PLANT LIFE, VOL. 14, NO. 1, JANUARY, 1958

HERBERTIA

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 yearbook devoted exclusively to the amaryllids, sponsored by the affiliated AMERICAN AMARYLLIS SOCIETY. The publications are international in scope. All paid up members are privileged to receive the current issues of PLANT LIFE, incl., HERBERTIA.

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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.

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DR. THOMAS W. WHITAKER, *Executive Secretary*
The American Plant Life Society
Box 150, La Jolla, California

PLANT LIFE, VOL. 14, NO. 1, JANUARY, 1958

HERBERTIA

1958

Year Book of
The American Amaryllis Society
25th issue

GENERAL AMARYLLID EDITION

EDITED BY
HAMILTON P. TRAUB
HAROLD N. MOLDENKE

THE AMERICAN PLANT LIFE SOCIETY
Box 150, La Jolla, 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.

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I. THE AMERICAN AMARYLLIS SOCIETY

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[THE AMERICAN AMARYLLIS SOCIETY—continued on page 151.]

PREFACE

This 25th issue of HERBERTIA is appropriately dedicated to Wyndham Hayward who was one of the prime movers in the organization of the AMERICAN AMARYLLIS SOCIETY in 1933. In recognition of his services to the Society, and his help in the advancement of the amaryllids over a quarter century, he received the HERBERT MEDAL AWARD in 1958. Mr. Hayward contributes an autobiography but it must be pointed out that he is a very modest man and he far from does himself justice. His influence on the advancement of the amaryllids has been far greater than he indicates. He has unselfishly given of himself in furthering the popularization of amaryllids and many other plants, and his host of friends in America and elsewhere testify to this. Mr. Hayward also contributes articles on some phases of *Amaryllis* culture in this issue.

The cover design of this GENERAL AMARYLLID EDITION of HERBERTIA shows *Sternbergia lutea*—based on a photograph taken by Sam Caldwell of Nashville, Tennessee.

There are various articles on AMARYLLIS in this issue. Mr. Hayward writes on cold susceptibility of *Amaryllis;* cold storing *Amaryllis* seeds, and *Amaryllis* propagation problems. Prof. Nelson, Mr. Hannibal *et al* report on *Amaryllis ambigua;* Prof. Nelson *et al* give further information about *Amaryllis evansiae.* Jack Scavia writes about a new round-flowered double *Amaryllis* such as breeders have been seeking for many years since the older doubles are usually too irregular in flower shape. Mr. Weil writes about the effect of colchicine on *Amaryllis.* Beckwith D. Smith contributes an article on his hybrid *Amaryllis;* Mrs. A. C. Pickard writes about the smaller (intermediate) hybrid *Amaryllis.*

In this issue, as is customary, other amaryllids are not neglected. Dr. Corliss reports on amaryllids seen on his 1957 European Tour; Mrs. Morris Clint concludes her interesting article on collecting amaryllids in Texas and Mexico; Beckwith D. Smith writes about his visits with amaryllid enthusiasts in Louisiana and Texas.

There are articles on the chromosomes of *Lycoris* species by S. Bose; on *Nerine bowdenii* variations by L. S. Hannibal; on fertile clones of *Lycoris* radiata by Wm. L. Hunt; on *Lycoris elsiae,* on hybridizing *Lycoris,* and on a new hardy golden *Lycoris* by Sam Caldwell; on more of his amaryllids by Reg. F. Harradine; on the control of the major bulb fly by Dr. Jos. C. Smith; on Sternbergias by Wm. L. Hunt; on *Paramongaia* by Dr. Jos. C. Smith and Mrs. Morris Clint; on germinating seeds by L. S. Hannibal; on *Agapanthus* and an old white *Crinum* by Wm. L. Hunt; on *Hymenocallis* by Dr. Jos. C. Smith; and on seed setting in *Sprekelia* by S. Bose and Dr. Flory. Three new *Amaryllis* species and two new *Lycoris* species are described; crosses in the tribe *Zephyrantheae* are reported, and a robust form of *Crinum americanum* is described.

There are reports on the 1957 Amaryllis shows in New Orleans, Louisiana and Mobile, Alabama; and other reports on local Amaryllis

organizations in Dallas, Texas and Hattiesburg, Mississippi, and still other contributions as shown by the table of contents.

Since the death of J. Marion Shull, who ably served as artist for the Society, there has been a need for some one to take his place. Mr. Douglas D. Craft, Instructor in the DEPARTMENT OF DESIGN, ART INSTITUTE OF CHICAGO, has kindly agreed to assume responsibility for design problems, particularly the covers of HERBERTIA. Mr. Craft is an *Amaryllis* enthusiast who will contribute his first article in the 1959 issue of HERBERTIA.

Contributors to the 1959 issue are requested to send in their articles by August 1, 1958 in order to insure earlier publication of this issue. Unless articles are received on time, publication will be delayed to June or July as with other issues in the past several years.

March 15, 1958,
Camino de la Costa,
La Jolla, California.

Hamilton P. Traub
Harold N. Moldenke

CORRIGENDA

PLANT LIFE, VOL. 13, 1957

Page 1, title page, change "23rd issue" to "24 issue".

Page 2, 1st paragraph, line 1, change "23rd" to "24th".

Page 4, 2nd line, change "24th" to "25th".

Page 43, Table 1, under the first "2a", change the second "2a" to "3a".

Page 82, under Tribe 14. Euchareae, between "84" and "85", insert "84a". PSEUDOSTENOMESSON (1 sp.) x=?"

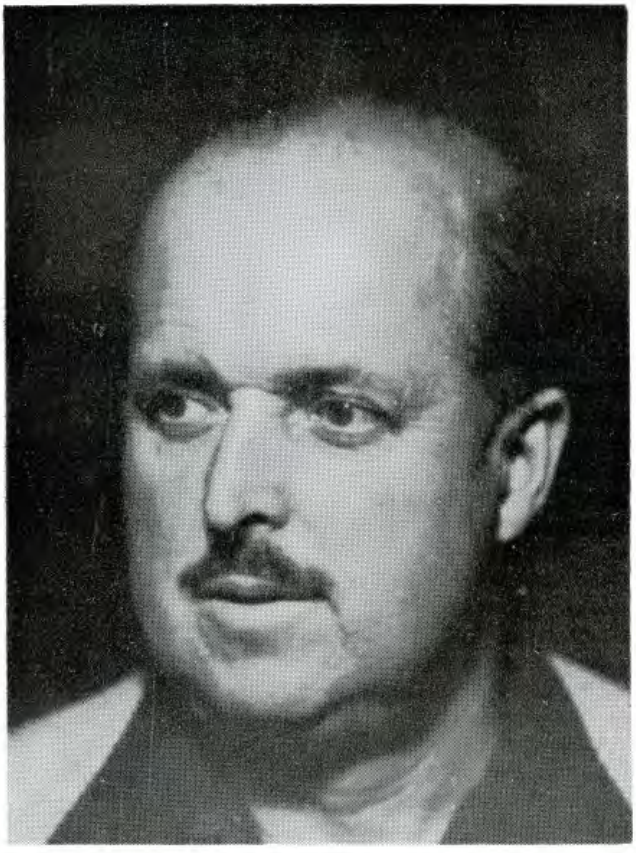
Page 83, 4th and 5th lines from the bottom, for "250 5th Ave., New York" read "120 Alexander St., Princeton, N. J."

Page 92, under L. S. Hannibal article, 3rd line, change "rerooted" to "reported".

Page 98, caption, Fig. 29, between "*Brunsvigia* x *multiflora*" and "Lindl.", insert "which is similar to *B. grandiflora.*"

Page 144, Table 1, *Z. Elliottiana,* Mookerjea (1955), change "32" in fifth column to "28".

Dedicated to
Wyndham Hayward



Herbert Medalist—Wyndham Hayward

Plate 1

WYNDHAM HAYWARD

AN AUTOBIOGRAPHY

Without doubt a vacation trip to Cuba in 1926, while working on the editorial staff of the PROVIDENCE JOURNAL AND EVENING BULLETIN, led directly to a horticultural career for the writer of this brief autobiographical account. It was while stopping in Jacksonville, Miami and other cities on the East Coast of Florida, that the exotic beauty of native and introduced tropical and sub-tropical plants seen in wayside plantings, streets, parks and so on, began to cast their spell.

The next season (1927) there came to the writer's family the possibility of moving to Florida, making an exchange of the home place in Wickford, R. I., for a house and lot with abundant citrus trees in Orlando, Florida. After three years on the staff of the ORLANDO SENTINEL in various capacities, came the depression, which hit Florida sooner than the rest of the country with the early collapse of the land boom of the 20's, and there was born a new horticultural career.

The need for raising meat and vegetables may have had some part in this change, and for the next decade it was a life of gardening with special emphasis on bulbs, tubers and tuberous rooted subjects as well as fruit trees and other exotics and ornamentals. High spots of the period were the farming of two acres of muckland in 1932-34, growing vegetables and flower bulbs, etc., the raising of hundreds of chickens, ducks, turkeys, and finally the founding of LAKEMONT GARDENS in Winter Park in 1934.

On my father's side, one widowed great-grand mother managed a farm in Rhode Island, my father was a garden enthusiast, with special feeling for fruit trees and vegetables, while a newspaper man by profession. In my own case besides a natural love for plants there was little to point to a horticultural career beyond the winning of a five-dollar gold piece in boyhood for having the best vegetable garden along about the 5th grade of school. But in Florida the presence and meeting of such inspiring plantsmen as Theodore L. Mead, Henry Nehrling, M. J. Daetwyler, Mulford B. Foster Dr. Hamilton P. Traub, Dr. H. H. Hume, Dr. David Fairchild, Dr. P. H. Rolfs, Prof. E. L. Lord and others, made a gardening career a foregone conclusion.

Born Oct. 25, 1903 in Providence, R. I., and raised in Providence and the little fishing village of Wickford, R. I., on Narragansett Bay, a small community in the best tradition of Old New England, the writer attended elementary and grammar schools in Providence, and high school at Wickford, (NORTH KINGSTOWN HIGH SCHOOL). After finishing the classical or liberal arts course at BROWN UNIVERSITY, A. B. 1924, there was one year of graduate study at Harvard University, majoring in comparative philology, with major fields in Romance, Semitic and Indic languages, where he received the Master of Arts degree in June 1925. At Brown he was elected to PHI BETA KAPPA in 1924.

Five years of newspaper work followed in Providence, R. I. and Orlando, Florida, with resulting slight opportunity to accumulate background material toward a life in scientific gardening. Thus the last quarter century and more has been a period of further abundant study and learning, with help, instruction and encouragement from many prominent authorities in the fields of plant science and plain "dirt gardening".

At present the writer owns and operates LAKEMONT GARDENS, specializing in bulbs, tubers and tuberous plants, at Winter Park, Florida, where he has lived at 915 South Lakemont avenue with his mother, Mrs. Emma L. D. Hayward, herself a life-long flower lover, for the past 23 years. She is 86 years old at this time, (April 1957) and still maintains an active interest in the affairs of the business and its plant stock and operations.

A common interest in Amaryllis led to the organization of the AMERICAN AMARYLLIS SOCIETY (which is now affiliated with the American Plant Life Society) in 1933 in cooperation with Dr. Traub (then stationed at the Orlando, Fla., UNITED STATES DEPARTMENT OF AGRICULTURE STATION), Judge E. G. Duckworth and Mr. Ralph W. Wheeler. The writer was secretary during most of the formative years, the continued growth of the Society has shown its sound purposes and helpful functions through the past quarter century. Its yearbooks comprise the greatest accumulation of general information and scientific data on the Amaryllis family ever published.

Besides *Amaryllis* and the other amaryllids, the writer's interests at Lakemont Gardens have included important cultures of *Gloriosa* species and hybrids, various "Ginger Lilies" *(Kaempferia, Hedychium, Zingiber, Curcuma,* etc.), *Achimenes,* one of the leading commercial collections, *Hemerocallis* hybrids, Crinums, Caladiums, *Haemanthus, Tacca* species, etc. Catalogues of the various specialties have been issued with remarkable irregularity, and mailing list of many thousands of plant lovers all over the world evolved.

Perhaps as the result of his journalistic experience, the preparation and publication of numerous more or less extended papers and articles on various phases of the horticulture of bulbs and tubers came naturally and has continued through the years. If there has been any mission to it all, this sincere and earnest effort to spread abroad the charm and appeal of worthy plant material, familiar and exotic, old and new, will have to stand as our contribution to the entertainment and instruction of the great gardening public. It has brought the rich, rewarding experiences and friendships.

VISITING AMARYLLIS ENTHUSIASTS

BECKWITH D. SMITH, *Jacksonville, Florida*

My wife and I had begun to give more and more consideration to the remarks of Horace Greeley when our only son wound up his college

term in Texas by marrying a native Texas girl. This impulse to "Go West" was further stimulated when the family began to grow with the addition of two darling little girls—and, when I read of the organization of an Amaryllis Society in Houston, Texas in the 1957 Herbertia, and remembering that along the way in Louisiana there were many ardent Amaryllis growers, the fever to make the trek got the best of us and we determined to go.

So, early on the morning of October 19, 1957, my wife, Mary Louise, and I, set out by car on a memorable visit. We planned our route through Mobile, Biloxi and Ferriday, planning to reach Houston the afternoon of the 21st. We were successful in reaching Biloxi, Mississippi that night and stopped for rest at a motel, with the sound of the lapping of the Gulf waters in our ears, lulling us to sleep.

Refreshed, we again got a new start the next morning, setting our sights on Ferriday, Louisiana, where we were to call upon Mrs. U. B. Evans at famous old Haphazard Plantation. Our expectation had been to reach that point around noon, but we encountered an unexpected delay. Somewhere along U. S. 90 we had taken a wrong turn, and by the time we had discovered our error we had penetrated too far into southern Louisiana to turn back. Since by this time my wife had appointed herself "Navigator", and was carefully studying an assortment of three tour maps, we decided to keep on. So we spent several rather uncertain hours meandering toward northern Louisiana, and Ferriday. During this time we crossed and criss-crossed the Mississippi and Louisiana lines so many times we were about ready to take out naturalization papers in one state or the other. However, even misfortunes of this nature will come to an end and we did reach Natchez, Mississippi about one thirty in the afternoon.

Now, discovering that Natchez was just across the Big River from Ferriday, we sped over the bridge, reached Ferriday and called Mrs. Evans. Mrs. Evans directed us to Haphazard, which was about ten miles west of Ferriday, and soon we were driving up through fallow cotton fields to the 'Big House'. Mr. and Mrs. Evans greeted us at the gate as we drove in the yard and we were ushered into a spacious living room and extended a most courteous welcome. I noticed first off the large fireplace, in which burned with cherry flame a log that measured all of six feet long.

The conversation immediately got around to Amaryllis. We then discovered that Mrs. Evans was the sister of Mrs. John Blow, a resident of Jacksonville, and a friend of ours and an Amaryllis fan. When we informed our hosts that this was our first trip west of Mobile, they told us much of the history of their State. We were introduced to the heavy pleasure of homemade 'dark' Louisiana coffee, which neither of us had savored before, and it made quite an impression. In fact, thereafter when we were served this heavy coffee, I always received a suprise at its vigor.

While the coffee was being served, we showed our kodachrome slides of Dutch Amaryllis grown in our garden at Jacksonville and those of

the John T. Weisner collection (previously reported on in HERBERTIA) grown at Fernandina Beach, and which we acquired in the spring of '57. Mr. and Mrs. Evans then showed us their colored slides of some of the Bolivian Amaryllis which had been collected by Professor Ira S. Nelson, of Southwestern Louisiana Institute at Lafayette, on his plant expedition in 1954. These outstanding slides included the yellow form of *Amaryllis evansiae* (named in honor of Mrs. Evans, who so actively sparked this plant exploration), various forms of *A. Belladonna* L., including pink, salmon, mandarin red and scarlet, with throat color ranging from whitish to greenish-whitish. We were, of course, stunned and amazed at the beautiful color variations in *A. evansiae,* which is predominantly yellow. Here, at last were the visual proofs of which I had read in HERBERTIA, and there was yet more in store!

After viewing this wonderful collection of color slides we were shown into the garden, and there before us were the actual same bulb plants growing in the rich organic soil on the banks of a most attractive lake. The sides of the banks were also planted with thousands of Louisiana Iris, and these grew in the same wonderful earth. As we walked from bed to bed, Mrs. Evans pointed out to us bulbs of Dutch origin which she said had been growing in their beds for ten years or longer. Some of these were truly massive in size, and we were informed they produced giant spikes of the finest flowers in solid, pure colors. In other beds there were growing the Bolivian types, such as the yellow *A. evansiae, A. x johnsonii,* A. pardina Hook. (the red-spotted Leopard Amaryllis), a hybrid known as 'Cuenca', *Rhodophiala bifida;* numerous types of *Habranthus* and *Zephyranthes,* and many Crinums. It was a literal feast to see these magnificent bulbs in growth, and so happily naturalized in the Louisiana soil, far from their native Bolivia. Only the fleeting passage of time forced us to cut short our visit and tear ourselves away from this idyllic setting, and we reluctantly made our adieus and departed for Alexandria, where we were to spend the night. Naturally we will always remember Mr. and Mrs. Evans, not only for their graciousness and kindness to us at their home, but also for their unstinted generosity in sharing some of these fine Bolivian bulbs for growing trials in the sandy soil of Duval County, Florida.

The next morning, October 21st, we departed Alexandria, proceeding into Texas without incident and reached Houston in the middle of the afternoon. Having already written ahead to Mrs. A. C. Pickard, Regional Vice-President of the AMERICAN AMARYLLIS SOCIETY, and organizer of the Houston Branch of the Society, we had a call waiting for us, and contacted her when we could get our breath after a rousing reception from the new grandchildren (to us, that is), and arrangements were made to attend the meeting of the Society the next day. We later found out that we had arrived just in time for the second meeting of this fine new society. We then settled down for the balance of the afternoon and the evening to establishing relations with the two delightful little girls, one six and one three, and neither of which had been previously seen by me.

The morning of October 22nd dawned cool and a little rainy, but soon two members of the Houston Amaryllis Society (Mrs. Ray Williams and Mrs. Hughes) came for us and we reached the Garden Center where the meeting was to be held at ten o'clock. This was our first sight of Mrs. Pickard, and we found her to be a most attractive and energetic lady. We were introduced to all of the very interested members of the Society and I made a short talk on the culture of Dutch Amaryllis in Florida, discussing soil, growing procedures and the increase of bulbs from seed, and propagation from cuttage, as was previously outlined by Dr. Hamilton P. Traub in HERBERTIA. I called attention to the fact that their 'gumbo' soil was well adapted to the growing of *Amaryllis* with the addition of heavy sand and natural organic humus. A bulb was cut up as a demonstration. Some of the ladies expressed horror at the apparent ruin of a good bulb, but it was explained to them the example was one of the good old hardy Florida Mead strain, and they relaxed.

We found that the HOUSTON AMARYLLIS SOCIETY had organized with a closed membership of twenty-six persons, although Mrs. Pickard stated that after a time they would open membership to other people interested in Amaryllis. After the meeting, Mary Louise and I were guests of Mrs. Pickard and the members at a delightful luncheon, where all had a wonderful time discussing our favorite flower, Amaryllis. We stayed on in Houston until Thursday, October 24th, at which time we found it necessary to start our reverse trip to Florida. The time in Houston, both with our flower friends and with our children and grandchildren, passed all too soon.

Coming through lower or southern Louisiana, we were much impressed with the enormous fields of sugar cane, and were as well delighted and impressed with the curious charm of old New Orleans when we stopped in that city for a day. At many points along the way on our return trip we saw numerous field plantings of Amaryllis, but were unable to do much exploring for the purpose of discovering more about them.

After coming back to Jacksonville and resting from our driving, we decided to finish up our tour by visiting in our own state. So, a couple days later, or on October 29th, we drove to Tampa to see Miss Ruth M. Clark (prominent in the growing and development of hybrid Amaryllis), spending several hours in her pleasant garden. While seeking direction to her home, I was unhappily bitten by a small yard dog, and the bite was quite painful for several days. However, the dog was found to be in good health, and I did not have to submit to the unpleasant rabies treatment. We spent the night in Lakeland, and the morning of the 30th reached Winter Park. Here we were to call on Mr. Wyndham Hayward, at his wellknown Lakemont Gardens. It was not a too busy day for this very pleasant gentleman, so he took considerable time with us and showed us all over his gardens and growing grounds, and we spent the time most happily. We would urge all Amaryllis fans visiting Florida to be sure and go to see Mr. Hayward if you want to obtain the very finest in Amaryllids to be had in Florida. He is a

grower of the highest type, and his gardens are fabulous, to say the least. Here the grounds are filled with tropical plants of all types and varieties beside Amaryllis. You will not only come away with your chosen bulbs or plants, but you are also bound to be happily infected with some of the effervescent enthusiasm which is a definite part of Mr. Hayward in his horticultural pursuits.

On our return to Jacksonville after our last call, we were even more enthused with the culture of Amaryllis than we had been before. Our contacts with other Amaryllis fans had been most rewarding, and we are now looking forward to a new season in the further development of our own Amaryllis in our own home garden. Why not come and see us?

COLLECTING AMARYLLIDS IN TEXAS AND MEXICO

MRS. MORRIS CLINT, *Texas*

[Concluded from page 83, HERBERTIA EDITION, PLANT LIFE Vol. 13. 1957]

Unfortunately, we have found all of these four numbers comparatively shy bloomers in cultivation. Perhaps it is their nature or they may need more time to become acclimated or maybe I have not yet solved the secret of their successful culture.

Just a few miles beyond this point, Morris saw a lone yellow *Zephyranthes* on the shelf above the road. It was a little brighter in color but apparently the same species we had collected south of Jacala the year before, M-449. We collected more bulbs in leaf from the ditch below and when they bloomed later in the year, we were not too surprised to find one of the yellow and red forms among them. The final chapter of the mixed collections from the Jacala area was about to unfold, for about a mile north of Jacala we discovered a heavy stand of bulbs which had just finished blooming. At first, we supposed they must be the yellow and red form, but were puzzled that the faded flowers were bright rose red and not a dull, dark red. At Puerto de la Zorra the same bulbs were found in some abundance and a few freshly opened flowers showed us that they were a bright rose red with a small white throat and long tepaltube. Remembering the tiny seedlings of M-466, I now strongly suspected that most of our two former collections of narrow leaved bulbs from Puerto de la Zorra were this filiform leaved species, M-569. A few rose red blooms later in the summer on these collections seems to prove me correct. So, within a 10 mile radius, in addition to the larger bulbs we have three small forms—two of which I feel sure will be classed as distinct species. To one not familiar with the tropical habitats of these small amaryllids this would not appear plausible, or even possible. Normally, growth and blooming habits in the wild of each species and even the various forms within a species vary from one another, yet all are so dependent on the unstable and unpredictable seasonal rainfall that it is frequently possible for the normal blooming seasons of two distinct species in a given area to overlap to some extent. On the other hand, due to the same inconstancy

one is never certain to have found a true picture of the populations of a given area even though frequent visits through successive seasons have been made.

In June, 1955, we scheduled a trip which was to take us to Antiguo Morelos, San Luis Potosí, Guadalajara, Morelia, Salamanca, Zimapan, Cuidad Valles and home. Our daughter, Marcia, went with us. The light yellow *Zephyranthes* near Nuevo Morelos were heavily in bloom over the entire valley and what a beautiful sight it was! As we started up into the mountains on the other side of the valley, we stopped to examine a group of pink *Zephyranthes*. These were a familiar form, but a closer look made me exclaim with incredulity, for just a foot or so away was a clump of the yellow flowering *Zephyranthes*. Seldom does one actually witness such a phenomena—the chance mingling of the bog and the mountainous species.

About 40 or 50 miles from San Luis Potosí, we ran into one of the most severe rain and hail storms I have ever witnessed. It was a nerve-wracking but unforgettable experience. Within 10 minutes the desert was white with hailstones and angry torrents of muddy water and floating hail ran in the ditches and crossed the highway at frequent intervals. Rain and hail hit the windshield with such force that vision was completely obliterated and only Marcia's directions from the rear kept us on the road, while we crept along at only a few miles an hour. As frightened as we were, we couldn't help but wonder what bloom the storm would bring forth.

The next day, as we drove onto the plateau south of the city, we found scattered blossoms of *Z. concolor*. One group had extra large, wide open flowers with very narrow tepalsegs. It was the most distinctive variation in the species we had so far seen. Much farther south one lone blossom of *Z. concolor* placed the species well within the state of Jalisco.

We owe our next collection to an amusing co-incidence. We were about 5 miles south of Lagos de Moreno, Jalisco and were teasing Marcia about our ability to judge just where *Zephyranthes* might be found. Pointing to a dry, sandy slope I said, "Why, for instance, there is a place right now", and had to wipe my eyes, and look a second time, for there they were, indeed! Though the slope was literally covered with tiny, pale pink blossoms, we would ordinarily never have seen them if the sun had not caught the blossoms just right, for they were blooming on stems so short that often the flowers were resting on the ground. We think we have collected this number, M-599, in a number of places on the plateau.

As we approached closer to Guadalajara, we began to suspect that we were too late to find *Zephyranthes* in bloom, for rainfall had been heavy and frequent over most of the countryside. However, the next morning we found quite a group of blooming bulbs on highway 15, about 20 miles east of Guadalajara. The terrain was fairly level, but rocky. We had been hoping to find *Z. fosteri* but these bulbs did not quite seem to qualify, for the large, rather spidery flowers of bright rose were

borne on a short pedicel. This number, M-602, reminded us somewhat of M-557 from the Canyon de Borregos. This collection kept us on sharp look-out and frequent stops were made, but we were sorely disappointed not to find more *Zephyranthes,* even in leaf. About 60 miles from Guadalajara, in the hills above Lake Chapala, one of our stops payed dividends, for we did find amaryllid bulbs—a heavy concentration of them among the lava rocks along the roadside. But what were they? Not *Zephyranthes* and certainly not *Sprekelia.* I do not know whether we would have guessed them to be *Hymenocallis* had we not found a few bloom scapes, for the narrow, glaucous leaves were unlike any of this genus that we had ever seen. When a few of the bulbs bloomed in our garden a few weeks later, we were completely enchanted with the dainty umbel of small, delicate blooms. We sincerely hope that this lovely dwarf species will take kindly to cultivation.

The next morning we found a few small pink *Zephyranthes* on a rocky hillside along the highway from Morelia to Salamanca. We were about 10 miles north of Morelia, in the state of Michoacan. The flowers were similar to M-599, collected the day before, except for one bulb, a very large, starry white blossom. It was the only one seen, although we spent some time searching for others. Two miles farther, in the flat, rocky soil of one of the valleys not far from Lago de Cuitzeo, we again came upon *Zephyranthes.* M-609 were large, robust bulbs with pretty white flowers with broad tepalsegs. The ovary seemed to be completely sessile, so they may prove to be a form of *Z. verecunda.*

In the state of Queretaro, it was Marcia who spotted the bright red "Mayitos" along the roadside. We soon discovered that the nearby hill was simply covered with blossoms—dark red, a larger flower of pink and a few of the familiar small pink. The red, M-611 and the pink, M-612 are probably forms of the same species. There was not a sign of bloom on identical hills in the neighborhood and we marveled at the erratic showers which could bloom *Zephyranthes* on one hillside and leave the very next one bare. We have traveled enough to know that it is a frequent occurrence, particularly at the beginning of the rainy season. On the plateau, it is easy to observe the formation and movement of these sudden rain squalls and we have often been amazed at the narrow paths taken by even the heavy showers.

We had hoped to find a few blooms on the large flowered bulbs in the mountains between Zimapan and Jacala, but nature and the temperamental habit of the bulbs were against us, for there was no sign of them, either in leaf, bloom or seed.

In July, 1955, we again took the loop to San Luis Potosí, Guadalajara, Morelia and Zimapan—to examine the flowers of a species of *Hesperaloe* near Cuidad del Maiz, to find flowers or seed of the Lake Chapala *Hymenocallis* M-604 [Fig. 6]* and perhaps to locate more *Zephyranthes* in leaf on the southern route. We arrived at El Mante early enough in the afternoon for a short scouting trip out the Tampico highway. We found a single small yellow *Zephyranthes* in bloom in

* Fig. 6 (see 1957 **Herbertia**).

the deep bar pit along the roadside and collected a number of others which had bloomed earlier. When these bloomed in our garden in the fall, we discovered that they were close to the small forms of *Z. pulchella.*

As we drove through the mountains just west of Maiz our attention was attracted by numerous shrubs with large clusters of dark blue flowers and were quite surprised when we recognized them to be Cenizo. It was raining, so we did not stop to examine them thoroughly. The *Hesperaloe* blossoms were disappointingly drab and unattractive for such beautiful plants and the continuing rain would have kept us from lingering, but we were completely astonished—though by now we should be immune to astonishment concerning the habits or habitats of *Zephyranthes*—to find the ground literally carpeted with *Zephyranthes* in full leaf. They had bloomed and leafed out in the short interval since our last visit to this spot. We fully expect these, M-633, to be the same as our M-469, collected in the foothills a few miles farther east, but who knows?

When we visited our *Z. concolor* collection site 14 miles north of San Luis Potosí, we found we had just missed a heavy bloom. Present in small numbers was a bulb we had failed to see on our many previous visits—M-643. The bulbs were large for the "Mayitos" of this area (which excepts *Z. concolor),* with a mass of dull green leaves about ¼ inch broad and large seed capsules on quite a long pedicel. The dried remains of the blossoms indicated that the flowers were rather large. They are not quite like anything we had collected in this region, but will they actually prove to be a new number for us, or are they one of our old friends transformed by the different environment of this rain strip?

The next morning, we stopped in the foothills just south of the city of San Luis Potosí, hoping to find bulbs of M-429, a very large, rose blossom we had collected in May of 1954 in scarce numbers and had not seen since that time. We hope that we found them in the heavy concentration of large bulbs with bright green, broad, decumbant leaves—almost the only *Zephyranthes* above ground.

We again took the side trip to our "Bulbous Paradise" on highway 45. The *Oxalis* which had carpeted the fields in June were gone, but the Tuberose-like plants were in full bloom, in several shades of peach, pink and white. The flowers are much prized by the Mexican people, who were in the fields gathering them by the armsful. We were told that they were called "Nardos", which is one of the names given to the Tuberose. While they are still to be properly identified, we assume they are a species of *Bravoa,* the Mexican Twin-flower. We found M-460 in full growth, while hardly a bulb of M-459 was in sight. On the way back to our highway to Guadalajara, Morris saw *Hymenocallis* blooming in a broad, natural drain, far below the roadbed. To our surprise and delight, it was apparently our Lake Chapala species. We found numerous bulbs in the grass, a few in the last stages of bloom and a number in seed. Also present in some abundance was our M-460, heavily in seed.

Not far from Guadalajara, it began to rain but this failed to restrain us when a heavy stand of *Hymenocallis* was spotted in a small

ravine far below the roadbed. The bulbs, M-658, were growing in large clumps along a small, rocky stream. Far different from the Lake Chapala species, the plants had long, narrow, upright leaves of dark green. A few old scapes were bulging with seed. We found that the larger bulbs were firmly anchored among the large rocks and were almost impossible to dislodge, but we were able to dig most of a large group of small seedlings. Not many miles south of this spot, we saw our dwarf Lake Chapala species in bloom in a shallow ditch along the roadside.

Our luck in finding *Zephyranthes* in leaf along highway 15 was no better than in June. At our original collection site of the Lake Chapala *Hymenocallis,* we learned that the plants had bloomed, shed their seed and were already beginning to go dormant. We talked with an old woman who stopped as we were busy locating seed among the rocks and heavy weed growth. She volunteered the information that early in the season the roadside in the immediate vicinity was colorful with red "Tempranillas", so perhaps we are at last on the trail of *Z. fosteri.* Fortunately, we had learned a year or so earlier that *Zephyranthes* are called "Tempranillas" in the state of Jalisco and not "Mayitos".

The Lake Chapala *Hymenocallis* was seen in flower once more in the state of Jalisco and twice in the state of Michoacan, one of the latter locations being not far from the state of Guanajuato, so the range of the species is far more extensive than we would have supposed on our trip in June.

While visiting the collection site of M-456, we learned from an old man of an even larger colony of the bulbs some distance away. These bulbs, growing in a caliche outcrop, were even larger in size than those formerly collected. We secured more information concerning the species from an old woman who had arrived to collect faggots. She stated that there were scattered colonies of bulbs on all of the adjacent hills in the immediate vicinity and that they bloomed at intervals with the first rains of spring, having a large white blossom. If her story is correct, this is one location where only one species of *Zephyranthes* is to be found, for she claimed that the only other bulb that she knew of was the white "Estrella" *(Milla biflora).* Yet it is but 14 miles farther east to the red hills of Queretaro where we collected the three forms of "Mayitos" in June!

At Puerto de la Zorra, we found the large, pink flowered bulbs, M-365, in full leaf and were a little surprised at their abundance. We have never found the glaucous #M-565-A at this location nor had we seen it anywhere from Zimapan northward on this trip, in spite of many stops and careful searching. We found masses of the yellow and red *Zephyranthes* M-665 in heavy bud, growing in pure leaf mold on a rocky ledge at Puerto de la Zorra. There must have been several hundred bulbs in an area less than 2 feet square. Among the bulbs collected for us by a small boy who was tending cattle in the neighborhood we sorted out four or five which looked different from the above. These bloomed for us shortly after our arrival home and they happened to be the pure yellow form, which places all three of the small bulbs at this

location. A violent rainstorm came up about noon, so we ate lunch in the car and were on our way at the first break in the rain. Even so, we drove through dense fog for the next 50 miles, so were robbed of further collecting.

We are now in our tenth year of plant exploration in Mexico and as the *Zephyranthes* season is almost upon us once more, I am reminded of the many courtesies we were extended by the representatives of the Mexican Department of Agriculture and the thoughtful co-operation and careful treatment of our plants and bulbs at the Plant Quarantine and Fumigation Station of the U. S. Department of Agriculture, both at Brownsville and Laredo. We hope to continue these explorations, adding some new territory each year and at the same time carry on the study of the populations of *Zephyranthes* in areas we are familiar with.

In conclusion may I say that in spite of the many amaryllids we have collected over the states of Tamaulipas, San Luis Potosí, Jalisco, Guanajuato, Queretaro, Hidalgo and Michoacan, we feel that we have barely scratched the surface, even in the areas we have covered. I am sure that the reader will agree. Many rumors, as yet unverified, have come to us of bulbs which can only be amaryllids of some sort: large white flowers with pink centers which have a delightful fragrance and are found only in an inaccessible and uninhabited lava region in the state of San Luis Potosí; our own "Blue Phantom" from the same state; very large and beautiful white flowers from the upper plateau near the city of San Luis Potosí; large red flowers high in the mountains of the state of Hidalgo and others "mas azulito" in the mountains farther north in the same state. Fact or fantasy, we listen to all of these tales with an open mind and have high hopes of running at least some of them to earth.

ALONG THE AMARYLLIS TRAIL

PHILIP G. CORLISS, *M. D.*,
Regional Vice-President

Enjoying friendly contacts with leading plantsmen of the world has been one of the most rewarding facets of my labors as 'Leader' of Garden Tours for Arnold Tours of Boston. The Fall Gardens Tour of 1957 was particularly rich in items of interest to amaryllis enthusiasts.

On Saturday, September 7, we attended the great Aalsmeer Flower Festival in the Olympic Stadium at Amsterdam. The next morning Mr. H. T. N. van Woesik of the firm of Ludwig and Co. called at our hotel, the Old Castle Wassanaar (near The Hague), and drove us to the National Dahlia Exhibition at Hillegom. Before visiting the dahlia show in the new 'Treslong' building we enjoyed a tour through the adjacent facilities of Ludwig and Company. Although it was not the season for peak amaryllis bloom, we found much to admire.

Mr. Jansen, of Ludwig and Co., has been breeding for picotee amaryllis for many years. We saw several fine seedlings of this type in bloom with a red pencil stripe edging the otherwise pure white segments.

Amaryllis reticulata var. *striatifolia* hybrid at Van Tubergen & Co., in 1957. Photo by Dr. Philip G. Corliss.

Plate 2

A perfect picotee—the edging complete and no other color on the flower —has not quite been reached but the achievement seems imminent. However, the firm believes it will be another ten years before it markets a picotee amaryllis which suits their requirements.

I was astonished to see that in propagating their named amaryllis varieties they often make as many as seventy cuttings from each mature bulb using the method developed by Dr. Traub and Mr. Heaton and reported, in past issues of HERBERTIA. When I said that I would

Fig. 1. *Nerine* x *Brunsvigia* hybrid at Van Tubergen & Co., Haarlem, in 1957. Photo by Dr. Philip G. Corliss.

lose (and have lost) all the parts were I to attempt such surgery, I was assured that they sometimes did, too. Their 'Five Star General', in fact, was for several years quite obstinate about propagating—often only four or five of the segments would survive. Now the General is more tractable and responds well to being minced. They had to abandon completely what they considered the finest dark red amaryllis they had ever developed—it refused completely to cooperate in propagation.

The day after we enjoyed the Ludwig ranges and their benches of

amaryllis we visited an entirely different kind of glass house at the Haarlem home of Van Tubergen and Company. These vast houses had no benches—the ones with amaryllids, at least—but served only as protection for bulbs planted in the ground.

Being unable to perpetuate nerines, or at least to bloom them more than the first year, but having *Brunsvigea rosea,* the Cape Belladona, pop up all over the garden every summer, I was delighted to contemplate future possession of an amazing hybrid of these two amaryllids. Blooming *WITH* handsome foliage were several scapes of *Nerine* x *Brunsvigea,* each umbel of which held some six or eight open flowers and ten to twenty additional buds (Fig. 1) The flowers of medium rose color were about as close to a mathematical mean in size between the two parents as one could imagine. Although further study will be required, I would venture a guess that these hybrids will prove of enormous garden value, succeeding where each parent may falter.

Our host at the Tubergen plant, Mr. J. Bijl, also showed us another amaryllid that was new to me. This was the large-flowered *Amaryllis reticulata* var. *stratifolia* hybrid (Plate 2). Notice the striped foliage which gives this species its name.

The final amaryllis treasure which rewarded our Fall 1957 trip was an handsome specimen which Mr. G. W. Robinson, superintendent of the Oxford Botanical Gardens, showed our group at the range at Oxford on Sept. 21. This was *Amaryllis aulica* x *A. calyptrata.* The outstanding feature of the flower is the intricate network of handsome raised veins on the tepalsegs. The blooms have bright rust-colored veins on petals of off-white; the green throat is dusted with brown.

DR. TRAUB'S "THE AMARYLLIS MANUAL"

WYNDHAM HAYWARD, *Florida*

The volume was received too late for an extended review of this great flower book, the first devoted exclusively to Amaryllis, in this issue of HERBERTIA. The full review will appear in the 1959 edition of HERBERTIA. The brief note follows:

The beginning of a new era of enlightenment in the scientific and popular study of Amaryllis, species and hybrids, may be said to have arrived on July 8, 1958 with the publication by Macmillan of Dr. Hamilton P. Traub's long-awaited "The Amaryllis Manual"*, a handsome, compact volume of 338 pages, with a remarkable color plate of the new miniature hybrid, *Amaryllis* x *henryae,* and 31 other illustrations. There is, of course, in this first great new work on Amaryllis since William Herbert's "AMARYLLIDACEAE", of 1837, a vast mine of horticultural information, scientific data and reference material, based on a lifetime of study of one of the world's great bulb genera, in the 16 chapters and five appendices. Amaryllis enthusiasts are hereby advised to run, not walk, to the nearest bookstore and place their orders for the long-awaited book.

* THE AMARYLLIS MANUAL, by Hamilton P. Traub. The Macmillan Co., 60 Fifth Ave., New York 11, N. Y. 1958. Pp. 338, including 32 illustrations. $7.50.

1. REGIONAL ACTIVITY AND EXHIBITIONS

NEW ORLEANS AMARYLLIS SHOW, 1957

MRS. WALTER R. LATAPIE, *Chairman*
Garden Circle, New Orleans

The Garden Circle's TENTH OFFICIAL AMARYLLIS SHOW was held on March 30th and 31st, 1957. In recognition of the event, a proclamation designating the period of March 30th to April 5th as "AMARYLLIS WEEK" was issued by the mayor. Forty garden clubs participated in

Fig. 2. Queen of the 10th Official Amaryllis Show, 1957. Miss Jeanne Wolfe is crowned by Commissioner-at-large, Victor H. Schiro.

the artistic arrangements and horticulture divisions. The Horticulture Divisions were also open to the general public.

The Show was judged by 15 Accredited Judges. Five Gold Cups (donated by the Garden Circle) and five AMERICAN AMARYLLIS SOCIETY awards, and numerous other gifts, were awarded. Mrs. A. Ducote Jr.,

of the Gentilly Garden Club received the Gold Cup for her artistic arrangement. The Dutch Horticulture Sweepstakes Gold Cup winners were Mrs. W. J. Perrin and Mrs. John Klein, Jr. Sweepstakes Gold Cup for American Horticulture was won by Mrs. Wm. Melder. Miss Donna Pence won the Junior Gold Cup. The Gold Cup for Public Schools was won by the Rabouin Vocational High School.

Amaryllis of all types are becoming more popular in New Orleans. However, there were more named Dutch entries in this year's show, than in the previous ones.

