relatively more difficult to make, and only a few such plants have thus far been obtained.

This interesting hybrid (see HERBERTIA *8*: 92. 1942) has now been named, *xHabranthus floryi* [Fig. 23], in honor of Dr. W. S. Flory, who has contributed much toward the advancement of the amaryllids.

xHabranthus floryi Traub, **hybr. nov.**—[*H. brachyandrus* X *H. tubispathus*]. Bulbus illi Habranthi brachyandri consimilis; foliis linearibus 36—40 cm. longis, 8 mm. latis, basim versus valde angustatis, versus apicem leviter angustatis; scapo 22 cm. alto; umbella uniflora; spatha 4—4.5 cm. longa, dimidio inferiore in tubo connato; pedicello 7—7.5 cm. longo; ovario 1 cm. longo; tubo tepalorum 8 mm. longo; segmentis tepalorum 4-seriatis 9—9.5 cm. longis, 1—2,7 cm. latis, lanceolato-obtusis rubellis, gula subviridi; paraperigonio in gula fimbriis composito; staminibus fasciculatis declinato-adscendentibus 4-seriatis, stylo brevioribus; stylo segmentis tepalorum 3.5 cm. breviore; stigmate 3-lobato, lobis 3—4 mm. longis.

DESCRIPTION.—Bulb similar to that of *Habranthus brachyandrus;* leaves linear, 36—40 cm. long, 8 mm. wide, narrowed markedly toward base, less so toward apex; scape 22 cm. tall; umbel 1-flowered; spathe 4—4.5 cm. long, united into a tube in lower half; pedicel 7—7.5 cm. long; ovary 1 cm. long; tepaltube 8 mm. long; tepalsegs of 4 different

sizes, 9—9.5 cm. long, 1—2.7 cm. wide, lanceolate-obtuse, pink, greenish at throat; paraperigone of fimbriae at the throat; stamens fascisculate, declinate-ascending, of 4 different lengths, shorter than the style which

Fig. 23. *xHabranthus floryi* Traub, hybr. nov. [*Habranthus brachyandrus* ♀ x *Habranthus tubispathus (robustus)* ♂]. Named in honor of Dr. W. S. Flory.

is 3.5 cm. shorter than the tepalsegs; stigma 3-lobed, lobes 3—4 mm. long. *Habranthus brachyandrus* (seed parent) X *H. tubispathus* (L'Herit.) Traub. Type: no. 189 in the Traub Herbarium; type illustration, Fig. 23.

4. AMARYLLID CULTURE

[REGIONAL ADAPTATION, SOILS, FERTILIZATION, IRRIGATION, USE IN LANDSCAPE, DISEASE AND INSECT CONTROL, ETC.]

THE BLUE AMARYLLIS—**WORSLEYA RAYNERI**

I. INTRODUCTION, BY EDITH B. STROUT, *Chairman, General Amaryllid Commmitte,* Kentfield, California

When I first read about *Worsleya Rayneri* of the Organ Mountains of Brazil, I thought immediately of the coastal area of California just north of San Francisco, particularly the moors around Point Reyes, where there are rocky cliffs, much fog, yet never freezing weather. It seemed a natural setting for trying to naturalize this blue amaryllid in this country.

Although I live a little further inland where fogs are less frequent and our summers very dry, I had a keen desire to try some of these bulbs if I ever had the opportunity. But it was not until 1948 when Mrs. Meadows and Miss Breckenridge imported some for the Amaryllis Round Robins that the experiment could be begun.

In August of that year I received three bulbs of *Worsleya rayneri,* two of which I have kept. Having no granite available, I planted two in 5 gallon cans using broken parts of concrete and Haydite building blocks for filler, and sand and leaf mold on top of this. One of the bulbs (later disposed of) was so situated that a light spray from the leaking hose nozzle played over it every day and it seemed to root quite quickly. The other two took many months, in fact, nearly a year before they rooted. One was kept outside even in the cold weather of 1949 and 1950 (20° F.) and seems happy in our foggy cold winters. The other one was kept inside the house; this one having more loam than leaf mold. Although it had rooted, the bulb is shriveling and is loose in the soil, obviously objecting to its surroundings and struggling hard to keep alive. It probably dislikes the dryness of my dwelling. I still feel that nearer the ocean where there is fog part of the day for the greater part of the year, *Worsleya Rayneri* would feel right at home. Unfortunately I do not know any amaryllid enthusiasts in such a location.

Endeavoring to find the right cultural requirements for my bulbs, it was with great interest and satisfaction that I received and read the letters from Sir Henry J. Lynch of Rio de Janeiro concerning his planting of *Worsleya rayneri.* His timely letters giving cultural suggestions, and some of the photos that he sent, are reproduced in part II, below. These will be of interest and help to all amaryllid enthusiasts.

II. The Use of the Blue Amaryllis, *Worsleya Rayneri*, in Landscape Gardening, by Sir Henry J. Lynch, Rio de Janeiro, Brasil

[THE FOLLOWING LETTERS WERE WRITTEN TO MRS. STROUT BY SIR HENRY, AND ARE REPRODUCED BECAUSE THEY GIVE CONCRETE INFORMATION ABOUT THE CULTURE OF THIS RARE PLANT.—EDITOR]

[February 25, 1950] The following account of my experience in the cultivation of the *Amaryllis procera* I hope will be of interest to you and to your Committee.

This plant as you of course know has been described as the "rare Blue Amaryllis sometimes called Empress of Brazil."

According to the Journal of the New York Botanical Garden for March 1941, page 65, it is said to grow in only one spot in the World, namely in the granite formation of which the Organ Mountains is composed. These form a part of the sea range of mountains (Serra do Mar) on the coast of Brazil between the South of the State of Pernambuco and the north of that of Rio Grande do Sul. They are given familiar local names. That part of the range called "Organs" because of its resemblance to organ pipes, is situated north of the Bay of Rio de Janeiro, in which are the summer resorts of Petropolis and Therezopolis.

The exact spot in the district where the *Amaryllis procera* grow is beyond the valley of "Retiro" (Seclusion) about 2 miles east of the center of the town of Petropolis and its limitation is said to be a line not more than one mile in length. The Valley varies in height of about 750 metres above sea level and the mountains forming the valley rise to an elevation of 1200 to 1500 metres. It is in the crevices high up the northern side of this spur that these *Amaryllis* grow in their native surroundings.

A friend of mine with his family went to live in this valley on the 4th July 1938. They are great garden flower lovers and are frequent visitors here. They happen to be with me now and have prompted me to write this account with which they are in agreement.

Shortly after residing in the valley a stray wanderer or orchid hunter brought down from the mountains above a few bulbs which my friend purchased for a small sum. On showing them to a nearby commercial horticulturist he identified them as the little known *Amaryllis procera* and gave my friends a description of their natural habitat. His description coincides in many respects with the articles on this plant since published in volumes 5, 6 and 7 of your journal Herbertia.

My friend gave me his bulbs and the chance acquaintance I thus made with this uncommon plant inspired me to experiment cultivating it in my gardens, beyond the town of Therezopolis at an altitude of 800 metres.

Although I have visited and passed the "Valley of Seclusion" twice a week with few exceptions during the last 12 years I have never had the desire to attempt climbing to the spot where the *Amaryllis procera* are said to grow.

Nevertheless on account of their rarity I endeavoured to find some

Worsleya rayneri (J. D. Hooker) Traub & Moldenke—portion of 30 meter bed facing n. n. w., showing how the BLUE AMARYLLIS grows on the estate of Sir Henry Lynch, Fazenda Bôa Fé, Therezopolis, Brasil.

Plate 19.

local inhabitant interested in procuring for me a quantity of bulbs. My interest was at a later date increased on reading your journal HERBERTIA.

It was not easy to find the desired person for none of the nursery gardeners possessed these plants and they all knew there was danger climbing these particular mountains, several lives having been lost in the venture. Following a long search I found one, a Syrian by birth who claimed to know all about the district and undertook to organize a group of companions to bring me a number of bulbs.

Fig. 24. *Worsleya rayneri*; showing another planting of the BLUE AMARYLLIS on the estate of Sir Henry Lynch, Fazenda Bôa Fé. Therezopolis, Brasil.

After a lot of bargaining I undertook to pay him quite a considerable sum of money in consideration of his delivering to me in his garden by a certain date not less than 600 (six hundred) mature bulbs.

This he faithfully did and on the appointed day I transferred from his lorry to mine 612 bulbs, all he was interested in collecting.

On being paid he grumbled at the sum agreed upon, alleging the venture had been more difficult than he and his companions had contemplated, but knowing this class of individual I was adamant and we parted the best of friends, with his promise to do anything I would ask of him except to return for more *Amaryllis procera* bulbs!

Well satisfied, I went on to my property where I proceeded to plant my treasures which weighed individually from 3 to 10 lbs. each. On arriving at my "Fazenda" 20 kilometres inland from the sea, I started to sort and arrange their positions in the beds prepared to receive them.

Of the six beds, four of them were 10 metres (33 feet) long by two metres broad, on an incline of 45 degrees facing N.N.E., a fifth was 14 metres long by one metre broad and the sixth 30 metres by 2½. These two are also on a slope at the same angle and face N.N.W. [Plate 19; Fig. 24] They all separate terraces of flower beds and lawns etc.

All the beds were made alike, that is to say the bottoms sloping at the degree mentioned are lined with solid granite flags drawn from my quarry, of various sizes from 6 to 18 inches across and one or two inches apart. On these flags the bulbs were placed upright at a suitable distance from each other, packed between each with pieces of granite rock and with plants that coexist with them brought from the mountains with the bulbs.

I have not sufficient technical knowledge to define the several varieties of plants brought with the bulbs and I am prepared to agree with Mr. Harry Blossfeld's classification on page 186 of HERBERTIA vol. 7.

Very little space was left for leaf compost and earth to fill in the remaining space, after a preliminary watering for a few days they were left to take care of themselves.

The slopes are slightly watered during spells of dry weather and the heavy dew that falls nightly here and in all the surrounding district seems to be sufficient for their needs.

Three of the four ten metre banks on which my bulbs were planted enjoy a full day's sunshine for there are no near trees to shade them and the only advantage shade may give is very scant and merely comes on to the bulb-roots from the intervening plants above mentioned. The fourth is shaded during the morning and the plants have not developed so well. The other two banks are slightly shaded during the first 2 hours of sunshine and appear to do as well as those with a full day's sun. There are a few bulbs in a quite different situation, similarly planted and do as well as those in the five beds.

During the 11½ years these plants have been thriving in my garden they have had a minimum of attention from my gardeners although I have personally watched their growth and habits.

Their flowering season is during the Brazilian Summer and my present season commenced with the first bloom appearing in November and some are still in bloom at the end of February.

This season a very large number perhaps more than usual, have produced from 4 to 9 flowers on each stem. These stems grow more than 29" in length from the center of the sickle leaves. My flowering plants measure 32 to 38 inches from the surface of the granite packing to the base of the flower stem. The sickle shaped leaves measure progressively from the central short ones to the outside longest ones 7 to 26 inches. Many of the plants continue to stand upright though others incline in different directions.

During the course of the year an excentric plant will give forth a

beautiful bunch of blooms and this may happen at any time outside their usual season which according to my friend's horticultural neighbour is the month of February.

A peculiar feature of the flower is that it should be called "blue" and described as Hyacinth blue.

Fig. 25. *Worsleya rayneri,* close-ups; as grown on the estate of Sir Henry Lynch, Fazenda Bôa Fé, Therezopolis, Brasil.

Mr. Harry Blossfeld on page 191 of HERBERTIA vol. 7 says of them "the color being a bright heaven blue with darker veins." It is curious that to the naked eye, as far as my blooms are concerned they vary from the hyacinth blue shown on page 124 of "Garden Flowers in Color" by G. A. Stevens, Macmillan Coy. 1937—to a darker hue approaching mauve. On the other hand when they are photographed on an "Ansco"

colour film in the brightest sunshine they have the blue colour of a tropical cloudless sky.

I have pleasure in sending you some snapshots taken in bright light without sun and also in the brightest sunlight. These will show you how different the colours are, the first when seen with the naked eye and the others through the camera lens reproduced on film and paper. [Fig. 25]

Many of my friends can testify to our never having seen the sky blue colour shown in some of the photographs and only the other colours above mentioned in a variety of shades.

The temperature in my locality during the course of the year varies very considerably. From midwinter—May to August—and midsummer —November to March—the difference may be as much as 55/60 degrees Fahr. in the shade. During the cold season in the early mornings the temperature will fall to under 40 (never freezing) and rise during the afternoon to 70/80. During the summer months falling to 50/60 and rising to 95 and 100 degrees, sometimes more.

The atmosphere is considered very dry as compared with the native home of these plants for they are never in any circumstances enveloped in cloud during the day and doubtful if even during the night. The rainfall during the summer is heavy whilst during the winter we have spells of dry weather.

