PLANT LIFE, VOL. 13, NO. 1, JANUARY, 1957

HERBERTIA

THE AMERICAN PLANT LIFE SOCIETY

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PLANT LIFE, VOL. 13, NO. 1, JANUARY, 1957

HERBERTIA

1957

Year Book of
The American Amaryllis Society
23rd issue

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

PREFACE

This 23rd issue of HERBERTIA is dedicated to Mrs. Morris Clint who received the 1957 HERBERT MEDAL AWARD for her outstanding contributions to amaryllid culture by introducing various species of *Zephyranthes, Habranthus, Sprekelia* and *Hymenocallis* from Mexico; and for her contributions toward popularizing the amaryllids in the United States. Mrs. Clint contributes a charming autobiography, and also a stimulating report on her amaryllid explorations in Mexico and Texas. The beautiful cover design is based on *Zephyranthes clintiae,* named in her honor, and it is the work of her gifted daughter Marsha Clint Wilson (Mrs. David E. Wilson).

This is also the first LYCORIS EDITION of HERBERTIA. The lycoris have been a neglected gardening opportunity which was understandable so long as only a few kinds were available. However, this is no longer true. Of the fifteen species recognized, twelve are at present available by a little searching in the United States. The color range is most interesting, including whitish, cream, straw, sulfur yellow, cadmium orange, red, blood-red, lavender, pink and bluish. Those who have them in their gardens eagerly look forward each season to lycoris time from late July to late fall. Most species can be grown in the southeast, south Texas, southern Arizona and California. *Lycoris squamigera, L. sanguinea, L. radiata* and *L. traubii* can be grown farther north but the exact range has not been established. It is hoped that those who grow them in the north will report in HERBERTIA for the benefit of the members. Those who do not have any lycoris should make good the deficiency without delay. A few members have started breeding experiments. Those who have been most active in popularizing lycoris are Sam Caldwell of Nashville, Tenn., Mr. Wyndham Hayward of Winter Park, Fla., Mr. Cecil Houdyshel of La Verne, Calif., and Mr. O. R. Johnson of Bound Brook, N. J.

In the present issue an attempt is made to include stimulating articles on lycoris which include contributions by Sam Caldwell, O. R. Johnson, Mrs. Klottz, Mr. Wood, Mr. Hayward and Dr. Bose. It is important to note that four *new* species of *Lycoris* are described in this issue, and one hybrid—a landmark. These articles serve as an introduction; more are to follow in future issues.

As in previous issues, the other amaryllids are not neglected. There are articles by Dr. Thornburgh, Mr. Klotzbach, Mrs. Pickard, Mrs. Elias, Mrs. Harding, Mr. Carsley, Mr. Weisner, Mr. Sayler and Dr. Joseph Smith. There is a report on the rediscovery of the Leopard Amaryllis by Prof. Nelson; *Amaryllis forgetii* by Mr. Harradine, and Round Robin Notes by Mrs. Flick.

Mrs. Seale writes about *Sprekelia.* Mr. Gilmer on *Hemerocallis,* Mr. Hannibal on *Brunsvigia rosea* (Cape Belladonna) hybrids, *Ammacharis,* and *Crinum.* Mr. Jones reports on crossing Texas Zephyranthes. Beautiful new species of *Habranthus* and *Chlidanthus,* and the new genus *Rauhia,* are described. There are reports on Amaryllis shows in New Orleans and Mobile, a report on visits with amaryllid enthusiasts by Dr.

Howard, and other worth while contributions.

The 1958 HERBERTIA, the 24th issue of the yearbook of the AMERICAN AMARYLLIS SOCIETY, will be dedicated to Mr. Wyndham Hayward of Winter Park, Florida, who was largely responsible for the revival of interest in the amaryllis since 1933 when the AMERICAN AMARYLLIS SOCIETY was organized.

Contributors to the 1958 issue are requested to send in their articles by September 1, 1957 in order to insure publication of this issue in early January if possible. Time of publication depends entirely on the receipt of the articles, and the cooperation of all towards early publication will be greatly appreciated.

April 15, 1957,
5804 Camino de la Costa,
La Jolla, California.

Hamilton P. Traub
Harold N. Moldenke

CORRIGENDA

PLANT LIFE, VOL. 12, 1956

Page 3, 2nd line of text; Page 5, Dedication; Page 6, Plate 1, legend; Page 7, title of article, and 2nd line of text, for "Edwin Owen Orpet" read "Edward Owen Orpet".

Page 21, Fig. 3, first line, for "Mrs. E. B. Seale" read "Mrs. B. E. Seale".

Page 75, in title "SPECIES NAMES AND SYNONOMY" change the last word to "SYNONYMY".

TABLE OF CONTENTS at end of volume, page [iii], entry for Page 7, and on page [v], entry for page 6, for "Edwin Owen Orpet" read "Edward Owen Orpet".

[PLANT LIFE LIBRARY—continued from page 130.]

GENETICS; THE MODERN SCIENCE OF HEREDITY, by E. O. Dobson. W. B. Saunders Co., West Washington Sq., Phila. 5, Penna. 1956. Pp. 329. Illus. The purpose of this excellent book is to present a genetics course for "those many students who may later apply their genetic knowledge in medicine, in plant or animal breeding, in one or another of the specialized fields of botany or zoology, or even as professional geneticists". The subject matter is grouped into four sections—principles of genetics, the more advanced aspects of genetics or special applications, human genetics, and historical retrospect. This is among the finest genetics texts and is highly recommended.

MICROBIOLOGY; GENERAL AND APPLIED. 2nd ed. by W. B. Sarles, W. C. Frazier, J. B. Wilson & S. G. Knight. Harper & Brothers, 49 E. 33rd St., New York 16, N. Y. 1956. Pp. 491. Illus. $5.75. This thorough revision of a standard comprehensive text is designed for students in general science, agriculture, home economics, pharmacy, chemistry and engineering. It introduces beginning students to the microorganisms: algae, bacteria, viruses, higher bacteria and protozoa. This clearly written and stimulating text is highly recommended.

Dedicated to

Katherine Lamberton Clint

Herbert Medalist—Katherine Lamberton Clint

Plate I

KATHERINE LAMBERTON CLINT

An autobiography

It is with pride and a deep sense of humility that I acknowledge the honor of the highest award of the American Amarylis Society with the usual autobiography. To the many who have contributed, either by inspiration, counsel or actual help, toward my endeavors, I wish to express my sincere appreciation and grateful thanks. Among these kind friends are Wyndham Hayward, Dr. Thad M. Howard, Dr. Walter S. Flory, Jr., Len Woelfle and Miss Willie May Kell. I am deeply indebted to Fred B. Jones for his help, both in research and in the field. I am especially indebted to Dr. Hamilton P. Traub for his technical advice, his unflagging interest in my work and his patience in evaluating my amateur observations. To my husband Morris I owe an equal share in this great honor, for his quick eye, his untiring job of chauffering, his unlimited optimism and enthusiasm which have made the difference between success and failure.

I was the eldest of three children, two girls and a boy, and was born on June 12, 1904 in Kentwood, Louisiana, where my father was manager of the local bank. My parents were Lois Adah Gill of Magnolia, Mississippi and Placide Marc Lamberton of New Orleans, Louisiana. My ancestors date back to pre-revolutionary days on both sides of the family—of Dutch, Irish and English extraction on my mother's side, while my father was half French and half Scotch.

When I was about a year old, my father accepted a position with the Carrollton branch of one of the larger banks in New Orleans. There, we lived for a short time with my Grandfather Lamberton and even after we moved into our own home in the comparatively new section of Carrollton, I paid long and frequent visits to the big, rambling, old fashioned house. My grandfather was a big, raw-boned Scotchman, 84 when I first remember him, who had run away from home as a boy and had many hair-raising tales to tell of his adventures in both the Mexican and Civil Wars. He was a civil engineer by profession, but had a wide Jack-of-all-trades ability. Among his many interests was a life long devotion to floriculture. He had mastered the art of budding and grafting and was amazingly successful in forcing plants into perfection of bloom. As a very young child I spent long hours with him among his beloved plants. Perhaps this constant association accounts for my own intense love of flowers, which must have developed at a very early age, for some of my most vivid childhood memories are recollections of my pleasure in blooming things.

In 1919, my family moved to Brownsville, Texas, where my father became Vice-president of the First National Bank. The young people accepted me generously as one of them and I became completely engrossed in the good time a small town offers a teenager. My high school education was divided between three different schools so that I might receive the four full years of Latin deemed necessary by my father. I

am now very grateful for my knowledge of this important subject but deeply regret that my science courses suffered in the many transfers and I failed to receive even a basic course in Botany. What little knowledge of this subject I now possess has been of necessity self-taught and mainly confined to those families of plants which hold special interest for me.

In 1924 we moved once again to New Orleans—much to my distress; for my love of Texas had become very strong. I was to enter Newcomb College in the fall, but tragedy intervened. While I was still visiting in Brownsville my entire family nearly lost their lives in a terrible fire. My mother was seriously injured and her lengthy and costly illness drove all thoughts of college from my mind. When she recovered I secured a position with the New Orleans Public Library. About a year later, a vacancy occurred in the Sofie B. Wright High School and I was chosen by the school board to fill the position of Librarian, which I held until my marriage.

In 1927 I was married to Morris Walker Clint of Brownsville, Texas. My husband's family were well established in town, having come from East Texas in 1909. Our marriage has been an extremely happy one and we have been blessed with three children: Morris, Jr., Marcia Virginia and Alan Marc.

From the day we first moved into our own home, a newly built rent cottage on raw unlandscaped ground, we found our interest in gardening to be a mutual pleasure. Doing most of the work ourselves, we sodded the lawn, dug and planted flower beds and eventually built a small lath house for seedlings and pot plants. During this period we won the annual award of the local Civic League for "the most improvement in home grounds."

A few years later we moved into our own home. By now we were well beyond the kindergarten age in gardening and began to have "growing pains," for we were no longer completely satisfied with the ordinary run of plants nor of our gardening knowledge. We subscribed to various gardening magazines, which we read avidly. As the nearest library of any size was several hundred miles away, we started our own botanical library. One of my proudest possessions was Bailey's Standard Cyclopedia of Horticulture which Morris gave to me for my birthday. Unlimited effort was spent in trying out various annuals and perennials in an effort to keep the garden pretty the year round. To fill the gap caused by the scarcity of perennials which would thrive this far north, we inevitably discovered the amaryllids and other bulbs. I believe we were the first in town to plant the *Amaryllis* and *Hemerocallis* hybrids of that period and the first to prove that *Agapanthus* could be made to bloom successfully in Brownsville.

When does a gardener become a "collector"? Looking back, I am not sure just when this happened to us. Perhaps the inclination was always with us to some extent, but after we moved into our present home in 1945, several things completed the transformation. We acquired a large acreage with "resaca" frontage on the edge of town for a prospective homesite and soon found ourselves "collecting" material for future landscaping—mostly rare tropicals and exotics which we ordered from

nurseries in this country and Hawaii. We joined the American Amaryllis Society and were so delighted with our first year book that we were not satisfied until we had a complete file of Herbertia, which I found a never-ending gold mine of information. We read of amaryllids we had never heard of before and were soon started on a "collection" of all available species and varieties. *Zephyranthes* became my special favorites, although the more spectacular Dutch hybrid *Amaryllis* caused a sensation in town. We made the acquaintance of an orchid grower and importer, Arthur Paul Summers, who had just moved to Brownsville from Panama. With Paul Summers help, Morris was able to realize a dream of many years—the growing of orchids. Soon we had a fine "collection" of botanical orchids, including many worthwhile species.

It is astonishing how quickly one runs out of space on even a large city lot. We purchased 2/3 of the empty lot adjoining us and built a lath house to hold our ever-growing collection of tropicals and bricked in a special patio for the orchids. Within a short time we had one of the finest assortments of tropical plants and botanical orchids in the south. The growing of orchids was quite a novelty in the Valley at that time and gave us a certain notoriety. A number of garden clubs from various parts of the Valley made "pilgrimages" to our home.

Unfortunately the freezes of 1949 and 1951, followed by two successive years of drought and water rationing took a heavy toll, not only of our plants but of our gardening morale when many plants and bulbs which had withstood the first hardships succumbed to toxic well water. In a way, perhaps our losses were fortunate, for it left us free for the rapid development of an interest which had started several years previously, in the fall of 1946, when Morris was asked to accompany Paul Summers on a jaunt into Mexico to collect orchid species. He came home with such glowing accounts of the beauty of that tropical mountainous country that a trip was planned for the ensuing spring, on which Mrs. Summers and I were to be included. Actually, two trips were made—in March and the latter part of April. These trips were destined to lead us into another "collecting" spree—only this time from the wild instead of from nurseries and catalogs. Certainly without them this article would not have been written.

Currently we are "up to our ears"—with more projects going on than we can possibly keep up with. We are bending every effort to get our remaining rare plants transferred from pots into the ground at the farm, where they will be more easy to care for. Besides the thousands of *Zephyranthes* bulbs in the trial garden, there are even greater numbers of seedlings, many of which are still in pots and flats. The beds of the trial garden bulge with *Crinum* species and varieties, besides numerous species of *Hymenocallis* and *Hemerocallis* clones. We have started an *Amaryllis* breeding program and are still in the process of completing a large shade house in the country to better care for these and other seedlings: cycads, *Beaucarnea,* dwarf palms, amaryllids and other rarities from Mexico. I believe our "collecting" has finally caught up with us.

COLLECTING AMARYLLIDS IN TEXAS AND MEXICO

Mrs. Morris Clint, *Texas*

It is inevitable, I think, when one's interest in plants is at all extensive, that eventually a gardening hobby grows to include to some extent the collection of plants from their native habitats. For many years our own collecting was confined to the Lower Rio Grande Valley of Texas. Unable to travel very far when our children were young, we utilized small outings, picnics, hunting and fishing trips for plant scouting expeditions and successfully transplanting many of the wildings we happened upon.

When the Victoria Road, which connected Brownsville with the Pan American Highway at Cuidad Victoria, Mexico, was opened to travel, our business and home responsibilities had eased sufficiently to enable us to make several short trips a year into the upper part of tropical and subtropical Mexico. The wealth of vegetation and bewildering assortment of plant life we encountered there was a real bonanza to gardeners who had about run out of plants to order from even the more exotic nurseries and before the Mexican plant quarantine restrictions became severe we brought out and successfully propagated some fine tropical plant material. This included *Zephyranthes clintiae* and other miscellaneous *Zephyranthes*, *Zamia loddigesii* var. *angustifolia, Ceratozamia mexicana, Zamia fischeri,* (note: I am indebted to Dr. Velva E. Rudd, Associate Curator, Division of Phanerogams, Smithsonian Institution, for the determination of these three cycad species.) *Dioon edule,* and unidentified species of *Ficus, Peperomia, Agave, Monstera, Anthurium, Calathea, Plumeria, Heliconia, Maranta, Begonia* and various cycads, bromeliads and ferns. Several years ago, restrictions were lifted on seeds and on plants of a bulbous or tuberous nature, which fortunately includes the two classes of plants we now find so fascinating—amaryllids and cycads.

Our present intense devotion to the collection of amaryllids in Mexico has developed rather gradually over the years and actually had its beginning prior to the collection of *Z. clintiae* and other *Zephyranthes* in 1947. I shall endeavor to take the reader chronologically through the series of events which led us into our current absorbing fascination and report on those collecting trips which have not yet been covered in Herbertia.

In October, 1946, on his first trip into Mexico, Morris saw what he is still certain was a light blue *Zephyranthes* on one of the mountainslopes bordering the valley of Puerto de Lobos, in the state of San Luis Potosí. Only one flower was seen and although he followed the succulent stem for 5 or 6 inches below ground, he was forced to abandon the bulb when the stem entered a crack in the immovable rock below. I can still remember my disappointment when he told his story upon his return and admitted that he had failed to bring back either the bulb or the flower. With a full knowledge of just what such a discovery would mean to the amaryllid world, it is small wonder that we have never ceased to search for this problematical rarity. Indeed, for several years it occupied all

our thoughts and we scheduled trips for various times of the spring, summer and fall in an effort to find the bulbs in bloom once more, for the lone blossom gave us no clue to the normal blooming date of the species.

Toward the end of April, 1947, we witnessed what we now know was a record bloom of *Zephyranthes* in the Puerto de Lobos region (Herb. 1952). After these bulbs bloomed again in our garden, I was prompted by Wyndham Hayward's article "Diminutive Amaryllids" (Herb. 1947) to write him of our discoveries—giving him a glowing account of what we had seen and of the variation among the bulbs we had collected. He responded with so much enthusiasm that I promptly sent him one of the red flowering forms. When this bulb bloomed for him, his own interest skyrocketed and he forthwith communicated the news to Dr. Traub.

During the summer of this same year, my son, Morris, Jr., brought home bulbs of a large and beautiful amaryllid he had found in bloom near El Sol, San Luis Potosí. This collection, our M-30, was subsequently determined by Dr. Traub as *Z. macrosiphon.* It was this collection which first opened our eyes to the fact that there might be still other *Zephyranthes* species well within our reach.

The publication in Herbertia of *Z. clintiae* as a new species in 1952 resulted in a lively correspondence with others who were also fascinated by *Zephyranthes* and other amaryllids: Fred B. Jones, Len Woelfle, Dr. Walter S. Flory, Jr., Thad Howard, Miss Willie May Kell. The enthusiasm of the writers and the wealth of information derived from this correspondence served to quicken our own growing interest, and directly resulted in starting us on an extensive study of our local *Zephyranthes* species. Beginning as an effort to locate or prove the existence of *Z. chrysantha,* originally described from collections near the town of Rio Hondo, Texas, about 30 miles north of Brownsville, our growing fascination for these little bulbs led us over the entire Lower Valley, including Cameron, Willacy, Hidalgo and Starr counties. We were astonished to learn that by far the greatest concentrations of the yellow flowering *Zephyranthes* species in the Valley were to be found virtually within the city limits of Brownsville, although we have collected them as far west as Rio Grande City (Fred Jones collected *Z. pulchella* in Webb County, near Laredo), in and near Rio Hondo, and almost to the coast—near Bayview. We paid a visit to Robert Runyon, discoverer of *Z. smallii,* and saw this species in bloom in his garden. Though Mr. Runyon's notes revealed that he had collected his original bulbs near Progreso, some 30 miles away, we learned that *Z. smallii* is now found in abundance only in and near Brownsville. In our several years study of the local species: *Z. pulchella, Z. smallii* and *Z. brazosensis,* we learned much of their behavior and formed many opinions of their apparent still active evolution. There is an astonishing amount of slight but noticeable variation—not only from field to field but even within the same field. As for *Z. chrysantha,* which supposedly differs only slightly from *Z. citrina* and *Z. pulchella,* I can only say that if it exists, it will surely be found somewhere in our collections. Numbered samples of the major variations of both Zephyranthes and Cooperias

collected over the Valley were sent in to Dr. Traub and others for trial and study and the same bulbs planted in our garden for our own study. One of these numbers, T 56, a large and lovely yellow Cooperia, has proved to be outstanding in size, beauty and performance in the garden. A real Find!

Meanwhile, Fred Jones had long been busy with the *Zephyranthes* species of his own neighborhood. His enthusiasm and successfully active field work encouraged us to visit him during their blooming season. On two occasions—in the fall of 1952 and 1953—we collected along the way from Brownsville to Corpus Christi and, with Fred as our guide, over the Coastal Bend area from below Corpus Christi to the mouth of the Guadalupe River. Here, we saw in bloom and collected in the wild: *Z. pulchella* in several variations, *Z. traubii, Z. jonesii, Z. brazosensis, Habranthus texanus* and a lemon yellow flowered *Zephyranthes* species, as yet unidentified, which Fred had discovered on an earlier field trip.

As a direct result of our mutual interest and mounting interest for *Zephyranthes,* we received several pleasant visits from Fred Jones and Thad Howard and in October, 1954 from Dr. Walter S. Flory, Jr. who came through Brownsville after a two weeks collecting trip in Mexico.

On our way to San Luis Potosi in April, 1953, there occurred an event which was to play an important role in the methods and course of our future explorations. On a chance "hunch", husband Morris found a most interesting white Cooperia, M-292, right in the middle of territory in Mexico we thought we had covered fairly thoroughly for years. This number bears a large and beautiful flower and seems to be somewhere between *Z. traubii* and *Z. brazosensis.* A stone's throw away, we collected a new form of pink *Zephyranthes* to add to our growing list of variations from this area. Though I have often felt the lack of a technical education, the regret is never keener than when confronted with the abundant variation found among the *Zephyranthes* populations in the 30 miles or so of mountainous territory from Naranja to Cuidad del Maíz. We have often wished for the opportunity of spending an entire season in this neighborhood in an effort to partially solve the riddles existing there, for even the variations in altitude and the extreme differences in soil, rainfall and general climatic conditions do not offer a completely logical explanation for the intensely active evolution which is no doubt still in progress.

About this time, friends brought us bulbs from the state of Mexico, collected near Ameca-meca, and spoke of seeing large pink *Zephyranthes* in the mountains north of Jacala, in the state of Hidalgo. Not long afterward, Thad Howard wrote us of collecting 4 distinct species of *Zephyranthes* on a single trip into Mexico in July, 1953. One can imagine how these various discoveries brought our collector's blood to the boiling point.

This brings us to the fall of 1953. We suddenly realized that we had actually covered very little territory in our travels over Mexico and had spent far too much time and effort searching for the elusive blue *Zephyranthes.* However, stubbornness prevailed on us to make one last effort to locate this phantom, so we planned a trip to Puerto de Lobos

for October, the month the bulb was originally seen in bloom. It was also proposed to drive southward from Tamazunchale to look for various kinds of seed and perhaps find *Zephyranthes* in leaf. Sad to relate, the blue *Zephyranthes* still remains an unsolved mystery. Though we saw *Zephyranthes* in leaf by the thousands, not a single bloom did we find. Fall rains hampered us on the entire trip and when we arrived at Tamazunchale, we were told that the rains were exceedingly heavy in the mountains below and extended all the way into Mexico City. It rained all night and well into the next morning and we began to fear that we would be forced to abandon the rest of the trip, which had originally been planned as a two day journey to Zimapan, about 100 miles away. However, about 10 o'clock the weather cleared and we decided to drive to Jacala and return the same day. It was soon apparent that we knew little of this particular mountainous stretch, for we ran into heavy fog and light rain just a few miles beyond Tamazunchale. Landslides had been numerous and the debris often still covered the road. To make matters worse, we came upon two serious accidents of the night before. We thought often of turning back, for our unfamiliarity with the highway only added to the danger of the impenetrable fog, but the eagerness of our search and the hope that the fog would soon dissipate led us on. We made numerous stops along the way, but failed to find *Zephyranthes* foliage in the abundance of tropical growth of all kinds brought out by the summer and fall rains. We were fascinated by the wealth of bloom—strange vines, flowering shrubs and trees and numerous wild flowers. A sea of blue proved to be *Cynoglossum,* which has become naturalized along a portion of the roadside. We must have seen at least 4 distinct species of *Salvia*—one dark blue beauty fully 4 feet high. The houses on the mountainsides were colorful with *Dahlia,* roses, *Begonia, Impatiens* and other blooming plants. The double flowering white daisy tree had been freely used and was now a sheet of bloom in immense banks.

At last we came out in sunshine as we reached the backbone of the range, just a few miles north of Jacala. This is truly beautiful country —gently rolling and more open than the jungles above, with a few scattered oak and pine trees, carpeted like a lawn with low growing grass and abundant with wild flowers. We stopped at a particularly lovely place called Puerto de la Zorra [Fig. 1] for lunch, mainly because it had the definite look of *Zephyranthes* territory. Sure enough, we found them in leaf just a few feet from the car. Our lunch was almost forgotten when we discovered that there were two distinct species—small bulbs which grew in clumps and had very narrow, slightly glaucous leaves which were in full growth and larger bulbs with very broad leaves which were rapidly going dormant. Although both were unfamiliar to us, we found the larger bulbs most intriguing and unusual and even wondered if they actually were *Zephyranthes.* These discoveries placed a new significance on our rapidly enlarging conception of the *Zephyranthes* species of Mexico and made us long for spring and the return of the blooming season.

On the way home, we visited L. E. Guerra, a plant lover and collector, at Tamazunchale, San Luis Potosí. We wished him to secure for

us bulbs of a particular *Hymenocallis* species grown to some extent in gardens over town. The *Hymenocallis* is a very beautiful one, belonging to the group with broad bladed, petioled leaves and the crisp, heavy textured flowers remain in good condition for several days. A number of years ago, we had acquired a small offset from a plant in one of the tourist courts in Tamazunchale. The bulb had grown well and flowered, but failed to set seed or form offsets. Of course, the talk soon turned to *Zephyranthes.* Mr. Guerra remembered seeing a few large white flowers and promised to bring us bulbs of these and to look for the *Hymenocallis,* also. When he arrived, about a month later, we were delighted,—for he brought us an unidentified pink species of *Zephyranthes* he had found in some abundance along the banks of the Rio Moctezuma near Tamazunchale, our number M-375, and bulbs of a species of *Hymenocallis,* M-374, which he had collected along the sandy banks of a river in the Isthmus of Tehuantepec. These prizes somewhat compensated us for his failure to locate the white flowering *Zephyranthes* (which he told us were never in great abundance) and the desired species of *Hymenocallis.*

Meantime, our Texas species were not forgotten. Miss Kell had sent us bulbs of *Z. longifolia,* collected for her in the Davis Mountains, but these had failed to bloom for us for we did not have a favorable place for them. However, during the fall and winter of 1953-54 we had cleared and prepared ground on our property in the country for a good sized trial garden to plant our growing numbers of *Zephyranthes* and other amaryllids. Reports of heavy rains in West Texas in mid-April decided us to make a trip to that area in hopes of finding *Z. longifolia* in bloom. As usual we made frequent stops along the way, looking for possible *Zephyranthes* and collecting various desert plants—*Yucca, Dasylirion, Nolina, Agave* and *Hesperaloe.* A few miles west of Del Rio, we were thrilled to find *Z. drummondii* D. Don in bloom—our first glimpse of this species in the wild—and were surprised at how much they varied from the form we had long grown in our garden. We were delighted to find several stands of *Allium coryi* in bloom on the rocky ledge above the highway a few miles north of Ft. Davis and brought home enough of this beautiful little yellow flowered species to share with others. It was another "first" for us. So far, we had seen no sign of *Z. longifolia.*

There had been almost no rain beyond the eastern slopes of the mountains and we began to doubt that we would find this species in bloom—perhaps not even in leaf. In fact, we would definitely have come home empty handed if our stubbornness and persistence had been any less. We found a few bulbs along the roadside just north of Ft. Davis and eventually discovered a heavy concentration of bulbs just peeping out of the ground in one of the broad, low valleys on the western side of the mountains. We were still not certain of just what we had collected, however, for Miss Kell had written that a small Cooperia species was also native to this area. Fortunately, we were not kept long in doubt. About 40 miles west of Ft. Stockton we drove through country which had received heavy rainfall and along the roadside and in the shallow ditches we found a few clumps of what must certainly be *Z. brazosensis* and the same little bulbs we had collected earlier. Buds on the latter

were already showing color and a few days after our arrival home, we were treated to our first glimpse of *Z. longifolia* in bloom. After this comewhat difficult accomplishment, perhaps we can be pardoned if our confidence arose in our ability to locate *Zephyranthes* in strange territory.

Therefore it seems plausible that we started on the historic trip of May, 1954, on which we were accompanied by Fred Jones, with an

Fig. 1. Habitat of *Zephyranthes* spp. M-449, M-565, M-569 and M-618—Puerto de la Zorro, approx. 7 mi. north of Jacala, Hidalgo, Mexico. Photo Clint, 10-5-53.

optimism which was at least partially justifiable. We had acquired many good collecting habits and a fair knowledge of how and where to look for *Zephyranthes*. We had learned to take exact mileage data wherever we found bulbs of any kind, which proved of immeasurable value when the same territory was covered again—not only in locating former collections, but often in discovering new forms and species hitherto invisible to us, for we had learned that for every bulb seen above ground there are usually hundreds or even thousands still dormant and unsuspected below the surface. On this and subsequent expeditions we

found out that the statement that I had made several years earlier "all Mexico is paved with *Zephyranthes*" was more literally correct than even we had imagined. As this trip has already been reported in Herbertia 1955, I will only add that after this unbelievable success, the Clints were now completely dedicated to the search for *Zephyranthes*.

Since we felt that we had been cheated out of possible discoveries in territory south of the immediate San Luis Potosí area because of the delay in the seasonal rains, we planned another trip in July of this same year. Our route took us on the Pan American highway to El Mante, Tamazunchale and Zimapan; westward on highway 45 through the states of Hidalgo, Queretaro and Guanajuato to Leon; north and eastward on highway 80 to San Luis Potosí, Cuidad del Maíz, Antiguo Morelos and home again. Though we were not to find many *Zephyranthes* in bloom, we had a fabulously successful trip. On the first day, just before entering the town of El Mante, in the sugar cane country, we saw golden yellow *Zephyranthes* which strongly resembled our Texas species in a shallow ditch along the roadside. For seven years we had sought bulbs in this same territory and had failed to find them—either in leaf or in bloom. Nor have we seen them since, even though we have thoroughly examined this self-same location on and near the same time of year,—all of which shows clearly the elusiveness of many species of *Zephyranthes*.

The next morning we were fortunate in finding in bloom the same light yellow *Zephyranthes* species discovered by Thad Howard a year earlier, and were told that the species was to be found in some abundance in low ground from Cuidad Valles to Tamazunchale. We actually saw them blooming in three widely separated spots, including Thad's original collection site. Not long after entering the state of Hidalgo, we were enchanted when we came upon a hillside covered with the lovely form of *Z. macrosiphon* we have carried for some years under our number M-30. It was our first sight of these bulbs in the wild and we were deeply impressed with their size and beauty. I believe Thad had collected this species the year before, probably in the same general neighborhood.

At Puerto de la Zorra, we found in leaf the same two species we had seen the past October, the small bulbs heavily in seed. Just beyond Jacala, I caught a glimpse of a large white Zephyranthes on the ledge above us. Morris thought I was joking and by the time I convinced him by my excitement that I was not, the white blossom was completely out of sight. Before us, however, was a rocky hillside covered with yellow *Zephyranthes*. The peak of bloom had been several days earlier and there were many ripe seed capsules from a former blooming. Several of the flowers were fresh enough for us to tell that we had found a small yellow *Zephyranthes* with quite a long tepaltube, No. M-449. Both bulbs and capsules were so similar to the ones collected north of Jacala, No. 446, just 8 miles or so away, that we quite naturally assumed them to be the same. Our first hint that these collections were a mixture of forms came when one bulb of each number bloomed shortly after our arrival home and unexpectedly proved to be light yellow heavily flushed with red, both within and without. The behavior of the seedlings was very mysterious, for those of No. M-446 stayed tiny and threadlike while

M-449 grew fast and lustily. It was not until the following year that we were able to completely unscramble these several collections from the Jacala area. But that is ahead of my story.

On the way from Zimapan to Leon, Guanajuato on highway 45, we found a few *Zephyranthes* in leaf at several stops, but it was at once

Fig. 2. *Habranthus* immaculatus Traub et Clint *sp. nov.* [M-456], as grown in the Clint trial garden, Brownsville, Texas. Blooms in second day after opening; scape 14 inches tall, flower 3½ inches across face. 2/3 natural size. Photo by Clint.

apparent that we had missed the main *Zephyranthes* bloom in this area, for rainfall had evidently been abundant for some time. In the western edge of the state of Hidalgo, we came upon masses of *Allium* in full bloom—a small bright species, somewhat similar in coloring to *A. drummondii.* Here, also, we saw our first *Milla biflora.* All in all, our col-

lecting was poor and left us unprepared for a most important discovery in the state of Guanajuato. This collection, No. M-456, represents one of those lucky breaks (we have had many of them) which are sorely needed when one collects along the roadside, as we do, with many miles to cover in a single day. Though we were pessimistic over our chances of finding bulbs along this route at the present time, when we came upon a ridge which was covered with an old "Tuna" plantation, it looked like such a promising home for *Zephyranthes* that we decided to give it a quick survey. To save time, we separated—each taking a different side of the road. I found a large stand of bulbs some distance away, dug a few and went back to the car to brag—to find that the laugh was on me, for Morris had found the same bulbs just off the highway on the opposite side of the road. We assumed them to be magnificent specimens of *Z. concolor* because of their similarity to that distinctive species and were pleased to have placed them in the state of Guanajuato. There was not a sign of even an old bloom scape—which we thought odd—and the bulbs were in full, luxuriant growth, often in huge clumps, which was also unusual for *Z. concolor*. The soil was a mellow clay loam with bountiful moisture content, which no doubt explained the phenomenal growth, but still we were astonished at the size of some of the bulbs, which were a good 3 inches in diameter, with leaves an inch or more across. We were not to discover our mistake in the identity of these bulbs until several scapes appeared in our trial garden the following year and they proved to be by far the most beautiful of all the bulbs we have so far collected—a truly immense blossom of pure white with a rich yellow throat. After careful study by Dr. Traub and the writer, M-456 was recognized as a new species, *Habranthus immaculatus* [Figs. 2 & 3], and it is published elsewhere in this issue of HERBERTIA.

The next day was to have its thrills, also. Less than 20 miles from Leon, but in the upper corner of the state of Jalisco, we were entranced by a large field which was solid white with *Milla biflora*. We left the car to take pictures of this gorgeous sight but became so excited and busy with what we found when we had walked a little ways into the field that it was not until we were once more on our way that we remembered that we had failed to get a single photo. We promptly named this place our "Bulbous Paradise" for among the blooming Millas we saw two distinct species of *Oxalis*—one bright red and one lavender—a tiny, dark blue irid, a small *Chlorophytum* species with spikes of large white flowers and very ruffled leaves, a tiny *Anthericum* with lemon yellow flowers, an unusual bulb which appeared to be closely related to *Tuberose* and a few *Zephryanthes* bulbs with almost fully ripe seed capsules, M459. The capsules appeared to be sessile and the stiffly upright, slightly glaucous leaves were very similar to my own seedlings of *Z. fosteri*. With the added fact that we were in the state of Jalisco, we immediately jumped to the erroneous but perhaps pardonable conclusion that we had fortunately stumbled on *Z. fosteri*. When the bulbs leafed out at home, our doubts arose concerning our tentative identification and the bubble finally burst when the bulbs bloomed the following April. Such is the tantalizing fortune of collecting bulbs in leaf and perhaps we shall one day learn not to jump to false conclusions, for bulbs in the wild can

often present an entirely different appearance in leaf, bulb and flower from those bloomed under cultivation—or even in the wild at different periods or seasons. In searching for more bulbs of M-459, we discovered still another distant species of *Zephyranthes,* growing in some quantity along a low wash filled with milky white water. This number, M-460, was mistaken at a distance for *Z. concolor* and we were delighted to place this species in the state of Jalisco, but as we approached closer we saw that the broad, slightly twisted leaves were a bright, shining green and the few dried and open capsules were apparently sessile and very small, as were the bulbs, for such a massive display of foliage. A year later we

Fig. 3. Type location of *Habranthus immaculatus* Traub et Clint, *sp. nov.* [M-456], about 24 mi. east of Celaya, Guanajuato, Mexico, 8-2-55, showing leaves about 12 inches tall. Photo by Clint.

were lucky enough to find a few flowers on both of these bulbs. Apparently, M-460 is the first to bloom and has a full, roundish flower of white, heavily flushed with pink. M-459 blooms later and has an open, star-shaped flower with narrow tepals of deep pink. The ovary of neither is completely sessile. It might be interesting to report on the strange soil structure we found when we dug these bulbs. The upper two inches or so was a light sandy loam, below this was 3 or 4 inches of coarse, very sharp sand. The bulbs themselves were in this sand, with roots deeply imbedded in a heavy clay soil beneath. All was completely saturated with moisture, which added to the difficulty of digging the bulbs without injury.