THE OFFICIAL AMARYLLIS QUEEN, Miss Jeanne Wolfe, was crowned by Councilman-at-large Victor H. Schiro (Fig. 2). Last year's Queen, Miss Joyce Lynne Nuss, presented the Maid,—Miss Judy Lee Centanni. The crown bearer was Miss Deborah Jefferson, and Miss Paula Jefferson was the Amaryllis bearer.

A great many people of New Orleans and vicinity enjoyed the Show, which was open to the public without charge.

GREATER GULF COAST AMARYLLIS SHOW, 1957

W. C. STRAIN, *President,*
Amaryllis Society of Mobile, Alabama

A floral treat was presented for garden lovers of Mobile, Alabama, Saturday and Sunday, March 16th and 17th, 1957, when the AMARYLLIS SOCIETY OF MOBILE, Alabama, presented the Fifth ANNUAL GREATER GULF COAST AMARYLLIS SHOW.

"Amaryllis in a Southern Home and Garden" was the theme of the show. Several thousand amaryllis enthusiasts visited the show and viewed the hundreds of specimen blooms and the many hobby tables, art exhibits and beautiful arrangements. The show was competitive and open to all whether members of the Amaryllis Society or not.

In addition to the ribbon awards, eleven sterling silver perpetual trophies were awarded to their winners. These trophies are perpetual except when won for three consecutive years by the same winner.

The program was divided into the following divisions; Horticulture (American Amaryllis); Artistic Arrangements; Horticulture (Dutch Amaryllis); Commercial; Hobby and Art.

Mr. Bill Robertson is President of the AMARYLLIS SOCIETY OF MOBILE and Mr. Ernest Thublin was show chairman. Mr. Thublin was ably assisted by Mrs. Robert Warth and Mr. William Lowe.

THE HOUSTON AMARYLLIS SOCIETY

MRS. A. C. PICKARD, *Regional Vice-President,*
The American Plant Life Society

THE HOUSTON AMARYLLIS SOCIETY was organized on August 1, 1957. The objectives of the Society are to foster closer cooperation of the members of the AMERICAN AMARYLLIS SOCIETY in this area in the study and

growing of Amaryllis through pot and garden experiments and the exchange of experiences at the meetings and garden visits, and to encourage the study of the subject through the available literature.

The Society meets on the 4th Tuesday of each month at 10 a. m. from August through May, excluding December. All members must include membership in the AMERICAN AMARYLLIS SOCIETY, and must engage in the growing of named Dutch hybrids. They are also encouraged to grow Amaryllis in the other divisions. The programs are given by the Society members, followed by a question and answer session. Our motto—a new Society should start with a good foundation. The programs begin with such subjects as "Soil formulas for growing Amaryllis"; "Primer concerning all phases of planting"; "Member slide lectures"; "Trends in Amaryllis breeding"; "Technique of hybridizing"; "Propagation—seed, offsets and bulb cuttage"; "Culture and care after blooming"; and "Disease, mites and insects of Amaryllis".

Some of the members are accredited Amaryllis judges and we expect to have more by the end of next year. A capable judge must learn by growing.

The Houston climate is very favorable to outdoor Amaryllis culture. Our Dutch hybrids grow and like it. Some of our members' gardens are a paradise of named Dutch clones.

We hope by the end of the year with the full cooperation of all of our members to advance to a greater degree of usefulness and thus serve as an inspiration to Amaryllis lovers elsewhere.

MEN'S AMARYLLIS CLUB OF NEW ORLEANS

In September of 1957, the MEN'S AMARYLLIS CLUB OF NEW ORLEANS, affiliated with the AMERICAN AMARYLLIS SOCIETY, was organized at a meeting held at the home of W. B. Morton, Jr., 3114 State Street Drive, New Orleans 25, La., according to an announcement by Walter R. Latapie, one of the charter members. The group will devote its efforts to the advancement of Amaryllis culture, and it will cooperate with the annual OFFICIAL AMARYLLIS SHOW staged by THE GARDEN CIRCLE OF NEW ORLEANS. Meetings will be held the first Saturday of each month.

The officers are: S. N. Cuchinotto, President; H. P. Fontcuberta, Vice-President; W. J. Perrin, Recording Secretary; and Timothy Calamari, Corresponding Secretary.

HATTIESBURG (MISSISSIPPI) AMARYLLIS SOCIETY

Brief mention was made of this Society in 1957 Herbertia. The following is the roster of officers: Mrs. Sam Forbert, Pres., 117 North 23rd Ave.; Mrs. R. A. Fowler, Vice-Pres., 208 15th Ave., Mrs. J. H. Snowden, Secy, 321 South 16th Ave., Mrs. F. T. Newton, Treas., Monroe Road, and Mrs. Melvin M. Thomas, Reporter, 200 South 29th Ave.

Mrs. Forbert writes that the Society members order their Amaryllis bulbs more or less from Ludwig, Hillegom, Holland; when they arrive in February, they are planted in pots indoors until after blooming, then they are planted outdoors in permanent locations in the garden.

EDITOR'S MAIL BAG

Mrs. Jean Aldred, of the AUKLAND LILY AND AMARYLLIS SOCIETY, 23 Donovan St., Blockhouse Bay, Aukland, S. W. 3, New Zealand, writes that members of their Society are interested in corresponding with members of the AMERICAN AMARYLLIS SOCIETY.

Mr. Thomas R. Manley, of the Selingrove (Penna.) Area Joint Schools reports that several of his students are working on scape deformations under typical home culture of hybrid Amaryllis, and that the data will be published in a future issue of Herbertia. Like all of Mr. Manley's experiments, these results will surely be of vital interest to the members.

Mr. Bruce Hinman, Geneva, Illinois, writes that he gave up the commercial growing of Alstroemerias five years ago, but that he is still keenly interested in these fine plants, and hopes to grow them in the future as an amateur. He writes that he had produced some "most interesting seedlings which seemed to be *Astroemeria violacea* hybrids. These were in a variety of colors, including a beautiful, clear rose pink. I gave these roots all to Mr. Giridlian, of Oakhurst Gardens in 1952, but I have never heard whether any survived."

Dr. Corliss extends an invitation to members of THE AMERICAN PLANT LIFE SOCIETY to join the Spring and Fall Garden Tours which he conducts each year. For full itineraries, prices, etc., write to Arnold Tours, 79 Newberry St., Boston 16, Mass.

We are sad to report that Dr. Arlow B. Stout, Herbert Medalist in 1939, and Curator Emeritus of the New York Botanical Garden, died on Oct. 12, 1957, at his home in Pleasantville, N. Y.

We are sad to report that Mrs. J. F. Stewart, of Downey, Calif., died in January 1956. Mr. J. F. Stewart has sold his Downey place and now resides temporarily at Apple Valley, Calif. He has farmed out some of his best hybrid Amaryllis stock so that he can start again when he takes up permanent residence again.

Your editor received a stimulating visit from Prof. Ira S. Nelson of SOUTHWESTERN LOUISIANA INSTITUTE in the fall. Prof. Nelson is planning another plant exploration trip to South America in 1958 under the sponsorship of the LOUISIANA SOCIETY FOR HORTICULTURAL Research.

Mr. W. M. James, your Secretary-Treasurer, and Mrs. James, visited with the Editor in early November 1957.

Our good friend Rev. C. W. Hall, 1401 Wooldridge Drive, Austin 3. Texas, has retired as head of the WESLEY BIBLE CHAIR, and is devoting his time to gardening. His collection includes many Crinums. He has a surplus of a few kinds which he would like to sell or exchange as an aid in securing others.

Mr. R. Latti, Prop., Lily Nurseries, Box 25, Nuweplaas, C. P., South Africa, who is a registered nurseryman, writes that he will try to help find South African plants for those who are interested. We are grateful to Mr. Latti for his kind offer.

Mr. & Mrs. D. V. Applegate, of Monona Plantation, Ferriday, Louisiana and Santa Cruz, Bolivia, visited us in the fall (1957). Mrs. Applegate, who is the daughter of Mrs. U. B. Evans, is keenly interested in amaryllids and started the collecting activities in Bolivia several years ago which led to the trip by Prof. Ira S. Nelson in 1954 under the sponsorship of the Louisiana Society for Horticultural Research.

Mr. G. K. Clout, 147 George St., Quirindi, New South Wales, Australia, has joined the Society. He is particularly interested in hybrid *Amaryllis* and promises to write an article for Herbertia in a few years about his experiences.

AMARYLLIS JUDGES CERTIFICATES

Since the last report in 1957 Herbertia (page 32), the following Amaryllis Judge's Certificates have been issued by the American Amaryllis Society:

32. Mrs. L. J. Wathen, 5938 Mercedes, Dallas, Texas.
33. Mrs. Fred B. Chambers, 3616 Armstrong, Dallas 5, Texas.
34. Mrs. Naneene Tuffly, 715 Skillman, Dallas 14, Texas.
35. Mrs. Charles Bell, Route 7, Box 399, Hattiesburg, Miss.
36. Mrs. Wm. H. Sparrow, 311 4th Ave., Hattiesburg, Miss.
37. Mrs. Joe Patterson, 4019 Broadway St., Houston 17, Texas.

For information about taking the examination for the Amaryllis Judge's Certificate of the American Amaryllis Society, write to Mr. W. D. Morton, Jr., 3114 State Street Drive, New Orleans 25, La.

NATIONAL AMARYLLIS JUDGES COUNCIL

Further progress has been made toward the founding of this organization under the leadership of Mrs. B. E. Seale of Dallas, Texas. All accredited Amaryllis judges are members of the Council. A fuller report will appear in 1959 Herbertia.

[MOLDENKE, GENERA & SPECIES—continued from page 60.]

lobes 6 mm. wide; style 4 cm. long.—Argentina: La Incrucijada (Encruicijada), Sierra Famatina, 2500—3000 meters altitude, collected by G. Hieronymus & G. Niederlein on January 21, and February 2, 1879.

H. angustifolium Pax, (l. c., p. 331.)—Stout, with the neck of the bulb greatly elongated; leaves coriaceous, elongate, linear, margined, glaucescent, appearing at the same time as the flowers; scape stout, tall, bearing the pseudo-umbellate about 6-flowered inflorescence; bracts forming an involucre; flowers greatly declinate, pedicellate, the pedicels longer than the spathe; tube of the perigonium short, the throat possessing a fimbriate corona, the laciniations unequal, narrowly lanceolate; filaments unequal, the longer ones barely surpassing the perigonium, the shorter ones included, all flat; style filiform, surpassing the perigonium and stamens; stigma trifid, the lobes erect; capsule trilobed, 3-sulcate; seeds flattened, black, very numerous in the cells. The neck of the bulb is to 13 cm. long; the leaves 1—1.5 cm. wide; the scape 80—100 cm. tall, almost 1 cm. in diameter at the middle and 0.5 cm. in diameter beneath the inflorescence; the pedicels 5 cm. long; the perigonium 7—8 cm. long, with the broader segments 1 cm. wide; the ovary 8 mm. long; the style 10 cm. long, with the lobes of the stigma 2 mm. long; the capsule 1.5 cm. in diameter.—Between the streamlets Lwon and Arroyo de Las Islas, between Mt. Agudo and San Pedro, Argentina.

H. petiolatum Pax, (l. c., p. 330.)—Bulb brown, globose, not elongated into a neck; leaves lanceolate, acute, narrowed into a short petiole at the base, scarcely chartaceous, appearing at the same time as the flowers; scape nearly equaling the leaves; involucral bracts 2, marcescent at time of anthesis, lanceolate; flowers scarlet, 1 or 2 per scape, pedicellate, declinate, broadly funnelform, the pedicels slender, shorter than the spathe; tube of the perigonium short, the throat guarded by small scales located between the base of the filamenta, the segments oblong, acute; filaments flat, inserted in the throat and slightly shorter than the perigonium, somewhat unequal; anthers versatile, linear; style filiform, surpassing the anthers; stigma trifid, the lobes erect, not recurved. The bulb is 3—4 cm. in diameter; the leaves to 20 cm. long, 2—2.5 cm. wide, narrowed at the base into a petiole that is 1—2 or more cm. long and 2—3 mm. wide; the scape to 20 cm. tall; the involucral bracts 3 cm. long; the pedicels 2—2.5 cm. long; the flowers 6—7 cm. long; the segments of the perigonium 1—1.5 cm. wide; the anthers 12 mm. long; the lobes of the stigma 2 mm. long.—Argentina.

Hemerocallis x *traubara* Moldenke, hybr. nov. Plantae hybridae species complures implicatae, magnitudine staturae variae, floribus magnitudine variis de tempore aestivo productis. Holotype: No. 620 (TRA). *H.* x *traubara* cl. 'Golden Triangle'.

2. SPECIOLOGY

[EVOLUTION, DESCRIPTION, CLASSIFICATION AND PHYLOGENY]

AMARYLLIS ELEGANS VAR. AMBIGUA

This plant has established a place for itself since it can be grown outdoors in California. Two forms, practically identical are illustrated in Fig. 3, which have been obtained from Ecuador and Costa Rica respectively.

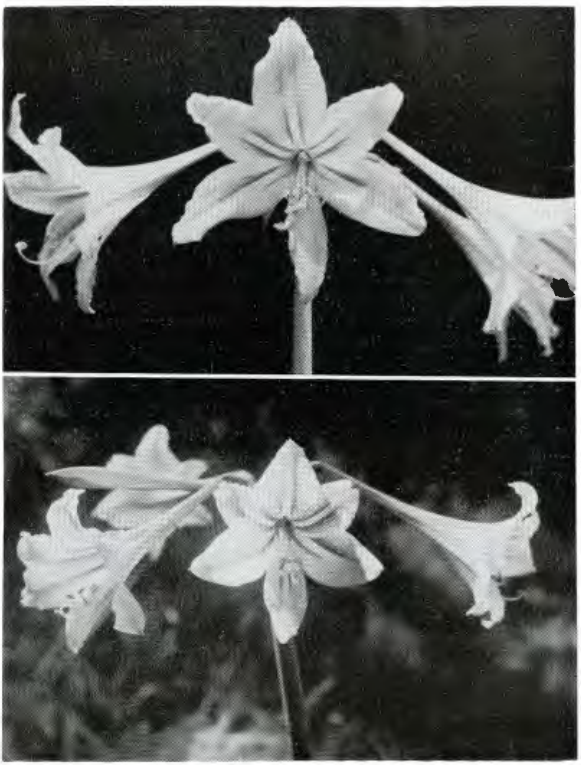


Fig. 3. *Amaryllis elegans* var. *ambigua. Upper,* from Cuenca, Eculor (cult.), photo by Ira S. Nelson; *lower,* from *Costa Rica (cult.)* Photo by L. S. Hannibal.

I. AMARYLLIS ELEGANS VAR. AMBIGUA FROM ECUADOR

Hamilton P. Traub and Ira S. Nelson

Amaryllis elegans var. *ambigua* (Herb.) Traub & Moldk., in Amaryllidac.: Tribe Amaryll. 186. 1949; Traub, in Amaryllis Manual, p. 267. 1958. Syn.—*Hippeastrum ambiguum* Herb., Bot. Mag. pl. 3542. 1837; *H. ambiguum* Herb. var. *ambiguum* (fide Int. Code, Art. 26), [syn.-*H. ambiguum* Herb. var. *longiflorum* (err. *longiflora)*

Herb.], in Bot. Mag. pl. 3542. 1837; Herb. Amaryll. 136. 1837; *Amaryllis* ambigua (Herb.) Sweet, in Hort. Brit. 3rd ed. 674. 1839; seub., in Mart. Fl. Bras. 3(1): 152. 1847.

This plant was originally introduced from Peru into England in the early 19th century where its status was variously interpreted. In the 1940's, Dr. Goodspeed brought back stock of it from South America but this is now apparently lost. Mr. Hannibal obtained it from Costa Rica as a cultivated plant about the same time. More recently Prof. Ira S. Nelson obtained it from two sources in Cuenca, Ecuador, in 1954, under cultivation, as reported in Bulletin 2, Louisiana Society for Horticultural Science, pages 24-25, 1957. It was pointed out that since it was originally described from Lima, Peru by Herbert in 1821 and was obtained from Ecuador in 1954, it appears that this plant is more widely distributed than was previously realized. The umbel is 4 to 5-flowered; the flowers are relatively long with a tepaltube 7.8 cm. long. The perigone is white, striped Tyrian rose, with the color more prominent in the upper part of the tepalsegs. The illustration Fig. 3, does not do the plant justice since it must be seen to be appreciated.

II. AMARYLLIS ELEGANS VAR. AMBIGUA FROM COSTA RICA

L. S. Hannibal, **California**

Back in 1943 the writer reported the flowering of this plant (under the misapplied name *Amaryllis conspicua),* and a photograph was reproduced on page 152 of 1943 Herbertia (Reprinted in 1954 Herbertia, page 22). [This is again reproduced in Fig. 3 for comparison with the introduction from Ecuador—Ed.]

Experience shows that this plant rarely responds to its own pollen, but that seeds set when pollens of other species of the same genus are used. However the resulting seedlings are not hybrids—The original crosses made in 1943 flowered this year and were identical with the seed parent in all respects. This is not the first time that such a phenomenon has been reported as Arlington Worsley experienced the same with *A. striata* (syn. *rutila),* (Gardeners' Chronicle (Lond.) p. 238, Nov. 1939).

We can recognize that the failure of *Amaryllis elegans* var. *ambigua* to accept *A.* x *johnsonii* pollen, as reported in 1943, is due probably to *A.* x *johnsonii* being a triploid. But will someone kindly explain why *A.* x *johnsonii* will set seed by selfing in warm weather, and these seedlings duplicate the parent in all ways. Several people have questioned the writer on this point. We would expect a hybrid to show some variation when selfed, even if a triploid, but here we have both *A.* x *johnsonii,* presumably a hybrid, and *Amaryllis elegans* var. *ambigua* received by the writer from Costa Rica, which has been regarded as a doubtful species, behaving strictly as species and varieties should. What is the answer?

Despite the fact that *Amaryllis elegans* var. *ambigua* and *A. elegans* are very slow to grow from seeds these bulbs are the hardiest *Amaryllis* known. They are the only bulbs which thrive out of doors in a region where three months of the year averages 40° F. *A.* x *johnsonii* can

tolerate such conditions, but few Amaryllis hybrids can for more than one year. None have survived two years, but *Amaryllis elegans* var. *ambigua* and *A. elegans* thrive on such treatment. In fact a resident of British Guiana reports that *A. elegans* grows by the hundreds on the river deltas in that area and that the bulbs are totally submerged for several months during the rainy season. Knowing how sensitive most *Amaryllis* are to an excess of water this comes with some surprise, but it probably explains one of the features contributing to the extreme hardiness of species in this particular subgenus.

Fig. 4. A group of *Amaryllis evansiae,* showing variations in flower shape. The shorter scapes of the plants in the foreground are due to cultural conditions. Photo by Ira S. Nelson.

AMARYLLIS EVANSIAE

HAMILTON P. TRAUB AND IRA S. NELSON

Amaryllis evansiae Traub et Nelson was first described in Baileya (4.: 85-88, figs. 30-31, 1956) ; and it was illustrated there and in Bulletin No. 1 (1956), LOUISIANA SOCIETY FOR HORTICULTURAL RESEARCH. The

species was collected by Ira S. Nelson under the sponsorship of that Society in Bolivia in 1954.

Amaryllis evansiae is very interesting since it is the first known in the genus to show marked variations within the species. In all the other 47 species, variation within the species is slight, even in *Amaryllis belladonna* L. which has a very wide range from Mexico, West Indies southward to Bolivia.

Such characters as leaf shape and length, bulb size and shape, and so on, are fairly uniform in *Amaryllis evansiae.* However, as shown in Fig. 4, the flower shape varies considerably. Although the stigma is usually capitate (obscurely 3-lobed), a distinctly 3-lobed stigma (with short rounded lobes) has been observed in a few individuals. The flower color varies considerably from very pale yellow, chartreuse (very light green) and pastel shades. All of this lends support to the hypothesis that this species is of relatively recent origin and not sufficient time has elapsed to allow for a stabilization of all of the characters.

It is hoped that nurserymen will soon list *Amaryllis evansiae* for sale in their catalogs. It can be rapidly multiplied from seeds. At least three forms should be selected for propagation—forma *flavescens* (very pale yellow); forma *virescens;* and forma *pastelescens* (pastel colored).

NEW AMARYLLIS SPECIES

HAMILTON P. TRAUB

In recent years, Dr. Lyman B. Smith, the noted authority on the BROMELIACEAE, of the U. S. NATIONAL HERBARIUM, made collecting trips to South America in collaboration with Dr. P. Paulino Reitz, Dr. R. Klein and Dr. Sulfridini, of the "HERBARIO BARBOSA RODRIQUES", Itajai, Santa Catarina, Brazil. Along with other specimens several known *Amaryllis* species, such as *A. breviflora, A. cybister,* and so on, were collected, and also one new species from Santa Catarina, Brasil. Specimens collected earlier by Dr. A. Macedo in Minas Gerais, and Dr. P. Dusén, in Parana, also represent new species.

These are described below and we hope that our Brasilian friends will send us living bulbs of these before too long.

AMARYLLIS MINASGERAIS

Specimens of this species were collected in the State of Minas Gerais in 1948 by Dr. A. Macedo. It belongs in the subgenus *Amaryllis* in which the throat of the tepaltube is not closed in by the paraperigone, and the stigma is capitate (only obscurely 3-lobed). It is allied to *Amaryllis belladonna* L. and its relatives, but differs from the former in having linear-lorate narrower leaves with a hyaline margin, only 1.5—2.3 cm. wide—less than an inch, and fully developed with the flowers, in the 4-flowered umbel, in the shorter spathe and pedicels, and in other particulars as shown by the following description. The species has been named in honor of its native habitat, the State of Minas Gerais.

Amaryllis minasgerais Traub, **sp. nov.**

Bulbus pyriformis, collo brevi; foliis lineri-loratis 1.5-2.3 cm. latis, margine hyalino; spathae valvis 2 lanceolatis 5.4-6.5 cm. longis; pedicellis 5—5.5 cm. longis; umbella 5-flora; perigonio miniaceo, fauce flavida; tubo tepalorum 3 cm. longo; segments tepalorum 7.5—8 cm. longis ellipticis 2.7—3.5 cm latis. staminibus quam stylo brevioribus; stylo quam segmentis tepalorum 1/5 brevioribus; stigmate capitato.

DESCRIPTION.—*Bulb* pear-shaped, 4.1 cm. long, 4 cm. in diam. below the middle, 2.3 cm. in diam. at the apex, neck 2 cm. long, 2 cm. in diam. *Leaves* produced with the flowers, linear-lorate, (cut to about 20 cm. on the type sheet, but apparently much longer), 1.5—2.3 cm. wide, (glaucous?), with hyaline margin. *Scape* 36 cm. tall. *Spathe-valves* 2, lanceolate, up to 5.5 cm. long, apex acutish or bluntish-roundish. *Pedicels* up to 5.5 cm. long. *Umbel* 4-flowered; flowers produced in the spring. *Ovary* 1.2 cm. long, 6 mm. diam. *Perigone* 10.5—11 cm. long, "vermilion, yellowish in the throat," according to the collector. *Paraperigone* consisting of a few short bristles. *Tepaltube* 3 cm. long. *Tepalsegs* 7.5—8 cm. long, elliptic, 2.7—3.5 cm. wide. *Stamens* shorter than the style; *style* 1/5 shorter than the tepalsegs; *stigma* capitate.

Holotype: No. 2-196-538 (US), A. Macedo (#1278), 10-15-48, Brasil, Santa Terezinha, Municipio Ituiutaba, State of Minas Gerais.

AMARYLLIS PARANAENSIS

In 1915, Dr. P. Dusén collected a specimen of an *Amaryllis* species in Parana which was erroneously referred to what is now known as *Phycella bicolor,* native to Chile, which has bright red flowers passing into yellowish-green towards the base. Dr. Dusén thus implies that the flowers of his collection in Parana has similar colored flowers, but this has to be checked against fresh flowers. Living bulbs from the type locality are therefore wanted in order to complete this detail of the description. The presence or absence of a paraperigone could not be determined from the dried specimen, and this detail also needs to be checked.

This new species has been named for its habitat in the State of Parana, *Amaryllis paranaensis.* It belongs in the subgenus *Amaryllis* in which the apex of the tepaltube is not closed in at the throat by the paraperigone, and the stigma is capitate. It is closest to *Amaryllis miniata* Rúiz et Pavon but differs in flowering in summer, in producing the leaves after the flowers, in having flowers more or less upright, not wide open, apparently red and yellowish-green, longer stamens reaching 1/3 below the style, and in other details as is shown by the following description.

Amaryllis paranaensis Traub, **sp. nov.**

Bulbi collum non valde productum; umbella 4-flora; scapo usque ad 39 cm. alto; spathe valvis 2 lanceolatis 2.2 cm. longis; pedicellis 2.5—3 cm. longis; perigonio plusminusve arrecto 7—8.5 cm. longo; tepalorum tubo 5 mm. longo; tepalorum segmentis oblanceolatis usque ad 6.5—8 cm. longis; staminibus longioribus quam segmentis tepalorum 1/3 brevioribus; stylo segmentis tepalorum paulo breviore vel subaequante; stigmate capitato.

DESCRIPTION.—*Bulb* up to 10 cm. long, about 6.5 cm. in diam. *Leaves* unknown, apparently produced after the flowers. *Scape* up to 39 cm. tall. *Spathe-valves* 2, up to 7 cm. long, 2.2 cm. wide below the middle, bracteoles very much smaller. *Umbel* 4-flowered. *Flowers* more or less upright, not wide open. *Pedicels* 2.5-3 cm. long. *Ovary* 8 mm. long, 5 mm. in diam. *Perigone* upright, 7—8.5 cm.

long. *Tepaltube* 5 mm. long. *Tepalsegs* oblanceolate, up to 6.5—8 cm. long, up to 1.8—2 cm. wide above the middle, apex acute. Longest *stamens* about 1/3 shorter than the tepalsegs. *Style* slightly shorter than, or subequaling the tepalsegs. *Stigma* capitate.

Holotype: US 1,481,899 (P. Dusén No. 16,749), Brasil: Parana, "Jaguariahyva, in campo prope marg. silvula," 2-26-15.

AMARYLLIS SANTACATARINA

Specimens of this new species were collected in 1956 by Dr. Lyman B. Smith and Dr. P. Paulino Reitz in the State of Santa Catarina. It belongs in the subgenus Lais, in which the tepaltube is not closed in at the throat by the perigone and the stigma is distinctly trifid. It is nearest to *Amaryllis flammigera* (Holmb.) T & U, from Misiones, Santa Ana, Argentina, with blood-red spathe-valves, and flowers bright red with purple veins. The new species differs from *A. flammigera* in having a longer bulb-neck, longer leaves, longer scape, no blood-red on the spathe, the umbel 6-flowered, longer pedicels, flowers scarlet with faint whitish star in throat, stamens shorter than the style. It differs also in other particulars as indicated in the following description. The presence or absence of the paraperigone could not be observed in the holotype, and this detail has to be checked when living material is received from Dr. Reitz. The species has been named in honor of the State of Santa Catarina.

Amaryllis santacatarina Traub, **sp. nov.**

Bulbi collum ca. 10 cm. longum; foliis sub anthesin non prorsus expositis, usque ad 41 cm. longis lorato-lanceolatis; scapo 54 cm. alto; spathae valvis 2 lanceolatis 5.7 cm. longis; umbella 6-flora; petiolis 2.5—4.5 cm. longis; florum majorum perigonio usque ad 7.3 cm. longo coccineo, fauce stella albida indistincta ornata; tubo tepalorum 7 mm. longo; florum majorum segmentis tepalorum usque ad 6.6 cm. longis; staminibus quam stylo brevioribus; stylo quam segmentis tepalorum breviore; stigmate trifido, lobis 2 mm. longis paulo recurvatis.

DESCRIPTION.—Lower part of *bulb* unknown. *Bulb-neck* about 10 cm. long. Leaves not fully developed at flowering time, up to 41 cm. long, lorate-lanceolate, up to 2 cm. wide in the dry condition, narrow acute-roundish. *Scape* 54 cm. tall above the bulb neck, narrowing gradually to the apex. *Spathe-valves* 2, lanceolate, 5.7 cm. long. *Umbel* 6-flowered, one flower smallish. *Pedicals* 2.5—4.5 cm. long. *Ovary* 11 mm. long, 4 mm. in diam. Flowers held horizontally to perhaps very slightly declined. *Perigone* of larger flowers up to 7.3 cm. long, scarlet, with faint whitish star in throat. *Tepaltube* 7 mm. long. *Tepalsegs* of larger flowers up to 6.6 cm. long, up to 1.8 cm. wide. *Stamens* shorter than the *style* which is shorter than the tepalsegs. *Stigma* trifid, lobes 2 mm. long, slightly recurved.

HOLOTYPE: L. B. Smith & Pe. R. Reitz No. 9101 (TRA), Santa Catarina, Brasil, Mun. Cacador; west of Cacador Taquara Verde (25 km), alt. 900-1000 m., burned over bog, Dec. 23, 1956.

CYTOLOGICAL INVESTIGATIONS IN **LYCORIS.** 2. CYTOLOGICAL SIMILARITIES BETWEEN **LYCORIS AUREA** AND **L. TRAUBII.**

SMRITIMOY BOSE, *The Blandy Experimental Farm, University of Virginia*

INTRODUCTION

Chromosome number and morphology in *L. aurea* have been studied by Inariyama as early as 1931. In his subsequent papers (1932; 1937 and 1953) he reported the existence of three different chromosome types in roottip and pollen mother cells of this species. Somatic numbers of 12, 13 and 14 were encountered. Bulbs of *L. aurea* having 2n numbers of 12 and 13 were found growing in Japan, while the type with 2n of 14 was collected only from Formosa. Plants having somatic chromosomes of 12 and 13 could not be distinguished from one another externally by their morphological characters. However the 14 chromosome type had larger bulbs and leaves compared with the former two types. So far as the chromosome morphology is concerned, there was a decrease in the number of V shaped chromosome with the increase in chromosome number. Plants having 12 chromosomes had 10 V's and 2 rods, while in 13 and 14 types 9 V's plus 4 rods and 8 V's with 6 rods were found respectively. This situation was also confirmed from meiotic studies.

Recently, Hayward (1957) described a new taxon, named *L. traubii,* which is very similar to *L. aurea* in its external morophology. Purpose of the present study was to make a cytological comparison of the chromosome number and morphology of the two morphologically similar types. Bulbs were generously furnished by Mr. Hayward and Dr. H. P. Traub.

MATERIALS AND METHODS

Table 1 lists the plant materials used in this investigation, together with their source and accession numbers.

Table 1

L. aurea and **L. traubii,** source and accession numbers.

Taxa	Source	Accession number
aurea	W. Hayward Orlando, Florida.	13103-55
traubii	W. Hayward Orlando, Florida.	13660-57
traubii	H. P. Traub La Jolla, California.	14068-57

Roottips were placed in a .2 per cent aqueous solution of colchicine prior to fixation. The rest of the procedure was the same as follows in the previous study (Bose, 1957). Prefixation in .2 per cent colchicine solution for 4 hours gave the best results.

A detailed analysis of the karyotypes was made and idiograms were drawn for the taxa studied here. A system has been arranged which

will standardize terminology for all types of chromosomes encountered in *Lycoris;* to have this most logical it has been necessary to give some different designations than those assigned for similar chromosomes in the previous paper (Bose, 1957).

Drawings were made with a camera lucida using a 1.25 N. A. apochromatic objective (x90) with a compensating eye piece (x15) giving a magnification at table level of x2500 approximately.

OBSERVATIONS

On the basis of the present study the chromosome complement can be classified into the following types:—Type A.—Chromosomes with median primary constrictions. Type B:—Chromosomes with submedian primary constrictions. Type D:—Chromosomes with nearly terminal primary constrictions and a dot like shorter arm. Type D1:—Same as type D but shorter in size.

The number of Chromosomes of each type occurring in the three taxa are listed in Table 2.

Table 2

Chromosome types in L. aurea and L. traubii.

Types	**L. aurea** 2n=12	**L. traubii** 2n=12	**L. traubii** 2n=13
A	6	6	5
B	4	4	4
D	2	2	2
D1			2

Karyotypes can be tabulated as follows:—*L. aurea* : 2n=12; 6 chromosomes of type A; 4 chromosomes of type B and 2 chromosomes of type D. *L. traubii* : 2n=12; 6 chromosomes of type A; 4 chromosomes of type B and 2 chromosomes of type D. *L. traubii* : 2n=13; 5 chromosomes of type A; 4 chromosomes of type B; 2 chromosomes of type D and 2 chromosomes of type D1.

Details of chromosome measurements and arm ratios are arranged in Table 3.

Table 3

L. aurea and **L. traubii** chromosomes: (1) average length in microns, and (2) chromosome arm ratios at mitotic metaphase following pretreatment with .2 per cent colchicine.

Chromosome type	**L. aurea (2n=12)** Length	Ratio **short arm** total lg.	**L. traubii (2n=12)** Length	Ratio **short arm** total lg.	**L. traubii (2n=13)** Length	Ratio **short arm** total lg.
A	23.2	.50	24.8	.50	24.8	.50
B	21.6	.47	22.8	.47	23.6	.46
D	11.8	.01	12.6	.01	12.6	.01
D1					10.2	.01

DISCUSSIONS

A comparison of the chromosome number and morphology of the 12 chromosome type *L. traubii* showed striking similarities with the 12 chromosome type of *L. aurea.* Even the length and chromosome arm ratios of V shaped chromosomes of the two were almost similar. The

same is also true for the rod-shaped chromosomes. It may be concluded from this that the 12 chromosome type of *L. traubii* imported from Japan to this country, is cytologically indistinguishable from the 12 chromosome type of *L. aurea,* also a native of Japan, so far as their somatic chromosome number and morphology is concerned. Hayward (1957) has separated these two taxa on the basis of leaf, flowering scape and flower character differences. The gross morphological differences by which these taxa are distinguished (Hayward, 1957) are apparently the result of genic changes. Traub (private communication) reports that

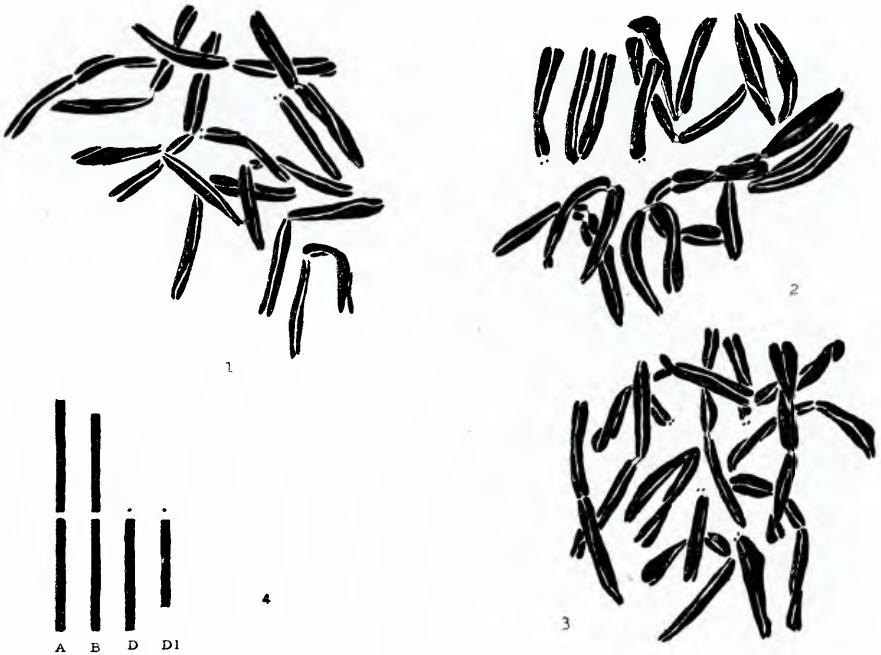


Fig. 5. Chromosomes of *Lycoris aurea* and *L. traubii.* Somatic metaphase polar views drawn at X2500, reduced to approximately X1150: 1. *Lycoris aurea,* 2n = 12. 5-2. *L. traubii,* 2n = 12. 3. *L. traubii,* 2n = 13. 4. Idiograms of each chromosome type found here: A (median centromere), B (submedian centromere), D (nearly terminal centromere), D1 (as D, but shorter).

hybrids between *Lycoris aurea* (seed parent) x *L. traubii* have been obtained, the seedlings show glaborous leaves dominant as in *L. traubii.*

Another clone of *L. traubii* studied here, had 13 somatic chromosomes. A similar number has also been reported in *L. aurea* by Inariyama (1932), who found 9 V's and 4 rods in this type. The 13 chromosome clone of *L. traubii* also has 9 V's and 4 rods. Since no bulbs of the *L. aurea* clone with 13 chromosomes were available a karyotype comparison could not be made in this case.

In *Lycoris,* out of fifteen species recognized so far (Traub, 1957), chromosome numbers have been determined for ten species. Number

and structural similarities have been noted with respect to the chromosomes of several species. For instance, *L. sprengeri, L. sanguinea, L. haywardii* and a variety of *L. radiata* all have 22 rod-shaped chromosomes, while both *L. squamigera* and *L. caldwellii* show 6 V's and 21 rod-shaped chromosomes. A critical cytotaxonomical comparison of these groups is highly desirable. A knowledge of meiotic chromosome behaviour and of the crossing abilities of species with the same chromosome numbers could aid in explaining their status and interrelationships.

The origin of V and rod-shaped chromosomes in three new species of *Lycoris* were discussed by the present author in a previous paper (Bose, 1957). The role of the centromere in the origin of chromosomes was emphasized at that time. Recent theories of Lima-de-Faria (1956), regarding the centromere structure and its possible role in chromosome organization has considerable suggested importance in explaining the origin and survival of telocentric chromosomes (Marks, 1957). In *Lycoris,* attempts should be made to get a clear picture of the centromere region of the V and rod-shaped chromosomes and also of the chromosomes with nearly terminal centromeres. In ordinary preparations of roottip chromosomes these regions appear as unstained gaps. Suitable stages of the chromosome cycle and use of the right prefixative and staining chemicals are of utmost importance in this connection. Attention has already been given by the present author to this end.

Variation in shape and bimodality of the chromosome in *Lycoris* and other plants has been explained by Darlington (1956) to be caused by the misdivision of the centromere and by the origin of so-called isochromosomes. We can, at present, take these to be important factors in the origin of *Lycoris* species, with differing chromosome morphology, under natural conditions. A project has been initiated which will attempt to secure experimental evidence bearing on these points. Bulbs of three different species of *Lycoris* have already been subjected to gamma rays from a Cobalt-60 source. A detailed study of resulting chromosome breaks, and reunions, with special attention to V and rod-shaped chromosomes and their centromere regions should shed light on this problem.

SUMMARY

In *Lycoris traubii* clones with 12 and 13 somatic chromosome types have been found. The type with 12 chromosomes is identical with the 12 chromosome type of *L. aurea* with respect to somatic chromosome number and morphology.

ACKNOWLEDGEMENTS

The author wishes to express his indebtedness to Dr. W. S. Flory, Jr., for his guidance and criticism during the course of this investigation.

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CYTOLOGICAL INVESTIGATIONS IN **LYCORIS.**

3. CHROMOSOME NUMBER AND KARYOTYPE ANALYSIS IN **LYCORIS INCARNATA.**

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INTRODUCTION

Lycoris is a very interesting genus from both the cytological and the taxonomic standpoints. With the four new species recently described by Traub (1957) and Hayward (1957), the total number of *Lycoris* species presently listed is fifteen. Ten of these have been the subject of previous cytological studies (Inariyama, 1931, 1932, 1937, 1953; Sato, 1938; Mookerjea, 1955 and Bose, 1957). This present report, coupled with one prepared concurrently on *L. traubii* (Bose, 1958a), brings to twelve the number of species of this genus for which chromosome records are available. Table 4 records the chromosome numbers and morphological data reported by different authors.

There are uncertainties as to the origin and as to the interrelationships of the several species. The chromosome complements of these, with their differences in both number and morphology offer one good source of evidence. For this reason data from previous works have been assembled and chromosome number determinations and karyotype analyses are being made for all the available species of *Lycoris*. This study should also have a bearing on points of taxonomic uncertainty.

Lycoris incarnata has not been the subject of previous cytological studies. The present paper reports the results of a study of the somatic chromosomes of this taxon. Bulbs of this species were generously furnished by Mr. W. Hayward.

Cytological methods employed were the same as followed in previous work of this series (Bose, 1958a).

Table 1 lists the plant materials used in this investigation, together with their source and accession numbers.

Table 1.

Lycoris incarnata and **Lycoris** sp. source and accession number.

Incarnata Taxa	Orlands, Florida. Source	Accession Accession number
incarnata	W. Hayward Orlando, Florida	13106-55 12041-50
L. sp.	W. Hayward Orlando, Florida	

OBSERVATIONS

The following types of chromosomes are found in the complement of *L. incarnata.* Type A:—Chromosomes with median primary constrictions. Type B:—Chromosomes with submedian primary constrictions. Type C:—Chromosomes with subterminal primary constrictions. Type C1:—Same as type B but shorter in size. Type D:—Chromosomes with nearly terminal centromere and a dot like shorter arm. Type D1:—Same as type D but shorter in size. B-chromosome:—A very short chromosome with nearly subterminal primary constriction. (Fig. 6).