As regards these plants growing from seeds I must confess to a certain doubt as to whether they do so to any extent. In my recollection I have only seen two seed pods during these 11½ years. The first at a very early date to which I paid no attention imagining there would be a yearly recurrence of many more. In this I was mistaken for the second one only appeared this year and unfortunately the stem broke off when still green having been eaten by a bug at its base.

On the other hand they reproduce quite intensively as off-shoots from a parent bulb. Some of my original bulbs have withered and disappeared leaving large famlies in their stead which spread in such a way that gives the impression they are growing from seed.

Another reason I have for doubting these plants grow from seeds is the fact that they are only known to grow in the particular spot aforementioned. Now the Organ mountains are all covered with fissures and crevices consequently one would think the winds and birds would carry the seeds to other parts but of this there is no evidence.

I have found some of my bulbs have been attacked by a bug said to be the maggot of a local white butterfly but I am not sure that is the origin of the particular bug.

One other thing. I have no definite evidence that the bulbs bloom more than once for I have never marked them. Judging from the large number of blooms I have had yearly during my 11 and half years' experience I would say they bloom freely for it is only the mature bulbs that give flowers and none of the offshoots in my gardens are approaching maturity.

I am writing from my week-end home the "Fazenda Bôa-Fé" and do not pretend to be more than a very amaturist gardener and landscape

architect on my 2500 acre property. I have tried to reproduce the natural habitat of native plants from observation and enquiry so I trust you will understand my not entering into a technical description of such a rare plant as the subject of this letter.

[March 17, 1950] Since writing you on the 25th February I have seen some correspondence between Major Pam and friends, from which I learn that the Blue Amaryllis, EMPRESS OF BRAZIL, to which my letter refers, has changed her name to *Worsleya Rayneri.* Due to this I inadvertently overlooked the articles on this plant published in vols. 10 and 11 of HERBERTIA under this new name.

I have now read Dr. Hamilton P. Traub's article in volme 10 with the greatest interest and I am glad to know of the successes at La Positas Nursery.

As I mentioned in my letter I am not at all technical, nevertheless his description of species corresponds very closely to my observations. Two minor differences nevertheless may interest you:

Leaves: I have just counted a large number of my bulbs and cannot find any mature ones with as few as 12 to 14. Mine are mostly 18 with a few 16 and 20.

Umbel: In my recollection I have never seen more than 9 blossoms on one plant, whereas he mentions 4 to 14.

Then turning to page 38 in volume 11, I note with particular interest that the same bulb does bloom more than once. I believed this to be so but had no proof.

Again there is some difference between the composition of the beds in La Positas and in my gardens. In the former they are said to be of decomposed granite. In their natural habitat this may be so but I had grave doubts and preferred to make my beds of hard granite blasted from my quarry. In any case it seems these bulbs will grow equally well in either hard or decomposed granite.

Another interesting line in this short article is that "Seedlings are proving difficult" and this would seem to bear out the opinion I expressed in my letter to you.

Whilst on the subject of seeds I would return to volume 10 and in particular to the illustrations on pages 87 and 88. There I see in quite a small number of plants at least three bearing fruit (presumably what I called a seed pod).

How different the experience in La Positas is to mine. Apart from never having seen in my large collection more than two bulbs bearing fruit I have only had one fruit on each.

In my letter, page 4, last paragraph but one, I mention (never freezing). This referred to in my gardens. In the natural habitat of this plant I am quite sure they suffer several degrees of frost every winter.

Trusting these further remarks may be of interest to you and your Committee.

xCRINUM CLONE CECIL HOUDYSHEL IN VIRGINIA

C. W. CULPEPPER, *Virginia*

The Crinums have many characteristics that make them very desirable as ornamentals. The luscious tropical foliage with its resistance to disease and to the temperatures and sun of warm climates, the freedom of the bulbs and the rootstock from disease, and the interesting variations in the flowers all make the group decidedly valuable in climates where they can be grown. They are warm climate plants but there are considerable differences among the different species in their resistance to cold. How well they can be wintered over outside in regions near the northern limits of their hardiness is not well worked out.

In 1942 Dr. Traub took up emergency rubber production research work in California When he left Beltsville, Maryland he intrusted to my care three mature sized bulbs of *xCrinum* clone CECIL HOUDYSHEL. Each of these had one or more small offsets starting from near the base of the bulb. They were planted in a sandy loam of good fertility about 2.5 feet apart in a row in full sun at Arlington Va. I thought it would be worth while to see if they could be kept over winter outside in this locality. They grew well even the first summer and just after the first light frost killed the outer portion of the leaves a mulch of oak leaves and pampas grass was placed around and over the plants deeply enough to be assured that the bulbs would not freeze during the winter. As soon as danger of frost was over the following spring the mulch was removed and the plants examined. The bulbs were found to be sound with even eight or ten inches of the neck also quite alive. Most of the mulch material was removed; enough being left to conserve moisture and keep down weeds during the following summer. The soil about the plants was given a top dressing of a 5-10-5 fertilizer and little other attention was required until after the first light frost in the fall. During the summer the main bulb and the offsets grew vigorously and the main bulbs produced one or more flower stalks but it seemed that the display of flowers was altogether too small for the amount of foliage, but this was not true in later years. The same procedure was followed the second winter as the first, and so on until the present (1949). As the years passed the plants increased in vigor and in the luxuriance of the foliage. They have been entirely hardy with this treatment and the offsets have been produced so abundantly that the clumps have become very large. The bulbs at present are very crowded many of them with necks 18 inches to 2 feet in length. In 1949 there were more than 40 flowering stems which gave an excellent display of flowers over a period of several weeks, consequently the balance of foliage and flowers were not as much out of proportion as in the early years. As the clumps became larger the flowering stems increased in length and were 44 to 56 inches tall in 1949. In addition to their fine display in the garden the flowers are very useful for cutting.

Tests were not made to determine if the bulbs would survive the

winters without protection but the general appearance of the bulbs in the spring when the mulch was removed indicate that they would not survive unless planted very deeply. It is hoped that this may be tested out when the plants are taken up and the bulbs separated.

DAYLILY NOTES, 1949 & 1950

J. S. Cooley, *Maryland*

I. THE 1949 DAYLILY SEASON AT HOLLYHURST

Daylilies began blooming early in May this year, which is the usual time. Gold Dust was very floriferous. Some seasons this variety is disappointing because of the meager blooming but not this year. Also, the early mid-season varieties such as Flava, Chrome Orange and Queen Mary gave abundant blooms. The fact that these early and early mid-season varieties extend the blooming season is lost sight of by many people who are acquiring a number of varieties. In evaluating the early varieties, one should not try to compare them with those blooming at a different season of the year such as the fine mid-season varieties.

The mid-season varieties began blooming about June 16 and such late ones as Dorothy McDade about July 18. Berwyn began blooming about July 15.

The two early red seedlings of ours that showed promise other years were very poor this year, as long as the weather was cool. The color was disappointingly dull and muddy, but the flowers that opened after the advent of warm moist weather developed a normal good color. This is the first year we have grown Duncan. It bloomed at the same time as Victory Montevideo but Duncan was not so good this year.

We need to continue our quest for an early red. In this region, however, the weather is likely to be too cool for the development of a good red. Whether or not this limitation can be overcome remains to be seen. Our two early red seedlings that bloom about the time of Queen Mary indicate that an early red is possible. The seedlings produced by crossing a red variety on Buckeye were very disappointing. It looks as though some other line of attack will be more profitable. The effect of cool weather on red color in daylilies will probably be encountered in our quest for late reds. A red daylily blooming as late as *H. multiflora* would probably develop a poor quality of red color because of cool weather at the time of blooming.

It is interesting to note that during a period of unfavorable weather for the development of good red color in daylilies, some varieties are much less affected by the adverse conditions than others. Berwyn is a good example of a variety that has good quality of red color even during a cool spell of weather. It may be possible by persistent effort to incorporate this color quality into varieties blooming earlier and later than the very satisfactory mid-season varieties. The accomplishment of

this will mark another step in the development and extension of the use of this fine group of plants.

II. THE 1950 DAYLILY SEASON AT HOLLYHURST

The winter here was very mild, but the spring was much cooler than usual. The late spring delayed blooming considerably. GOLD DUST bloomed later and much more freely than APRICOT. The idea is held by some that the irregular and often sparse blooming of certain early varieties, such as APRICOT, is due to insufficient cold during the winter to break dormancy. Our observations point to the conclusion that there are a number of contributing factors and if insufficient cold is concerned, it is only one of a number of factors entering into the complex.

Hemerocallis flava was unusually free blooming this year. This species blooms at the same time as bearded iris and therefore makes a very beautifrul supplement to the iris colors of blues and purples. It is strange that more gardeners do not make use of the early varieties such as *H. flava.* As the blooming of *flava* is passing CHROME ORANGE begins. This variety is in the early mid-season class blooming along with QUEEN OF MAY, QUEEN MARY, SEMPERFLORENS, and SUN GOLD. Sometimes some of the early mid season varieties give very sparse bloom—maybe due to cold injury to the bud primordia. CHROME ORANGE, however, has been very dependable year after year. Sometimes the weather is such that some days the blooms burn but in general this variety is a splendid garden flower. It is a free bloomer, it has large flowers of good finish and texture. *It is the only variety the great naturalist, the late Theodore L. Mead, introduced and is a tribute to the good judgment of the introducer.* Moist warm weather in the latter part of June and early July was very favorable for daylily bloom. The richness of color in the mid-season daylilies was especially fine this year. A few warm bright days the latter part of June following moist and cool weather resulted in severe burning of many varieties of daylilies. Early in July the weather was moist and warm with only a moderate amount of sunshine. During this period when many of the mid-season varieties were in bloom the colors were very rich and beautiful. Such varieties as SAN JUAN, MAYOR STARZYNSKI, LIDICE, DR. STOUT, J. A. CRAWFORD, PATRICIA, CORLISS, CABALLERO and many others were very beautiful. That is to say the weather was favorable for beautiful flowers on all the color types, the reds, the yellows, and the pastel blended shades.

The extensive activity in the breeding of daylilies at the present time will undoubtedly work for the ultimate improvement of this fine garden flower. It is to be hoped that the best of the enormous number of introductions will be preserved for posterity. The outstandingly good new varieties would probably be less likely to be lost to the world if there were fewer introductions. That is to say, if each breeder would use all the restraint possible to introduce only those that are better than what we already have, it would tend to keep down the number of new varieties to be appraised. Even if a variety is only slightly superior to one we already have its introduction should make for some slight progress. We

are probably too close to the changing conditions in the varieties of daylilies to appreciate that fact fully. It is no doubt true that the outstandingly good varieties will come to the top under any conditions and be preserved. This is probably a time when one will have to exercise a great deal of forbearance and not decide to quit getting any new ones just because one expensive variety we purchased was inferior to those we already had.

THE 1950 DAFFODIL SEASON

GRANT E. MITSCH, *Chairman,*
Narcissus Committee, Canby, Oregon

For the past two years we have been telling of abnormally late cold seasons but the current season has been one to make us forget previous winters in the point of severity. The freezing temperatures did not hold on so long without a break as in 1949, but we witnessed the coldest weather of our twenty-five years spent in Oregon. Aside from fact that it did not last as long, there was one other redeeming feature in this winter's performance:—the ground was covered with snow most of the time.

Quite dry and pleasant weather prevailed through autumn and the early part of the winter, but with the advent of the new year, winter arrived with a vengeance. New Year's Day brought about two inches of snow and the thermometer dropped to 16° F. A day or two later there was a regular blizzard. Most of the snow melted by the 5th of the month and there followed several days of intermittent snow and rain. Rains coupled with freezing temperature were frequent and highways became so glazed with ice that travel was hazardous. The trees and shrubs were beautiful to behold with their jeweled raiment until the load became so heavy that branches started breaking. Fortunately the ice soon melted, but there soon followed brisk biting northeast winds bringing a cold air mass in from Canada with more snow accompanying. Most of the snow melted a few days later but the respite was of very brief duration as cold winds brought more and the temperature dropped to about 5° F. below zero January 31st, a record to be matched three days later. In another four days I dug a bulb of *Narcissus minimus* from the garden and potted it. The next day it had a bloom open! It is a marvel how these spritely little flowers can take such adverse weather! Yet, were it not for the snow it would perhaps have succumbed.

Many thousands of Camellias and Rhododendrons were killed down to the snow level besides many more being killed outright. Many other comparatively tender shrubs and trees suffered a like fate. Much of the fruit crop was destroyed or damaged. But the snow did protect the field crops such as grain and hay, and it prevented the soil from being frozen more than at the very surface, allowing the roots of bulbs to continue functioning. Thus, in spite of the severe winter, we had FEBRUARY

GOLD in bloom by February 25th, the first time in three years that it had lived up to its name.