As we turned north on highway 80, we were almost immediately aware of the contrast of the dry, desolate landscape with the area we had just

left. We re-visited all of our former collection spots but found little of interest to report. On one ridge M-428 had just bloomed, while less than 2 miles away, on the next ridge where we had collected M-426, there was hardly a bulb above ground and masses of pale pink *Allium* had taken their place. One or two bulbs of a large flowered *Allium* species with glistening white blossoms were collected, but we were too early to find them in any quantity.

We had planned to search carefully on the plateau above San Luis Potosí for the large white "Mananica" we had been told about in May, but found nothing unusual—in fact, all the plants but *Z. concolor* had disappeared under ground once more. We collected a lavender and white *Allium* species in one locality, but most of the territory was dry

Fig. 4. *Zephyranthes* sp. M-244, from Canon de Borrego, San Luis Potosi, Mexico. Two-flowered individual scape; in Clint trial garden; scape 9" tall; flowers dark rose-red. 8-19-55. Photo by Clint.

and barren of bloom. We stopped once to investigate bright coral panicles of bloom as we passed through that part of the desert plateau which supported quantities of *Hechtia,* to find that a species of *Echeveria* was present in some abundance—snuggling under the protection of the thorny clumps. As we approached the mountains just west of Cuidad del Maiz we noticed signs of recent shower activity, but even so we were completely unprepared for the mass of "Mayitos" which greeted us as we rounded a bend in the foothills. The bulbs were present in some abundance among the large clumps of *Hechtia* and, strangely, the soil was of good quality—apparently of volcanic origin. To date this locality holds a record with us for being the most fantastic spot one can imagine finding *Zephyranthes.* The bulbs bore evidence of extreme drought conditions, for they were insulated with the heaviest quantity of dry slough-

ing coats. The leaves were narrow and slightly glaucous and the flowers were white, heavily flushed with pink—so heavy in texture that they were actually stiff—and were borne on a very long pedicel. This is a perfect example of the part played by environment, for when the bulbs bloomed the next year in our trial garden, the heavy texture was gone and so was the color. Though entirely different from them in the wild, this collection, M-469, is close enough in form to be called a dowdy sister of the lovely M-412, collected on a caliche outcrop about 40 miles north of San Luis Potosí in May.

In May of 1955, we again took a trip into Mexico accompanied by Fred Jones, and again luck rode with us, for we were not far from the main highway on the road to San Luis Potosí when Fred spied *Zephyranthes* blooms in the roadside ditch in the broad valley near Nuevo Morelos. They were a large pale yellow flower very similar to Thad's Cuidad Valles collection, differing only slightly in form, coloring and leaf character. In the mountains beyond, we found *Zephyranthes* in two colors: white flushed with pink and a bright purplish red. I noticed that the majority of the red flowers were abnormal in an odd fashion, for they had only 4 tepalsegs, a two pronged stigma and two locule seed capsules. We have collected other forms from this same general neighborhood which frequently have an extra complement of tepalsegs, four lobed stigmas and capsules. Last year a real oddity appeared in our garden—a twin-flowered scape on No. M-244 [Fig. 4]. There were more blossoms on the western edge of Canyon de Borregos, large, narrow

Fig. 5. *Zephranthes* sp. M-565 (= M-445), 20 mi. north of Zimapan, Hidalgo, Mexico; also collected at Puerto la Zorro (M-445). Scape about 18" tall, flowers white, heavily flushed with pink. 5-20-55. Photo by Fred B. Jones.

segmented rose blossoms which seemed to dwarf the tiny bulbs which bore them.

On the plateau near San Luis Potosí, the rains were late and the few bulbs we saw in flower were inferior in quality because of insufficient moisture. Disappointingly, the drought extended southward and along highway 45. Our "Bulbous Paradise" in Jalisco and the Tuna plantation in Guanajuato were bare and dry and not a single bulb above the ground. We were far behind our time schedule when we passed through the state of Queretaro and almost missed the masses of dainty pink *Zephyranthes* in bloom along the roadside. Conversation with an old woman who passed as we were digging the bulbs disclosed that there were other bulbs in the same location which bloomed later. These bulbs

Fig. 6. *Hymenocallis* sp. M-604, south shore of Lake Chapala, alt. 6300 ft. Bloomed in trial garden Brownsville, Texas, 6-19-55, narrow glaucous leaves. Photo by Clint.

were "mas claro" in color and were much used for stomach troubles by the local natives. So, as usual, we find what is true in almost any given location—there is rarely only one form of *Zephyranthes* present.

The next day was to prove an important one, for we were to solve several of our former collecting riddles. We had traveled less than 20 miles from Zimapan when I spied a large *Zephyranthes* blossom on the rocky shelf above us. When we got out to investigate, we saw that there were two forms—one [M-565-A] pure white and the other [M-445 & M-565] white, heavily flushed with pink [Fig. 5], somewhat similar in

[COLLECTING AMARYLLIDS—Clint, continued on page 83.]

1. REGIONAL ACTIVITY AND EXHIBITIONS

AMARYLLIS EVANSIAE IN HONOR OF MRS. U. B. EVANS

CLAUDE W. DAVIS, *Louisiana*

A new species of yellow *Amaryllis* from Santa Cruz, Bolivia was officially announced and named "*Amaryllis Evansiae*" in Alexandria, Louisiana on February 4, 1956, at a banquet given in honor of Mrs. U. B. (Jo) Evans, Ferriday, Louisiana, who received the Annual Award of the Horticultural Travel Foundation, Inc., New York City. These two events, the discovery of a new species of yellow Amaryllis, and the selection of Jo Evans as "The Woman Who Has Done The Most For American Horticulture in 1955", are so closely interrelated that the story would be incomplete to relate them separately.

One of Mrs. Evans' numerous activities which resulted in her selection by the Horticultural Travel Foundation, was the organization of the Louisiona Society for Horticultural Research. Under her leadership this organization promoted a plant exploration trip to Panama, Columbia, Ecuador, Peru and Bolivia for the purpose of collecting native flora which might be of horticultural value in Louisiana. Her daughter, Mrs. Donald V. Applegate had lived for seven years in Santa Cruz, Bolivia, and it was through visits to Marianna that Mrs. Evans learned of the many rare and beautiful native plants which flourish in the mountain valleys of the eastern slopes of the Andes Mountains.

Professor Ira S. Nelson, Horticulturist, Southwestern Louisiana Institute, Lafayette, La. was selected by the Society to make the trip to South America. He left on August 1, 1954 and collected plant material in all of the aforesaid countries. A total of over 900 bulbs and other plants were brought back to Louisiana. Most of the plants were amaryllis, but the collection also included orchids, bromeliads, Crinums, Zephyranthes, a Jacaranda considered to be hardy in the Southern States, a red passion flower and other miscellaneous trees and vines. Professor Nelson states:

"The most exciting find was a series of variations resembling *A. belladonna* in most characteristics except color and color pattern. Some few of these were growing with belladonnas, but most of them were not found close to typical belladonna populations. The range of color variation extended from a cream white to pale yellow. Most of them developed a pink blush after opening. Some exhibited green throats, others yellow throats. A few clones had a pink outline of a star in the throat. The flowers of only one clone had stigmas distinctly trifid. All others had an obscurely 3-lobed but capitate stigma.

"The habitat in which this series was found growing varied from 500 to 2000 feet in elevation and from sandy, open plains to accumulations of almost pure leaf mold deposited on the mountain sides. A few clones were growing in full sun, but most of them were found growing

in rather dense shade in deciduous jungle. The soil was always light and well drained.

"Due to the day-to-day color change of these blushing *Amaryllis* I could never be sure whether I was seeing a new one or a different color phase of one already collected, but I am confident that I brought back at least a dozen that are distinctly different.

"The blushing *Amaryllis* from Santa Cruz justified the entire trip. They are delicate of color, graceful of form and of a size that should be useful for both garden and cut flower purposes. Certainly they are a new departure from the *Amaryllis* known in the States."

Fig. 7. Mrs. U. B. Evans receiving a flowering plant of *Amaryllis evansiae* Traub et Nelson at the banquet, Febr. 4, 1956, at Alexandria, Louisiana. Photo Alexandria (La.) Daily Town Talk.

The telegram announcing the name of this new species was read at the banquet in the Hotel Bentley and Mrs. Evans was presented with a potted plant of *A. Evansiae* in full flower. The message was as follows:

La Jolla, California,
Feb. 3, 1956.

"Mrs. U. B. Evans and Mrs. Marianna Evans Applegate,
Hotel Bentley,
Alexandria, Louisiana.

In recognition of your foresight and determined efforts in connection

with bringing new Amaryllis breeding stock to American horticulture, the yellow Crucenian Amaryllis, which is a new species to science, shall forever bear the name *Amaryllis Evansiae.*

(Signed) Hamilton P. Traub and Ira S. Nelson."

Mr. Adrian Frylink, Director, Horticultural Travel Foundation, presented Mrs. Evans with the annual award of the Foundation. It consists of a 38-day tour to historic and interesting garden spots in England, France, Belgium, Holland and Germany. In his presentation speech Mr. Frylink expressed the belief that the secret of Mrs. Evans' success as a horticultural leader is because with every seed, every scion, every bulb and flower that she gives away, she wraps a little bit of Jo Evans in the gift.

Nomination for this award was made by the Louisiana Garden Club Federation, with Mrs. Robert Ehrhardt (of Shreveport, Louisiana), serving as chairman of the Nominating Committee. The selection of Mrs. Evans was from among 1,100 nominees in 41 states on the basis of research, plant breeding and plain "dirt gardening." In addition to being an excellent gardener, Jo Evans has earned distinction as a writer for horticultural journals, a lecturer to garden groups, and a past president of the Louisiana Garden Club Federation. While president of this organization she established a scholarship fund for research in floriculture and ornamental horticulture, and she was largely instrumental in securing from the Louisiana Legislature the original appropriation to establish floricultural research at the Louisiana State University.

The banquet honoring Mrs. Evans was sponsored by the Federated Garden Clubs of the Eighth Louisiana District, with Mrs. Homer H. Harris of Alexandria serving as chairman and toastmaster. Mrs. Harris is Advisory Chairman, Louisiana Garden Club Federation and a Member of the Board, National Council State Garden Clubs. The several hundred guests who were in attendance represented gardeners and flower-lovers from the entire state who had assembled to pay tribute to one whose accomplishments have received national recognition.

Among the speakers who told of Jo Evans' work and praised her achievements were Mrs. N. P. Martone, Iowa, Louisiana, President of the Louisiana Garden Club Federation, Mrs. Lewis M. Hull, Boonton, New Jersey, Past President, National Council of State Garden Clubs and now Associate Editor of the magazine, "Flower Grower", Mrs. Robert Ehrhardt, Shreveport, La., Chairman of the Nominating Committee, and Mrs. Walter Colquitt, Shreveport, Louisiana, who received the Annual Award of the Horticultural Travel Foundation in 1955. Mrs. E. B. Knotts, Sicily Island, Louisiana, presented Mrs. Evans with a bouquet of red roses and a check for $100.00 from the Federated Garden Clubs of the Fifth Louisiana District. The check was immediately endorsed by Mrs. Evans and contributed to the Horticultural Travel Scholarship of the Louisiana Garden Club Federation.

Amaryllis Evansiae and other plant material which was collected by Professor Nelson is being increased through his efforts by use of the

greenhouse facilities of Southwestern Louisiana Institute for distribution to the membership of the Louisiana Society for Horticultural Research.

EDITORIAL NOTE.—*Amaryllis evansiae* Traub et Nelson was duly published in Baileya 4: 84-88, figs. 30 & 31. 1956. The reader should also refer to the 1956 Herbertia Edition of Plant Life vol. 12. pp. 30-34, figs. 6, 7 and 8. 1956; and Louisiana Society for Horticultural Research Bulletin No. 1. March, 1956, pp. 13: 15-17, and colored plates; for data on *Amaryllis evansiae* by Prof. Ira S. Nelson.

EDITOR'S MAIL BAG

In May of 1956, Wyndham Hayward was honored by the Orlando (Florida) Garden Club with the Certificate of Merit "in recognition of outstanding horticultural achievements and important contributions to the world of plants."

It is in deepest sorrow that the writer has to report the death of Edward Owen Orpet, of Santa Barbara, Calif., the 1956 Herbert Medalist, on Nov. 12, 1956.

Dr. Moyses Kuhlmann, of the Instituro de Botanica, Sao Paulo, Brasil, contributes an article on the Aztec Lily, *Sprekelia formosissima* in the Spring number of "Flôres do Brasil", 1954. In connection with this he mentions *Sprekelia spectabilis* which is a form of *Amaryllis cybister,* and not a *Sprekelia.*

NEW ORLEANS AMARYLLIS SHOW, 1956

MRS. M. M. SANCHEZ *President*
Garden Circle, New Orleans, La.

The Hon. de Lesseps Morrison, Mayor of New Orleans, proclaimed the period of March 19th to March 25th, inclusive, Amaryllis Week in New Orleans in recognition of the 1956 Official Amaryllis Show of New Orleans which was held March 24th and 25th, 1956.

The Garden Circle sponsored one of the most outstanding shows (exclusively Amaryllis) ever staged in New Orleans on Saturday and Sunday March 24th and 25th, 1956. This was the eighth Official Amaryllis Show of New Orleans and was dedicated to the late Mrs. W. D. Morton, Jr.

The show was beautifully staged using the entire space of the McMain Junior High School cafeteria, 5712 So. Claiborne Avenue. The many Dutch and American Amaryllis made a very colorful appearance and the artistic arrangements were most outstanding.

The show was judged by thirteen acredited flower judges—all accredited judges of The American Amaryllis Society. There were four Gold Cups, Tri Color Ribbons, Sweepstakes, Club Ribbons, and five American Amaryllis Society Awards in horticulture were given.

The quality of all horticulture exhibits, both Dutch and American, were very outstanding. The exhibits are becoming better each year.

The main event of the show was the crowning of the Queen, Miss Joyce Linn Nuss, by the President of The New Orleans Commission Council, Victor H. Schiro. *Maid,* Miss Lynn Lyerer, Miss Carol Schilleci (1955 Amaryllis Queen); *Crown Bearer,* Cindy Lou Mackenroth; *Amaryllis Bearer,* Debbie Jefferson; *Garland Bearers,* Nora Cross, Donna Monier, Jean Robert, Janet McLahlan and Carol Mickal; and *Registrars,* Miss Dianne Digiovannie and Sharon Jacob. Commissioner Schiro presented to the new Queen a gold key to the city.

Fig. 8. The 1956 Amaryllis Queen of New Orleans, Miss Joyce Linn Nuss; crowned by the President of the New Orleans Commission Council, Victor H. Schiro.

Plans are now under way for the 1957 show which promises to be bigger and better as each show has been in the past.

GREATER GULF COAST AMARYLLIS SHOW, 1956

ROBERT E. PARKER, JR., and PERCY S. SKINNER, JR.,
Show Chairmen

The Fourth Annual Greater Gulf Coast Amaryllis Show was held, April 7 & 8, 1956, in the Murphy High School Cafeteria, South Carlin

Street, Mobile, Alabama. The theme of the Show was "Amaryllis Around the World" with the objective of bringing together in friendly competition the hybrid Amaryllis of all strains and other members of the Amaryllis family from all parts of the world.

The show was divided into six divisions—(1) American hybrid amaryllis, (2) artistic arrangements, (3) Dutch hybrid amaryllis, (4) commercial exhibits, (5) hobby exhibits, and (6) art exhibits (oil, water color and pastel paintings of amaryllis and other amaryllids.) Admission was free and the show was well attended.

The theme of the show, "Amaryllis Around the World" was depicted on a little table at the entrance of the exhibition room, it consisted of a globe of the world around which were shown a small train, cars and airplanes which carried potted amaryllis.

The show colors were green and white with all pots covered with green florists' paper and the exhibition tables with white cloths.

The best Dutch hybrid Amaryllis was 'Purple Queen' (Warmenhoven), and the best American hybrid Amaryllis was 'Red Velvet'.

VISITS WITH PLANT ENTHUSIASTS

T. M. Howard, D. V. M., Texas

PART II.

Several seasons ago in Herbertia (1955, pp. 28—30), I contributed the first part of an article concerning my visits with several enthusiasts in the world of Amaryllis. This is the second half of the original article.

After completing my college education, I entered the Army in 1953 as an officer in the Veterinary Corps, with a special training school in Chicago as my first assignment. This gave me an excellent opportunity to visit a few people that were interested in Amaryllids in this area. One of these folks was Glen Moore, a post-graduate student at the University of Chicago. Mr. Moore's hobby was principally *Hymenocallis* and he was doing some remarkable work with this neglected genus. At that time he was writing a thesis on the respiration of the *Hymenocallis* seed. He had previously done similar research on the seeds of Crinums. It seems that the large fleshy seeds of these plants had fascinated him while he was in the Pacific area during World War II. He marveled at the way these big seeds sprouted and formed a complete little bulb while still unplanted, and then shriveled, leaving only the bulb to remain. Later on he was to write his thesis on this little incident of metamorphosis in nature. He became so interested in *Hymenocallis* that he managed to acquire a most impressive botanical collection of many different species, most of which were undescribed. The thing that made his interest seemingly important was the fact that he was crossing the various species in order to secure new hybrids. One of the rooms in the greenhouse at the University was filled with pots of hybrid seedlings as well as potted plants of the various species. Unfortunately, Mr. Moore's work was temporarily halted when he graduated and had to return to his home

in Utah with his plants. The move forced him to dry off his seedlings and very likely set them back for a season. I have lost all contact with Mr. Moore since that time, but I sincerely hope that he has kept up with his hobby and that he has by now realized the flowering of his hybrids.

One weekend while in Chicago, I motored down to Cincinnati, Ohio for a visit with another enthusiast with whom I had become acquainted by correspondence—Len Woelfle. Like Glen Moore, he also was principally interested in *Hymenocallis* and others of that group. He too has done considerable work in trying to hybridize members of this genus, but he has focused most of his attention on members of the "Ismene" group, whereas Moore was working principally with the evergreen, robust "spider lily" types. Like Glen Moore, Mr. Woelfle's interest in *Hymenocallis* is uncommon, since this genus is little appreciated by the average gardener and grossly neglected by most botanists. We could use more folks like these two men to unravel some of our botanical-horticultural problems. I certainly did enjoy the warm hospitality of the Woelfles during my brief visit and hope that perhaps our paths may cross again in the not too distant future.

During this late summer of 1953 I contacted Raymond B. Freeman, of Western Springs, a suburb of greater Chicago. Mr. Freeman was interested in Alliums, and quite naturally he had a very nice collection in his garden. I am afraid that I took him by surprise when I introduced myself, as he had expected to meet a much older man, perhaps of middle age or better. Never-the-less we had an enjoyable visit discussing Alliums and the differences between gardening in Illinois and gardening in South Texas. The Freeman garden would be considered typical of American suburban life, save that the Alliums that grew there made this garden most out-of-the-ordinary.

I did not stay very many weeks in Chicago, before I completed the special school and was sent to Ft. Benning, Ga. This was a stroke of luck, as it gave me opportunities to visit with other Amaryllid enthusiasts in Florida and Alabama. While attending a New Year's bowl game in Jacksonville, Fla., I managed to drive down to Orlando and visit two of the more prominent figures in horticulture in the persons of Wyndham Hayward and Mulford B. Foster. Both they and their gardens were outstanding. Both shared that enthusiasm that makes friends of total strangers in the world of horticulture. Mr. Hayward's garden is hidden from the road by dense citrus trees and shrubbery that surrounded the Lakemont Gardens. Within this grove were his home and greenhouses as well as his many bulb beds. I fear that the morning of January 1 is not the time to come a-calling, even in our informal South, but Mr. Hayward was most gracious and proceeded to show me the grounds with its many exotic treasures that grew so lushly in the fine central Florida climate. Due to previous correspondence, I was no stranger to Mr. Hayward and conversation came very easily. We covered a lot of subjects that morning. He informed me that he was constantly waging a never-ending battle with weeds, and that he was not always the victor. Like many others in the plant business where large grounds are kept, his place occasionally suffered for lack of reliable labor at reason-

able wages. After a most enjoyable visit, Mr. Hayward directed me to Mulford Foster's gardens.

I was unprepared for Mr. Foster and his gardens. I was about as overwhelmed as a backwoods Hillbilly visiting a big city for the first time. Meeting Mr. Foster is an off-beat experience in the field of horticulture. True, every dyed-in-the-wool enthusiast has a "message" of a sort to stimulate another of similar interests, but Foster was in every way real and his greenhouses awesomely different. His Bromeliads were magnificent and his Amaryllids seemed all the more exciting as he described how and where he collected each one. Time went all too fast, and I had to say goodby to this energetic gentleman. His boundless enthusiasm, and insatiable curiosity in seeking the as-yet-undiscovered has led him into many foreign countries in his quest for new species. Considering his discoveries and his resulting hybrids, it would be an understatement in the use of lavish adjectives to praise his contributions to horticulture.

Later, in early spring, I was to receive an invitation from Mrs. Grace Primo to attend the annual Amaryllis Show in Mobile, Alabama. Mrs. Primo is a real down-to-earth gardener like most of us, but she too possesses that extra bit of enthusiasm that makes her prominently authoritative in her field. She has done more than her share in order to popularize amaryllids in the lower south, particularly Crinums. In the past, her list of various *Crinum* species and hybrids was nearly as lengthy as any to be found in this country. I enjoyed my visit immensely and regret that I have not been able to again return to Mobile during the Azalea and Camelia season.

While in the service, one is constantly being moved about, so it was no surprise to find myself back in Texas to finish my military obligation to Uncle Sam. While stationed at Ft. Hood, Texas, I was able to resume more collecting trips into Mexico, and re-visit my old friends, Fred Jones and Morris and Kitty Clint. Paradoxically, I, in turn, was honored by a visit from another prominent plantsman, Wm. Lanier Hunt. Mr. Hunt and I had a very nice chat about gardening and he showed me some of his fine color slides taken in Europe and in his North Carolina gardens. So you see, when people are interested in unusual hobbies, distance ceases to be a problem and mutual interests can be as binding as the kinship of blood relations.

AMARYLLIS ROUND ROBIN NOTES, 1956

Mrs. Fred Flick, *Chairman,*
Amaryllis Round Robins, Carthage, Indiana

[The following notes were extracted from Round Robin letters by Mrs. Fred Flick, who is Chairman of the Amaryllis Round Robins.—*Editor.*]

Len Woelfle.—"Since so many of you have troubles with *Hymenocallis* of the Ismene group not blooming for you let me make this a letter about them. I will tell you what I do with them to get bloom. I now

have about fifteen or twenty species of *Hymenocallis* from all over the states and Mexico, plus species from S. America.

I generally get bloom from all, but do have a little trouble with 'Advance' and *macleana.* I have never been able to determine why they do not bloom consistently. I believe I have been planting *Macleana* too deep so that it gets too much moisture soon after planting. My soil is rather heavy clayey loam. I never use fertilizer.

I usually plant them in the garden in May when the soil is fit to work, in beds 3 ft. wide, raised a little above the soil, and about 4" deep, so that the bulb is about flush with the surrounding soil. This is not necessarily for drainage, but more so I don't have to dig so much each spring. I leave three foot spaces between the rows.

So starting about May 15th, I plant the bulbs. We usually have good rains in May and June, and about the middle of June they start to bloom. Some are in bloom at almost all times during the summer up until September, depending on the variety. I usually dig all my bulbs by the middle of October. I cut off the tops and most of the roots; put them in paper bags until the next spring. Store them over winter in the basement at temperatures from 50 to 70 degrees F. That is for 'Advance', 'Festalis', 'Sulphur Queen', *amancaes, narcissiflora, macleana, harrisiana,* a couple of Mexican species, the ones from our South which have a rather heavy green leaf, 2—3 inches broad and a long neck, known as *tenuiflora, rotata, littoralis, caribaea,* etc., and *Elisena longipetala.*

No one seems sure about the species, of most of our N. American *Hymenocallis.* The narrow green leaved variety from Louisiana and east Texas known as *liriosme* and *galvestonensis* are hardy at Cincinnati, Ohio to zero or below without protection. The one from east Texas that has erect, glaucous foliage and blooms from naked scapes in late summer after the foliage dies down, known as *occidentalis. H. Eulae* is also hardy here. The Indiana species from southwestern Indiana, having glaucous, erect foliage and a large beautiful flower is hardy too, and blooms in July. These seem to do well only if left out of doors in the soil over winter." From Ohio.

Edith Strout.—"*Amaryllis* x *johnsonii* type from Costa Rica bloomed for the first time this year. This bulb came originally from Mr. Hannibal. It did not seem as funnel shaped as the *johnsonii* from Ascension Island. It was definitely fragrant, and was a cardinal red."

"*Haemanthus multiflorus* will open its flower spike in a matter of three or four days from the time the bud first appears until it is in full bloom; and it only lasts a short time, four or five days.

Haemanthus andromeda is very slow to develop. It took over a month for its bud to develop and open, and it lasted for two weeks.

Haemanthus katherinae has never bloomed for me." From Calif.

Polly Anderson.—The most colorful plant in my garden this late July is a plot of evergreen *Watsonia* from seed from South Africa. They are smaller flowered, but more prolific than the regular deciduous kinds, last longer and of course have evergreen foliage, bloom in midsummer instead of April. They are limited to one color range; from light apricot through pink and orange rose and light red, with no whites or lavenders." From Calif.

AMARYLLIS JUDGE'S CERTIFICATES

Since the last report in HERBERTIA 1955 (pages 31-32), the following Amaryllis Judge's Certificates have been issued by the AMERICAN AMARYLLIS SOCIETY:

18. Mrs. B. E. Seale, 4036 Prescott, Dallas, Texas
19. Mrs. Robert Ewing, 7122 Lakewood Blvd., Dallas 14, Texas
20. Mrs. Hugh A. Purnell, 2926 Maple Springs, Dallas 19, Texas
21. Mrs. Margaret Scruggs Carruth, 3715 Turtle Creek Blvd., Dallas, Texas
22. Mrs. A. C. Pickard, 1702 North Blvd., Houston 6, Texas
23. Mrs. Sam Forbert, 117 North 23rd Ave., Hattiesburg, Miss.
24. Mrs. R. A. Fowler, P. O. Box 670, Hattiesburg, Miss.
25. Mrs. G. B. Reneau, 2625 Persa St., Houston, Texas
26. Mrs. Luther N. Davis, 2206 Hardy St., Hattiesburg, Miss.
27. Mrs. Melvin Thomas, 220 29th Ave., Hattiesburg, Miss.
28. Mrs. Mary Lucas, 609 South 21st Ave., Hattiesburg, Miss.
29. Mrs. B. P. Russum, 406 6th Ave., Hattiesburg, Miss.
30. Mrs. J. W. Snowden, P. O. Box 226, Hattiesburg, Miss.
31. Mrs. F. T. Newton, P. O. Box 1185, Hattiesburg, Miss.

Examinations for the Amaryllis Judge's Certificate. For information about taking the examination for the Amaryllis Judge's Certificate of the AMERICAN AMARYLLIS SOCIETY, please write to Mr. W. D. Morton, Jr., 3114 State Street Drive, New Orleans 25, La. Judges are requested to attend a local refresher short course each year, if possible, in order to keep up with progress in this field.

NEW LOCAL AMARYLLIS SOCIETIES

During the year 1956 the Hattiesburg Amaryllis Society was organized through the leadership of Mrs. R. A. Fowler and Mrs. Sam Forbert. A more detailed report will appear in the next HERBERTIA.

As we go to press, word has been received that the Corpus Christi Amaryllis Society was organized under the leadership of Mrs. H. L. Harris; that the Houston Amaryllis Club is being organized under the leadership of Mrs. A. C. Pickard. Other local Amaryllis societies are in the organization stage. Fuller reports will appear in 1958 Herbertia.

NATIONAL AMARYLLIS JUDGES COUNCIL

All accredited Amaryllis judges are members of this organization which was proposed by Mrs. B. E. Seale of Dallas, Texas and founded in 1957. Fuller report will appear in 1958 Herbertia.

2. SPECIOLOGY

[EVOLUTION, DESCRIPTION, CLASSIFICATION AND PHYLOGENY]

CYTOLOGICAL INVESTIGATIONS IN LYCORIS 1. THE SOMATIC CHROMOSOMES OF **LYCORIS CALDWELLII, L. HAYWARDII** AND **L. HOUDYSHELII**

S. Bose

INTRODUCTION

Cytological studies in seven species of *Lycoris* Herb. have been carried out by Inariyama (1931; 1932; 1937 and 1953). His finding of 2n=12 in *L. aurea* (L'Hérit.) Herb. was the lowest somatic chromosome number encountered, while his highest was in *L. radiata* (L'Hérit.) Herb. with a 2n of 33. In addition to this he reported the existence of 2n=13 and 14 chromosome types in *L. aurea* and of 2n=22 in a variety of *L. radiata*. Other species for which chromosome numbers, and descriptions have been supplied by the same author are, *L. straminea* Lindl. 2n=16; *L. albiflora* Koidz. 2n=17; *L. sprengeri* Comes ex Baker 2n=22; *L. sanguinea* Maxim. 2n=22 and *L. squamigera* Maxim. 2n=27.

Other workers such as Sato (1938) and Mookerjea (1955) have also studied the karyotype in some species of *Lycoris*.

The present author is making a detailed survey of chromosome numbers and types, and of cytological variations occurring, in the several species of Lycoris. The report presented here is based on a study of the somatic chromosomes of three new species of the genus. Particular attention has been devoted to an analysis of their karyotypes and to consideration of their cytological and phylogenetical relationships with other species of *Lycoris*.

The morphological description and systematic position of these three new species are discussed by Dr. Traub and Mr. Caldwell elsewhere in this same issue of Herbertia.

MATERIALS AND METHODS

The following new species of *Lycoris,* described in this issue of Herbertia (Traub, 1957) were included in the present investigations:— (1) *L. caldwellii* Traub; (2) *L. haywardii* Traub; and (3) *L. houdyshelii* Traub.

Bulbs for this study were generously furnished by Mr. Wyndham Hayward of Lakemont Gardens, Winter Park, Florida.

Roottips were placed in a saturated solution of paradichlorobenzene (Meyer 1945) 2-4 hours prior to fixation. This pretreatment in P. D. B. not only helped in scattering the chromosomes but also resulted in details of their morphology being more readily observed. Fixation was in acetic:alcohol, 1:3, for 24 hours. Following fixation, roottips were hydrolysed in 10% HCl for 10 minutes before placing in 2% aceto-orcein. The staining solution containing the roottips was then heated over an

alcohol lamp for a few seconds. Roottips were left in the aceto-orcein for from 15 minutes to 4 hours. Deeply stained portions of the roottips were smeared and considerable pressure was applied to get maximum flattening and spreading of the chromosomes. The slides were then gently heated again over the flame to intensify the stain. It was found that a pretreatment for 3 hours in P. D. B. gave best results with materials of all the three species.

Fig. 9. (= 1). *Lycoris caldwellii* Traub. 2n=27. Somatic metaphase chromosomes; polar view. x2500.

In each of the three species included in the present study a detailed analysis of the karyotypes was made and idiograms were drawn for each of them. Only very flat plates with well spread and unbroken chromosomes permitting careful observation of details were examined.

Conclusions regarding the morphology of the chromosomes were drawn from the observations of four excellent plates in each case. Special attention was devoted to the finding of satellited chromosomes the im-

portance of which in the karyotype analysis in *Amaryllidaceae* has been stressed by Sato (1938).

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

OBSERVATIONS

On the basis of the present study the chromosome complements can be classified into the following types:—Type A—Chromosomes with median primary constrictions. (18.4 μ). Type B—Chromosomes with subterminal primary constrictions. (8.6 μ). Type C—Chromosomes with subterminal primary constrictions and a satellite on the shorter arm. (10 μ). Type D—Chromosomes with nearly terminal primary constrictions and a dot like shorter arm. (9.2 μ).

According to size differences existing among the individual chromosomes of types B and D they are further subdivided into the shorter Types; B1 (7.2 μ) and Type D1 (8 μ).

Idiograms for each type are depicted in Figure 4.

Karyotypes of three species:

L. caldwellii Traub. 2n=27. 6 chromosomes of type A; 11 chromosomes of Type B; 2 chromosomes of type B1; 6 chromosomes of type D and 2 chromosomes of type D1. (See Figs. 1 and 4). Total length of chromosomes complement, 280.6 μ

L. haywardii Traub. 2n=22. 16 chromosomes of type B; 2 chromosomes of type B1 and 4 chromosomes of type C. (See Figs. 2 and 4.) Total length of chromosome complement, 192.0 μ

L. houdyshelii Traub. 2n=30. 3 chromosomes of type A; 15 chromosomes of type B; 2 chromosomes of type B1; 4 chromosomes of type C; 4 chromosomes of type D and 2 chromosomes of type D1. (See Figs. 3 and 4.) Total length of chromosomes complement, 291.4 μ

Table I summarizes, for each of the three species concerned with here; (1) the number of chromosomes of each type, and (2) the total 2n number observed. Table II presents data on the measured lengths of each type of chromosome and for whole complements, of each species.

In addition to the usual number of 22 encountered in *L. haywardii* cells with 11 and with 23 somatic chromosomes were noticed.

DISCUSSION

Types of chromosomes found in the three new species of *Lycoris* dealt with here, are quite similar to those in the somatic complements of previously studied species of the genus. The A type described here corresponds with the V shaped or medianly constricted chromosomes of Inariyama. The rod-shaped chromosomes dealt with by the same author corresponds with the rest of the types differentiated here (as B; B1; C; D; D1). Type C with satellites on the shorter arm were noticed in two out of three of the species. *(L. haywardii* and *L. houdyshelii).* Chromosomes of this type have been identified by Sato (1938) in *L. squamigera,* and by Mookerjea (1955) in *L. radiata.* It seems likely that improved

technique may reveal more of the C type to be present. Several other chemicals are being tried as pretreatments with this possibility in mind.

Inariyama (1931; 1937) considered *L. squamigera* with 6V and 21 rod-shaped chromosomes to be a triploid and a natural hybrid between two species of *Lycoris*. Nothing definite can now be suggested regarding the original of *L. caldwellii* with its 6V and 21 rod-shaped chromosomes. It would seem, as if its origin would prove to be somewhat similar to that of *L. squamigera*.