The number of chromosomes of each type occurring in *L. incarnata* are listed in Table 2.

Table 2.

Chromosome types in **L. incarnata.**

Types	L. incarnata
A	2
B	2
*C	17
*C1	4
D	2
D1	2
B-chromosome	1

* Same as types B and B1 respectively, used in the previous study (Bose, 1957).

Karyotypes can be tabulated as follows:—*Lycoris incarnata:* 2n=29 plus 1 B-chromosome; 2 chromosomes of type A; 2 chromosomes of type B; 17 chromosomes of type C; 4 chromosomes of type C1; 2 chromosomes of type D; 2 chromosomes of type D1 plus one B-chromosome.

Details of chromosome measurements and arm ratios are arranged in Table 3.

Table 3.

Lycoris incarnata chromosomes: (1) average length in microns and (2) chromosome arm ratios at mitotic metaphase following pretreatment with .2 per cent colchicine.

Chromosome type	**L. incarnata** Length	Ratio **Short arm** total lg.
A	23.12	.50
B	20.8	.44
C	10.8	.14
C1	8.8	.18
D	11.8	.01
D1	8.6	.02
B-chromosome	2.6	.28

In 1950, sometime before our other material of *Lycoris incarnata* was received, a single bulb labelled as *L. incarnata* was secured. This bulb has never flowered. A count of its somatic chromosomes shows this *Lycoris* sp. to have a 2n number of 18, with the chromosome morphology quite different from other species of *Lycoris* studied. It seems doubtful if this is a separate clone of *L. incarnata* and for the present this is merely being listed as *Lycoris* sp.

The chromosomes for *L. incarnata* and *Lycoris* sp. may be found in Fig. 6.

Fig. 6. Chromosomes of *Lycoris incarnata* and unidentified *L.* sp. Somatic metaphase polar views drawn at X2500, reduced to approximately X1150: 1. *Lycoris incarnata,* 2n = 29 plus 1B. 2. *Lycoris sp.* unidentified, 2n = 18. 3. Idiogram of each of the chromosome types in *L. incarnata,* A, B, C, C1, D, D1 and B-chromosome.

DISCUSSION

The karyotype analysis shows that the chromosomes can be broadly divided into V and rod-shaped elements, similar to those found in previously studied species of *Lycoris.* In *L. incarnata* however the V chromosomes can be distinguished quite readily as medianly or submedianly constricted ones. One very interesting chromosome type was found here. This is a very small chromosome compared with all other types. This type of chromosome has been called various names, e.g. B-chromosome, supernumerary chromosome, accessory chromosome etc., by different workers (Randolph, 1928; 1941, Muntzing, 1945; 1949;

1954 and Ostergren, 1947). In *Amaryllidaceae,* they have been observed in *Cooperia, Narcissus, Haemanthus,* and *Crinum* (Darlington and Wylie, 1955). This is the first time, so far as known, that a B-chromosome has been reported in any species of *Lycoris.* A glance at Table 4 will show that this type of chromosome is quite unusual in *Lycoris.* The usual karyotype consists of V and rod-shaped elements.

Nothing definite can be said now regarding the origin of the B-chromosome observed here. Darlington's (1956; Table I) recent review of the origin of B-chromosomes in different plants suggests that these are generally derived from A or normal chromosomes. Irregular meiosis in plants with rings and fragmentation is believed to play a part in their origin. More recently Swanson (1957) has discussed the studies on supernumerary or B-chromosomes by various workers. The cytological characteristics and behavior of the B-chromosome in *L. incarnata* will be studied through the entire cell cycle with particular reference to its origin, behaviour and heterochromatic or euchromatic nature.

Table 4

Chromosome number and morphology reported in **Lycoris** species.

species	2n	Chromosome morphology	Author
albiflora	17	5V 12R	Inariyama, 1953.
aurea	12	10V 2R	Inariyama, 1953, Bose, 1958a.
	13	9V 4R	Inariyama, 1953.
	14	8V 6R	Inariyama, 1953.
caldwellii	27	6V 21R	Bose, 1957.
haywardii	22	22R	Bose, 1957.
houdyshelii	30	3V 27R	Bose, 1957.
incarnata	29 1B	4V 25R 1B	Bose, 1958b.
radiata var. pumila	22	22R	Inariyama, 1953.
radiata	33	33R	Inariyama, 1953, Mookerjea, 1955,
sanguinea	22	22R	Inariyama, 1953.
sprengeri	22	22R	Inariyama, 1953.
squamigera	27	6V 21R	Inariyama, 1953, Sato, 1938.
straminea	16	6V 10R	Inariyama, 1953.
traubii	12	10V 2R	Bose, 1958a.
	13	9V 4R	Bose, 1958a.
species	18		Bose, 1958b.

The problem of origin of different chromosome numbers with different chromosome morphology in *Lycoris* has already been discussed by the present author (Bose, 1957; 1958a), to some extent. A glance at Table 4 shows that in *Lycoris,* species with different chromosome numbers are found. In some species they are very likely the results of chromosome doubling and polyploidy (probably both euploidy and aneuploidy being involved). In others hybridization may have played a part. Somatic numbers such as 13, 14, 16, 17, 27 and 29 plus 1 B-chromosome could evolve through hybridization or in some cases simply through alteration of chromosome morphology. As regards the chromosome morphology of different species such phenomena as polyploidy, translocations and hybridization can be taken into account. In taxa with 22 and 33 rod-shaped chromosomes, as in *L. radiata,* we see the result of adding a full haploid complement to a diploid set. On the other hand species whose chromosome complements are composed of

5 V's and 12 rods, 6 V's and 10 rods or 6 V's and 21 rods, may be assumed to have originated through hybridization between different species of *Lycoris* (Inariyama, 1937; 1953). Species with 4 V's and 25 rods plus 1 B-chromosome or 3 V's and 27 rods may also be assumed to have originated through hybridization and structural alteration of chromosomes.

SUMMARY

Chromosome number in *Lycoris incarnata* is found to be 2n=29 plus 1 B. The B-chromosome is reported for the first time in any species of *Lycoris*.

ACKNOWLEDGEMENTS

The author wishes to express his indebtedness to Dr. W. S. Flory, Jr. for his guidance and criticism during the course of this investigation.

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TWO NEW LYCORIS SPECIES

HAMILTON P. TRAUB

In 1957 HERBERTIA, the FIRST LYCORIS EDITION, an attempt was made to present as much information as possible about these beautiful plants in order to stimulate an interest in their wider culture in the United States. The key presented in the 1957 issue showed that 15 Lycoris species had been described, and in the same issue Mr. Caldwell illustrated another unnamed species under culture. This species and still another new species are named and described in the present paper.

KEY TO REVISED SUBGENUS 2. LYCORIS

Subgenus 1. Symmanthus is not affected by the new additions and thus it will be necessary to present only a revised key to Subgenus 2. Lycoris which is given in Table 1. This shows important differences between the two new species—*Lycoris elsiae* and *L. chinensis*—and the species previously described.

TABLE 1. KEY TO SUBGENUS 2. LYCORIS OF GENUS LYCORIS

1b. Perigone distinctly irregular; leaves with lighter stripe or band in center (except in *L. caldwellii;* see 11b, below):

SUBGENUS 2. **LYCORIS**

8a. Flowers not chrome yellow, saffron yellow or cadmium orange color; widest leaves up to 1.5 cm. wide:
9a. Flowers red or clear pink; tepaltube up to 5 mm. long:
10a. Flowers red; leaves 6—9 mm. wide; tepaltube up to 5 mm. long, 2n=22 (China & Japan) ..... 8. *radiata*
10b. Flowers clear pink; leaves much wider (China) ..... 9. *rosea*
9b. Flowers not red or clear pink; tepaltube 4—23 mm. long:
11a. Stamens and style much exserted from perigone; tepaltube 4—17.5 mm. long:
12a. Tepaltube 4—6 mm. long; leaves medium green: Tepalsegs 3.5—4.1 cm. long, 5.2—12 mm. wide; flowers straw-colored, sometimes flecked reddish; chromosomes 2n=16 (China) ..... 10. *straminea*
12b. Tepaltube 8.5—13 mm. long; leaves medium or dark green:
13a. Umbel tightly packed; leaves medium green; tepalsegs quite variable in size and shape, 3.3—4.4 cm. long, 6—12 mm. wide; flowers creamy colored with pinkish band in center; chromosomes 2n=17 (Japan) ..... 11. *albiflora*
13b. Umbel loosely arranged; leaves medium or dark green; tepalsegs 4—5.1 cm. long, 7—13 mm. wide; flowers cream-white, slightly deeper colored in center, to salmony pastel:
14a. Flowers cream-white, slightly deeper colored in center; tepaltube 8.5 mm. long; chromosomes 2n=30 (China) ..... 12. *houdyshelii*
14b. Flowers salmony pastel; tepaltube 12—13 mm. long (Japan) ..... 13. *elsiae*
11b. Stamens shorter than, and style subequaling, the perigone; leaves produced in February, without whitish stripe in center and dark green; tepaltube 20—23 mm. long; flowers peach colored in bud, opening to pale yellow,

changing to creamy-white with age; tepalsegs 7.2 cm. long, 2n=27 (China) ..... 14. *caldwellii*

8b. Flowers chrome yellow, saffron yellow or cadmium orange:

15a. Flowers chrome yellow; leaves produced in early spring: Leaves glabrous; tepaltube 17.5 mm. long (China) ..... 15. *chinensis*

15b. Flowers saffron yellow or cadium orange; leaves produced in fall and winter; tepaltube 12—19 mm. long:

16a. Leaves glabrous; flowers saffron yellow; spathe-valves ovate; tepaltube 19 mm. long; tepalsegs narrowly-oblanceolate, 12—15 mm. wide; chromosomes 2=12 (China) ..... 16. *traubii*

16b. Leaves glaucous; flowers cadmium orange; spathe-valves lanceolate; tepaltube 12 mm. long; tepalsegs narrowly-elliptic, 10—11 mm. wide; chromosomes 2n=12 (China, Upper Burma) ..... 17. *aurea*

LYCORIS ELSIAE, SP. NOV.

The reader should turn to Fig. 18 of 1957 HERBERTIA for the illustration of this new species. Through the kindness of Mr. Sam Caldwell, who grew the plants, and Dr. Elsie Quarterman, Director of the Herbarium of Vanderbilt University, Nashville, Tenn., who preserved the specimens, it has been possible to describe the new species—*Lycoris elsiae*—which was named in honor of Dr. Quarterman who has assisted in preserving these and other specimens of *Lycoris* cultivated in the United States.

The closest relative is *L. houdyshelii*. *L. elsiae* blooms in late Aug. —early Sept., has a tepaltube 12—13 mm. long and salmony pastel flowers whereas *L. houdyshelii* blooms in late July-early Aug., has a tepaltube 8.5 mm. long, and cream-white flowers. There are still other differences as shown by the descriptions of these two species. Since they differ on the specific level in important characters and are reproductively separated by having different blooming dates, *L. elsiae* has to be recognized as a distinct species.

Lycoris elsiae Traub, **sp. nov.**

Foliis atroviridibus glaucis, subtus pallido-viridibus linearibus 1.2—1.3 cm. latis, ad basin usque ad 8—9 mm. angustatis, ad apicem rotundatis; floribus tarde Augusto usque at Septembro productis; umbella 6- vel 7-flora; perigonio subsalmonicolore, segmentis tepalorum oblanceolatis usque ad 7 mm. latis intensiore mediopictis; tubo-tepalorum 1.2—1.3 cm. longo; staminibus styloque e perigonio exsertis.

DESCRIPTION.—Bulbs and leaves somewhat larger than in *L. radiata*. *Leaves* linear, dark green with bluish cast, under side lighter green, 32 to 36.5 cm. long, 1.2 to 1.3 cm. wide, narrowing to 8—9 mm. wide at the base, apex roundish. *Scape* produced in late August to early September, 45 cm. tall. *Spathe-valves* 2, lanceolate, up to 3 cm. long. *Umbel* 6—7-flowered. *Pedicels* 7—9 mm. long. *Perigone* larger than most of *L. radiata* blooms, soft salmony in color, "with the deepest pinkish shading in a band along the center of each tepalseg; cream and yellow tints blend with the pink, and the perigone finally fades to a flesh color with ageing." *Ovary* up to 7 mm. long, 5 mm. in diam. *Tepaltube* 1.2 to 1.3 cm. long. *Tepalsegs* oblanceolate, 4 cm. long, up to 7 mm. wide. *Stamens* exserted from the perigone. *Style* longer than the stamens. *Stigma* minute.

Holotype: No. 593 (TRA), Caldwell, Aug. 31, 1957, Nashville, Tenn. (Cult.); No. 594 (TRA), isotype.

NOTES.—This species is somewhat tender even in Tennessee and should be adapted to the lower South.

LYCORIS CHINENSIS, SP. NOV.

In 1957 HERBERTIA, under *Lycoris traubii* (see top page 42), Mr. Hayward included the plant grown at the U. S. Plant Introduction Garden (P. I. 162-443) which originally came from the Sun Yat Sen Memorial Garden, Nanking, China, in 1948. It has been recently illustrated on page 370, Nat. Hort. Mag. 1957. Through the kindness of Dr. J. L. Creech, of the U. S. Plant Introduction Garden, Glenn Dale, Maryland, bulbs of this plant were obtained in the early summer of 1957, and these bloomed in the latter part of July. These showed that this plant is distinct from *L. traubii* and *L. aurea,* and it has been named for its habitat—*Lycoris chinensis.*

L. chinensis produces its glabrous foliage in early spring, blooms in July, has a tepaltube 17.5 mm. long, short ovate spathe-valves, tepalsegs narrow and all assurgent. Both *L. aurea* and *L. traubii* produce their foliage in fall and winter, and bloom in Sept.-Oct., and thus *L. Chinensis* is reproductively isolated from the former and entitled to rank as a distinct species. There are still other important character differences as shown by the descriptions and the key.

It is important to note that *L. chinensis* is the first yellow-flowered lycoris described that is hardy as far north as Maryland. Only future tests will disclose the full northern range of this species.

Lycoris chinensis Traub, **sp. nov.**

Foliis verno productis; floribus tarde Julio usque ad Augusto productis; umbella 4- vel 5-flora; perigonio flavo ("chrome yellow 605/2 RHS"); segmentis tepalorum assurgentibus; staminibus styloque declinato-adscendentibus multo exserts; paraperigonio flavo, margine brevissimo dentibis 6 minutis munito; segmentis tepalorum oblanceolatis 5.8 cm. longis, 5.8—11 mm. supra mediam latis, superne valde reflexis, marginibus corrugatis.

DESCRIPTION.—*Bulbs* globose, with short neck. *Leaves* glabrous produced in early spring. *Scape* produced in late July-August, 21 cm. tall, somewhat flattened. 7 x 8.5 mm diam. at the base, 4 x 5 mm diam. at the apex, light green. *Spathe-valves* 2, ovate, 2—2.5 cm. long, apex blunt; bracteoles very much smaller, up to 7 mm. long. *Umbel* 4—5-flowered. *Pedicels* 1.1—2.4 cm. long. *Ovary* 4.5 mm long, 4.5 mm. diam. *Perigone* chrome yellow (605/2 RHS). *Tepalsegs* assurgent, *stamens* and *style* declinate-ascending, extremely exserted. *Tepaltube* 1.75 cm. long, 3 mm diam. at the base, 8 mm diam. at the apex. *Paraperigone* yellow, a very short rim with six minute teeth. *Tepalsegs* oblanceolate, ruffled on the margins and reflexed markedly in the upper part. *Setsegs* 5.8 cm. long, 8 mm. wide above the middle, apex acute. *Petsegs* 5.8 cm. long, 11 mm wide above the middle, apex roundish. *Style* overtopping the stamens, stigma minute.

HOLOTYPE: No. 585 (TRA), 7-25-57, La Jolla, Calif. (cult.), grown from a bulb (P. I. 162443) kindly furnished by Dr. J. L. Creech, of the U. S. Plant Introduction Garden, Glenn Dale, Md. The bulbs of P. I. 162443 were originally obtained from Sun Yat Sen Memorial Garden in Nanking, China, in 1948.

NOTES.—This plant is very important for the lycoris breeder since it will contribute a more frost resistant constitution along with yellow flowers.

LYCORIS ELSIAE

SAM CALDWELL, *Tennessee*

In 1957 HERBERTIA, Fig. 18 of an un-named *Lycoris* species was pictured. Since that date, the species has been named *Lycoris elsiae* Traub, in honor of Dr. Elsie Quarterman, Director of the HERBERIUM OF VANDERBILT UNIVERSITY, Nashville, Tenn., who has assisted materially in preserving authentic dried specimens of the *Lycoris* species in cultivation in the United States.

The quest for a truly white lycoris has led me over the years to acquire numerous samples of bulbs described by dealers as having white or lightly tinted flowers. Enough of these trial plantings have not bloomed to justify one interesting conclusion. Though the bulbs came under six different names and from as many different sources, most of them have turned out to be apparently the same thing—a most beautiful lycoris with the general flower form of *L. radiata* but a coloring that is a delicate blend of pink, salmon and yellow tints. During the early 1950's this lycoris was in fairly good supply—from Japanese sources, I believe—among the bulb dealers in this country.

I have wondered what to call it, because the flowers don't fit well under the description of any species or variety recognized by Traub & Moldenke in "AMARYLLIDACEAE: TRIBE AMARYLLEAE" (1949), or in Dr. Traub's new key to the species of *Lycoris* in 1957 HERBERTIA. I am pleased that it has now been appropriately named, *Lycoris elsiae.*

Lycoris elsiae has very much the same growth habits as *L. radiata.* For me it usually flowers around the first of September. Leaves come up as the flowers fade away, and the green leaf clumps persist until spring, just as in the case of *radiata.* Leaves on my bulbs of *Lycoris elsiae* run generally a little larger than on *radiata* bulbs, especially on those planted in pots and kept in the cold greenhouse.

Unfortunately, the leaves are definitely more susceptible to cold damage than those of *L. radiata.* I can hardly rate this as a "hardy" lycoris in the middle Tennessee area, since our near zero winter temperatures "burn" the blade tips and sometimes shrivel and whiten the leaves for half their length. This, of course, results in few flowers the next fall. I have more than 25 well established mature bulbs planted outdoors and yet feel fortunate when as many as three or four of the beautiful blooms show up in September. Thus far the pot grown bulbs have been erratic in bloom production. They make profuse foliage clumps in the cold greenhouse and some years give a scape or two, but are not reliable in flowering.

During the 1955-1956 winter I inverted an old aquarium and two large glass jars over outdoor clumps of *Lycoris elsiae*, hoping that the improvised cloches might protect their leaves. The foliage did come through the winter in rather better condition than unprotected leaves nearby; also, two of the three protected clumps produced blooms in September, 1956, while no other bulbs of *Lycoris elsiae* flowered for me. However, it will take several more years of testing to determine just

how helpful the glass covers are.

The early September scapes push up to 18 or 19 inches high—a little taller than most of my *L. radiata* blooms—and the flowers of *Lycoris elsiae* are noticeably larger than those of *radiata.* Mine have had six or seven flowers to the umbel, the entire umbel with pistils and stamens radiating outward measures six to seven and a half inches across. Fig. 18 in 1957 HERBERTIA gives a clear representation of the flower form.

The coloring is what our garden club ladies will call "lovely"—illusive soft tints of salmon, with the deepest pinkish shading in a band along the center of each segment. Cream and yellow tints blend with the pink, and the flowers gradually fade to a flesh color as they age.

This lycoris should be particularly popular in the middle and lower South and other areas with similar mild climates.

It is of some interest to note the different names under which I have received my bulbs: (1) "L. radiata albo," from Rex Pearce, Moorestown, N. J., November, 1950; (2) "L. radiata carnea," also from Pearce, November, 1951; (3) "L. alba," from Wyndham Hayward, Winter Park, Fla., who had secured them as Japanese imports from the San Francisco Nurserymen's Exchange, November, 1951; and (4) "L. albiflora carnea," from Cecil Houdyshel, La Verne, Calif., September, 1952. These have all bloomed one or more times, but not all together. However, to the best of my ability to observe, they are identical. It is possible that there may be minor variations in the intensity of color among various individuals, but not more than would be accounted for by variations in light and temperature conditions at flowering time. In general, the color has been strongest when cool, cloudy weather prevailed as the buds opened.

I should add that not *all* of my "white" or pale lycoris have conformed to the type of *Lycoris elsiae.* One received from Mr. Houdyshel in August, 1950, as *L. albiflora,* bloomed that same year in September—a little 12" scape with six "off white" or ivory colored flowers in an umbel similar to the *L. radiata* blooms, but smaller than *radiata.* This was USDA stock, according to Mr. Houdyshel, and I presume it is the true *L. albiflora.* My bulbs never bloomed again—they have deteriorated badly, although a few persist and send up a few puny leaves each fall.

Another bulb, labeled "L. radiata alba," came from Bob Anderson, of Los Angeles, in July, 1948. It had a small flower in September of that year—about the size and shape of L. radiata blooms—but tinted apricot, much like the coloring of *Lycoris elsiae.* It, too, has multiplied sparingly and several small bulbs remain, though they have never become strong enough to bloom again. Undoubtedly this lycoris and the one mentioned just previously will flower in a milder climate; my failure with them seems due to our cold winters.

Two other lots of bulbs are still to flower. One group, received from Growers Exchange, Farmington, Michigan, in October, 1952, as "L. alba" from Japan, has grown outdoors since then, and from the appearance of the foliage I am expecting it to be *Lycoris elsiae.* The other lot came in July, 1955, from Noel Morey, then of Aptos, Calif.

With the bulbs Mr. Morey wrote, "I was very fortunate to get these *L. albiflora* bulbs in the fall of 1954 from Mr. O. E. Orpet. They evidently are fertile, as Mr. Orpet says he grew them from seed, and they are probably not in commerce." These have not bloomed for me but they have made good foliage.

Incidentally, I have never been able to set seed on *Lycoris elsiae* or any of the others discussed above, in spite of numerous attempts, both selfing and cross-pollinating the blooms. I feel that there are many uncertainties in the stocks of white and near-white lycoris, and it will be years before we can get the taxonomy of these straightened out. Meanwhile, it's an intriguing hobby to keep working with them.

CROSSES INVOLVING RHODOPHIALA, HABRANTHUS AND ZEPHYRANTHES

HAMILTON P. TRAUB

A first report on these crosses appeared several years ago (Traub, 1952). Since that date the progenies have been grown outdoors in California so that ample herbarium material has been accumulated and the plants have been studied in detail from living specimens. The purpose of the present paper is to describe and name these hybrids.

(1) RHODOPHIALA HYBRIDS

Several years ago, *Rhodophiala bifida,* vars. *bifida* (red), and *spathacea* (lavender pink), both from Argentina, were crossed with *R. chilensis* (pale yellow), from Chile, and abundant offspring were obtained. This was not unexpected since Ficker (1951) had shown that the chromosome numbers of these two species are the same, 2n=18.

These first generation seedlings have now been tested outdoors in California and have proved to be fertile. The summer-flowering habit of *R. chilensis* is dominant over the autumn-flowering character of *R. bifida,* but the red or pink flower color of the latter is dominant over the pale yellow color of the former.

The second generation seedlings obtained by selfing the first generation hybrids are thriving and soon should reach the flowering stage when an additional report will be made on the segregation of characters in the individual offspring.

The hybrid has been named *Rhodophiala* x *lajolla* for the location where the progeny have been extensively tested.

Rhodophiala × **lajolla** Traub, **hybr. nov.**

Planta inter *R. bifida* et *R. chilensis* hybrida; foliis linearibus usque ad 71 cm. longis, 7 mm. latis, ad apicem subrotundatis; spathe bivalvata vel tantum unilateraliter usque ad basin fissa; umbella 4—7-flora, raro 2-flora; pedicellis 3.7—5.5 cm. longis; perigonio rubello vel rubro; tubo tepalorum 4 mm. longo; segmentis tepalorum lanceolatis 5.1 cm. longis, 7—11 mm. latis; staminibus usque ad 4 longitudines perventis, quam segmentis tepalorum ca. dimidio brevioribus; stylo quam segmentis tepalorum ¼ breviore; stigmate trifido.

DESCRIPTION.—*Leaves* 5—8, linear, concave on upper side, up to 71 cm. long, 7 mm. wide, apex roundish. *Scape* 18.5 cm. tall. *Spathe* 2-valved, or split to the base

on one side only, lanceolate, 6—7.2 cm. long. *Umbel* 4—7, rarely 2-flowered. *Pedicels* 3.7—5.5 cm. long. *Perigone* red colored. *Ovary* 5—6 mm. long, 4—5 mm. in diam. *Tepaltube* 4 mm. long. *Tepalsegs* lanceolate, 5.1 cm. long, 7—11 mm. wide, apexes of setsegs acute, petsegs roundish. *Stamens* of four different lengths, slightly more than half as long as, and *style* about ¾ as long as, the tepalsegs. *Stigma* trifid.

Holotype: No. 605 (TRA), cult. 7-20-57, La Jolla, Calif., Hamilton P. Traub: PARATYPES: Nos. 299, & 607, cult. La Jolla, Calif. 1955 & 1957.

(II) RHODOPHIALA—HABRANTHUS HYBRIDS

Next crosses between *Rhodophiala bifida* vars. *bifida* and *spathacea*, (x=9; 2n=18) and *Habranthus juncifolius* (x=7; 2n=14), from Argentina, were made (Traub, 1952). The progeny obtained have been tested outdoors in California and have proved to be sterile. These data support the hypothesis that the two distinct genera, *Rhodophiala* and *Habranthus*, belong in the same tribe (ZEPHYRANTHEAE).

This bi-generic hybrid has been named X *Rhodobranthus woelfleana*. The generic name is derived from parts of the names of the parent genera, and the specific name honors Len Woelfle, who is much interested in the introduction and culture of *Rhodophiala* and *Habranthus* species.

X Rhodobranthus Traub, **hybr. gen. nov.** (Amaryllidaceae)
X Rhodobranthus woelfleana Traub, **hybr. nov.** (generic holotype)

DESCRIPTO GENERICO-SPECIFICA:—Planta inter *Rhodophiala* et *Habranthus* hybrida; foliis linearibus paulo complanatis fistulosis usque ad 64 cm. longis; spatha inferne connata, superne bifida vel fenestrata, vel tantum unilateraliter usque ad basin fissa; umbella 2—6-flora; pedicellis 5.5—9 cm. longis; perigonio pallido-lavandulaceo vel roseo vel rubro; tubo tepalorum 4 mm. longo; paraperigonio a fimbriis brevissimis constato; segmentis tepalorum lanceolatis 4.2—6.6 cm. longis, 1—1.3 cm. latis; staminibus declinato-adscendentibus usque ad 4 longitudines perventis, quam segmentis tepalorum plus dimidio brevioribus; stylo quam segmentis tepalorum ¼ usque ad dimidio brevioribus.

COMBINED GENERIC AND SPECIFIC DESCRIPTION.—*Leaves* 2—3, linear, somewhat flattened, hollow, furrowed on the upper side, up to 64 cm. long, 3—5 mm. wide, apex acutish or roundish. *Scape* 15—25 cm. tall. *Spathe* united below, upper part bifid or fenstrated; or split to the base on one side only, apex undivided; apex acute, 6—7.5 cm. long. *Umbel* 2—6-flowered. *Pedicels* 5.5—9 cm., rarely 2.5 cm. long. *Perigone* light lavender, Tyrian rose, to red. *Ovary* 7—8 mm. long, 3—5 mm. in diam. *Tepaltube* 4 mm. long, 4 mm. diam. at the base, 5 mm. diam. at the apex. *Paraperigone* of very short fimbriae at the base of the tepalsegs. *Tepalsegs* lanceolate, 4.2—6.6 cm. long, 1—1.3 cm. wide. *Stamens* declinate-ascending, of four different lengths, less than half to about half the length of the tepalsegs. *Style* half to ¾ as long as the tepalsegs. *Stigma* trifid.

HOLOTYPE: No. 602 (TRA), 9-11-57, cult. La Jolla, Calif., Hamilton P. Traub. PARATYPES: Nos. 369, 370 and 371, cult. Beltville, Md. 1950 & 1951; Nos. 600, 601, 603, and 604, cult. La Jolla, Calif. 1957.

(III) HABRANTHUS—ZEPHYRANTHES HYBRIDS

Attempts to cross *Rhodophiala bifida* with *Zephyranthes grandiflora* (x=6; 2n=48; see Flory 1944), from Mexico (?), failed. But crosses between *Habranthus juncifolius* and *Zephyranthes grandiflora* were successful (Traub 1952). The progeny were tested outdoors in California and proved to be sterile.

Thus the chain, *Rhodophiala* x *Habranthus,* and *Habranthus* x *Zephyranthes* is completed, and this data lends support to the hypothesis that the three genera involved are closely related and belong together in the tribe ZEPHYRANTHEAE.

It is now in order to consider previously reported crosses of *Habranthus* and *Zephyranthes.*

(A) PIONEER WORK OF PERCY-LANCASTER

Working in India, Percy-Lancaster (1912-1913) carried further the experiments of his father, and he reported on a number of hybrids including (1) hybrids within the genus *Zephyranthes* (including *Cooperia),* which latter have to be placed under *Zephyranthes* as hybrids, and (2) hybrids between *Zephyranthes* and *Habranthus* species, which have to be included under a new name.

All of these were included by Percy-Lancaster under the name X *Cooperanthes,* and no holotype was indicated. The name indicates that he based it on *Zephyranthes* and *Cooperia* and thus the lectotype has to be selected from the hybrids under (1) above. Traub (1954) separated these two classes of hybrids.

Hybrid **Zephyranthes**

For purposes of nomenclature, a part of the taxon, X *Cooperanthes* (Percy-Lancaster, 1912-1913) is typified by X *Cooperanthes blanda* Percy-Lancaster (Jour. Roy. Hort. Soc. 38: 531. 1912-1913), as the lectotype, and includes that portion of the taxon produced by crossing species within the genus *Zephyranthes* (including *Cooperia),* since *Cooperia* cannot be separated from that genus on biological grounds. Thus all of these and similar hybrids are placed under *Zephyranthes,* and the name X *Cooperanthes* Percy-Lancaster *ex parte* becomes a synonym of *Zephyranthes.*

X Sydneya Traub; **Zephyranthes—Habranthus** hybrids

This leaves that portion of X *Cooperanthes* Percy-Lancaster that covers the hybrids between *Zephyranthes* and *Habranthus* without a name. Traub (1954) proposed the new name, X *Sydneya* (in honor of Mr. Sydney Percy-Lancaster) to cover this part of the taxon. The holotype was indicated as X *Sydneya lancastrae* Traub (Plant Life 10: 47. 1954), syn.—X *Cooperanthes lancastrae* Percy-Lancaster, in Jour. Roy. Hort. Soc. 38: 531. 1912-1913 [*Zephyranthes brazosensis* Traub x *Habranthus robustus* Lodd. ex Herb. (err. *H. tubispathus* (L'Hérit.) Traub), Plant Life 10: 47. 1954].

X Sydneya Traub, Hybr. **gen. nov.** (Amaryllidaceae)
X Sydneya lancastrae (Lancaster) Traub (generic holotype)
(Plant Life 10: 47. 1954.)

Descripto generico-specifica:—Plantae inter *Zephyranthes* et *Habranthus* hybridae, signis parentes intermediis praeter perigonio non zygomorphe et staminibus usque ad 2 longitudines perventis.

(B) X SYDNEYA CASTELLANOSII

The inter-generic hybrid, *Habranthus juncifolius* x *Zephyranthes grandiflora,* referred to at the beginning of Section III, belongs under X *Sydneya.* The hybrid has been named in honor of Dr. Castellanos of Buenos Aires, Argentina, who sent the bulbs of *Habranthus juncifolius* which were used in the breeding experiments.

X Sydneya castellanosii Traub, **hybr. nov.**

Planta inter *Zephyranthes grandiflora* et *Habranthus juncifolius* hybrida; foliis linearibus usque ad 40 cm. longis 6—11 mm. latis; spatha inferne connata, superne non divisa, vel bifida; umbella 1-flora; pedicellis 3.3—6 cm. longis; perigonio rubello, intus albido, vel carmineo—roseo; tubo tepalorum 7—8 mm. longo; paraperigonio a setis paucis brevibus constato; segmentis tepalorum 6—7 cm. longis; staminibus usque ad 2 longitudines perventis, quam segmentis tepalorum dimidio brevioribus; style quam segmentis tepalorum ¼ breviore; stigmate trifido.

DESCRIPTION.—*Leaves* linear, flat, 25—40 cm. long, 6—11 mm. wide, apex acutish. *Scape* 17—32 cm. tall. *Spathe* united below, upper not divided, or bifid, apex acute, 3.2—3.8 cm. long. *Umbel* 1-flowered. *Pedicel* 3.3—6 cm. long. Perigone slightly declined, pink, whitish within, or carmine rose. *Ovary* 8 cm. long, 4 mm. in diam. *Tepaltube* 7—8 mm. long. *Paraperigone* of a few short bristles at the base of the tepalsegs. *Tepalsegs* oblanceolate, 6—7 cm. long, width variable, 1—1.8 cm., 1.6—2 cm., or 1.8—2.2 cm. wide, apex acute or roundish. *Stamens* of two different lengths, about half as long as the tepalsegs. *Style* about ¾ as long as the tepalsegs. *Stigma* trifid. *Capsule* 1.4 cm. long, 1.9 cm. in diam. *Seeds* numerous, blackish, discoid or D-shaped, flat, sterile.

HOLOTYPE: No. 606 (TRA), cult. Hamilton P. Traub, La Jolla, Calif., 7-24-57. PARATYPES: Nos. 364, 365, 366, 367, & 368, cult. Hamilton P. Traub, Beltsville, Md., 1951 to 1952.

(IV) RHODOPHIALA EXCLUDED FROM AMARYLLIS L.

It has been shown that *Rhodophiala bifida* is related to *Habranthus juncifolius* to the extent that sterile hybrids can be obtained by crossing. They are morphologically distinct. This lends support to the hypothesis that although they are closely related, *Rhodophiala* and *Habranthus* are in fact two distinct genera in the tribe ZEPHYRANTHEAE.

In the present experiments, *Rhodophiala bifida* could not be crossed with *Zephyranthes grandiflora* which shows that these two genera have diverged to such an extent as to preclude crossing. But a link between the two has been established by another experiment reported under (III) above, when *Habranthus juncifolius* (which crosses with *Rhodophiala bifida)* was crossed with *Zephyranthes grandiflora,* again with sterile offspring. Thus the three general are each distinct from one another but apparently belong together in the tribe ZEPHYRANTHEAE.

Baker (1888) had reduced the genus *Rhodophiala* Presl to a synonym of *Amaryllis* L. (under the synonym *Hippeastrum)* on the basis of gross morphological characters. This is understandable since chromosome data and the results from breeding experiments were not available to him. We now know that in *Amaryllis* L. (x=11; 2n=22, 44, 66 chromosomes; see Traub, 1958) crosses between other species in the genus proper having similar chromosome numbers, in most cases, can be obtained as a rule with fertile offspring. This shows very close relationship within the genus proper. However, when attempts were

made to cross *Amaryllis* L. (x=11) with *Rhodophiala* (x=9), *Habranthus* (x=6, 7) and *Zephyranthes* (x=6, 7) species, all of them uniformly failed. This has been the experience of others also.

Amaryllis L. (x=11) and *Rhodophiala* (x=9) differ markedly in their basic and somatic chromosome numbers which apparently precludes crossing, but have similar floral characters which have apparently evolved along parallel lines. However, *Amaryllis* L., in the tribe AMARYLLEAE, is relatively larger in all its parts and has relatively broader sessile or petiolate leaves whereas *Rhodophiala,* in the tribe ZEPHYRANTHEAE, has relatively narrow sessile linear leaves. Thus the genera can be readily distinguished as taxons, and chromosome data and breeding experiments as already indicated show that they are not closely related. On that basis *Rhodophiala* has been restored as a distinct genus (Traub, 1953).

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ROBUST FORM OF CRINUM AMERICANUM?

HAMILTON P. TRAUB

On July 5, 1952, Mrs. Ruth Patrick Hodge collected living specimens of *Crinum americanum* 5 miles north of Beaumont, Hardin County, Texas, and sent them to Mrs. Mary G. Henry, who sent some of the bulbs to the writer for study. Mrs. Hodge noted that the plant was stoloniferous, with elongated bulbs, 6 cm. long, 2.2 cm. in diameter.

A detailed study has been made of these bulbous plants since 1952. Part of them are the typical *Crinum americanum* L., which is the type of the genus *Crinum,* and these go dormant in winter. However, one of the plants is much more robust, the leaf margins are hyaline and provided with minute teeth, and it retains its leaves through the winter (Fig. 7). The umbel is 7-flowered. The fruit is extra large and is provided with an antenna-like projection reminiscent of an antenna of a

space satellite. The antenna-like structure represents 4/5 of the tepal-tube which remains alive after the flower has faded. The seeds are extra large (Fig. 7). Further study will be needed to determine the identity of this plant.

Some of the seeds are being sent to Dr. Flory for chromosome determinations since the robust plant stature may be connected with polyploidy, and only such determinations can settle that point. Another report will be made after the chromosome study has been completed.

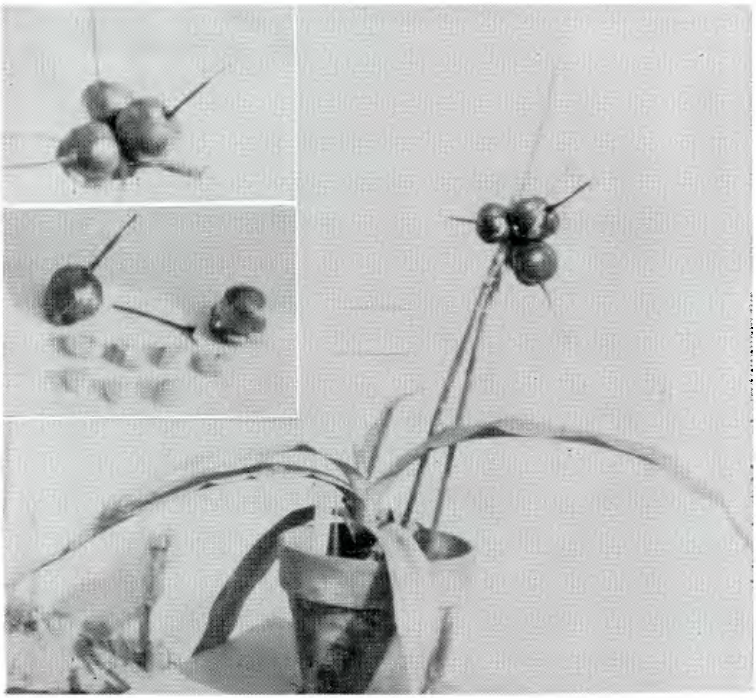


Fig. 7. Robust form of *Crinum americanum,* from Beaumont, Texas, showing that the plant had retained its leaves (Nov. 1957), when the typical form in the same pot had already gone dormant. Insets in upper left hand corner: *upper,* close-up of a cluster of fruits; *lower,* single fruit, and dissected fruit, showing seeds, pericarp and antenna-like projection.

REGISTRATION OF NEW AMARYLLID CLONES

Registrar: Mr. W. D. Morton, Jr.

This department has been included since 1934 to provide a place for the registration of names of cultivated *Amaryllis* and other amaryllids. The procedure is in harmony with the INTERNATIONAL CODE OF BOTANICAL NOMENCLATURE (edition publ. 1956) and the INTERNATIONAL

CODE OF NOMENCLATURE FOR CULTIVATED PLANTS (edition publ. 1953). Catalogs of registered names, as well as unregistered validly published names, will be published from time to time as the need arises. The first one, "DESCRIPTIVE CATALOG OF HEMEROCALLIS CLONES, 1893-1948" by Norton, Stuntz and Ballard was published in 1949. This may be obtained at $2.50 prepaid from: Dr. Thos. W. Whitaker, Executive Secy, THE AMERICAN PLANT LIFE SOCIETY, Box 150, La Jolla, Calif. A catalog of Amaryllis names, and also a catalog of the names of other cultivated amaryllids, is scheduled for publication in 1959 HERBERTIA.

Fig. 8. Hybrid *Amaryllis* cl. 'La Forest Morton' (Ludwig, 1956). Photo New Orleans Times Picayune; Mrs. Rachel Daniels, Garden Editor.

Only registered clones of Amaryllis and other amaryllids are eligible for awards and honors of the AMERICAN AMARYLLIS SOCIETY. Numbers of registered clones are preceded by a prefix, an abbreviation for the genus concerned. Thus, A-390, the "A" standing for *Amaryllis;* Z-1, the "Z" standing for *Zephyranthes,* etc.

Correspondence regarding registration of all amaryllids such as *Amaryllis, Lycoris, Brunsvigia, Clivia, Crinum, Hymenocallis,* and so on, should be addressed to: Mr. W. D. Morton, Jr., Registrar, 3114 State Street Drive, New Orleans 25, Louisiana. The registration fee is $2.00

for each clone to be registered. Make checks payable to AMERICAN PLANT LIFE SOCIETY.