MITE and a MAGNIFICENCE x *N. cyclamineus* seedling were again among the very first flowers to bloom, but by March 4th we were able to cut a nice lot of ROUGE and BRUNSWICK. These should be two fine market flowers in the future, as in addition to being early, they are high quality flowers. ROUGE is a flower of nice form and bright coloring and the unusual yellow perianth suffused with pinkish buff gives it distinction. For some years we have been carrying on a DAMSON x FORTUNE seedling which is very early blooming and has a large cup of most intense chrome orange. Its perianth is not as flat and smooth as we would like and the flower tends to face down a bit too much, but because of its brilliance, size, and prolific blooming we enjoy it very much for early cut flowers.

While the Daffodils started blooming earlier than a year ago, the weather remained cool and damp and after the first early flowers opened, other things were very slow coming out until the last week in March. Even then, it rained nearly every day until the late varieties were opening, making it difficult to do any pollenizing. The cool damp weather was quite ideal for the red cups and never have I seen finer blooms of some of these. BAHRAM was magnificent with its large very smooth rich yellow perianths and blazing solid orange red cups. It is giving some very nice seedlings. Crossed with a seedling of CHEERIO x MARKET MERRY which we have named ARDOUR, it gave numbers of smooth flowers with brilliant red cups. ARDOUR crossed with other things has given very nice flowers and we used its pollen quite extensively this year. This flower first bloomed five or six years ago in a lot consisting of only three or four bulbs, I believe, and being about the best red cup we had bred up to that time, the same cross was repeated both ways on a much larger scale but nothing of much merit has appeared in the resulting seedlings. Unfortunately, the cup of ARDOUR is quite susceptible to burning in sun or wind, but because of the substance of the large broad flat perianth, and the brilliance in coloring, it appears to have value in breeding. We will eagerly anticipate the results of a group of seedlings from it crossed with SUN CHARIOT. A series from DIOLITE x CARBINEER gave a goodly number of very smooth large well formed flowers; most of these had red rimmed cups with a few solid orange red crowns.

KRAKATOA was quite sensational this year and a group of blooms picked for the Tacoma show furnished a spectacular focal point for the exhibit. NARVIK as usual was splendid and it appears to be one of the most promising of all the red cups either for exhibition or commercial use. It is not a large flower. We have never seen larger nor more brilliant blooms of ROYAL MAIL, GARLAND, DUNKELD, TAMINO, CHUNGKING, and INDIAN SUMMER were all very fine.

There is still nothing to beat GALWAY for an all yellow Daffodil. Of the trumpet varieties, KINGSCOURT is about the best but MILANION is very good and so is the entirely different very early blooming FRONTIER. We had some splendid yellows from CAMBERWELL KING x MORTLAKE, and one of the finest we have ever seen came from KING OF THE NORTH x CONTENT, a flower built on the lines of KINGSCOURT but larger and with a flatter perianth. This same cross gives many of those unusual

greenish lemon or sulphur colored flowers and an occasional reversed bicolor. Mr. Wilson's MOONSTRUCK and SPELLBINDER came from these parents and we have had numerous flowers of this type. HUNTER'S MOON x CONTENT, and KANDAHAR x CONTENT have given similar flowers and almost white but still possessing a little of the cool color tones found in CONTENT came from this variety crossed on CANTATRICE. CONTENT pollen used on GODOLPHIN, POLINDRA, and BINKIE yielded several interesting flowers. We consider BINKIE one of the most desirable flowers for cutting, its beautiful form and unique cool coloring making it a most charming subject for vases.

WHITE DAFFODILS have always been favorites with us and we always thrill to the chaste beauty of TRUTH, ZERO, and CANTATRICE which are among the first to bloom of the large pure whites. COOLIN has been exceptionally fine the last two years. LUDLOW is unsurpassed for beautiful form, quality, and purity. None of these are quite as spectacular as KANCHENJUNGA with its enormous heavily frilled trumpet, or the giant tall BROUGHSHANE, both of which appeal to visitors more than any other named whites we grow. A seedling from KANCHENJUNGA x ADA FINCH was most striking, being a very large clean pure white flower on a tall stem. Several blooming for the first time from KILLALOE x BROUGHSHANE looked very promising and should prove worth while when grown from full size bulbs. Perhaps the biggest Daffodil we have ever seen came from KANDAHAR x ADA FINCH; a very coarse flower but one which makes quite a garden display. On the other hand, for perfection of form and balance, there is nothing more beautiful than CHINESE WHITE, and it is already proving a good parent. From a group of seedlings of this and GREEN ISLAND crossed both ways we had several most beautiful flat crowned flowers of lovely form bloom, and curiously, there were two or three pink toned flowers among them.

CHINESE WHITE is only one of the good Daffodils in its class; we still think most highly of FOGGY DEW, TINSEL, SYLVIA O'NEILL, and GLENSHANE. Apparently they all furnish good breeding material, for while we have not bloomed many seedlings from any but SYLVIA O'NEILL, some nice flowers have appeared. From a lot of RUBRA x SYLVIA O'NEILL we selected a number of interesting things when they started blooming in their fourth year, several more were taken out the following season, and this, their sixth year, we picked about half the blooms from the remaining bulbs, any one of which was quite the equal of its parents and all with beautiful cups varying from pure white to some edged with lemon, gold, and orange salmon, in some cases there being but a narrow picotee edging, and others with a broad band of color. From ALBERNI BEAUTY x SYLVIA O'NEILL came several beautiful flowers, one being a larger more striking flower than SYLVIA O'NEILL. ANGELINE x SYLVIA O'NEILL produced a number of very delicately marked flowers. From CUSHENDALL x CANTABILE there were numbers of beautiful green eyed flowers, one having a perianth so rounded and broad that the inner segments touched.

Pink tinted flowers are intriguing to most Daffodil fanciers and while we do not grow nearly all the varieties in this color class, we have

quite a number of them. There is still room for much improvement, not only to increase color intensity and better the form of the flowers, but to stabilize the coloring already present. Weather conditions have much to do with color but what affects one variety may not another. During 1949 when we had clear sunshiny weather during most of the blooming season, DAWNGLOW, ROSARIO, and the old MRS. BACKHOUSE had about as fine coloring as I had ever seen while WILD ROSE and some of our seedlings were more deficient in color than any other time in our experience. This year with continuous damp weather, the first three had less color than last year whereas WILD ROSE, LISBREEN, LOUGH MAREE, INTERIM, and others had much better. MABEL TAYLOR had good coloring both years but I think somewhat less than some other seasons. A small flowered seedling from (WHITE SENTINEL x MRS. R. O. BACKHOUSE) x WILD ROSE which came with intense rosy pink coloring two years ago and was very pale last year returned with its original coloring again this season. SHIRLEY WYNESS has comparatively little color at best but has proven a good parent. Crossed with PINK A'DELL it gave numbers of flowers with good form, the crowns being nicely frilled and several with quite good shell pink coloring, one being the best pink we had during 1949, the color being quite uniform throughout the trumpet-like crown. TUNIS x SHADEEN gave numbers of well formed tall-stemmed flowers with just a suggestion of pinkness, but one flower was of good size with the entire crown a rich deep salmon pink which lasted well. From PINK LADY x SHOT TOWER came several well colored flowers with rather unusual bell shaped crowns. EVENING crossed with MABEL TAYLOR and MRS. BACKHOUSE gave flowers of nice form and several with good coloring. Most of them were rather small but they may increase in size when bloomed from mature bulbs. A large series from SHIRLEY WYNESS x MABEL TAYLOR started blooming in their fourth year and practically all that opened had more or less color; the first time we could look down a row of unselected seedlings and see nearly all the flowers with pink coloring. Most of these leave much to be desired but there were several which showed promise and nearly all had attractively frilled crowns. One flower from this cross looked much like a smaller JOHN EVELYN with a pink crown. From WILD ROSE x BROUGHSHANE came several quite large flowers with pale pink coloring which should prove useful for further breeding. Perhaps the most startling flower to appear in a pink cross this year came from INTERIM x MABEL TAYLOR. Even though from a small bulb, it gave quite a good sized flower of very nice form, having flat smooth perianth and a medium sized crown, rather long, with about a half inch band of intense coloring that might be described as rich salmon rose with a copper suffusion. This was not a large series but nearly all the flowers that bloomed from this cross were interesting as to form and coloring. We look forward to seeing these and others from the same cross which did not bloom including a larger lot from the same pedigree. The first comparatively good pink we had come from WHITE SENTINEL x MRS. R. O. BACKHOUSE. This seedling crossed with INTERIM produced a lot of only about half a dozen bulbs of which three or four bloomed this year. The best was a flower with white perianth and white crown with a band of quite clear pink about half its length; an inter-

esting thing in contrast to others which have yellow, primrose, or cream as their basic color. KENMARE has never given enough color here to really warrant being called a pink, but combined with MABEL TAYLOR it gives good sized flowers with salmon pink crowns.

With bi-color flowers other than the pinks and yellow-reds we have done less hybridizing—although we have some of the best named varieties. PREAMBLE looks like the best bi-color trumpet yet to appear although those with less contrast in coloring contain noteworthy representatives in SPITZBERGEN and TROUSSEAU. Of the large cupped varieties, BODILLY and POLINDRA are still difficult to surpass. We were much impressed with SEBASTOPOL this year. Of the larger red cups KILWORTH and FERMOY are outstanding and of the small cupped Daffodils, there are a number that are very good, among which LIMERICK and BRAVURA rate at the top.

While we had rather bad weather during the blooming season and could not accomplish much either in hybridizing or taking notes as we would wish, it has not been a bad season at that!

NARCISSUS NOTES 1950

J. S. COOLEY, *Maryland*

As the years come and go each growing season seems to bring to mind the influence of weather conditions on some plant in which we are especially interested. If one is disposed to try to interpret the effect of these environmental influences on the health and vigor and productiveness of certain plants, *Narcissus* for instance, he usually has plenty puzzling things to try to account for. The past year, with the mild winter and cold spring, was a good example of such a set of conditions. The leaves of some varieties emerged as early as December. The weather continued mild in December, January and February and the early varieties had bloom scapes well formed early in March. The weather changed suddenly to the cold side about March 15. When the early varieties were nearly in full bloom the thermometer registered 22° to 25° F. for a number of nights. For about a month cool weather prevailed with temperatures often below freezing. This cool weather undoubtedly had its effect upon narcissus blooming. However the complexity of such a situation is so great it is difficult to evaluate properly the different causal factors. Among the earliest bloomers there was a great variation in tolerance for weather that was freezing or below. FEBRUARY GOLD showed greater tolerance of the cold than any other variety blooming at that time. In fact it was surprising to see the flowers and scapes frozen stiff in the morning and yet recover when the temperature rose later in the day. The varieties THE FIRST and MALVERN GOLD were decidedly affected by the cold. Some of the buds on THE FIRST blasted and others did not unfold properly. THE FIRST as well as some other varieties gave a very poor yield of blooms. This makes one wonder whether or not some of the bud primordia were frozen to death before they emerged. If this condi-

tion obtained in the case of THE FIRST it may help to account for the poor yield of flowers of many varieties this year.

Another aspect of the cold was poor unfolding and development of flowers. Some varieties did not unfold their flowers completely thus remaining funnel form instead of wide open with flat perianths. Another effect of chilling was a crinkling of the flower. This was particularly true of GOLDEN SCEPTRE and also some other Jonquilla hybrids. The flowers of some of the Jonquilla hybrids also failed to make the necessary development after the buds opened, thus making a short crinkly flower. On the other hand the orange cupped varieties, such as FORTUNE and RED CROSS, were unusually beautiful with their rich glowing orange cups. These as well as other orange cup varieties often fail to produce orange cup flowers—only a yellow.

In spite of the effect of the weather on certain Jonquilla hybrids, their general effect was good and it was surprising and gratifying to note how many visitors were attracted to the intimate beauty of the little Jonquillas. They realized the potentialities of this group as a garden flower or a cut flower for small arrangements. As the beauty and dependability of the Jonquillas becomes known it is possible that increased interest will develop in this group. It is true that some persons saw only the giants, such as ADVANCE GUARD, GOLDEN HARVEST, STRESSA, and the like.

Another effect of the cold was a browning of the tips of the leaves, resembling the effect of basal rot, but on examining the roots no basal rot was found, The symptoms indicated that the cold injured the tips of the leaves and the browning and death of the injured parts took place some time after the injury occurred.

As a group, *Narcissus* still lacks the popularity it merits both as a garden flower and as a cut flower. With the great advance that the breeders have made with this flower in recent years it does seem strange that it is not more generally used by the home gardeners and flower lovers.