The finding of a haploid chromosome number in one root tip cell of *L. haywardii* can be attributed to somatic reduction (Huskins and

Table I

Chromosome numbers in *Lycoris* species: (1) of each different type, and (2) of the somatic complements.

Number of chromosomes of	*L. caldwellii*	*L. haywardii*	*L. houdyshelii*
Type A	6		3
Type B	11	16	15
Type B1	2	2	2
Type C		4	4
Type D	6		4
Type D1	2		2
2n complement	27	22	30

Table II

Average length in microns (μ) of *Lycoris* chromosomes at mitotic metaphase, following pretreatment with P. D. B.

Average chromosome lengths of	*L. caldwellii*	*L. haywardii*	*L. houdyshelii*
Type A	18.4		18.4
Type B	8.6	8.6	8.6
Type B1	7.2	7.2	7.2
Type C*		10	10
Type D	9.2		9.2
Type D1	8		8
Total complement	280.6	192.0	291.4

* *Including satellite*

Cheng; 1950). Cells with 23 chromosomes may possibly originate through non-disjunction. Spindle abnormalities, as noted by Snoad (1955) in *Hymenocallis*, can also give rise to cells with 11 and 23 chromosomes.

The most interesting thing observed here was the presence of a large number of chromosomes with nearly terminal centromeres. Until studied carefully these often appear to be telocentric, but detailed examination usually reveals a small amount of chromatin beyond the centromere. Such chromosomes have been found in other genera of the *Amaryllidaceae*, as for example in *Allium* and *Nothoscordum* by Levan (1935) and in *Nothoscordum* by Levan and Emsweller (1938). The latter authors

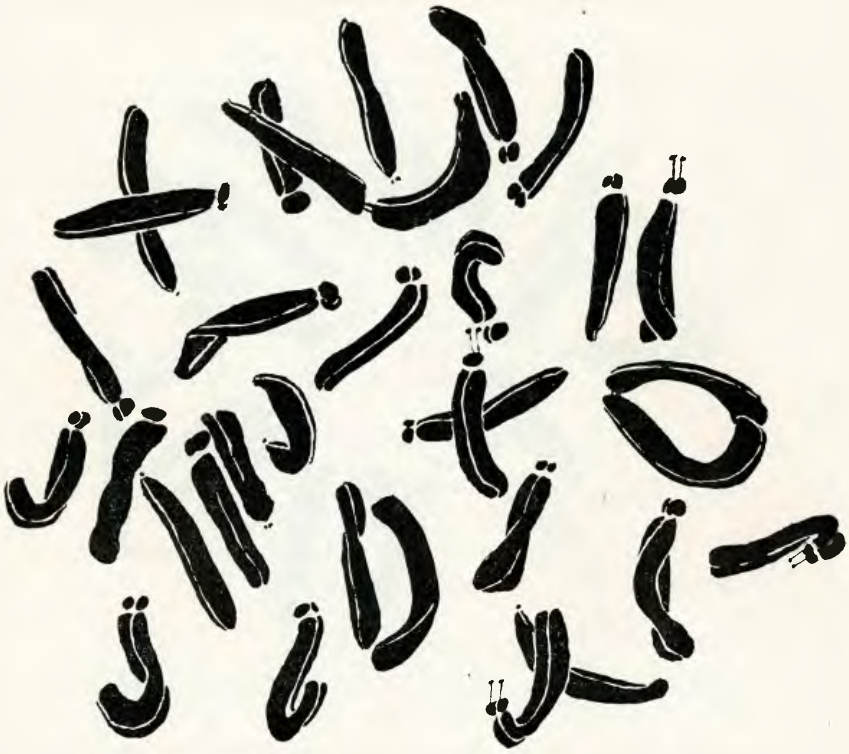
have termed the same type of chromosomes as t chromosomes or terminally attached chromosomes. Recently Flory (1950) and Schmidhauser (1954) observed similar chromosomes in *Hymenocallis*. Levan and Emsweller and also Schmidhauser assumed that these chromosomes with apparently terminal centromeres were found by transverse fragmentation of the centromere of a medianly constricted chromosome. The former workers strengthened their assumption by observing the Metaphase I pairing of a medianly constricted or m chromosome with two t or telocentric chromosomes in *Nothoscordum fragrans*. Furthermore the total length of each m chromosome was found to be approximately equal to that of two t chromosomes. The same condition was observed by Schmid-

Fig. 10 (= 2). *Lycoris haywardii* Traub. 2n=22. Somatic metaphase chromosomes; polar view. x2500.

hauser in the somatic chromosomes of *Hymenocallis*. In the present study also the D type of chromosomes with nearly terminal centromere were approximately half the length of a chromosome with a median constriction. In other species of *Lycoris* the pairing of two rod-shaped chromosomes with one V-shaped chromosome has been noticed by Inariyama (1932). He tends to believe however that in *Lycoris* every V shaped chromosome is formed by the fusion of two rod-shaped chromosomes. Meiosis has not been studied in the three present species hence data bearing on this point cannot be advanced from this study.

Inariyama (1937; 1953) suggested the basic number in *Lycoris* to be 11 rather than 6. He assumed that a species with 22 rod-shaped

chromosomes gave rise to all other types by the fusion of some rod-shaped chromosomes. The role of hybridization and polyploidy was also considered by him in this connection. His alternative theory, which he does not favor, proposes that a species like *L. aurea* with the maximum observed number of V-shaped chromosomes gave rise to all other types in *Lycoris* by fragmentation of V's. On the first theory we have to assume that the fusion of two rod-shaped chromosomes would give rise to a chromosome with two centromeres. In the second theory, a fragmentation across the centromere would presumably leave the new chromosomes without a centromere, in effect at least.



3

Fig. 11 (= 3). *Lycoris houdyshellii* Traub. 2n=30. Somatic metaphase chromosomes; polar view. x2500.

The decrease or increase of chromosomes or of basic numbers in a plant by simple end to end fusion of single chromosomes, or by fragmentation of a chromosome, have been questioned by Darlington (1937; pp 69-71 and 559-560) and later by Stebbins (1950; pp 445-447). They assume that neither a chromosome without a centromere nor a chromosome with two centromeres can function normally. Moreover these

phenemena are not observed in the chromosome complements of naturally occuring populations. According to Darlington's scheme modified by Stebbins (l.c.) the loss or gain of a centromere or the loss or gain of a chromosome is believed to originate through unequal translocations; furthermore the activeness or inertness of the centromere is thought to play a part in the increase or decrease of the basic number.

The theory propounded by Darlington (1939a; 1940a), when studying *Fritillaria,* concerning the mechanism of the formation of telocentric chromosomes by misdivision of the centromere and the origin of isochromosomes by sister-strand reunion of broken ends, should be considered in connection with chromosome evolution in *Lycoris.*

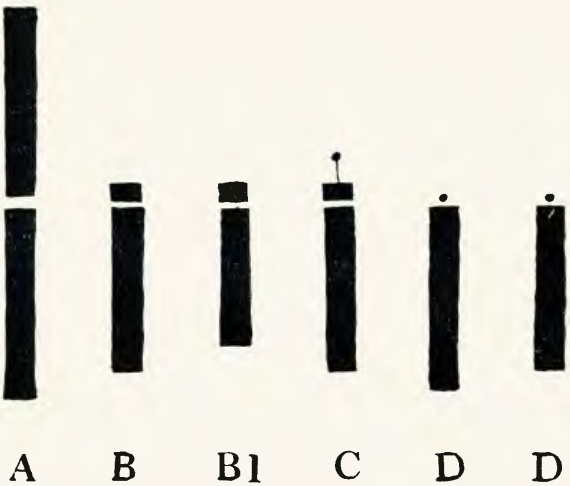


Fig. 12 (= 4). Idiogram of each of the chromosome types; A, B, B1, C, D, and D1.

Careful meiotic, and mitotic, studies of most *Lycoris* species must be available before there is a really valid basis for suggestions regarding the evolution of chromosomes, and of basic chromosome numbers, here.

SUMMARY

Chromosome numbers in three new species of *Lycoris,* have been determined. Somatic chromosome numbers are:—*L. caldwellii,* 2n=27; *L. haywardii,* 2n=22; and *L. houdyshelii,* 2n=30. A detailed karyotype analysis has been carried out, and descriptions given. In *L. haywardii* cells with 11 and 23 chromosomes were observed also.

The origin of chromosomes with nearly terminal centromeres is discussed. The problem connected with the evolution of chromosomes, and of basic numbers in *Lycoris,* is discussed, in the light of various theories.

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LYCORIS TRAUBII SP. NOV.

WYNDHAM HAYWARD, *Florida*

Several years ago Japanese bulb dealers began exporting to America stock of a saffron-yellow flowering *Lycoris* Herb, species, possibly originating in Formosa. The writer at first believed that it was a variety of *Lycoris aurea* (L'Hérit.) Herb., and he reported his conclusions on page 160, with illustrations, in the March 1955 issue of HORTICULTURE (Boston, Mass.), where he pointed out that the new plant was definitely superior in a number of characteristics to the well-known *Lycoris aurea.* After further study it became clear that the new plant was distinct from *L. aurea,* and the new species has been named for Dr. Hamilton P. Traub, of La Jolla, California, who has worked for a long time to straighten out the taxonomy and nomenclature of the genus *Lycoris.*

The more important differences between *Lycoris traubii* Hayward and *L. aurea* (L'Herit.) Herb. are listed in Table 1.

TABLE 1. The more important differences between *Lycoris traubii* and *L. aurea*.

Character	*L. traubii*	*L. aurea*
Leaves	Appearing in the fall about a month later than in *L. aurea; glabrous,* lorate-lanceolate	Appearing early in the fall; *glaucous,* almost elliptic
Spathe-valves	relatively short (4 cm.); ovate	relatively longer (8 cm.); lanceolate
Pedicels	up to 9 mm. long	15—22 mm. long
Flower habit	more or less horizontal	somewhat upright
Flower color	saffron-yellow	Cadmium-yellow
Tepaltube	19 mm. long; curved downward	12 mm. long; straight
Tepalsegs	narrowly-oblanceolate; 12-15 mm. wide	narrowly-elliptic; 10—11 mm. wide
Hardiness to cold	relatively cold resistant; known to be grown in Maryland; wider range not investigated	relatively tender; in U. S. thrives outdoors only in lower South; south Texas and southern Calif.

Lycoris traubii Hayward, **sp. nov.**

Umbella 6-flora, floribus croceis, tubo tepalorum 1.9 cm. longo decurvato, paraperigonio labriformi brevissimo minute 6-lentato, genitalibus a perigonio multo exsertis.

DESCRIPTION.—*Bulb* globose. *Leaves* 7—11 per bulb, appearing in the fall about a month later than those of *Lycoris aurea,* and persisting until spring; up to 22.5 cm. long, 2.1 cm. wide at the middle, tapering gradually to a roundish apex, and to 1.6 cm. wide at the base; glabrous Spinach Green (Wilson, 0960) on the upper side, with a narrow lighter stripe in the center, lighter dull green, non-glabrous, on the under side; fairly upright. Scape produced in September, solid, almost round, entirely light green, 32.5 cm. tall, 1.1 x 1.2 cm. in diam. at the base, 6.5 x 7 mm. in diam. at the apex. *Spathe-valves* 2, ovate, apex blunt or pointed, 4 cm. long, about 1.5 cm. wide at the base; bracteoles smaller, up to 2 cm. long, but usually smaller. *Umbel* 6-flowered. *Pedicels* very short to 9 mm. long. *Flowers* with saffron yellow (Wilson, 7/1) band in center of the tepalsegs, rest of tepalsegs, and rest of flower, including the tepaltube, stamens and style, lighter saffron yellow (Wilson, 7/2); flowers held horizontal or slightly declined. *Ovary* 11 mm. long, 7.5 mm. in diam., 3-sided, with rounded edges; ovules about 6 per locule. *Tepaltube* curved downwards, 1.9 cm. long, 4 mm. in diam. at the base, 9 mm. in diam. at the apex, 3-sided, with rounded edges. *Paraperigone* yellow, consisting of a very short rim with 6 minute teeth. *Tepalsegs* 6.8—7 cm. long, 1.2—1.5 cm. wide at or slightly above the middle, apex acutish, narrowing to 7 mm. wide at the base, narrowly-oblanceolate, margins somewhat undulate, apex reflexed. *Stamens* and *style* much exserted from the perigone; style longer than the stamens; *stigma* minute, red.

SPECIMEN: No. 558a + 558b (holotype, TRA), 9-22-56, cult. La Jolla, Calif., Hamilton P. Traub.

NOTE.—*Lycoris traubii* is imported yearly by the thousands from Japan, and the bulbs are sold extensively by bulb dealers. ***L. traubii*** is grown outdoors under the name *L. aurea* at the U. S. Plant Introduction Garden, Glendale, Maryland (See Creech, Nat'l Hort. Mag., Apr. 1952. pp. 167-173.). Reports in HERBERTIA are needed about its performance and culture in other parts of the country, particularly the

Fig. 13. *Lycoris traubii* Hayward *sp. nov.* Photo by Wm. T. Wood.

North Central States and Canada. The reader should also turn to the brief article on *Lycoris traubii* by Mr. Wood, of Macon, Georgia, and the second report by Drs. Traub & Moldenke on *Lycoris* x *woodii,* both in the present issue of HERBERTIA. Mr. Wood imported *L. traubii* (under the name, *L. aurea)* from Japan before the last war, and has grown it for many years, and used it in hybridizing.

LYCORIS HAYWARDII, L. HOUDYSHELII AND L. CALDWELLII

HAMILTON P. TRAUB, *California*

For a number of years several undescribed *Lycoris* species have been grown in the United States; some under various unrecognized names. Mr. Wyndham Hayward imported *Lycoris* bulbs from China in the 1940's up to 1948 when the communists took over. After 1945, many *Lycoris* bulbs under various names have been imported from Japan by Mr. Hayward and others. Most of these, including some undescribed species, have yellowish or creamy-yellow flowers, sometimes streaked with pinkish, particularly with aging.

So long as the *nomen subnudum, Lycoris straminea* Lindl., was not connected with its type specimen, it did not appear proper to name the species with creamy-colored flowers because later one of these might turn out to be that species. The type of *Lycoris straminea* Lindl., was at last located as reported in 1956 HERBERTIA. Thus it is now possible to describe the new species.

As an introduction to the new species, these have been included in the following revised key along with those previously known. The new species are *L. haywardii, L. houdyshelii* and *L. caldwellii* described in the present paper, and also *L. traubii* [Fig. 13] which Mr. Hayward has most graciously named for the writer in another paper appearing in this issue of HERBERTIA (Hayward, 1957).

TABLE 1. KEY TO THE SPECIES OF **LYCORIS**

1a. Perigone fairly regular; leaves without a stripe or band in center (see also *L. caldwelli* with similar leaves):

Subgenus 1. **SYMMANTHUS**

2a. Flowers bluish-mauve, rose-lilac, orchid pink and blue or purple-carmine and prussian blue:
2a. Tepaltube very short (barely defined according to Worsley):
Stamens and style not exserted from perigone (Upper Burma) .....1. *argentea*
3b. Tepaltube 11 mm. long to over 25 mm. long:
4a. Leaves 2—2.5 cm. wide; tepaltube over 25 mm. long:
Perigone 8.9—10 cm. long; flowers rose lilac (Japan) .....2. *squamigera*
4b. Leaves less than 2 cm. wide; tepaltube 11—13 mm. long:
5a. Flowers produced in July-August; tepalsegs 4.2 cm. long; flowers in the reddish-violet range, orchid purple, hyacinth blue at the tips (Japan) Fig. 16 .....3. *haywardii*
5b. Flowers produced in Sept.-October; tepalsegs 6.1 cm. long; vivid rose in throat, otherwise purple and carmine, prussian blue in upper part (Central China) Fig. 15 .....4. *sprengeri*
2b. Flowers without any lilac or blue:
6a. Tepaltube 4—5 mm. long:
Flowers brick-red; stamens slightly exserted from the perigone (Korea) 5. *koreana*
6b. Tepaltube 11—13 mm. long:
7a. Tepalsegs lanceolate, acute; flowers flesh-colored to light rose (Central China) Fig. 14 .....6. *incarnata*
7b. Tepalsegs linear-lanceolate, or linear-oblong; flowers usually blood-red-scarlet, rarely white or apricot fading to gray (Japan) .....7. *sanguinea*

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

Subgenus 2. **LYCORIS**

8a. Flowers not saffron yellow or cadmium orange; 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 (China & Japan) Plate 2....8. *radiata*
10b. Flowers clear pink; leaves broader (China) .....9. *rosea*
9b. Flowers not red or clear pink; tepaltube 4—23 mm. long:
11a. Stamens and style much exserted from the perigone, tepaltube 4—11 mm. long; leaves produced in autumn, with whitish stripe in center:
12a. Tepaltube 4—6 mm. long:
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—11 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 pale creamy-colored with pinkish band in center of tepalsegs; chromosomes 2n=17 (Japan) ..... 11. *albiflora*
13b. Umbel loosely packed; leaves dark green; Tepalsegs 4.8—5.1 long, 11-13 mm. wide; flowers cream-white, slightly deeper colored in center of tepalsegs, turning whitish with age; chromosomes 2n=30 (China) Plate 3 ..... 12. *houdyshelii*
11b. Stamens shorter than, and style subequaling, the tepalsegs; 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 (China) Plate 4 ..... 13. *caldwellii*
8b. Flowers saffron yellow or cadmium orange:
14a. Leaves glabrous, lorate-lanceolate; spathe-valves ovate, 4 cm. long; flowers saffron yellow, tepaltube 19 mm. long; tepalsegs narrowly-oblanceolate, 12—15 mm. wide (Formosa?) Fig. 13 ..... 14. *traubii*
14b. Leaves glaucous, almost elliptic; spathe-valves lanceolate, 8 cm. long; flowers cadium orange; tepaltube 12 mm. long; tepalsegs narrowly-elliptic, 10—11 mm. wide (China) ..... 15. *aurea*

LYCORIS HAYWARDII [Fig. 16]

Lycoris sprengeri Comes ex Baker produces rose-carmine-prussian blue flower, not widely open, in Sept.-Oct. *L. haywardii,* which produces smaller orchid-purple-hyacinth blue flowers with tepalsegs outward-spreading in July-August, is related to the former. However, due to effective reproductive isolation imposed by the difference in time of flowering, *L. haywardii* has to be recognized as a distinct species. There are other differences as shown by the following description. Some of these are discussed by Mr. Caldwell in another article which appears in the present issue of HERBERTIA (Caldwell, 1957).

Lycoris haywardii Traub, **sp. nov.**

Umbella 4- vel 5-flora, floribus rubello-violaceis, cum caeruleo hyacinthi notatis, tubo tepalorum 1.1 cm. longo, segmentis tepalorum 4.4 cm. longis 6 mm. latis, staminibus quam segmentis tepalorum brevioribus, stylo a perigonio paulo exserto.

DESCRIPTION.—*Chromosomes,* 2n=22 (Bose, 1957). *Bulb* globose. *Leaves* produced in late January—early February, persisting until spring, deep green, glaucescent, 46—48 cm. long, 8—9 mm. wide in the middle, apex rounded, tapering to 6—7 mm. at the base. *Scape* produced July to mid-August, about two weeks before its nearest relative, *L. sprengeri,* 27.5 cm. tall, solid, 9 x 7 mm. diam. at the base, narrowing to 6 x 4 mm. at the apex. *Spathe-valves* 2, free, up to 3.7 cm. long, lanceolate; bracteoles filiform. *Umbel* 4—5-flowered. *Pedicels* 1.4—2.3 cm. long. *Ovary* 4—6.5 mm. long. *Perigone* smaller but deeper colored than *L. squamigera,* and slightly lighter colored than *L. sprengeri;* it is wider open than *L. sprengeri* and the tepalsegs are less overlapping, and less reflexed up to 5.5 cm. long, in the reddish-violet range, orchid purple (Wilson, 31/2), with a somewhat deeper mid-rib, changing to hyacinth blue (Wilson, 40/1 or 40) at the apexes, particularly the setsegs. *Tepaltube* up to 1.1 cm. long, 4 mm. in diam. at the base, en-

larging to 6 mm. in diam. at the apex. *Tepalsegs* oblanceolate, setsegs up to 4.4 cm. long, 6 mm. wide at the base, 11 mm. wide 3/4 from the rounded apexes; petsegs up to 5 mm. wide at the base, 10 mm. wide 3/4 from the rounded apex. *Stamens* somewhat shorter than the tepalsegs. *Style* moderately exserted from the perigone; *stigma* almost pointed. *Anthers* with yellow pollen. Stamens and style reddish-purple in color. Habitat: Japan.

SPECIMENS: No. 554 (holotype, TRA), Sam Caldwell, Nashville, Tenn.; No. 291 (paratype, TRA), 6-24-53, Wyndham Hayward, Winter Park, Fla.

NOTES.—According to Caldwell, the type plants of *L. haywardii* are self-fertile, and the seeds are large, shiny, black; the plants are resistant to cold and are considered as frost hardy at Nashville, Tenn.

LYCORIS HOUDYSHELII [Plate 3]

In 1948 Mr. Hayward imported four kinds of *Lycoris* from a Chinese nurseryman in Shanghai just before the Chinese mainland was taken over by the communists and all commercial contact was broken off. One of these lots was labeled "Lycoris alba". When it flowered for Mr. Hayward in late June-July 1953 in Florida and for Mr. Caldwell in Tennessee, it was at once apparent from specimens sent to the writer that this plant differed from its nearest relatives, *Lycoris albiflora* Koidz. and *L. straminea* Lindl. The new species had broader dark green leaves, wider tepalsegs and differed from its relatives in other characters as indicated in the description which is given below. It should also be noted that *Lycoris houdyshelii* has a unique chromosome complement for the genus, 2n=30 (Bose, 1957), which contrasts markedly with those of *L. straminea*, 2n=16 and *L. albiflora*, 2n=17 (Traub & Moldenke, 1949). The new species is among the finest Lycoris of all when bloomed under optimum conditions as is seen in the photograph taken by Sam Caldwell in his Tennessee garden (Plate 3). The new species has been named for Mr. Cecil Houdyshel, of La Verne, Calif., the fine gentleman who has done so much to gladden the hearts of gardeners by specializing in beautiful rare plants, including *Lycoris,* which are sold at reasonable prices.

Mr. Hayward writes with reference to *Lycoris houdyshelii* that "it is clear milky white, almost an oyster white, with sparkling brilliance in full sunlight."

Lycoris houdyshelii Traub, **sp. nov.**

Umbella 6- vel 8-flora, floribus flavido-albis, interdum rubello-penicillatis, tubo tepalorum 8.5 mm. longo, segmentis tepalorum 4.5 cm. longis 8 mm. latis, genitalibus a perigonio multo exsertis, paraperigonio labriformi brevissimo paene microscopico.

DESCRIPTION.—*Chromosomes,* 2n=30 (Bose, 1957). *Bulb* globose, 2.8—3.8 cm. in diam. *Leaves* deep green, appearing in September, persisting to spring; 6—8 per bulb, 33—42 cm. long, 10—13 mm. wide in upper 1/4, apex rounded, gradually narrowing to 8—9 mm. wide at the base, slightly lightening in color along the upper center. *Scape* produced

in late July-August, 41.5—51 cm. tall, 7.5 x 11 mm. to 9 x 11.5 mm. in diam. at the base, 4.2 x 5.5 to 5.5 x 5.7 mm. in diam. at the apex, light green. *Umbel* 6—8-flowered. *Spathe-valves* 2, free, papery, medium brownish, lanceolate, up to 8 mm, wide at the base, 2.5—3.3 mm. long, acute at the apex; bracteoles much smaller, some filiform. Perigone irregular but not extremely so, margins of the tepalsegs slightly ruffled, particularly in mid-portion, cream-white, slightly deeper colored in the middle of the tepalsegs, turning whitish with age, sometimes slightly penciled pinkish; filaments cream-white, sometimes pink-tinged, style cream white, pink tipped. *Tepaltube* 8.5 mm. long, 4 mm. in diam. at the base, 6 mm. in diam. at the apex. *Paraperigone* a very short, almost microscopic transparent rim. *Tepalsegs* up to 4.5 cm. long, up to 8 mm. wide, linear-oblong to linear-oblanceolate. *Stamens* and *style* declinate-ascending, much exserted from the perigone. Anthers 3—4 mm. long. Style overtopping the stamens; stigma minute, almost pointed. Habitat: China.

Specimens: No. 549 (holotype, TRA), 8-17-56; Nos. 550 & 551 (isotypes, TRA), 8-17-56, Sam Caldwell, Nashville, Tenn.

Notes.—According to Sam Caldwell, this species is fully frost hardy at Nashville, Tenn.

LYCORIS CALDWELLII [Plate 4]

Lycoris caldwellii differs from all of the species in subgenus 2. *Lycoris* in having stamens shorter than, and the style subequaling, the tepalsegs, a longer tepaltube, 20—23 mm. long, and dark green leaves without the whitish stripe in the center. There are other differences as shown by the following description. Some of these are discussed by Mr. Caldwell in another article appearing in the present issue of Herbertia (Caldwell, 1957).

Lycoris caldwellii Traub, **sp. nov.**

Umbella 5 flora, floribus pallide flavis demum flavido-albis, tubo tepalorum 20—23 mm. longo decurvato, segmentis tepalorum 7.2 cm. longis 1.4 cm. latis, staminibus quam segmentis tepalorum paulo brevioribus, stylo segmentis tepalorum subaequanto.

Description.—*Chromosomes*, 2n=27 (Bose, 1957). *Bulb* globose, about 2.5—3.8 cm. in diam., fairly long-necked. *Leaves* similar to those of *L. squamigera* but narrower, appearing in February and persisting to spring, 33—36 cm. long, 9—12 mm. wide at the middle, apex rounded, tapering to 6—7 mm. wide at the base. *Scape* produced in late August—September, up to 52.5 cm. tall, green, solid, 1.1 cm. in diam. at the base, 6 mm. in diam. at the apex. *Umbel* 5-flowered. *Spathe-valves* 2, free, narrow-linear, about 3.4 cm. long, soon withering. *Pedicels* slender, usually 1.1—1.7 cm. long, rarely up to 3.3 cm. long. *Ovary* 7—9 mm. long. *Flowers* in bud peach-colored, opening to pale yellow, changing gradually to creamy-white with aging. *Tepaltube* 20—23 mm. long, curved downwards, somewhat flattened on the sides, 3.5 x 4.5 mm. in diam. at the base, 5.5. x 7.5 at the apex. *Tepalsegs* up to 7.2 cm. long, narrow-linear-lanceolate, slightly undulate on the margins, apexes re-

Lycoris radiata (L.'Hérit.) Herb., self-fertile form, as grown at Nashville, Tennessee. Photo by Sam Caldwell.

Plate 2

curved, 1.4 cm. broad; setsegs with pointed cusps, and petsegs rounded at the apex. *Stamens* slightly shorter than the tepalsegs. *Style* subequaling the tepalsegs. *Stigma* pointed. Habitat: China.

Specimens: No. 552 (holotype, TRA), Sam Caldwell, Nashville, Tenn.; No. 222 (paratyle, TRA), 9-6-54, Sam Caldwell, Nashville, Tenn.

Notes.—According to Sam Caldwell, this species is hardy at Nashville, Tenn.

CHROMOSOME DATA AND HYBRIDIZATION

The available chromosome data has been summarized by Traub and Moldenke (1949), and Bose (1957). This shows that out of the 15 species recognized, chromosome data for only four species is lacking. Plants are available of *L. incarnata* and *L. traubii* and this data will most likely be supplied by Mr. Bose in a later issue of Herbertia.

Mr. Bose (1957) has made progress toward the interpretation of the available data. Hybridization may have had an effect on the evolution of the chromosome numbers. Creech (1952) reports progeny when the fertile biologic type of *Lycoris radiata* (L'Hérit.) Herb. [Plate 2], 2n=22, was pollinated by *L. aurea* (2n=12, 13, 14). The chromosome number in the hybrid as reported is 2n=19. It is hoped that further chromosome studies of this hybrid may be made. The intermediate species, *L. albiflora,* 2n=17, and *L. straminea,* 2n=16, could have originated by hybridization.

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FOUR NEW **LYCORIS** FOR AMERICAN GARDENS

Sam Caldwell, *Tennessee*

In October of 1948 I received from Mr. Wyndham Hayward, Winter Park, Florida horticulturist, three or four bulbs each of *Lycoris "alba," "L. incarnata"* and *"L. aurea".* Mr. Hayward had himself received these bulbs—about 100 of each, I believe—in a shipment out of Shanghai, China, before the Communists took over there.

At that time I was planting small groups of all the lycoris species I could obtain, in an effort to determine which ones would prove hardy enough for outdoor culture in middle Tennessee and which ones might be adaptable as pot plants.

As the years passed it became evident that Mr. Hayward had "hit the jackpot" in his Shanghai shipment. All of the original labels have proved to be incorrect. But the bulbs are treasures—each of the three kinds is new to cultivation, or so it appears at this time. They make up an amazingly varied and beautiful trio of lycoris. Scarcity of stock will restrict them to the collections of plant connoisseurs for some years, but eventually they should be widely grown.

Fig. 14. *Lycoris incarnata* Sprenger. Photo by Sam Caldwell, Nashville, Tenn.

These species have been named *L. houdyshelii, L. haywardii* and *L. caldwellii.* In addition one apparently un-named species is also discussed and illustrated in the present paper. Naturally I'm pleased and flattered that one should be called in my honor. Actually, my part in the "discovery" was almost accidental. I merely planted the bulbs back in 1948 and left them alone. Three years later, one of them flowered, and after six years all had bloomed.

Below are separate notes on the three species as I grow them. Certain general information applies for all of them. All have grown out of

doors at my farm near Nashville, Tennessee since the fall of 1948 (except one group which remained in a pot for the first two years). They are in a well drained brownish loam soil testing about 6.2 on the pH scale. Winters get much colder here than is generally realized. Night temperatures during January and February may fall to a few degrees above zero, or even a few below. Most unusual, and the very coldest on record, was 13 below zero registered on February 1, 1951. Luckily, about eight inches of snow and ice blanketed the ground at that time, and my lycoris were not damaged.

Our cold spells may last two or three weeks and the ground freezes, of course, but milder periods always come to break up the cold. There is much freezing and thawing—quite damaging to many plant materials. But we do not have the deep, hard, all-winter freezing of the ground which most northern gardeners experience, so I cannot say how these lycoris will stand that condition.

Lycoris squamigera is dependable here, barring severe late freezes that damage the growing foliage. So also is *L. sprengeri. Lycoris incarnata* [Fig. 14] does well, too, but its foliage—on which subsequent blooms depend—is more often damaged by cold than are the leaves of *squamigera* and *sprengeri. Lycoris radiata* is better known here than any of the other species and is reasonably satisfactory. However, it is not so floriferous here as in Georgia, Alabama and other states where winters are milder. After a particularly "rugged" winter, which noticeably flattens and "burns" the leaves on *L. radiata,* we have relatively light bloom the next fall. *Lycoris aurea* is hopeless outdoors here, though it is a good pot plant in a cold greenhouse.

LYCORIS HOUDYSHELII [Plate 3]

The three bulbs I received in October, 1948, as *L. "alba,"* looked much like bulbs of *L. radiata;* they were rounded, about one and a quarter inches in diameter and had short necks. All roots were gone, but the dried remains of a flower scape hung on one bulb, indicating at least that they were of flowering size. Because I wasn't sure about the hardiness of this species, I put two bulbs in a pot and the other out in the ground.

No growth at all appeared for a full year. In October, 1949 deep blue-green leaves began to push up on the outdoor bulb and on one only of the potted bulbs. The other bulb in the pot was dead.

From the first this lycoris gave promise of being something "different," and I think it has remained my favorite. I had most of the kinds then available, including several other *"albas," "radiata albas,"* and *albifloras,* but the foliage on this Shanghai *"alba"* was distinctive—wider, longer and a deeper green than the leaves of any of the others.

Now that the bulbs are well established, foliage usually appears in September each year—six to eight leaves from each bulb. Leaves are eight to twelve inches long and a half to three quarters of an inch wide, with a distinct midrib. There is a little lightening of color along the midrib but not such a definite band of lighter color as in the leaf of *L. radiata.* Leaves persist all winter—indeed, I judge that they are more

Lycoris houdyshelii Traub, *sp. nov.*, as grown at Nashville, Tennessee. Photo by Sam Caldwell.

Plate 3

resistant to cold than the leaves of *L. radiata*—and they die away in spring.

The first bloom came on the outdoor-planted bulb, on August 22, 1951—a sturdy scape 22 inches tall with six big flowers about two and three-quarters inches across, making a large umbel. With the outward radiating stamens and pistils the umbel is about eight and a half inches across. The flowers open with a cream-white tint and then turn clear white; pistils are white, tipped pink, and the anthers carry yellow pollen.

On very close inspection it is possible to find an occasional red hair-line mark along a flower segment, as though traced with a fine-pointed pen. Appearance of these lines is erratic, and they are so thin as to be hardly noticeable from a short distance. They are more likely to be long near the edge than the middle of a segment, and some flowers have none at all. They detract in no way from the over-all pure white effect of the umbel.

I was so excited over this big, stunning blossom that I called Mr. Hayward over the long-distance telephone and told him about it. He was greatly interested, as none of his own bulbs had bloomed, nor had he any reports of bloom from anyone else to whom he had supplied this species.

There were no flowers the next year, but two fine scapes with eight flowers each opened August 17, 1953. Again skipping a year, the bulbs came back with two excellent scapes (six flowers on each) on August 20, 1955. It was then that I made the accompanying photographs to preserve an impression of the great beauty of this outstanding lycoris.

It is good to know that we really have a new species here and that it has been named for Mr. Cecil Houdyshel, the fine gentleman of La Verne, California, who has brought so much happiness to gardeners by choice and rare plants.

Incidentally, I dug, divided and reset my bulbs of this species just after the 1955 blooms faded. They had increased at a very conservative rate. From two original bulbs (the potted one had been transferred to the ground in 1951) I had exactly ten bulbs—all of good size, one and one-eighth to one and one-half inches in diameter. There were no small offsets whatever.

Though moved "bare root," the bulbs were lifted and reset quickly and carefully, so that the white roots were not broken and did not dry out. I was delighted in mid-August, 1956, to see five fine scapes push up on these bulbs transplanted only the year before. In their new location they have more moisture than before and also are shaded for about half the day. As a result of this, apparently, the flowers last longer—about a week in good condition. The color tends to remain cream-white instead of reaching the snowy whiteness of the blossoms produced out in full sun, but they are still very beautiful. One most interesting effect is that when the blooms are three to four days old they become flushed with irregular patches of rosy pink along the segments, and the filaments and styles turn pink on the upper side only, remaining white underneath. It appears as though light from above might cause the color change.

Thus far I have not been able to make this lycoris set seed, but its pollen has proved fertile in a cross I made on my fertile strain of *L. radiata.*

LYCORIS HAYWARDII [Fig. 16]

My three original bulbs, labeled "*L. incarnata,*" ranged from three-quarters to one and one-eighth of an inch in diameter and were rather long and less globe-shaped than those of *L. houdyshelii.* They had no roots. Again, for test purposes, I planted one in the ground and two in a pot, in October 1948.