HYBRID AMARYLLIS CLONES

Introduced by Ludwig & Co., Hillegom, Netherlands:

'La Forest Morton' (Ludwig, 1956). [Fig. 8] Registration No. A-390; date: 11-3-57; introduction date: 1956. Height 26"; spring flowering; Leopoldii (D-5b), 7½" across face; color china rose (024/1 RHS) changing to deeper color, lilac purple (031/1), close to pansy purple (033), and almost black at bottom of throat. Named in honor of the late Mrs. W. D. (née La Forest Smith) Morton, Jr. See also preliminary announcement, page 66, in 1956 HERBERTIA.

Introduced by Harry St. John, 2614 Holley Grove, New Orleans, La.—

'Harry St. John' (St. John, 1957). Leopoldii 5b; scape 20"; flower length 5"; diam. across face 7"; dark red, deeper red throat; tepalsegs pointed and reflexed; plant evergreen, blooming season, March. A clone raised 30 years ago; parentage not known. (Reg. No. A-391; 11-13-57). Distributed 7-8-56.

Introduced by Mrs. John Klein, Jr., 2504 Mistetoe, New Orleans 18, La.—

'Klein Pink' (Klein, 1957). Leopoldii 5a; scape 26"; flower length 4", diam. across face 8"; pink to tip of tepalsegs, light green throat, tepalsegs reflexed; plant evergreen, blooming season spring. From Holland grown seeds. (Reg. No. A-392; 11-13-57). Distributed 7-8-56.

Introduced by M. Van Waveren & Sons, Hillegom, Holland:

'Kathleen Ferrier', pure white, distributed 1956, registered 2-15-58
'Royal Velvet', deep red to purple, distributed 1956, registered 2-15-58
'Salmon Beauty', salmon pink, distributed 1956, registered 2-15-58
'Modern Times', deep blood red, distributed 1956, registered 2-15-58
'Snowstorm', pure white, distributed 1956, registered 2-15-58

Complete descriptions of these five clones will be included in 1959 HERBERTIA.

Introduced by S. P. Gasperecz, 1219 Short St., New Orleans, La.—

'Susie Pink'. Leopoldii 5a. 28" tall; flower 7½" diam. (Rose Madder 23; light greenish throat); mildly fragrant; parentage ('Crimson Beauty' x 'Pink Perfection'); March; evergreen. Registered: No. 398; April 26, 1958; Introduced, 4-13-58.

'Amita'. Leopoldii 5b. 30" tall; flower 7½" diam., rose bengal 25, narrow stripe in center of segs; mildly fragrant; parentage: 'Doris Lillian' x 'Pink Perfection'; March; evergreen. Registered: No. 399, 4-26-58; introduced 4-13-58.

'Baby Pink'. Leopoldii 5b. 26" tall; flower 6½" diam.; solferino purple 26/3, light greenish throat; mildly fragrant; parentage: 'Pink Favorite' x 'White Giant'; March; evergreen. Registered: No. 400, 4-26-58; introduced 4-13-58.

Introduced by Mrs. Margie Clements, 703 Ridgewood Drive, Metairie, La.—

'Margie Clements'. Double. 22" tall; flowers 5½" diam., dutch vermilion 717, segs of four layers, overlapping, pointed and reflexed; parentage: 'American Trumpet' x *Amaryllis belladonna* var. *plena* (Cuban clone); spring; evergreen. Registered and Introduced: No. 401, 5-5-58.

Introduced by R. E. Duggan, 6864 Milne St., New Orleans 24, La.—

'Dr. Johns." Belladonna type. 24" tall; flowers 7½" diam.; cardinal red 822, segs much reflexed; mildly fragrant; parentage: Mead strain cross; spring; evergreen. Registered: No. 402; introduced, March 1954. A very prolific bloomer, 3 to 4 scapes per bulb each season.

'Stella.' Double. 22" tall; flowers 7" diam., geranium lake 20; three rows of segs overlapping, reflexed, margins ruffled, darker colored in throat; parentage 'Dr. Johns' x *Amaryllis belladonna* var. *plena* (Cuban clone); spring; evergreen. Registered and Introduced: No. 403, 5-5-58.

Introduced by Henry P. Fontcuberta, 2717 Cleveland Ave., New Orleans, La.—
'Audrey'. Leopoldii 5b. 24" tall; flowers 6" diam.; rose opal 022, whitish-greenish throat; segs reflexed; mildly fragrant; parentage: Mead strain crimson 22 x 'Pink Perfection'; spring; evergreen; Registered: No. 405, 5-5-58; Introduced, 4-13-58.

Introduced by Tim Calamari, 1623 Pauger St., New Orleans 16, La.—
'Timmy'. Leopoldii 5b. 26" tall; flowers 5½" diam.; 3½" length; cherry red, 722, tips recurved, segs with light whitish margin, faint white stripe in center, velvety appearance; mildly fragrant. Parentage: Dutch orange x Mead red, white throat. Spring; evergreen. Registered: No. 404, 5-3-58; introduced 4-12-58.

Introduced by M. Van Waveren & Sons, Hillegom, Netherlands:
'Clown'. White striped vivid red. Registered: No. 406, 7-12-58.
'Fulda'. Orange scarlet. Registered: No. 407, 7-12-58.
'House of Orange'. Flaming orange. Registered: No. 408, 7-12-58.
'Morning Kiss'. Salmon pink. Registered: No. 409, 7-12-58.
'Northern Queen'. Salmon orange, tinted carmine red. Registered: No. 410, 7-12-58.
'Queen of Scarlets'. Brilliant scarlet. Registered: No. 411, 7-12-58.
'Red Champion'. Deep brilliant red. Registered: No. 412, 7-12-58.
'Red Guard'. Deep scarlet. Registered: No. 413, 7-12-58.
'Red Lion'. Dark red. Registered: No. 414, 7-12-58.
'Rose Queen'. Fine old rose, slightly darker throat. Reg.: No. 415, 7-12-58.
'Salmon Giant'. Warm coppery salmon pink. Registered: No. 416, 7-12-58.
'Salmonea'. Delicate light pink. Registered: No. 417, 7-12-58.
'Scarlet Leader'. Deep scarlet-red, darker red spot in center. Reg.: No. 418, 7-12-58.
'Scarlet Pimpernel'. Pure scarlet. Registered: No. 419, 7-12-58.
'Senator Wallace'. Beautiful rose, shaded white. Registered: No. 420, 7-12-58.
Complete descriptions of these 15 clones will be included in 1959 HERBERTIA.

Introduced by Ludwig & Co., Hillegom, Holland—
The following registrations as of August 1, 1958 were received too late for inclusion of the descriptions in this issue of HERBERTIA. The descriptions will be included in 1959 HERBERTIA. The names and registration numbers follow:
'American Express' No. 421; 'Apple Blossom' No. 422; 'Bridesmaid' No. 423; 'Bouquet' No. 424; 'Brilliant' No. 425; 'Candy Cane' No. 426; 'Champion's Reward' No. 427; 'Daintiness' No. 428; 'Delilah' No. 429; 'Diamond' No. 430; 'Doris Lillian' No. 431; 'Fantasy' No. 432; 'Franklin Roosevelt' No. 433; 'Five Star General' No. 434; 'Halley' No. 435; 'Helen' No. 436; 'Invincible' No. 437; 'Love's Desire' No. 438; 'Ludwig's Dazzler' No. 439; 'Ludwig's Masterpiece' No. 440; 'Ludwig's Scarlet' No. 441; 'Ludwig's Goliath' No. 442; 'Lucky Strike' No. 443; 'Margaret Rose' No. 444; 'Maria Goretti' No. 445; 'Margaret Truman' No. 446; 'Mothersday' No. 447; 'Nivalis' No. 448; 'Peacefulness' No. 449; 'Pink Favorite' No. 450; 'Pink Perfection' No. 451; 'Pinksterflower' No. 452; 'Roselinde' No. 453; 'Rossini' No. 454; 'Salmon Joy' No. 455; 'Shakespeare' No. 456; 'Red Radiance' No. 457; 'Silver Lining' No. 458; 'Siren' No. 459; 'White Giant' No. 460; 'Winter Joy' No. 461; 'Wyndham Hayward' No. 462.

HYBRID ZEPHYRANTHES CLONE

Introduced by Dr. Thad M. Howard, 307 W. Jones Ave., San Antonio, Texas—
'Ruth Page' (Howard, 1958). A hybrid between *Z. rosea* (seed parent) and *Z. citrina*. A vigorous clone, similar in habit to the seed parent, but half again as large in its floral parts; the foliage is more upright; long declinate style; pedicel 1¼ to 1½ inches long, tepaltube a half inch long, mature bulbs nearly an inch in diameter; offsets produced freely, Registration No. Z-1. The registration was received too late for the inclusion of a picture of the clone, which will appear in 1959 HERBBERTIA.

[PLANT LIFE LIBRARY—continued from page 139.]

COLOR IN THE WINTER GARDEN, by G. S. Thomas. Chas. T. Branford Co., 69 Union St., Newton Centre, Mass. 1958. Pp. 220. Illus. $6.50. The author, a well known professional English horticulturist, describes a considerable number of trees, shrubs, and herbaceous and bulbous plants which are available to provide color in bloom, berry and foliage in gardens in winter. Cultural requirements, uses in arrangements, flowering and planting periods of the plants are discussed. This most charming book is highly recommended.

PLANT PATHOLOGY, by J. C. Walker. 2nd ed. McGraw-Hill Book Co., New York. 1957. Pp. 707. Illus. $10.00. This is a revised edition of Dr. Walker's outstanding text which presents "comprehensive treatments of better-known representative diseases which may serve as guides to the general principles underlying the science of plant pathology." This is a must for all who are interested in plant pathology.

VEGETABLE CROPS, by H. C. Thompson and W. C. Kelly. 5th. ed. McGraw-Hill Book Co., New York. 1957. Pp. 611. Illus. $8.50. The purpose of this 5th edition of the standard text on the subject is to acquaint "the student with the facts and principles on which successful production and handling of vegetables are based." It serves "equally as well as a college text book, or as a reference book for county agricultural agents, extension specialists, teachers of vocational agriculture seedsmen and other commercial concerns that have contact with the vegetable industry." The text has been brought up-to-date and is highly recommended.

FUNDAMENTALS OF HORTICULTURE, by J. B. Edmond, A. M. Musser, and F. S. Andrews. 2nd ed. McGraw-Hill Book Co., New York. 1957. Pp. 456. Illus. $6.75. This second edition of an excellent book is divided into three parts—a study of the fundamental processes; the application of these to horticultural practices, and a discussion of the principal horticultural crops. Highly recommended.

SOILS AND SOIL FERTILITY, 2nd ed., by L. M. Thompson. McGraw-Hill Book Co., New York. 1957. Pp. 451. Illus. $6.50. This second edition of a well-known text deals with the "physical, biological and chemical properties of soils in relation to their formation, classification, and management from the fertility point of view." This clearly written text is "general enough to meet the needs of college students who take only one course in soils" and it is "also sufficiently technical to serve the needs of the graduate student." Highly recommended.

THE NORTH AMERICAN DESERTS, by E. C. Jaeger, Stanford University Press, Stanford, Calif. 1957. Pp. 308. Illus. $5.95. The purpose of this excellent text is to present for the first time "a comprehensive yet simple picture of all of our North American deserts, deserts five in number which together extend from central Mexico almost to the border of Canada." This charming and informative book, profusely illustrated, will appeal to all who are interested in desert living and travel, and it cannot be too highly recommended.

A MANUAL OF AQUATIC PLANTS, by N. C. Fassett. University of Wisconsin Press, Madison. 1957. Pp. 405. Illus. $6.50. This edition of the late Dr. Fassett's classic text is published with the revision Appendix by Eugene C. Ogden with the purpose of bringing the nomenclature into agreement with present day usage, supplementing some of the keys, and extending the ranges of many species. The Manual covers the region from Minnesota to Wisconsin and eastward from the Gulf of St. Lawrence to Virginia. Highly recommended.

SPRING FLORA OF WISCONSIN, by N. C. Fassett. 3rd ed. with revisions by Margaret S. Bergseng. University of Wisconsin Press, Madison. 1957. Pp. 189. Illus. This is a revision of the late Dr. Fassett's manual of plants growing without cultivation and flowering before June 15 which had not been completed at the time of his death. The revision was completed by his colleagues. Botanists generally will welcome this clearly and concisely presented work so characteristic of Dr. Fassett. Highly recommended.

[PLANT LIFE LIBRARY—continued on page 110.]

AMARYLLID NOTES, 1958

HAMILTON P. TRAUB

CORRIGENDA

Traub, Hamilton P. AMARYLLIDACEAE, in João Angely, Catalogo e Estistica dos Generos Botanicos Fanerogamicos. No. 26. 1957:

Page 3, under ALLIUM L., delete "Nectaroscordum Lindl. (1836)."

Page 4, under BESSERA Schult. f, delete "Bessera Schult. (1809); Bessera Spreng. (1815); Bessera Vell. (1825)."

Page 7, under STENOMESSON Herb., add under "Sin.", "Crocopsis Pax (1890)."

Page 7, under TULBAGHIA L., delete "Tulbaghia Heist. (1753)."

Page 7, under VALLOTA Herb., delete "Valota Adans. (1763)."

Fig. 10. *Haemanthus zambesiacus* from Southern Rhodesia, flower on left, foliage on right. *Eucomis undulata* with linear leaves in background. Photo by L. S. Hannibal.

HAEMANTHUS ZAMBESIACUS

In a recent communication, Mr. L. S. Hannibal sent in a photo of *Haemanthus zambesiacus* which is reproduced in Fig. 10. This species is from Southern Rhodesia. The reader is referred to page 55, 1956 Herbertia for a brief description of this species by Mr. Hannibal.

AMARYLLIS BREVIFLORA (HERB.) SWEET

Amaryllis breviflora (Herb.) Sweet. Baker (Amaryll. 1888) was apparently in error in indicating the habitat of this species as "Buenos Aires, *Tweedie*". Herbert (Amaryll. 137. 1837) had previously indicated "Specim. Herb. Hooker (ex Braz. meridionali?) *Tweedie*". A specimen from Santa Catarina, southern Brazil, recently identified favors Herbert's statement. This is Reitz & Klein No. 1298, 11-5-53 (US No. 2,142,544), Campo do Massiambú.

AMARYLLIS VITTATA VAR. TWEEDIANA

In 1954, Prof. Ira S. Nelson, while on a collecting trip sponsored by the LOUISIANA SOCIETY FOR HORTICULTURAL SCIENCE, sent back bulbs of this species which is illustrated in Fig. 9. This is really a very beautiful species—the illustration does not do it justice—and has to be seen to be fully appreciated. It has been previously illustrated by Traub & Nelson in Bulletin No. 2, LOUISIANA SOCIETY FOR HORTICULTURAL RESEARCH. 1957.

Fig. 9. *Amaryllis vittata* var. *tweedieana.* Photo by Prof. Ira S. Nelson.

Amaryllis vittata var. **tweediana** Traub

in The Amaryllis Manual, Macmillan, N. Y. p. 268. 1958. Syn.—*Hippeastrum ambiguum* var. *tweedianum* (err. *tweediana)* Herb., in Bot. Mag. sub pl. 3542. 1837; Herb., in Amaryll. 136, pl. 22 (err. 21), fig. 3. 1837 (specim. Herb. Hooker. S. Brasil? Tweedie).

Description.—*Leaves* lanceolate, 1.5 cm. wide at the base, 2.5 cm. wide above the middle, 46.5 cm. long. *Scape* 22.5 cm. tall. *Umbel* 2-flowered. *Spathe-valves* lanceolate, 8.7 cm. long, apex acute. *Pedicels* 2.5 cm. long. *Ovary* 2.2 cm. long, 1 cm. in diam. *Perigone* 14.5—15.5 cm. long. with two deep purple stripes, with white stripe between, or purplish in center, white outwards, on each tepalseg. *Tepaltube* 4 cm. long, 6 mm. in diam. at the base, 11 mm. in diam. at the apex. *Tepalsegs* oblanceolate, acute or acuminate, 11 cm. long; upper setseg 5 cm. wide, two side setsegs 4cm. wide: two side petsegs 4.4. cm. wide, lower petseg 3 cm. wide, *Stamens*

2.5 cm. shorter than the *style,* which subequals the tepalsegs. *Stigma* trifid, lobes 2.5 mm. long, rounded.

Specimen No. 423 (TRA), Nelson, 2-13-56, cult. Lafayette, La., grown from bulbs obtained by Ira S. Nelson in 1954 from Ricardo Dillman in Cochabamba, Bolivia. The original bulbs were obtained by Mr. Dillman from the Rio Beni region some years previously.

CAPE BELLADONNA, BRUNSVIGIA ROSEA (LAM.) HANN.

In 1955 Mr. L. S. Hannibal kindly sent the writer Cape Belladonna *(Brunsvigia rosea* (Lam.) Hann.) bulbs Stanford Nos. 1 and 2, representing selections from the wild near Stellenbosch in South Africa by the late Miss K. C. Stanford.

In August 1957 No. 2 bloomed at La Jolla, Calif. The scape was 40 cm. tall; the umbel was 6-flowered, with 2 abortive buds. The flowers were very light pink, becoming a little deeper pink with age. The flowers were not hand pollinated, but in spite of this a very good crop of seeds set (24 seeds per capsule), apparently due to pollen transfer by the humming bird moth. The petioles had elongated to 9.5—13 cm. long in fruit; the capsules were 3.6 cm. long, 2.1 cm. in diam. The seeds were whitish when harvested, but changed to pinkish when exposed to the sun. They were fleshy, angular, ranging from 5 x 7 mm. in diam., 8.5 mm. long *to* 10 x 11 mm. in diam., 13 mm. long. The greater proportion of the seeds was in the larger size range.

According to Hannibal in a recent communication (9-6-57), No. 2 is "typical of the variants growing near Stellenbosch. It resembles Marloth's plant (Flora So. Afr. 4: p. 125), although the color is slightly more variable . . . as you may recall our *Brunsvigia rosea major* which grows so well in California and England is not typical of the average Cape species. Most of the Cape variations haven't the vigor, stature, color or number of flowers. And most of them refused to flower for me for years . . . Wouldn't be surprised if the original Blanda type came from this area."

Hemerocallis x *yeldara* Traub, hybr. nov. Plantae hybridae species complures implicatae, magnitudine staturae variae, floribus magnitudine variis de tempore vernale productis. Holotype: *H.* x *yeldara* cl. 'Apricot'; TRA No. 616; leg. J. S. Cooley, cult. Beltsville, Maryland, 5-20-58.

Hemerocallis x *stoutara* Traub, hybr. nov. Plantae hybridae species complures implicatae, magnitudine staturae variae, floribus magnitudine variis de tempore autumnale productis. Holotype: No. 619 (TRA). *H.* x *stoutara cl.* 'Miss Arcadia'.

Amaryllis x *degraaffara* Traub, *hybr. nov.* Hybridae inter species aliquot obviae *(A. reginae, A. vittata, A. psittacina, A. striata, A. aulica, A. belladonna,* etc.), plantae maximae, flores maximi modice patuli. Hybrids involving several species *(A. reginae, A. vittata, A. psittacina, A. striata, A. aulica, A. belladonna,* etc.), plants very large; flowers very large, moderately open. Holotype: Traub No. 513 (TRA).

Amaryllis x *pearceara* Traub, *hybr. nov.* Hybridae inter species aliquot obviae *(A.* x *degraaffara, A. leopoldii, A. pardina),* plantae maximae, flores maximi patuli. Hybrids involving several hybrids and species *(A.* x *degraaffara, A. leopoldii, A. pardina),* plants very large; flowers very large, wide open. Holotype: Traub No. 514 (TRA).

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.]

Urecolina miniata Benth. & Hook. f., Gen. Pl. 3: 732. 1883.—Differs in having its leaves narrower (broader, however, than we see depicted in the illustration and always petiolate), the perianth vermilion, the lobes short, free, and the filaments more narrowly dilated at the base, with a membrane not uncommonly shortly transversing the tube, not, however, connate into a ring and more or less extended in different flowers. *Stenomesson croceum* Hook., Bot. Mag. pl. 3615, excluding the synonymy is according to W. Herb. similar to this species, *U. miniata,* as far as the imperfect diagnosis indicates. This species is closely related to all its congeners known to us and to *Stenomesson,* differing in the basal membrane of the filaments being obscure and not connate into a perfect cup. *Leperiza eucrosioides* Baker appears to be referable to *Phaedranassa.*

Urecolina pendula Herb. (l. c)—Perianth lemon-yellow, the limb rather broadly urceolate, becoming greenish at the apex, the basal membranes of the filaments very thin, perfectly or imperfectly connected in a tranverse line. In *U. latifolia* the perianth is wholly like that in *U. pendula,* but is somewhat narrower and the transverse line between the filaments (according to the illustration) is more conspicuous, but we have not seen any actual specimens.

Eustephia argentina Pax, Bot. Jahrb. 11: 328. 1890.—Leaves linear, obtuse; scape tall; exterior involucral bracts 2, rose, lanceolate, the interior ones membranous, pale, much smaller, setaceous; inflorescense many-flowered, pseudo-umbellate, the flowers unequally long-pedicellate, nodding, subsecund; flowers developing with the leaves, tubular-funnelform; perigonium scarlet, the tube very short, the segments oblong-obovate, the 3 exterior ones acute, the 3 interior ones very obtuse, slightly emarginate, apiculate; stamens slightly surpassing the perigonium; filaments attached to the segments of the perigonium, only slightly connate at the very base, dilated to 2/3 their length, one-dentate above the middle on both sides, the tooth obtuse; anthers versatile; ovary triangular; style filiform, subequaling the stamens; stigma 3-lobed; capsule triquetrous; immature seeds with a black shiny testa. Bulb not known; leaves 20—30 cm. long, 5—6 mm. wide, apparently subglaucescent; scape to 20 cm. tall; involucral bracts 6—8 cm. long; flowers 12 or more; pedicels conspicuously unequal, 3—12 cm. long; perigonium to 3 cm. long, 1.5 cm. in diameter, the lobes to 6 mm. wide; style scarcely 3 cm. long.—Argentina; very frequent on the higher spots, Cuesta dela Negrilla y del Durazno, province of Catamarca, collected by Schickendantz in November and December, 1873.

Eustephia marginata Pax (l. c.)—Bulb brown, ovoid, the neck elongated; leaves narrowly linear, coriaceous, narrowly white-margined, glaucous, scabrous-margined; scape tall; involucral bracts all quickly marcescent, pale, the exterior ones longer; inflorescence many-flowered, pseudo-umbellate, the flowers unequally pedicellate, nodding, produced at the same time as the leaves, funnelform; perigonium rose, the tube very short, the exterior segments oblong-obovate, the interior ones narrower than the exterior ones, very obtuse; stamens slightly surpassing the perigonium, the filaments attached to the segments of the perigonium, scarcely connate at the very base, dilated to 2/3 their length, one-dentate on both sides above the middle, the tooth acute; anthers versatile; ovary triangular; style filiform, exserted, surpassing the stamens; stigma capitate, small. The bulb is 4 cm. in diameter; the leaves to 30 cm. or more in length, scarcely 5 mm. wide; the scape almost 12 cm. tall; the involucral bracts 8 cm. long; the flowers not quite a dozen per inflorescence; pedicels 3—6 cm. long; perigonium 3.5 cm. long, 1.5—2 cm. in diameter, the exterior

[MOLDENKE, GENERA & SPECIES—continued on page 26.]

3. GENETICS AND BREEDING

PLANT BREEDING — HOBBY AND PROFESSION

JACK SCAVIA, *Lakeside, California*

Growing hybrid amaryllis bulbs for the wholesale market offers a real challenge to anyone in this country. Foreign competitors have 10 to 20% of our labor costs; several firms in Holland have generations of bulb breeding behind them, and some have government subsidies as well.

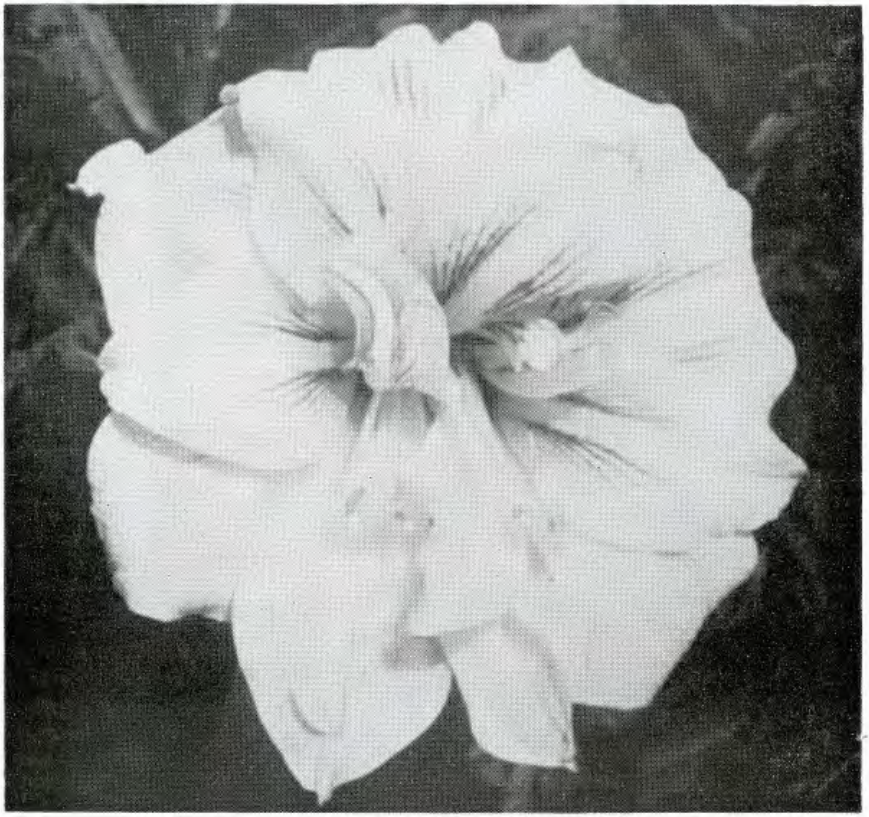


Fig. 11. Double Hybrid *Amaryllis* cl. unnamed. Photo by Jack Scavia.

Outdoor production is not a great deal of help due to high cost of suitable land. From my meager experience, I feel the only answer is better quality and something different. Outdoor growing produces sturdier growing plants, and the fact that the bulbs do not have to be shipped as far as when imported gives the buyer better quality stock.

With the thought of trying for something "different" I started

several years ago with some general run amaryllis hybrids, bulbs from several California breeders and five named Dutch clones. Too late I realized I should have kept only the very best; too many times the dominant parent influences the seedling with its qualities; and usually the general run or average bulbs dominate the named clone.

I added a few *Amaryllis* species to my breeding stock. With me the species are very trying; some produce no seeds at all, others make sterile seeds and rarely do I find a seedling worth keeping for breeding.

With my limited experience, colchicine seems to hold out some hope to amaryllis fans. Results are very erratic, many treated bulbs being unaffected, some far below original quality, and a few with very desirable traits. I have grown a number of good miniatures from large-flowered types treated with colchicine. I have noted some mutations with 8, 10, 12 and even 18 tepalsegs. To me it seems the induction of color variants is one of colchicine's best assets—brown, copper and bronze shades turn up now and then. Using a dilution of 0.2% to start, the grower can experiment with this and weaker dilutions of colchicine. Seeds and small offsets may be soaked in the drug 8 to 12 hours. Large bulbs may be injected by the hypodermic procedure.

My most outstanding results to date have been with double hybrid amaryllis. I added some bulbs of the double, 'Helen Hull', to my breeding stock. Seedlings from doubles crossed on singles do not include a high percentage of quality doubles. I have used the pollen from 'Helen Hull', but so far all double seedlings I have bloomed have irregular shaped tepalsegs, standing out from the center of the bloom at various angles. Occasionally I find a mutation in my colchicine treated stock with 8 to 10 tepalsegs, all arranged flat but none is as attractive as the one shown in the illustration (Fig. 11). In this there are three times the usual number of tepalsegs in a flat symmetrical form. This will be propagated for naming and distribution in due course.

EFFECT OF COLCHICINE ON HYBRID AMARYLLIS

ANDREW T. WEIL, *Pennsylvania*

I first became acquainted with colchicine in January of 1957 when I found a brief mention of it in a biology textbook. My curiosity led me to begin a research project on the drug, and thus I soon understood what colchicine could do to plant cells, how it produced mutations, and how it could be used. Before long, I found myself so interested in plant mutations that I decided to undertake a series of experiments using colchicine to produce them artificially.

My first problem was the selection of the type of plant with which to experiment. Since I wanted quick growth, I decided to choose some bulbous plant. The large flowers of *Amaryllis* hybrids were perfect subjects, for due to their size, mutations in them could be easily detected. For my project I used fifty Giant American Hybrid *Amaryllis* bulbs and two types of colchicine—a one-tenth of one per cent (0.1%) solution, and a four-tenths of one per cent (0.4%) emulsion. All of the

experiments were performed on the flowering stems; no attempts were made to affect either the leaves or the bulb itself.

In mid-February the first experiment was conducted. The terminal bud of a bulb's flowering stem (scape) was dipped into colchicine solution as it emerged from the bulb. When the plant bloomed two weeks later there were *no* apparent differences between these blooms and those of untreated control plants. In each case of external solution treatment the flowers opened when the scape was about thirteen inches tall. This was also true of plants in the control group.

Experiment #2: This was performed on several bulbs. One-quarter (¼) ml. of colchicine solution was injected directly into the bud of each

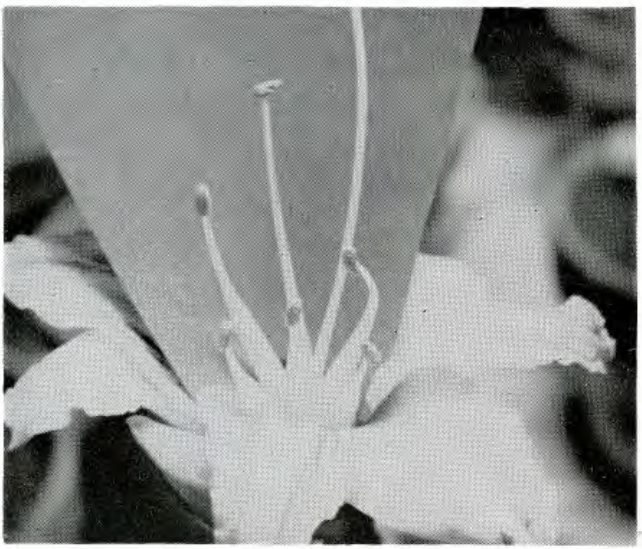


Fig. 12. Colchicine treated hybrid *Amaryllis*. Flower from bulb in Expt. 4, which received injection of 0.4% colchicine emulsion. Note elongated pistil, variation in lengths of stamens, and swelling of stamen bases. Photo by Andrew T. Weil, Phila.

bulb as it emerged. Again, the scapes reached thirteen inches before the blossoms opened, but now the flowers were altered. The petepalsegs and setepalsegs of all treated flowers were slightly thickened; and more striking, they were crinkled and had ruffled edges. This crinkling and ruffling was observed *whenever solution was injected directly into the terminal bud of the scape.* However, did the colchicine produce this effect or was the ruffling caused by the injection alone? To rule out the latter possibility, I set up a control experiment in which I injected one-quarter (¼) ml. of distilled water into the buds of two different bulbs. When these control plants bloomed, their flowers had straight, smooth tepalsegs (=petepalsegs and setepalsegs). This meant that the ruffled tepalsegs had been caused by the colchicine solution.

Experiment #3: The buds of several bulbs were dipped into four tenths per cent (0.4%) colchicine emulsion. *In every case,* the flowers (ruffled, as in experiment 2) opened when the flowering stems were only four or five inches tall!

Experiment #4: One-quarter (¼) ml. of 0.4% colchicine emulsion was injected into each bud of several bulbs as they emerged. This again caused the flowers to bloom on a short flowering stem, but also brought about several startling changes. First, the tepalsegs, in addition to being ruffled, were displaced, so that the flowers became monstrosities. Second, the pistils were greatly elongated while the stamens became shortened. In every case, the filaments of the stamens became swollen at their bases (Fig. 12). The anthers contained little or no pollen, and the flowers set seed poorly.

Most of the flowers were artificially self-pollinated and some of the resulting seeds were sent to Prof. Ira S. Nelson in Lafayette, Louisiana, who will examine the seedling root tips to learn whether the mutated flowers bred true. If not, the seeds will produce normal plants and will not pass on their mutations. In any case, I feel my project was both rewarding and successful, and I hope to enlarge and continue it in the future.

NERINE BOWDENII VARIATIONS

L. S. Hannibal, *California*

Nerine bowdenii was found originally by Mr. Cornish Bowden while making a trip up into the mountains back of King Williams Town, Cape Province, in 1903. Since the bulb's introduction several variants have appeared on the market, the most popular in England being 'Fenwick' which was grown by Mark Fenwick at Stow-in-the-World, Gloucestershire.

In contrast, here on the Pacific Coast we have the variant *N. bowdenii* var. *magnifica* which has been released during the last few years from the garden of the late E. O. Orpet in Santa Barbara. Variety *magnifica* is a beautiful plant, being much larger in stature and blossom than the original type species. It is the writers understanding that var. *magnifica* was a Richard Diener production. Diener was an active Amaryllis breeder who had a specialized nursery in Oxnard some 20 years ago, and a number of nice things came from his garden including the Diener hybrid Amaryllis.

Variety *magnifica* is probably a polyploid, but whether a hybrid or not may be debatable. The foliage and growth habits differ appreciably from the type species, and the plant is completely sterile. Thus unfortunately, little can be done with it horticulturally.

Apparently there is another large clone of *N. bowdenii* known as forma *gigantea* which was once grown by Herbert Chapman and at the Dublin Botanical Garden by Sir Frederic Moore. At present little is known regarding this latter clone.

Nerine bowdenii is notorious for producing parthenogenetic seeds. The late Major Pam discussed this in the Journal of the Royal Horticultural Society, page 128, March 1955. The writer has just about given up trying to use the plant as a breeder due to the same trouble. A thorough emasculation of the blossoms is of no aid. Seeds still develop in copious amounts. Where those crosses with *N. bowdenii* have been effected it has been with *N. bowdenii* pollen.

Out of the usual seed production from *Nerine bowdenii* about 50% show chlorophyll deficiencies, and amongst all seed the degree of pigmentation varies widely. The viability of the seed also varies greatly, some sprouting quite rapidly and others taking months. The same applies to foliage development. In spite of considerable care, and germination on moist vermiculite, mortality is usually quite high and it has only been until recently that the writer could avoid losses in excess of 50% during the first year. The bulk of the loss is with the seed that germinate poorly or have little inclination to produce roots. Since this difficulty occurs in several strains of *N. bowdenii* it cannot be attributed to the eccentric behavior of one specific clone which in itself could carry abnormal chromosome patterns.

Parthenogenetic seeding habits are not uncommon amongst many of the *Amaryllids,* and particularly in *Nerine* and *Brunsvigia rosea* (Cape Belladonna), and its forms. However the chromosome instability of *N. bowdenii* is particularly unique and justifies further investigation. This behavior probably accounts for the several strains in the trade, and others, including a white or two which are in collections in England.

TWO FERTILE CLONES OF **LYCORIS RADIATA**

William Lanier Hunt, *North Carolina*

For years, I kept getting letters from Louisiana and the Lower South in summer mentioning that red spider-lilies were in bloom. This seems to have started in 1931. Then some one sent me some bulbs. They bloomed in late July! Later on, in a batch of bulbs to be identified, came more lycorises. They bloomed about two weeks later. Both of these clones produced seeds every year, and I began to get pollen from everything in sight and fertilize them. The results were the usual parthenocarpic creatures which all looked like the seed parent.

These clones offer us a great opportunity for creating some new lycorises. Whether or not my clones are the same ones mentioned by Mr. Sam Caldwell will have to be determined in order to see what we have here in breeding material. The lengthening of the flowering season for *Lycoris radiata* is a welcome feature of the fertile clones if they do no more for us. The two fertile clones lead off the season in July and August, and the old sterile one flowers in September. With the several new species overlapping these flowering times, the lycoris season comes to be a real event in late summer and early fall, for the other species fill in the gaps and overlap all these to make a nearly continuous flowering period from *L. squamigera* to *L. aurea.*

HYBRIDIZING LYCORIS

SAM CALDWELL, *Tennessee*

The cross breeding of lycoris species is an activity you can still "get into on the ground floor." Very little of it has been done. This is true probably because the only two species grown very widely in this country —*L. squamigera* and *L. radiata*—are represented in gardens by infertile forms, and no seed can be obtained.

I've heard of a few hybrids. Mr. William T. Wood, of Macon, Ga., in 1941 used *L. radiata* pollen on *L. traubii* blooms, and got seeds which eventually produced the hybrid *L. woodii.* I understand that the flowers are yellow, resembling those of the seed parent.

In 1950, Mr. B. Y. Morrison, then living in the metropolitan Washington, D. C. area, had in his garden the somewhat rare seed-bearing form of *L. radiata.* Dr. John Creech pollinated some of its flowers with pollen from a yellow-flowered *Lycoris* labeled "L. aurea". [This species at the USDA Plant Introduction Garden, Glenn Dale, Md., has been named *L. chinensis* Traub in the present issue of HERBERTIA, and is not the *L. aurea* grown around St. Augustine, Fla.] Mr. Morrison delivered the seeds to Dr. Creech who grew the seedlings. One of the resulting hybrid seedlings has bloomed; the flowers are "yellow with longitudinal reddish stripes," according to Dr. Creech.

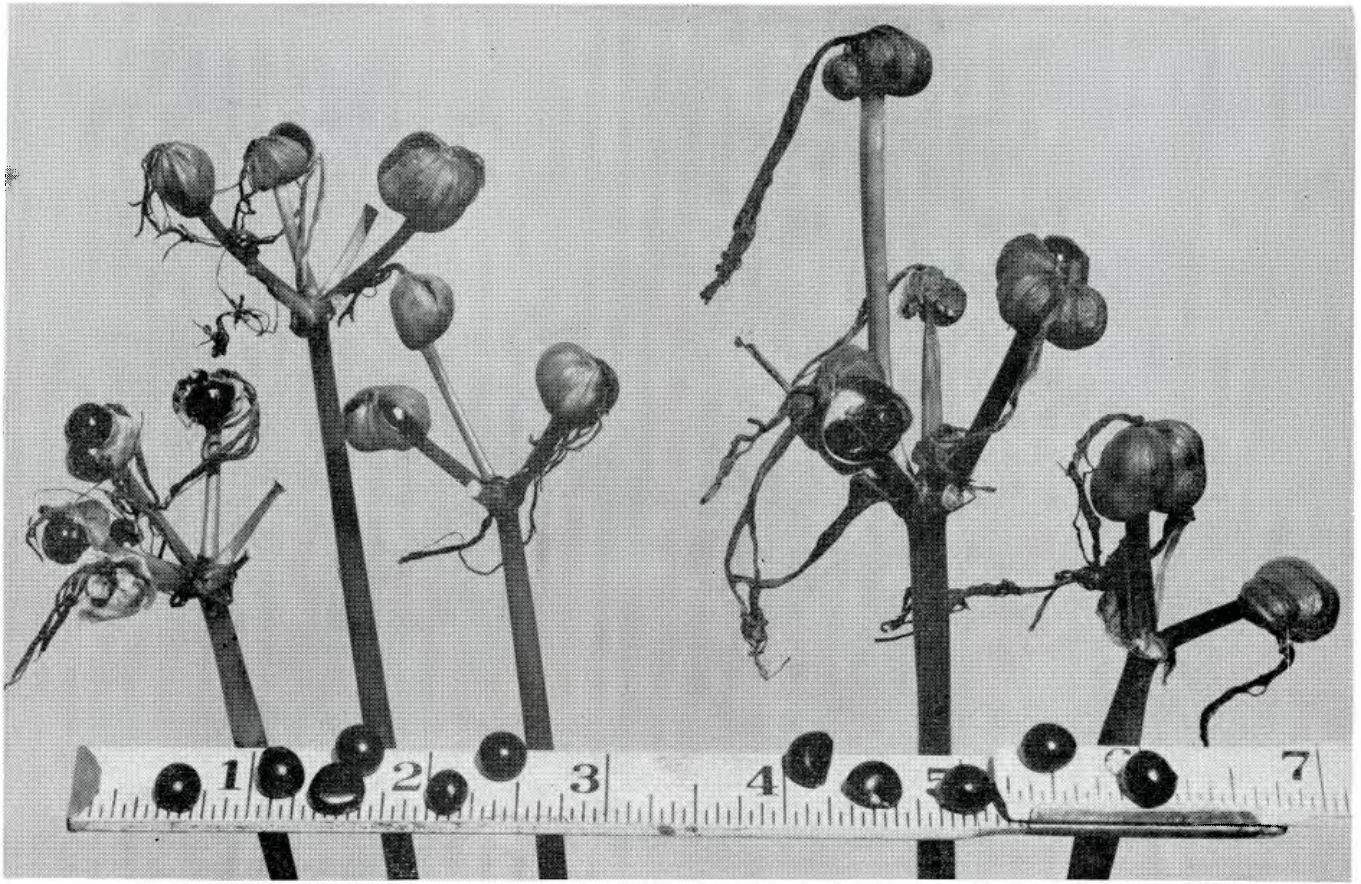
In 1956 Dr. Hamilton Traub successfully made a *L. aurea* x *L. traubii* ♂ cross, at La Jolla, Calif., and in 1957 he succeeded with the reverse, *L. traubii* ♀ x *L.* ♂ *aurea.* In fact, he sent me seeds of each; they have germinated and are growing.