Conditions this year were very unfavorable in this region for the setting of seed. Some seasons are unfavorable for pollination because of warm weather, but this year when the temperature was below freezing so many nights after the blooming started, it apparently was too cold for fecundation to take place. My pollination of early varieties gave practically no seed. A few of the later varieties which bloomed after the weather was somewhat warmer set a little seed.

The cold moist spring has been very favorable for leaf development. The tall and vigorous plants this year should be producing fine bulbs and therefore we should expect fine flowers next year.

It may not be amiss to mention here some of the varieties that were good and also some that were not good. FEBRUARY GOLD, GOLDEN HARVEST, BEERSHEBA, FORTUNE, DAWSON CITY, TRIVITHIAN, MRS. BREWSTER, LOVENEST, ALCIDA. LUCINIUS. HERA, HORACE, and ACTAEA were good, while WHITELEY GEM, THE FIRST and MALVERN GOLD were injured by the cold.

EVALUATION OF DAYLILIES IN MISSOURI

GEORGE E. LENINGTON, *Missouri*

For the past several years, visitors to the Lenington Display Garden [Fig. 26], in Kansas City, Missouri, have voted for the *Hemerocal-*

Fig. 26. Portions of Lenington *xHemerocallis* Trial Garden, Kansas City, Missouri —(Upper left, and right; and lower left) Mid-June, 1949; view in upper left, looking toward K. C. Life Ins. Co., apt. house and office bldg.; (lower right), taken Oct. 4, 1948, showing Mr. Lenington, and second bloom scape of CERISE.

lis they considered best. At the end of each season, tabulation of the votes gave interesting information yet it seemed evident that the visitors

were voting for the varieties they had in their own gardens, or the ones with which they were the most familiar, rather than for those with improved form, color or substance. For that reason, in the spring of 1949 the name-stakes were replaced with numbered stakes and the visitors made their selections by number instead of by name. (A printed list of the variety names and numbers was given each visitor AFTER he made his selections.)

As expected, tabulation at the end of the season (1949) revealed that the old favorites had been replaced by newer and better hybrids. For example, the top 15 varieties were as follows: 1. PAINTED LADY, 2. NARANJA, 3. CAMELOT, 4. CONSTANCE, 5. HONEY RED HEAD, 6. SCARLET SUNSET, 7. WEKINA, 8. BLACK HILLS, 9. FELICITY, 10. CAPT. BLOOD, 11. MRS. HUGH JOHNSON, 12. FLAME FAGOT, 13. RUBY SUPREME, 14. MAJESTIC, 15. CERISE.

The same procedure was followed again during the 1950 season. Of the 234 varieties in the display garden, the following were the most popular:

Early—1. FLAVINIA, 2. JUDGE ORR, 3. ELIZABETH.

Intermediate—1. QUEEN OF GONZALES, 2. DUNCAN, 3. CAPRICE.

Summer blooming—1. CRIMSON STAR, 2. GARNET ROBE, 3. NARANJA, 4. PINK BOWKNOT, 5. WINDSOR TAN, 6. CONSTANCE, 7. MAJESTIC, 8. REVOLUTE, 9. BROCADE, 10. KNIGHTHOOD, 11. PAINTED LADY, 12. PATRICIA, 13. COMET, 14. BRACKEL, 15. THE CHAMP, 16. TA MING, 17. SILVER STARS, 18. CAPT. BLOOD, 19. SIDE SHOW, 20. RUDBECKIA, 21. PYGMALION, 22. MRS. B. F. BONNER, 23. MARIONETTE, 24, MING TOY, 25 NORTH STAR, 26. BICOLOR, 27. HESPERUS, 28. BALLET GIRL, 29. MIDWEST MAJESTY, 30. BOLD BEAUTY, 31. ORANGE BEAUTY, 32. JULY APRICOT, 33. SCARLET SUNSET, 34. DUCHESS OF WINDSOR, 35. HAILE SELASSIE, 36. BLACK PRINCE, 37. SAN JUAN, 38. BLACK HILLS, 39. BETTY SLICK, 40. DR. SLAUGHTER, 41. THE DIRECTOR, 42. GOLDEN GIANT, 43. OPHIR, 44. WEKIWA, 45. AMHERST, 46. ARTEMIS, 47. COLONIAL DAME, 48. FAIR ALICE, 49. MARCO POLO, 50 PLUM MIST.

Late—1. MARTIE EVEREST, 2. AUTUMN PRINCE, 3. BRIGHT EYE.

Nearly two dozen varieties failed to receive a single vote—even though the garden was host to more than 600 visitors—so they will be replaced by varieties that have been growing in the small garden. In addition, 26 others will be added, making a total of 260 to be seen by the 1951 visitors. The new introductions, which are being received this fall, will be planted in the small garden—to become replacements in 1951 and 1952.

Anyone wishing to visit the display garden is cordially invited to do so. Located in the heart of Kansas City, Missouri at 3535 Penn., on the grounds of the Kansas City Life Insurance Co., it is easily reached by all means of transportation.

AN AMARYLLIS BIRTHDAY CAKE

MARY G. HENRY, *Pennsylvania*

This year as usual I rejoiced in a happy family gathering on my birthday with most of my children and 11 grandchildren at the evening meal.

Fig. 27. Henry Birthday Cake; featuring the new *xAmaryllis gladwynensis.* Photo by M. G. Henry.

My joy was quite complete when my "birthday cake" appeared.

Almost as lifelike as if just laid on the cake was a gorgeous replica, in full and well-matched color, of *xAmaryllis gladwynensis!* [Fig. 27] The flowers were the same perfectly marvelous carmine and the bulb of chocolate completed the picture. It was made and decorated by my daughter Josephine.

PLANT LIFE

VOLUME 7

[Number 2, April]

1951

GLORIOSA LILY EDITION

EDITED BY

HAMILTON P. TRAUB

HAROLD N. MOLDENKE

THE AMERICAN PLANT LIFE SOCIETY

Box 2398, Stanford, California

PREFACE

The 1950 GENERAL EDITION features an important article by Mr. Hayward on the GLORIOSA LILIES. Mr. Hayward has made a special study of this genus and he shares his findings with the readers. He is also well versed in the culture of this fine group and passes this information along also.

There are other interesting articles in this issue—Mrs. Henry writes about an interesting western trip in 1950; Mr. Allgeyer writes on plant growing experiences; a quotation from the late Henry Nehrling is reprinted; and a note on cytological mountants is included for those who wish to study chromosomes in plants.

December 10, 1950

Hamilton P. Traub
Harold N. Moldenke

FLORIDA—LAND OF FLOWERS

"The late afternoon hours of spring, summer and autumn in Florida have an indescribable charm, a charm peculiarly their own, and the early morning hours are scarcely less enchanting. This is the time to enjoy nature, to enjoy our gardens and flowers. In the evening glow or very early in the morning, I am fond of wandering through my *Amaryllis* and *Caladium* gardens to meditate on the ineffable glory of nature, to think of my ideals and of all that makes life beautiful. How charming is this Florida evening glow as it falls on the brilliant blossoms of the *Amaryllis* or on the georgeous leaves of the Caladiums! In the cedars nearby the cardinal sings in jubilant notes its evening hymn, the mockingbird pours forth its unrivaled melodies from the top of an orange tree, and the loud whistling calls of the chuck-will's widow resound from the thickets of near woodlands. It is twilight. The air is wonderfully soft and salubrious, and the bright stars appear, and shine as they only can shine in Florida—the land of flowers, the land of my ideals in horticulture."—*Henry Nehrling* (in Proc. Florida State Horticultural Society, 1908)

THE GLORIOSA LILIES

WYNDHAM HAYWARD, *Florida*

The GLORIOSA LILY, at least in the species *Gloriosa rothschildiana,* is rapidly assuming an important place in the sun of cut flower horticulture both in the United States and Europe. Its place in the garden also looms ever larger.

The species *Gloriosa rothschildiana* [Fig. 28] is one of the newest of horticultural favorites, viewing it from the longer perspective. It was first described in 1903 in the (English) Gardeners' Chronicle by James O'Brien, gardener to the Hon. Walter Rothschild, M. P., following its coming into flower at the Rothschild estate, Tring Park, Tring, England.

Its discovery by Maj. H. B. Rattray, in the Uganda district of East Africa may safely be described as one of the high points in modern garden and plant exploration annals. Shortly after its first flowering in England it was illustrated and described in a number of European garden papers, and proved a sensation when shown at various flower shows. O'Brien soon sent tubers to his fellow plantsman and pioneer Florida horticulturist, the late Henry Nehrling, at Gotha, Fla., who found the plant admirably adapted to ordinary garden culture in Florida.

From these first few tubers have come the thousands that are now being grown by commercial growers and dirt gardeners all over the world. In Holland, the firm of C. G. Van Tubergen, as reported in a recent number of the Royal Horticultural Society Journal, cuts an important crop of commercial cut flowers from the *Gloriosa* bulbs blooming in its greenhouses.

At least one nursery in California grows the tubers under glass for the production of flowers for the Los Angeles market. In Florida three or four growers mainly in the central part of the state where the bulb seems particularly adapted, grow the *Gloriosa* by the thousands for the sale of both cut flowers and tubers.

The *Gloriosa* is a popularly fascinating and scientifically interesting subject, which accounts for its rapidly increasing vogue in the recent 20th century since the bulbs have become available in larger quantities. The first species known to horticulture was *G. superba,* known to pre-Linnaean writers, as Herrmann, under the name of *Methonica malabarorum.* Linnaeus gave it the generic name *Gloriosa,* and so it has remained despite the efforts of botanists to refer the genus back to *Methonica* as late as the mid-19th century.

According to the Botanical Magazine, which has a plate of this beautiful subject as No. 77, "the extravagance of the present generic name, its being accompanied by a specific one little less exaggerated, its being an adjective, and more worthy of the whim of a Dutch Florist than of the taste of Linnaeus, have provoked several attempts to get rid of it for that of *Methonica,* an appellation the plant is known by in Malabar." (1810)

Its unusual name, it must be admitted, well signifies the realization

of the early plant workers of its exceptional beauty and the exotic qualities of its coloring and form. Freely translated it might be referred to "The Superb Glory Lily," which is certainly "painting the lily," but admittedly deserving in the case of the *Gloriosa.*

The genus *Gloriosa* is a small one, between 10 and 15 species being known today, and of these only four or five are known in gardens. Only recently have some garden hybrids been reported in Florida by Jules Colle of Fern Park. The species grown in the United States include *G. superba* [Fig. 29, A], *G. rothschildiana* [Fig. 28], *G. carsoni* and *G. plantii* (*viriscens*) [Fig. 29, B] besides a remarkable yellow-flowered type with claret shadings introduced into Florida lately from Trinidad gardens by Mrs. Wilhelmina Greene, the well known wild flower and tropical plant artist. It is now being grown by Mrs. Green and Ralph W. Wheeler in Winter Park, Fla., and may prove to be a form of the previously described *G. rothschildiana* var. *citrina,* (Gardeners Chronicle July 22 and Sept. 16, 1905). It is one of the most remarkably attractive forms of the genus. Recently *G. verschuuri* has been named in Holland. It is near *G. rothschildiana.*

The genus *Gloriosa* consists of climbing bulb vines, most closely related to *Littonia* and *Sandersonia* of the *Liliaceae.* They have tubers and remarkable curling tendrils on the tips of the leaves by which they are widely known, and with which they climb and cling for support. These "claspers" as they were known in the old botany works, "foliis cirrhiferis" Linnaeus stated in the Species Plantarum, 1753, hold firmly to any twig or stem to which they attach themselves, and are so strong that usually the leaf will tear before the tendril will pull loose.

Various species grow to different heights. Under glass they may be many feet tall when grown in part shade and with heavy manuring. Large size tubers will also produce remarkably long, strong vines under some conditions for all species. Large tubers of *G. superba* may produce a vine of eight to 10 feet in height, in Florida, sometimes more than that. *G. rothschildiana* when grown in the strong sun is usually three to six feet tall, depending on the soil, moisture, and size of the tuber.

The flowers of *G. superba* are much twisted and crisped with six recurved or reflexed petals, opening first a greenish yellow and turning to red and yellow as the flower expands. When near maturity the flower deepens in color, turning orange red and later darker red in shade.

There is an interesting type which may be *G. superba* var. *lutea,* (possibly the same as the *Gloriosa virescens* var. *grandiflora* shown in Gardening Illustrated, Nov. 11, 1905) found with the common *G. superba* in Florida commercial collections. It opens a rich citron yellow and turns tawny red gradually as the flower matures and fades. It is a beautiful thing, as the light golden color holds after picking at the right stage. It is being propagated too increase the stock.