The bulbs evidently took a long time to make roots, for no leaves showed up until March, 1950, when rather weak, narrow blue- or gray-green blades pushed up. In later years, with bulbs well established, the foliage has started in late January or early February—just one to two weeks after foliage starts on my true *L. incarnata.*

For the first three or four years I felt that this lycoris was too tender to "take" our winters. The sickly little foliage clumps collapsed during cold spells and showed definite signs of injury. The bulbs apparently gained vigor with age, however, as they now make wider, deeper green leaf blades, with much less of the glaucous appearance so noticeable in the earlier foliage. In fact, the mature leaf clumps look like those on *L. incarnata* and *L. sprengeri,* and seem to be quite as resistant to cold as are the leaves of *incarnata.* I would rate it as "hardy" here. The leaves die down, of course, when warm weather comes in spring, as does all the lycoris foliage.

From the beginning the foliage on these bulbs had a general resemblance to that of *L. incarnata,* and since I had received them under that name, I assumed that they were correctly labeled. Knowing *L. incarnata* to be hardy here, I transferred the two potted bulbs to the ground in the fall of 1950.

The winter of 1952-'53 was unusually mild for us; 18 degrees above zero was our lowest temperature, and all lycoris foliage held up exceedingly well. As a result, the summer and fall of 1953 brought the best lycoris bloom I've ever had. Not one, but four scapes began pushing upward from these bulbs in late July and on the 29th of the month they were in full bloom. The 18-inch scapes carried four flowers each, individual flowers measuring two and three-quarters inches across. At once it was evident that here again was something new—not *L. incarnata* at all.

My photograph shows the bloom form of *L. haywardii* very well. The color is an orchid pink, deepest along the segment midribs, with conspicuous streaks and patches of blue at the tips, much as in the case of *L. sprengeri* [Fig. 15]. In fact, this lycoris is going to be confused with *L. sprengeri.* However, there are differences, and I have included a picture of *sprengeri* to help make them clear. By looking at the two pictures carefully it will be noted that the flowers of *L. haywardii* have a decided "flare"—the "petals" are less overlapping and less rolled back at the tips than in the *sprengeri* blossoms. My impression, too, is that the coloring in *L. haywardii* is just a little lighter than in *L. sprengeri,*

though it has not been possible to make a direct comparison. *Haywardii* blooms for me a week or more before *sprengeri,* and the last *haywardii* flowers are faded before the first *sprengeri* bloom opens.

Incidentally, *L. haywardii* seems quite generous in bloom production. Following the four scapes in 1953, there were nine scapes in mid-August of 1954. I feel that steady bloom would have continued in '55

Fig. 15. *Lycoris sprengeri* Comes ex Baker, as grown at Nashville, Tennessee. Photo by Sam Caldwell.

but for the fact that a disastrous 16-degree freeze on March 25, 1955 ruined all lycoris foliage, which had previously been lured into soft, lush growth by several weeks of 70-degree weather. Even the usually reliable *L. squamigera* didn't bloom in '55.

To most observers, *L. haywardii* will be somewhat between *L. squamigera* and *L. sprengeri* in appearance; it is smaller but deeper colored

than the former and a bit lighter than the latter. Altogether it is a fine lycoris and should be particularly valuable in Florida and the Lower South, where *L. squamigera* does not bloom well. Mr. Hayward tells me that *L. haywardii* flowers freely at Winter Park, Florida.

For me it has set seed to its own pollen and made large, shiny black, viable seeds.

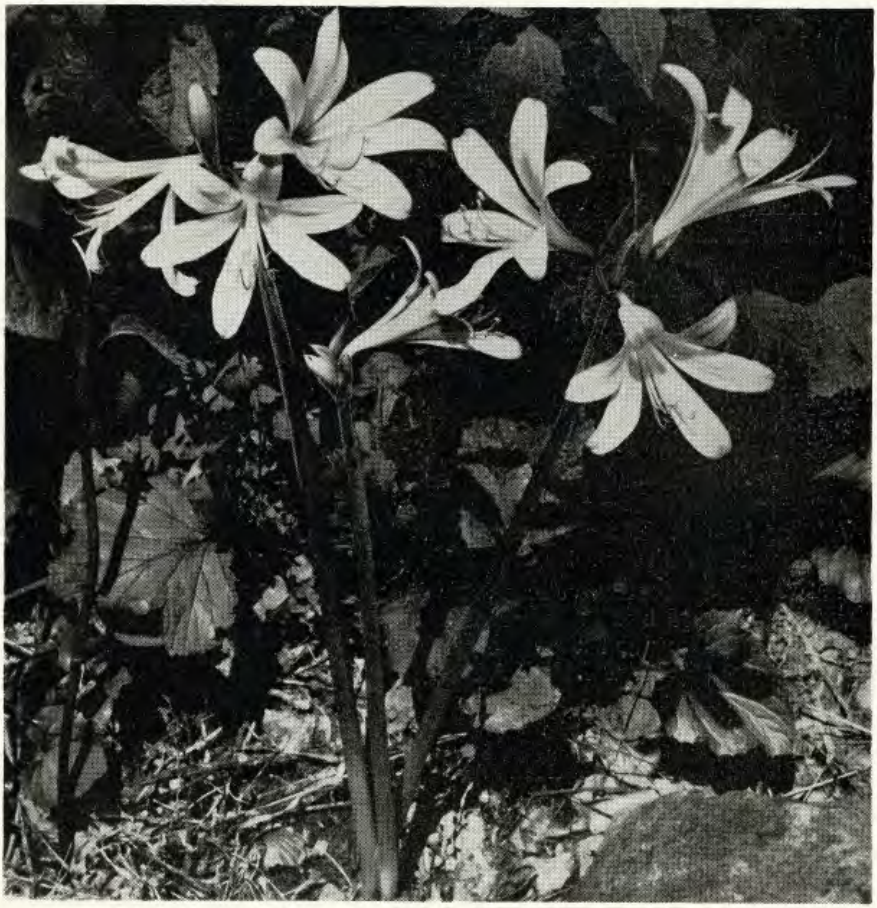

Fig. 16. *Lycoris haywardii* Traub, as grown at Nashville, Tennessee. Photo by Sam Caldwell.

LYCORIS CALDWELLII [Plate 4]

The four bulbs which came from Mr. Hayward in October, 1948 were approximately an inch and a half in diameter, fairly long necked and had no roots. They were labeled "*L. aurea,*" and as that species is not hardy here, I planted all of the bulbs in a large pot and wintered

them in my cold greenhouse. Nothing happened for more than a year, and I thought the bulbs were dead. In January, 1950, however, four little clumps of leaf blades appeared in the pot. Curiosity about the "clump" formation made me dig down into the soil to investigate. I saw that each of the old bulbs apparently had disintegrated, but a number of small bulblets had formed and grown up out of the old basal plates.

From the appearance of the foliage on these little bulbs it was very clear that they were not *L. aurea.* I thought that they might be either *L. incarnata* or *L. squamigera*—both of which are hardy here. So I shifted the entire pot of bulblets to the ground, outdoors. They continued to grow along each year, starting their flat leaf blades up in February. Leaves were not quite as wide as those on *squamigera,* but otherwise they were very similar in appearance and growth habits.

Meanwhile, in September, 1951 Mr. Hayward sent me two more bulbs of this same lycoris—two firm, sound bulbs that he had nursed up to a good size—about an inch and a half in diameter, with fresh, live roots. I set them both in a ten-inch flower pot and wintered them in the cold greenhouse, where they made robust, *squamigera*-like foliage, starting in January. This died down in spring. In August, 1953 a scape started up out of the bare dirt in the pot, and I was intrigued by the "peachy" pink-yellow color of the buds. To make sure that grasshoppers wouldn't injure the flowers, I took the pot indoors. There were five buds, and to my disappointment, they opened only one or two at a time, so that there never was a complete umbel of flowers attractive enough to photograph. Perhaps it was the indoor light or some other factor that caused the "staggered" flower opening. As it later developed, this is not characteristic of the species.

The color, creamy yellow, struck me as unusual, but I was not greatly impressed by the flower and I mentioned it almost casually in a letter to Mr. Hayward about some other matters. Immediately he replied with a, "WHAT IS THAT 'creamy yellow lycoris'? . . . Send a bloom to Dr. Traub. . . . Maybe you have a new species!"

Fortunately, the last of the five flowers in the umbel was still reasonably fresh, and I air-mailed it to Dr. Traub in Arcadia, California.

Even better, the next year, on September 1, 1954, I had two perfect scapes 21 inches high, with five flowers each, on my outdoor bulbs. This time there could be no doubt about the true color and appearance of the flowers. Again the buds started up with the color of a ripening peach—a blend of pink, salmon and yellow. Upon opening fully, however, the flowers displayed only a pale yellow color, and this changed gradually to cream-white with age.

I photographed the flowers (see accompanying pictures), then cut one scape and air-mailed it to Dr. Traub. Because I retained it for picture purposes until it was fully developed, and then it had the long trip to California in fearfully hot weather, I fear that little of the yellow tint was left when it reached Dr. Traub.

At that time I supposed this unusual lycoris might be *L. straminea,* but since then I've been advised that it does not conform to the type

Lycoris caldwellii Traub, *sp. nov., as grown at* Nashville, Tennessee. Photo by Sam Caldwell.

Plate 4

material of *straminea*. I am told also that it is considered a new species, to be named for me. Regardless of the name, it is a most attractive lycoris and probably will turn out to be a satisfactory garden flower. There has been no real opportunity to determine whether it sets seeds, because I've cut two of the three scapes I've had thus far. But no seeds developed on the other one.

Fig. 18. *Lycoris* sp. (un-named), as grown at Nashville, Tennessee. Photo by Sam Caldwell.

AN UN-NAMED SPECIES [Fig. 18]

In addition to the three new named species discussed, there is a beautiful un-named species as shown in Fig. 18. It has very much the same growth habits as *Lycoris radiata* and flowers for me around the first of September. In flower it differs markedly from *L. radiata* as shown in the illustration. A more detailed report on this species will be included in the 1958 HERBERTIA.

THE LEOPARD AMARYLLIS REDISCOVERED

HAMILTON P. TRAUB AND IRA S. NELSON

During his 1954 collection trip to South America under the sponsorship of the Louisiana Society for Horticultural Science, the junior

Fig. 19. *Amaryllis pardina* Hoof. f. (1867), collected by Ira S. Nelson in Bolivia, 1954; grown at Lafayette, Louisiana, 1955. In lower left corner, *A. pardina* collected by Mr. M. A. Carriker, Jr., Rio Beni region of Bolivia in 1931; grown by Dr. de Schauensee at Philadelphia in 1950.

author brought back bulbs of an *Amaryllis* species from Bolivia that was later identified as the LEOPARD AMARYLLIS, *A. pardina* Hook f. (1867),

first described from living specimens collected by Pearce in the Andes of South America.

Blooms from the bulbs collected by the junior author were obtained under greenhouse culture at Lafayette, Louisiana in April 1955 (see Fig. 19), and again in February 1956 when the plant was identified by the senior author from blooms sent by air mail to him at La Jolla, Calif.

There are several forms of this species. The two most common are white minutely dotted red, or yellow minutely dotted red. The first mentioned form is the one rediscovered and is the one pictured in Plate 19. In 1931, Mr. M. A. Carriker, Jr., collected this same form of the LEOPARD AMARYLLIS in the Rio Beni region of Bolivia, but unfortunately, it was never distributed, and is by now probably lost. The small inset on the lower left of Fig. 19 represents the Carriker plant from a photo taken by Dr. de Schauensee of Philadelphia. This form is an outstanding plant with tepalsegs fairly regular and it can be easily seen how this was a valuable asset in breeding the Leopoldii hybrids along with a species also with wide open, regular flowers, *Amaryllis leopoldii,* which has never been rediscovered.

It should also be noted that the flowers of *Amaryllis pardina* are very long lasting. The scape sent to the senior author on February 11, 1956 by air mail from Lafayette, La., was placed in water on arrival at La Jolla, Calif., and was still in prime condition when it was put in the plant press for the herbarium on February 17.

In a few years stock of this fine species should be available through plant dealers when the bulbs have been propagated in sufficient numbers.

AMARYLLIS FORGETII

REG. F. HARRADINE, *Potters Bar, England*
Corresponding Member APLS

In HERBERTIA 1956, pp. 34 to 37, are reports by Mrs. Edith Strout, Mrs. Paul Kane and Mr. L. S. Hannibal on an Andean *Amaryllis* species, thought to be *Amaryllis forgetii.*

Dr. Vargas, in 1955, sent me a parcel of bulbs which included nine of an *Amaryllis* species collected near Cuzco, Peru. They flowered very soon after being potted up, but in a weak, half-hearted manner. However, they made good growth and in due course showed the usual signs of wanting a resting period. I dried them off completely and kept them really dry for some two months or so. Then the tips of buds appeared on some, and these were given a good soaking and put on the bench in the heat, bringing them quickly into flower. The first bulb flowered in late July and the last bulb has just finished (Jan. 7, 1957).

This time all the flowers were perfect. Eight bulbs each gave two scapes, each scape having two flowers. The last bulb, smaller than the others, gave one scape with a single flower. There were no variations in flowers or foliage, one being an exact replica of the others.

The following description agrees very closely with that given in Traub & Moldenke—"Amaryllidaceae: Tribe Amarylleae" for *Amaryllis forgetii.*

Bulb small, about 1¾ inches diameter. Neck developed by the wrap-round bases of the leaves and measures about 2¼ inches from the true top of the bulb. Leaves 6, lanceolate tipped, growing with the scape, but developing fully after flowering, dull green, light at first, darkening in development, grey green on the back, ruddy for about four inches at the base, 24 to 26 inches in length, 1½ inches maximum width. Peduncle 21 inches, slender, tapering, maroon at base as in the leaves. Spathe valves 2½ inches long. Pedicels 1¾ inches. Flower stellate, arrogantly perfect, scentless, dull crimson (RHS 824/3), throat and keel bright green (RHS 60/3 to 60/1), forming a very attractive green star. The three upper tepalsegs are crimson to the tips, but the lower ones have much more green, particularly the center one, which appears more to be green oversplashed with crimson. The surface of the tepalsegs is distinctly 'quilted' (reticulated). Fully expanded flower measures about 5½ inches horizontally and 6 inches vertically. Paraperigone is incurved and bears tufts of white hairs about ¼ inch long. Stamens are about the same length as tepalsegs, the style exserted for ¼ inch beyond the lowest tepalseg. Stigma trifid.

Tepalsegs do not twist, but are very slightly reflexed. Crimson colour is very dull, particularly on the outside, not at all velvety and I see no outlining of the green star.

I gave one of the plants, in flower, to Kew. Unfortunately, Mr. Sealy was away, but opined that it was *Amaryllis forgetii.*

I find these plants require much water whilst in growth and definitely enjoy a dust dry resting period. When in flower they stand up to very high sun temperature without wilting.

Tried unsuccessfully to self it, but have a fine batch of seedling resulting from pollination with *A. reticulata striatifolia.* Leaves are now some three inches in length and all have the maternal leaf texture and colour, but a few have the paternal white stripe. Have used *A. forgetii* pollen on a Bolivian form of the American Belladonna, *A. belladonna L.* The seeds will soon be ripening.

AMARYLLID NOTES, 1956

Hamilton P. Traub, *California*

Mr. L. S. Hannibal of Fair Oaks, California, sent in the photo of the blood-red flowered variety of *Crinum bulbispermum* (Fig. 20). The ordinary variety *roseum* is such a very light pink that it hardly deserves notice and it is good to know that a real red variety is now under cultivation in the United States. The variety was collected in Natal by Dr. Rodin of the California Polytechnic Institute.

Crinum bulbispermum var. *sanguineum, var. nov.* Varietas a forma typica speciei floribus sanguineis recedit.

Flowers blood-red. Native to Natal, South Africa.

Callipsyche eucrosioides var. *rauhiana* Traub, *var. nov.* Varietas a forma typica speciei floribus roseo-rubris et filamentis viridibus recedit.

Umbel 11-flowered; flowers rose-red, filaments green. Holotype: E-15 (HEID), Rauh-Hirsch, 8-30-54, Pasaje, Eucador, alt. 300 m.

Amaryllis gh. *reginaeoides* Traub, *gh. nov.* Hybridae inter species aliquot obviae *(A. reginae, A. vittata, A. psittacina, A. aulica, A. belladonna* L., *A. striata,* etc.), plantae maximae, flores maximi modice patuli.

Hybrids involving several species *(A. reginae, A. vittata, A. psittacina, A. aulica, A. belladonna* L., *A. striata,* etc.), plants very large; flowers very large, moderately open. Holotype: Traub No. 513 (TRA).

Amaryllis gh. *leopoldaeoides* Traub, *gh. nov.* Hybridae inter species

Fig. 20. *Crinum bulbispermum* var. *sanguineum,* as grown at Fair Oaks, Calif. Photo by L. S. Hannibal.

aliquot obviae *(A.* gh. *reginaeoides, A. leopoldii, A. pardina),* plantae maximae, flores maximi patuli.

Hybrids involving several species *(A.* gh. *reginaeoides, A. leopoldii, A. pardina),* plants very large; flowers very large, wide open. Holotype: Traub No. 514 (TRA).

Hemerocallis gh. *yeldiana Traub, gh. nov.* Plantae hybridae species complures implicatae, magnitudine staturae variae, floribus magnitudine variis de tempore vernale prodictis. Holotype: Traub No. 515 (TRA), *H.* gh. *yeldiana* cl. 'Apricot' cult. La Jolla, Calif.

Hemerocallis gh. *stoutiana* Traub, *gh. nov.* Plantae hybridae species complures implicatae, magnitudine staturae variae, floribus magnitudine variis de tempors autumnale productis. Holotype: Traub No. 517 (TRA). *H.* gh. *stoutiana* cl. 'Miss Arcadia' cult. La Jolla, Calif.

Hymenocallis palmeri S. Wats. emend. Traub. Taxon 5: 195—196. 1956. Corrigenda:

page 196, first column, 2nd paragraph—
Lines 9 and 10, from bottom:
for "locate the holotype of *H. humilis* S. Wats.
"No. 555, Indian River, Fla., 1874, which"
read "locate the holotype of *H. humilis* S. Wats.,
"Palmer No. 555, Indian River, Fla., 1874, which"
Line 5 from bottom: for "S. Wats." read "Palmer".

REGISTRATION OF NEW AMARYLLID CLONES

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

This information is published to avoid duplication of names, and to provide a space for recording brief descriptions of new Amaryllid clones. Names should be as short as possible—one word is sufficient. It is suggested that in no case should more than two words be used. *The descriptions must be prepared in the form as shown in the entries below, and must be typewritten and double-spaced.* The descriptive terms used should be in harmony with those given in the "Descriptive Catalog of Hemerocallis Clones, 1893-1948" by Norton, Stuntz and Ballard. This may be obtained at $2.50 prepaid from: Dr. Thomas W. Whitaker, Executive Secretary, The American Plant Life Society, Box 150, La Jolla, Calif., U. S. A.

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.

Registered amaryllid clone names take precedence over similar names published elsewhere without registration. This rule is retroactive.

A list of recognized registered clone names of amaryllids will be published in a later issue of HERBERTIA.

HYBRID **HYMENOCALLIS** CLONE

Introduced by Len Woelfle, Cincinnati, Ohio—

'Pax'—This new *Hymenocallis* (subgenus *Ismene)* hybrid is the originator's 1950 cross No. 5002, a seedling out of *Hymenocallis Amancaes* x *H. narcissiflora* , the reverse of the 'Sulphur Queen' cross. Parentage differs from that of 'Olympia' whose progenitors were 'Sulphur Queen' x *H. narcissiflora* .

Ismene 'Pax' [Fig. 21] differs from 'Sulphur Queen' in having a substantially white cup and tepals with yellow markings deep in the cup

and at base of perianth segments, and having more strongly recurved lobes. Unlike 'Sulphur Queen' it shows no tendencies to develop crooked perianth tubes or imperfect blooms. Anthers of this clone also seem to develop more perfectly than in 'Sulphur Queen' and have an abundance of golden yellow pollen.

Except for being slightly smaller in all parts, and having more strongly recurved lobes, the bloom is not unlike that of 'Olympia'. The plant is robust in growth, attaining about the same dimensions as "Festalis" and "Olympia", which in my garden usually surpass the species and the other hybrids.

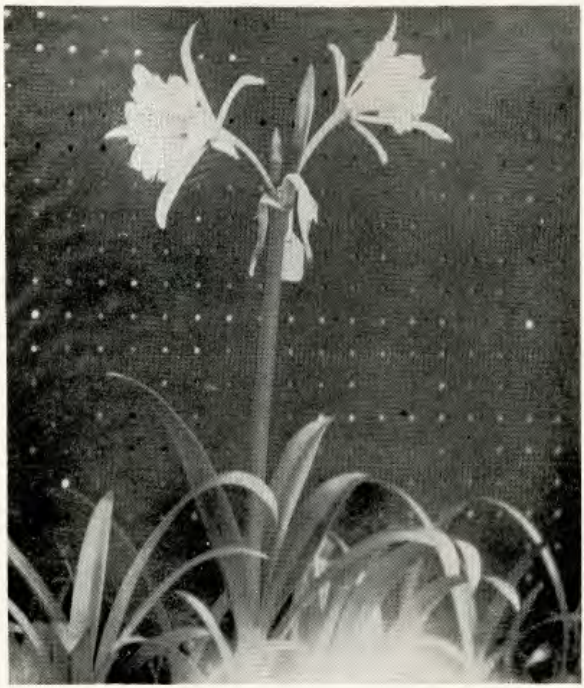

Fig. 21. *Hymenocallis* hybrid—clone 'Pax', as grown at Cincinnati, Ohio. Photo by Len Woelfle.

It flowers here consistently at about the same time as the 'Queen' and 'Olympia', about the middle of June, and should be an excellent intermediate addition to this group.

HYBRID **BRUNSVIGIA** CLONES

Introduced by L. S. Hannibal, Fair Oaks, Calif.—

The basis of segregation of the two hybrid types *(Brunsvigia rosea* and *Brunsvigia* x *multiflora)* is most readily made on the following features: A radial umbel, long pedicels and numerous flowers can be

accepted as *B.* x *multiflora* characteristics, whereas less than twelve flowers in a compact umbel facing the sun is typically *B. rosea.*

'Blushing Sally': An attractive *Brunsvigia rosea* hybrid having some *B.* x *multiflora* blood. The plant has a large compact umbel bearing numerous large flesh pink flowers. The tepals are long, slender, and irregular reflexed giving the plant a jaunty air. As the flowers age the entire blossom takes on a deep bluish pink hue, thus the name.

'Grace': A seedling clone of *Brunsvigia rosea* which Frank Leach found in his garden about 1951 and named for Mrs. Grace R. Hannibal. The parent of this clone is unquestionably the 'Frank Leach' which was registered some years ago. 'Grace' has a compact umbel of nicely ruffled flowers bearing the first pictotee markings ever noted in *Brunsvigia* hybrids. It has been used widely as a pollinator on 'Hathor' and has led to many beautiful seedlings with similar markings.

'Blaze': A *Brunsvigia rosea* hybrid having a compact umbel of large vividly colored blossoms. The pedicels and tubes are extremely short whereas all tepals are very long and irregularly reflexed in a spiral pattern. The deep chrome throat or eye is readily visible and gives the effect of a yellow flame set off in a whirling blaze of rose red petals.

'Purity': A large showy snow white form of *Brunsvigia* x *multiflora alba* derived from selfing 'Hathor.' The tepals are very broad, well reflexed, particularly regular and very smooth in texture. The pedicels are four to five inches long and tend to radiate out equally from the umbel as spokes of a wheel. The size of the umbel, perfect symmetry of the individual flowers and their equal spacing makes this a plant which has no peers.

'Janice Gayle': This is a *Brunsvigia rosea* and 'Hathor' cross having ten or twelve widely flared blossoms on the scape. The tepals are quite slender, well reflexed with the tips colored a bright pink. The throat is short and colored a light yellow. The scape is quite slender. The open nature of the flowers with their long slender petals gives them a delicate airey appearance which is only rivaled by a *Sprekelia.* The plant has been named for Miss Janice Gayle Hannibal.

'Cream Pitcher': This is a cream white *B.* x *multiflora* seedling derived from Hathor'. The petals are relatively broad and attractively ruffled. Unlike most white Multifloras the throats of the blossoms are a deep butter yellow which carries up well into the limb and gives the petals a cream yellow shade. G. K. Cowlishaw mentioned some 20 years ago that a butter yellow blossom was one of his goals. If yellow in the Brunsvigia is like yellow in the Daffodil then a deep yellow blossom is a recessive seedling, and obviously yellow is not readily obtainable.

'Concord Lass': A large flowered *B.* x *multiflora* hybrid having slender, symmetrically pointed well reflexed petals of very smooth texture. The throat and tepals are snow white whereas the tips of the petals are faintly marked flesh pink. Such delicate coloring rarely occurs in hybrid Brunsvigias without appearing as washed out. In this instance the faint hues are clear and sharp, and are enhanced by the unruffled texture of the petals.

'Pacifica': This *Brunsvigia* x *multiflora* clone has been under observation for several years as the scape, pedicels and blossoms are massive compared to most of the hybrids. The well reflexed blossoms with their broad smooth petals are as large as a Diener Hybrid *Amaryllis* (Syn. *Hippeastrum).* There is undoubtedly no plant known with such a perfect texture unless it be 'Purity'. No ruffle or surface irregularity mars the serenity of the tepals. The coloring of the limb is a pale flesh pink while the throat is white. No yellow eye is present. Each blossom is capable of lasting a week or more without wilting, even in hot weather. This permits the entire umbel to come in flower at one time.

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.]

Amaryllis chilensis Ruiz et Pav., Fl. Peruv. et Chil. 3: 46-47. 1802.—Spathe usually 2-flowered, with the corolla campanulate, the nectary scales 3- or 4-fid, and the stamens declinate, the alternate ones shorter. The *Amaryllis chilensis* of L'Héritier, Sert. Ang. 11, described as having the spathe 1-flowered, sub-bifoliate, and lanceolate, the flowers pedunculate, and the leaves linear.

Root-fibers filiform; bulb subrotund, tunicate; scape 1 foot tall, erect, terete, hollow, purpurascent, shiny; leaves longer than the scape, many, linear, attenuate at both ends, compressed, obsoletely lineate, spongy-honeycombed within; spathe 2-flowered, rarely 1-flowered, diphyllous, the bracts linear-lanceolate, membranous, striate, rosy-white, longer than the peduncles; flowers pedunculate; corolla campanulate, 2 inches long, the tube short, yellow, the limb 5-parted, orange in color, the lobes lanceolate, spreading; nectary scales 6, inserted in the mouth of the tube, appressed to the stamens, 3- or 4-fid; filaments declinate, half as long as the corolla, the 3 alternate ones longer; anthers incumbent, assurgent; style declinate, longer than the stamens.

It grows in woods and fallow fields at Concepcion, Chile. It blooms in October and November. A vernacular name is "Hamancae encarnado."

Observation 1. The dried specimens and illustration of this species were lost in a memorable shipwreck. Observation 2. The Lilio-Narcissus monanthos, coccineus of Feuill. Obs. t. 3, p. 29. pl. 2-I is in reality a different species from the *Amaryllis chilensis* of L'Héritier, Sert. Ang. p. 11. Observation 3. The flowers exhibit no small similarity to those of *A. miniata, A. belladonna,* and *A. reginae.*

Amaryllis miniata Ruiz et Pav., Fl. Peruv. et Chil. 3: 57. 1802.—Spathe 2—4-flowered, corolla campanulate, flaring, the uppermost lobe reflexed, the lowest narrower, and the stamens and pistil decumbent. Root-fibers fasciculate, long, filiform, flexuous; bulb subrotund-ovate,

large, tunicate, white, but when cut and exposed to the air turning to a vermillion color; scape solitary, central, often with 2 lateral ones from a single bulb, shorter than the leaves, erect-patulous, terete, obsoletely two-edged, hollow, scarcely purpurascent, very lightly whitish-pulverulent; leaves ensiform, glabrous, lineate on both surfaces, more shiny above, erect from the middle to the base, carinate, spreading and flat toward the apex, the apex itself deflexed; spathe purpurascent, 2—4-flowered, somewhat 2-edged, the bracts as many as the flowers, unequal, membranaceous, spreading, oblong-lanceolate, acute, marcescent, the interior ones gradually smaller; flowers pedunculate, nodding, large, showy; peduncles unequal, terete, curvate during anthesis, erect in the fruiting stage; corolla fleshy, vermillion, shiny, almost 3 inches long, longitudinally lineate-striate, its tube short, scarcely 6 mm. long, obtusely trigonous, 12-lined on the outside, green-spotted, green on the inside, the throat spreading, spotted with greenish-white little stars, the limb campanulate, 6-parted, the lobes spreading, lanceolate-oblong, equally long, the outermost ones broader, the upper one resupinate, and the 3 interior ones the lowest narrower; nectary scales 6, white, many-setose, inserted at the interestices at the bottom of the throat, of the corolla; filaments subulate, almost as long as the style, incurved at the apex, incumbent upon the base of the corolla segments, inserted at the base of the segments, alternating with the nectary scales, the 3 alternate ones shorter, greenish-white below, flesh-colored above, white at the apex; anthers large, white, yellow after the shedding of the pollen, incumbent, linear, tetragonal, 4-sulcate, 2-locular, emptying through lateral channels; ovary obovate, obtusely trigonous, triquetrous; style greenish-white beneath, red above, filiform, as long as the corolla, declinate with the stamens; stigma trigonous-trilobed; capsule obovate-oblong, trigonous, 3-locular, 3-valved, blackish in color; seeds many, black, imbricate. It grows abundantly in the wooded Andes, in ploughed places and in gardens at Chinchao, Macora, Machaynio, and Masapata. It blooms in July, August, and September—in the last-mentioned month progeny of plants brought alive from Peru have also blossomed in the botanical garden at Madrid. Vernacular name: lacre de montaña, because of the fact that this bulb, when cut and exposed to the air, quickly takes on the color of cinnabar (of Lacre, that is sealing-wax) in all its cuts; furthermore, the natives seal letters with the juice of this bulb, and finally the name of the flowers corresponds to their color (red).

Observation 1. It is related to *Amaryllis belladonna* L., from which it differs in having the bulb white, becoming red upon being cut and exposed to the air, the corolla rather flaring, glabrous at the base, the exterior segments broader, the uppermost resupinate, the lowest of the interior ones narrower, and in the other characters given in the description. Observation 2. We hope to publish a picture of this species in the Appendix.

Hemerocallis gh. *traubiana Moldenke, gh. nov.* Plantae hybridae species complures implicatae, magnitudine staturae variae, floribus

magnitudine variis de tempore aestivo productis. Holotype: Traub No. 516 (TRA), *H.* gh. *traubiana* cl. 'Golden Triangle', cult. La Jolla, Calif.

HABRANTHUS IMMACULATUS SP. NOV.

HAMILTON P. TRAUB and KATHERINE L. CLINT

On an historic collecting expedition into Mexico in July 1954, the Clints, of Brownsville, Texas, brought back many amaryllids which have in some instances not yet been identified. One outstanding item, M-456, collected on July 11, 1954, in the State of Guanajuanto, several miles east of Celaya, on a gently sloping hillside, alt. 6450 ft., in the full sun, and in very porous clay loam, has proved to be new to science. It flowered for the junior author at Brownsville, Texas, in 1955 and again in 1956, and for the senior author at La Jolla, Calif., in late June and again in late September 1956. It was crossed with *Habranthus robustus* (from Argentina) and the progeny are thriving in the experimental plot. Our plant has been identified as one of the very finest *Habranthus* species, and has been approximately named *Habranthus immaculatus.* The large perigone is 7.7 cm. long, and 8 cm. across the face; it is pure white with a light greenish-yellowish throat, and is slightly fragrant.

It was assumed by some workers in the past that *Habranthus* species were confined to the southern hemisphere. This led to the hypothesis that *Habranthus andersonii* var. *texanus* (native to Texas) must have been introduced. Since *Habranthus immaculatus* from Mexico has been crossed with the South American *Habranthus robustus,* it appears that the members of the Subtribe *Zephyranthinae* of the Tribe *Zephyrantheae* (Traub, 1957) are closely related and have spread widely from a common ancestral stock. This is further reinforced by the crossing of the Mexican *Zephyranthes grandiflora* with the Argentinian *Habranthus juncifolius* (Traub, 1952).

Habranthus immaculatus Traub et Clint, **sp. nov.**

Herba bulbosa, bulbo tunicato; foliis 4 linearibus erectis 33—36 cm. longis, 1.5 cm. latis, glaucescentibus; scapo cavo 23.7 cm. alto; umbella uniflora; spatha 4.4 cm. longa, parte inferiori tubulosa; perigonio 7.7 cm. longo albo, tubo quam perigonio brevioribus; stigmate profunde trifido.

DESCRIPTION.—*Bulb* tunicated globose, relatively large. *Leaves* 4, upright, 33—36 cm. long, 1.5 cm. wide, linear, glaucescent, slightly twisted at the apex, appearing after the first flowers. *Scape* hollow, 23.7 cm. tall at anthesis, elongating to 30.4 cm. tall in fruit, reddish-glaucescent below, changing to dull glaucescent greenish above, flattish, 5.5 x 8 mm. at the base, 4 x 5 mm. at the apex. Umbel 1-flowered. *Spathe* 4.4 cm. long, united below, grayish-greenish, the bifid free segments pointed, opposite, 1.2 cm. long. *Pedicel* 4.2 cm. long at anthesis, elongating to 10 cm. in fruit. *Ovary* 8 mm. long, 3.8 mm. in diam, at the base, 4.8 mm. in diam. at the apex. *Perigone* held horizontally, 7.7 cm. long, 8 cm. across the face, slightly fragrant, pure white, light greenish-

yellowish throat, lower portion of tepalsegs and tepaltube tinged greenish on outside. *Tepaltube* 9.5 mm. long, 5.5 mm. in diam. at the base, 9.1 mm. in diam. at the apex. *Tepalsegs* narrowly obovate, of four different sizes: top setepalseg 6.7 cm. long, 3.1 cm. wide, two side setepalsegs 6.7 cm. long, 2.8 cm. wide; two side petepalsegs 6.7 cm. long, 2.6 cm. wide, bottom petepalseg 6.7 cm. long, 2.5 cm. wide. *Stamens* of four different lengths, fasciculate, declinate-ascending, shorter than the style, filaments white; anthers semi-circular, pollen yellow. *Style* white, somewhat shorter than the tepalsegs, declinate-ascending, *stigma* deeply trifid, forks 5 mm. long. *Capsule* 1.9 cm. long, 2 cm. in diam. at the base, 2.2 cm. in diam. at the apex, triangular, lobes not prominent; *seeds* numerous per locule, D-shaped, flat, black, 11 mm. long, 6.5 mm. wide.

HOLOTYPE: Traub No. 540 (TRA), cult. La Jolla, Calif., 5-27-56; grown from bulb collected by Mr. & Mrs. Morris Clint several miles east of Celeya, State of Guanajuanto, Mexico, July 11, 1954, alt. 6450 ft.