I am a bit presumptuous to write this piece, because all there is to show for my own hybridizing efforts are dozens of pots full of seedling bulbs, from one to five years old—no flowers as yet. However, even the leaves of some of the seedlings have a "different" appearance, so I have high hopes. These notes are to encourage others to get started in what may turn out to be a fascinating horticultural activity.

First you must have established flowering bulbs of some kinds of fertile lycoris—the more the better—to serve as seed parents. I have the following to work with now, listed in order of their season of bloom: (1) *L. sanguinea,* (2) *L. haywardii,* (3) *L. radiata* (fertile type—not common garden form), and (4) *L. sprengeri.*

These four set seed freely every year in my plantings. I also have *L. aurea* and *L. traubii,* which seed in Florida, but under pot culture with me they have never matured sound seed. Only recently I have added an unidentified hardy, fertile, golden-flowered lycoris, which should be useful in future hybridizing.

In addition, I have the following which are sterile, or, at least, have never borne seed in my garden: (1), *L. squamigera,* (2) *L. incarnata,* (3) *L. houdyshelii,* (4) *L. caldwellii,* (5) *L. radiata* (sterile), (6) *L. albiflora* (probably true stock; never bloomed after first year. Evidently too tender for outdoor cultivation here), and (7) *Lycoris elsiae,* (A fine near-white, tinted salmon and pinkish; received under various



Lycoris fruits and seeds. *Left, Lycoris radiata* (fertile form); right, *Lycoris sprengeri.*

Plate 3

names—"*L. alba*," "*L. radiata alba*," "*L. radiata carnea*," and "*L. albiflora carnea.*")

Though these never set seed, I continue to use their pollen on some of the fertile species, in the hope of getting "takes."

My breeding techniques are very simple. Because all the seed-bearing lycoris seem highly fertile to their own pollen, the first precaution in hybridizing is to see that the plants you are working with are not allowed to self-pollinate. I work with little groups of bulbs, isolated by 100 feet or more from others of their own kind. Each day as the flowering season starts I go over the clumps carefully, pry open each bud which has nearly reached the opening stage and remove all the anthers before they have a chance to "unfold" and release their pollen.

At the same time I work over each umbel with a ripe anther from the desired male parent, rubbing pollen onto the stigma of every open flower. I've never been quite sure when the stigma is most receptive (on newly opened flowers, I suspect), so to play safe, I repeat the operation for three days. Scapes are labeled with records of the crosses made. Then it is only a matter of waiting for seed to mature—until October with most species.

Seeds are large (often ¼ inch or more in diameter), shiny and black when ripe (Plate 3). I gather them as soon as the capsules start splitting and plant them immediately. They shrivel badly if allowed to dry very long. I do not know but suspect that excessive drying affects adversely their viability.

There are undoubtedly several satisfactory ways to handle the seed. It has been my practice to plant them about an inch deep in pots of a sand-soil-leafmold mixture, kept in a cold greenhouse over winter, with the soil moist. In a warm location lycoris seed start germinating within a few weeks, but under my cold greenhouse method of handling they simply lie in the soil through the winter. As the soil warms in March and April, they germinate. Even then, there is nothing above ground to show you what is going on. But down in the soil, nearly every seed develops into a slender bulblet shaped like a tear-drop.

Leaves, like coarse grass blades, spring up the next fall, about a year after seeds have been planted. One odd characteristic is that both selfed and hybrid seedlings from *L. sprengeri* make fall growth, although mature flowering size bulbs of this very hardy species do not produce their leaves until spring.

My seedlings are agonizingly slow in getting up to blooming size. In fact, none have reached it yet, in five years. Probably the fact that I keep them in pots—and too crowded in some cases—has slowed them down. I plan to build a special "nursery bed" outdoors, but with protection, for them next year. Meanwhile they look healthy, are adding a little size each year, and give me much to look forward to whenever they do start blooming.

Thus far I've tried crosses only when overlapping bloom periods of

[CALDWELL, LYCORIS HYBRIDIZING—continued on page 107.]

4. AMARYLLID CULTURE

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

GROWING AMARYLLIDS IN NORTH FLORIDA

BECKWITH D. SMITH, *Jacksonville, Florida*

My interest in Amaryllids was stimulated by my mother, who grew them extensively in Marianna, Florida, which is located in the northwestern part of the state, just under the Alabama line. She loved zephyranthes, lycoris, sprekelias and many of the crinums familiar in that area. Observing her success, I determined to do likewise, and obtained my 'start' in bulbs from her.

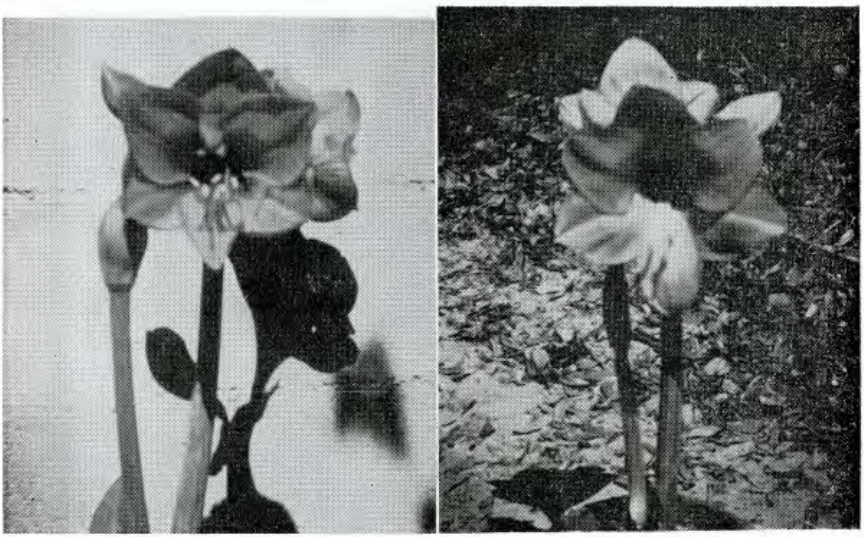


Fig. 13. Hybrid *Amaryllis* clones, *right,* 'Mary Lou' *left,* 'Red Duval'. Originated by Beckwith D. Smith.

Not being satisfied with a few bulbs, I was eager to secure an increase for a better display of flowers, but the only way available to me at that time was to grow them from seed, which was very slow. However, I did grow them on and in the end obtained many good bulbs. The bulbs I have grown in the Jacksonville area include *Lycoris aurea* and *L. radiata* (I cannot bloom *L. squamigera); Sprekelia formosissima; Hymenocallis narcissiflora, Haemanthus multiflorus; Gloriosa rothschildiana, G. superba, Clivia miniata,* Mead *Amaryllis,* and, for the last seven or eight years the better forms of well known Dutch clones of *Amaryllis,* principally the Ludwig strain, and also crosses between these and a few of Van Meeuwen and Warmenhoven strains. I suppose my experience in growing Amaryllids will cover a period of better than

fifteen years. Fertilizing for a number of years was more or less haphazard, and my bulbs were grown in the sandy loam which is prevalent around the city.

After having grown and crossed the Mead strain *Amaryllis* for a number of years without much success in obtaining desirable flowers, I

Fig. 14. Hybrid *Amaryllis* cl. 'Irma'. Originated by Beckwith D. Smith.

was considerably discouraged until a flower shop displayed some blooming plants of Dutch hybrids. My delight and astonishment at these beautiful flowers was so great that I immediately dumped the bulk of my Mead stock, and thereafter began purchasing Dutch bulbs exclusively. In a few years the results of cross pollination were startling, as well as were the self colors which I was able to obtain, and at this time I have

many bulbs which produce solid colors of beautiful flowers including many hues of red, rose, pink, orange, and white.

After starting with the Dutch bulbs the old hit or miss method of fertilizing was abandoned. I grow all my bulbs in raised beds, in which is incorporated a rich mixture of peat, rotted leaves, sheep manure and bone meal. Top dressing is given from time to time of additional well rotted cow manure, and occasionally a spray is applied of soluble fertilizer. Also, organic limestone is dusted on the beds at least once during each growing season. The bulbs make a spring growth, during which they fill out rapidly, and during the fall months of September and October they also put on a growth spurt. Bulbs which do not go dormant from natural inclination thereafter are forced into dormancy by the first killing frost in early winter. Growth is actively resumed in March.

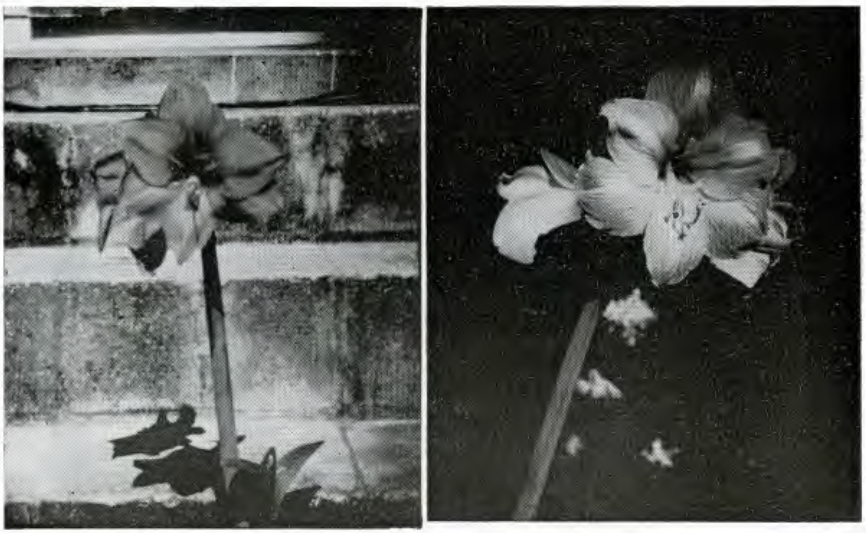


Fig. 15. Hybrid *Amaryllis* clones, *right,* 'Ruth Clark'; *left,* unnamed seedling. Originated by Beckwith D. Smith.

During this year (1957) the Dutch hybrids grown and collected by John T. Weisner of Fernandina Beach, and about which he has given progress reports in prior issues of HERBERTIA, were acquired by purchase and these will be used in further breeding efforts in my growing beds. An effort will be made to further propagate these named clones and seedlings with a small stock of Bolivian Amaryllis which were presented to me by Mrs. U. B. Evans, of Ferriday, Louisiana, a most charming lady and ardent disciple of *Amaryllis* culture, when I visited her this summer.

Some of my better Dutch hybrids are "Mary Lou" (Fig. 13), named for my wife, which is a rose pink clone from a cross between 'Pink Perfection' (Ludwig) and 'Doris Lillian' (Ludwig); "Irma",

named for my mother, (Fig. 14), which is a white clone with yellow throat, a cross between 'Ludwig's Dazzler' (Ludwig) and 'Maria Goretti' (Ludwig); "Duval Red" (Fig. 13) which was produced from pollen from 'Queen Superiora' (Van Meeuwen) on 'Lucifer' (Van Meeuwen); 'Ruth M. Clark' (Fig. 15), (named for a friend in Tampa, who has had notable success with hybrid *Amaryllis),* which was produced from pollen from 'Red Master' (Warmenhoven) on a field run Mead seedling. I call this cross a red and white, and, finally, an un-named orange hybrid (Fig. 15) obtained from a cross between 'Diamond' (Ludwig) and 'Salmon Joy' (Ludwig). Many seedlings are large enough to bloom next spring, and the better types will be segregated. To my way of thinking, the Dutch *Amaryllis* are the best so far obtainable, and there are still many possibilities for breeders to develop even finer flowers from the almost inexhaustible generic complex they afford.

MORE OF MY AMARYLLIDS

REG. F. HARRADINE, *Corresponding Fellow APLS*
102 Byng Drive, Potters Bar, England

In Herbertia, 1956, I described the Amaryllids and related plants garnered since I first started collecting them in 1950. That article brought me many letters—from North and South America, South Africa, Europe, India and New Zealand. Unfortunately, the name of my home town—Potters Bar—was omitted from my address given in HERBERTIA but as so many letters succeeded in reaching me, I am hoping none went astray. These letters were most friendly and encouraging.

I find I mentioned the names of nearly a hundred plants. As now, June 1957, my collection contains more than 220 named and unnamed species and/or varieties, I thought, maybe, you would like to hear more about my Amaryllids.

AMARYLLIS. The bulbs from British Guiana which I thought were *A. stylosa* have proved to be *A. belladonna major.* This grows well with me and regularly, in the Spring, each bulb gives two stems, with two flowers per stem. They are charming, so delicate in colour, shape and poise. I have another variety of *A. belladonna* from San Ignacio, Bolivia, the leaves of which grow more horizontally. The flowers are somewhat smaller than var. *major,* but are identical in details. The colour of these two varieties is rather difficult to describe, being neither red, nor pink, nor orange—an intermediate colouring—R H S 13/2 is as near as I can get to it.

Adrian Thompson, from British Guiana, visiting me a few weeks ago, brought for me, two bulbs of *Amaryllis barbata,* collected from Surinam. These have since flowered, and very beautiful they were. Large creamy white, with pale green throat. Typical wavy tepalsegs. I am fortunate in having such a lovely thing added to my collection. By a lucky chance, the Bolivian variety flowered at the same time and I was able to cross pollinate both of them. Pods are now well developed promising a good crop of seeds. I have several bulbs of the smaller type

species, have had them four years, but cannot persuade them to flower. Bulbs of *Amaryllis belladonna* var. *plena* have recently reached me from India.

Amaryllis blumenavia, from Mr. Mulford B. Foster, has been slow but is now growing well. From British Guiana I have bulbs of three varieties of *A. elegans*—pure white, almond scented—white with faint pink stripes—greenish white with pink stripes, also scented. In addition, seedlings of the variety *ambigua.* None of these have given flowers. Indeed, it has been a struggle to get them to survive, but they are now growing healthily. I hope eventually to see their lovely blooms. For a novice like me, trying to give these delicate things conditions similar to those of their native habitat leads to much head scratching! *Amaryllis immaculata* is another far from easy member. My bulb is a fine one and is healthily solid. Dormant at the moment, I am waiting for it to show signs of growth, and this time I hope it will be a bud.

Amaryllis correiensis (organensis) and *A. reginae* are growing well, but have not flowered. *A. reticulata* (plain leaves) has just reached me from India, together with *A. reticulata* var. *striatifolia* hybrid clone 'Mrs. Garfield.' *A. striata* var. *fulgida* is a fine plant, much more sturdy than the type. Flowers are somewhat similar, especially in colour, to those of the Bolivian *A. belladonna* previously mentioned. Four flowers in the umbel. Quite a lovely, delicate thing. For your records, I should mention that I have received direct from Argentina, a large parcel of bulbs of the type species, *A. striata,* which were collected from Entre Rios, Argentina. This place, I make to be about 150 miles east of La Paz, on the border of Uruguay.

My remaining *Amaryllis* species are all unidentified. Two from British Guiana, one of which is having a rare struggle to keep alive, the other has developed into a fine plant and has flowered twice. After the habit of *A. johnsonii,* but differs in many small details. Have very intriguing bulbs from Bolivia, (San Ignacio). They seem to be naturally deciduous, yet one is in full growth and the other dry resting. Medium sized, globular bulb, with hardly any neck, light brown tunics over bright green inner skin. Two strong, thick, leathery grey green leaves, strongly keeled, more or less parallel sided, about ¾ inch in width, reaching 12 inches in length, bluntly pointed. Leaves grow very vertical. On the back, the keel is coloured maroon for half its length. Each bulb has had two growing cycles, but neither has produced more than two leaves per cycle. I am most anxious to see this one flower. Can it be *A. viridiflora?* [Editor's note: it may be *Amaryllis cybister.*]

A bulb labeled *A. tucumana* flowered and proved itself to be anything but what the label said! More like the San Ignacio *A. belladonna,* but petals more regular and not waved. I could detect no paraperigone, but I may be wrong about this, for remember, I am very much a novice. For the time being I have put it amongst the unidentified. It is probably a species collected from the Tucumana district.

Seeds taken from a herbarium specimen collected from Arampampa, Bolivia, germinated and I have potted up 14 fine little bulbs, which are just beginning to sprout leaves. From a dried flower sent with the seeds, I imagine this to be another Bolivian *A. belladonna.*

Other unknowns are bulbs from Bolivia, collected from Puente Villa, Inquisivi, Chojlla, Sucre and Iquico. Not sufficiently developed to warrant description yet. Photographs of the flowers of some of them show rare loveliness. I rather think the species from Iquico will prove to be the new *Chlidanthus* of which Dr. Traub already has knowledge. [See 1957 HERBERTIA, pages 70-73.]

Lastely, arriving only a few weeks ago, bulbs of a species of *Amaryllis* from La Convension, Peru. Have just had a letter advising despatch of a parcel from Peru containing . . . "Hippeastrum [=*Amaryllis*] sp., pink blossom, very nice, and from a new place, far away from Cuzco, from the jungle; . . . perhaps a new species." What tremendous fun and excitement there is in this collecting of rare and elusive Amaryllids!

Now for the other genera. Visiting this year's Chelsea Show, Mr. Th. Hoog of van Tubergen, found time to visit me and we had a delectable evening together. Amongst other things which I hope to receive from him in due course, will be Brunsdonna tubergenii and *Hymenocallis quitoensis* (syn. *Leptochiton quitoensis).*

Brunsvigia natalensis has really got going this year and the foliage indicates a very healthy bulb. From Australia, earlier this year, I received several varieties of the Cape Belladonna hybrids, *Brunsvigia rosea—variabilis, multiflora, intermedia, perfecta, purpurea* and *spectabilis,* also the famous clone 'Hathor'. With these came also *Pancratium fragrans.* Having also received *P. canariense* and *P. zeylanicum,* I now have five species of this genus. I have yet to see any of them bloom.

A bulb sent to me as *Crinum zeylanicum* has turned out to be *Boophone,* and I feel sure it is the very rare *B. ciliaris.* I already have *disticha.*

Many Crinums have reached me. They are all growing well and many of them are sure to flower this year. Some buds are already showing. For the present I will just mention their specific names—*amoenum, bulbispermum* var. *sanguinum, graminicolum, johnstonii, latifolium, laurentii, powellii album,* and *P. harlemense,* and *rattrayii.* My collection of Crinums now numbers 22 species and varieties.

The only addition to *Cyrtanthus* has been the *obliquus,* which though it has grown well, has not yet flowered.

Eucharis fosteri, Eurycles sylvestris, Eustephia cocinea, E. "jujuyensis" and *Griffinia hyacinthina* are all in growth. *Hymenocallis macrostephana, H. rotata, H. senegambica, H. harrisiana* are all, most probably, well known in the States. One which is, perhaps, not quite so well known, sent from India, is *H. (Ismene) concinna.* The leaves and manner of growth are very similar to *H. harrisiana.* These *Hymenocallis* do well in my warm house and I get flowers from most of them. The hybrid 'Sulphur Queen' is a beautiful flower and has a very strong fragrance. *H. amancaes* also, is beautiful and fragrant. All appeal to me very much, they are so exquisitely and gracefully beautiful. I now have 15 species and varieties.

Hyline gardneriana has arrived recently from India. *Hypoxis villosa,* a close relation of the Amaryllids, from Southern Rhodesia, is interesting, but not startling. Long, slender, rough textured leaves, growing stiffly vertically. The flowers, on thin wiry stems, held rather fugitively within the leaves. Deep buttercup yellow, about one inch across, similar to the small ornithogalum, but without the centre cone. Each flower lasts about a day or so.

Additions to *Lycoris* species are *albiflora* and its variety *"carnea," sanguineus* and *sprengeri*—all from van Tubergen. All the *Lycoris* have lost their foliage and soon it will be time for the flowers—if they intend being so kind! I find them rather shy, or do I expect these things to settle down too quickly?

My Nerines now add up to 26 by the addition of the species—*Nerine fothergillii, falcata, laticoma (lucida),* and *salmonea* and the hybrids 'Aurora' and 'Hera.' Last season was very disappointing, very few flowered. We had very little sun during the preceding summer, so little in fact, that I did not need, even for one day, to put up any form of shading. Sunbaking seems essential to Nerines for any hopes of flowers. However, this year they are already losing their foliage and the bulbs look fat and well. We are getting plenty of sun, and I hope this season to have a bumper show. *Nerine salmonea* is a very fine, brilliant, deep pink. Came from Australia.

Now some real rarities. *Lepidopharynx deflexum,* from Bolivia. I know nothing about this other than what appears in the book by Drs. Traub and Moldenke—"Amaryllidaceae". I do not think it has been mentioned in any of the HERBERTIAS. I gather it is an ancient plant and rare. I doubt if it is in any collection outside America. I have six good bulbs, all dormant at the moment. *Worsleya rayneri.* Who, amongst Amaryllid devotees, has not longed to possess the "Blue Amaryllis"? I never thought to get it, but a friend from Rio de Janeiro, home on vacation last year, promised to get it for me if at all possible and was as good as his word. Two very fine specimens, sent by air, reached me about ten days after being dug. Consequently they have suffered very little check and are growing already. Having read all that has been written about this plant makes me wonder if I shall succeed in keeping it, let alone bring into flower. We shall see—I have many difficult bulbs—they are still there, and growing!

Strong, healthy looking leaves suggest that my bulbs of *Phaedranassa carmioli* and *P. chloracra* are quite happy. I know little about them so cannot forecast regarding flowers.

Another group of plants about which I know very little is the *Stenomesson.* As they are mostly found in rocky places on high ground, I assume drainage to be most important. Also, as the rocks are mostly of limestone, that they need a neutral or calcareous soil. As to their habits, the plants will give this information. All my bulbs, so far, have come from Peru. I have the species *croceum, humile, variegatum* (pink), *variegatum* (cream), *pearcei* and a species ex Cuzco. This latter is showing leaves very similar to *Urceolina,* rather different to the others. I also have *Pseudostenomesson morrisonii* Vargas.

Of *Zephyranthes* I now have 22 species etc. Many are just seedlings. Received as bulbs are—*braziliensis, sulphurea, smallii, traubii,* sp. ex Cuzco and sp. ex Lima. This latter is remarkable in that the leaves are like those of a small *Phaedranassa.* As seedlings I have—*brazosensis, clintiae, concolor, erubescens, pulchella, longifolia* and unidentified species ex Taft (Texas), ex Panama, ex Santa Cruz (Bolivia), and ex Commarapa (Bolivia).

To bring this long list to a conclusion I have only to mention three of the genus Tecopileae—*cyanocrocus,* and varieties *leichtlini* and *violacea.* This is the CHILEAN CROCUS, noted, I believe for its lovely colour. Not an Amaryllid, but a close relative.

Nearly seven years since Amaryllis first cast her spell! It seems but half that time. I have read a great deal, especially since I became the happy possessor of all the volumes of HERBERTIA, and although I have succeeded in collecting so many of these rare and lovely things, I feel I have only made a beginning, such a large number yet remain to be found. Again, very few of my plants have flowered. When they have become properly established and give flowers with some sort of regularity, imagine the opportunities there will be for hybridising. I have already made a start with *Amaryllis forgetii* X *A. reticulata striatifolia; A. belladonna* (San Ignacio) X *A. forgetii; A.* hyb. 'Rose Queen' X *A.* sp (British Guiana); *A. belladonna* (San Ignacia) X *A. barbata* and the reverse cross. The first cross, in particular, from the foliage, looks most interesting. Characteristics of the two species have definitely been exchanged—it is reasonable to assume that the flowers also will show a similar transference of character. They have reached 3 inch pots.

When I built my first greenhouse, my ambition did not go much further than pelargonums and fuschias, etc. I little thought it would lead to the housing of so much treasure. I would again like to take the opportunity of emphasising that, but for the great good-heartedness of my many horticultural friends, I would have had nothing to write about. Bless them, they are wonderful.

In conclusion, may I make a request? If any of those who read these notes of mine, have information which I obviously lack, and which would be so valuable to me in growing these plants, I should be most grateful if they would write to me.

COLD SUSCEPTIBILITY OF AMARYLLIS

WYNDHAM HAYWARD, *Florida*

At least four species and varieties of *Amaryllis* show a distressing sensitivity to cold in Central Florida. Among these are *Amaryllis Albertii,* the double form found in the West Indies, *Amaryllis belladonna* Linn. (Syn.—*Hippeastrum equestre)* native from the West Indies and Mexico to Bolivia and Chile, *Amaryllis striata* and *Amaryllis reticulata* var. *striatofolia* and its named form, 'Mrs. Garfield.'

Mr. Claude W. Davis of the University Hills Nursery, Baton Rouge, La., writes under date of 9/5/55 to inquire why his *Amaryllis belladonna* Linn. bulbs obtained from a plantation in the delta country south of New Orleans, refuse to bloom well in the garden at Baton Rouge some distance farther North in the state. The likelihood is that the answer is to be found in more severe cold weather experienced at Baton Rouge in winter than south in the Delta country.

In Central Florida, in a climate only slightly warmer than prevails at Baton Rouge, *Amaryllis belladonna* Linn., a common garden bulb, will bloom widely after a few warm seasons. After several cold winters, when the temperatures go down into the 20's, the bulbs are injured or shocked and give only sporadic blooms. They are quite tropical and suffer systematically, it appears when frosted. In plantings at Lakemont Gardens in recent years, two long lines of *Amaryllis belladonna* Linn, (the common orange-red form identified as variety "Major" in all probability) were cut down by frosts, the foliage frozen to the ground on several occasions. In the spring after such freezing, the bulbs, an inch or so under the soil, were found rotted at the top in many instances. The recovery was usually satisfactory the next summer growing season, but a succession of frosts in succeeding winters has decimated the two rows of some hundreds of bulbs until they are almost gone.

All this time the thermometer seldom went below 30, and never below 25 degrees. Mr. Davis reports that the winter temperatures at Baton Rouge do not often go below 25 degrees F., and that they have "a light freeze or two each winter, but the temperature seldom goes below 25 degrees and that is not for long." He says the bulbs were reported to have been free blooming at their original plantation home south of New Orleans.

Amaryllis belladonna Linn., seems to take kindly to the sandy soils of Central Florida. In fact the bulbs grow better and larger without special fertilizing and mulching, etc. Fine stands of the bulbs are occasionally found in rows on old country places in warm locations, where the bulbs have multiplied famously. If grown in too rich soils, moist and with too abundant fertilizing the bulbs of this species tend to multiply excessively, forming so many offsets that the parent bulbs are crowded to reduced size. Besides the temperature factor, of course there is the matter of the growing medium and other cultural requirements of all of these bulbs. Other things being equal and satisfactory, the temperature factor seems to be the most important.

Amaryllis reticulata and its striped-leaved form, variety *striatifolia*, were collected in South America in recent years by Mulford B. Foster. He reports both the green-leaved form and the striped-leaved variety, a handsome plant in good condition, grow famously with little care in his greenhouses at Orlando, Fla., whereas the author has had difficulty growing the 'Mrs. Garfield' form of *A. reticulata* var. *striatifolia* in flats and pots outside under trees or in the lath house where the bulbs get temperatures as low as 30 degrees. This kind of cold weather does not injure such hardy types as *Amaryllis* x *johnsonii* and *Amaryllis acramanii*, as reported elsewhere.

Amaryllis albertii has been imported into Central Florida gardens many times, but the writer has always experienced failure with it unless grown in a protected place. In beds in the lath house or in the open garden, the bulbs grow well all summer, but at the first frost, maybe 30 degrees in winter, the foliage goes down and the bulbs show damage to the tissues on the upper or top side in a few days or weeks after the cold spell has passed. The tissue turns brown and dark, even though the bulbs are planted two inches deep in the ground, apparently shocked by the cold temperatures.

This behavior is found in other super-tropical plants as *Alpinia purpurea,* the "Red Ginger" of Hawaii, when grown in Florida. The plants of "Red Ginger" when grown in Florida will make a foot of growth or more the first summer from roots shipped from Hawaiian nurseries, and then die down and rot away the first time they are frosted by weather below freezing, even a mere degree or two (30 or 31 degrees F.). Many times they fail to come back at all the second season, the roots having rotted away completely in the winter following the frost. This species comes from warmer areas of the East Indies, and is ultra-tropical, not being able to withstand the slightest frost or freezing temperatures in the garden. Presumably in a heated greenhouse they could be brought through without difficulty. Other species of *Alpinia,* as *A. speciosa* ("Shell Ginger",) can stand several degrees of frost and are seldom damaged in Central Florida. *A. speciosa* comes from the higher altitudes of northern India.

Amaryllis striata Lamarck *(syn.—Amaryllis rutila)* is found as a pot plant in Florida and other states. Many times the bulbs have been handed down so-to-speak from generation to generation as pot plant heirlooms. The author knows of a family where bulbs of *A. striata* var. *crocata* have been cherished for 75 years in New England. They have never succeeded in the open or in lath house conditions with the author at Lakemont Gardens, although occasionally bulbs will survive in the ground in sandy loam for a few years when planted deeply (3 inches down to top of bulb).

In pots when not subjected to frost or freezing temperatures, bulbs of *A. striata* thrive well under good culture. In the greenhouse or in protected beds under overhanging roofs and *in sheltered corners of the garden where frost does not ordinarily reach, they may multiply like rabbits and make huge bulbs of 3 inches or so,* very large for this species. They prefer a sandy loam with extra good drainage, and this may be less protection for these *Amaryllis* in cold spells than heavier more humusy growing mediums.

THE SMALLER (INTERMEDIATE) FLOWERED AMARYLLIS

Mrs. A. C. Pickard, *Texas*

If you enjoy the intermediate as well as the giant blooms, you will enjoy the lovely "Graceful" amaryllis clones. We are indeed grateful

to Van Meeuwen & Sons of Hemstede, Holland for their foresight in offering this lovely pure red dainty flower.

Many of you will recall the introduction of this original Gracilis strain in 1950 Herbertia. I understand they are out of this stock for a while. Because of outstanding qualities and features, these clones stole the show. They aroused my enthusiasm to the extent that I purchased a few of the clones when first introduced to the market. They are expensive "fellers" but through the years the original bulbs have retained their vigor.

These perfectly proportioned intermediate flowered formed amaryllis have the same qualities as the large flowering Dutch hybrids and make excellent pot plants because of their size and pure red color without any green in the throat of the flowers. It does not seems strange that these "Graceful" clones will always remain a prized possession because the hybridizer of these rare beauties spent 25 years of the best years of his life in the hybridization and selection of this intermediate strain.

With its interesting background the writer has found after quite a few years of growing this Amaryllis that its cultural requirements are the same as those for the large flowered Amaryllis with one exception. Be stingy with plant food. Keep this particular clone a bit hungry (not stuffed). Always plant a bulb in fertile soil mixture and keep moderately moist during the flowering and growing season. Like their big cousins they like a rest during the early fall months.

It is advisable to use pot culture for several seasons. They are valuable as a blooming pot plant and can be planted more than one to the pot to give maximum bloom in limited space. Each mature bulb will usually produce two to three 18-20 inch scapes topped by 4-6 flowers to each scape, with perfectly formed velvety textured flowers. It is indeed a treat to own even one pot of these beautiful novelties in bloom at Christmas. We feel that at any price they are cheap compared to the quality of florist grown Poinsettias which are often beautiful but fleeting.

Remember if the room temperature is high the blooms cannot last. Also a sunny window will be costly to the flowers. Otherwise with a bit of care the blooms will last for weeks. After the last bloom has died, cut the flowering stalk down to about 2 inches from the top of the bulb and continue to grow good lush foliage during the spring and summer in semi shade. Do not let the pot dry out during the growing season. Then keep an open eye for the "Graceful" clone is noted for its prolific offsets, and in no time you will have a bountiful stock. Remove the babies when they develop their own roots and have a tendency to get out in the flower world to flaunt their lovely blooms, and they usually are quite grown up gals in two years.

The flowers set seeds to self-pollination, but it takes at least three years to produce a blooming size bulb from seed and then a year or two longer to decide if the flower is distinct, but all are worth waiting to see. We are anxiously waiting to see our first blooms this spring from self

pollination of the "Graceful" clone and feel assured some of these seedlings will produce pleasing flowers that have delicate grace and charm.

Amaryllis is the answer to the "hobby bug." For those who are not too particular as to solid colors, Ludwig & Co., of Holland, offer a novelty, "Ludwig Gracilis" in a lower price range with medium flowers in mixed shades. The colors vary from orange to rose and most all have a faint streak in the throat.

Speaking of smaller flowers—the dwarf species are not to be forgotten or overlooked. The *Amaryllis striata* and var. *fulgida* all produce flowers of great charm in a range of color from salmon, salmon pink and cheerful red. Usually a pointed star marks the throat of the flowers. The species are excellent seed plants and produce many small offsets that often lie dormant for several months before producing leaves. Due to their delicate color and size these small species will always be stars in the genus *Amaryllis*.

With my taste for growing and hybridizing, I have come to the conclusion there is no cure for the chronic mental ailment "amaryllisitis" and I am resolved to make the best of the situation. Grow more amaryllis and enjoy beauty.

COLD STORING AMARYLLIS SEEDS

WYNDHAM HAYWARD, *Florida*

The "cold storage" temperatures of an ordinary electric refrigerator in the food compartment are adequate to prolong the vitality and viability of hybrid *Amaryllis* seeds many months beyond their usual span of life in the hot, humid Florida climate. This seems all the more remarkable when it is considered that the *Amaryllis* is a bulb of sub-tropical and in some species purely tropical origin.

This adaptation of the seed to cold storage was shown in the late spring of 1957 at Lakemont Gardens, Winter Park, Florida by the planting of four packets of Ludwig & Co., hybrid *Amaryllis* seeds on May 24th in four 6-inch plastic pots, lightly covered with the same potting soil and watered and shaded for some weeks thereafter.

While there have been reports that *Amaryllis* seeds retained their vitality after a year or even two years in the California climate, Florida weather conditions are notoriously unfavorable for the seed's viability. The Ludwig seeds are imported from Holland by the hundreds of packets by Lakemont Gardens every year, and experience has shown that while the seeds will continue to give a good germination for at least two months after its arrival, which is usually around the 1st of July each season. By September or October however there is a major loss in the seeds' ability to grow.

Some years the seeds retain fair vitality until October or November, but many seasons there will be less than 10 per cent germination of the Ludwig new crop seed planted in those months. Hence the interesting project of storing four packets, two of the pure white seeds, which is always of lower germinating power, and two of the rose-pink shades

seed, usually a reasonably vigorous type, in the authors home refrigerator in late summer, around September 1st, 1956, while the seed still gave a good germination result from test plantings 75 or 80 per cent.

The packets were carefully wrapped but not sealed in a polyethelene bag such as is used for food in the electric refrigerators. Tests of the overnight temperatures of the upper shelves of the electric refrigerator showed that these ranged from 35 to 40 degrees F. or so, depending on the weather, temperatures of the house and the amount of heavy ice coating on the freezing unit. No effort was made to control the humidity, but it is presumed that this was reasonably high. Often there would be dripping water from the lower part of the unit onto the catch-tray.

The following year, the seeds were planted 25 (one packet) to a six inch pot, late in May as indicated, the black papery wafers being laid flat on firmed sandy compost, and covered with a light sprinkling of the same compost. The pots were watered every day or two and kept out of heavy drip under a mandarin (citrus) tree, with little direct sun, but plenty of light. In three weeks there were a number of seedlings sprouted, and by four weeks the seeds of pink hybrids had sprouted uniformly 75 to 80 per cent and the pure white seeds gave 11 and 12 seedlings respectively in the two pots from their packets of 25 seed each.

These young seedlings were two inches high and growing fast, ready to be lined out in a flat by the end of June. The germination was as good as may be obtained many times with fresh seed just arrived from Europe. So far as known, *Amaryllis* seed stored at ordinary house temperatures in Florida over the summer, fall and succeeding winter has never shown any germinating power the following spring with the rare exception of an occasional seedling from many seed planted. Often not a single seed will sprout. This seed was conserved in good germinating condition at least six months past its usual life span in Florida.

The only time this seed was exposed to temperature higher than 40 or possibly 45 degrees F. was during occasional de-frosting periods of 10 to 20 hours during the nearly *nine months* it was in cold storage.

VEGETATIVE PROPAGATION OF AMARYLLIDS

CLAUDE W. DAVIS, *Baton Rouge, Louisiana*

My interest in the vegetative propagation of *Amaryllis* and related bulbous plants began back in the summer of 1955. For about five years I had been growing a bulb of Ludwig's beautiful 'Doris Lillian', and while it bloomed each season it had never produced an offset. I had been offering *Crinodonna corsii* cl. 'Fred Howard' for sale, but natural increase from offsets was insufficient to meet the demand. I know that various plants could be increased faster by cutting up the bulbs, having read of the technique of "cutting" with amaryllids which had developed by Dr. Hamilton P. Traub and published in SCIENCE and HERBERTIA (Traub, 1933; 1934; 1935; 1936) and by I. W. Heaton in HERBERTIA (Heaton, 1934; 1936). See "Literature cited" at end of article.

I sought information on "how to do it" from Dr. Hamilton P. Traub, from Mr. Wyndham Hayward of Winter Park, Florida and from Prof. Ira S. Nelson, S. L. I., Lafayette, La., and received helpful suggestions and encouragement from all of them, so in early September I sharpened up my knife and went to work.

The bulbs were split vertically, as one would cut an apple from the stem to the blossom end. Each bulb was divided into either four or eight sections or "pieces of pie", depending on the size of the bulb. Each section was further divided by beginning at the center and counting four or five scales and with the blade of a pocket knife carefully removing these, together with the section of the bulb stem to which they were attached. The process was repeated until the entire section was divided into small pieces of four or five scales held together by a section of the bulb stem.

Before cutting, the foliage was removed at the neck, and the bulb was carefully washed. After the bulb was cut, the sections were soaked for a short while in a mild fungicide. Because it was available, I used Dithane Z-78 at the same strength which is recommended for spraying roses, but any one of several commercial fungicides would help prevent rotting before the new growth begins.

The sections were then placed vertically in a standard greenhouse flat, four inches deep, and covered to the top with vermiculite. The flats were well watered and placed on shelves in a storage room which had windows, but no source of heating in the winter. (It is probable that a mixture of sharp sand and peat would do equally as well as vermiculite for bedding material.) Then came the long wait before new bulbs were formed at the base of the scales and top growth appeared. The flats were kept moist and eventually, in two or three months, my faith was rewarded as new growth began to show above the vermiculite. With heat and more light in the storeroom, growth might have been faster, but the winters are mild in Baton Rouge with temperatures dropping outdoors only a few degrees below freezing, and then only for a short time.

In the spring the new plants were transplanted out of doors in light shade in the ground. The bed was slightly elevated for drainage and the texture of the soil was improved by working into it some sharp sand, peat moss and a small amount of the commercial, dried sheep manure. Two years later (in the fall of 1957) the new bulbs are about the size of a black walnut. If present rate of growth continues the plants should reach blooming size after three years of growth, or in the spring of 1959.

The results from this project were so encouraging that I repeated the process in the fall of 1956 and with a larger number of bulbs. The increase obtained from one bulb of a variety is shown in Table 1 for each of the two years.

TABLE 1

1955		1956	
'Salmon Joy'	39	'Bouquet'	22
'Doris Lillian'	44	'Sweet Seventeen'	25
'Ludwig's Scarlet'	14	'Pink Favorite'	20
'St. James'	21	'Red Master'	11
Dutch white seedling	14	'Daintiness'	15
Mead hybrid	31	'Ludwig's Dazzler'	8
Crinodonna corsii		'Cherry Queen'	16
cl. 'Fred Howard'	39	'Wyndham Hayward'	15
		'Queen's Page'	22
		Crinodonna corsii	
		cl. 'Fred Howard'	42

The procedure is so simple that these results could be duplicated by anyone with the nerve to slice up a good bulb and the patience to wait for results. In a colder climate it would undoubtedly call for the use of some form of heat during the fall and winter months.

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AMARYLLIS PROPAGATION PROBLEMS

WYNDHAM HAYWARD, *Florida*

Most of the difficulties mentioned below in the propagation of hybrid *Amaryllis* by bulb cuttage have been encountered and studied by various growers in Florida to assure a reasonable success of the method in the hands of any careful grower. A vegetative method of *Amaryllis* propafation was first announced by Miss Luyten in Holland, but the different cuttage method worked out in Florida by Dr. Hamilton P. Traub (HERBERTIA, vols. 1 & 2, 1934 & 1935) has been universally adopted in Holland and the United States.

Propagation by cuttage can be done either in the greenhouse as in Holland and the North, or under lath house conditions in the lower South. The author, who made numerous propagations of named clones and selected seedlings during the 30's and early 40's, prior to World War II, has made careful consultation with John Weisner of Fernandina Beach, Fla., who is the principal American grower doing a major work in this field at this time.

The various problems of vegetative propagation of *Amaryllis* may be grouped under five headings: (1) time of cuttage; (2) technique

of cuttage; (3) propagating medium; (4) genetic factors of bulb as affecting the results; (5) treatment and transplanting of propagations.