Gloriosa rothschildiana has wider foliage than *G. superba,* shorter, stockier stems, stronger tendrils, and larger, showier scarlet and yellow flowers, which expand, recurve and deepen in color as the flower matures, turning crimson-lake at the last. The best blooms may be six or more inches in diameter. There is a great variation among seedling-grown

stock as to the length and width of the petals, and the amount of the crisping or undulation of the segments. The best specimens are regarded as being those with the broader segments and less of the crisping.

Henry Nehrling reported hybrids of *G. superba* and *G. rothschildiana* in his horticultural writings in Florida, and some of the smaller types among *G. rothschildiana* seedlings with narrower, more crisped segments may have some of this hybridity in their ancestry, as all *G.*

Fig. 28. *Gloriosa Rothschildiana* O'Brien. Photo by Wyndham Hayward.

florida stock of the *G. rothschildiana* until recent years is believed to be derived from the few bulbs Nehrling received more than 45 years ago from O'Brien in England.

Since World War II, *Gloriosa rothschildiana* bulbs have been imported for comparison and commercial purposes by American growers from Holland and India. Some conscientious plant exploration to determine more facts about the plant in its native habitat, including pos-

sible natural variations appears a highly pressing need today.

Gloriosa carsoni was first described by J. G. Baker in the Kew Bulletin, 1895. It was recently introduced into the United States (1949) by R. S. Cammack of Maitland, Fla., and the writer. Bulbs are being grown in England and Holland at this time. The plant is from East Central Africa. *G. carsoni* has more the tall, free, branching habit of *G. superba,* with more obtuse leaves and 20 or more flowers on a large plant. The flower has more the shape of the *G. rothschildiana,* but is smaller, light yellow and claret-brown in shade, not spectacular, but a handsome tropical vining subject. The tubers are similar to those of *G. superba* and *G. rothschildiana,* which are L or V-Shaped, in normal specimens. Small bulbs are sometimes curved or round or even nearly straight, in these three species.

Gloriosa plantii has orange and yellow flowers, opening at first a pale yellow-green, which is believed to have been the reason for the original name of the species, *G. virescens.* In America and England it has been popularly known as *G. plantii.* The vine is more dwarf than in the case of the other *Gloriosa* species, the leaves more lushly green and glossy, with two branches in the case of most mature specimens. There may be a large number of flowers and they are similar to *G. rothschildiana* in shape, bright and attractive in their coloring, and very useful in the background of the garden, where they can be induced to grow on stakes or wires to a height of two or three feet, with sideways branching. The tubers of *G. plantii* are the most remarkable of the genus yet observed, long and slender, flexible, yet brittle and difficult to dig without breaking. They run under the ground in all directions sometimes curving around into a complete loop and continuing on several inches more. They usually are of pencil thickness or slightly larger and up to two feet in length. They are almost never of the formal V or L shape of the other species.

Gloriosa virescens was first described in 1825 as plate 2539 of the Botanical Magazine, based on a plant obtained from Mozambique in East Africa. It appears to be the most widely distributed of the *Gloriosa* species in Africa. The name *virescens,* meaning greenish-flowered, is usually ascribed to the fact that flowers of this *Gloriosa* are notably lighter-colored when grown under glass. In other words, it is likely that *G. virescens* is the same plant as that grown today as *G. plantii,* which is light yellow-tan when first opened even under lath house conditions. Since this identity remains somewhat in doubt it has been thought best to retain the name *plantii* in this article on a temporary basis.

The genus *Gloriosa* contains its mystery, the second recorded species, *G. simplex,* which for years was accepted as a synonym of *G. virescens* and *plantii* (see Bailey: Standard Cyclopaedia of Horticulture under *Gloriosa.* Also Kew Index, Main Volume, page 1035.) This in spite of the previously published statement that *G. simplex* had blue flowers, and there is no hint of possibility that *G. virescens* had blue flowers at any stage.

Linnaeus published the species *G. simplex* in a rare work known as Mantissa, page 62, in the 1760's. He described it as having acuminate

leaves, with no clinging terminal tendrils. For this reason he named it simplex. He based the species on an account of "Gloriosa coerulea" in Miller's (Gardening) Dictionary, and mentions "habitat in Senegal, folia non cirrhosa, flores coerulei": (habitat in Senegal, leaves without claspers and flowers blue.) Linnaeus indicates that he never saw the plant alive himself.

Fig. 29. A, *Gloriosa superba* var. *lutea,* at the yellow phase; and B, *Gloriosa plantii (virescens).* Photos by Wyndham Hayward.

Reference to Miller's Dictionary in the proper edition reveals the interesting information that seeds of "G. coerulea" were sent to England from France by the gardener to the French King at the Trianon in Paris, M. Richard, and were brought to Paris by M. Adanson from Senegal, ("who discovered the plant growing there naturally.")

"This is said to have a blue flower" relates Miller, "but the plants which are in the Chelsea garden have not yet flowered. This hath a climbing stalk, which is garnished with smooth leaves about three inches long and two broad, ending in acute points, but have no tendril or clasper." Further he adds that the "stalks as yet have not grown more than two feet high, but have the appearance of climbing like the other sort." (*G. superba.*)

"The leaves," Miller adds, have a strong disagreeable scent on being handled, so as to be troublesome to the head if too near, or long smelt to." (!) from the statements in Miller's account of this mysterious *Gloriosa* species, namely; blue flowers, and disagreeable scent of the leaves when crushed, it seems hardly likely that Adanson's plant was a true *Gloriosa* as now known. No further account of the plant has been found in the literature, with reference to the question whether on flowering it proved to be a genuine *Gloriosa* with blue flowers! The name *G. simplex* remains therefore under a cloud of uncertainty, with no just reason for its application to *G. virescens* or *G. plantii.*

The first bulbs of *G. plantii* are reported to have been sent to England by R. W. Plant from Natal, in 1851, and the subject was consequently described as *G. plantii.* Later it was referred to *G. virescens* as a variety. The species *G. virescens* remains the most variable of the Gloriosas, and *Methonica grandiflora,* Bot. Mag. 5216 is usually referred to it as a variety.

Propagation of *Gloriosa* plants is by seed, and division of the tubers or natural increase by both means. All the species except *G. rothschildiana* seed readily in nature, and this seed, after the proper ripening period, can be grown into little tubers in another season. Two or three seasons will be necessary under ordinary conditions to produce large blooming size bulbs. Tubers of *G. rothschildiana* may grow to a foot long and reach the thickness of one's wrist. Seed of this species is produced more readily by inter-clonal pollination.

In commercial practice, the tubers are broken at the angle, the large arm sold and the smaller arm retained for planting stock. The usual commercial size of *G. rothschildiana* tubers is the thickness of one's little finger and larger, and four to six inches long. The growth of this species has a similarity to that of gladiolus in its periodicity. The bulbs will grow, bloom, mature their bulbs and foliage, die down, remain dormant and start to grow again two or three times a year under careful culture. This has its advantage in commercial cut flower practice. The other species are usually grown once a year, planting in the spring and digging the tubers in late fall or early winter.

As a result of its quick growing capacities, *Gloriosa* bulbs may be planted every week in greenhouse or Southern sub-tropical outdoor culture, and a continuous sequence of bloom obtained. A large, mature bulb, ripened and started to sprout will produce flowers in six to ten weeks, and will be ready to dig in two months, more or less, additional.

In Central Florida the bulbs seem to prefer sandy-loam soils on the acid side. They can be grown on heavy type soils, nearly pure muck, but there is danger of heavy loss of tubers from *Sclerotia* fungus attacks

where the drainage is not perfect. In the greenhouse the bulbs are sometimes grown in peat and sand with fertilizer added via soluble solution (Hy-Gro, etc.). They require little humus, no manure, and only a slight fertilization of the soil before planting with any good 5-7-5 mixture. Liquid fertilizer may be applied from time to time while the bulbs are growing and the watering should be generous, but not enough to cause "wet feet."

After the plants are a foot or two tall, they should be staked or tied to wires, or allowed to climb on some frame or brush. In nature they clamber through shrubbery to the sunlight. Bright sun induces more brilliant color of the flowers, stronger, stockier vines, but reduces stems and height of the plant. For cut flowers the vines may be trained on fence wire, and the flowers will be produced on wiry stems in the axils of the leaves as the plant grows taller.

Any good screened leaf mold type sandy loam, sterilized and well drained may be used to sow the seed. This should be in part shade, as of a lath house in the sub-tropics. The flowers and foliage have remarkable keeping qualities when cut, and stand shipping long distances, similar in this regard to the flowers of such old favorites as *Lilium rubrum.* The pollen may be removed before shipping. Special boxes are used with careful placement of the flowers inside.

Best results in planting *G. rothschildiana* are obtained by the amateur and professional grower who waits until the bulb is starting to sprout before planting. This is much like the recommendations for gladiolus. A thoroughly dormant *Gloriosa* bulb will grow in time, but may be several months showing itself above ground unless sprouted before planting.

The tubers have considerable vitality. Of half a dozen which the writer placed in an electric refrigerator food storage compartment in the winter of 1949-50 for six months, where they were subject to considerable desiccating influence and continuous temperatures of 40 to 55 degrees F., two survived with good vitality despite the thoroughly tropical nature of the plant. They produced large and vigorous vines and flowers. The other tubers were still sound when planted, but the bud eyes were dried beyond possibility of growth. Normally these tubers would have sprouted badly months earlier. The experiment showed the possibility of storage of *Gloriosa* tubers in a cool temperature with proper humidity, for the purpose of retarding growth over extended periods.

The *Gloriosa,* at least the species *G. rothschildiana,* is widely adapted to Northern gardens. During 1950, Mrs. William C. Bowers of Cooperstown, N. Y., who winters in Winter Park, Fla., purchased bulbs of *G. rothschildiana* from the writer in late spring and bloomed them at her summer home garden, Closet Hall, and exhibited them in July in the Cooperstown flower show, receiving the blue ribbon for the first showing of these flowers in that event's history. Another dirt gardener in Connecticut reported some years ago obtaining 20 blooms on a strong *Gloriosa rothschildiana* plant in the garden outdoors. Mrs. Bowers grew her *Gloriosa* partly in the ground in garden beds and partly in large pots placed outside after the bulbs had been started. She reported those

in the full sun in the open ground in a loamy soil made the strongest growth and the largest flowers.

Littonia, another South African plant novelty, has odd three-fingered tubers like those of *Gloriosa,* and produces a climbing stem with clasping tendrils of similar nature. The flowers are little orange-yellow bells and very charming. The culture is similar. *Sandersonia* also has orange colored bells.

The tubers of *G. rothschildiana* are not hardy in cold climates and will rot in the ground in cold wet weather. In Florida and other warm climate areas they will grow and increase from year to year in the garden or along the edge of shrubbery without attention.

Note: The chemical properties of *Gloriosa superba* have been studied and the tubers found to contain a poisonous alkaloid principle previously identified as superbin, which is now considered equivalent to colchicine, but this requires verification. We are indebted to Prof. W. M. Lauther of the University of Florida, College of Pharmacy, for the following:

"Your reference to C. J. H. Warden is interesting. He published three *Gloriosa superba* papers, Ind. Med Gazette, 1880, Vol. 15, p. 253; 1881, Vol. 16, p. 138 and Phar. Journal (British) Series III, Vol. XI, p. 496, 1880. He was professor of chemistry at Calcutta Med. College. According to him, 'superbine' is related to the bitter principle of squill. He found 10 mg. to be fatal to a cat.

"His work has been continued by the famous Wellcome Research Laboratories of London. I refer to the paper by Hubert W. B. Clewer, Stanley J. Green and Frank Tutin, in the Journal of the Chemical Society (British) Vol. 107, p. 835, 1915. These investigators say that Warden's toxic bitter principle is colchicine. They also isolated several other chemicals. We have now decided to follow their work, since we feel that *G. rothschildiana* and *superba* ought to be similar, The high ash content (2.8% for air dried sample) has us puzzled."

Dr. Lauther advises that the College of Pharmacy has assigned the project of analysis of *G. rothschildiana* to a graduate student. There is lkelihood that colchicine and other alkaloids will be found.

This matter is presented in such detail as filling an important lacuna in the horticultural literature on the subject. None of the well known extended horticultural treatments of *Gloriosa* mention the poisonous properties of the tubers and plants. From Indian sources it has been learned that the tubers of *G. superba* are used by natives attempting suicide. In other words the warning may safely be issued to all gardeners and research workers using *Gloriosa* plants and tubers to beware of their poisonous character.

Just how poisonous the tubers and foliage will prove as grown in America will remain for future research workers to determine following the publication of such results as the investigations in Florida under Dr. Lauther's direction. The fact that the plants have been observed to have few insect or other pests is a strong supporter of the poison factor, something not uncommon in garden plants. Few insects have ever been

known to eat the foliage of *Gloriosa* plants, and little damage to the tubers from worms or insects has been found. Occasionally a worm hole can be found in a tuber, but never a live specimen thriving on the material.