NOTES.—This fine species sets seeds readily to self pollination and thus it will be possible to obtain wide distribution in a relatively short time.

See Figs. 2 and 3.

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HABRANTHUS CARDENASIANA SP. NOV.

HAMILTON P. TRAUB and IRA S. NELSON

In 1954, the junior author discovered an unidentified species of *Habranthus* growing in fields recently cleared of deciduous jungle growth on the Hacienda Souce about 35 kilometers east-northeast of Santa Cruz, Bolivia. The soil was a deep black sandy loam. The owner of the land reported that it was near neutral in its pH reaction. The land is relatively flat but drainage is good. Rainfall is seasonal with distinct wet and dry seasons, and temperatures range from 5° to 43° C.; the altitude is approx. 445 meters above sea level. The blooming season in Bolivia ranged between Sept. 9 and 25 in 1954.

Bulbs of this species grown by the senior author bloomed in May and June in 1955 and 1956 and was identified as new to science. It has been named for Dr. Martin Cardenas of the University of Cochabamba, Bolivia, who kindly assisted the junior author in collecting amaryllids in Bolivia.

Habranthus cardenasiana Traub et Nelson, **sp. nov.**

Planta bulbosa, foliis pallide viridibus usque ad 22 cm. longis, 5.5—6.5 cm. latis, scapo 4.5—14.5 cm. alto, umbella uniflora, spatha 3—4.4 cm. longa, 1/4—1/3 supra basim tubulosa, floribus intus albis, extus usque

ad 2/3 supra basim flavido-subviridibus, superiore 1/3 rubellis, tubo tepalorum 2—3 mm. longo, segmentis tepalorum 5.5—6.1 cm. longis 1.4—1.7 cm. latis, stylo usque ad medium segmentorum porrecto, stigmate profunde trifido, staminibus usque as 4 longitudines crescentibus, semper quam stylo brevioribus.

Description.—*Leaves* light green, glaucescent, linear, tapering slightly toward the base and the apex, up to 22 cm. long, 5.5—6.5 mm. wide. *Scape* 4.5—14.5 cm. tall, glaucescent. *Spathe,* pinkish to reddish, at anthesis, 3—4.4 cm. long, tubular for about 1/4 to 1/3 of its length below. *Pedicel* 3.6—5.6 cm. long, light green. *Ovary* 6.5—7.5 cm., 4 mm. in diam. *Flower* somewhat declined, *perigone* 5.7—6.3 cm. long, white inside, pinkish in upper 1/3 and yellowish-greenish below on outside. *Tepaltube* 2—3 mm. long. *Setsegs* oblanceolate, acute, up to 5.5—6.1 cm. long, top setseg 1.7 cm. wide, the two side setsegs 1.4 cm. wide. *Petsegs* narrowily oblanceolate, acute, two side petsegs 11 mm. wide, bottom petseg 9 mm. wide. *Style* about half as long as the tepalsegs, stigma deeply trifid, with filiform recurved forks. Stamens shorter than the style, disposed at four different lengths.

Holotype: Traub No. 542 (TRA), cult., La Jolla, Calif., 5-24-56, grown from bulbs collected by Ira S. Nelson 35 kilometers east-northeast of San Cruz, Bolivia in 1954.

Notes.—This plant is of easy culture and should become a popular subject in gardens in the lower South, south Texas, southern Arizona, and California.

CHLIDANTHUS BOLIVIENSIS SP. NOV.

Hamilton P. Traub and Ira S. Nelson

In 1953, Dr. Martin Cardenas, and his assistant, Miss Ann Marie Kruger, of Cochabama University, discovered a *Chlidanthus* species growing on the southern slope of the mountain immediately northwest of Cochabama, Bolivia. These bulbs were stored, and Dr. Cardenas gave the junior author some of them in 1954. In 1954, the junior author and Miss Kruger collected additional bulbs of this species in the place of original collection which is at an alt. of approx. 9,400 feet.

The bulbs grew on a southerly exposure of an extremely steep mountain side which was covered with grass. Low shrubs and terrestial bromeliads were sparsely scattered over the area which is apparently entirely above the tree-line. The soil is grayish-yellow and into which is incorporated decaying grass roots and leaves. A considerable amount of shale is mixed in the soil. The area has a semi-arid aspect. Rainfall in the area is light, and comes in a more or less definite season. Temperatures drop below freezing for short periods and occasional snows appear in winter. Clear skies and sunshine prevail most of the year.

For obvious reasons, this new species has been named appropriately *Chlidanthus boliviensis* [Fig. 22].

Bulbs of the *Chlidanthus* species were grown outdoors at La Jolla Calif., by the senior author and they flowered in late May and early

June in 1956. It was at once evident that they were quite distinct from *Chlidanthus fragrams* which was growing in quantity in the same area. Our plant differs from *C. fragrans* in having a much larger bulb with a much longer pseudo-neck, longer, wider, lighter green, concave leaves with lyaline margins minutely toothed; umbel 5—6—12-flowered; flowers always pedicellate, pedicels elongating to 1.8 cm. at anthesis; flowers

Fig. 22. *Chlidanthus boliviensis* Traub et Nelson, *sp. nov.* (left) as flowered by Dr. Cardenas at Cochabamba University in 1954 from dry bulbs in storage; umbel 5-flowered. Type location (left) on steep mountain side above tree line. Photos by Ira S. Nelson.

opening in succession. It differs in other particulars as indicated in the following description.

Chlidanthus boliviensis Traub et Nelson, **sp. nov.**

Planta bulbosa, bulbo maximo, pseudocollo 10 cm. longo 1.3—1.4 cm. diametro, foliis 9 vel 10 pallide, viridibus linearibus usque ad 63 cm. longis 1.5 cm. latis, ad apicem rotundatis, marginibus hyalinis minute denticulatis, scapo 23 cm. alto, umbella 5—6—12-flora, pedicellis usque

ad 1.8 cm. longis, tubo tepalorum 6.7 cm. longo, perigonio lucide flavo, segmentis tepalorum 3.5 cm. longis, 1.1—1.3 cm. latis, filamentis subulatis 3—9 mm. longis ad basim segmentorum adnatis, stylo quam staminibus breviore, stigmate trifido.

DESCRIPTION.—*Bulb* very large, with pseudo-neck formed by interlacing of basal leaf-sheaths, 10 cm. long, 1.3—1.4 cm. in diam., brownish-reddish. *Leaves* 9—10, lettuce green (Wilson, 861), linear, up to 63 cm. long, up to 1.5 cm. wide in lower half, narrowing gradually to a rounded apex, concave, especially in lower part, margins hyaline, minutely toothed; starting at the time of flowering but not fully developed until later. *Scape* produced in the spring from the center of the bulb, solid, light green, flattish, without sharp edges, 23 cm. tall. 8 x 10.5 mm. diam.

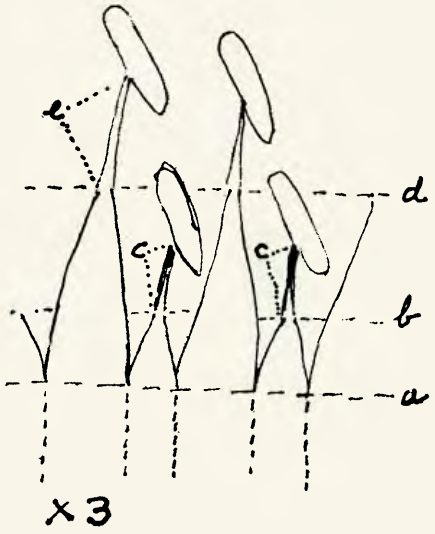

Fig. 23. *Chlidanthus boliviensis* Traub et Nelson, *sp. nov.* Stamens: a, apex of tepaltube; b, end of attachment of filament to setepalsegs, c, free portions of sepaline stamen-filaments; d, end of attachment of filaments to petepalsegs; e, free portions of petaline stamen-filaments. All enlarged three times.

at the base, 6.5 x 9 mm. diam. at the apex, somewhat shorter when flowers first open, elongating as the others open. *Spathe-valves* 4, up to 6.5 cm. long, lanceolate; *bracteoles* smaller. *Umbel* 6-flowered; flowers opening in succession at intervals of 2 to 3 days. *Pedicels* at first short (below 1 cm. long) when in bud, but elongating up to 1.8 cm. long at anthesis; 3-sided. *Ovary* at anthesis 2.1 cm. long, 4.2 mm. in diam. at the base, 5.1 mm. in diam. at the apex; 3-sided. *Tepaltube* 6.7 cm. long, 4.3 mm. in diam. at the base, 7.3 mm. in diam. at the apex; 3-sided. *Perigone* bright yellow, fragrant, wide open at anthesis, 5.8 cm. in diam. at apex. *Setsegs* 3.5 cm. long, 1.1 cm. wide, ovate; *petsegs* 3.5 cm. long, 1.3 cm. wide, ovate. The free portions of the *stamens* arise from two levels at the base of the tepalsegs [Fig. 23]; the long flat lowermost portions of

the filaments are fused to the inside of the tepaltube up to the apex, and extend beyond as subulate portions fused to the bases of the tepalsegs; the subulate portions fused to the setsegs are 2 mm. wide at the base, 3 mm. long, those fused to the petsegs are 3.5 mm. wide at the base, 9 mm. long; thus the final free filiform portions of the *filaments* arise from two levels on the tepalsegs and alternate from 3 mm. long for the sepaline to 9 mm. long for the petaline filaments [Fig. 23]. *Anthers* are affixed about 1/3 up from the base, 6 mm. long at anthesis, cream yellow before anthesis, pollen yellow. *Style* somewhat longer than the longer stamens; *stigma* trifid.

HOLOTYPE: Traub No. 529a (TRA), cult. at La Jolla, Calif., 5-29-56; grown from bulb collected by Ira S. Nelson near Cochabamba, Bolivia in 1954.

NOTES.—With the new species available it will be possible to undertake breeding experiments by crossing with *Chlidanthus fragrans*. In this manner it may be possible to obtain greater variety in this genus.

GENUS **RAUHIA** AND **R. PERUVIANA, GEN. & SP. NOV.**

HAMILTON P. TRAUB, *La Jolla, California*

In 1954 and again in 1956, Prof. Dr. W. Rauh, and his colleague, Dr. Hirsch, of Heidelberg University, made scientific collecting expeditions to the Andes of Peru and Ecuador. Each time, among the material collected, the *Amaryllidaceae* were represented, and in particular, an undescribed amaryllid was discovered at Jaén in the Jaén-Bellavista valley of Peru. This plant, which has been appropriately named *Rauhia* for its discoverer, is the subject of this brief article.

Our plant is unique in a number of particulars. The bulb is very large, up to 20 cm. in diameter! The leaves are obovate, apex subacute; the scape is solid, up to 100—120 cm. tall, but the flowers are quite small, greenish-whitish. Although the other characters are outstanding, it is the flowers with which we are especially concerned. In our plant there is no staminal tube or cup, and the stamens are inserted inside the tepaltube 2/5 from the base; the free filiform filaments are in two groups, one of two shorter, and one of four longer, filaments. This is a unique condition in the *Amaryllidaceae*.

On the basis of gross morphology, our plant belongs in that portion of the subfamily *Amarylloideae* (Traub, 1957) which is composed of three tribes, as follows:

1a. Scape solid:

2a. Seeds flat, winged or angled; (a) staminal cup absent with the subulate lower portions of the stamen-filaments attached to the base of the tepalsegs, or (b) staminal cup present and stamen-filaments attached to the rim or inside the staminal cup: *Chlidanthus, Pancratium, Stenomesson,* etc. .....Tribe 1. *Pancratieae*

2b. Seeds fleshy; (a) tepaltube absent, staminal cup short, attached to the base of the tepalsegs, free stamen-filaments long, or (b) tepal-

tube present and with staminal cup present: *Hyline, Urceolina, Eucharis, Hymenocallis, etc.* .....Tribe 2. *Euchareae*

1b. Scape hollow:

Seeds flat, winged, tepaltube present, with (a) a circular outgrowth below the apex of the tepaltube, stamen-filaments dilated at the base, inserted at the mouth of the tepaltube, or (b) stamen-filaments free, filiform, or variously modified, or united at the base or at the apex: *Lepidopharynx, Phaedranassa, Callipsyche, Eustephia, Stricklandia, Eustephiopsis,* etc. .....Tripe 3. *Eustephieae*

In our plant the scape is solid, the seeds are flat, winged, and thus it belongs in the tribe *Pancratieae* according to the classification, but the tribal boundaries have to be modified in order to accommodate it as shown in the revised statement that follows (amplified portion in italics):

1a. Scape solid:

2a. Seeds flat, winged or angled; (a) staminal cup absent with subulate lower portion of stamen-filaments, in two series of 3, attached to the bases of the tepalsegs, *or, staminal cup absent with filiform stamen-filaments, two shorter than the other four, attached inside the tepaltube 3/5 from the base;* or (b) staminal cup present and stamen-filaments attached to the rim, or below it, inside the staminal cup: *Chlidanthus, Rauhia, Pancratium, Stenomesson,* etc.
Tribe 1. *Pancratieae*

With the relationship to the related genera established, the next step is to present a combined generic and specific description for the monotypic new genus and the type species in accordance with Article 41-1 of the International Code (Lanjouw, et al (ed.), 1956):

Genus *Rauhia* Traub, *gen. nov. (Amaryllidaceae)*
Rauhia peruviana Traub, *sp. nov.* (generic holotype)

Descripto generico-specifica:—Plantae bulbosae, bulbo tunicato maximo 15—20 cm. diametro, foliis 2 obovatis as apicem subacutis 22 cm. longis, ad basim 9.5 cm. latis, scapo solido 100—120 cm. alto, spatha bivalva, valvis liberis, pedicellis usque ad 2.3 cm. longis, ovario 1.2 cm. longo, perigonio 3.8 cm. longo subviridi-albido, tubo tepalorum 2.2 cm. longo as basim 2 mm. diametro usque as 10 mm. ad apicem ampliato, segmentis tepalorum subaequalibus rectis ad apicem conniventibus, staminibus in tubo tepalorum 2/5 supra basim affixis, horum 2 segmenta subaequantibus, 4 a perigonio exsertis, stylo stamina longiora excedente, stigmate capitato, capsula per loculis dehiscente, seminibus numerosis oblongis alatis fusco-brunneis vel subnigris.

Holotype: Rauh No. 329 (= No. 535a + 535b, TRA), 10-25-56, Jaén, Peru.

Combined generic and specific description.—*Bulb* tunicated, globose, very large, up to 20.7 cm. long, up to 20 cm. in diam. *Leaves* 2,

sheathing at the base, obovate, 22 cm. long, 9.5 cm. wide, narrowing to 7.5 cm. wide at the base, and to a subacute apex. *Scape* solid, appearing with the leaves, 100—120 cm. tall. *Spathe-valves* 2, broadly ovate, acuminate, 1.5 cm. at the base, 2.5 cm. long. *Umbel* many-flowered (17 or more). *Pedicels* up to 2.3 cm. long, 2 mm. in diam. *Ovary* 1.2 cm. long, deeply 3-lobed in lower part, 5 mm. in diam., round in upper part, 2 mm. in diam., ovules numerous in each locule. *Perigone* 3.8 cm. long, greenish-whitish, declined, of relatively thick substance. *Tepaltube* 2.2 cm. long, 3 mm. in diam. at the base, enlarging to 10 mm. in diam. at the apex. *Tepalsegs* continuous with the tepaltube and showing no demarcation, straight, slightly conniving at the apex, subsimilar, 1.6 cm. long, lanceolate; setepalsegs oblong, apex acutish, 6 mm. wide; petepalsegs 7 mm. wide, oblong, apex roundish. *Stamens* attached 2/5 from the base of the tepaltube, two 3.1 cm. long, subequaling the tepalsegs, four 3.6 cm. long and exserted from the perigone, anthers 7.5 mm. long, 2 mm. in diam., medianally affixed, versatile. *Style* overtopping the stamens, stigma capitate. *Fruit* a loculicidally dehiscing, deeply lobed capsule; seeds numerous in each locule, flat, oblong, winged, black or dark brown.

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LECTOTYPES OF LINNEAN GENERIC NAMES (AMARYLLIDACEAE)

To the International Code as adopted and revised at Amsterdam 1935, there appears a supplement, the proposal by A. S. Hitchcock and M. L. Green for "Species Lectotypicae Generum Linnaei" (Standard-Species of Linnean Generic Names: Phanerogamae). The names of *Amaryllidaceae* appearing in this list, based on Species Plantarum, ed. 1. 1753 and Genera Plantarum, ed. 5. 1754, have been adopted in connection with the present writer's manuscript on the taxonomy of this family. The selection of the lectotypes of these genera are hereby definitely confirmed and designated as follows: (1) *Allium* L. (lectotype): *A. sativum* L.; (2) *Amaryllis* L. (generic lectotype: *cf.* Herbert, Bot. Mag. sub pl. 2113. 1819; Append. Bot. Reg. 12. 1821; Amaryll. 144. 1837; Uphof, Herbertia 5: 109. 1938; Traub & Moldk., Amaryllidac.:Amaryll. p. 72. 1949; Amaryllis Manual, App. B. 1957): *Amaryllis belladonna* L. [species lectotype: Hermann pl. 194, Parad. Bat. 1698: *cf.* Traub & Moldk., Amaryllidac.:Amaryll. p. 38. 1949; Traub, Taxon 3: 102-111. 1954; Amaryllis Manual, App. B. 1957] (3) *Crinum* L. (lectotype): *C. americanum* L.; (4) *Galanthus* L. (lectotype): *G. nivalis* L.; (5) *Gethyllis* L. (lectotype): *G. afra* L.; (6) *Haemanthus* L. (lectotype): *H. coccineus* L.; (7) *Hemerocallis* L. (lectotype): *H. lilio-asphodelus* L. *cf.* W. J. Dress (Baileya 3: 107-108. 1955); (8) *Narcissus* L. (lectotype): *N. poeticus* L.; and (9) *Pancratium* L. (lectotype): *P. zeylanicum* L. ——*Hamilton P. Traub.*

CLASSIFICATION OF THE **AMARYLLIDACEAE**—SUBFAMILIES, TRIBES AND GENERA

HAMILTON P. TRAUB

In a recent paper, the enumeration of the genera and species of the *Amaryllidaceae* was reported (Traub, 1957a). In the present article, the classification of the *Amaryllidaceae* down to the generic level—subfamilies, tribes and genera—is reported. The classification is taken from the writer's manuscript on the taxonomy of the *Amaryllidaceae*—subfamilies, tribes, genera and species—which is now nearing completion and which will be published in the not too distant future.

BRIEF HISTORICAL REVIEW

Period 1763—1809. Only ten years after the appearance of Linnaeus' Species Plantarum (1753), Michel Adanson (1727-1806), who studied under Jussieu, published his version of a natural system of plant classification, including the *Amaryllidaceae* under the name, [family] *Narcissi* (Adanson, 1763). Bernard de Jussieu, of the Jardin des Plantes, Paris, never published his system, but his nephew, Antoine Laurent de Jussieu (1748-1636) revised and improved his uncle's system and published it (de Jussieu, 1789). He also included the *Amaryllidaceae* under the name, [family] *Narcissi.* The de Jussieu system of 1789 was later revised by another eminent French botanist, Jaume St.-Hilaire (1805). He included the *Amaryllidaceae* under the name [family] *Amarylleae* (see Table 1).

TABLE 1. *Amaryllidaceae* according to St.-Hiliare (1805)

I. Ovary superior	II. Ovary inferior	III. Allied genera
*Gethyllis L.**	*Haemanthus* L.	*Hypoxis* L.
Milla Cav.	*Amaryllis* L.	*Leptanthus* Mich.
Bulbocodium L.	*Pancratium* L.	*Heteranthera* Ruiz & Pav.
Hemerocallis L.	*Narcissus* L.	*Pontederia* L.
Crinum L.*	*Eustephia* Cav.	*Polianthes* L.
Agapanthus L'Hérit.	*Leucojum* L.	*Alstroemeria* L.
Tulbaghia L.	*Galanthus* L.	*Tacca* Rumph.

* Error; ovary inferior; belongs in Division II.

These classifications were necessarily based wholly on gross morphological similarities which are still the basic criteria of the taxonomist today. Apparently in general the umbellate inflorescence, with some exceptions, together with the change from the superior to the inferior ovary within the family were considered as unifying principles. It should be noted that the general outlines of the most advanced classifications of today are foreshadowed in the conclusions reached by these keen-sighted pioneers—*Milla (Allieae), Tulbaghia* and *Agapanthus (Agapantheae), Hemerocallis (Hemerocalleae),* all in the superior-ovaried division of the family; *Amaryllis, Narcissus, Pancratium,* etc. *(Amarylloideae),* in the inferior-ovaried division. The third division, *Polianthes, Alstroemeria,* etc., is of course out of place as we know today, but this could only be cleared up later when information from various other scientific disciplines, including chromosome data, could be brought to bear.

Period, 1810—1932. The de Jussieu—St.-Hilaire classifications of the *Amaryllidaceae* were far ahead of their time, and they contrast markedly with those of Robert Brown (1810), Lindley (1830;1836), and their successors. Brown (1810) laid down the dictum that the amaryllids are to be confined to the inferior-ovaried section 2 of de Jussieu. This uninspired decapitation was accepted by Lindley (1830; 1836) who maintained that "The only orders with which this [the Amaryllidaceae] need be compared are *Liliaceae,* from which it is known by its inferior ovary . . ." In general, the lead of Lindley was followed by Bentham & Hooker (1883), Pax (1887); Pax & Hoffman, (1930) and Baker (1888). Thus progress was arrested until 1933, when almost simultaneously a number of workers shed new light on the subject.

Period 1933 to the present time. The inspired conclusions of Hutchinson (1934), based on gross morphological evidence, when published had already been reinforced in part by the chromosome data of McKelvey & Sax (1933) and Whitaker (1934), who showed conclusively that the Brownian dictum was artificial and untenable in some particulars. Thus new visitas were opened.

According to Hutchinson (1934) it is the capacity to produce the umbellate inflorescence—not the position of the ovary—which constitutes the main unifying principle in the apparent evolution of the *Amaryllidaceae.* Evolution is vertical from the superior to the inferior ovary within the family. McKelvey & Sax (1933) and Whitaker (1934) showed by chromosome evidence that the inferior ovaried Agave and its relatives (then grouped in the *Amaryllidaceae)* could no longer be separated from such a superior-ovaried genus as *Yucca* (then grouped in the *Liliaceae).* This enlarged group, including *Agave* and its relatives, as well as *Yucca,* was recognized as the family *Agavaceae* by Hutchinson (1934). (See also Traub 1953; Darlington & Wylie, 1956.)

Hutchinson (1934) also removed the related tribes—*Allieae, Agapantheae* and *Gilliesieae*—from the *Lilliaceae* and placed them in the *Amaryllidaceae* on the basis of the umbellate flowering habit, a characteristic condition in this family, and thus followed the precedent set by de Jussieu (1789) and St.-Hilaire (1805). This portion of Hutchinson's revision (Table 2) is apparently also supported by the chromosome data as summarized below (for complete data on the generic level, see the classification toward the end of this paper).

TABLE 2.

I. Ovary superior:		
Subfamily I. *Allioideae*	x=	5, 6, 7, 8, 9, 10, 11, 12, 14, 15
Tribe 1. *Allieae*	x=	5, 6, 7, 8, 9
Tribe 2. *Agapantheae*	x=	6 15
Tribe 3. *Gilliesieae*	x=	10(11)
Tribe 4. *Hemerocalleae*	x=	11, 12, 14
II. Ovary inferior:		
Subfamily II. *Ixiolirioideae*	x=	12
Subfamily III. *Amarylloideae*	x=	6, 7, 8, 9, 10, 11, 12, 14, 15, 23

Since the ancestral stock from which the *Amaryllidaceae* originated was liliaceous, it is to be expected that among the superior-ovaried part, the subfamily *Allioideae,* which is the closest to the *Liliaceae,* the basic x=5 has been retained to a limited extent, and that this basic number is not found in the more advanced inferior-ovaried part, the subfamily *Amarylloideae.* Darlington & Wylie (1956) therefore are apparently in error in retaining the two tribes, *Allieae,* x=5, 6, 7, 8, 9 and *Agapantheae,* x=6, 15, in the *Liliaceae,* while leaving the related tribe *Gilliesieae,* x=10(11), and the tribe *Hemerocalleae,* x=11, 12, 14, in the *Amaryllidaceae.* This amounts to an horizontal decapitation that ignores the morphological similarities as well as the chromosome data and thus severs the root base of the evolutionary line. It is clear that the four tribes—*Allieae, Agapantheae, Gilliesieae* and *Hemerocalleae*—all belong in the *Amaryllidaceae* on the basis of the gross morphology and the chromosome data.

CLASSIFICATION OF THE SUBFAMILIES, TRIBES AND GENERA

When Hutchinson (1934) presented his new classification of the monototyledons, he expressed the thought that it was up to taxonomic workers to take various portions under their wing and work them out in detail down to the tribal, generic and species levels. The writer, who had been working on the taxonomy of the amaryllids for many years, and who immediately recognized the excellence of Dr. Hutchinson's work, took up the challenge for the monograph of the *Amaryllidaceae.* Thus the classification presented here follows in general the delimination of the family by Hutchinson (1934) with necessary changes required on the basis of research since 1934.

Changes since 1934. On the basis of work by Whitaker (1934) and Granick

(1944), the genus *Hosta* has been removed from the tribe *Hemerocalleae* and transferred to the family *Agavaceae* (Traub, 1953; Darlington & Wylie, 1956). The residual tribe *Hemerocalleae* has been removed from the *Liliaceae* and placed in the *Amaryllidaceae* on the basis of morphological and chromosome similarities (Traub, 1938; Traub & Moldenke, 1949); this conclusion was confirmed by Darlington & Wylie (1956).

Within the family, since 1949, it has been necessary to change the name of one tribe and to increase the number of tribes from 14 to 15 in order to accommodate the diversities encountered. In a number of instances it has been necessary to shift genera from one tribe to another.

Revisions by various workers. The pre-Hutchinsonian classifications of the *Amaryllidaceae,* beginning with Robert Brown (1810) include no members with superior ovaries. This earlier work is not reviewed in the present paper.

Traub (1938) presented a classification of the tribes of *Amaryllidaceae* following the Hutchinson (1934) system. This was revised by Traub & Moldenke (1949). The present is a third revision, but differs from the foregoing in bringing the grouping down to the subtribal and generic levels. Its objective is to correlate the present knowledge concerning the probable relationships within the family.

A number of single genera and parts of genera have been revised by various workers since 1934, but these do not come within the scope of the present paper. Only revisions of groups of related genera or tribes, or parts of tribes or subtribes consisting of more than one genus are therefore included. The pertinent work since 1934 is briefly summarized, and credit to the workers is hereby gratefully acknowledged.

In the tribe *Allieae,* Hoover (1939;1940;1941;1955) has worked out the relationships between *Brodiaea, Dichelostemma, Triteleia* and *Triteleiopsis* (the major part of the subtribe *Brodiaeinae),* and Ingram (1953) revised the genera *Bloomeria* and *Muilla* in the same subtribe. Moore (1955) detailed the relationships between *Dandya, Bessera, Petronymphe;* and *Milla,* representing the subtribe *Millinae.*

Hutchinson (1939) monographed the tribe *Gilliesieae.* Traub [1942(1943)] revised the tribe *Ixiolirieae.* Traub (1952;1956) showed that *Rhodophiala* and *Phycella* do not belong in the tribe *Amarylleae* (as synonyms of *Amaryllis* L.) as maintained by Baker (1888), but that *Rhodophiala* belongs in the tribe *Zephyrantheae* on the basis of breeding experiments, and chromosome data; and that *Phycella* belongs in the tribe *Eustephieae* for the reasons stated by Stapf (1929).

Traub & Moldenke (1949) revised the tribe *Amarylleae.* Fernandes (1945) by means of chromosome studies worked out the relationship between two members of the tribe *Narcisseae (Narcissus* and *Tapeinanthus).* Traub & Moldenke (1947) monographed the tribe *Galantheae (Galanthus, Leucojum,* and *Lapiedra);* and Stern (1956) revised the genera *Galanthus* and *Leucojum* of the same tribe.

Although progress has been made, it is apparent that much critical work remains to be accomplished in the future.

In the following revised classification, all of the recognized genera are accounted for; the list of synonyms has been published elsewhere (Traub, 1957a).

Chromosome data and other criteria. To the classification here presented, the available chromosome data, from summaries (Flory, 1944; Darlington & Wylie, 1956; Traub, 1957b), have been added *to test* the hypothesis (which such a classification really is) as far as possible with such data. It is realized that evolution due to *gene mutations* on the chromosome chain is of even more fundamental significance than the recital of chromosome *numbers.* The gross morphological data, the phenotypic picture, which represent the expression of the genus under the given environmental conditions, will ever remain the chief measure which the taxonomist has of gene action. When they can be obtained, the marshaling of data from still other disciplines such as embryology, behavior of chromosomes during meiotic division, physiology, bio-chemistry, histology, breeding experiments, and so on, are helpful in arriving at a decision in complicated cases.

Number of genera and species. In a recent statistical enumeration of the *Amaryllidaceae* (Traub, 1957a), 97 genera and 1522 species were recognized for the family. Since publication *Caloscordum* has been reduced to the synonymy of *Allium.* After critical studies have been made in some instances, the number of

genera and species will probably be reduced somewhat—possibly by less than five percent.

Further revisions. Suggestions from other workers concerning any errors of commission and omission are welcomed. With the necessary qualifications indicated above, the classification is put forward subject to further revision as may appear desirable on the basis of further research.

Symbols. The letter "x" refers to the basic chromosome number from which apparently various multiples have been built up, 2x, 4x, 8x, etc. (See Darlington & Wylie, 1956; Traub, 1957b.)

Use of classification. It has found immediate use in arranging the specimens in the Traub Herbarium by tribes and genera. Collectors of living plants may use it in choosing additions for their collections. It shows up the gaps in the chromosome atlas of this family which should be filled in by research workers.

I. CLASSIFICATION OF THE AMARYLLIDACEAE—SUBFAMILIES AND TRIBES

1a. Ovary superior (33 genera; 711 species) ..... SUBFAMILY I. ALLIOIDEAE
x=5, 6, 7, 8, 9, 10, 11, 12, 14, 15

2a. Inflorescense umbellate:

3a. Flowers actionomorphic:

4a. Rootstock a corm or bulb (19 genera; 663 species) ..... Tribe 1. ALLIEAE
x=5, 6, 7, 8, 9

4b. Rootstock rhizomatous (2 genera; 34 species) ..... Tribe 2. AGAPANTHEAE
x=6, 15

3b. Inflorescence usually zygomorphic (9 genera; 14 spp.) ..... Tribe 3. GILLIESIEAE
x=10, (11)

2a. Infloresence a raceme, a bostryx to sub-umbellate, or terminal solitary flowers on scapes (3 genera; 17 spp.) ..... Tribe 4. HEMEROCALLEAE
x=11, 12, 14

1b. Ovary inferior:

5a. Scape leafy in lower part (2 genera; 3 spp.) ..... SUBFAMILY II. IXIOLIRIOIDEAE
x=12

Inflorescence subumbellate (2 genera; 3 spp.) .... Tribe 5. IXIOLIRIEAE
x=12

5b. Scape not leafy; inflorescence umbellate: (63 genera; 809 spp.) ..... SUBFAMILY III. AMARYLLOIDEAE
x=6, 7, 8, 9, 10, 11, 12, 14, 15, 23

6a. Parandroecium (modified filaments) usually absent, if present, then not conspicuous:

7a. Anthers schistandrous:

8a. Fruit not baccate, except in *Gethyllis* (in *Zephyrantheae):*

9a. Bulb coat not held together by minute fibers when broken:

10a. Paraperigone, if present, usually inconspicuous, except in *Placea* (in *Amarylleae):*

11a. Spathe united into a tube for part of its length below, except in *Rhodophiala* (8 genera; 160 spp.).. Tribe 6. ZEPHYRANTHEAE
x=6, 7, 9, 11, 12

11b. Spathe valves free (see also *Rhodophiala under 11a, above:*

12a. Tepaltube not enlarging markedly toward the apex,

tepalsegs longer than the tepaltube (6 genera; 80 spp.) .....Tribe 7. AMARYLLEAE
x=6, 7, 8, 9, 11, 15

12b. Tepaltube usually enlarging markedly toward the apex, tepalsegs usually shorter than the tepaltube (5 genera; 52 spp.) ....Tribe 8. CYRTANTHEAE
x=8, 11

10b. Paraperigone present, and usually conspicuous (2 genera; 23 spp.) .....Tribe 9. NARCISSEAE
x=7, 10, 11, 15

9b. Bulb coat held together by minute fibers when broken (9 genera; 208 spp.) .....Tribe 10. CRINEAE
x=11, 12

8b. Fruit baccate (4 genera; 88 spp.) .....Tribe 11. HAEMANTHEAE
x=7, 8, 9, 11

7b. Anthers porandrous (3 genera; 32 spp.)....Tribe 12. GALANTHEAE
x=7, 8, 9, 11, 12

6a. Parandroecium (modified filaments) usually present, often as a conspicuous cup:
13a. Scape solid:
14a. Seeds flat, winged, or angled, hard (7 genera; 48 spp.) .....Tribe 13. PANCRATIEAE
x=11, 13

14b. Seeds fleshy, oval or angular (9 genera; 73 spp.) .....Tribe 14. EUCHAREAE
x=12, 23

13b. Scape hollow (10 genera; 23 spp.) .....Tribe 15. EUSTEPHIEAE
x=23

II. GROUPING OF GENERA UNDER SUBTRIBES, TRIBES AND SUBFAMILIES

Subfamily 1. ALLIOIDEAE (711 spp.) x=5, 6, 7, 8, 9, 10, 11, 12, 14, 15
Tribe 1. ALLIEAE (663 supp.) x=5, 6, 7, 8, 9
Subtribe 1. ALLIINAE x=6, 7, 8, 9 (598 spp.)
1. ALLIUM (550 spp.) x=7, 8, 9
2. NOTHOSCORDUM (17 spp.) x=8. 9
3. STEINMANNIA (1 sp.) x=?
4. IPHEION (24 spp.) x=6
5. TRISTAGMA (7 spp.) x=?
6. LEUCOCORYNE (14 spp.) x=?
7. LATACE (1 sp.) x=?

Subtribe 2. BRODIAEINAE x=5, 6, 7, 8, 9 (40 spp.)
8. MUILLA (4 spp.) x=?
9. ANDROSTEPHIUM (2 spp.) x=?
10. TRITELEIOPSIS (1 sp.) x=?
11. TRITELEIA (15 spp.) x=5, 7, 8
12. BLOOMERIA (2 spp.) x=?
13. BRODIAEA (10 spp.) x=5, 6, 7, 8
14. DICHELOSTEMMA (6 spp.) x=9

Subtribe 3. MILLINAE (11 spp.) x=?
15. DANDYA (1 sp.) x=?
16. BESSERA (2 spp.) x=?
17. PETRONYMPHE (1 sp.) x=?
18. MILLA (6 spp.) x=?
19. DIPHALANGIUM (?) (1 sp.) x=?