(1) The time of bulb cuttage into pieces varies from August to October. Doubtless it depends on the time the bulb reaches effective dormancy. Certain strains and varieties of *Amaryllis* will tend to lose their leaves and even their roots in August in Florida cultures. They would probably be satisfactory for use in propagation at that time if the weather is not too hot and dry. A long spell of hot and dry weather in August or September, unless the propagator is prepared or equipped to give the propagations adequate attention in the matter of watering and shading, might be disastrous in results. Most of the *Amaryllis* bulbs will be found to be reasonably matured for the season and going dormant by the middle of October. At least they have made their best growth.

(2) The original technique of Miss Luyten in her cuttage method as described by her in the early numbers of HERBERTIA contemplates a virtual "gouging" of the scales of the bulbs from the base or root crown. Dr. Traub's and I. W. Heaton's techniques as described in the early Herbertias call for a vertical sectioning of the bulb like cutting pie on a central axis which is the vertical center of the bulb. The foliage is cut off first, slightly above the top of the bulb, and the root base with any roots attached may be left on, or it is sliced off close to the bulb. In the latter case this root base can be planted with the cuttings and will produce several bulblets in some cases.

The Traub and Heaton methods provide for horizontal sections or cuttings of the vertical divisions if the bulb is large enough, to make two to four smaller propagating pieces of the bulb, all with two or three leaf scales attached to a small piece of the root base or crown. The Luyten method calls for removal of sections of the scale from the root base with portions of the base attached, but it seems doubtful if the importance of having a strong piece of the root base attached occurred to Miss Luyten, as there appears to be little meristem in the scales themselves.

(3) For his propagating medium Mr. Weisner of Fernandina Beach, Fla., has reported that he uses coarse white building sand (presumably white washed fresh-water lakebottom sand) such as is sold all over Florida for building and cement work. In a flat 4 inches deep, he puts two inches of the sand with a quantity of commercial dried, pulverized and sterilized sheep manure mixed in, then on top of that a two-inch layer of the plain white sand with no other admixture. Then the propagations are planted in the top sand, so that the tips of the leaf scales stick out a fraction of an inch or more. The flats are then shaded and protected from frost the remainder of the winter, and watered sparingly when needed to prevent becoming dry. Now and then he may water with one of the commercial liquid fertilizers in weak solution.

The Traub and Heaton techniques call for the use of a sand-and-peat propagating medium. This could vary according to the coarseness of the sand, and the texture of the peat, which should be a fine grade

sifted horticultural type. The sphagnum type peat (imported) has usually been used, but unless too sour, it may prove possible to use the southeastern states carex type peat in fine sifted form. Usually a furrow is made in the peat across the flat, and the little pieces of cut *Amaryllis* bulb are set in a row like little soldiers and the peat and sand mixture drawn to them from both sides to cover them. The pieces may be erect or slanting. The tips of the leaf scales should show in a row after planting. The rows may be two to four inches apart in the flat.

(4) The genetic factors involved may be the most important thing affecting the success of the operation on any particular bulb or clone. Certain bulbs have a small base or basal crown by nature and make poor propagators. Certain clones have little vigor genetically and produce few sprouts from the pieces. Certain clones make smaller bulbs naturally and are slow to multiply for that reason in comparison with others. From small bulbs only 24 to 40 cuts may be made while 50 to 75 can be made from a large bulb. However, Mr. Weisner reports that he has settled on 30 to 40 pieces as being most satisfactory for the average cuttage count of his propagations from each bulb. A "good propagator" may even produce more bulbs than the number of pieces planted, some pieces producing two, or even three bulblets. Pure whites and pinks are notoriously poor propagators, and one might be satisfied with less than half the usual results in their cases. Some fine bulbs lack disappointingly the power of reproduction when propagated by the cuttage method. Others yield to it like rabbits. Unfortunately the better propagators are usually the poorer quality hybrid *Amaryllis* from an ornamental, artistic or exhibition point of view, but fortunately certain of the finest quality Amaryllis are also good propagators. Tenderness of the bulb to frosts may figure in the result.

(5) At present in Florida the propagations are permitted to remain in the propagating medium in their flats for several months during the winter, shaded, watered and protected from frost as necessary. A sharp freeze in Florida which may occur any winter in December, January or February, can ruin the entire year's crop of propagations as the damp flats are in perfect shape to be frozen several inches deep if left exposed in the unheated lath house outdoors as is the custom in Florida. In greenhouses the precautions against freezing would be unnecessary. Temperatures down to actual frost do not seem to affect the propagations seriously other than to slow down the rate of development of the young bulblets forming on the pieces.

Tiny leaves will begin to show above the flats in December to March, and by April, when the time has come to transplant the propagated bulblets, these will be found, under good conditions, to have developed to sizes from a small pea to large marbles. In Mr. Weisner's technique the bulblets make roots which go down into the sheep-manure-fertilized lower layer of sand, and gain rapidly from that time on. In the Traub method, the bulbs can be watered with any good soluble fertilizer of a well-balanced ration, especially with plenty of nitrogen and potash, which are extremely important to *Amaryllis*.

In spring the bulblets are transplanted to their growing beds in the lath house or field, or to pots and flats with wider spacing, in the usual growing composts. From that time on their handling is exactly similar to the growing of seedlings except that the different clones are carefully grown in separately marked rows. They may be marked in their flats when first planted with waterproof labels, such as the common white plastic kind (Gro-Quick) sold today.

CONTROL THE MAJOR BULB FLY

JOSEPH C. SMITH, *M.D.*

It is advisable for those obtaining bulbs from persons other than competent nurserymen to inspect them carefully for evidence of disease and insect pests. I have received bulbs with a number of things lodged between the leaves at the base. This summer some very valuable white *Lycoris* were received, and it was noted that some were softer than others. One was then cut open lengthwise through the center between the leaves, and a large grub of the Narcissus or major bulb fly was found eating out the heart of the bulb. The rest of the bulbs were cut and a single grub was removed from each. These were killed and the halves of the bulbs planted. Fortunately lycoris will propagate by cutting in this manner, and leaves have appeared this fall where the halves were planted. Most of the amaryllids will propagate from a cut bulb, and it is much safer to find and kill these larvae than to risk infesting your area when bulbs come from an area known to have the greater bulb fly. The lesser bulb fly is not so vigorous and its larvae usually attack and succeed in killing only diseased and weakened bulbs.

Control measures of bulb flies will be found in Dr. Traub's new book, "Amaryllis Manual".

HYBRID AMARYLLIS IN THE GREENHOUSE

J. F. STEWART, *California*

This article is based upon the writer's experiences in the glasshouse culture of hybrid Amaryllis at Downey, in Southern California, and does not cover conditions encountered in colder climates where the houses are artificially heated, although the general culture should be similar in all cases, except that in the heated houses, with their high humidity, there would be greater danger of fungus attacks. Our houses are not heated, other than the small amount given off by the propagating beds, but there is a gas connection in the larger one for the possible emergency use of a heater in winter weather.

Numerous types of houses are available, from lightly constructed small and comparatively inexpensive ones with wood frames, to very ornate and beautiful ones of wood or metal, and the more or less standard commercial types. They can be erected by a carpenter or a good do-it-yourself man. Some are sold assembled in sections that can be erected by the purchaser, and some are erected complete by the

manufacturer. Each individual will match his glasshouse to his own conditions, but in our case the choice was limited by financial considerations. Large houses are more satisfactory than small ones. One thing should be stressed; get the highest quality possible, even at some sacrifice of size. Your glasshouse should outlast you.

Since for hybrid Amaryllis culture two of the most important considerations are light and ventilation, heat being a separate one governed by special conditions, the house should be set in the open, away from buildings and trees if possible, with the door and ventilator openings so located as to take advantage of the prevailing winds. We use greenhouse glass paint to filter the sunlight for one house, and widely spaced lath on the other, but do not like the lath and will remove it and use paint on both houses from now on. The function of the paint is to exclude enough of the sun's rays in summer to keep the heat within reasonable bounds. It can be washed off by the fall rains, or a hose if necessary, to admit more light in winter. Most plants, including hybrid *Amaryllis,* tend to be compact and stocky when grown in full sunlight, but to stretch out and become leggy and tender when grown in subdued sunlight or shade. Between these extremes a compromise must be reached as to the density of the paint to be applied to the glass.

We have pot benches all around the walls of the houses, except at the doors, and propagating benches in the center of the larger house. The tops of the benches which are to be used for potted bulbs are made of one inch by three inch slats, spaced about one inch apart to allow air to circulate. Ours are 39″ wide and 31″ high, which is about right for a tall man. The propagating benches, or hot-beds, are made solid, without spaces between the boards, and have sides and dividing partitions 6″ high. Holes are bored in the bottoms for drainage.

The house is wired for lights and outlets for the electric soil heaters. These are flexible lead covered wire heating elements coiled on the bottom of the propagating beds, and controlled by thermostatic switches to maintain the desired temperature range. The matter of propagating will not be gone into here, but will be discussed in another article.

The glass in the east and north walls is not painted, and in the south and west is painted down to the tops of the benches only. This lets in enough light under the benches to make it possible to use most of the space under the benches around the walls for seed beds, where we start our best seeds. Here the original soil, a sandy loam, has been retained and is used as is. The seeds are sown, thickly, in furrows about ⅜″ deep, which, instead of being v-shaped, are flat bottomed and about 1½″ wide. These rows are spaced at 6″ center to center, and run at right angles to the glasshouse wall. The soil is lightly packed on the seeds, smoothed over to make a flat, level bed, watered with a fine spray, and then kept continuously moist, but not soggy, until sprouting is complete. The soil should not become caked. There is some drip from the pot benches above but it does not become a problem. When sprouting is complete, fertilizing should be started, using a fertilizer high in

phosphorus and potash. We use 5-10-10 placed as a narrow band between rows, using about a level tablespoonful to the 30″ row, working it in with the small hand cultivator and watering well with a fine spray. This is repeated at about eight week intervals until time to transplant the bulbs the following season. For safe transplanting to outdoors, the bulbs should be at least a ½″ in diameter, and should be well watered until established, being sure that the water reaches the roots. Transplanting during a hot dry spell should be avoided. Scarce or highly valuable seedlings should be transplanted to flats or small pots until they are an inch to an inch and a half in diameter before being put outdoors or into permanent pots.

It is quite true that a well grown Amaryllis bulb will bloom under almost any conditions, even to the extent of putting out a low grade bloom with no soil at all, but it will respond readily to good treatment. There are probably as many different opinions about the composition of an ideal potting soil as there are Amaryllis growers, but it seems safe to say that it should be neutral or slightly toward the alkaline side. It should be sufficiently loose for good drainage but not so loose that water will run through and leach out the nutrients, and should be fairly rich, with a high proportion of phosphorus and potash. We try to use a mixture of one part leaf mold or compost, one of building sand and one of our own garden soil. To this we add finely ground bone meal (bone "flour") at the rate of one measuring cup to a batch of about two cubic feet of the mixture, and about a half cup of agricultural lime. The amount of lime would possibly vary for other soils. This should be turned and screened until thoroughly mixed. Animal manures are to be avoided, except such as have previously been thoroughly assimilated by the soil or compost. Note that too much nitrogen promotes tender leggy growth. This soil should be moistened and allowed to stand until the moisture is thoroughly distributed, so that a squeezed handful will hold its shape in the opened hand, but can be readily crumbled without leaving lumps. It is essential, and this is important, that the soil be neither powder dry nor soggily wet when used. The powdery dry soil will completely and solidly fill the pot, and then when watered will swell and compact, making root growth difficult and drainage poor. Too wet soil will give similar results by puddling and forming a hard lump when dry, which condition is difficult to remedy, except by repotting.

It is advantageous to have a good sized potting bench, large enough to hold the soil, pots, and tools, and of a height to suit the user. The back and sides should be at least six inches high, to retain the soil and equipment. A simple bench is easier to keep clean and sanitary, but it can be fitted with bins, shelves, and so on, if desired.

Now comes the question of containers. Again arguments will arise, and it would be difficult to justify any arbitrary rule, but here is the way we see it. For seedlings, propagations, and small offsets, use nothing smaller than four inch pots, because smaller ones dry out too rapidly, in them the bulbs become root-bound too soon, and it is difficult to keep

the fertilizer away from the bulbs. Full grown bulbs, except the extra large ones, do well, and bloom well, in six inch pots, but we use eight inch to allow offsets to grow to good transplanting size. Dipped gallon cans are good containers, but do not aerate as well as pots, do not last as long, are more difficult to transplant from, and the bulbs in them seem to be less disease resistant than those in pots. The soil surface should be nearer the top of the can than the pot. Glazed pots are not nearly as satisfactory as common clay ones, and we have discontinued using the former.

Potting must be carefully done. When bulbs are transplanted from the garden to pots during the growing season, all roots are retained, and, because of the profusion of roots, great care must be taken to assure that no air space remains under the base of the bulb. In the bottom of the pot we use a pot shard, with one edge resting on another small piece, over the drain hole, then about one half inch of crushed rock, and then about three inches of soil. Work a good handful of soil in among the roots to make a ball at the base of the bulb and set it in the pot, fill the balance of the pot and lightly compact the soil. When potting dormant bulbs, the roots of which are quite short, proceed as above, except that a mound of soil is formed at the center of the pot, on top of the three inch layer, over which the roots are spread with the base of the bulb directly on the mound of soil, then the balance of the pot filled and lightly compacted. All this is to be gauged so that when the potting is completed the bulb will be set with about one half of the base portion, exclusive of the neck, in the soil, and the top of the soil about three quarters of an inch below the top of the pot. Set the pot in its place on the bench and water it slowly, so as not to wash the soil.

This is the time to mark each bulb with a permanent marker. We are using aluminum strips now, about ¾″ wide and six long, which we mark with steel stamp numbers, using a simple code of our own for basic data, and a serial number under which we record specific information in a notebook. We use this serial number arrangement throughout our work for keeping track of seed beds, flats, bulb rows, potted plants, etc. If a marker is lost it is then necessary to wait for blooms; maybe three years. Keeping the bulbs in color groups is a good idea.

[To be continued in **Plant Life, Herbertia Edition,** 1959.]

NOTES ON STERNBERGIAS

WILLIAM LANIER HUNT, *North Carolina*

Sternbergias are certainly the fall blooming yellow flowered bulbous plant pre-eminent for parts of the United States where their winter produced foliage can survive. Nothing can touch *Sternbergia lutea,* (Bot. Mag. sub. t. 290) for sheets of yellow in September and October. They are tough, easy to grow and extremely satisfactory in the landscape, as they do not have to be often transplanted to flower. The evergreen foliage is handsome as a ground cover in winter and lasts

in good condition, most years, until daffodil foliage goes down. Mrs. Wilder, in her Adventures with Hardy Bulbs, remarked on the fact that *Sternbergia lutea* was hardy in protected spots in the vicinity of New York City.

There appear to be several of *Sternbergia lutea* in collections and gardens in this country. The old form from early Virginia gardens is a tried-and-true for the South above Middle Florida. From an old garden in North Carolina, the writer has collected a very wide leaved form which may be a form of *S. lutea.* The blossoms are rather small and the scapes short. Flowering some time after the Virginia type, these plants are valued more for the handsome wide winter green foliage than for the flowers.

A few years ago, the writer was astonished and rejoiced to find in a "ten cent store" some small bulbs of *Sternbergia.* They have turned out to be a form with much lighter green leaves than the Virginia type has—even when given the same fertilizer. The flowers are smaller and not so freely produced, and the advantage in having them seems to lie in their somewhat late season which overlaps with that of the Virginia aristocrats and continues for a week or more. A nice surprise amongst these bulbs was a form of *Leucojum* with *teeth edged* scape! This one does not seem to fit into my friend, Sir Frederic Stern's book anywhere!

The writer has never grown the two species of "cylindrical flowered" sternbergias: *S. colchiciflora* and *C. macrantha,* said to bloom in the fall in England and to produce the foliage in spring. These are well illustrated in Bot. Mag. sub. t. 744 and in Bot. Reg. sub t. 2008. Mrs. Loudon's The Ladies' Flower-Garden of Ornamental Bulbous Plants has pictured *S. lutea* and *S. colchiciflora.*

The "spring flowering" *Sternbergia fischeriana* begins to flower in my North Carolina collection in November. The foliage is then about two inches long. Buds appear, and on the warm sunny days which ensue, the first flowers open on scapes of an inch or more. Toward Christmas, the leaves have attained four to five inches and begun to show their beautiful habit of twisting into spirals. Flower scapes are then three to five inches long, and the patch becomes an eye-catching spot.

Nowhere is the semi-glaucous foliage of *S. fischeriana* better illustrated than Parkinson's *Paradisus.* Faithful old Parkinson has shown us exactly how this foliage looks. In middle Carolina, the temperature drops to a few degrees below zero for a few hours in the night in early January. This freezing does not affect the handsome twisting foliage at all. Neither do the regular sudden drops of forty degrees and more in four hours. While *S. lutea* is lying more or less on the ground in cold weather, *S. fischeriana* seems to defy the cold with erect foliage. The flowers get frozen, but more are immediately produced like those of *Iris unguicularis.* Seed vessels are produced on *S. fischeriana,* and it will be interesting to see whether crosses can be made with the other species and forms. The writer has not consulted the CHROMOSOME ATLAS on this subject.

For cultural and landscape notes, see PLANT LIFE, Vol. 8. No. 1, 1952, page 119. In that article, the writer stated that he was going to see if a planting of bulbs over ten years old might be made to flower again without transplanting by scattering an inch of good soil and some bone meal over the top and then replacing the mulch of pine needles. Results: the 2nd year after this treatment, fourteen out of the average of sixty-six bulbs in each clump flowered. Of course, such a planting

Fig. 16. Paramonga Lily, *Paramongaia weberbaueri,* from Peru, side view, as grown in Dr. Traub's garden at La Jolla, Calif. Photo by Dr. Joseph C. Smith.

must soon be taken up and replanted because of over crowding, but this treatment worked at a time when it was impossible to dig. Who shall say, however, that Laziness, not "Necessity", ". . . is the mother of invention"!

Still more landscape notes can be found in HERBERTIA, Vol. 3, 1936, page 145. It was the zephyranthes meadow pictured on page 143 of this 1936 issue that inspired the writer to search for more bulbs, other than the common spring flowering ones, with which to reproduce this wonderful effect.

THE PARAMONGA LILY

JOSEPH C. SMITH, *M.D., California*

This is the most beautiful amaryllid you can hope to see. Nothing surpasses it in beauty unless you happen to be partial to red and then only the giant red hybrid *Amaryllis* will rival it. The PARAMONGA LILY is a bright canary yellow flower among its upright medium green foliage. In addition it possesses a spicy nutmeg aroma. Like the Inca civilization it was found hidden away in the Andes of Peru. It was sent for identification from Peru to Dr. Traub.

Fig. 17. Paramonga Lily, *Paramongaia weberbaueri,* from Peru, front view, as grown in Dr. Traub's garden at La Jolla, Calif. Photo by Dr. Joseph C. Smith.

The scientific name of this plant is *Paramongaia weberbaueri* which was taken from the ancient ruin of Paramonga its native habitat and the name of Dr. Weberbauer, who specialized in Peruvian botany. In the classification of plants it finds a place between the *Pancratium* and the Ismene group of the *Hymenocallis.* Its structural form and growth

habits are much like the Ismene but the bulb has no pseudo-neck and its seed are flattened and black more like those of the pancratiums.

The accompanying pictures (Figs. 16 and 17) were taken of a specimen flowering in Dr. Traub's garden at La Jolla, Calif., in 1957. This is the second year that he has flowered it. Last year the flower was of necessity turned into an herbarium specimen. A few seeds were set this year and distributed, three to a person, as far as they would go. Every effort will be made to get this magnificent plant into wide cultivation as fast as possible. It makes offsets about as readily as the Ismene group and with more seed per capsule a faster spread of this plant will be readily accomplished.

Cultural requirements are the same as those of Ismene group in this area. Minimum temperature tolerance has not been checked. However, with winter dormancy they can be handled like the Ismene group and they will most likely succeed as well in most areas. In southern California they can remain in the ground the year around and be expected to flower each returning season. Here the bloom comes in June or July, a little later than most of the Ismene group and nearer the blooming season of *Pancratium maritimum*. Like the latter its seed pods require longer to ripen than do those of the Ismene group which usually ripen in four weeks or less. *Pancratium maritimum* requires eight weeks or better to ripen its seeds.

It is possible that paramongaia may cross with some of its nearest genera as the Ismene group, *Pancratium,* or *Pseudostenomesson.* This will be checked.

How this desired species escaped capture into cultivation so long is hard to understand. But, now that it is in captivity it will most certainly be popular with its ease of cultivation and its marvelous possibilities in flower arrangements.

SENDING SEEDS BY MAIL

HAMILTON P. TRAUB, *California*

Seeds are often sent by mail in letters. In the past most were sent in ordinary paper packets without additional protection and the results have been disappointing in many cases due to broken seeds. One well-known seed house wraps larger seeds in a small amount of cotton fiber around the seeds and this mass is then placed in the packet which in turn is placed in the letter envelope. This gives some protection, but the writer has received such seeds as *Worsleya rayneri* wrapped in this manner with loss through breakage since the cotton fiber flattens very easily. Thus a better method has to be found.

When seeds are not rare, the writer places the seeds in ordinary seed packets and protects the seeds by stapling medium stiff (medium weight and somewhat flexible) corrugated pasteboard on both sides of the packet. The protected packets are then placed in the letter envelope, and the notation, "Please Hand-Stamp", is put on the outside of the envelope. So far no reports of losses have been received.

When sending *very rare larger* seeds, it is better to use a card of stiff corrugated pasteboard slightly smaller than the letter envelope. Small excavations are made on one side of the board, the seeds are placed in these, and then scotch tape is placed over the open places that house the seeds. This method was used in sending out the total 1957 crop of 31 seeds of the outstanding new amaryllid, *Paramongaia weberbaueri.* In order to obtain wide distribution in the shortest time, 4 seeds were sent to Mrs. Morris Clint, and three seeds each to nine other amaryllid enthusiasts in the United States and Great Britain. Reports have thus far (January, 1958) been received from Mrs. Clint, Mr. Hannibal and Mr. Woelfle, who have all obtained 100% germination, each using a different method for germination. It will be interesting to make a more complete report including the results obtained by the remaining experimenters in 1959 HERBERTIA.

Mr. Wyndham Hayward, Winter Park, Florida, writes under date of December 9 that two of the seeds of *Paramongaia weberbaueri* are up, growing nicely, and came through the recent light frost with no damage.

Footnote.—Mr. Woelfle wrote later that his Paramongaia seedlings damped off.

GERMINATION OF PARAMONGAIA SEEDS

KATHERINE L. CLINT, *Texas*

On September 13, 1957, we received 4 seeds of *Paramongaia weberbaueri* from Dr. Traub, who wrote that this Peruvian amaryllid was spectacularly lovely but very rare indeed, with but few seeds available for distribution. Our ultimate success seems to justify recording the entire process in some detail.

A 5″ azalea pot was filled to within an inch of the brim with our standard potting soil, which consists of 1/3 sand, 1/3 peat and 1/3 soil, plus a small amount of crushed granite. After watering enough to settle the soil somewhat, we added a ½″ layer of our pet germinating medium: 1 part finely sifted, well-aged peat, 1 part parakeet or bird gravel and ½ part screened sphagnum. This was also dampened and the seed inserted vertically in the medium so that only the bare tip of the upper edge was visible. The pot was then watered thoroughly and placed in the greenhouse. This was on September 15. Neither glass nor plastic was used to cover the pot and subsequent watering was purposely held to a minimum for fear of rotting the seed. Stored or fresh rain water was used at all times.

During the ensuing period, we had an unusually high percentage of germination—with many kinds of seed—which seemed to indicate that all conditions were perfect for most seed germination. Consequently, when a month passed and *Paramongaia* showed no signs of sprouting, we felt more than a little worried. About October 17, we had a period of light drizzling rain and the pot of seeds was taken outside to take advantage of this (for us) sure-fire cure for hard-to-germinate seeds.

Even this failed, for although one seed seemed to swell briefly, germination did not take place—10 or 12 days passed and the little worry changed to distress—clearly a change in tactics seemed indicated. I remembered how hard and firm the seeds had appeared before planting, so decided to give them the "wet" treatment. During the approximately 45 days since planting, the seeds had become partially uncovered, so they were re-covered completely with a mixture of half and half bird gravel and finely sifted fir bark (about ⅛″ deep). It was hoped that the highly acid fir bark plus a heavy daily watering would succeed in breaking through the apparently tough seed coat. Now, whether it was the proper time for germination to occur and the new treatment merely completed the process or whether this method, if started earlier, would have cut the germination time is still an unanswered question. The fact remains that results were immediate and startling. In 3 or 4 days, the first seed began to swell and was soon above ground, with the other 3 following in rapid succession. On this date—November 22—the seedlings are from 3 to 5 inches high and growing lustily.

GERMINATING SEEDS IN VERMICULITE

L. S. Hannibal, *Fair Oaks, California*

The germination of any seed, whether a husky cocoanut or the microscopic product of an orchid, represents no difficulty when the right environments for growth are established, but deviate from the required conditions and anyone is bound to encounter failure. The *Amaryllidaceae* are no exception. All members of this family have rather specific requirements, but as a general rule very few are as difficult to germinate as most people have been led to believe.

First, in practically every species of the *Amaryllidaceae,* the seeds require moisture and high humidity during the period of germination—It matters little whether it be a tropical *Zephyranthes* or trumpet *Narcissus* from northern Europe, moisture must be readily available until the bulblet is established and rootlets functioning.

Secondly, one can not overlook temperature. For some *Crinum* and tropical *Amaryllis* a germination temperature of 70 degrees or thereabouts appears desirable, but for the semitropicals a temperature between 65 and 70 appears more successful, and temperate-climate bulbs do better slightly below 60 F. In practice one should hold to the lower temperature limits in lieu of the higher to avoid dampoff or decay. Germinate your seels after the heat of the summer is completely over.

Third, one must consider the planting medium, and with the *Amaryllidaceae* this is a critical factor. In the native environment most species grow in open meadows or brushy hillsides where the soils are normally heavy loams and well mineralized. True, there are a number of ecological exceptions about the Caribbean where species are found endemic to acid or sandy soils, or to alkaline coral formations, but these are in general exceptions.

Actually, if one were to examine various germinating seeds in the wild little of them would be found covered with soil. The greatest bulk would be scattered in amongst damp decaying vegetative litter. The initial rootlets would be striking down into the loam and primary leaflets fighting to find a bit of sunlight. So we can ask frankly why plant seeds of *Amaryllidaceae* in soil when nature rarely does so herself?

Some years ago the USDA station at Beltsville suggested planting seeds on living spagnum moss. Like others the writer tried this, but found it hard to keep the moss sufficiently moist. At about the same date expanded Vermiculite appeared on the market and this too was tried as a planting medium. Of the two vermiculite was found better suited to Amaryllids since the seedlings were free of the red fungus which is so common in *Amaryllis*—nor were the rootlets stunted or burned by organic acids from decaying spagnum moss. This latter condition is more prone to appear in *Nerine, Brunsvigia rosea* (Cape Belladonna), and other *Brunsvigia* species.

The writer has forgotten just when he first tried sealed plastic containers to hold the moisture content constant within the vermiculite but it has proved to be the perfect answer to a dire necessity. The containers with the germinating seeds could be left for weeks unattended and rarely did one lose any. 100% yields were the usual thing, and if the bulbs were small like *Zephyranthes* or *Nerine* they could be left in the sealed container for a year or two. In several instances Plant-Chem or other chemical growth mixtures have been tried sparingly in the vermiculite, but the benefits have always been slight. Excluding nitrogen the vermiculite contains enough mineral to maintain vigorous growth.

Larger seeds like *Crinum* also germinate readily by this treatment. Such seeds are placed on an inch or two of moist vermiculite in a glazed ceramic dish such as used for watering chickens. These dishes are covered with a sheet of glass to retain the moisture, and the bulblets are only removed after roots some three or four inches long are in evidence. At this stage the bulblets can be planted in deep flats or out of doors in regular beds.

So when the writer recently received three seeds of *Paramongia weberbauer* from Dr. Traub, they were tucked away in a dry location until the heat of the summer was over. Then in early October some fairly fine fresh vermiculite was placed in a clean plastic food container and given sufficient water to make the entire mass moist. The dry seeds were tucked into the moist vermiculite edgewise such that each seed was just covered. Germination took from 2 to 4 weeks. Now at five weeks all seeds have vigorous rootlets and two have primary leaves 2 inches long.

The only question which the writer can't answer is why winged seeds germinate better when planted on edge. The late Hermon Brown noted this phenomenon. (See also Traub, HERBERTIA 1953, page 122.) It may be that germination is effected better if the seeds are aereated by partial exposure thus imitating in part the almost total exposure under natural conditions as explained earlier in this article.

A HARDY GOLDEN LYCORIS

SAM CALDWELL, *Tennessee*

Having had a deep interest for more than 25 years in acquiring and growing all the different kinds of lycoris available, I was greatly thrilled recently to "discover" right here in Nashville, Tennessee a fine, hardy, golden-flowered lycoris that may turn out to be a species new to cultivation. The "tip-off" came from a local listener to my garden radio program. I followed the lead and came up with this story:

Back in the 1920's, Mrs. Oscar Nelson, now residing with her husband in Nashville, was serving as a missionary for the Southern Methodist Church in Huchow, China. Her mother, the late Mrs. Henry Sperry, visited her in Huchow in 1924 and '25, returning to the States in October, 1925. She brought to Nashville with her one or more bulbs of a golden "spiderlily" that grew wild in the Huchow area.

That was the start. The bulbs lived, bloomed, were admired by friends and were shared by Mrs. Sperry with members of her family and probably a few friends, but they were never widely distributed. No one apparently knew of their rarity. Some bulbs were lost in changes of residence. I can now find only a few people who have them, though they seem to increase at a modest rate and are quite healthy and satisfactory bloomers in this climate. They have now been grown here, outdoors, for 32 years.

I have yet to see the flowers, but saw color slides of two clumps flowering in a local garden last summer. In the slides the blooms appear to be almost identical with *Lycoris aurea*, except that their color is apparently deeper. In fact, people here who have had this lycoris for years refer to the flowers as being orange colored. Deep gold is probably more accurate. The scapes appear to be 15 to 20 inches tall, and the flower tepalsegs are curled and crinkled along their edges as in *L. aurea*, *L. radiata* and others.

This lycoris differs in growth habit from *L. aurea* and *L. traubii*, two other yellow species with which it might be confused. Whereas both of these two start foliage growth in the fall, the new one (which for convenience I am calling "L. sperryi") makes leaves in spring, as does *L. squamigera;* they die down later and blooms come on bare scapes in August, according to my local informants. Some of these data will have to be confirmed by my own observations.

I've managed to secure several blooming size bulbs. They are relatively large—around two inches in diameter, with long, tapering necks to make a total base-to-tip height of about 5½ inches. They look, in fact, like good, mature bulbs of *L. aurea*, as that species grows around St. Augustine, Fla.

This new one is self fertile. One local grower saved seed from her blooms of last summer and gave me four to plant. They are large, round, shiny and black—much like seeds of other fertile lycoris I have, except that these are extra large, about three-eighths of an inch in diameter.

One thing that surprises me is that this particular lycoris was not introduced to cultivation in this country years ago. The bulbs must have been easily available to collectors. "They grew wild and were fairly plentiful on the hillsides and mountains between Huchow and Hangchow," Mrs. Nelson told me. "We used to go out and gather the blooms, which came in July or August, if I remember correctly," she added. The area is in Chekiang Province, about 100 miles from Shanghai.

"It is in about the same latitude as Jacksonville, Florida," said Mrs. Nelson, "but the winter climate is much colder. There was snow and ice, and the canals sometimes froze over so we could walk across them. Winters were about as cold as we have in Nashville, but were shorter. There was not much real cold weather until late December, and it began to warm up in February. March and April (probably when the lycoris foliage was growing) were usually very rainy months."

Now that I have bulbs of my own to observe, I'll be reporting further on this lycoris. Leaves and scapes will be air mailed to Dr. Traub. The plant is definitely different from and much hardier than both *L. aurea* and *L. traubii.* At this writing (Dec. 15, 1957) both of these species are in full leaf, having started their foliage back in September. *"L. sperryi"* is quite dormant at this time. *L. aurea* is so sensitive to cold that I have to keep it in pots, under glass. *L. traubii* is somewhat hardier. I've had it in the past, but am testing it out of doors this winter. The leaves appear badly damaged by a recent 9-above-zero freezing spell, but I am hoping they will recover. A planting of *L. traubii* outdoors, but in a very protected spot, at Memphis, Tennessee, has been doing well and blooming for three years. I fear that our more severe Nashville winters may prove too much for it, but will not know for several years yet. The new "L. sperryi," of course, could be hardy much farther north, since it remains dormant through the winter and, like hardy species *L. squamigera* and *L. sprengeri,* makes foliage in the spring.

There is a good possibility that this "L. sperryi" is exactly the same as *Lycoris chinensis,* described in this issue (the one growing at the U. S. D. A. Plant Introduction Garden in Glenn Dale, Md., under the label, "L. aurea"). Dr. John L. Creech gave some details on that one in the April, 1952 *National Horticultural Magazine.* It is described in detail by Dr. Traub in this issue. It is clearly *not* the *L. aurea* seen around St. Augustine, Fla., which I assume is the true species. The U. S. D. A. stock has lived for some years in Maryland, and according to Dr. Creech, ". . . foliage appears in spring, disappearing in May . . . flowers in early August." Those details don't fit the true *L. aurea* or *L. traubii* at all, but do coincide with the habits of the Nashville *"L. sperryi."* By careful checking and comparing, we should be able to clear up some of this confusion in 1958.

Meanwhile, this golden colored lycoris—whether a new species or a hardy variant of an old one—should make an excellent garden subject and should open up new avenues for the hybridizer. Fortunately, its bloom period covers or comes very near to the time that several of my

other fertile species of lycoris are flowering—*L. sanguinea, L. radiata, L. haywardii* and *L. sprengeri.* So with the "new blood," I'll attempt many new crosses in 1958.

I regret that no bulbs of "L. sperryi" are available here at this time for distribution to interested fanciers. I shall try to increase my own small stock in order to share it with others. However, the natural increase by offset is evidently not very fast. The few people here who have bulbs only wish they had more. Perhaps these notes, if published, will come to the attention of someone else who knows this lycoris and a source of supply.

AGAPANTHUS FOR SOUTHERN GARDENS

WILLIAM LANIER HUNT, *North Carolina*

The great need for blue summer flowers in Southern gardens inspired my attempts to grow agapanthus in my test garden in middle North Carolina. The results have been favorable indeed, as none of the following has ever been winter killed in an area where we have an inch of frozen ground in some winters. *Agapanthus africanus mooreanus* and its form, *minor, A. intermedius* (?), *A. pendulus, A. orientalis,* "dwarf mountain form" and *A. inapertus* have all survived at least five winters in this garden with only a two-inch mulch of pine needles.

The tendency of the foliage to come out too soon and to be killed back in spring or the time of formation of flower buds are the two factors suspected as the reason for little bloom from the plants. However, they may have been starving to some extent, and so they were fertilized this past summer with an extra feeding of cotton seed meal to which they responded at once. We shall see what the results will be in 1958.

There seem to be innumerable forms of agapanthus wandering around the collections in England. The Hon. Lews Palmer, Hon. Treasurer of the Royal Horticulture Society, discovering my passion for agapanthus at tea at one of our shows in Vincent Square in 1956, invited me down to see his collection and the work he is doing in breeding the best forms he has gathered together in his garden at Winchester. Mr. Palmer's articles and awards for these plants can be found in The Journal of The Royal Horticultural Society. The most recent of these is in Vol. LXXIX, Part One, Jan. 1954, page 25.

One sees agapanthus of the *mooreanus* type growing outdoors in many English gardens, and the botanical gardens usually have large clumps of different types either in cold frames or just up against the greenhouse walls. At the Edinburgh Botanical Garden, I noticed the following: *A. pendulus,* Transvaal, *A. inapterus* (!) (for inapertus), *A. patens,* 13-20, Orange Free State, campanulate flowers, *A. longispathus,* 107-45, *A. erectiflorus,* 120-44.

At Kew, the old clumps of agapanthus raised years ago by my friend, the late Mr. Raffill, are still to be found, here and there around the Temperate House. They used to be in tubs on the terrace in summer. It was Mr. Raffill's plants which originally inspired me to try them for

cold hardiness in the Southern United States. Since that time, Mr. Giridlian's work has developed many beautiful varieties, and these are all to be tried out here. For such a display as one gets from these gorgeous blue flowers, it would be worth either covering them in winter in the Southern States or taking up the rhizomes as we must do for the tender, showy old plants of "The Blue Lily of the Nile" which our grandmothers grew in their "pits".

HYMENOCALLIS NOTES

JOSEPH C. SMITH, *M.D., California*

During the year at least one more *Hymenocallis* species has been relocated—*Hymenocallis latifolia*—and identified by Dr. Traub. It has been reintroduced from Mexico by Mrs. Morris Clint and located in cultivation at Punta Gorda, Florida by the writer. This is a most desirable species, and it is hoped that it can soon be distributed widely in cultivation. This will no doubt be accomplished quickly due to the fact it sets seeds and produces offsets freely.

The writers supply of this species was obtained through Mr. C. L. Burlingham of Punta Gorda. Mr. Burlingham states that his plants were grown from seed secured some years ago from the gardens of other residents of that city. All of the plants studied from this source appear to be identical, however, some variation or hybridization might appear as there are wild species in the area. This uncultivated species from the fields has not as yet been identified. It is a smaller species with only one greenish flower in the wilds but produces two or three in cultivation.

Hymenocallis latifolia from this source is a very beautiful plant especially when grown in partial shade. Its shiny medium green leaves are broad and upright reminding one of a hybrid amaryllis especially when grown with the bulb half out of the soil. Specimens grown in full sun show more bloom on the leaves and a cupping in their upper half. A definite bulb-neck varies in length according to the depth the bulb is planted. On bulbs planted at the soil surface it is relatively short two inches or less whereas on deeper plantings the leaves fan out at the soil surface with a neck of corresponding length.

The umbel contains eighteen flowers on mature specimens. The color is white and the tepalsegs are narrow. The cup is funnel-shaped with widely flaring edges and is approximately one and a half inches in diameter. The fragrance is exquisite reminding one somewhat of roses. There is some variation in flower size between plants grown in part shade and those given full sunshine the latter being the smaller. It appears that this plant likes at least fifty percent shade. It is evergreen and a constant grower. In California blooming has occurred from July to October though it is reported to bloom earlier in Florida. This may be due to more winter growth in the latter state whereas it is forced into relative dormancy by the cooler winter climate of the former state. [Editor's note: in California he has it in flower as late as January, 1958.]

During the past two years the writer has got together a collection of the available *Hymenocallis* species and hybrids including some as yet unidentified. This is a most interesting group of plants to work with, and it is hoped that more interest can be stimulated in cultivating these neglected native American amaryllids. Some of them are found growing in our southern states from the Ohio river southward. The evergreen types make excellent house plants, while the deciduous types can be handled as easily as gladiolus in the summer garden.

OLD WHITE CRINUM

William Lanier Hunt, *North Carolina*

Of the many old crinums in Southern gardens, one that I like very much is a white one that blooms in late spring or early summer. It has

Fig. 18. An old white *Crinum of Southern Gardens.* Photo by William Lanier Hunt.

a terrible habit of flopping over immediately after the first flower opens. In cool weather, it will remain upright for a day or so, but the scape

cannot hold up the long flowers and the weight of the mass, and down they go onto the ground.

This *Crinum* has all the ear marks of many other products of *C. bulbispermum,* but the flowers are pure white in warm weather. A sudden cool spell—a rare thing in late May and June in North Carolina —will put a slight suffusion of almost gray on the outside of the flowers. Again, when flowering in the fall, after a heavy feeding in September to induce this flowering, the flowers will take on this suffusion. For the most part, however, one can count on the marvelous white blossoms in early summer. The filaments are light violet, and there is a definite and decided odor of anise, different from any other crinum's odor with which I happen to be familiar. A search through the literature has not rewarded me with the mention of such a scent in crinums. For cut flowers (Fig. 18) for the house, this crinum is tops because of the subtle scent. Many others are too heavy to live with.

A handful of complete fertilizer dissolved in a bucket of water and poured around the clumps of this white crinum and watered in with the hose usually results in a new scape or two in a week to ten days. Most crinums can be induced to flower this way to prolong their blooming period.

A PRELIMINARY STUDY OF SEED SETTING IN **SPREKELIA FORMOSISSIMA** HERBERT

S. Bose and W. S. Flory, Jr.
The Blandy Experimental Farm, University of Virginia

The Aztec Lily, *Sprekelia formosissima* Herbert is a native of Mexico. Morton (1937) reports it as occurring in the states of Chihuahua, Durango, Mexico, Jalisco, Michoacan and Guerrero of that country. In addition we have collected it in Morelos, and Mrs. Morris Clint has received bulbs collected (by L. E. Guerra) in the state of Hidalgo. The states where *Sprekelia* is found are on the central plateau for the most part with elevations mostly varying between 5000 to 6500 feet and with the average May through July temperatures varying from about 68 to 78 degrees Fahrenheit.* In Mexico, D. F. and Hidalgo the elevations are greater and the temperatures are usually lower.