Caution is therefore advised to keep the tubers and plant material out of the hands of young children who might put the same in their mouths. No cases of *Gloriosa* poisoning have been reported so far as known in America, but the possible presence of such deadly factors as colchicine indicates a strong need for precaution in this regard.

PLANT GROWING EXPERIENCES

WALTER ALLGEYER, *Michigan*

In the past 20 years I have grown a large variety of bulbs and plants, many of which are woods wildings. The woods near here are

Fig. 30. *Hosta plantaginea* Aschers.
Photo by Walter Allgeyer.

full of many varieties, and it is interesting to grow them in the home garden, especially if one has the large shade trees to help make them feel at home.

I have also grown 100 varieties of daffodils, jonquils, and the smaller species, all of which do very well here, and in tulips I have also grown both the hybrids, and many species.

Finding my soil rather heavy I spread sand between the rows, and later this was worked into soil. I found that this made a wonderful change in the soil. My bulbs grew to very large size, and had lovely large blooms. I use only bone meal as fertilizer, as these bulbs do not take barnyard manures very kindly.

For several years I have also grown Callas; they do well in the open soil, and should be kept moist during summer's growth. The Red Calla does very well, blooming freely, and forming nice clusters of bulbs. The care is about same as for other bulbs, only planting them out later, so late frosts will not harm them. In fall I take them up, and place them in flats, on some dry sand, and set them down in basement to rest. I cover the bulbs with some sand so that they do not dry out.

Hemerocallis, too, make lovely bloom in the garden, and now with the new colors, reds, wines, and purples, they just about fill the wants for bouquets. Grown easily in any soil, not bothered by any insects, they are a must for every garden. I have a large plant of Hyperion which this year produced many blossoms, and among them some with twelve petals, instead of the regular six. I tried pollinating these blooms, and one finally took, and I have four plants from the seeds. Perhaps one of the plants will turn out to be a twelve-petal flowering one; time will tell.

The illustration [Fig. 30] shows a clump of *Hosta plantaginea.* The many beautiful Hosta species deserve more attention than they are receiving at present.

Another very interesting plant is the woods wilding, Golden Seal, a medicinal plant. This does very nicely in the shade of my large oak trees, under the north side. I have a small bed of this plant, and find it very interesting to grow, it has large dark green leaves, and while the blossoms are small, and hardly noticeable, the later large red berries make up for small flowers. It is easily grown from fresh seeds. It can be taken up and divided most any time of the summer, and will never even wilt. In among these plants I have planted many other woods plants, such as *Trillium,* Blood-root, Wild-ginger, Wild Poppy, Mayflower, *Hepatica,* and the Woods Lily, Turks Cap.

This bed makes a lovely showing all spring and summer and needs but little care. One thus has at least part of the woods near. As the large oaks take a lot of moisture in summer, I water the bed when necessary, to keep the plants fresh and growing.

I have many other plants, of which I may try to write at a later date.

PURE ARABINATES AS INGREDIENTS IN DIRECT STAIN-MOUNTANTS

HAMILTON P. TRAUB, *Principal Physiologist, Division of Fruit & Vegetable Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, Beltsville, Maryland.*

Permanent stain-mountants based on the principle of combining a suitable stain with water-soluble mounting media—(a) gelatine or pectin with sorbitol and acetic acid or (b) gum arabic with sorbitol and formic acid—were proposed in a stimulating article by Zirkle (1940), to whom we are all greatly indebted. These were proposed by Zirkle as starting points, and gelatine or pectin mountants are now commonly used. The optical properties of these are satisfactory for some purposes, but there is need, as suggested by Zirkle, for a mountant in this class with improved optical properties that shows the chromatin outline sharply.

It should be noted that the gum arabic of commerce consists of the salt of an organic acid, arabinic acid (Smith, 1939), with metals such as calcium, magnesium, and potassium (Neubauer, J. pr. chem. 1854, 62: 193.) together with some impurities. The preparation and use of the pure salts of arabinic acid have the advantage of eliminating any impurities that may be present in the commercial article and that might interfere with good optical properties when the salts are used as mountant ingredients. The various arabinic acid salts also impart distinctive values of their own. Accordingly, the writer recently explored the possibilities of using these compounds in cytological technic. He has found that the pure salts of arabinic acid, arabinates, [1 gm.], give direct stain-mountants with excellent optical properties when combined (a) with d-sorbitol c. p. [1 gm.] and [10 ml. of] the Pianese-Zirkle ferric-formo-carmine (Pianese, 1892, 1894; Zirkle, 1940); or (b) with d-sorbitol c. p. [1 gm.] and [10 ml. of] ferric-aceto-formo-carmine—various mixtures of ferric-formo-carmine and the Schneider-Belling ferric-aceto-carmine (Schneider, 1880; Belling, 1926); or (c) with d-sorbitol c. p. [1 gm.] and [10 ml. of] ferric-aceto-carmine with 2% glycerol by volume added. Preparations made with arabinate-sorbitol-ferric-aceto-carmine without the addition of ferric-formo-carmine or glycerol may sometimes become clouded when dried under certain conditions which makes them useless as permanent mounts in such cases.

Since the arabinates are subject to hydrolysis on heating in acid solution, the ferric-formo-carmine and ferric-aceto-carmine are prepared separately and the arabinate and d-sorbitol are added after the carmine solutions have cooled and have reached equilibruim under room conditions. The finely pulverized arabinate and d-sorbitol are added to the filtered ferric formo-, aceto-formo-, or aceto-carmine solution (which has cooled at least over night), and the mixture is stirred until the arabinate is dissolved. When the carmine solutions are prepared, it is best to use ferric nitrate as the source of iron at the rate of 0.05 gram per 100 ml.

volume of the carmine solution, and not 0.5 gram as indicated (probably a typographical error) by Zirkle (1940).

It was found desirable to heat the slide preparations for 20 seconds on a hot plate at a standard temperature as reported by Traub (1951b) in place of the inexact and messy flaming procedure.

These mountants are less viscous than when aceto-carmine is combined with gelatine or pectin. This makes it relatively easy, for instance, to prepare direct permanent root-tip squashes for the study of chromosome numbers in plants.

These studies with arabinate stain-mountants were begun six months ago and no attempt is made at this time to indicate any final conclusions. The present tentative conclusions are subject to revision if observation of the preparations over a longer period should so indicate. The reason for the present brief note is to give a background for the results recently reported with arabinate direct stain-mountants by Traub (1951a). The thorough exploration of the distinctive value of each of the arabinates in combination with cytological stains will take time, and more complete reports will be published elsewhere later—the first will appear in the near future (Traub, 1951c).

The various arabinates were prepared by interaction between arabinic acid (Smith, 1939) and various ethanol soluble metal or other salts in aqueous solution. In a few cases, it was necessary to carry out the interaction in 10% HCl or 4% HNO_3. When the interaction was completed, the time depending on the kind of salt, the arabinic acid salts formed were precipitated with three volumes of 95% ethanol and washed on a filter paper several times with 95% ethanol and absolute ethanol. They were again taken up in water, or dilute acid solution, and reprecipitated two or three times and were then dried to constant weight in a vacuum oven at 60° C.

Up to the present the following have been prepared: Aluminum-; ammonium-; barium-; beryllium-; bismuth ; calcium-; cerium-; cesium-; chromium-; cobaltous-; cupric-; ferric-; ferrous-; gold(auric)-; iridium-; lead-; lanthanum-; lithium-; magnesium-; manganese-; mercuric-; nickel-; palladium-; platinic-; potassium-; rhodium-; rubidium-; stannic-; stannous-; silver-; sodium-; strontium-; uranyl-; vanadly-; yttrium-; and zinc-arabinate.

Beryllium- and mercuric-arabinate are not recommended for use in mountants due to the toxic nature of the metal ions.

A more comprehensive presentation of these experiments will appear elsewhere.

LITERATURE CITED

Belling, J. The iron-acetocarmine method of fixing and staining chromosomes. Biol. Bull. 50: 160—162. 1926.

Pianese, G. I nervi, le reti e le terminagions nervose del pericardio, e il dolors nella pericardite. Gio. Intem. Sci. Med. Napoli, *14:* 881—894. 1892; Zeit. wiss. mik. *10(4):* 501—503. 1894 (abstract).

Schneider, Anton. Ueber Befruchtung. Zoologischer Anzeiger 3: 252—257. 1880. (footnote, p. 254).

Smith, F. The constitution of arabic acid. Part I. The isolation of 3-d-galactosido-1-arabinose. Jour. Chem. Soc. (Lond.) Part I: 744—755. 1939.

Traub, Hamilton P. Colchicine-induced *Hemerocallis* polyploids and their breeding behavior. Plant Life, 7: 83—116. 1951a.

Traub, Hamilton P. The temperature factor with special reference to the preparation of arabinate direct permanent mounts. (In press, 1951b).

Traub, Hamilton P. Arabinate direct permanent mounts. (In press, 1951c).

Zirkle, Conway. Combined fixing, staining and mounting media. Stain Tech. 15: 139—151. 1940.

WESTERN TRIP—SPRING 1950

MARY G. HENRY, *Pennsylvania*

My western trip this spring was extremely interesting. I must say it was a relief when the three lectures were over. Before leaving the State of Washington, Mr. Carl English, a correspondence friend of over fifteen years, and also Mr. J. R. Fletcher, Northwestern Regional Chairman of the American Rock Garden Society, took my daughter Josephine and me on a camping trip in the Cascade Mountains. I enjoyed this enormously. We slept high up in a rocky canyon. The temperature was below freezing and the stars were so brilliant they seemed to pierce the sky.

Lewisia rediviva was in full bloom on exposed hillsides, also a charming bright blue *Brodiaea* and an enchanting *Calochortus*. For the first time I saw *Paeonia Brownii* blooming in its own lair. As the season was somewhat late, I was able to gather some interesting seeds.

Ernest Perks brought my car to Seattle and Josephine and I motored south through Washington and Oregon to San Francisco. I went on a sort of *Camassia* "spree" and collected some in gorgeous shades of blue. Many were so dark, they verged on indigo. We found some creamy white ones and also some whites that were shaded with pale blue. These beautiful hardy bulbous plants should be in every garden for they are long lived, as hardy as rocks, and especially valuable as good blue flowers are all too rare. Being an ardent conservationist, I only felt able to take a few specimens from each group.

The Brodiaeas, too, delighted me beyond words. For years I have seen their pictures in the Carl Purdy catalogue, but I never realized their full beauty until I saw them "in the flesh." There were several species of blue *Brodiaea*. *Brodiaea* laxa (I think) fairly competed with the Camassias in their wonderfully rich deep blues. There was a species that had white flowers and each segment had a navy blue stripe down the center. It was one of the loveliest flowers I ever saw. Some of the species had large heads of purest golden yellow and some had yellow flowers streaked with garnet brown. These beautiful and showy flowers, which reminded me of tiny *Agapanthus*, must be seen to be appreciated.

They should be grown in eastern gardens more frequently and where the climate is severe, they are well worthy of being grown in pots. The flowers are very long lasting.

Among Alliums, *A. falcifolium* was outstanding, but there were other pretty ones, too.

Coming down into California, we drove through the Redwood forests. Our first view of the Redwoods, *Sequoia sempervirens,* was in late afternoon. The rain had just stopped. The slanting rays of the sun shone through the mist until they touched the forest floor, where

Fig. 31. Mary G. Henry passing through the famous Wawona Tunnel Tree (*Sequoia gigantea*). Her car, equipped for field work, has an "attic" in which are carried spare tires, plant presses, rope, etc. The rear compartment is insulated and ventilated for plants. Inside the car is a bookcase, a desk with reading light, a picnic basket, camera, field glasses, axe, picks, spades, labels, and also numerous geological and topographical maps.

Rhododendron californicum bloomed in all its glory. It was indeed a never-to-be-forgotten sight. We were fortunate that the beautiful California *Azalea* was in full bloom too—very lovely and deliciously fragrant.

There seemed to be Brodiaeas at almost every turn, and I saw a few of the enchanting red one, *B. ida-maia.* There were a number of others too and all were beautiful.

The coast line of northern California is a rough and jagged one and the turf on the rocks jutting out into the sea forms a carpet that is colorful and beautiful beyond words. This is composed of Scarlet Paint

Blush, Lupines in pink and white, blue and white and plum and white, a prostrate *Eryngium* of stylish design. *Brodiaea coronaria macropoda* are completely adorable tiny things, blue with white centers, only 1 to 3 inches high, and stunning silvery sedums.

After a few days in San Francisco, Josephine took the train home and I continued my way in the car with Ernest to the Yosemite. Its beauty is not in the least exaggerated, and the stern and simple beauty of El Capitan is very inspiring, but I must say the hordes of tourists did irk me and I could not enjoy the scenery except when I got off by myself in the mountains. After all, I love the trees and flowers and always find them ample and sufficient company.