Tribe 2. AGAPANTHEAE (34 spp.) x=6, 15
20. TULBAGHIA (25 spp.) x=6
21. AGAPANTHUS (9 spp.) x=15

Tribe 3. GILLIESIEAE (14 spp.) x=10, (11)
22. SPEEA (1 sp.) x=?
23. SCHICKENDANTZIELLA (1 sp.) x=?
24. TRICHLORA (1 sp.) x=?
25. ERINNA (1 sp.) x=?
26. SOLARIA (2 spp.) x=?
27. MIERSIA (2 spp.) x=10, (11)
28. GETHYUM (1 sp.) x=?
29. GILLIESIA (4 spp.) x=?
30. ANCRUMIA (1 sp.) x=?
Tribe 4. HEMEROCALLEAE (17 spp.) x=11, 12, 14
31. HEMEROCALLIS (15 spp.) x=11
32. HESPEROCALLIS (1 sp.) x=12
33. LEUCOCRINUM (1 sp.) x=14
Subfamily 2. IXIOLIRIOIDEAE (3 spp.) x=12
Tribe 5. IXIOLIRIEAE (3 spp.) x=12
34. IXIOLIRION (1 sp.) x=12
35. KOLPAKOWSKIA (2 spp.) x=?
Subfamily 3. AMARYLLOIDEAE (809 spp.) x=6, 7, 8, 9, 10, 11, 12, 14, 15, 23
Tribe 6. ZEPHYRANTHEAE (160 spp.) x=6, 7, 9, 11, 12
Subtribe 1. ZEPHYRANTHINAE (125 spp.) x=6, 7, 9
36. ZEPHYRANTHES (74 spp.) x=6, 7
37. HABRANTHUS (19 spp.) x=6
38. SPREKELIA (1 sp.) x=?
39. RHODOPHIALA (31 spp.) x=9
Subtribe 2. STERNBERGINAE (35 spp.) x=11, 12
40. STERNBERGIA (7 spp.) x=11, 12
41. APODOLIRION (6 spp.) x=?
42. GETHYLLIS (21 spp.) x=?
43. KLINGIA (1 sp.) x=?
Tribe 7. AMARYLLEAE (80 spp.) x=6, 7, 8, 9, 11, 12, 15
Subtribe 1. LYCORINAE (27 spp.) x=6, 7, 8, 9, 11, 12, 15
44. LYCORIS (15 spp.) x=6, 7, 8, 9, 11, 15
45. UNGERNIA (8 spp.) x=12
46. GRIFFINIA (4 spp.) x=?
Subtribe 2. AMARYLLINAE (53 spp.) x=11
47. WORSLEYA (1 sp.) x=?
48. AMARYLLIS (46 spp.) x=11
49. PLACEA (6 spp.) x=?
Tribe 8. CYRTANTHEAE (52 spp.) x=8, 11
50. HANNONIA (1 sp.) x=?
51. ANOIGANTHUS (5 spp.) x=8
52. VALLOTA (1 sp.) x=8
53. MOLDENKEA (1 sp.) x=?
54. CYRTANTHUS (44 spp.) x=8, 11
Tribe 9. NARCISSEAE (23 spp.) x=7, 10, 11, 15
55. NARCISSUS (22 spp.) x=7, 10, 11
56. TAPEINANTHUS (1 sp.) x=(7), 15
Tribe 10. CRINEAE (231 spp.) x=11, 12
Subtribe 1. CRININAE (208 spp.) x=11, 12
57. CRINUM (148 spp.) x=11
58. BRUNSVIGIA (16 spp.) x=11
58a. xCRINODONNA (1 sp.) x=?
59. BOOPHONE (2 spp.) x=11
60. NERINE (35 spp.) x=11, 12
61. AMMOCHARIS (5 spp.) x=11
62. CYBISTETES (1 sp.) x=?

Subtribe 2. STRUMARIINAE (23 spp.) x=?
63. HESSEA (15 spp.) x=?
64. CARPOLYZA (1 sp.) x=?
65. STRUMARIA (7 spp.) x=?

Tribe 11. HAEMANTHEAE (88 spp.) x=7, 8, 9, 11
66. HAEMANTHUS (77 spp.) x=8, 9
67. CLIVIA (5 spp.) x=11
68. CHOANANTHUS (2 spp.) x=?
69. CRYPTOSTEPHANUS (5 spp.) x=(7), 11

Tribe 12. GALANTHEAE (32 spp.) x=7, 8, 9, 11, 12
70. LEUCOJUM (11 spp.) x=7, 8, 9, 11
71. LAPIEDRA (2 spp.) x=11
72. GALANTHUS (10 spp.) x=12

Tribe 13. PANCRATIEAE (48 spp.) x=11, 23
73. CHLIDANTHUS (3 spp.) x=?
74. RAUHIA (1 sp.) x=?
75. VAGARIA (1 sp.) x=?
76. PANCRATIUM (20 spp.) x=11
77. PARAMONGAIA (1 sp.) x=?
78. PAMIANTHE (1 sp.) x=23
79. STENOMESSON (21 spp.) x=?

Tribe 14. EUCHAREAE (73 spp.) x=12, 23
80. HYLINE (2 spp.) x=?
81. URCEOLINA (3 spp.) x=?
82. EUCHARIS (21 spp.) x=?
83. PLAGIOLIRION (1 sp.) x=?
84. CALLIPHRURIA (2 sp.) x=?
85. HYMENOCALLIS (36 spp.) x=12, 23
86. ELISENA (3 spp.) x=23
87. CALOSTEMMA (3 spp.) x=?
88. EURYCLES (2 spp.) x=?

Tribe 15. EUSTEPHIEAE (23 spp.) x=23
Subtribe 1. LEPIDOPHARYNGINAE (1 sp.) x=?
89. LEPIDOPHARYNX (1 sp.) x=?
Subtribe 2. EUSTEPHIINAE (22 spp.) x=23
90. PHAEDRANASSA (5 spp.) x=23
91. CASTELLANOA (1 sp.) x=?
92. CALLIPSYCHE (3 spp.) x=?
93. PHYCELLA (7 spp.) x=?
94. EUSTEPHIA (2 spp.) x=?
95. HIERONYMIELLA (1 sp.) x=?
96. STRICKLANDIA (1 sp.) x=?
97. EUCROSIA (1 sp.) x=?
98. EUSTEPHIOPSIS (2 spp.) x=?

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[COLLECTING AMARYLLIDS—Clint, continued from page 22.]

color and appearance to *Habranthus robustus.* The flowers were quite large, 2 inches across the face and 2¼ to 2½ inches long, with a very short tepaltube and a long, declined, deeply trifid style. They were set at an angle on a long pedicel and were borne on an 18-20 inch, robust scape from leafless bulbs. The white flower was no doubt the one I had seen the year before just south of Jacala. We have assigned the number M-565-A to this form. The pink flowered form [M-445 & M-565] was none other than the bulbs we had twice collected in leaf at Puerto de la Zorra! The two are similar in form, if not in color, except that M-565-A has glaucous leaves and larger bulbs and seed capsules. Further study will reveal whether the bulbs are distinct from one another or whether they are but forms of the same species. Strangely, these mountainous and shade loving bulbs seem closely allied to the two desert plateau bulbs: *Z. concolor* and *Habranthus immaculatus* [M-456].

[To be concluded in 1958 Herbertia.]

[PLANT LIFE LIBRARY—continued on page 83.]

its present distribution. A most stimulating book for the student of phytogeography. Highly recommended.

BIOLOGY OF ROOT-INFECTION FUNGI, by S. D. Garrett. Cambridge Univ. Press, 32 E. 57th St., New York 22, N. Y. 1956. Pp. 293. $5.50. This important book on the nature of root-infecting fungi and their control is based largely on intensive researches carried on during the past quarter century. This book fills a definite need and is highly recommended.

BACTERIAL ANATOMY, edited by E. T. C. Spooner and B. A. D. Stocker. Cambridge Univ. Press, 32 E. 57th St., New York 22, N. Y. 1956. Pp. 360. Illus. $6.00. The fifteen articles in this book were presented as papers at the 6th Symposium of the Society for General Biology in London, April 1956. The researches show that the description of the bacterial cell is gradually being put on a factual basis by means of the newest research tools. This stimulating book is highly recommended to zoologists, botanists and others interested in the relationship between bacteria and other living things.

MODERN ASPECTS OF pH, by James Small. D. Van Nostrand, 250 5th Av., New York. 1954. Pp. 247. The new pH as presented in this important book is "based upon an empirical standard as a result of the official recognition that what is being measured is not the concentration but the *activity* of hydrogen ions in

relation to activity of other associated ions. The book is written with "special reference to plants and soils. It is highly recommended.

SOIL, by G. V. Jacks. Philosophical Library, 15 E. 40th St., New York. 1954. Pp. 221. Illus. $5.00. The purpose of this clearly and concisely written book is to give the farmer, the student of agriculture and others an insight into the new science of soil management. Highly recommended.

PLANT PHYSIOLOGY, 4th ed. revised, by M. Thomas, S. L. Ranson and J. A. Richardson. Philosophical Library, 15 E. 40th St., New York 16, N. Y. 1956. Pp. 692. Illus. $12.00. This revised 4th edition of a standard text on Plant Physiology is written for the advanced student of botany, and students in chemistry, physics, agriculture, and other subjects. The text is grouped into parts as follows: I. protoplasm; II. the absorption, translocation and elimination of water, solutes and gases; III. nutrition and metabolism; IV. growth and movement. Highly recommended.

NEW CONCEPTS IN FLOWERING-PLANT TAXONOMY, by J. Heslop-Harrison. Harvard Univ. Press, Cambridge, Mass. 1956. Pp. 135. Illus. $1.25. The author considers the recent progress in taxonomy as due to the experimental study of evolution which serves as the factual basis for classification, particularly on the species level. After a concise discussion of the development of taxonomy, the rest of the book is devoted to the nature of variability, breeding systems, cytology (caryology) in relation to taxonomy, and experimental categories. The author places special emphasis on the study of living natural populations or adequate samples of these, rather than on isolated, usually dead specimens. A must for all taxonomists.

THE PRINCE OF BOTANISTS—CARL LINNAEUS, by Nora Gourlie. H. F. & G. Witherby, 5 Warwick Court, London W. C. 1. 1953. Pp. 291. Illus. 30/- net. This is a most charming biography of the great Linnaeus which is based on extensive research. It is just the kind of book about Linnaeus for which the readers have been waiting. Highly recommended to all members.

PLANT TAXONOMY, by E. L. Core. Prentice-Hall, Inc., 70 5th Av., New York 11, N. Y. 1955. Pp. 459. Illus. $7.50. In part one of this important new book the principles of taxonomy are discussed more or less in the order in which they were formulated. The rest of the book is devoted to an account of the main families of vascular plants. This stimulating book by an eminent authority on the subject is highly recommended.

THE HARDINESS OF PLANTS, by J. Levitt. Academic Press, 111 5th Av., New York 3, N. Y. 1956. Pp. 278. Illus. $7.00. The purpose of this book is to summarize the known facts on hardiness, and to stimulate further research. It is intended for the student in plant physiology, and also for workers in agronomy and horticulture. The material is grouped into three sections—low temperature hardiness, low moisture or drought hardiness, and high temperature hardiness. Highly recommended.

ORGANIC INSECTICIDES: THEIR CHEMISTRY AND MODE OF ACTION, by R. L. Metcalf. Interscience Pub. Inc. 250 5th Av., New York 1, N. Y. 1955. Pp. 392. Illus. $8.50. The purpose of this book is to summarize most of the available information on the chemistry and mode of action of insecticides, the relation of their chemical structure to toxicity, their metabolism in plants and animals. and their toxic hazards to higher animals. The book is written for the student and investigator in the hope that it will stimulate the logical and orderly growth of insect toxicology. Highly recommended.

A PRACTICAL MANUAL OF MEDICAL AND BIOLOGICAL STAINING TECHNIQUES, by E. Gurr. 2nd ed. Interscience Publ. Inc., 250 5th Av., New York 1, N. Y. 1956. Pp. 451. Illus. $6.50. This revised edition of the author's earlier work contains much new material, and fills the need for a practical manual dealing with most branches of microscopic staining, entirely divorced from theory and general statements. The sections include general methods, animal histology, botanical methods, cytological methods, fluorescence microscopy, histological methods and smear preparations. Highly recommended.

[PLANT LIFE LIBRARY—continued on page 100.]

3. GENETICS AND BREEDING

SECOND REPORT ON LYCORIS X WOODII

HAMILTON P. TRAUB and HAROLD N. MOLDENKE

This is a *Lycoris traubii* Hayward ♀ x *L. radiata* (L'Hérit.) Herb. ♂ cross. The early history of this cross appeared in Traub & Moldenke's "Amaryllidaceae: Tribe Amarylleae" (1949), page 182. The cross was made by Wm. T. Wood, of Macon, Georgia. The seeds had been received by the senior writer in 1941 as "*L. aurea* x *L. radiata*" since at that time what is now recognized as *L. traubii* was still included with *L. aurea* (L'Hérit.) Herb. The seed parent used by Mr. Wood is pictured in Fig. 13, which shows a specimen of *L. traubii*. Thus the correction has to be made. The seedlings were grown under pot culture at Beltsville, Maryland, from 1945 to 1951 when one of them flowered on May 31, 1951. The bulbs were dried off in 1952 and transferred to Arcadia, California, where they were planted outdoors in February 1953. Another moving was necessary due to smog-polluted air in the Los Angeles basin, and thus in 1954 the bulbs were again dried off and moved to La Jolla, Calif., and planted outdoors in January 1955. Thus they could not become established during these years, but are now thriving and will most likely flower again in 1957. Due to cultural difficulties, Mr. Culpepper of Alexandria, Virginia, has not had any flowers on his seedlings of this cross up to the present time.

Lycoris x woodii Traub & Moldenke, **hybr. nov.**

Planta hybrida *(Lycoris traubii* x *L. radiata);* foliis hos parentium intermediis glabris viridibus; umbella 9-flora; pedicellis 3—15 mm. longis; perigonio flavo; tubo tepalorum 13 mm. longo, segmentis 6.1 cm. longis, 1—1.2 cm. latis, anguste oblanceolatis acutis; staminibus styloque modice excertis.

Leaves intermediate between the parents, wider than in *L. radiata,* with a whitish stripe in the center, glaborus green; umbel 9-flowered; pedicels 3—15 mm. long; flowers with shorter tepaltube (13 mm. long) than in *L. traubii;* tepalsegs 6.1 cm. long, 1—1.1 cm. wide in contrast with 6.7—7 cm. long, 1.2—1.5 cm. wide in *L. traubii;* perigone with yellow color dominant; stamens and style moderately exserted from the perigone.

NOTES.—Creech (Nat'l Hort. Mag. Apr. 1952, pp. 167-173) reported the reverse of this cross, *Lycoris radiata* (fertile form) ♀ x *L. traubii* ♂ (under the name *L. aurea)* which was made in 1950. The chromosome number of this cross from root tips, determined by Don Wetherell of the University of Maryland as 2n=19, has been reported by Dr. Creech in the paper cited.

CROSSING TWO TEXAS **ZEPHYRANTHES**

FRED B. JONES, *Corpus Christi, Texas*

Two of the most widely differing of Texas' eight or nine *Zephyranthes* are *Z. pulchella* J. G. Smith and *Z. drummondii* D. Don, the latter still known in horticulture as *Cooperia pedunculata.* The two differ in color, form and size of the perianth, length of the tepaltube, foliage, time of opening, flowering season and habitat.

The bulbs of *Z. pulchella,* the golden-yellow rain lily of the southwestern part of the state, flourish in normally dry situations where water stands several inches deep after a heavy rain. The blooms come in the late summer and early fall months and it is an impressive sight to see an acre or more of these tiny golden stars raised above quiet, shallow water. Opening near sunrise and closing at sunset, the flowers exude a faint fragrance. The leaves are dark green, long and narrow and appear with the flowers.

Fig. 24. Left, *Zephyranthes* hybrid—*Z. pulchella* J. D. Smith x *Z. drummondii* D. Don, Apr. 27, 1956. Seeds planted summer 1952. Right, *Z. drummondii* D. Don. Photo by Fred B. Jones.

Z. drummondii D. Don is quite different [Fig. 24]. It is a larger plant in all its parts, growing widely over the state, and in contrast to *Z. pulchella,* seeks everywhere the high ground where drainage is good. The large snowy-white flowers appear in the spring months. If, as sometimes happens, no showers occur in spring, then the bulbs will bloom normally in summer or even in the fall. The flowers are highly fragrant, open in mid-afternoon and remain open throughout the night. The stigma consists of three linear parts, rather than three rounded lobes as in *Z. pulchella,* and it is entirely hidden in the long tepaltube. At the mouth of the tube are arranged the rather inconspicuous stamens. The leaves are broad and distinctly glaucous, being especially noticeable during the winter months.

It was in the summer of 1952 that the writer, having observed these two species in their natural haunts on many occasions and having for

several years cultivated them in his garden, was given an opportunity to try to cross them; for it so happened that both species came into bloom at nearly the same time. Emasculating three or four of the white flowers of *Z. drummondii,* an abundance of the golden pollen of *Z. pulchella* was dusted on their stigmas. Two capsules reached maturity and their seeds germinated readily. Three years later, in the spring of 1955, several of the seedlings bloomed, but all were white and closely resembled the maternal parent, *Z. drummondii.* Just as expected: maternal forms! (See article on parthenogenesis, *Herbertia* V, 1939). A year later, in April, 1956, a heavy shower brought to life this batch of bulbs and perhaps two dozen scapes appeared. It was soon evident that two flowers would be yellow, proving that a chromosome exchange had taken place four years before. Both flowers were primrose yellow, not golden yellow; one was somewhat close to *Z. pulchella* in form and size, the other more closely resembled *Z. drummondii.* The latter hybrid was photographed beside a rather typical example of *Z. drummondii* [Fig. 24]. It will be noted that in respect to length of the tepaltube, width of the segments and size of the perigone, this hybrid is influenced strongly by its golden paternal parent. The stigma has three rounded lobes, yet it barely emerges from the mouth of the tepaltube. The flower inherits the fragrance of its maternal parent but opens not in mid-afternoon or early at sunrise, but in mid-morning. The foliage is glaucous but not as wide as that of *Z. drummondii.*

Would one have had reason to expect two such contrasting species to hybridize and produce an offspring having a mixture of the traits of both parents? Perhaps so, for Sydney Percy-Lancaster, the venerable horticulturist of New Delhi, India, succeeded long ago in crossing a close relative of *Z. pulchella (Z. citrina)* with *Z. brazosensis,* a close relative of *Z. drummondii.* (See *Herbertia* III, 1936). Despite this fact, it came as a surprise that these two particular species, often occupying the same general locality in south Texas, could be crossed. It is no doubt true that natural barriers of one kind or another do prevent frequent hybridization in nature. *Z. drummondii,* for example, is self-fertilized shortly after the flowers open, if not before. The slightest movement will cause grains of pollen to fall from the anthers into the open tepaltube and onto the stigma. Yet, infrequent hybridization may occur between not only these particular species but between others whose ranges likewise overlap. But there is no record, so far as this writer knows, of any hybrid populations having ever been found in Texas, that is, of *Zephyranthes.* Certainly, in his own field studies, he has not found one. These results again substantiate the conclusion that the nomenclatural genus *Cooperia* is untenable as a biologic entity and has to be united with *Zephyranthes.*

AMARYLLIS BREEDING REPORT, 1956

JOHN T. WEISNER, *Florida*

Out of approximately two thousand hybrid Amaryllis seedlings I have bloomed several have been selected that are quite outstanding.

Probably the best of the lot is 'Buccaneer' (Fig. 25). This is a very large dark red. In fact it has been consistently the largest flower I have bloomed. It is even larger than 'Red Master' (Warmenhoven) and of better shape. This seedling is a cross between 'Wyndham Hayward' (Ludwig) and a large red seedling that I had.

Fig. 25. John Weisner hybrid *Amaryllis*—clone 'Buccaneer'; dark red; flower 10" in diam. Photo by John Weisner.

'Dr. Robert Moon' (Fig. 26) probably has received more praise than any amaryllis that I have grown. It is hard to describe this color; however, I will say that it is the nearest yellow I have seen in a hybrid Amaryllis. The dark (chocolate) throat sets this flower apart. It was named for a very dear friend of mine who unfortunately had a heart attack while out looking at his flowers.

The rose pink seedling (Fig. 27) has not been named. This flower has probably the best shape of any I have seen in the more imbricated class 5a (Leopoldii). The color is very nice. In my opinion and others who are familiar with the named Dutch hybrid Amaryllis clones, this is far superior to 'Sweet Seventeen' (Warmenhoven), 'Margaret Rose' (Ludwig) and others of this type. This is a cross of 'Margaret Truman' (Ludwig) and 'Queen's Page'. I have propagated this bulb and should have offspring bulbs of sufficient size to bloom next spring.

The salmon seedling has not been named. It has a very flat face but lacks something in shape.

Fig. 26. John Weisner hybrid *Amaryllis*—clone 'Dr. Robert Moon'; very light salmon, darker salmon (chocolate) throat; flower 8" in diam. Photo by John Weisner.

Seedling #65 (Fig. 28) is better than the average. This is a cross of 'Albino' (van Meeuwen) and pollen from 'White Giant' (Ludwig). It is not an outstanding seedling but is above the average of the whites on the market today.

I have many other seedlings, many of which have definitely been disappointments. Seedlings of 'Pink Perfection' (Ludwig) and 'Pink Favorite' (Ludwig) have usually come true as to color but generally speaking their shapes do not come any way near to those of their parents.

'American Fashion' (Ludwig). This one appears to give the best chance of producing superior offspring. Seedlings of this clone generally have good flower shapes, and the colors are in various shades of pink.

'Moreno' (Warmenhoven), selfed gives good reds of fine shape.

If the breeder is interested in true pinks--baby ribbon pinks—then he should use 'Roselinde' (Ludwig) as the parent (selfed).

More Amaryllis enthusiasts should raise their own seedlings. The reward is great—they will have a Christmas present in each new bud as it unfolds.

I JOIN THE AMARYLLIS BREEDERS

S. W. Sayler, *Florida*

Amaryllis are my favorite plants. At first I grew many bulbs from seeds of the Mead strain, and wanting to branch out, I bought some un-named Dutch hybrids. Hybridizations from these produced many fine seedlings which first bloomed in 1955. They were in many colors and shades and of perfect form. This led me to buy a complete color range of named Dutch clones. Seedlings from these will bloom in the spring of 1957. These are from such crosses as 'Bouquet'; 'Marie Goretti' x

Fig. 27. John Weisner hybrid Amaryllis—clone un-named; rose pink; flower 8" in diam. Photo by John Weisner.

'White Giant'; 'Wyndham Hayward' x 'American Express'; 'Doris Lillian' x 'Margaret Truman', and so on.

I am also growing seedlings from John Weisner's hybrids which contain some very fine reds, salmons, pinks and pure whites of perfect form and large size. I also had several seedlings to bloom from Mead strain and Dutch hybrid crosses. These gave some fine flowers of very good form and size, but no real self colors. I see no advantage in such crosses unless for a hardier bulb that can be grown outdoors in Florida. More of these crosses are planned in the future.

During 1955 about fifty of the seedlings produced double flowers, many in self colors. The pollen parents were McCann's double hybrids and *Amaryllis belladonna* var. *albertii* (double).

Seedlings are grown in flats made by removing a four-inch board from the bottom of various sized shipping boxes which have a depth of 6—7 inches. This opening is covered with a piece of hardware cloth (netting) which is covered with a piece of burlap. The flat is filled with good garden soil containing enough sharp sand for good drainage. The seeds are spread thickly over the surface and are lightly covered with sand or soil. As they grow they are given an occasional feeding with a good soluble fertilizer. By spring they will be ready for planting in the garden, and will bloom in three years. It is best to plant seeds soon after ripening for good germination.

The cuttage method developed by Dr. Traub and Mr. Heaton is used. After removing the neck, the bulb is cut vertically down through the base. Several such cuts are made. The cuttings are planted in flats

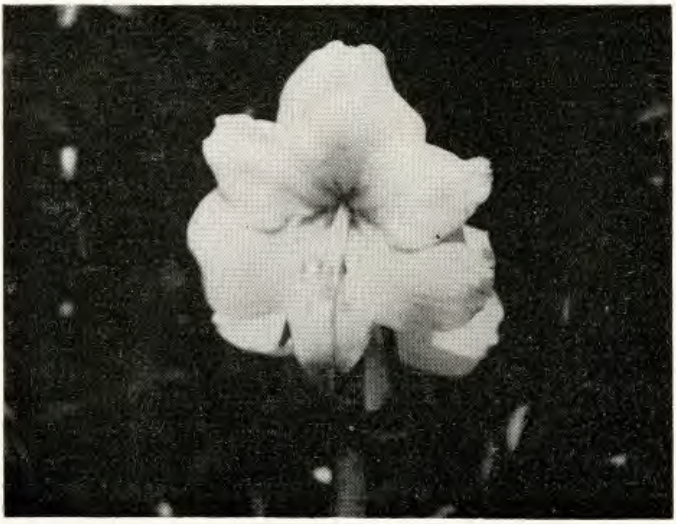

Fig. 28. John Weisner hybrid *Amaryllis*—clone #65; a better than average white; flower 9″ in diam. Photo by John Weisner.

containing clean builder's sand. In a few weeks, the little bulblets form. When large enough they are planted in the garden, and will bloom in about three years with good culture.

Amaryllis are adapted to a wide range of soils, but good drainage is essential. The potting soil used is made up as follows: 1 part good garden soil; 1 part sharp sand; ½ part well rotted manure. Bone meal is also added. After the bulbs start to grow, an occasional feeding with a liquid fertilizer will be beneficial. Beds in the garden are prepared with extra top soil, manure and bone meal. The bulbs are planted with necks exposed above the soil level. In pots, about half of the bulb is exposed above the soil level. Most of the experiments have been carried on in light shade to full sun.

It is my objective not only to produce clones as good as those produced by others in the past but also to branch out in producing hybrids in the various other divisions. In this way amaryllis will have a still greater appeal.

SEGREGATES IN CAPE BELLADONNA, **BRUNSVIGIA ROSEA** (LAM.) HANN. HYBRIDS, INCLUDING A THROWBACK TO **BRUNSVIGIA GRANDIFLORA** LINDL.

L. S. Hannibal, *California*

In the 1955 Herbertia (Plant Life 11: 67-75. 1955), seed color inheritance and breeding patterns in the Cape Belladonna, *Brunsvigia rosea* (Lam.) Hann., hybrids were rerooted. In the present report, the study is extended to include segregation of other characters, including a report on a throwback to one of the other parents, *Brunsvigia grandiflora* Lindl.* [Fig. 29].

During the last few years the writer has flowered a large number of seedling *Brunsvigia rosea* hybrids [Plate 5]. The diversity that has appeared amongst these plants has exceeded all expectations. Initially the numerous flower shapes and color variations were quite confusing, but as time passed definite basic patterns became obvious. As of today over twenty-five specific characteristics have been noted.

A part of these features can be traced to the original species or subspecies (varietal) parentages which have been used, but the wider range of colors and diverse floral shapes which have appeared in recent hybrids are patterns that have resulted from recombinations of genes. Larger size is due to hybrid vigor. These variations have developed to the point wherein accurate description of a clone or type cannot be permanently established or recorded unless we can clearly pinpoint several common or outstanding characteristics.

However, before discussing the diverse features which can be obtained in breeding, it is fitting that a summary of available Cape Belladonna, *Brunsvigia rosea* types and hybrids be given, and where known, that some comment be made about their breeding possibilities. Most improvements in plants are made by bringing out latent or recessive features, and to do this one must work with heterozygous material in place of homozygous or stable strains. Named types or horticultural clones to be found in California are as follows:

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*Editorial Note.—The reader should note that Mr. Hannibal presents additional proof that the Cape Belladonna, *Brunsvigia rosea* (Lam.)Hann., is truly a *Brunsvigia*. A few sentimentalists who are not in tune with biological facts have made attempts to keep it separate from *Brunsvigia*, and they have even made attempts to appropriate the name for the American Belladonna, *Amaryllis belladonna* L., for this *Brunsvigia* species. Such attempts are both contrary to the biologic facts and also the International Code for Botanical Nomenclature.
—*Hamilton P. Traub.*

BRUNSVIGIA ROSEA TYPES

Brunsvigia rosea major:—Our most common garden form of the Cape Belladonna which has been in cultivation since the sixteenth century when it was introduced into the Mediterranean area. It is unquestionably the *Brunsvigia rosea* (Lamarck) of the literature, but is larger and more hardy than the wild forms usually found about the Cape. As a breeder it is too homozygous in composition to be of much value for breeding. *B. rosea pallida:*—Commonly called *minor* and likewise widely distributed. This clone flowers a month later than *major,* is smaller in stature and has pale pink blossoms. As a breeder it often yields plants with exceptionally large blossoms. The narrow foliage, slender scape, and occasional tendency of producing cream pink blossoms when crossed with the *B.* x *multiflora* types suggests that this plant is far more distinct in character than is evident from the blossoms. It is worth trying as a breeder.

B. rosea rubra bicolor [Plate 5] :—a late flowering deeply pigmented form occasionally found in California gardens. It may also be the old English *purpurea* since the *bicolor* coloring becomes a deep purple in cool weather. However, it normally satisfies Truffout's plate in Flores des Serres, t. 1415, 1861. The plant probably holds little promise as a breeder.

B. rosea Frank Leach :—A seedling from an unknown source found more than 60 years ago in a Berkeley garden by Mr. Leach. The plant has a heterozygous chromosome makeup and its seedlings have turned up with everything from 'Blanda' to Varabilis or Picotee types.

BRUNSVIGIA ROSEA
HYBRIDS WITH OTHER BRUNSVIGIA SPECIES [Plate 5]

B. x *parkeri:*—The true form from Kew has very wide petals with bluntly rounded tips. Since it is a *B. grandiflora* x *B. rosea* cross like the *B.* x *multiflora* hybrids it is well worth using as a breeder, particularly since many of the seedlings have very broad petals.

B. x *multiflora alba:*—First introduced from Australia by Mrs. Bullard, then by Mr. Orpet. A fair breeder but tends to give very similar *alba* seedlings when selfed.

B. x *parkeri alba:*—Identical to the *B.* x *multiflora alba* forms.

B. x *multiflora rosea:*—Several similar forms are in cultivation and are capable of yielding either *alba* or colored seedlings depending upon the breeding techniques used.

B. x *multiflora* 'Hathor':—The large well known white Multiflora introduced by Bradley in 1911. As a breeder this plant has no peers if used as a seed parent. An apparent genetic translocation makes it possible to obtain a great diversity of seedlings which range from typical *B.* x *multiflora alba* to some very vividly colored rosea hybrids.

B. x *multiflora* 'Glory':—This Allister Clarke hybrid yields a great variety of highly colored seedlings, some of which are practically throwbacks to *B. grandiflora* Lindley, which is included in its parentage [Fig. 29].

Flower of the Cape Belladonna, **Brunsvigia rosea** (Lam.)Hann. var. **rubra bicolor** (top row, third from left); and floral diversity in **Brunsvigia** hybrids, involving the Cape Belladonna and other Brunsvigia species—**Brunsvigia x multiflora: Top row,** left to right, (1) blunt-tipped broad tepalseg form, (2) white semi-spider form. **Center row,** (1) long-trumpet form, (2) large-flowered form, (3) clone 'Blazing Star', (4) white orchid-flowered form. **Bottom row:** (1) smooth broad-tepalseg form, (2) clone **'Pacifica', and (3) rolled tips** with narrow setepalsegs. Photo by L. S. Hannibal.
Plate 5

B. x *tubergenii:*—A *B. josephinae* and *B. rosea* hybrid which has been introduced from Holland, but as far as the writer knows has not been used in further breeding. It should be crossed with the Multifloras at the first opportunity.

Elwes Hybrid:—the clones known as *B. rosea purpurea major* and *B. rosea rubra major* which were introduced by Elwes and used as breeders by Van Tubergen to give rise to the colorful Van Tubergen hybrids known as 'Kimberley', 'Pretoria', 'Jagerfontein', etc. A few of these bulbs have been imported over the years and may be well worth crossing with the Multifloras. But it is quite probable that in warmer climates these colors blanch out and thus the clones may not be too outstanding.

DISCUSSION

Most of the above described bulbs are not difficult to obtain. In addition to these there are numerous *B.* x *multiflora* 'Hathor' and *alba* hybrids which Mr. Orpet and others about Santa Barbara have placed on the market. Many of these have more promise as breeders than do some of the named clones above.

However this report is more concerned with the numerous new floral features which are turning up amongst the diversity of new hybrids which the writer has recently flowered or observed. The early workers with daffodils, *Hemerocallis,* or *Amaryllis* hybrids encountered similar confusing floral patterns, and these have now been cleared up by systematic classifications of flower types and characteristics. The methods for each differ in minor respects but the benefits derived from such studies have always eliminated the prevailing confusion and have been of advantage to collectors and breeders. Plants can be scored as to features and types, and improved types can be bred by having a clearer insight regarding the goals and characteristics desired. *Brunsvigia rosea* has been in horticulture since 1712; it is time that its potentialities be known.

Color is probably the most noticeable feature in any type of blossom, but with these hybrids it has been found to be an elusive factor since many clones are temperature and flower age sensitive. The normal variations in weather can bring about marked color changes. A sharp drop from day temperatures of 80° or 90° F. to 60° F. or less will turn many near whites into deep pinks or lavenders. Deep pinks in turn may become wine-purple or "purpurea" patterns, or "bicolors" will become solid pinks. Thus color is far from reliable.

Flower shapes [Plate 5] for any particular clone are far more specific. There may be minor differences between the first and last flowers to open from the same umbel, but these are rarely significant. In most instances floral shape promptly establishes the hybrid type or strain, and thus the flower shape is the first feature to examine.

Basically there are two distinct petal patterns, an elliptical shape and a linear shape. The elliptical shape is a rather broad petal with a relative blunt tip. A representative is that of *Brunsvigia* x *parkeri* as best example. *B. rosea major* and *B. rosea bicolor* are fair illustrations. In contrast the linear or *Nerine* type petal is usually rather narrow, be-

ing only half or three-fourths of an inch wide and five or six inches long. The throat to the linear typed flowers is seldom constricted as with the blossom to the elliptical petals, and this tends to enhance the tendency of the petals to reflex. Many of the *B.* x *multiflora alba* types tend to evolve to this pattern with the extremes of the type resembling large well reflexed Nerines when in flower.

Obviously there are intermediate petal patterns which fall between the elliptical and linear types. With a little practice one can decide quite readily if they are semi elliptical or semi linears. A relatively rapid flare at the base of the petal establishes the linear pattern.

Secondly the petal tips should be examined. Some can be quite blunt, and others drawn out to a lance tip. *B.* x *parkeri* is distinctly blunt, whereas *B. rosea major* is inclined to be lancelike. 'Hathor' has an elliptical petal, but the tip is distinctly pointed. Strangely enough, some of the most linear petals are particularly blunt, which yields a choice type of blossom. One may ask if petal length determines the type of tip. It may to a partial extent, but some short petals are lance tipped and numerous long ones are blunt.