The Aztec Lily only seldom produces seed without hand pollination when grown outdoors in northern Virginia. Bulbs are usually stored in a warm basement (45-50° F.) during the six-month winter period and are planted outside during the latter part of April after danger from severe frosts become unlikely. Flowers are then produced rather quickly and many plants flower during the three or four weeks following bulb setting. Many plants produce flowers during the month of June, and an occasional flower appears in July. Plants allowed to grow continuously in pots in the greenhouse usually flower during late April and May.

* From "Notes About Mexico's Climate." The Pamex Travel Club, Mexico City.

Personal communications from several persons based on experiences with growing *Sprekelia* outdoors in other parts of this country, suggest that it is not uncommon for seed capsules to be produced very infrequently especially when efforts are not directed toward seed production. It was noticed during the period from 1947 through 1954 that *Sprekelia* flowers produced in the garden never, or apparently never, developed seed capsules under natural conditions—without hand pollination. It had also been noted that a few capsules followed flowering in a cool greenhouse, especially after some hand pollinating had been done. These obesrvations have led to some simple experiments directed at throwing light on some of the factors affecting seed production in this species. Limited data bearing on the part played by artificial pollination and by temperature are reported here, and some preliminary conclusions are suggested—based on this and on the work and observations of others.

PROCEDURE

The work reported here is based on studies carried out during the 1955, 1956 and 1957 seasons. In each of these seasons observations were made on plants which carried flowers (1) as they grew in field plots; (2) as they grew in pots in the greenhouse; or (3) as they grew in pots which were placed in a warm room for 48 hours immediately following pollination.

Temperatures in the three locations varied within the following limits (in degrees Fahrenheit) during the course of the time that the reported pollinations were becoming initiated:

	Day	Night
Field		
1955	58° - 89°	50° - 65°
1956	66° - 97°	51° - 71°
1957	69° - 96°	50° - 75°
Greenhouse	68° - 95°	68° - 72°
Warm Room	80° - 90°	80° - 90°

Some additional temperature data for the plants in the field plots is summarized in Table 1.

Table 1. Temperature data summarized for the periods during which **Sprekelia** crosses were made in the field.

	Temperature in degrees F.		
	1955 June 5-28	1956 June 7 - July 8	1957 June 7 - July
Minimum			
High	65	71	75
Low	50	51	50
Mode	57	64	64
Mean	57.6	63	63.3
Maximum			
High	89	97	96
Low	58	66	69
Mode	80	89	87.5
Mean	78.2	87.2	86.8

It is apparent that very different minimum temperatures were encountered by the plants in the three different locations, although there were wide temperature ranges—especially in the field plots.

In 1955 about 35 bulbs were set in the garden. In 1956 and 1957 about 150 bulbs were available for the outdoor planting, as well as an increased number for the indoor studies, because of a generous gift of bulbs from Dr. T. W. Whitaker. Several dozen bulbs, mostly in five or six inch pots, were carried in the greenhouse each year.

Self-pollinations were made on plants in all three locations in each of the three years. Cross-pollinations were made each year of the study on plants carried in the warm room for a period.

After noticing that most flowers fail to produce capsules without hand pollination, and that only a low percentage produce capsules in the field following hand pollination—the ovaries of a few flowers of field grown plants were treated in 1955, with one per cent of naphthalene acetic acid carried in a lanolin base. This hormone treatment has not been tried out in connection with the warm room treatment.

RESULTS

A number of capsules well filled with viable seeds developed following controlled hand pollinations (Fig. 19). Our data on these are summarized in Table 2.

Table 2. **Sprekelia** self- and cross-pollinations made with numbers of seed capsules resulting—during three years, in three different locations each year.

	Self-pollinations			Cross-pollinations		
Year	Made	Capsules resulting	Per cent setting	Made	Capsules resulting	Per cent setting
			Field			
1955	16	1	6.3			
1956	26	2	7.7			
1957	52	6	11.5			
Totals	94	9	9.6			
			Greenhouse			
1955	8	2	25.0			
1956	5	1	20.0			
1957	9	2	22.2			
Totals	22	5	22.6			
			Warm Room			
1955	12	5	41.7	21	6	28.6
1956	22	10	45.5	47	16	34.0
1957	31	14	45.2	49	15	30.6
Totals	65	29	44.6	117	37	31.6

It may be noted from Table 2 that after self-pollinations the following approximate proportion of flowers matured capsules in the several locations: Field, 10%; Greenhouse, 23%; Warm Room, 45%. Cross pollinations in the warm room yielded about a 32 per cent capsule development, as may also be seen from Table 2.

It is evident from the above that, on a percentage basis, more than twice as many flowers produced seed capsules in the greenhouse as in the field. Again, about twice the proportion of flowers from plants placed in the warm room produced capsules as when plants were left in the greenhouse.

The very preliminary experiment with naphthalenacetic acid—used to see if the hormone stimulant would induce seed setting—was mentioned under procedure. In June of 1955 eight *Sprekelia* flowers were hand pollinated. The ovaries of four of these were then treated with one per cent emulsion of N. A. A. in lanolin, the other four being observed

Fig. 19. *Sprekelia formosissima; upper,* two capsules nearing maturity 25 days after hand-pollination in a field plot. July 1957; *lower,* seedlings produced from 1956 seeds, July 1957. Photos by Bose & Flory.

as controls. Ovaries of the four treated flowers evidenced a swelling which continued until the capsules were approximately of a mature size. Examination showed, however, that growth was due almost entirely to a thickening of the ovary wall, and that seed development was negligible or lacking. Hormone treatment has only been tried in this limited way with plants which flowered in the field.

Some information as to (1) number of seeds per capsule, (2) time required for seed development, and (3) seed germination have been com-

piled as a corollary to the experimental work, and will be briefly summarized below.

The 80 seed capsules produced, and recorded in Table 2, varied from 50 to 65 in number of seeds per capsule. The 80 capsules produced a total of 4526 plump seed—an average of almost 57 seeds per capsule.

The capsules produced in 1957 matured in from 26 to 31 days—and averaged 29 days from pollination to seed maturity.

The majority of seed planted germinate quickly and give sturdy seedlings (Fig. 19). Something over 300 seedlings are now being used in cytological studies. The five lots of seed planted most recently totalled 173 seed. From these 105 seedlings have been secured, a germination rate of about 61 per cent. Quite often a near 100 per cent seed germination results.

DISCUSSION

Sprekelia seldom produces seed without hand pollination, within our observation. Rex Pearce in 1934 had mentioned that this taxon will seed freely if hand pollinated. Our observations confirm Pearce's in general. We have found seed to be produced much more readily—following hand pollination—in warmer locations.

Minimum temperatures were consistently lowest in our field plots (where fewest capsules were set) and highest in the room (where most capsules developed), with the greenhouse being intermediate with respect to both minimum temperatures and proportion of capsules produced.

Smith and Cochran (1935) working with tomatoes *(Lycopersicon esculentum* Mill.) found that temperature has a marked effect (1) on the germination percentage of pollen (with maximum germination at 50° F., 60 hours after pollination, being 21.5 per cent; at 100°—at the end of 42 hours—being only 6.3 per cent; while at 85°—after 60 hours—maximum was 66 per cent and with the germination percentage being almost as high at 70° as at 85°) and (2) on pollen tube growth (with maximum growth rate being at 70° F., with that at 85°, 50° and 100° ranging in decreasing order.)

Work reported here indicates a definite correlation between high temperatures and increased proportion of seed capsule development. While we have no data concerning effect of temperatures directly on pollen germination and pollen tube growth with *Sprekelia*, it seems likely that stimulation of pollen germination and tube growth may be the factors responsible for our results. Our *Sprekelia* flowers have not been exposed to temperatures likely to be inhibiting by their highness.

This study has shown that hand pollination, and minimum temperatures higher than those commonly encountered in the early summer outside in northern Virginia, are both factors favoring seed capsule development. There are doubtless other environmental as well as genetical factors that have definite effects on capsule development. Photoperiod, soil moisture, and humidity are doubtless among the pertinent environmental factors. One of us (Bose) is making a detailed cytologi-

cal study of *Sprekelia* and is finding that in addition to the usual high number of somatic chromosomes, that there are lines with at least two different lower somatic chromosome numbers. These results will be published in a separate report. It is likely that such varying chromosome numbers may have effects on the results from either or both self- and cross-pollinations. It is possible, too, that compatibility factors—as well as other genetic influences—may effect capsule development and seed production. All these possible effects, of course, would be in addition to those produced by hand pollination and by temperature factors.

It may be noted from Table 2 that a lower percentage of capsules developed following cross-pollination, then after self-pollination. While we might speculate on the reason for this we have no satisfactory explanation concerning this fact at the present time.

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NEW DISEASE OF AMARYLLIS BULBS — INTERIOR BLACK ROT

Mr. John E. Davis of Salem, Oregon, reported a new disease of *Amaryllis* bulbs—Interior Black Rot. This came too late for inclusion in the writer's forthcoming book, "The Amaryllis Manual". Every effort will be made to obtain basic information about this disease so that an efficient method of control may be worked out. Progress reports will appear in future issues of Herbertia.—*Hamilton P. Traub*

[CALDWELL, LYCORIS HYBRIDIZING—continued from page 68.]

various species made it convenient. However, it should be possible to keep pollen viable for several weeks in cool, dry storage, and I plan to use that method to make some new crosses in 1958. For such help as it may give other lycoris fanciers, here is the record on my attempts at lycoris breeding:

L. radiata X *L. sprengeri* and the reverse cross, *L. sprengeri* X *L. radiata*—Both of these "take" nearly every time. I have numerous seedlings coming along. These could be very valuable, not only for the interesting possibilities in color and flower form, but also for the extra hardiness they might inherit from *L. sprengeri.* Red "radiata type"

flowers on bulbs hardy enough to thrive well up into the North are just one of the possibilities.

L. radiata X *L. haywardii*—this cross produced good seed on my first attempt, the past season (1957).

L. radiata X *L. houdyshelii*—Most attempts have failed completely. I have a few seedlings from this cross but fear they may be from addidental selfing of the parent, *L. radiata.*

L. radiata X *L. caldwellii*—As with the *L. houdyshelii* cross, this has failed in nearly every attempt. Seeds developed one time, but again, may have resulted from accidental selfing of the seed parent.

One or more attempts have been made at the following crosses, and all have failed: (1) *L. haywardii* X *L. squamigera,* and the reverse, (2) *L. radiata* X *L. squamigera,* and the reverse, (3) *L. radiata* X *L. incarnata,* and the reverse, (4) *L. incarnata* X *L. squamigera,* and the reverse, (5) *L. sprengeri* X *L. incarnata,* and the reverse, (6) *L. sprengeri* X *L. houdyshelii,* and the reverse, and (7) *L. sprengeri* X *L. caldwellii, and the reverse.*

These failures do not prove necessarily that similar crosses might not succeed in other cases, under other growing conditions. The seeding habit of lycoris species apparently is somewhat erratic. A California correspondent planted bulbs of the same fertile strain of *L. radiata* that I have. He wrote me that they bloomed, all right, but did not set seed. Here in Tennessee they always have a good crop. We'll have to learn a lot about these plants simply by experiment.

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GENERAL EDITION

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Box 150, La Jolla, California

PREFACE

This general edition of PLANT LIFE is noteworthy for the report on the introduction of the ACHOCHA, the CORNUCOPIA CUCUMBER, by Mrs. Marianna Evans Applegate from Bolivia. This promises to become an outstanding new vegetable crop for the United States, but the exact range where it can be grown has yet to be determined.

In addition there are articles on native Shellflowers by Dr. Howard, and a report by Dr. Corliss on his 1957 European tour, particularly concerning nematode control in bulbs, and the growing of bulbs in Italy by Holland growers in order to advance flower formation. Dr. Uphof begins his series of articles on the genus GAGEA.

March 15, 1958,
Camino de la Costa,
La Jolla, California.

Hamilton P. Traub
Harold N. Moldenke

[PLANT LIFE LIBRARY—continued from page 56.]

A GLOSSARY OF MYCOLOGY, by W. H. Snell and Esther A. Dick. Harvard University Press, Cambridge, Mass. 1957. Pp. 171. Illus. $5.00. In this important new book an attempt has been made to include as many as possible of mycological terms and other terms useful to students of mycology. The illustrations are by Henry A. C. Jackson. This excellent reference work fills a definite need and will be welcomed by all biologists. Highly recommended.

INTRODUCTORY PLANT SCIENCE, 2nd ed., by H. T. Northen. Ronald Press, 15 E. 26th St., New York 10, N. Y. 1958. Pp. 718. Illus. $6.75. This second edition of an outstanding text of botany "presents the beginning student with a realistic and challenging introduction to plant science" so as to make it "a memorable experience." It is written in the author's usual clear and easily readable style and is highly recommended.

GENERAL BIOCHEMISTRY, 2nd ed., by J. S. Fruton. John Wiley & Sons, 440 4th Av., New York 16, N. Y. 1958. Pp. 1077. Illus. $18.00. This second edition of an outstanding text "offers an introduction to the subject for qualified college seniors, students of medicine, post doctoral research students in the biological sciences and chemistry. Due to rapid progress in this subject, most of the chapters have been revised, and one new chapter has been added. Highly recommended.

TOPICS IN MICROBIAL CHEMISTRY, by F. M. Strong. John Wiley & Sons, 440 4th Av., New York 16, N. Y. 1958. Pp. 166. Illus. $5.00. The subjects covered in this stimulating book include antimycin, coenzyme A, kinetin and kinnins which are obtainable from microorganisms and are physiologically active at very great dilutions. The main objective is to show how the use of certain experimental techniques contributed to progress in these fields. Highly recommended.

THE PRINCIPLES OF HEREDITY, 5th ed., by L. H. Snyder and P. R. David. D. C. Heath & Co., 285 Columbus Av., Boston 16, Mass. 1957. Pp. 507. Illus. This 5th edition of an outstanding text is designed "to acquaint the beginning student of heredity with the facts and principles of inheritance" and "to arouse and hold the interest of the student and stimulate his thinking." The various chapters have been thoroughly revised, and the book has been brought up-to-date by the addition of a chapter on the genetics of bacteria and viruses. This stimulating text is highly recommended.

ACHOCHA, THE CORNUCOPIA CUCUMBER

HAMILTON P. TRAUB

In 1955, Mrs. D. V. (née Marianna Evans) Applegate of Monona Plantation, Ferriday, Louisiana, and Santa Cruz, Bolivia, brought back seeds of ACHOCHA, and distributed it to a number of gardeners. This belongs to the CUCUMBER family. The fruits were successfully grown in Baton Rouge, Lafayette and New Orleans in Louisiana and by Eugene T. Du Pont of Laguna Beach, Calif. The only complaint received about the plant by Mrs. Applegate is that "it tends to take over the place". According to Mrs. Applegate, "this is no problem in the garden, and in frost-free areas, one vine would keep a family in large edible fruits the year round."

Mrs. Applegate writes that the word, ACHOCHA, is probably an Amerindian name. She states that this fruit was not observed growing in the wild; that "it is the most common fruit—to be used as a vegetable—that is offered in the markets in Santa Cruz, Bolivia. A half bushel would cost a few cents in U. S. money. It does not grow in the Cochabamba area, and when it is brought into the Cochabamba market, it is considered quite a delicacy, and is comparatively expensive. It has not been seen growing in La Paz, Lima and Arequipa.

We are indebted to Dr. Oscar Clarke, of the University of California at Riverside who furnished the information about the scientific name of this plant to Mr. Eugene T. Du Pont who passed it on to us. It is as follows:

"*Cyclanthera pedata* var. *edulis* in Engl. & Prantl, Nat. Pflanzenfam. 4: abtlg. 3b-5. A variety with large edible fruits cultivated in Peru and Bolivia."

According to Index Kewensis, the original taxon under the name *Cyclanthera pedata* Schrad. was published in Ind. Sem. Hort. Goett. 1831; cf. Linnaea 8: litt. 23, 1833. This is native to Mexico, and after the publication of var. *edulis* becomes automatically, under the Int. Code, *C. pedata* var. *pedata.* The oblong fruit is covered with soft prickles; the plant is perennial, and is known as the CLIMBING CUCUMBER.

PLANT DESCRIPTION

Eugene T. Du Pont, of Laguna Beach, Calif., the well-known artist and plantsman, who is responsible for the wonderful series in color, THE ROMANCE OF FLOWERS, writes that the seeds were obtained from Mrs. Marianna Applegate, and were

"planted in the spring of 1957 in a fairly sunny spot. Every seed planted sprouted within a week or two and grew very fast. Water was freely given, and a few applications of complete fertilizer, and manure, were made. The stems branched freely and rambled over everything—

some reaching to 30 feet. The leaves are very decorative, light green, many measuring 6 to 8 inches across. Flowers began to appear in June. Male flowers were borne in clusters on long stems arising from the leaf axils, and the female flowers were borne singly right in the axils. Both kinds are very small, under ¼ inch wide. The early bloom set no fruit, and it was noted that no pollen carrying insects were present. In July and August many small butterflies and bees became active pollen bearers and the fruits began to set. The plants began to die back in November. The roots seem to be dying back too, so probably it is an annual, but a few will be left in the ground to check this point."

CULTURAL RANGE

The full cultural range of ACHOCHA is not known at present. It thrives in Louisiana and therefore should also be at home in the rest of the lower South. Mr. Du Pont has shown that it is adapted to southern California. Its adaptability as a summer growing cucurbit in the North has yet to be demonstrated.

THE FRUITS AND SEEDS (Fig. 20)

Mr. Du Pont sent ACHOCHA fruits to the writer in December 1957. These are most interesting. They are glaborous (smooth) on the outside, but Mr. Du Pont writes that "the fruits on one vine had weak spines on the surface, about ⅛ to ¼-inch long and very thin. They were prickly looking but not to the touch."

The following description was made from fruits furnished by Mr. Du Pont. The color varies from sap green (HCC 62/2) to lettuce green (861/1) with somewhat deeper green veins running lengthwise of the fruit. The fruits are hollow with a rind about 3/16 inch in thickness. In shape they are shortly necked and the balance of the fruit is cornucopia-shaped, 6¾ to 7¾ inches long. The short neck which is hollow only for half its length is ¾ to 1 inch in diameter. From the neck the fruit enlarges abruptly to 2 to 2½ inches in width, then tapers gradually to a pointed apex which is curved as is shown in Fig. 20. Thus the common name, CORNUCOPIA CUCUMBER, is apt. A strand, about ¾ as long as the fruit, grows in the hollow fruit from the apical end. It is attached for about half its length to the rind; the seeds are borne on the remaining free portion. The seeds are black and resemble a turtle with its head extended from its carapace. They are 7/16 inch (1.1 cm.) wide, 9/16 inch (1.5 cm.) long, and almost 3/16 (4 mm.) thick. The surface of the carapace-like part is provided with three ridges at the edges of both sides; and pointed upraised projections are found between the upraised ridges; the apex resembles a turtle's head.

On the basis of the fruit shape which resembles a cornucopia, the common name CORNUCOPIA CUCUMBER has been adopted.

RECIPES

Under date of January 29, Mrs. Applegate writes that ACHOCHA is a delicious food that may be prepared in several ways; *broiled, stuffed* and in *stews* and *soups:*

"The fruit is washed, seeds removed, cut into strips lengthwise, and boiled no longer than 15 minutes. It is drained and garnished with grated cheese;

Fig. 20. Fruits and seeds of ACHOCHA, the CORNUCOPIA CUCUMBER. Note that seeds are turtle-shaped. Photo by G. A. Sanderson.

"again, the fruit is prepared as above, boiled for only 5 minutes, chilled and served as a salad with sauce vinagrette.

"The top of the fruit is cut from the fruit, seeds removed, scalded, and stuffed with one's favorite stuffing, making use of left over meats, fish or poultry. The stuffed fruits are baked in a shallow pan, and one's favorite tomato or mushroom sauce is poured over them. This makes a delightful main course.

"Achocha adds a bit of zest to both vegetable soups and stews; it is added to these about 15 minutes before serving time."

We are grateful to Mrs. Applegate for these recipes. When the fruits were received from Mr. Du Pont in December, the information furnished by Mrs. Applegate had not been received. The writer turned over the fruits to his sister, Mrs. Raymond Young, who prepared them for the table: (a) BROILED AND STEWED CORNUCOPIA, by broiling in a manner similar to that suggested by Mrs. Applegate above, and (b) CORNUCOPIA SALAD, by shredding and serving uncooked as a green salad, mixed with other ingredients such as lettuce, cabbage and so on. Both of these dishes are delicious.

OTHER USES. Undoubtedly other ways of preparing the CORNUCOPIA CUCUMBER will be developed by imaginative cooks, particularly the immature fruit. It may also be used in floral decorations, particularly for Thanksgiving Day. It is evident that the CORNUCOPIA CUCUMBER will become a very popular vegetable in the United States. Apparently the fruits are durable enough so that they can be shipped. They have been stored in the refrigerator for a considerable time.

NATIVE SHELLFLOWERS

THAD. M. HOWARD, *D. V. M., Texas*

For lack of a better name, SHELLFLOWER is a term loosely applied to various Irids that share certain peculiar characteristics with one another, such as pleated foliage, and delicate short lasting flowers of unusual form and beauty. Perhaps the best known of these is the colorful *Tigridia pavonia.* Few people are aware that the gaudy *Tigridia* is but one of a large tribe that includes many rare and fascinating little floral gems that grow almost beneath our noses along the coastal plains and prairies of the lower south and south west sections of the United States.

Early botanists must have been impressed with the structure of the styles of these plants, because many of the genera bear such names as *Nemastylis, Salpingostylis, Eustylis,* and *Chlamydostylis.* None of these names could be termed pretty, and this may be one reason why they may never become household words among average gardeners. The real reason for their lack of popularity is that many of them are quite rare, and also the flowers of some are of such short duration, that they are easily overlooked by the casual eye. A few, such as *Nemastylis geminiflora* are widespread, and commoner than most people realize. When one finds them mentioned in horticultural literature, they are all spoken of as growing from corms, but this writer has yet to find a

cormous *Tigridia, Nemastylis, Herbertia, Eustylis,* or *Cypella.* Perhaps some species do have corms, but it is ridiculous to keep perpetrating such an error in literature without at least examining the bulbs of these plants. Anyone who recognizes a true bulb by its tunicated separate sheaths will know that these Irids possess true bulbs, rather similar to Dutch Iris.

Commonly called CELESTIAL LILY, *Nemastylis geminiflora* (Fig. 21) differs from most of its other SHELLFLOWER Irid relatives in that the flower segments are all relatively similar in size and shape, while other members of the group usually possess a floral structure of contrasting

Fig. 21. Native Shellflowers: *left, Nemastylis geminiflora; right, Eustylis purpurea.* Photos by Dr. Thad M. Howard.

1. **Nemastylis geminiflora** Nutt.
(Syn.—**N. acuta** (Bart.) Herb.)

proportions. At first glance, CELESTIAL LILIES may appear to resemble a giant *Sisyrinchium;* however the texture of the flowers is far more delicately fragile. When the sun shines on them early in the morning, the succulently satin sheen of the frosty blue color fairly sparkles. Indeed, the blueness of these flowers is perhaps their most outstanding virtue. It might be pointed out here that it would be misleading to imply that all flowers are a rich deep blue, for, like all of natures flowers, there is considerable variation in hue from one flower to the next. Some flowers are palest blue, while others approach purple, but the majority are quite blue.

These fragile blossoms are of good size, when compared with the usual fare of the so-called "minor" spring-flowering bulbs, being 2-3″ across the face, and prominently accentuated by bright yellow anthers which curl in the white center of the flower. Although the individual

flower closes during the heat of the day, a well grown plant may produce as many as a dozen blooms in one season. The thin wiry stem branches somewhat, with each branch terminating in a green spathe from which arise two flowers in succession. The 8″ stem barely overlooks the narrow pleated grass-like foliage.

The culture of CELESTIAL LILIES is relatively easy. They desire an open, sunny location in soil that is well-drained and fairly heavy and neutral to alkaline in pH reaction. Very thin sandy soils and too much acidity are not to their liking. Once planted they may be left undisturbed forever, since they rarely will ever form offsets, and will never become crowded. Furthermore, one need not be too concerned about proper planting depths, since they will quickly adjust themselves to their own preferred depth with the aid of their strong contractile roots, until they may eventually pull themselves down to a foot or so. This habit has discouraged many a bulb collector from ever digging many bulbs in the wild, for digging a small bulb growing six to twelve inches deep in heavy black soil is not a task for the weak muscled gardener. It is an athletically ambitious undertaking.

CELESTIAL LILIES should prove to be hardy in our more northerly climates since it can be planted deeply enough to escape most cold damage. They are probably the hardiest of the shell flower clan, and once happily situated, they can be forgotten.

Like many other members of this group, CELESTIAL LILIES practically never increase by offsets; however, it is an easy task to acquire a good supply of them in a short time from the freely produced small brown seeds. These seeds can be planted in the fall; will germinate in early spring and bloom the third year after planting. The dark-skinned bulbs of CELESTIAL LILIES are always covered by many layers of old tunics that seemingly never rot. This thick husk overcoat belies the size of the bulb, and may give one the impression that the bulb has shriveled, but 'tain't so. If these husks are removed, it will be found that the bulb is really much smaller than it first appeared to be, and that it is not a flabby or shriveled dead thing, but quite firm and alive.

While *Nemastylis geminiflora* is perhaps the most common species to be found in Texas, another very similar species, *Nemastylis tenuis* (Herb.) Benth. & Hook., is found along the coastal and Rio Grande plains in the southern part of the State. There is also another related form, *N. tenuis* var. *pringlei* (S. Wats.) R. C. Foster, that occurs in the mountains of southwest Texas and the State of Chihuahua, Mexico. *N. brunnea* Wats., is also listed from Mexico.

Not long ago, a new species of *Nemastylis, N. floridana,* was discovered in the northeastern coastal region of Florida. It is described as bearing violet-blue flowers, with the same ephemeral habits as other members of this genus. It differs most notably from our common *Nemastylis* in that it blooms in the fall, from mid-afternoon till dusk, while our spring blooming species flower in the forenoon. The range of this plant is restricted, being confined to marshes, swamps, and flatwoods of northeastern Florida. In contrast, *N. geminiflora* is widespread,

being listed from Texas, Missouri, Louisiana, Kansas, Arkansas, and Tennessee.

Actually, *Nemastylis* is a genus that contains but a relatively few known species in the United States, and is characterized by having the filaments nearly free. However, Baker, in his HANDBOOK OF THE IRIDAE, includes *Chlamydostylis* as a subgenus of some 17 species found from Mexico to South America, and characterized by having the filaments united in a column to the summit. *Eustylis purpurea,* a plant that is closely related to the *Nemastylis,* is sometimes listed as *N. purpurea* by some botanists. This is a very distinctive plant, and the flowers in no way grossly resemble the usual *Nemastylis.*

The genus *Eustylis* is not recognized by all botanists (its type was originally described as a species of *Nemastylis),* but that this is a matter of opinion. To the average layman, *Eustylis* and *Nemastylis* are much too different to be considered in the same genus, but with some botanists it may be another matter. Certainly these two plants do not look alike.

Another plant that has been confused with *Nemastylis* is the very rare BARTRAMS IXIA *Salpingostylis coelestina.* This is a very closely related monotypic genus confined to a small area southwest of Jacksonville, Florida. In the 1950 edition of HERBERTIA, Wyndham Hayward wrote a very enlightening article about this little-known plant. The foliage is longer than that of *Nemastylis geminiflora* and the flower is distinguished by possessing a long, pendant, trumpet-like style, and more broadly ovate perianth lobes. A flower to be enjoyed only by the early morning risers, they are said to be called "violets" by local folks.

2. **Herbertia drummondiana** Herb.

(Syn.—**H. coreulea** Herb.; **H.** watsonii Baker; **Alophia drummondii** (Graham) R. C. Foster; **Trifurcia** Herb.)

Although *Herbertia drummondiana* has many synonyms, it is sometimes called "pleated leaf Iris", or more simply, herbertia. In 1827, it was christened *Herbertia* by Sweet. Later, in 1838, Herbert named it *Alophia;* again in 1840, Herbert called it *Trifurcia,* thereby giving rise to much confusion as to the generic name of this little bulbous Irid. The genus is said to be found from Texas to Chile and southern Brazil, but the form that we are concerned with is native to the coastal plains of Louisiana and Texas.

This species is fairly widespread, but like *Nemastylis,* it is not well known even in its own locale. Only two flowers are produced from the terminal spathe in early spring, but they are little dandies, resembling somewhat a tiny violet-blue Tigridia. The sepals are usually pale violet with a darker violet band outlining the white base, which is violet spotted. The petals are light violet in the upper part becoming a darker violet below and white spotted at the base. There are only a few leaves, and these are long and slender, rather folded or plicate. The flowers are about 2″ across, and like tigridia, the three center segments are quite small, but the three larger segments are prominent enough to

command attention. Like so many Irids, *Herbertia* fits into that group of flowers loosely termed "orchid-like" because of the appearance suggested.

Herbertias may be easily propagated by seed as they don't usually form any offsets. Like CELESTIAL LILIES, the bulbs are buried deeply in the ground and are hard to dig. They seem to like the heavy type of soil that will grow CELESTIAL LILIES to perfection, but prefer instead a neutral to mildly acid pH. They should prove to be practically as hardy as CELESTIAL LILIES because of their deeply seated bulbs and their emergence following warm spring days.

Herbertia watsonii Baker may be only a form of *H. drummondiana.* It is said to be different in that the outer segments are oblanceolate, 1″, and the inner segments obovate, ½″ long, however some botanists regard *H. watsonii* as no more than a synonym of the species.

3. **Eustylis purpurea** Small
(Syn.—**Nemastylis purpurea** Herb.)

One of the most exciting members of this group, *Eustylis purpurea* (Fig. 21) is noteworthy for being perhaps the loveliest of the entire clan. One might simply describe it as being very much like a miniature violet-purple *Tigridia.* Describing this flower is no easy task, since the soft hues, delicate dotting of the cup, and striking shape of the blossom in general, makes one realize how difficult it can be to attempt to transfer nature's artistic achievements into mere word pictures. Because of the subtle violet hues, it is no gaudy flower, but it captures the imagination as though to say "stay awhile and look at me". Truly one must study this flower in order to fully appreciate one of nature's floral triumphs.

Sometime in mid-spring, the palm-like pleated foliage begins to emerge from the sandy loam of its native habitat, and before long the wiry stem branches and terminates into several pointed spathes, from which emerge the flowers for several days in succession. They may attain a height of eighteen inches and bloom many times before the seeds ripen in early summer. Since it shares foliage, flowers and habits very similar to tigridia, it should be handled in much the same way. It should probably be classed as half-hardy, since it is a native of the U. S., and can likely stand considerably more cold than tigridias.

The slightly nodding 2″ flower may be described as having three large outer segments and three smaller inner segments, the larger segments forming a cup-like depression at the center of the blossom. This cup has a pale greenish-tan background spotted lightly with purplish-brown dots. Beyond the cup, the three segments flare into broad, violet or purple bits of color. The three small inner segments add the dramatic finishing touches to the flower. Each inner segment is colored the same as the cup at the center, but slightly more than midway past the outer half of the segment, a broad band of yellow crosses transversely. The yellow band terminates in another band of deep purple at the tip of the segment. This little purple tip also has a tiny cup-like depression.

Describing such a flower is difficult, and truly one must see it and study it to fully appreciate it.

Unlike *Herbertia* and *Nemastylis,* the bulbs of *Eustylis* are buried only a few inches below the soil surface in light sandy loam of a mildly acid nature in lightly shaded wooded areas in Louisiana, East Texas, and the Texas coastal prairies. It seems to like adequate moisture while growing, being at its best in cool wooded areas where there is enough filtered sunlight to make it happy, though it also seems to do very well in full sun. In Louisiana it is sometimes called PINE WOODS LILY according to Caroline Dorman. In keeping with other members of this group, *Eustylis* is propagated by seed.

During the war years or the mid-forties, an article appeared in the now extinct magazine HOME GARDENING FOR THE SOUTH, written by the late Ruth Marsalis Dorman, entitled "Three Little Cousins". This charming little article was devoted to the three little Irids, *Nemastylis, Herbertia,* and *Eustylis,* that Ruth Dorman knew so well in Louisiana. It was illustrated with sketches by Caroline Dorman through the courtesy of the LOUISIANA DEPARTMENT OF CONSERVATION. To quote from Ruth Dorman's article regarding *Eustylis;* "This little flower has a bit of romantic history. It was "lost" for many years. Caroline Dorman had known it from childhood. When she grew older and became seriously interested in botany, she searched all available literature on plant taxonomy, but could not find a trace of her little friend's scientific name. When she had about given up, Dr. John K. Small came to her place on a botanical expedition, and she called his attention to it. He had never seen it! She gave him plants, and, later, he looked it up in old files of botanical journals. There he found it had been named and described by Asa Gray. Although "lost" to science, it had been giving its beauty unstintedly each summer to those who loved it as PINE-WOODS-LILY."

4. Other Shellflowers

A few years ago, Mr. and Mrs. Morris Clint of Brownsville, Texas, collected another of this group of miniature bulb Irids in the Puerto de los Lobos region in the State of San Luis Potosi, Mexico. As far as I know, it has not yet been identified. It is rather like a tiny white *Nemastylis* in form, but has broad pleated foliage like a dwarf TIGRIDIA. They found it growing with *Zephyranthes Clintiae,* in full sun and part shade all over the mountains along Highway 80, in San Luis Potosi. This little Irid flowers in the summer and early fall with tiny white, mildly fragrant flowers opening in the late afternoon and early evening. It produces seeds freely and seedlings seem to grow vigorously and may flower when only a year old. Though not showy, they are so dainty and unusual that perhaps they may some day find their way into the gardens of folks who appreciate such rare floral gems. Let us hope so.

There are so many species of bulbous Irids in Mexico that it will be years before many of them will be mentioned in books about rare bulbs. While traveling through Central and Southern Mexico in mid-summer of

1957, I found several unknown species in bloom. I managed to collect a few, which later grew and flowered in my garden, but no doubt there are many others yet to be found.

One species in this collection was a tiny little lavender-flowered *Nemastylis* with narrow, grassy foliage, I also collected bulbs of two distinct *Herbertia*-like Irids, one purple and the other lavender-pink. The former grew on small mountain sides, near Morelia, in Michoacan, while the little lavender pink one grew in the rolling prairies west of Toluca, in the State of Toluca. I found a pleated leafed species that was much like *Tigridia* until it flowered, and then it was unlike any other Irid that I have ever seen. Though neither large nor showy, the flower was easily fantastic in color and form. The three outer segments were yellow with maroon-brown spots, while the three inner segments were white with the same spots, and edged yellow at the blunted tips. The three larger outer segments rolled inward so that the ultimate form of the flower was that of a pendant little balloon-like bell, suggesting a *Fritillaria.* The three inner segments were banded with a little cream-colored band that seemed to function as a gland, and forming a perfect triangular band within the flower. This little triangular band became very dewy after the flower opened. I have no idea what genus this Irid belonged to, but it certainly is one of the oddest members of this group.

There are many other species of SHELLFLOWERS that have not been mentioned, but most of these are to be found south of the United States border. Many stunning species of *Tigridia* are to be found in Mexico, flowering in warm, damp, lightly shaded hillsides in the upper altitudes. *Tigridia pavonia* is perhaps the best known species, but other species have also played a vital part in furnishing the germ-plasm lines that enabled the hybridizer to produce such a brilliant array of colors. There is not much need to mention them at any length in this article, since they are already established as relatively popular summer-flowering bulbs in the trade. The same applies to a lesser extent with the *Cypellas,* the golden-buff *Cypella herbertii,* and the violet *C. plumbea,* which are occasionally to be found among collections of rare bulbs.

Tigridias are generally available in most catalogs that list the usual fare of summer flowering bulbs, but one must search very carefully through catalogs listing unusual bulbs to find even a few lesser-known SHELLFLOWER. A few prominent horticulturists such as Wyndham Hayward, James Giridlian, and Rex Pearce occasionally list some of them in their catalogs from time to time.

HOLLAND NOTEBOOK

PHILIP G. CORLISS, *M.D.*
Somerton, Arizona

From the notes made on my 1957 Fall Garden Tour of Europe I have selected the following items concerning horticulture in Holland which should be of interest to some members of The American Plant Life Society.

(1) The government of The Netherlands insists that employment be given to males whenever possible. This may be a sensible approach to the problem of juvenile delinquency. Whatever the reason, there are only nine women employed in the Netherlands properties of the great K. & M. concern. Some of the Dutch firms now have operations in other countries, notably Denmark, where they can employ women freely.

Fig. 22. *UPPER,* hot-water treatment of daffodil bulbs for killing nematodes.

LOWER, BULB AT LEFT: Dutch bulb producers grow bulbs in southern Italy for advancing pre-formed flower; BULB AT RIGHT: with smaller pre-formed flower in bulbs grown in Denmark, for K & M. of Nordvijk (see text).

Photo by Dr. Philip G. Corliss.

(2) The Dutch firms are growing great quantities of bulbs in southern Italy, where the embryo flower developed within the bulb is much more advanced than in similar bulbs grown in northern Europe. (Fig. 22) These operations are not for production of cut flowers, but only for production of bulbs for export sales.

(3) It is a traditional custom at Van Tubergen and Co. and other

nursery firms that each company employee be given a plot of land from which the early spring bulbs have been lifted, for use as a kitchen vegetable garden. At the time of our visit in early September, these tidy vegetable gardens were ready for harvest. Cabbage, collards, and root vegetables, in that order, were most prevalent.

(4) I was delighted to see in use the water bath where daffodil bulbs are treated for the elimination of 'eel-worms' (nematodes). (Fig. 22) The temperature of the bath must be maintained at 43.5 degrees C. for two hours. If it falls more than one half degree below 42.5 it is ineffective; if it goes more than one half degree above 43.5 the bulbs are destroyed! There is no thermostat to regulate the temperature—it is operated by one skilled workman! The heat is supplied by burning liquid paraffin; the flow of the paraffin drops is regulated by turning an ordinary faucet! If the temperature gets too high, the operator can turn a crank which raises the bulbs out of the water. The bulbs are placed in the bath in coarse burlap sacks. The water contains a red mercury compound which promotes faster root development!

CONSIDER THE AROID, HYDROSME RIVIERI

BECKWITH D. SMITH, *Jacksonville, Florida*

Five years ago I was much intrigued with a picture of one of nature's curiosities in the Arum family, the BLACK SACRED LILY OF INDIA, which appeared in a Sunday supplement. After much casting around among plant dealers a source of supply was found and I ordered a dozen bulbs. These were planted in ordinary garden soil on arrival, which was in August, and the bulbs were watered well with the expectation of seeing them develop into a palm-like foliage as described in the dealer's advertising, but, alas, the bulbs all rotted in the ground and were an utter disappointment! Of course, I did not know it, but the bulbs were set out during the dormant season, and I have found from successive growing seasons that they have a strong tendency to rot if so planted when they should be resting.

Nothing daunted, another supply of bulbs was obtained, but this time they were held until the latter part of April the following year, when they were planted in a sandy loam soil, enriched with rotted leaves and cow manure, after the growing sprouts had appeared in the center of each bulb. This planting was a happy one. The bulbs made beautiful segmented, palm-like foliage, the size of the bulbs increased from a small, plum size to a diameter of two and three inches. Some made offsets. None bloomed. That was the beginning of a most interesting plant growing experience. The bulbs were dug, dried off and stored in the house for the next year cycle.

This bulb plant was formerly called *Amorphophallus rivieri,* but since has been properly designated *Hydrosme rivieri,* commonly termed DEVIL'S TONGUE or SNAKE PALM, the latter no doubt due to the mottled effect of the stalk which resembles snake skin. The origin of *Hydrosme rivieri* is said to be Cochin-China. There has been very little published

about its culture. In full growth the bulbs will make a diameter of from 5 to 6 inches, or larger. It puts up handsome tropical foliage, up to four feet tall, and blooms in spring before the foliage. The one leaf is much divided, umbrella-like, and an immense and magnificent purplish-maroon calla-like bloom will arise, which stinks to heaven. The odor is abominable for a while. It is best to put it outdoors at this time until the smell abates. Fortunately this objectionable smell lingers only for a few days. Apparently, the fetid odor attracts insects in its native habitat. Certainly, the flies are attracted to it. But I have not yet been able to produce seed. All of my increase in new bulbs has been from outgrowths around the top collar of the mother bulb when in full summer growth. All of the roots come from around the top of the bulb. The bottom of the bulb is as bald as a billiard ball. This, consequently, indicates to the prospective grower that the bulbs must be placed at least three or four inches below the surface of the planting soil, else the roots will burn and shrivel away from a too hot summer sun. In fall when foliage yellows and withers away the bulbs should be lifted and all roots rubbed off. It is normal for the roots to die off at this time for the resting period, and to prevent any danger of rotting. Bulbs should not be left outside in a cold garage, where they might decay, but should always be stored in a warm building, keeping them entirely dry. In spring be sure to keep your eye on the mature bulbs—they are liable to start blooming at any time!

Believe me, when I say this is a most magnificent plant, and one that you will long enjoy. Its tropical foliage during the summer months is most striking, and at any time during its development you will find it a stimulant to conversation and in all ways an odd and prized possession, exotically different.