After that I visited Kings Canyon. I was thrilled beyong words to find *Yucca whipplei* in full bloom on steep canyon walls and even on the summits of the mountains. It was most spectacular and it was a sight I had dreamed of seeing some day. This was the "some day" and I was not disappointed.

I had quite an exciting time with a big 5 ft. rattlesnake. Some Brodiaeas were ahead and I stepped within about 18 inches of him. With my bare legs I would have been an easy mark, but it was kind enough to rattle. I think he could have struck me if he had not been in tall wiry grass. He was a handsome creature and gave me a real thrill.

After that I went to the Sequoia National Park and saw hundreds of big trees, *Sequoia gigantea.* They were so grand and each one I saw seemed more wonderful than the one before. This was my first visit to California. I had been to every other state in the United States. Somehow I postponed California because everybody else seemed to go there, but I really wanted to see the big trees and now I want to return some day and see them again.

Fremontia californica was in its fullest golden bloom on a mountainside, where illuminated by the setting sun, it made a breathtaking sight. Their enormous yellow flowers, as big as dogwood blossoms, covered the 5 to 10 ft. bushes solidly to the ground.

Going south I came to the Mojave Desert, which at this time was rather a depressing sight, except for one mass of utterly delightful golden yellow Brodiaeas, which waved in the breeze. Every other bit of foliage was browned and dry.

Then I saw the man-made Lake Mead and Boulder Dam, which, as it destroyed much natural beauty, did not interest me at all. The nearby city of Las Vegas is a fairylike city of marvelous modern architecture.

From there I went to Utah, where I motored through Zion Canyon and Bryce Canyon, the latter of such beauty and remarkable form and coloring, it looks as though it belonged to a different world than ours.

The Grand Canyon, Arizona, came next. I had been there over 40 years ago. In those days one could enjoy the grandeur without the present day commercialism. It was simpler then. We were content to enjoy the natural beauty of this sublime spot and we spent most of our time on horseback. Now there is a large hotel and there are walls,

parapets and paved roads. Huge horn-blowing busses are running in and out all day long. Also, the tranquillity of the atmosphere has vanished.

In various places I found handsome Agaves in bloom, one had lovely creamy white flowers and another had blooms of golden yellow.

One of the biggest thrills of my life came one day when we got lost in the mountains in Arizona. Mrs. Rose Collom was with me at the time. We were on a little narrow rocky road, only wide enough for one car. When we came near the top of a mountain, *Agave parryi* appeared on every side [Plate 20]. They provided a spectacle of magnificence that I can never forget. The buds and large unexpanded flowers were glossy blood-red. Therefore, some of the spikes were all red, some were entirely yellow and some combined the two colors of the buds and open flowers. I could hardly believe my eyes when I measured one beside the road and it was 21 ft. 3 inches tall. It was more like a tree than a spike of flowers!

In Texas I found my largest and most splendid species of *Hymenocallis.*

Although I have Yuccas from about thirty localities planted in and around my rock garden, I just could not resist collecting a few more.

I must not forget the Cactus. I fell in love with their large fragile looking flowers in etherial pale shades of pinks, sea greens and creamy whites, and acquired eight species. Of course my hands also acquired many thorns.

Soon I found myself in the Oklahoma mountains. This, my third visit to the Ozarks, was interesting as always and I had quite a little adventure on top of one of the mountains there. I spied what to me was a new variety of the pretty purple *Liatris squarrosa* which grew about 6 to 8 inches high and bore flowers singly. The little plants grew along the edge of a perpendicular cliff about 50 or 60 ft. high. I remarked to Ernest there were so many here I should be able to find an albino and it would be just my luck that it was part way down the cliff. I looked over the edge and sure enough there in a little crack away below the top, a stunning little white Liatris looked up at me! Ernest tied the tow rope around me and lowered me over the cliff, so I could pry the little Liatris out of the crack. It was a lot of fun and one of the high spots of the trip.

From there my way led me into Arkansas, Louisiana, Mississippi and then up through Kentucky and Tennessee to Indiana, where, with someone's help, I was able to find my most northerly station for *Hymenocallis.*

The eight weeks passed far too quickly. During this period I covered, all too rapidly, over 12,000 miles. The car by this time was pretty chock-full of plants. As I always like to get home before the car, to open my mail, I took the train home from Louisville, and arrived at Gladwyne July 15th.

Agave parryi of Arizona—blood-red buds open to golden yellow flowers. Mrs. Mary G. Henry is standing at the base of the plant. Photo by Mrs. Rose Collom.

Plate 20

PLANT LIFE LIBRARY

PLANT VIRUSES, by Kenneth M. Smith. Methuen & Co. (London) and John Wiley & Sons, 440—4th Av. New York 16. 2nd ed. 1948. pp. 78. illus. $1.50.

This second edition of this concise illustrated text was made necessary to keep pace with the rapid progress in this field. Besides the historical chapter, there are chapters on virus diseases, modes of virus transmission, the viruses in the insect vectors, the viruses themselves, serology of plant viruses, control of plant viruses and the nature of viruses. All of those concerned with plants will want to own this concise text.

MENDELISM AND EVOLUTION, by E. B. Ford. Methuen & Co. (London), and John Wiley & Sons, 440—4th Ave., New York 16. 5th ed. 1949. pp. 122. $1.25.

This the 5th edition of this well known text, giving "a short survey of the evolutionary aspect of modern genetics," is an important contribution to the subject. It includes a brief preliminary section on the principles of particulate inheritance to bring the subject of the book within the reach of all who are interested in evolution, whether they have had previous acquaintance with genetics or not. The longer section is devoted to mendelism and evolution.

PROBLEMS OF MORPHOGENESIS IN CILIATES, by André Lwofi. 1950. John Wiley & Sons, New York 16. pp. 103. illus. $2.50.

This is another in the excellent Biological Research Series published by John Wiley and Sons. It is a concise volume devoted to the morphology and biology of the ciliates. The author "considers the behavior of the kinetosomes and analyzes the various aspects of their movements and activities in development, division and evolution." The book includes 32 illustrations and a bibliography.

BOTANY: AN INTRODUCTION TO PLANT SCIENCE, by W. W. Robbins and T. E. Weier. 1950. John Wiley & Sons, New York 16. 11. 480. illus. $5.00.

This copiously illustrated text, written primarily for beginning students, cannot be too highly recommended. The authors emphasize the recent discoveries in the field, and they have endeavored to give the student "an understanding of the scope of botany and its relation to agriculture, forestry, and medicine and to the other physical siences.

CONSERVATION OF NATURAL RESOURCES, Edited by Guy-Harold Smith. 1950. John Wiley & Sons, New York 16. pp. 552. Illus. $6.00.

This very timely book, which is the composite work of various authors, reviews the history of conservation in the United States, and the disposal of the public domain, and then each resource in turn is considered in detail—forest, water supply, mineral kingdom, wildlife, rec-

[PLANT LIFE LIBRARY, continued on page 168.]

PLANT LIFE

Volume 7

[Number 3, July]

1951

THE AMERICAN PLANT LIFE SOCIETY

THE AMERICAN PLANT LIFE SOCIETY

Box 2398, Stanford, California

THE AMERICAN PLANT LIFE SOCIETY

For the roster of the general officers of the Society, the reader is referred to the inside front cover of this volume.

I. THE AMERICAN AMARYLLIS SOCIETY

[An integral branch of the APLS, and functions as a comprehensive Committee for the advancement of the Amaryllids.]

W. M. JAMES, *Chairman* WYNDHAM HAYWARD, *Vice-Chairman*

(a) WILLIAM HERBERT MEDALISTS

*Mr. Henry H. Nehrling, *Fla.*
*Mr. Theodore L. Mead, *Fla.*
*Mr. Arthington Worsley, *Eng.*
Mr. Ernst H. Krelage, *Holland*
Mr. Cecil Houdyshel, *Calif.*
Maj. Albert Pam, *Eng.*
Mr. Pierre S. duPont, *Del.*
Mr. Jan de Graaff, *Oregon*
*Mr. Fred H. Howard, *Calif.*
Mr. Sydney Percy-Lancaster, *India*
Dr. J. Hutchinson, *Eng.*
*Mr. Carl Purdy, *Calif.*
Dr. A. B. Stout, *N. Y.*
Mr. H. W. Pugsley, *Eng.*
Mr. W. M. James, *Calif.*
Prof. Dr. A. Fernandes, *Portugal*
Miss Elizabeth Lawrence, *N. C.*
Dr. Henry A. Jones, *Md.*
Mr. R. G. Huey, *Ky.*
Mr. Guy L. Wilson, *Northern Ireland*
Mr. R. W. Wheeler, *Fla.*
Dr. R. A. Dyer, *South Africa*
Capt. C. O. Fairbairn, *Australia*
Mrs. Mary G. Henry, *Penna.*
Mr. Mulford B. Foster, *Fla.*

*Deceased.

(b) CORRESPONDING FELLOWS

Antilles—Dr. H. F. Winters, *Mayaguez, Puerto Rico*
Argentina—Sr. Jose F. Molfino, *Buenos Aires*
Australia—Mr. Fred M. Danks, *Canterbury, Victoria*
Brazil—Sr. Joao Dierberger, *Sao Paulo*
Canada—Mr. John S. Lotan, *Hull, Quebec*
Central America—Mr. Ralph Pincus, *Chicacao, Guatemala*
Palestine—Mr. Tsevi Ginsburg, *Emek Hefer*
Holland—Mr. Ernst H. Krelage, *Haarlem*
India—Mr. Sidney Percy-Lancaster, *Alipur, Calcutta*
Kenya Colony, East Africa—The Lady Muriel Jex-Blake, *Nairobi*
Union of South Africa—Mr. R. A. Dyer, *Pretoria*
Venezuela—Dr. H. Pittier, *Caracas*

(c) REGISTRATION OF PLANT NAMES

Registrars: Dr. J. B. S. Norton, and Prof. W. R. Ballard.

Correspondence about the registration of plant names should be sent directly to Dr. Norton, *4922 40th Place, Hyattsville, Maryland,* and a self-addressed, stamped envelope should be enclosed if a reply is expected.

(d) AMARYLLID SECTIONS

GENERAL AMARYLLID SECTION

GENERAL AMARYLLID COMMITTEE—Mrs. Edith B. Strout, *Chairman, Kentfield, California*

Maj. John W. Schaefer, *Wash.* Miss Elaine Brackenridge, *Texas*

HEMEROCALLIS SECTION

DAYLILY (HEMEROCALLIS) COMMITTEE—Mr. Elmer A. Claar, *Chairman, 617 Thornwood Lane, Northfield, Ill.*

Dr. Hamilton P. Traub, *Maryland* Mr. Wyndham Hayward, *Florida*
Mr. R. W. Wheeler, *Florida* Dr. Philip G. Corliss, *Arizona*
Dr. J. S. Cooley, *Maryland*
Mr. W. Quinn Buck, *California* Dr. J. B. S. Norton, *Maryland*

[Members of the Hemerocallis Jury are *ex officio* members of the Daylily Committee]

REGISTRATION OF DAYLILY NAMES—Registrars: Dr. J. B. S. Norton, *4922 40th Place Hyattsville, Maryland,* and Prof. W. R. Ballard, *5102 41st Ave., Hyattsville Maryland.*

[Correspondence about priority of Daylily names should be sent directly to Prof. Norton, *but a self-addressed, stamped envelope should be enclosed if a reply is expected.*]

DAYLILY JURY (For evaluating Daylilies)—Prof. L. H. MacDaniels, *Chairman, Cornell University, Ithaca, N. Y.*

Those in charge of Official Cooperating Trial Gardens are *ex-officio* members of the Daylily Jury.

OFFICIAL COOPERATIVE DAYLILY TRIAL GARDENS

Prof. John V. Watkins, in charge of Daylily Trial Garden, College of Agriculture, University of Florida, Gainesville, Fla.

Mr. Paul L. Sandahl, Supt., in charge of Daylily Trial Garden, Dept. of Parks and Public Property, City of Des Moines, Iowa.

Prof. Ira S. Nelson, in charge of Daylily Trial Garden, Dept. of Horticulture, Southwestern Louisiana Institute, Lafayette, La.

Prof. L. H. MacDaniels, in charge of Daylily Trial Garden, Dept. of Agriculture, Cornell University, Ithaca, N. Y.

Prof. H. T. Blackhurst, in charge of Daylily Trial Garden, Division of Horticulture, Texas Agric. Expt. Station, College Station, Texas.

Mr. John E. Voight, RFD One, Box 76, Hales Corners, Wisc., in charge of Daylily Trial Garden, at The Botanical Gardens, Whitnall Park.

Mr. W. Quinn Buck, in charge of Daylily Trial Garden, Los Angeles Arboretum, 291 No. Old Ranch Road, Arcadia, Calif.