Petal tips can be deeply V-channeled along the mid rib as with 'Hathor', or they can be flat in cross section. Usually the V-channel accentuates the lance tip, but at present this detail has not been too closely examined as to petal types, thus the interrelationships are not clearly defined. In a few instances clones have appeared where the sepaline segments rotate 90 degrees about the midrib producing three vertical standards.

Petal texture is quite varied with ruffled forms like 'Hathor', or non-ruffled forms with smooth glistening surfaces which closely resemble the purity of a Madonna Lily. The ruffled or crinkled condition appears to be due to an irregular cellular growth. This feature is attractive, but is not as select as are some of the larger smooth textured, well reflexed hybrids.

There is wide diversity in the reflexing habits of petal tips to different clones. Usually the broad elliptical petals with blunt tips do not reflex too readily, whereas the tips of linear petals may roll back upon themselves several times. The ruffled texture or the V-groove to the petal tip often tends to distort the reflexed roll of the petals, causing the tepals to assume airy spirals or twists, and giving the blossoms rather unusual shapes. Such a distorted blossom with appropriately vivid colors has led to the establishment of Orchid, Nerine, and Spider types of blossoms.

As already noted an unconstricted throat gives rise to an open flower. Constriction creates a well defined trumpet as found in *B. rosea major* and most species forms. Accentuation of the trumpet is possible, but does not yield show flowers. In some recently developed seedlings the near absence of any throat gave rise to some very flat faced flowers.

It had been an assumed fact that the trumpets or throats of all *B. rosea* blossoms were uncurved, thus the recent flowering of a D. C. W. Chandler seedling caused the writer to reconsider this point, as the trumpets to this clone were quite curved. Not knowing the history of

Chandler's seedlings we have no means of tracing the cause, but the curved tube suggests the presence of *Brunsvigia josephinae* in its make-up, which is not improbable.

Umbels are another means of plant type identification. The blossoms can be in either a compact or open arrangement, depending in part upon the length of the pedicels, and then secondly, there is a tendency for the umbel to either turn all flowers to the sun, or to orientate the blossoms in a radial pattern as with the *B.* x *multiflora* types. The number of flowers can range from six per umbel for some of the Stellenbosch subspecies of *B. rosea* to 40 or more for some of the larger 'Multiflora' hybrids. Numerous flowers, long pedicels, and a radial umbel can be accepted as reliable evidence indicating the Australian source of many hybrids containing "multiflora" blood which are now on the market.

Each clone has a very specific flowering date. The *B.* x *multiflora* forms are nominally late flowering, but some of the recent hybrids flower in October, giving a flowering range of three months. This late flowering characteristic is of particular interest to the cut flower grower since it extends the time that flowers should be available for the market. The source of such a factor appears to be present in only one or two clones, other than 'Glory'.

Flower colors, as mentioned are quite diverse. The white or alba flowers all lack color pigmentation. This condition is recessive and is nominally associated with the *B.* x *multiflora types.* Some seedlings of *B.* x *parkeri* have been reported to have yielded white clones also, but the writer has never observed such a condition with his Kew plants.

Color may vary from light solid pinks, to bicolors, variables (where the color changes with age), purples, near reds, Picotees, peppermints (red and white striping), and orchid patterns. The pale pink Blanda and Picotees patterns can be derived from the intro-specific hybrid Frank Leach. *B.* x *parkeri* contributes no end of variables; lavender shades appear in some of Hather crosses with purpureas. The orchid types and peppermints are all derived from Allister Clark's great ruffled red "Glory". For show bench blossoms the flat solid colors, such as are present in *B. rosea major* have little to offer unless coloration is very intense. The bicolors and peppermints attract the most attention and intensification of these shades is quite desirable.

It often takes several years to properly evaluate colors for any one specific clone, and it is the writers opinion that the average daytime temperatures should be noted if a RHS number is applied. Likewise readings should not be taken at dusk or in the late afternoons as the red pigments are over accentuated. No color evaluations should be made at temperatures 95° F, or higher as heat breaks down pigments. During hot weather most good pinks wash out to a dirty white.

Most *B. rosea* clones indicate some yellow pigmentation in the throat of the blossoms. This is most pronounced when the flowers first open. In a few deep red purple blossoms this yellow shows up prominently on the exterior of the trumpet giving a copper bronze hue. George Cowlishaw named this type 'Sunset'. The shading is derived by crossing with *B.* x *multiflora rosea.* The deeply shaded types developed by the

writer have been referred to as the 'Stormy Sunset' series. Occasionally yellow pigmentation is sufficiently evident in white hybrids to give these a cream shade.

Both George Cowlishaw and the writer have maintained for some years that the *B.* x *multiflora* hybrids contained the blood of *B. grandiflora* Lindley, and that J. C. Bidwell or John Baptist had been in error in stating that *B. multiflora* Aiton (B. orientalis) was the missing parent. From time to time types have appeared which resemble the missing Eubrunsvigias in a number of ways. In October 1955 the writer flowered a deep coral pink hybrid which in all respects resembles and fulfills the description of *B. grandiflora* Lindl. (See Herbertia 1951, page 52). The appearance of this colorful throwback [Fig. 29] now makes it possible to introduce a new series of *B.* x *grandiflora* types of a particular hardy, late flowering nature. It is quite apparent that the *B.* x *multiflora* foliage, which is distinctly glaucous, is derived from this *B. multiflora* source, as any attempted comparisons to the foliage of *B. josephinae* of *B.* x *vantubergenii* has always created some question.

Fig. 29. (Left) *Brunsvigia appendiculata* Leighton; (right) segregate from Cape Belladonna hybrid, *Brunsvigia* x *multiflora* Lindl., thus it is a throwback and indicates that the latter species intered into the Cape Belladonna Hybrids. Compare with Fig. 8, page 52, Herbertia 1951. Photos by L. S. Hannibal.

Arlington Worsley, who raised several hybrid Brunsvigias to the flowering stage has attributed the leafy stem which sheaths the foliage of both *B.* x *parkeri* and the 'multiflora' hybrids to the *Eubrunsvigia* parentage. George Cowlishaw in turn believes the leafy stem is derived from the use of *B. rosea blanda.* The writer is undecided about these views, but has noted that tunicated or pear shaped bulbs may orient their foliage flush with the ground, whereas spherical bulbs usually have

a pseudo stem and lift their foliage well clear of the ground. This distinction has appeared in geographical variations of the Cape Town and Stellenbosch forms of *B. rosea,* and could have been accentuated by the use of these bulbs in Australia.

In summing up these many diverse features found in the *B. rosea* hybrids it is obvious that we have a number of dominant factors which are invariably apparent in species or F-1 hybrids, and latent factors (recessives) which may show up in subsequent seedlings. Most *Eubrunsvigia* features are recessive, such as the radial umbel, long pedicels, narrow petals, or spherical bulb. Ruffled texture, or absence of pigmentation (alba flowers) appears to be derived from structural hybrid sources containing *B. grandiflora* blood. Selfed seedlings of Hathor usually yield about 75% elliptically shaped petaled forms. However only a very small percentage of these Hathor seedling result in plants with petals that are as broad as those of the parent. Presumably Bradley selected Hathor out of a great number of special crossings. The story of this hybrids development would be an interesting one if it were known. Bradley's daughter reports that Hathor was a chance seedling found flowering in the garden. Most of Hathors selfed seedlings have unruffled petals, but one should not conclude that this ruffled condition is recessive since practically all of 'Glory's' crosses have ruffled petals.

Intensely colored hybrids are not overly common. Less than a half dozen good clones have been obtained, with the exception of some of Glory's seedlings and the 'Stormy Sunset' series from the *B.* x *parkeri* x *B.* x *multiflora* crossings. However, the throwback *Brunsvigia grandiflora* Lindl. (Fig. 29) seedlings mentioned above gives promise of introducing strong color genes into future hybrids.

Nominally the back-crossing of colored forms with alba types gives pale pink shades, but this is not always true. The writer is now inclined to believe that the color gene may still be present in the alba clones, but is so located as to be inactive. Crossing with colored clones occasionally reactivates this inert color gene, giving fairly deep pinks, or on a few instances an entirely new color such as the light lavender pattern which recently turned up. These 'Lavenders' are quite distinct from the old English 'Purpurea', a clone which the writer now considers to be none other than our "cold sensitive" rubra bicolor. Unfortunately most of these lavender clones do not have good floral substance and the bulbs have been disposed of.

Just what the future holds for *B. rosea* hybrids is becoming rather unpredictable. Two generations of cross breeding here with heterozygous hybrids has given no end of surprises. *B. grandiflora* Lindl. has been recovered as a throw-back hybrid [Fig. 29], and is available for further backcrossings. Even *Nerine* x *fletcheri* (the *Nerine bowdenii* x *B. rosea* cross) gives promise of future breed-possibilities. It is rather obvious that the hybrids are mostly semi-segregating or sometimes non-segregating in breeding habit. But come what may, clear cut identification will no longer be quite so difficult to establish.

[PLANT LIFE LIBRARY—continued from page 84.]

FEATURES OF EVOLUTION IN FLOWERING PLANTS, by R. Good. Longmans, Green & Co., 55 5th Av., New York 3, N. Y. 1956. Pp. 405. Illus. $6.00. The purpose of this book is to redirect attention to facts concerning evolution in flowering plants, to show that "some at least, of the best known speculations about organic evolution are seen to have less general applicability than is usually claimed", and to summarize the author's conclusions on the subject. The book is in three parts—background to flowering plants, review of the whole group with special reference to evolutionary problems, and a small selection of problems which single out plants of special interest in the story of evolution.

AN INTRODUCTION TO THE BOTANY OF TROPICAL CROP PLANTS, by L. S. Cobley. Longmans, Green & Co., 55 5th Av., New York 3, N. Y. 1956. Pp. 357. Illus. $7.25. The purpose of this book is to survey the botanical features of the more important typical crop plants—cereals, sugar cane, fiber crops, oil-seeds, pulses, starch-storage crops, spices, beverages and drugs, fruits, vegetables, rubber and essential oils. It is designed as a text for agricultural students in the tropics and elsewhere; it is also of interest to all who, in any capacity, deal with tropical crops and their products.

THE OLD SHRUB ROSES, by G. S. Thomas. Chas. T. Branford Co., P. O. Box 41, Newton Centre 59, Mass. 1956. Pp. 224. Illus. $6.50. This charming book concerns the re-discovery of the old shrub roses in the gardens in Europe and the United States (by G. S. Thomas), and notes on the origin, evolution and genetics of our garden roses (by Dr. C. C. Hurst). The book is in two parts—the development and cultivation of the rose, and the old roses in cultivation to-day. A must for all who are interested in roses.

THE COMPLETE BOOK OF GARDENING AND LAWN CARE, by W. PEIGELBECK. Random House, 457 Madison Av., New York 22, N. Y. 1956. Pp. 144. Illus. $2.95. This practical book is "for everybody who has found the average gardening book hard to read, . . . complicated." It begins with the preparation of the site, covers the various gardening operations; and ends with the control of pests, and a gardener's calendar. Even the experienced gardener may be interested in the variety of ideas concretely presented.

PLANT PROPAGATION AND GARDEN PRACTICE, by R. C. M. Wright. Criterion Books, 100 5th. Av., New York 11, N. Y. 1956. Pp. 192. Illus. $4.50. Originally written for British gardeners, this refreshing text has been carefully edited to conform to American gardening conditions. It gives "step-by-step instructions on such important subjects as air-layering, budding, chemical sterilization, cross-breeding, cuttings, grafting, pollination, seed propagation, thinning, transplanting, . . . weed control," and details for the propagation of various cultivated plants. Highly recommended.

A SOURCE-BOOK OF BIOLOGICAL NAMES AND TERMS, 3rd ed., by E. C. Jaeger. Chas. C. Thomas, Publ., Springfield, Illinois. 1955. Pp. 317. Illus. This revised edition of a standard work includes also a supplement of more than 1000 new entries. In the introductory sections, the building of names and terms, types of names, applications of names, and so on, are considered. The Greek, Latin and other elements from which scientific biological names and terms are made are listed alphabetically. Their meanings, and examples of their use in nomenclature, are concisely given. This is a must for students, teachers and workers in the biological sciences.

DISEASES OF FRUIT CROPS, by H. W. Anderson. McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. 1956. Pp. 501. Illus. $8.50. This excellent new book was written for research workers, teachers and practicing horticulturists. It furnishes detailed information on the diseases of the pome fruits, drupe or stone fruits, brambles, grapes, strawberries, gooseberries and currents, cranberry, and blueberry, in the temperate zone, both in America and in foreign countries. Highly recommended.

[PLANT LIFE LIBRARY—continued on page 130.]

4. AMARYLLID CULTURE

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

THE AMAZING **LYCORIS**

O. R. JOHNSON, *New Jersey*

The *Lycoris* members of the Amaryllis family are indeed a very interesting group and well worthy of wider use, specially in view of their easy growth and natural ease of multiplying which makes for practically trouble free growing and greater flower economy.

True, the interest in them during the past few years has increased considerably, however, in many sections of this great country of ours they would produce rich bloom at a time when most other lilies have finished blooming. This alone is a valuable asset to thousands of flower lovers.

So that you may better understand some of the following passages, I will explain my position concerning *Lycoris*. My wife, my two sons and myself have operated for a number of years the firm of Johnson Bros. P. O. Box 463 Bound Brook, N. J. and more recently a bulb range close to the seashore at Barnegat, N. J. additionally.

We specialize in imported hybrid *Amaryllis* and *Lycoris* bulbs. The photos in this article showing the foliage stage and the blooming stage of *L. Squamigera* is a planting of nearly 10,000 of these bulbs which we had imported from Japan. Since we are amateur photographers the photos [Fig. 30] fail to do full justice to the planting but will suffice to give you an idea what we are trying to convey to you in the article.

Since most of our work with *Lycoris* has been with *L. squamigera,* also known as the hardy *Amaryllis hallii* and commonly called "Magic Lily of Japan", we will discourse on this one first.

L. squamigera is amazing in more than one way. For instance it thrives equally well in Maine or Michigan as it does in the gulf states and Florida. Over the years we have shipped this variety to nearly all the states and our repeat orders originate country wide.

It is almost unbelievable the amount of punishment and neglect this species will take and still bloom well and multiply normally. For example: one season our shipment of these bulbs from Japan reached us in January, late. They came in crates and the weather was close to zero and they had been unloaded from the ship and placed in storage on the unheated dock awaiting plant quarantine and customs procedures which usually take a few days.

Eventually we had them at our place and filled all backorders advising customers to hold them in a cool location until soil thawed; then plant them according to instructions. We held the unsold bulbs until late May (not having time to plant before) and planted them out to observe their reaction from what we thought might be their finish.

But no such thing occurred, in November they produced a small

rosette of leaves, coasted through the winter unchanged and early in March the foliage really took off and grew into a healthy mass of dark green. This foliage died down completely in mid June and on August 10th the bud stems alone without foliage appeared and within a few days the buds separated from each other and gradually, one after the other, opened out in full bloom of exquisite light pink, tinged lavender. Such performance as this receives our deepest admiration and we thank GOD for such outstanding bulbs.

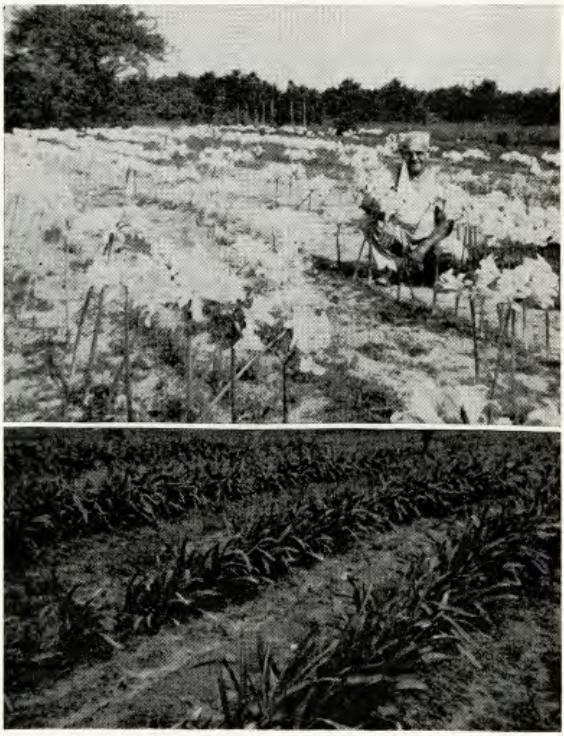

Fig. 30. *Lycoris squamigera* Maxim. (upper) in flower, Aug. 15, 1954; (lower) leaves before dying down, May 1954. Johnson *Lycoris* fields, New Jersey. Photos by O. R. Johnson.

We suggest planting and growing instructions for *Lycoris* species as noted toward the end of this article.

Lycoris radiata. This species is a duplicate of the *L. squamigera* with the exceptions that the flower stem is shorter, the blooms smaller and solid medium red, blooming size bulbs much smaller and blooming period about three weeks later. The strap leaves are much smaller both ways and have a distinct grey stripe thru their center lengthwise. Just as hardy as *L. squamigera* and planted only half as deep. If planted deeper they fail to bloom.

Lycoris aurea, the Golden Magic Lily. This variety produces a rich medium yellow bloom late in October on stems about 18″ tall. We've tried to winter this variety over here in New Jersey but to no avail to date, however, we continue to try to find some method of growing it. The deep south and the west coast generates the keenest interest in *L. aurea* as well as the middle south since it is not necessary in these areas to dig the bulbs up each year to save them.

As for *Lycoris radiata alba,* this variety produces a rich ivory white bloom but otherwise is in the same category as *L. aurea.*

Lastly, *Lycoris sanguinea,* the last variety we've added to our *Lycoris* list, and the one we have the least experience with, puts forth a small salmon pink solid bloom in October on short stems to 12″ tall. We have included this species this season in our wintering over trials here. From our short experience with it we classify it with *L. radiata* (red) in characteristics except for hardiness, bloom color and gray stripe thru leaves.

Lycoris species are native to upper Burma, China, Japan and Korea. Those mentioned above produce blooms with petals partially recurved. We import ours from Japan and each season we endeavor to order in excess of the hardy types so that we can plant out the excess to grow on and make good stock with roots.

We feel that supplying our customers with bulbs with live roots they will be better served. Since we are unable to date to winter over some species we therefore do not supply these with live roots.

Blooming size bulbs range in size as follows:

L. squamigera 5″ circumference
L. radiata 1½″ circumference
L. sanguinea 1″ circumference
L. radiata alba 4″ circumference
L. aurea 4″ circumference

We have found from growing these bulbs at both our places (70 miles apart) that those grown at the shore in sandy loam produce slightly lighter color in blooms than those grown in heavy soil at our other place; and the bulbs grow better in sandy loam. Propagation is by bulb division which forms naturally. We feed *Lycoris* bulbs once yearly when vigorous foliage growth begins using concentrated plant food such as Spoonit, Miracle Gro, etc.

PLANTING AND GROWING LYCORIS BULBS

The Lycoris species belong to the Amaryllis family and are very interesting and amazing in their performance.

Most spectacular bloom appearance is obtained by planting bulbs in groups, any shape, 12 inches apart rather than planting in rows. The row method can be used well if it is to be a background planting. In planting *Lycoris* alone we suggest a supplemental plant, such as the petunia, planted in front to detract from the naked appearance of the *Lycoris* flower stems which bloom without foliage about mid August for *L. squamigera* and a few weeks later for the other varieties.

Foliage dies down early in the summer, the bulb rests; then flowers

appear, and following this, the foliage starts to show and grow slowly through the fall and quite heavy in the spring.

Lycoris squamigera should be planted 4″ deep in the Philadelphia area. North of this area plant 5″ deep; below the Philadelphia area plant 3″ deep; but in the deep south plant only 2″ deep. This variety grows flower stems 18″ to 30″ tall, and is hardy.

Lycoris radiata (red) is handled in the same manner as *L. squamigera* except that it is planted only half the depth. Flower stems of this variety grow 12″ to 18″ tall; and it is also hardy.

Lycoris radiata (white), *L. aurea* (golden), *L. sanguinea*, blood-red-scarlet. These three varieties are not hardy north of the Richmond Washington area. Have been successfully grown in Oklahoma and on Pacific coast and wintered over. Where not hardy they can be pot grown quite well. In planting out use depths recommended for *L. radiata* (red).

Plant all *Lycoris* bulbs in well drained, rich humusy soil in either full or part sun, water well when planting and plant bulbs upon arrival. Dig and divide when too many flower stems develop too close together which is from three to five years.

In most cases *Lycoris* bulbs require a season or more to become well established and perform normally. When pot growing the tender varieties, transplant in the open garden when soil becomes warm, and dig and repot before frost for indoors, being careful not to disturb ball of roots in handling.

We suggest a winter mulch for all Lycoris planted out as a precautionary measure except in the deep south.

LYCORIS IN NORTH CAROLINA

Mrs. Mary Katherine Klottz
(as told to Wyndham Hayward)

One of the favored sections of the United States for *Lycoris* culture is the Piedmont Section of North Carolina. Miss Elizabeth Lawrence has reported previously on the growing of various species of *Lycoris* in her garden writings, and now new information comes from Mrs. Mary Katherine Klottz, of Salisbury, N. C., also in the Piedmont section.

Mrs. Klottz reports:

Lycoris squamigera (Amaryllis hallii) the 'Magic Lily', does well here, the foliage comes up in early spring and the pink blooms come in midsummer.

"*Lycoris incarnata,* a closely allied species to *L. squamigera,* behaves in similar fashion, the foliage coming up in spring, and blooming its flesh-pink flowers in mid-summer.

"Bulbs of *Lycoris 'purpurea'* in my garden under this name seem to be identical with *L. sprengeri*, the foliage appearing in the spring, and blooming in mid- to late summer. The coloring of the flowers is rose-pink with a bluish cast on ends of petals.") [This is possibly an important observation as there has been much conjecture as to the actual identity

of bulbs offered by the Japanese dealers as L. 'purpurea'. (Not *L. squamigera* var. *purpurea).*—W. H.]

[The most important observation in Mrs. Klottz's report is on the habit and blooming of *Lycoris caldwellii,* first described in this issue of HERBERTIA—W. H.]

"*Lycoris caldwellii* as obtained from Lakemont Gardens has bloomed well for me and is a beautiful light yellow! Very much like *Lycoris albiflora* from Japan, in form, but larger. Another difference is that in North Carolina the foliage does not come up until the spring (like *L. squamigera),* whereas the foliage of the Japanese *L. albiflora* comes up in the fall. The flowers of *L. caldwellii* are just fading when the flowers of *L. albiflora* are coming into bloom. The *L. caldwellii* flowers on scapes are about two feet tall and the umbel six or seven inches across.

"The character of the foliage and the time of its emergence would seem to place this species *(L. caldwellii)* in the group with *L. squamigera, L. incarnata, L. sprengeri* and *L. 'purpurea'* having a longer dormancy period. The leaves of all of these are a light bluish gray or slate-colored, with some variation. *Lycoris* aurea is not hardy here and does not bloom reliably in my garden experience.

"*Lycoris albiflora*—The foliage comes up in the fall, and the bulbs bloom in late summer, and while the flowers are called "white" in the price lists and other descriptions, to me the color is more of a pinkish cream in the specimens that I have. I have bulbs received under the name of *L. albiflora* var. *carnea* (Japan) blooming side by side in my garden and if there is any difference between the two, I cannot tell it.

"*Lycoris radiata*—the well known *Red Spider Lily* of the South. The narrow foliage comes up in the fall, soon after the blooms fade. It is the last *Lycoris* flower of the season to bloom here in the fall.

"These bulbs all bloom abundantly with me with very little attention. At time of blooming the bulbs are in partial shade; however when the foliage is up it receives sun a good part of the day. As my garden is on the west side of the house it does not receive the very early morning sun at any time. This seems to be an important factor with the success of some Lycoris. Trees provide partial shade at the time of blooming.

"Salisbury, N. C., has a moderate climate, typical of the cool Piedmont section of the state. Our temperature seldom goes below 10 degrees above zero, F. One night about 15 years ago it went down below zero, but such extremes are very rare. We often have temperatures in the low 20's. Last winter we had temperatures of 12, 13 and 14, several nights. Our winters are usually characterized by alternate freezing and thawing, often with the ground freezing at night, and thawing the next day.

"The ground may stay frozen for several days at a time in cold spells. Sometimes we may have above-freezing weather for days at a time in winter. Our first killing frost usually comes about the middle of October. However, we have not had one yet this year (Nov. 6, 1956). Some winters we have no snow or only light snow flurries. But we usually have one good snow for the children of four to six inches. January and February are the coldest months, although our largest recent

snow was on March 1, 1927,—14 inches. We often have late spring freezes that destroy the fruit crops and kill lilies emerging from the ground."

Editorial Note.—Mr. Sam Caldwell, of Nashville, Tennessee, has located a source of *Lycoris radiata* bulbs that set seeds profusely. He obtained these from a lady living in Georgia. The members interested in breeding *Lycoris* should obtain this fertile stock. The sterile stock usually available is excellent for blooming but is practically useless to the breeder since it may never set seeds, although its pollen may probably be used on other fertile *Lycoris* species.—Hamilton P. Traub.

LYCORIS TRAUBII IN GEORGIA

Wm. T. Wood, *Georgia*

In 1936 I imported from Japan several items that included 10 bulbs labeled "*Lycoris aurea.*" I am not familiar with *Lycoris aurea* which is cultivated in the St. Augustine, Florida, region. My imported species has broad tepalsegs and is therefore *Lycoris traubii* [Fig. 13] as named in this issue of Herbertia.

The imported bulbs were planted in a light soil in semi-shade, and fertilized with bone meal. They bloomed every year since but have not been fertilized in the last five years. The flowers were smaller than usual this year which is apparently due to crowding and lack of fertilizer. They have multiplied and in addition they have re-seeded to some extent.

LYCORIS AUREA AS AN OUTSTANDING POT PLANT

Hamilton P. Traub, *California*

Lycoris aurea, the beautiful golden lycoris from China, is not hardy above the lower Southeastern states, south Texas and central and southern California. However, that should not prevent gardeners above this belt from growing and enjoying this outstanding plant. In the 1940's and early 1950's, the writer carried on an experiment which showed conclusively that *L. aurea* could be grown successfully in pots. It was in fact one of the most showy subjects in his collection.

In 1946, Wyndham Hayward, that stimulating and catalyzing horticulturist, sent several bulbs of *Lycoris aurea* of the St. Augustine strain that is naturalized in gardens on the west Florida coast. He suggested that the writer make a close study of this species under greenhouse conditions in Maryland. The writer had lived in Florida for 10 years in the 1930's and early 1940's and he had noticed that the constant summer rains did not harm the flowering qualities of the dormant *Lycoris aurea* bulbs. He therefore decided to simulate the Florida conditions under greenhouse culture. Three bulbs were potted in each of two 8-inch pots with the long bulb-necks above the soil surface. They were never allowed to dry out but were watered copiously and fertilized regularly during the growing season—fall, winter and spring. When the leaves began to die down in early summer, *Begonia evansiana* tubers were planted in

each of the pots beside the bulbs, and water and fertilizer was regularly applied during the summer. The begonias made a fine display, and these died down in the early fall about the time that the lycoris blooms appeared. After a number of years, the pots were literally filled with lycoris bulbs and it was no longer practicable to grow begonias in the pots with the bulbs in the summer months. Thereafter the pots containing the lycoris bulbs only were regularly *watered* but not fertilized during the summer dormant period.

Under this culture the bulbs thrived and bloomed regularly each fall and increased regularly by splitting of the bulbs. When the writer moved to Arcadia in 1952, the bulbs were planted outdoors and they continued to flower regularly. When they were again moved in 1954 to La Jolla, they still flowered, and bloomed regularly in 1955 and 1956. All of the other lycoris species resented transplanting and have not bloomed as a rule since moving to California, but in their present location outdoors, they are gradually coming back to the flowering stage with fine leaf growth each year. They will most likely bloom again in the fall of 1957.

Thus the important fact to remember in the pot culture of *Lycoris aurea* is to keep the bulbs watered throughout the year. Of course there must be excellent pot drainage at the start. After the pot becomes rootbound, then the danger of insufficient drainage is over because the roots lap up the moisture rapidly. It is obvious that repotting will be necessary after five or more years when the pot is filled to overflowing with bulb offsets. Then again one should start with three bulbs in each 8-inch pot.

Although this experiment was carried out under greenhouse conditions, it should be possible to apply the results to pot culture in the home if the gardener will make an effort to allow the plants to produce full leaf growth through the winter and spring months indoors. This is all important since the flower buds in the bulbs are formed during this growing period. Sufficient light should be given in a southern exposure. After the flowering period in the fall, the tall foliage is quite ornamental and should add to the window display.

PRODUCTION OF AMARYLLID BULBS IN HYDROPONIC CULTURE

Carrol L. Klotzbach, Hydroponics, Inc. Cayey, P. R.

Being a professional grower in hydroponics I am probably more aware of the misapprehensions current concerning the culture. While it does not live up to the repute given by many promoters (intent on selling farms, chemicals and blue sky) there are some interesting results to be reported.

The usual hydroponic bed and the one found most successful is generally from three to four feet wide, made of concrete, well drained by means of a tile covered trough in the center which also serves as an irrigation conduit. There is a slope from sides to center of 1¼ inches

and the gravel depth averages eight inches. It is in such beds that my experiments have been carried out with no special treatments in the way of solutions, those used at the same time were irrigating various other crops such as tomatoes, cucumbers, melons, lettuce, etc.

Since the solutions used are usually of first interest and are usually much overblown in importance let us start with them. The quantities shown are for 100 gallon lots, the figures are not precise to the fine decimals. In practice the phosphorus component varies and serves to buffer or stabilize the pH . . . which same we like at 6.2 though there is no attempt by daily juggling to achieve this level as a constant. For a competent and complete discourse on solutions suggest you see "Soilless Growth of Plants", Tom Eastwood, Rheinhold Publishing Company, New York.

N	90 ppm	using KNO_3	9 oz.	
K	260 ppm	from above salt.		
K	140 ppm	K_2SO_4	4 oz.	
P	90 ppm	Monocalcium Phosphate	56.33% P_2O_5	5 oz.
Ca	300 ppm	$CaSO_4$	18 oz.	
Mg	50 ppm	$MgSO_4$	8 oz.	
Fe	1 ppm	$FeSO_4$	.067 oz.	
B	1 ppm	H_3BO_3	.08 oz.	
Mn.	.25 ppm	$MnSO_4$	.013 oz.	
Cu	.025 ppm	$CuSO_4$	.013 oz.	
Zn	.025 ppm	$ZnSO_4$	.015 oz.	

On large farm areas the general practice is to test and build solutions twice a week, the so-called minor elements are added weekly.

I have been unable to have check plants in soil. However, discussions with bulb growers here indicate that hydroponically grown amaryllis size up faster and tend to offset more than is average in soil. Slicing is also quite successful in gravel culture.

Last fall I sliced ten 3½" diameter bulbs. (All bulbs and seeds are Ludwig). Each bulb was sectioned into 24 pieces, care being taken to preserve the roots as far as possible. These were immediately replanted in gravel, about half inclined at 45 degrees, the balance vertical. Nearly all "took" and most have produced two fine bulbs and in some cases (and I wish I knew why) a slice has produced six. The slices at 45 degrees did noticeably better than those planted vertical. The same effect has been noted on bulbs purposely so inclined, the number of offsets is definitely increased.

Another method I am in process of trying to prove out consists of slicing off the basal plate of an old bulb just below the scales. The base is immediately dusted with Rootone and (as I so scientifically did it) . . . permitted to lay around in the shade on a workbench. After 50 days I had what appeared to be a nice tiny pearl necklace around the bottom, ten days more and I was able to see that these were not roots forming but fine little evenly spaced bulblets. I then set out the bulb in the gravel bed where it now rests easily among its offspring now

numbering twenty-six. There are more to come, additional offsets are popping up through the scales. It appears now that I may lose the old bulb but time alone will tell. At any rate it looks like a good swap . . . and a way of getting a good vegetative increase.

Seedlings have done well also many at eight months measuring 1¼ and 1½ inches diameter. Many have also offsets as small as ½" dia. and a short time ago I lifted one inch bulbs that had two offsets almost as large as the mother bulb.

My original shipment from Holland of one hundred bulbs gauged a little under two inches diameter. Most of these are now about five inches in diameter and have been in eighteen months. During this time they have had no special care and have been lifted twice to remove offsets and one other time for a move to another bed. Growth has been practically continuous except for the above checks.

I have unfortunately been moving about too much for any real continuity of experiment. One of the importances of the hydroponic method here is that bulbs so grown may be shipped, being clean and free from soil borne diseases and parasites. Another is that here the work of keeping down weeds and grasses is so great as to inhibit good growth and any chance of profit.

Another that has done very well is Ismene Calathina, mine are away ahead in size and number of offsets to a simultaneous soil planting. I have had to revise my spacing estimates after only six months of trial on these.

Spacing on the amaryllis seedlings is such that I have 3,000 growing on in a 125′ x 3′ bed, spacing approximately 3½" x 4". Expect to lift and separate offsets in about one year and at the moment it looks as though I shall have perhaps 2,500 bulbs 2½ to 3 inches to sell and enough offsets to plant three beds. On all that I shall report when it happens.

I shall appreciate comments from readers on this behavior. What I have reported may be of no particular interest, it may be that far better results have been achieved in field culture.

To summarize. I think hydroponic methods will be valuable to the small grower engaged in commercial production. I do not think the method suitable for the hobbyist except those of the most rabid variety.

The advantages seem to lie in the (perhaps) increased number of offsets, the elimination of weeding, difficulties of soil irrigation, fertilization, borers of course are generally out of the picture. One can also produce clean and, if care is taken and no bad luck sets in, disease free stock. It may be mentioned that with most media one irrigation per day, except in very hot dry weather, should suffice. Also that good results may be had by using mixed materials such as Hyponex, thus eliminating test equipment requirements other than some means of determining pH. Small tanks of solution could be built, used for ten days and replaced in their entirety with no great waste.

My first copy of HERBERTIA is at hand. I am now one of the rabid variety mentioned above, I assume there is no cure for chronic "amaryllitis".

EVALUATION OF DUTCH HYBRID AMARYLLIS

NELL PICKARD, *Houston, Texas*

As I look back over my past years of *Amaryllis* experience, my first thought is how much pleasure these plants give for so little care. By the nature of its hardiness and long period of bloom, the Dutch hybrid *Amaryllis* lends a splendid feature to our garden. Gaining rapidly in popularity, *Amaryllis* are truly one of the most up and coming perennials we can choose.

Amateurs and professional growers find them easy and interesting, the flowering scapes displaying from two to four lovely blooms that last for days in the garden or as cut flowers. The beautiful strap like foliage remains attractive through the summer. My garden is shaded by several Mimosa trees which are decidious, making a nice early Spring garden.