A REVIEW OF THE GENUS **GAGEA** SALISB.

J. C. Th. Uphof, *Florida*

In 1943, Dr. Traub monographed the Tribe *Ixiolirieae (Amaryllidaceae)* consisting of the two genera *Ixiolirion* Fisch. ex Herb. and *Kolpakowskia* Regel (Traub, 1943)*. At that time he assumed according to the customary classification that these genera had no near relatives in the *Liliaceae.* Further research raised some doubts in his mind, and he formulated the hypothesis for testing experimentally that the *Ixiolirieae,* with inferior ovaries, are closely related to the genus *Gagea* Salisb., with a superior ovary, in the Tribe *Tulipeae (Liliaceae),* according to Hutchinson (1934)**.

The first step in checking such an hypothesis experimentally is to make an inventory of the genus *Gagea,* and at the request of Dr. Traub, I am pleased to present a general review of the genus *Gagea.* It is a genus consisting of little bulbous herbs which have always attracted my attention since I was a young man in the Netherlands. The four different species of *Gagea* found there have always been considered among the rarest species of our flora. Occasionally I would admire these little jewels at an exhibition of wild plants in Amsterdam, although to my regret I was never able to find them in the Netherlands, growing in their native habitat. In later years while botanizing in the Harz Mountains and the Thuringer Wald in Germany I had better luck. I still remember the masses of *Gagea lutea* during a sunny spring day in the Bruehle, a forest reserve near Quedlinburg am Harz. There were hundreds of these lovely little yellow flowering plants in the woods.

It is no wonder that early botanists had noticed them. In going through some of the early herbals of my private library, I noticed that Dodonaeus [1] had recorded them and called them *Bulbus sylvestris.* Looking through the equally outstanding work of his friend and compatriot Clusius [2] I find some illustrations which we recognize as belonging to *Gagea.* One is called *Ornithogalum pallido flore* and the other *Ornithogalum Pannon luteo flore.* He gives extensive descriptions of both of them. In a number of other early works they are described under *Ornithogalum* for example in the herbal of Chabraeus [3]. The illustrious Boerhaave [4], professor of medicine and botany at the University of Leiden, sums up 11 species of *Ornithogalum* that were grown in the extensive Hortis Medicus or Botanical Garden at Leiden. Some of

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* Traub, Hamilton P. The Ixiolirion Tribe. Herbertia 9: 53-59. 1942 (1943).

** Hutchinson, J. Families of Flowering Plants, Vol. 2, Monocotyledons. 1943.

[1] **Rembertus Dodonaeus.** Stripium historiae pemtades sex sive libri XXX. 222, Antwerpiae. 1583.

[2] **Caroli Clusius.** Rariorum Plantarum Historiae. 188-189, Antwerpiae. 1601.

[3] **Dominica Chaebraei.** Omnium Stirpium Sciagraphia. 219, Genevae. 1677.

[4] **Harmanus Boerhaave.** Index Alter Plantarum quae in Horto Academico Lugduno-Batavo II: 142-143, Lugduni. Batavorum. 1720.

them are now considered to belong to *Gagea*. *Ornithogalum* was also the recognized name by Linnaeus in his Species Plantarum. In the second edition of this work [5] he mentions eleven species, the first two that he describes, *O. luteum* and *O. minimum*, are now known as *Gagea lutea* (L.) Ker-Gawler and *G. minima* (L.) Ker-Gawler.

For many years there was no recognized change in the name of the genus until 1806.

It was R. A. Salisbury [6] who called attention to the fact that the genus name of *Orithogalum* was not tenable for a certain group of plants which he called *Gagea*. It is of interest to read his views expressed in these early days which have often been overlooked or forgotten and which would fit very well into our present day ideas. Salisbury states in relation to the establishment of *Gagea* that "In distinguishing many genera of the vast natural class of Monocotyledonus vegetables, it appears to me that the inflorescence is a character of primary importance, and I have little doubt that in future ages botanists will pay more attention to it than they have done hitherto, in all genera whatsoever . . . In the genus which I am now going to establish, this character of the inflorescence, if there was no other, distinguishes it from all the neighboring genera with an hypogenous corolla; or to use the Linnean phraseology, germen superum. Several species of it are already described under *Ornithogalum*, with which they neither agree in habit nor fructification; in a truly natural series, I believe they must follow *Hypoxis*, but that genus has a tuberous root, and germen inferum. I presume, therefore, to call them after a botanist who is indefatigable in collecting rare European plants, Sir Thomas Gage, Bart. F. L. S. and whose liberality in distributing them, places his name very high among those of his contemporaries." This statement is followed by a latin diagnosis of the new genus *Gagea*. Salisbury recognized seven species, e.g.— *G. fascicularis* being the first, followed by *G. bracteolaris, G. stellaris, G. spathacea, G. pygmaea, G. bulbifera* and *G. reticulatum*. Some of these were later reduced to synonyms.

Within the next hundred years the advance made in the study of the genus *Gagea* was gradual and not very extensive. Koch [7] and Boissier made important contributions. The latter author treated especially the species of the Orient [8] with smaller additions contributed by Sommier [9].

The present Century witnessed the addition of a considerable number of valuable contributions, the description of many new species, and

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[5] **Carolus Linnaeus:** Species Plantarum, ed. II. Tom. I: 439, Holmiae. 1762.

[6] R. A. Salisbury. On the characters of a distinct genus hitherto confounded with Ornithogalum, and called Gagea; with some remarks on the importance of the inflorescence in distinguishing Genera. Konig and Sims, Ann. Bot. 2:553-557, 1806.

[7] W. Koch. Linnaea 22:225-229, 1849.

[8] E. Boissier. Flora Orientalis Tom. V:200-206, 1881.

[9] S. Sommier. Due Gagea nuove por la Toscana ed alcune osservazioni sulle Gagea di Sardigna. Boll. Soc. Bot. Ital. 246-256, 1897.

an attempt to group the species under subgenera, sections and subsections in accord with their *probable* relationship within the genus. One of the first authors to give a general review of the known species was Pascher [10] in 1904, and who soon afterward published a monograph in 1905 [11] of the Asiatic species. He considered the species from the standpoint of genetic development. To this genus he considered at first *Gagea* proper, to which he added also *Hornungia* Bernh. and *Plecostigma* Turcz. To the latter he added *Szechenyia* Kanitz. He divided *Gagea* into two large subgenera, e.g.—*Eugagea* Pascher and *Hornungia* (Bernh.) Pascher. *Eugagea* has mainly spherical, cylindrical seeds, they are edged; in *Hornungia* the seeds are flat and thin. He believed that sect. *Platyspermum* Boiss., *Plectostigma* Turcz. and *Szechenyia* Kanitz should also be added to this subgenus. His grouping is followed in the arrangement of the various species in this article, and therefore I will not go into further details until later.

During the same year that Pascher published his work on the Asiatic species, there was also another ardent student of the genus *Gagea,* namely Terracciano who wrote an extensive monograph on the species of the Orient [12]

He too arranges the species into groups differing from those of Pascher. He also published an account of the genus in Northern Africa from where he mentions 10 species [13]. Soon the same author made a revision of the species that occur in Spain [14].

Later on a number of other species were added by various authors, especially by Russian botanists, who contributed many additions from Asia. The largest number of species described in any work, is no doubt given by Grossheim [15] who recognizes 74 species from the Soviet Union. The descriptions are in Russian, except the diagnosis of 14 new species which are presented in Latin. The author follows mainly the grouping of Terracciano, whereas Krause [16] follows that given by Pascher. He groups the genus within the *Allioideae-Allieae.* of the *Liliaceae.*

The species of the Genus *Gagea* belong to the temperate Zone of the Northern Hemisphere in the Old World. There are two large areas of

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[10] **Adolf A. Pascher.** Übersicht über die Arten der Gattung Gagea. Lotos, Neue Folge, 14:109-131, 1904.

[11] **Adolf A. Pascher.** Conspectus Gagearum Asiae. Bull. Soc. Imp. Nat. Moscou. 353-375, 1907.

[12] **Achille Terracciano.** Gagearum florae Orientalis. Bull. Herb. Boissier 5:1061-1076, 1113-1128; 6:105-120, 1906.

[13] **Achille Terracciano.** Les espèces du genre Gagea dans la Flore de l'Afrique Boréale. Bull. Soc. Bot. France. Memoires. 52:1-26, 1905.

[14] **Achille Terracciano.** Revisione monografica della specie de Gagea della flora espagnola. Palermo, 1905.

[15] **A. Grossheim** in: **V. L. Komarov.** Flora U S S R. 4:61-112, 734-738, 1935.

[16] **K. Krause.** Liliaceae in: **Engler** und **Prantl,** Die Naterlichen Pflanzenfamilien. 2 Aufl. Bd. 15 a : 318-319, Leipzig. 1930.

distribution which may be regarded as a close continuation of each other. Most species are found in Central Asia, westward they spread through Caucasia, Mesopotamia and to the countries bordering the Mediterranean, including Southern Europe, as well as Northern Africa and the islands. Toward Eastern and Northern Europe the number of species gradually diminishes with only nine species in France, Belgium and Switzerland [17]. Hegi describes eight species in Germany [18]. In the Netherlands the number of species has been reduced to four [19] and they belong to the rarest representatives of the Dutch flora. In Great Britain [20] but one species is mentioned. In the Scandinavian countries there are only a few species.

In the Far East the number of species decreases eastward. In the extreme eastern countries the number of species decreases and finally in Korea and Japan there are only two or three species.

Some species of *Gagea* are distributed over a considerable area, for example *G. lutea*(L.) Ker.-Kawl. is found over almost all of Europe, inclusive of Corsica and Sardinia; it is also found in Caucasia and Siberia; *G. pratensis* (Pers.) Roem. et Schult. is likewise widely distributed over Europe and further into Asia Minor. Other species are known from only a few localities, e.g., *G. kashmirensis* Turr. occurs in Kashmir; *G. juliae* Pach. has been reported from Cyprus; *G. assyriea* Terracc. from Mountain Tur Tschell in Assyria and *G. Korshirskyi* Grossh. is native to the Mountains of prov. Darvas, Buchara. One has however, to be careful in deciding whether some species are really endemic, because many areas have been explored very little botanically.

There are a few species that are found in alpine regions, among which is *G. liotardi* (Sternb.) Roem. et Schult., *G. confusa* Terracc., *G. lowariensis* Pasch. and *G. pamirica* Grossh.

The number of known species has increased during the last few decades. Krause in Engler und Prantl, Die Natuerlichen Pflanzenfamilien 2 Aufl. Bd. 15 a: 319. 1930 recognized 35 species. According to the accounts of new species that have been described later, especially in Russian publications, the number of species are risen to 109. In this review, descriptions of 92 species are included, and 17 are listed as little known and doubtful. This was necessary in a number of cases because I could not obtain translations of the original descriptions in Russian not accompanied by Latin diagnoses.

These are some of the high-lights among the studies of the genus *Gagea.*

A comparative study of genera along the boundaries of two plant families will most likely produce some interesting results. First, a

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[17] **Gaston Bonnier.** Flore Complète de France, Suisse et Belgique Tom. X: 74-77, 1936.

[18] **Gustav Hegi.** Illustrierte Flora von Mittel-Europa. Bd. II: 205-213, 1910.

[19] **H. Heukels. Rev. by W. H. Wachter,** Geillustreerde Schoolflora van Nederland. 13 ed. 713-714, 1949.

[20] **George Bentham and J. Hooker. Rev. by A. B. Rendle.** Handbook of the British Flora. 7 ed. 478, 1913.

careful comparative morphological study of *Gagea* (in the *Liliaceae)* and of the *Ixiolirieae* (in the *Amaryllidaceae)* with special reference to evolutionary tendencies in each, should be made. This can be followed as suggested by Dr. Traub with comparative chromosome studies and breeding experiments. It should be noted that the geographical distribution of the *Ixiolirieae* parallels that of *Gagea* to a certain extent since the former are found from Asia Minor to Central Siberia, Pakistan, Turkestan, Buchara and nearby regions.

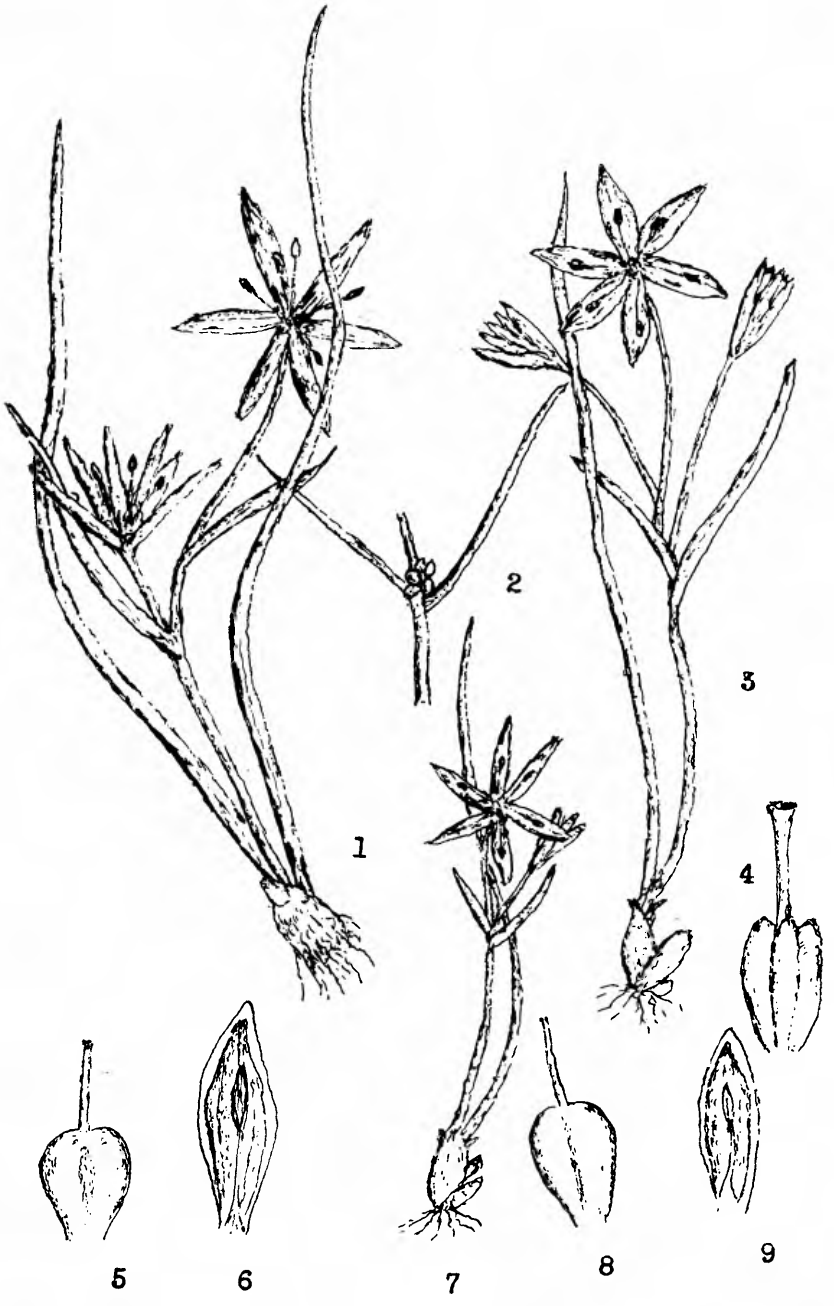
Many thanks are due for the kind help I received from the Library Staffs of the New York Botanical Gardens, and of the U. S. Department of Agriculture, Washington, D. C.; and to Dr. A. C. Smith, Curator of the Division of Phanerogams of the Smithsonian Institution, Washington, D. C., and to Dr. S. F. Blake, Senior Botanist of the U. S. Department of Agriculture.

Diagnosis of the Genus **GAGEA**

Gagea Salisb. in Koenig et Sims, Ann. of Bot. 2:555, 1806; *Stellaster* Heist. Syst. 19, 1748; *Ornithoxanthum* Link., Handb., Tom. 1: 161, 1829: *Hornungia* Bernh. in Flora 23: 392, 1840; *Bubbillaria* Zucc. in Abhandl. Akad. Muenchen 3: 299, 1843; *Plecostigma* Turcz. in Trauvetter, Imag. Flor. Ross. 9, 1844; *Boissiera* Haeseler ex Willkomn et Lange, Prodrom. Flor. Hispan. Tom. I: 218, 1861; *Solenarium* Dulac. Flor. Hautes-Pyrén. 117, 1867.

Small herbaceous bulbous plants. Bulbs 4 to 12 mm. in diameter. Leaves few, linear to lanceolate *(G. arvensis),* flat, channelled with longitudinal groove *(G. saxatilis),* being toward the apex cap-shaped, glaborus, sometimes ciliate along the margins. Basal leaves 1 to 2, sometimes 3; leaves around the stem, below the inflorescence 2 to 3. Inflorescense a few to many-flowered umbel, occasionally 1-flowered. *(G. saxatilis);* usually surrounded by leaf-like bracts, sometimes absent *(G. pusilla).* Pedicels of the same inflorescence usually of various length. Segments of the perigone 6, free, seldom more or less, expanded, 3 to 5 veined, yellow, golden yellow, yellowish, greenish, seldom white or pink; the inner ones glossy; the outer ones dull, with greenish, seldom whitish or pink stripes on the back, carrying at the base a nectar gland. Stamens 6, longer or shorter than the style. Filaments filiform sometimes flattened at the base. Anther sacks ovoid or elongated, erect, connected by the base of the filament. Ovary superior, obovate to elongate, 3-celled; each cell with many ovules. Stigma small, faintly 3-cleft. Fruit a three-sided capsule with a thin wall, few seeded. Seeds spheroid, cylindric *(G. foliosa)* or flattened *(G. alberti),* usually brown, often with longitudinal and latitudinal ridges *(G. liotardi);* sometimes furnished with appendages *(G. lutea).* Embryo half as long as the endosperm.

Salisbury (1806) proposed the genus *Gagea,* and recognized seven species: *G. fascicularis Salisb.* (= G. Lutea (L.) Ker-Gawl.); *G. bracteolaris* Salisb. (= *G. pratensis* (Pers.) Roem. et Schult.); *G. stellaris* Salisb.; *G. spathacea* (Hayne) Salisb.; *G. pygmaea* Salisb. (= *G. lio-*



1. **Gagea arvensis;** 2. bulblets developed in the avils of the leaves; 3. **Gagea liotardi;** 4. pistil of **G. liotardi;** 5 & 6. pistil and perigone segment with stamen of **G. pusilla;** 7. **G. pratensis,** 8 & 9, pistil and perigone segment with stamen of **G. pratensis.**
Plate 4

tardii (Sternb.) Roem. et Schult.); *G. bulbifera* (L.) Salisb.; and *G. reticulata* (Pall.) Salisb.

Salisbury did not designate a holotype. Pascher (1904) restricted any choice of a lectotype to the subgenus *Eugagea* by adopting that name, but he did not designate any particular species as the lectotype. In accordance with the Code, *Gagea bracteolaris Salisb.* (= *G. pratensis* (Pers.) Roem. et Schult.) is hereby designated as the lectotype.

KEY TO THE SUBGENERA, SECTIONS AND SUBSECTIONS OF **GAGEA**

1a. Seeds roundish, angular, edged ..... SUBGENUS I. GAGEA
2a. First and second leaves free, each forming in its axil an erect bulb ..... SECTION 1. DIDYMOBULBOS
3a. Stamens as long as the perigone ..... Subsection 1. *Chrysanthae*
3b. Stamens shorter than the perigone:
4a. Stamens half as long as the perigone ..... Subsection 2. *Pygmaea*
4b. Stamens usually reaching above the middle of the perigone ..... Subsection 3. *Arvensis*
2b. First leaf free:
5a. Second leaf rudimentary ..... SECTION 2. MONOPHYLLOS
6a. Basal leaves *not* round, tubular:
7a. Basal leaves *not* thick, narrow-linear ..... Subsection 1. *Minimae*
7b. Basal leaves thick, somewhat terete, linear ..... Subsection 2. *Luteoidea*
6b. Basal leaves round, tubular ..... Subsection 3. *Fistulosae*
5b. Second leaf *not* rudimentary:
8a. Second leaf surrounding the peduncle ..... SECTION 3. HOLOBOLBUS
8b. Margins of second leaf more or less grown together as far as the inflorescence ..... SECTION 4. TRIBOLBOS
1b. Seeds flat, thin ..... SUBGENUS II. HORNUNGIA
9a. Stigma faintly or shortly 3-lobed ..... SECTION 1. PLATYSPERMUM
10a. Ovary attenuate at the base ..... Subsection 1. *Reticulatae*
10b. Ovary stipitate ..... Subsection 2. *Stipitatae*
9b. Stigma distinctly 3-parted ..... SECTION 2. PLECTOSTIGMA
1c. Little known and doubtful species.

DESCRIPTION OF THE SUBGENERA, SECTIONS, SUBSECTIONS AND SPECIES

SUBGENUS I. **GAGEA.** Syn.—**Eugagea** Pascher, Lotos, n. ser. 14: 110. 1904. Seeds roundish, angular or edged.

SECTION 1. **DIDYMOBULBOS** Koch, Linnaea **22:** 229. 1849. The first and second foliage leaves free, and not surrounding the peduncle; each one having in its axil an erect bulb; the third and second leaves serving at first as a protection for the inflorescence.

Subsection 1. **Chrysanthae** Pascher, Lotos, n. ser. 14: 114. 1904. Stamens as long as the perigone; style considerably longer than the ovary; a distinct internode below the inflorescence.

1. Gagea chrysantha Schult. Syst. 7:545; *G. chlorantha* Schult. Veg. 264, Boiss. Flor. Orient. 5:209, 1881; *Ornithogalum chloranthum* Bieberst. Flor. Taur. Cauc. Suppl. 264; *G. bohemica* Regel, Act. Hort. Petrop. 3:291; Flor. Turkom. 114, 115.

Description.—Plants often short, 1 or few flowered. Basal leaves linear, long attenuate, ciliate. Flowers 12 to 16 mm. long; outer segments of the perigone more or less ovate; the inner segments longer.

NOTES.—Native to Caucasia, northern Iran, Asia Minor. Here belongs var. *cyprica* Pascher from Cyperus and Asia Minor.

2. G. AMBLYOPETALA Boiss. et Helm. Diagn. 1:7; Boiss. Flor. Orient. 5:206, 1881.

DESCRIPTION.—Basal leaves somewhat succulent. Cauline leaves opposite or alternate, ovate, grooved at the base, gradually becoming linear, attenuate. Inflorescence umbel-like. Flowers large, three or four times shorter than the pedicels. Segments of the perigone subovate oblong or long obovate. var. *Heldreichii* Boiss is a more robust plant; var. *depauperata* Boiss. is slender.

NOTES.—Native to Asia Minor, especially the western and southern coastal region.

3. G. MONTANA Pasch. in sched. Herb. germ. Prag; *G. amblyopetala* var. *montana* Pasch. Lotos N.F. 14:121, 1904.

DESCRIPTION.—Differs from *G. amblyopetala* by its stronger bulbs, stem and inflorescence. Basal leaves are linear, 3 to 6 mm. wide, rather succulent. Cauline leaves are distinctly separate from each other, robust. Lower ones are linear. Inflorescense relatively long. Flowers about 15 to 18 mm. long. Outer segments of the perigone obovate to long obovate, at the apex acuminate; inner segments obtuse. Capsule one third as long as the perigone, obovoid, attenuate at the base.

NOTES.—Native to Asia Minor. Exsiccatae: Heldreich, Herb. Norm. Graec. nr. 1290.

4. G. SMYRNAEA O. Schwarz in Fedde Repert. 36:70, 1934.

DESCRIPTION.—Plants 3 to 5 cm. high. Bulbs two. Tunic straw-like, more or less leathery. Basal leaves two, as long or longer as the inflorescence, filiform, slender not grooved. Cauline leaves three, lanceolate, acuminate, glabrous or along the margins pilose-ciliate. Flowers one, 12 to 15 mm. long; anthers more or less orbiculate. Ovary oblong; style thread-like; stigma more or less globose or lobed.

NOTES.—This species is related to *G. amblyopetala* Boiss. et Heldr. The pedicels and segments of the perigone are, however, glaborus. Native to the mountains of Asia Minor, at 1000 to 2000 m. alt.

5. G. KASHMIRENSIS Turrell in Kew Bull. 11, 1928.

DESCRIPTION.—Bulbs two of unequal size. Stem erect to 14 cm. long Basal leaves two, linear to almost filiform, about 10 cm. long. Cauline leaves alternate, unequal, dilated at the base, lanceolate, furnished with a spath; apex attenuate; margins more or less white ciliate. Inflorescence 3 to 6-flowered. Pedicels more or less erect, about 1 to 2 cm. long. Flowers yellow; segments of the perigone narrow elliptic; the outer ones acute, 5 to 7-veined; the inner ones more or less obtuse, 3 to 4-veined. Stamens 6 to 7 mm. long; anthers oblong, 2 mm. long. Ovary obovoid, toward the base attenuate, 2 to 2.5 mm. long, 1.5 to 2 mm. wide; style 5 mm. long.

NOTES.—According to Turrell in addition to the presence of a white-haired indumentum on the stem and leaves, this species appears to differ from *G. amblypetala* Boiss. et Heldr. in the smaller and relatively more elongated bulbs and in a usually more pronounced internode between the two cauline leaves. It is native to Kashmir, Sriangar at about 1700 m. alt.

6. G. BITHYNICA Pasch. Lotos N.F. 14-120-121, 1904; *G. elongata* Pasch. in sched. Herb. Dir.

DESCRIPTION.—Plants slender, 15 to 25 cm. long. Tunic of the bulbs ash-colored, brownish, somewhat membranaceous, fibers none. Bulbs frequently small, reduced, globose often somewhat unequal. Basal leaves slightly depressed, more or less circular in crosssection; at the base attenuate, 1 mm. wide, obtuse. Cauline leaves more or less opposite, grooved at the base; the lowest 4 to 5 mm. wide and 2 to 4 cm. long, the upper 2 to 4 mm. wide and 1.5 to 3 cm. long. Inflorescence few flowered. Pedicels slender, longer than the flowers, somewhat erect. Flowers small, usually 6 to 8 mm. long, on robust specimens seldom to 12 mm. long, distinctly yellow. Outer segments of the perigone oblong or obovate-oblong, obtuse or nearly rounded at the edge; inner segments obovate, oblong with a rounded apex. Stamens about half as long as the perigone. Ovary somewhat obvoid, 3-sided, attenuate at the base; at the top slightly notched or somewhat margined; style about twice as long as the ovary. Capsule obovoid, twice as long as wide, attenuate at the base, truncate and somewhat emarginate.

NOTES.—This species can be easily distinguished from the related *G. chrysantha* by its very long flowering stalks; the light yellow flowers; the long internodes and the short filiform leaves. Native to Rumelia and Asia Minor. Exsiccatae: Piehler P. exs. Flor. Rumel. et Brit. *(G. amblyopetala)* Bornmueller. It. Anat. III, nr. 5593, 5594.

[To be continued in PLANT LIFE, Vol. 15, 1959.]

PLANT LIFE LIBRARY

AFRICAN VIOLETS, GLOXINIAS, AND THEIR RELATIVES, by H. E. Moore, Jr., Macmillan Co., New York. 1957. pp. 323, Illus. $10.00. Part one is devoted to growing gesneriads, "where they come from, and how they grow in the wild and in cultivation, pests and diseases, hybrids and hybridization. Part two is concerned with kinds of gesneriads at present grown in the United States." Part three consists of appendices on synonymy, pronunciation, meaning of names, chromosome catalog, etc. There are 5 color plates and 40 line drawings.

BOTANY FOR GARDENERS, by Harold W. Rickett. Macmillan Co., New York. 1957. Pp. 236. Illus. $4.50. Dr. Rickett has produced an outstanding text on "how plants grow" in which he explains the scientific basis common to all garden practices. This clearly written, well-illustrated text is a "must have" for all gardeners.

GARDENING: A NEW WORLD FOR CHILDREN, by Sally Wright. Macmillan Co., New York. 1957. Pp. 183. Illus. $2.75. The purpose of this book is to present the "basic fundamentals of year-round gardening, through which adults may guide their juniors." This charming book with a new approach is highly recommended.

SOIL FERTILITY AND FERTILIZERS, by S. L. Tisdale and W. L. Nelson. Macmillan Co., New York. 1956. Pp. 430. Illus. $7.75. The purpose of this book is to "present some of the fundamental concepts in a manner suitable for use by students of agriculture at the junior and senior levels in college." There is a brief historical introduction, and this is followed by chapters on "the elements required in plant nutrition, their role in plant growth and development, and the soil reactions that these nutrients enter into and which affect their availability to crop plants." Highly recommended.

HANDBOOK OF BIOLOGICAL DATA, edited by W. S. Spector. W. B. Saunders Co., West Washington Sq., Philadelphia, Penna. 1956. Pp. 584. The purpose of this handbook on the basic established data in the biogical and medical sciences is "to serve the student, teacher, and the expert who seeks information outside his own area of specialization." The information supplied by thousands of biological scientists is presented in tabular form. Highly recommended.

LIFE, AN INTRODUCTION TO BIOLOGY, by G. G. Simpson, C. S. Pittendrigh and L. H. Tiffany. Harcourt, Brace & Co., 383 Madison Av., New York 17, N. Y. 1957. Pp. 845. Illus. The authors believe that "there is a unified science of life," and they have attempted "to keep principles always foremost in mind and . . . to underpin the principles with supporting facts, and to show how the principles do arise from these facts." The book, representing a full-year course, is written for both the nonprofessional student of biology, and for those beginning a professional career. The parts of the book are concerned with (a) the living world and biological principles, and (b) the cell, maintenance and integration of the organism, the continuity of life, the diversity of life, populations and communities, and history of life. This book makes one envious of biology students today who have access to such a sound, attractive and stimulating text. Highly recommended.

PRINCIPLES OF PLANT PATHOLOGY, by E. C. Stakman and J. G. Harrar. Ronald Press, 15 E. 26th St., New York 10, N. Y. 1957. Pp. 581. Illus. $8.00. The purpose of this outstanding new book, by two eminent plant pathologists, is to "develop and illustrate the fundamental principles and concepts of plant pathology." They show that there is "real unity in the great diversity of information regarding plant diseases and their control." Special emphasis is placed on pathogens that afflict food producing plants, particularly those of international importance. This is required reading for all who are seriously interested in plant pathology. Highly recommended.

THE COMPLETE BOOK OF GREENHOUSE GARDENING, by H. T. Northen and R. T. Northen. Ronald Press Co., 15 E. 26th St., New York 10, N. Y. 1956. Pp. 353. Illus. $6.50. This attractive new book by two authorities on greenhouse gardening was written to introduce the home gardener "to new possibilities,

new ways of making the most of his space and to enable him to grow the plants of his choice to perfection." The first nine chapters are devoted to general subjects concerning gardening under glass, and the remaining chapters give detailed information about the floral and vegetable crops. Any short comings, such as the inadequate treatment of the species and hybrid clones, and the omission of the cuttage method of propagation, under Amaryllis can be made good in a later edition. On the whole the book is excellent, and is highly recommended to all.

THE SPECIES PROBLEM, by E. Mayr (ed.). Amer. Assoc. Adv. Science, 1515 Massachusetts Ave., N. W., Washington 5, D. C. 1957. Pp. 395. Illus. $8.75. This outstanding book contains the papers presented at a symposium on the species problem in 1955. E. Mayr, the editor, discusses species concepts, and the difficulties and importance of the biological species. Verne Grant, John Imbrie and H. L. Carson discuss the species problem in plants, in paleontology and in genetics; J. L. Brooks, T. Sonneborn and C. L. Prosser consider the species problem with reference to fresh water organisms, protozonas, and the physiological aspects of the subject. John A. Moore looks at the species problem from the viewpoint of an embryologist. This stimulating book is required reading for all serious students of biology. Highly recommended.

EVERGREEN ORCHARDS, by W. H. Chandler, 2nd ed. Lea & Febinger, Washington Sq., Philadelphia 6, Penna. 1958. Pp. 535. Illus. $8.50. In this second edition of Dr. Chandler's outstanding text, the subject has been expanded to include several species not previously included. The text is written "in the hope that all good students of tree horticulture will want to see as much of the world as possible through their special field of study, and become acquainted with as much different tree behavior as possible." The crops included are citrus fruits, avocado, olive, litchi and related fruits, mango, cashew, evergreen nuts, papaya, passion fruit, annonas, myrtle fruits, etc., stimulant crops, coconut, oil palm, date, banana, and pineapple. This charmingly written text will be welcomed by all teachers and students of tree horticulture.

THE TREE IDENTIFICATION BOOK, by G. W. D. Symonds and S. V. Chelminski. M. Barrows & Co., 425 4th Av., New York 16, N. Y. 1958. Illus. $10.00. This new departure in method for the practical identification of over 130 different trees in any season includes over 1500 pictures. The book is in two parts—pictorial keys designed for genus recognition, and master pages for species identification. The book is "designed for everyone—the beginner, the expert tree-enthusiast, the teacher, or the student from elementary school through post-graduate work, the professional botanist."

THE NEW GREENHOUSE GARDENING FOR EVERYONE, by E. Chabot. M. Barrows & Co. 1955. Pp. 252. Illus. $4.75. This popular treatise on greenhouse gardening is an up-to-date handbook "for enthusiasts who want maximum results with minimum effort," no matter if the operation is carried on for pleasure or profit. The first six chapters are devoted to greenhouses, soils, fertilizers, etc.; the next seven chapters are concerned with details about the floral, vegetable and tree crops; and the remaining chapters with propagation, potting, pest and disease control, etc. Highly recommended.

THE LITTLE BULBS, by Elizabeth Lawrence. Criterion Books, 100 5th Av., New York 11, N. Y. 1957. Pp. 248. Illus. $4.00. This charming book about little bulbous plants is based on the gardening experience of Miss Lawrence in North Carolina and Mr. Krippendorf in Ohio. The earliest flowers such as hellebores, anemones, etc., are considered first; then follow chapters on naturalizing bulbs, snowdrops and snowflakes, squills and daffodils, hardy cyclamens, colchicums and crocuses, wood sorrels, irids, amaryllids, little bulbs in pots, and sources of bulbs. The reading of this book is a most interesting experience that is recommended to all.

ADVANCES IN PEST CONTROL RESEARCH, Vol. I., by R. L. Metcalf (editor). Interscience Publishers, 250 5th Av., New York 1, N. Y. 1957. Pp. 514. Illus. $11.00. Ten outstanding authorities present comprehensive reviews as well as critical evaluations of new concepts and developments in the field of pest control. This is required reading for all who are seriously interested in a sound scientific basis for pest control. Highly recommended.

PLANT DOCTORING IS FUN, by Cynthia Westcott. D. Van Nostrand Co., 120 Alexander St., Princeton, N. J. 1957. Pp. 280. Illus. $4.50. This is a biographical account of how Dr. Westcott "became a plant doctor and the fun she has had being one." This highly entertaining account of her varied activities is written in a charming style, and is highly recommended.

BE YOUR OWN NURSERYMAN, by R. Scharff. M. Barrows & Co. 1957. 425 4th Av., New York 16, N. Y. Pp. 223. Illus. $3.50. This is a practical book on the production of trees, shrubs and vines for those interested in landscaping the suburban home or the rural estate. The first nine chapters are devoted to general nursery practices; the next four chapters to trees, shrubs and vines for nursery and home, and the last chapter to the sale of surplus stock.

THE FLOWER ARRANGEMENT CALENDAR 1958, by Helen Van Pelt Wilson. M. Barrows & Co., 425 4th Av., New York 16, N. Y. The publishers sponsor an annual flower arrangement calendar contest. In this little book some of the photographs of floral arrangements accepted by the publishers are reproduced in calendar form for 1958. This calendar will be welcomed by the many who are interested in flower arranging.

PLANT ECOLOGY, by William Leach. John Wiley & Sons, 440 4th Av., New York 16, N. Y. 1957. Pp. 106. Illus. $2.00. The objective in this 4th revision of a standard text is to give "a clear and easily understandable account of both theoretical and practical sides of plant ecology, with a view to meeting to some extent the needs of the school, the training college and the university alike." This concise little book will serve as an introduction to the subject. Highly recommended.

SOIL-PLANT RELATIONSHIPS, by C. A. Black. John Wiley & Sons, 440 4th Av., New York 16, N. Y. 1957. Pp. 332. Illus. $7.00. The purpose of this outstanding new college text is to emphasize soils as a substrate for plant growth. It contains "a thorough analysis of some of the major soil-plant relationships" and is 'designed to give an over-all understanding of these relationships which can be applied in analyzing and interpreting specific situations." Highly recommended.

THE FAUNAL CONNECTIONS BETWEEN EUROPE AND NORTH AMERICA, by C. H. Lindroth. John Wiley & Sons, 440 4th Av., New York 16, N. Y. 1957. Pp. 344. Illus. $15.00. In this excellent book an attempt is made to "estimate the faunal exchange between Europe and North America" on the basis of "groups of animals which may be regarded as sufficiently worked through," and to "add some cases of special interest from other groups." The growing importance of the north makes this book particularly timely. Highly recommended.

GLACIAL AND PLEISTOCENE GEOLOGY, by R. F. Flint. John Wiley & Sons, 440 4th Av., New York 16, N. Y. 1957. Pp. 553. Illus. $12.00. Although based on the author's "Glacial Geology and the Pleistocene Epoch," this is a new book which emphasizes the North American Pleistocene, and "reflects the unprecedented advances in Pleistocene research during recent years." However, it remains primarily a text of glacial geology. Among the discussions are those of sea-floor stratigraphy, soils, frozen-ground phenomena, and geochemical contributions to chronology and the measurement of temperatures. Highly recommended.

AN INTRODUCTION TO GENETIC STATISTICS, by Oscar Kempthorne. John Wiley & Sons, 440 4th Ave., New York 16, N. Y. 1957. Pp. 545. Illus. $12.75. The purpose of this outstanding new work is "to present the basic statistical concepts and tools which the genetic research worker needs, with examples from genetics." This is a required text for those engaged in genetic research. Highly recommended.

A TREATISE ON LIMNOLOGY, Vol. I. Geography, Physics and Chemistry, by G. Evelyn Hutchinson. John Wiley & Sons, 440 4th Av., New York 16, N. Y. 1957. Pp. 1015. Illus. $19.50. This is the first of two volumes addressed to workers in limnology and other fields with the objective of giving "as complete an account as possible of the events characteristically occurring in lakes. It examines the whole sequence of interdependent geological, physical, chemical and biological events that operate together in a lake basin." This outstanding work by an eminent scientist is highly recommended.

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For the roster of the general officers of the Society, the reader is referred to the inside front cover of this volume.

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[Affiliated with the American Plant Life Society]

[AMERICAN AMARYLLIS SOCIETY, continued from page 2.]

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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. $5.00 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 (1—X; 1—90), includes a portrait of George Yeld. $2.50 postpaid.

PERIODICALS

(A) HERBERTIA [First series, 1934 to 1948, incl.], devoted exclusively to the amaryllids (Amaryllidaceae), and the workers concerned in their advancement. A complete set of these volumes is indispensable to all who are interested in the amaryllids. Libraries should note that this may be the last opportunity for complete sets.

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A NATURALIST IN PALESTINE, by Victor Howells. Philosophical Library, 15 E. 40th St., New York 16, N. Y. 1957. Pp. 180. Illus. $6.00. This fascinating book is based on the author's travels across Palestine over a nine months' period before it was split into Israel and Jordan. He writes "both as a naturalist and as a sharp-eyed and sympathetic traveler." This utterly charming book is written primarily for the layman, and recommended for all readers.

LIGHT, VEGETATION AND CHLOROPHYLL, by T. Terrien, G. Truffaut and J. Carles. Philosophical Library, 15 E. 40th St., New York 16, N. Y. 1957. Pp. 228. Illus. $6.00. Translated from the French by Madge E. Thompson, this book presents a concise exposition of present day knowledge of light as a form of energy, the light requirements of plants, the chemistry of chlorophyll and photosynthesis. Highly recommended.

JAPANESE GARDENS, by Jiro Harada. Chas. T. Branford Co., 69 Union St., Newton Centre, Mass. 1956. Pp. 160. Illus. $8.50. This attractive book by an outstanding authority on the subject, reinforced by 200 first-rate illustrations, will be welcomed by American gardeners generally. The general principles underlying Japanese gardening are first presented and then their development is traced over a period of thirteen centuries. All gardeners will want this utterly charming volume for their garden libraries. Highly recommended.

A COMPLETE GUIDE TO HARDY PERENNIALS, by Frances Perry. Chas. T. Branford Co., 69 Union St., Newton Centre, Mass. 1958. Pp. 288. Illus. $5.75. This book, in which more than 2000 species and varieties are described, is based on about thirty years of experience with perennials in the herbaceous border by an outstanding English authority. Chapters are devoted to history, preparing the border, planning and planting, pests and diseases, propagation, lists of hardy plants, and plants for special places and purposes. This beautifully illustrated book, including forty color plates, is highly recommended.

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PLANT LIFE

VOLUME 14

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EDITED BY
HAMILTON P. TRAUB
HAROLD N. MOLDENKE

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Cover design by Hamilton P. Traub of *Sternbergia lutea* is based on a photograph of this species taken by Sam Caldwell in his Tennessee garden.

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