Note: Introducers of new daylily clones should send plants directly to the Trial Gardens for testing. As soon as practical each trial garden will publish, in HERBERTIA, lists of the 10, 25, 50 and 100 best daylilies, on the basis of the clones tested, for the climatic region in which it is located.

DATA CARD FOR HEMEROCALLIS

When describing daylily clones, all breeders and growers are requested to use the Official Data Card for Hemerocallis, devised by the eminent artist and horticulturist, J. Marion Shull, and full described in HERBERTIA, Vol. 7, 1940, and Vol. 14, 1947. These cards should not only be used in describing new clones but also for the description of all older clones grown in the various climatic regions.

For information write to—

Mr. E. Frederick Smith, Membership Secretary,
The American Plant Life Society,
Box 2398, Stanford, Cal.

SCORE CARD FOR HEMEROCALLIS

For the official score card for Hemerocallis see HERBERTIA, Volume 7, page 126, 1940. Reprinted in Vol. 14 (1947), page 37.

AMARYLLIS SECTION

AMARYLLIS COMMITTEE—Mr. Hermon Brown, *Chairman, Gilroy, Calif.*

Col. Russell S. Wolfe, *South Carolina*
Mr. R. W. Wheeler, *Florida*
Mr. A. C. Buller, *South Africa*
Supt. R. G. Huey, *Kentucky*
Dr. J. C. Du Puis, *Florida*
Mr. Cecil Houdyshel, *California*
Mr. Stanley Johnson, *Penna.*
Mr. Wyndham Hayward, *Florida*
Maj. John W. Schaefer, *Wash.*

FLOWER TYPES AND SCORE CARD FOR HYBRID AMARYLLIS

For classification of flower types and score card for Hybrid Amaryllis see PLANT LIFE *6*: 43-46. 1950.

NARCISSUS SECTION

NARCISSUS COMMITTEE—Mr. Grant E. Mitsch, *Chairman, Daffodil Haven, Canby, Oregon*

Mr. Edwin C. Powell, *Maryland*
Mr. Jan de Graaff, *Oregon*
Mr. Fred M. Danks, *Australia*
Mr. Guy Wilson, *North Ireland*
Mr. Kenyon L. Reynolds, *California*
Dr. Edgar Anderson, *Missouri*
Mr. Arno H. Bowers, *Calif.*
Mr. Frank Reinelt, *California*
Mr. Lionel Richardson, *North Ireland*
Mr. E. A. Bowles, *England*

ALSTROEMERID SECTION

ALSTROEMERID COMMITTEE—Mr. H. L. Stinson, *Chairman, 3723 S. 154th St., Seattle 88, Wash.*

Mr. W. M. James, *California*
Mr. Mulford B. Foster, *Florida*
Mr. John F. Ruckman, *Pennsylvania*
Mr. Bruce Hinman, *Illinois*

ALLIEAE SECTION

ALLIEAE COMMITTEE—Sgt. Bernard Harkness, *Chairman, Moravia, N. Y.*

Mr. F. Cleveland Morgan, *Quebec*
Mr. Claude A. Barr, *South Dakota*
Dr. Henry A. Jones, *Maryland*
Mr. F. L. Skinner, *Manitoa*
Mr. Elmer C. Purdy, *Calif.*
W. R. Ballard, *Maryland*

AFFILIATED SOCIETIES

Garden Circle, New Orleans, Mrs. W. D. Morton, Jr., Pres., 3114 State Street Drive, New Orleans, La.

II. OTHER COMMITTEES

GESNERIACEAE COMMITTEE—Dr. Kenneth H. Mosher, *Chairman, 7215 Dayton Ave., Seattle 3, Washington*

Mr. E. Frederick Smith, *California*
Mr. Wyndham Hayward, *Florida*

ARACEAE COMMITTEE—Mr. Wyndham Hayward, *Chairman, Winter Park, Florida*

Mr. Len Mirzwick, *California*
Dr. Hamilton P. Traub, *Maryland*
Mr. Fred M. Danks, *Australia*
Mr. A. A. Longmire, *California*

III. PUBLICATIONS OF THE AMERICAN PLANT LIFE SOCIETY

BOOKS

1. **AMARYLLIDACEAE: TRIBE AMARYLLEAE**, by Traub & Moldenke (including the genera *Amaryllis, Lycoris, Worsleya, Lepidopharynx, Placea, Griffinia,* and *Ungernia;* Manila covers; 194 pages, incl. 18 illustrations. $4.00 postpaid.

This is required reading for every amaryllid enthusiast.

2. DESCRIPTIVE CATALOG OF HEMEROCALLIS CLONES, 1893—1948, by Norton, Stuntz, and Ballard. A total of 2695 *Hemerocallis* clones are included and also an interesting foreword, and explanatory section about naming daylilies. Manila covers; 100 pages (I—X; 1—90), including a portrait of George Yeld. $1.50 postpaid.

PERIODICALS

1. HERBERTIA, vols. 1—15 (Devoted to the *Amaryllidaceae*)
Vols. 1—5 (1934—1938), $17.50 Vols. 6—10 (1939—1943), $17.50
Vols. 11—15 (1944—1948), $18.50 Vols. 1—15 (1934—1948), $52.50

Single copies of vols. 1 to 15, when available, are $3.50 each, except vol. 11, $4.50.

2. PLANT LIFE, vols. 1—7 (Beginning in 1949, vol. 5, PLANT LIFE includes the annual HERBERTIA edition as one of the numbers.)

Vol. 1 (1945), *Narcissus* symposium and *Bromeliaceae* edition, 104 pages, incl. 25 illustrations, $2.50.
Vol. 2 (1946), *Verbenaceae* edition, 100 pages, incl. 9 illustrations, $2.50.
Vol. 3 (1947), Winter and Spring *Gladiolus,* and the History of the Dutch Bulb Industry, 1940—1945; 42 pages, incl. 10 illustrations, $1.50.
Vol. 4 (1948), AROID LILY (Calla) edition, 48 pages, incl. 11 illustrations, $1.50.
Vol. 5 (1949), *Gesneriaceae* edition, and 1949 HERBERTIA (Australian edition), 134 pages incl. 34 illustrations, $5.00.
Vol. 6 (1950), 1950 HERBERTIA (Hybrid *Amaryllis* edition), and GENERAL PLANT LIFE edition, 162 pages, incl. 47 illustrations, $5.00.
Vol. 7 (1951), 1951 HERBERTIA, and GENERAL PLANT LIFE edition (In preparation, 1950, and scheduled for publication early in 1951.), $5.00.

Vols. 1—5 (1945—1949), $13.00.
Single volumes, 1—7, when available, at the prices quoted above.

Make checks payable to the AMERICAN PLANT LIFE SOCIETY, and send orders to—

Mr. E. Frederick Smith, Membership Secretary,
The American Plant Life Society,
Box 2398, Stanford, Calif.

IV. PLANTS RECEIVING APLS AWARDS IN 1950

The following awards were made since January 1950.

ZEPHYRANTHES ALBIELLA; Award of Merit (A. M.), March 30, 1950. Presented to the trial collection by Dr. Paul Eppel, Bogota, Colombia. One of the most satisfactory pot plants.

ZEPHYRANTHES PUERTORICENSIS; A. M., March 30, 1950. Presented by Dr. H. F. Winters, Mayaguez, P. R. An excellent pot plant.

xCYRTANTHUS clone GLADWYNE; A. M., April 11, 1950. Presented by Mrs. Mary G. Henry, Gladwyne, Penna. A most satisfactory pot plant.

EUCHARIS FOSTERI; A. M., June 28, 1950. Presented by Mr. M. B. Foster. An excellent evergreen pot plant.

xAMARYLLIS HENRYAE (type plant); A. M., December 5, 1950. Presented by Mrs. Mary G. Henry. A carmine pink miniature large-flowering hybrid, evergreen, and the best of pot plants.

[PLANT LIFE LIBRARY, continued from page 162.]

reational resources, and the conservation of resources from the standpoint of local, state and national planning. It is a book that fills a definite need and is highly recommended.

THE WORLD OF PLANT LIFE: A GENERAL BIOLOGY, by W. F. Pauli. 1950. Houghton Mifflin Company, Boston 7, Mass. pp. 653. Illus. $5.00.

This excellent and adequately illustrated text for the college student is intended as "an introduction to the entire wide field of general biology." In his presentation, the author has endeavored to stress the scientific method, to attract and stimulate the student, and to present a unified outlook on general biology on the basis of organic evolution. It is a text that should have immediate appeal, not only to college students, but also to students of biology generally, and should go through many editions.

THE PRINCIPLES OF NURSERY MANAGEMENT, by W. P. Duruz. 1950. A. T. de la Mare Co., 448 W. 37th St., New York 18. pp. 125. $3.50.

This concise illustrated text is devoted to the many phases of the nursery business and was "written to fill the need for a guide to the practice and study of nursery management." It is a book that all who are interested in the subject will want to own for constant reference.

GRAY'S MANUAL OF BOTANY, by Merritt Lyndon Fernald. 8th ed. Illus. 1950. pp. 1632. American Book Company, 88 Lexington Ave., New York, 16. $9.50.

This monumental 8th edition of the standard text on the flora of the Southeastern United states and adjacent Canada, has been largely rewritten and expanded by the late Dr. Fernald. The detailed descriptions of the taxonomic groups is preceded by a synopsis of the orders and families, an artificial analytical key to the families. The text is copiously illustrated, and adequate keys to the species are provided under each of the genera. There is a glossary of terms, and an index to names of

[PLANT LIFE LIBRARY, continued on page 174.]

PLANT LIFE

Volume 7

[Number 4, October]

1951

SEEDS AND PLANTS DIRECTORY

THE AMERICAN PLANT LIFE SOCIETY
Box 2398, Stanford, California

AMARYLLIS

HYBRIDS, MEADE STRAIN

Blooming Size Bulbs . . . various colors, grown in our own garden.

"To the lovers of Flowers an inspiration"

$50.00 per hundred
25 and 50 lots at hundred price

(all prices f.o.b. Miami)

DU PUIS BULB GARDEN
6043 N. E. 2nd AVENUE
MIAMI (38), FLORIDA

SPECIAL OFFERS

We again offer some special prices to members of America Plant Life Society. The following will be sent in their dormant season. Please ask for our catalog listing Amaryllids, Iris, Saintpaulias, Gloxinias, Caladiums, Tub. Begonias, Orchids, Billbergias, etc. Much valuable culture information is included.

Crinum Cecil Houdyshel, large, $2.50
Haemanthus Katherinae, $4.00
H. natalensis, $3.50
Tulbaghia fragrans, $1.50
Brunsvigia multiflora, var. Hathor, pure white, small $2.50. Large $4.00
Lycoris Sprengeri, hardy $2.50
Howard and Smith Amaryllis, best American strains, assorted, 3 for $2.25

When ordering, please identify yourself as a member of A. P. L. S.

CECIL HOUDYSHEL
Dept. A. P. L. S.
LA VERNE, CALIF.

FRAGRANT ALSTROEMERIAS

(A. caryophyllaea)

Lovely fragrant, winter blooming Alstroemerias; blooming size—
$5.00 per dozen postpaid

M. B. FOSTER
718 Magnolia Ave.
Orlando, Florida

CHOICE BULBS

At Reasonable Prices

Amaryllis advena (Red and Rose Pink), Cooperia Drummondi and Pedunculata (Texas Rain Lilies), Lycoris radiata, Amaryllis Johnsonii, and several of the best varieties of Crinums.

C. W. HALL

908 West 29, Austin, Texas

CHOICE

Amaryllis, Hemerocallis, Lycoris, Habranthus, Gloriosas, etc.

Send for free list.

Middlepen Plantation
Orangeburg, S. C.

Choicest Alstroemerias

From My Collection of Over a Dozen Species and Varieties.

Descriptive circular of species and cultural directions gratis.

HARRY L. STINSON

3823 S. 154th St., Seattle 88, Wash.

[TABLE OF CONTENTS—continued from page 4.]

[PLANT LIFE LIBRARY, continued from page 168.]

families, genera and species. Like its predecessors, it is a text that all students of the field covered must have near at hand at all times for convenient reference.

A HISTORY OF HORTICULTURE IN AMERICA TO 1860, by U. P. Hedrick. 1950. Oxford Univ. Press, 114-5 5th Ave., New York 11. pp. 551 Illus. $7.50.

Although shorter treatises have previously appeared on this subject, this is the first comprehensive book on the history of American horticulture up to 1860. Part I is devoted to Indian gardens and the colonial period; Part II covers the post-Revolutionary period up to 1860; and Part III is devoted to the topics, botanical explorers and botanic gardens, the dawn of plant breeding, horticultural literature, and horticultural societies. The book is illustrated, and will be an important addition to the gardener's library.