Many excellent Dutch hybrid *Amaryllis* clones are offered on the market of which I have many growing in my garden bigger and better each year. It is the personal opinion of the writer that the Dutch Hybrids are so superior in form, color and texture to the usual Mead strain mixtures. The former are also just as easy to grow. Much misinformation is passed in regard to growing Dutch *Amaryllis* by those who do not purchase the best hybrids and know very little about their habits and culture or likely have some of their own seedlings from some flower merely bearing the name *Amaryllis*.

If you care to grow your own from seed, select the very best parents to raise the level of bloom quality. As you study *Amaryllis,* you will become more particular about the flower types you choose for breeding. The majority prefer wide flat faced blossoms. Others consider some of the trumpet shapes as worthwhile. Many of the fine strains imported have figured prominently in the breeding of some well known American strains on the market today.

While most of the Dutch Hybrids are similar in form, a well trained *Amaryllis* enthusiast will soon learn to distinguish the different forms. Fortunately the Dutch Hybrid clones come in a pleasing price range to all. Just bring one good *Amaryllis* into flower and you say it is worth the cost.

For the past several years, Mr. Thomas Manley's excellent reports have been carefully followed. Space will not allow comments on all the lovely Dutch clones and their fine qualities but I will mention a few of my favorites that have rated perfect in performance in the garden.

'Doris Lillian' (Ludwig) is a very clear deep rose, petals do not recurve but give the appearance of a large bloom. 'Pink Perfection' (Ludwig), after two years in the garden, has bloomed with grace and a delightful rose color. 'Bouquet' (Ludwig) is always glamorous. It is a deep salmon overcast with pink with a deep rose throat. Stamens are also dark. A true novelty for any garden. 'Margaret Truman' (Ludwig) is a very pretty rose, with rose stamens and dark throat.

'White Giant', (Ludwig) excels all the whites in my garden with its lovely wide petals flat and round, with great substance, and fragrance.

The fine strains of reds are unlimited and are always very popular. 'Wyndham Hayward' (Ludwig), is particularly outstanding as a red and quite worthy of the honorable name. 'Red Master', (Warmenhoven) is a huge dark red and is certainly an asset to any collection. 'Queen Superiora' (Van Meeuwen) will always be among my favorites. Very large with crinkled ears in the throat. Excellent dark red, growing more beautiful each year.

The miniature form, Amaryllis "Gracilis", DeGraff strain, blooms every year and cause much comment due to their small size and perfect form.

Amaryllis striata and its varieties should not be overlooked as pot plants, they offer attractive rewards to the flower arranger. With all of its fine qualities one wonders why the species is not more widely known. The Gulf Coast area, especially Houston, Texas, has proven to be a hospitable home to the Dutch Hybrid *Amaryllis* and species. The rate of natural increase from offsets is not so fast as some strains but they are all well worth waiting for.

One of the chief landscape possibilities of *Amaryllis* lies in the fact that the bulbs can be left undisturbed for several years. If one plants them in good loamy soil, and a moderate amount of fertilizer is given during the growing season, a light shading from the hot sun will keep the foliage in good condition. A light mulch should also be used to keep the ground cool in summer and protected in winter. The Dutch hybrids usually are dormant in late fall after the bloom scapes are made. If it is necessary to take the clones out of the ground they should be repotted immediately. It is not necessary to remove them for a drying off period. I have observed that when the same bulb blooms in the garden over a period of several seasons, the color will be more intense. Light and shade also play their role in color. As to length and texture of stem, it has been found that adding a little more nitrogen will make for longer stems in most bulbs. Some bulbs are marketed that are too small to produce the expected size of bloom. Also a good bloom will only come from a well rooted bulb.

In conclusion, I would like to mention that very little difficulty has been experienced with the growing of Dutch Hybrid *Amaryllis* and the clones have adapted themselves to our conditions and I sincerely hope that these few lines may induce a wider use of the most worthy Dutch Hybrid clones.

HYBRID AMARYLLIS — THE POTTED QUEEN

ROBERT G. THORNBURGH, M.D., *California*

Let the gentle reader not mistake the title of these remarks that the conclusions were arrived at by the use of potables. Others have thought of the hybrid amaryllis as a queen since that regal title has been used so frequently in the naming of their varieties. Whether they merit the title of queen or not, no one will deny that they are so outstanding when seen that near-by flowers are likely to go unnoticed.

It is still difficult to find good clones but in spite of this, due to our Dutch cousins and their efforts, beautiful strains of hybrid amaryllis are available although in short supply. Though not difficult to grow, they mature just slowly enough to make their production on a commercial basis less profitable to most bulb producers. We have heard that the English produce fine hybrid amaryllis and that excellent strains also are produced in Australia, yet they are not sufficient in amount to show up in the United States markets. Accordingly, we have those energetic people in Holland to thank for what little of the finest varieties of hybrid amaryllis we can get.

This is an excellent place to mention to those who are insistent that named sorts be clones that in this respect there are two companies who have proven utterly reliable. Ludwig's and van Meeuwen's produce clones in all their named sorts that year after year prove reliably the same. Bear in mind that there can always be a mix up in packing bulbs or after passing through several hands it is possible to mix them up. Usually this accident does not happen for the very reason that most retailers do not wish to disappoint their customers by such carelessness but hope to get their reorders the following year. There are firms who regularly produce hybrid amaryllis in named sorts who after running short substitute similar non-clone bulbs with similar colors using the same clone name for the substitute.

It is probably the opinion of a good many including myself that van Meeuwen's have the finest reds obtainable. In the same way it could be said that Ludwig's have the finest whites and the finest pinks that can be obtained at this time. This is a statement not easy to make since van Meeuwens' has a top bracket named clone in 'Albino' and Ludwigs' have two red clones that have not been excelled by anyone. These are 'American Express' and 'F. D. Roosevelt'.

Last year of all the newly observed red bulbs it would seem that van Meeuwens' 'Alcyone' and Ludwigs' 'F. D. Roosevelt' were the most impressive. Both of these were several tables above 'Red Master'. Of the whites I have yet to see a better one than either 'Ludwigs' Dazzler' or Marie Goretti. Of the pinks, Ludwig's 'Pink Perfection' still maintains superiority. 'Doris Lillian' is the best of the rose varieties.

This year several new varieties have been introduced but were received too late for blooming and report but they will be reported upon in the next issue of HERBERTIA. Of these Ludwig's 'Five Star General' is a signal red with a white star center. It should be a good change from so many self colors. It would seem that with the introduction of that refreshingly different and gay variety, 'Candy Cane', that Ludwigs' is continuing the good work in the introduction of a wider range of color patterns. Van Meeuwen has had a variety of light red with a white star center called 'Rose Queen' that has always been in such demand that it is usually difficult to obtain unless ordered early in the season. Many of you will recall van Meeuwen's introduction of a strain several years ago called "Graceful" which was written up in the HERBERTIA. They were deep self reds of miniature *Amaryllis striata* stock but were sold out and now are no longer in the market. For those of you who missed

obtaining one of these it is to be recalled that the Ludwigs also carry a fine *A. striata* miniature strain called "Gracilis" and that these, though not named as clones as yet, are to be obtained in several color shades. Some of them are even red and white. They are quite hardy, offset well and are less expensive. Those that I have brought to bloom have been unusually good self colors. It should be said that Warmenhoven's is the only company that has one of these, apparently derived from *Amaryllis belladonna,* in named variety. It is called 'Christmas Joy' and is a bright self scarlet. It has bloomed for me over a two year period and, believe it or not two of them bloomed on the second year on Christmas day, the first to show up in pots. That made it worthy of its name.

The following descriptions are from personal observations and therefore only opinion, not scientific fact. The salmon shades have seldom held much appeal, whereas all bright colors such as reds, pinks or whites seemed far more attractive. Perhaps you can forgive so many high ratings as a manifestation of a personal enthusiasm held poorly in check. In the past several years a search for more varieties that contained outstanding contrasts has been made. Ludwigs' 'Candy Cane', van Meeuwens' 'Rose Queen' and Ludwigs' 'Apple Blossom' have filled a much needed place. This year the new variety 'Five Star General' has been offered for the first time by Ludwigs'. Actual picotees are practically unobtainable since they were taken off the market by van Tubergens' especially in named varieties. They are to be found in great abundance, however, at the Howard and Smith nursery in Monetebello, California but one must select them while in bloom around Easter time.

The late Hermon Brown strove for a purple variety in his last efforts to produce good varieties. As yet only Warmenhovens' have approached this color in their 'Violetta' and this shade is noted only in its bud stage. The yellow hybrid amaryllis is still as scarce as a Loch Ness sea serpent. A yellow color can be seen, however, in the throat of 'Ludwigs' Dazzler' one of the best white varieties now to be found.

WHITE

'Ludwig's Dazzler'.—This one is undoubtedly the best white hybrid amaryllis obtainable today. It is a sturdy bulb and sends up blooms with such good substance that the face of blooms are flat. No green present, only a little touch of butter-yellow tint in base of throat. Very round and flat. Grade AA. Ludwigs.

'Marie Goretti'.—Ludwigs. Grade AA. It is indeed difficult to choose between this and the 'Ludwig's Dazzler' and if only one were available, this one might well be the choice. It is exceedingly graceful with its delicately wavy margins. Try to obtain one of these.

'Leading Lady'.—Warmenhovens. Grade B. This is an excellent white much resembling 'Marie Goretti'. It was rather tubular and did not open well perhaps because at the time it was a bit overheated in the bright sun light and dry surroundings. Two scapes of two blooms each per bulb. Also had undulating margins and cool green throat. The second scape opened very well though still of the tubular shape but it was

pure white anteriorly with only minimal green along the keel of petals posteriorly.

'Queen of the Whites'.—Five of these bulbs obtained last season opened with flat face but every one had very narrow tepals leaving space between tepals often clear to base of bloom. Every blossom had pink streaks on the upper two anterior petals. These were all grade C except one which was rated C plus. Warmenhoven.

'White Giant'.—Grade A. Another white that frequently justifies its name. Ludwig's.

'Albino'.—van Meeuwen; Grade A. A very satisfactory white and the only one that this company keeps regularly on the market which speaks for its quality.

BICOLORS

'Apple Blossom'.—Ludwigs' Grade AA. This may well be the best of the varigated blooms offered by Ludwig's today. After observing it bloom for a period of two years I feel that it is one that I can hardly do without. It has brought much comment from those who have seen it in bloom here. Strangely enough this variety can hold its own in combination with other hybrid amaryllis of more vigorous hue and still appear outstanding. It mixes well with combinations of red, white or pinks. The throat is white with greenish tint with a button of red directly at the base of the throat. The tips of the tepals take on the blush pink tint of the flower that its name commemorates.

'Candy Cane'.—Ludwigs', Grade A. This is one of the most definitely marked varieties that show a symmetrical pattern on its face. There is no other duplicate of this offered anywhere. It is a mandarin red, 17/1, on the Royal Horticultural Colour Chart. Tepals have short stripes coming forward from the throat for half to two-thirds distance to tip. The border is outlined by same width of stripe of white. This is a striking bloom but placed next to more brilliant colors loses its charm.

'Clarence M. Harvey'.—Originally found at the Howard & Smiths nursery. It is identical in pattern to Ludwig's "Candy Cane' except that the color is currant red, 821/1, giving the impression that it is maroon. This has not shown a vigorous tendency to offset and as yet nothing has been done to multiply it vegetatively.

'Five Star General'.—Ludwig. Although this one was received in the month of February this year (1955) it was not in time to bloom for this description. It is likely to prove very good from the pictures that were made of it in black and white. It has a shape much like Ludwig's 'American Express' but has a wide border of signal red with a white star-shaped center. Since this one seems to multiply very slowly even with cuttage, it will be scarce for a while.

PINK and ROSE SHADES

'Pink Perfection'.—Grade AA; Ludwig. This one is still the best of all the pinks. Not only is it really a solid pink but it is vigorous and will multiply, offset, set seed vigorously and even divide occasionally on

its own by cleavage and yet go on the next year and do the same in a most vigorous self-perpetuating manner. The tepals are not apt to be wide unless the bulb is large but with a good unmolested root system the bloom will even be large on a medium sized bulb. If you can only afford one pink, this should be it. Carmine Rose 621.

'Doris Lillian'.—Grade AA; Ludwig. This is quite a bit like 'Pink Perfection' except that the color is a deeper rose being very bright at first, a cherry 722/3 but changing as the flower ages. Perhaps the form is more often better than that of 'Pink Perfection' but on a small bulb the tepals tend to be narrow too. It is as vigorous as 'Pink Perfection'.

'Margaret Truman'.—Grade AA; Ludwig. Again this is a toss up as to this one or 'Pink Perfection'. Perhaps it is the equal. Carmine rose 621.

'Love's Desire'.—Grade A plus; Ludwig. A French rose 520 at the tips. In the mid-portion of tepals this becomes a porcelain rose of between 621/1 and 620. Indefinite white central stripe on each tepal. The color seems to be produced in many striate lines that blend into the rose-pink of the tepals. Deep in the throat a soft blended green seems to give just the right touch to bring out the rose effect.

'Crimson Beauty'.—Grade A; Ludwig. Neyron rose 623. Tubular but well balanced tepal formation. Medium in size. Is a delicate color with veining and fine lines. Minimal green. This one is especially attractive if left by itself.

'Bouquet'.—Grade B; Ludwig. Azalea pink, between 618/1 and 618. A clear salmon being much deeper in the throat than distally. Even though this is a tubular type it has plenty of grace. Because of its weak color, if displayed near more gaudy blooms it will go unnoticed. Though single blooms will please those who like this shade of salmon, it would be very outstanding with a clump of bulbs all in bloom at the same time to make a good show. For those of you in California who can leave hybrid amaryllis in the ground out of doors, it is a good trick to let a bulb multiply unmolested in the same spot for several years to gain this effect. It can also be produced in an oversized pot so that roots are not lost by the annual repotting procedure.

'Moreno'.—Warmenhoven; Grade B. Geranium Lake, 20/3, distally and 20/2 in the throat. Tubular, fairly clear anteriorly with stripes on the keel posteriorly running lengthwise of the tepals. Very pretty!

'Fidelity'.—Grade AA; Ludwigs. Porcelain rose 620/2. Very wide tepals but medium in size. Flat face. Apple green in throat. The green does not detract but enhances the effect.

'Violetta'.—Grade A; Warmenhoven. The center is geranium lake, 20/3, and the outer 20/1. Stippled short stubby stripes at the center of tepals about two inches long and ¼ inch wide. Extremely large tepals which are so gigantic that in time they have to recurve. The buds before opening are rose madder 23 on the posterior surface of tepals which actually gives a soft violet appearance until the bud opens when the effect vanishes. Undoubtedly this is the closest yet observed here that begins to approach the violet shades.

LIGHT REDS

'Caruso'.—Ludwig; Grade A plus. Two scapes of three blooms each. Both the anterior and posterior tepals were nearly round in shape. Very small ears in the throat. Perfectly clear anteriorly with exquisite veining. Mandarin red 17/1. Very flat face and short tube.

'Invincible'.—Grade A plus. Capsicum red 715. Perfectly clear with no adulterant color posteriorly. Wide face. No ears. Two scapes of four blooms each. A warm appearance.

'Faust'.—Meeuwen; Grade A plus. Dutch vermillion 717/1. Large flat face. Perfectly clear both anteriorly and posteriorly with no green or yellow adulterant. The posterior petals are uniformly nearly round and large whereas the anterior tepals are smaller by contrast. Small petaloids in the throat mark this as a characteristically van Meeuwen flower and endear it to this observer. Two scapes of three blooms each.

'Garibaldi'.—van Meeuwen; Grade B. Vermilion 18/1. Petaloids present. Small flowers being very wavy and recurved. Very clear anteriorly. Two scapes of four blooms each. This one is expected to do better next season on a better root growth.

'Red Emperor'.—Grade A plus. Perhaps this one should be graded a double A since it is so very bright and such a beautiful shaped flower. The tepals tend to be wavy but are extremely broad. The little petaloids in the throat vary in size, shape and length and often twist on themselves, a delightful effect. Very heavy substance to tepals seems to hold up well unless in the very hot temperatures when this produces a floppy effect. At the very tip of each of the tepals there is a bead of near white that is novel.

'Dido'.—van Meeuwen; Grade B. Capsicum red 715/2. The yellow stripes in the center detract from the appearance but it is otherwise good.

'Champion's Reward'.—van Meeuwen; Grade B. Center blood red 820/1 blending to lighter Dutch vermillion 717 at the outer edge. Clear except for yellow streaks in minimal amount at the center. A small bulb did not produce a big flower.

'Goliath'.—van Meeuwen; Grade A. Vermillion 18. This has an amazing ability to reflect light resulting in a glossy bright sheen. The anterior is a self clear color deepening in the throat. Posteriorly an interesting contrast is gained by irregular veining of pastel green just at the distal portion.

'American Express'.—Grade AA; Ludwig. Make no mistake about it. This is one of the best reds that can be found. Very flat, wide, round and brilliant in its ability to reflect sunlight. Scarlet 19. Very clear this year both on anterior and posterior aspects with deeper shading in throat. No ears or petaloids may be the reason this flower looks so big when it measures no bigger than the rest. Very velvety texture and good substance to tepals.

'Gondibar'.—van Meeuwen; Grade B minus. Scarlet 19. Very pretty. Tepals narrower than the typical van Meeuwen. Veining is prominent.

'Halley'.—Ludwig; Grade AA. Poppy red between RHS 16/1 and 16 with a deeper throat shading. No adulterant color of green, yellow or other to be found. This form leaves little to be desired in this type of flower. Two scapes bloomed simultaneously, one with three and one with four blooms giving a spectacular effect.

'Cherokee'.—Warmenhoven Grade A plus. Very, very good. A shade darker than Scarlet 19.

'Scarlet Triumph'.—Warmenhoven; Grade AA. This is without the least doubt the best of the Warmenhoven reds. An extremely large, flat faced and clear bright red. The name is appropriate and perhaps the triumph part should apply to the breeder.

'Red Master'.—Warmenhoven; Grade B minus. Brick red 016 on the Royal Horticultural Colour Chart. Almost a Burnt Orange 014. This was a light dull red that gave one the impression of some of the finishes on cordovan leather in furniture table covers. Of seven bulbs obtained directly from Holland without any intermediate handling to make errors from the producer these reds were of this uniform color. Since Thomas Manley described these as deep wine reds, his were obviously not clones of these bulbs received directly from Warmenhoven's representative. At first it was felt that the Red Master of Warmenhoven was only a name for a class of reds rather than clones. This has been refuted, however, but it is the second time that this writer has met up with this experience on ordering several Red Masters of Warmenhoven's. A bulb of Red Master given to me by a personal friend in Florida did turn out to be a deep blood red 420 with current red 821 deep in the throat. The bulb received from my friend had a Grade AA bloom but it still did not come up to the deep red of 'Alcyone' or 'Franklin D. Roosevelt.'

DARK REDS

'Franklin D. Roosevelt'.—Grade AA; Ludwigs. Two scapes of two blooms each. Extremely flat with short tube. Current red 821 centrally where it deepened to a blood red 820 distally. Glows in the light. Small petaloids present. This and 'Alcyone' were the very best of the deep reds.

'Alcyone'.—van Meeuwen; Grade AA. Blood Red 820 in throat and 820/2 on face of petals. Slightly wavy with tendency to crenation of petal margins. Crinkled petaloid ears twist together.

'Superba'.—van Meeuwen; Grade AA. Another of the very finest deep reds that is so dark that to get any more so would spoil it. The darkest red that was observed was Mr. Rice's 'Zulu' but it is nearly black and thereby loses its attractiveness.

'Ludwig's Scarlet'.—Grade A plus. Signal red 719, to blood red 820/2 deep in the throat. Fine minimal stripes in throat did not mar this one. It reflects light a bit better than usual.

'Giant Goliath'.—van Meeuwen; Grade AA. Vermillion 18. Like Hollywood's term "Super-Colossal" this one had no trouble in living up to its name with its very wide face and short tepaltube. The face was nine inches and each tepal was 4½ inches across posteriorily. In spite of the heavy tepal substance it did not droop or flop. The ears were smaller in size than usual.

'Royal Ruby'.—Warmenhoven; Grade A. Large scarlet 19 with good substance and heavily veined.

Let it be restated that this grading is a matter of pure personal opinion and was done for the pleasure of it. There is not a single bloom that can be called ugly. They are all so beautiful that one wonders just how far enthusiasm can go. It should be mentioned here that there are miniature striata varieties available again though not in clones as yet. The beautiful "Graceful" strain of van Meeuwen's disappeared from the market. Ludwig has a strain called "Gracilis" that abounds in scarlets, light and deep reds and red and white varieties. It is possible that in the future these may be obtained in the colors desired though they are not at this time so represented. Perhaps they can be obtained in the coming season and once seen the miniatures can be appreciated for what they are.

MY EXPERIENCE WITH AMARYLLIS

Mrs. Joseph Elias, *Connecticut*

On March 3, 1948, when I obtained my first Dutch Hybrid Amaryllis, I never realized how interested I would become in this group of plants. On the 14th of May of that year two of the largest, loveliest, deep red flowers opened, and that started me off! Today, eight years later, I have about 200 blooming size potted Amaryllis and several hundred smaller bulbs, in addition to a new crop of spring sown bulblets ready for their first transplanting. The first season is the only one in which I keep the plants growing throughout the year.

To make the task of caring for them as simple as possible, I pot up in the fall only those bulbs which either have bloomed, or have grown to possible blooming size during the summer. These are potted in screened compost, lightened with sand, with some bonemeal added. Others are dug up, put into flats and kept in a warm dry cellar until the following spring. For two years these smaller bulbs have been stored in soil, but this year I've put some away in vermiculite, and others without any covering.

The larger potted bulbs are allowed to dry off for about three months, with only a watering about once a month. After the first of the year they are gradually brought up to the living rooms for growth. First they are given a thorough soaking, then I wait for signs of active growth, after which watering is increased as the leaves develop.

When remodeling our house last year, we put in special storage cabinets under the living room windows with 18″ wide counter tops for potted plants. We took into consideration the brilliant colors of the blooms and finished the walls in a soft green, with knotty pine paneling. Early this year we had approximately 50 blooming plants in our front window, and with a heavy fall of snow outside, these brilliant blooms visible through the window frequently stopped traffic.

I select a few special plants for pollinating each year, looking especially for clarity of color and possible fragrance. To continue good leaf growth after flowering, I feed liquid plant food about every three weeks until May, when the plants are set out into the open ground for the summer. Aside from an occasional watering in very dry weather, and pulling the few weeds that come up through the mulch of grass clippings, no further work is done until the frost threatens in the fall. This year the plants grew outdoors until the end of September.

A gardening friend, Mrs. Leo Miller, Sr., tells me that some years ago she and her late husband grew the bulbs in a 20 foot row for summer blooming in the garden. In the fall these were brought indoors and treated as other summer blooming bulbs for winter storage.

I have started a collection of species Amaryllis and other amaryllids which at present is limited to the following list: *Crinum* 'Cecil Houdyshel', *Agapanthus africanus, Clivia miniata, Lycoris squamigera, Hymenocallis narcissiflora, Amaryllis elegans* var. *ambigua, A. striata* var. *fulgida, A. belladonna, A.* x *Johnsonii, A. psittacina, A. belladonna* var. *plena (albertii), A. striata* (type), *Rhodophiala bifida* (oxblood-red), and *R. bifida* var. *spathacea.*

WHAT AMARYLLIS MEAN TO ME

Mrs. E. C. Harding, *Anahuac, Texas*

What does Amaryllis mean to me?—breath-taking beauty. It is early April. I just came from a walk in the yard. The Amaryllis blooms are simply out of this world! Many are seedlings blooming for the second and third times. I wish I knew more about Amaryllis so I could detect the strains in my seedling flowers. Thus, Amaryllis means research and study to me, also.

I have a few "red lilies", inherited from Grandmother, just the common *Amaryllis* with which the average gardens about town are content with. To them the name "Amaryllis" is this "red lily"—admired, enjoyed, but nothing to get excited over! I enjoyed my clump and still do. They are dainty and bright and bring remembrance of a happy childhood and a beloved Grandmother!

I suppose to this day I would be content with this old fashion clump but for a gift. In 1948 a flower pal of Louisiana sent me two bulbs of a hybrid red amaryllis, a batch of seedlings ready to bloom the following year, and some seed to plant.

Amaryllis took on new meaning, new size, greater beauty—a new world opened up before me—that of the hybrid Amaryllis. In 1950, I was so pleased with my "start" I begged or bought many amaryllis seeds from flower pals over the United States. A few had bulbs of named strains so I grew some that produce lovely flowers.

When my seedlings began to bloom, I felt that several ranked among the very best. Last Spring I saved my own seed to plant. I still need a good pink and a white-flowered clone. I plan to purchase these two bulbs and continue to build up a large bed by doing my own crossing.

I already have various shades of red, oranges, and salmons; solids and stripes; large (to me), moderate, and small flowers. During the past winter, a native of Oklahoman loaned me some of his flower slides for study, including a few slides of hybrid Amaryllis. Then I saw Amaryllis at their glorious best! How much more I must improve my strain before I achieve such a goal! This year I am ordering seeds of the Dutch and American strains, and a few Ludwig strain Holland grown pinks. In the next few years I expect to see flowers of a size, shape and color new to me. If these prove to be hardy here I plan to buy named clones as the years pass by.

We live in a mild climate where the ground seldom freezes. The Amaryllis we have, have wintered in beds in the yard without a single loss. We prepare deep beds and mulch well with leaf mold. We use bone meal and old barn yard fertilizer in early spring and again in the summer. The number of flowers we have obtained, and their loveliness prove that we are not far wrong with methods of culture. Each year since I became aware, Amaryllis have achieved new meaning to me! Today, they mean an unexplored horizon of a superb group of plants whose beauty I am yet to fully realize.

MY WAY WITH AMARYLLIS

Mrs. Emily B. Jefferies, *Florida*
Horticulture Chairman, Orlando Garden Club

It is early September, and there is a hint of fall in the air and the squirrels in the hickory tree are having a feast on the ripe nuts and dropping the shells on anyone passing below. With the ripening of the hickory nuts I know it is time to get out and start to uncover the Amaryllis beds from their summer blanket of weeds, camphor, cherry laurel and oak seedlings, all standing six to eight inches high. No hoeing or grubbing here, this must all be done by hand. As each handful is pulled I give it a sharp shake to dislodge the dirt clinging to the roots and lay the weeds in handfuls between the rows of Amaryllis. Our soil here in Central Florida is very sandy and, as all plant food leaches out very quickly, it must be constantly enriched with humus and leaf mold so I throw nothing away in the way of plant food. The weeds are given several days to dry out and the beds are then given a top-dressing of "Mil-organite," castor pumace and bone meal and the sprinklers turned on and let run over the beds for several hours.

The Amaryllis bed is situated on the west side of the house, making a rough rectangle of about 15 by 50 feet, interspersed here and there with Hibiscus and Camellia bushes. The bed gets the full morning sun and is shaded in the afternoon by a large camphor tree and a hickory tree. The soil of the bed is very loose and porous and rich in humus and leaf mold, and as I pull weeds I cannot keep from marveling at how the bulbs have grown during the summer. Last year's seedlings are about an inch in diameter and the larger bulbs seem to have grown in proportion.

The bed is never allowed to dry out, getting a good watering two or three times a week and oftener in the summer and early spring if it is needed. When the hickory leaves start falling, I mulch the beds heavily with the leaves and mulch again in the spring when the oaks start to shed their leaves.

If we have frost during the winter the tops of the Amaryllis may be killed back, but I have never found (after 20 years) that the bulbs were injured in any way, often blooming out of the bare bulb in the spring with three, four and even five scapes, each having from 3 to 5 large flowers to each stalk.

The beds are kept weeded during the winter until after flowering in the spring, when they are again given a good feeding of "Mil-organite," castor pomace and bone meal, mixing it well into the soil.

The beds are allowed to grow up in weeds during the summer as I think this helps to shade the bulbs and keep them cool and damp during the hot, dry weather.

Sometimes as I weed, I find a bulb that has sunk below three quarters of the depth of the bulb; if so, I pull it up and reset it, as for some reason the Amaryllis do not seem to bloom as well and form as large a bulb if allowed to sink below the neck of the bulb.

A few of the bulbs in the beds are Mead strain, having been given to us by the late T. L. Mead. Mr. John Springer gave us a few more and, from then on, we had the Amaryllis fever. Later on, a few seeds of Dutch hybrids were imported from Holland along with several bulbs of named varieties. A few more bulbs from Mr. Wyndham Hayward's collection were added later. All of these bulbs, the originals as well as the later additions and the various crosses are growing together under the same conditions and all seem to do equally well. The Dutch bulbs as well as the Mead bulbs grow, thrive and large, beautiful flowers each year.

Now that the work of weeding is over, it is with a wonderful sense of accomplishment that I survey the large fat bulbs and visualize the wonderful display of bloom and color in the Spring. It is at this time that visions of blue ribbons at the "Spring Bulb Show" begin to dance in my head. Which ones shall I take up and put in pots? I always have a hard time deciding this,—the largest bulbs or some of the new seedlings?

To make sure of having enough Amaryllis in bloom at the right time, I always pot up at least twice as many as I think I will want to enter in the show, because so far I have not found any way to force Amaryllis to bloom at a stated time. If anyone ever does find a sure-fire method of forcing Amaryllis, I will be glad to know about it.

For show purposes, I try to select the best bulbs in the bed, as free from blemishes as possible. The larger bulbs go into twelve and fourteen-inch pots, 2½ to 3-inch bulbs are put into eight and ten-inch pots.

After I have selected the bulb and the pot to go with it, a layer of osmunda fibre is put in the bottom of the pot to take care of the drainage, a layer of compost is added and wetted thoroughly. I then either lift the bulb with soil intact and fill in any space left in the pot with compost,

washing the dirt down around the bulb, making sure any air space left between the roots of the bulb is filled with soil. As I work, I pull the bulb toward the top so that at least three-quarters of the bulb is above the soil level.

Sometimes I plant the bulbs bare rooted, taking them from the beds with as many roots left on as possible. The potting is started then in the same way, a layer of osmunda fibre, then a layer of compost. The roots of the Amaryllis are then arranged in the pot, adding compost and leaf mold a little at a time, watering well after each addition, making sure that open spaces and air pockets between the roots are filled with dirt until the soil is within one-half inch of the top of the pot, and the base of the bulb is just under the soil level. This last method takes more time and I have not noticed any difference in growth or bloom habit between the two methods.

If the bulbs are potted in the fall, by March the pots will be so filled with roots that they will be showing on top of the soil and even over the rims in some cases.

I keep the pots well watered at all times, never allowing them to dry out. A little liquid fertilizer may be fed about once every six weeks but if the compost was rich and loamy they should need very little fertilizer of any kind until they are set back in the beds after blooming in the Spring.

Last year at show time I took up blooming plants, placed them in pots and cans, watered them well and, wonder of wonders, got blue ribbons on them. The foliage did not wilt nor did the flowers droop. The day after the show they were set back in the holes they had come from. They went right on growing, not seeming to mind having been moved. I wonder if I can do as well this year? I'm going to try.

DISCOVERING AMARYLLIS

GERALD CARSLEY, *Ontario, Canada*

One day, five years ago in Toronto, while glancing through a flower catalog, I saw it. It was a photograph of an *Amaryllis,* and I decided then and there not only to order some, but to try to find out as much about them as I could. Later on when the bulbs came and were planted, I was presented with a bouquet of eight glittering white blossoms to each bulb, scented sweetly, but very faintly. The Amaryllis leaves little to be desired as a complete plant. Bulbs, scapes, leaves, blossoms, are all blended together in design to produce a symphony of beauty.

Later on from Ludwig & Co., I ordered a pure white Amaryllis named 'Ludwig's Dazzler'. I remember the first impression it fixed in my mind. When the sheath opened, the four exposed buds looked more beautiful than most flowers, for they looked in appearance like silk—white silk. And the final blossom was such a dazzling white, that any other white article had a tinge of cream when held beside it. As a matter of fact it looked so beautiful that I had to touch it to prove to myself that it was real. In Holland, Ludwig & Co. have had specimens of this

particular variety that were eleven inches in diameter. To support my studying I worked in the summer at Banff, where I carted with me a bulb to keep me company. There it flourished in a greenhouse at 5,000 feet above sea level 2,000 miles away from the previous location. Here one could see and discover a lot by just observing. For instance the humidity and even temperature caused the width of the leaves to grow between two and one half to three inches, and also caused it to bloom three times a year. What astounded me was the fact that under these conditions, there was exhumed from its petals a most ethereally sweet perfume. It seems that one should worry more about the quality of the Amaryllis leaves, and look for more width rather than length for maximum health. We found that a bulb really rests from the time when the outer two or four leaves mature, so that with some bulbs it's worth while to leave the leaves on. The Amaryllis, like you and I, is an individual, and so if a result is to be obtained, an action must be produced. For, if the leaves are left on, the bulbs rarely shrink, but watering should be decreased at various intervals. There doesn't seem to be a set rule for potting mixture formulae, but as long as the medium is a heavy, aerated type, you are safe. Since my Amaryllis was doing so well at Banff, I decided it deserved a better home than I could give it, so there it is, and there it still remains. There is also at Banff in a lady's possession an Amaryllis species which has ten blossoms on one scape, each three inches wide: in colouring it is an apricot pink with a cream throat. It was bought by the present owner while she was in Mexico, from a traveller. Its origin is a mystery, but the perfume possessed by it is intensely spicy.

I find it fun to train the leaves on Amaryllis to approach as close as possible the leaves of a Clivia. This plus a stalk in bloom presents something a little different. Speaking of something different, one day two years ago when one of my Amaryllis bloomed, a most unusual surprise presented itself—one of my blossoms had ten petals, eleven stamens, and two pistils. The texture of this flower was a smooth glass-like silk, while the other three were a rich red velvet in appearance with one of the three being different than the other two by having seven stamens, and the normal one pistil. Of course all three had had six petals and as mentioned before, the one pistil each. I am told that this phenomenon happens occasionally but the condition is not hereditary.

Upon examining Amaryllis, I noticed that the entire system of growth is a product of a triangle and a hexagon. It has six petals, six anthers, the stigma is split in three, the stalk which is oval appears like a rough hexagon, and the stalk, when cut and examined show that the cells are a clear cut hexagon in shape. The seed pod has a hexagon shape when cut at right angles to the length of it. Also the seed pod has a hexagonal shape in the secondary covering to which the seeds adhere. The seed pod also has three air pockets and the seeds are present in three groups of two. The anthers are triangular. Even the veins in the petals form both patterns running crosswise to triangular parallel veins, roughly shaped like a triangle and a hexagon. So it appears that metaphorically speaking these plants are living crystals.

FORCING HYBRID AMARYLLIS

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

The object in this experiment was to have a Dutch hybrid amaryllis in bloom for Thanksgiving 1956. 'Red Master' was chosen as the variety to be used, and the preparations were begun approximately five months ahead of the anticipated date of bloom. A bit of the history of this bulb should be given as a background to the description of the present performance.

It was purchased from the bulb importer in November 1955 and potted up December 1st. It immediately started activity by sending up a scape with two beautiful florets which opened seven weeks later in the last week of January. Seed were set and these were mature and harvested the first week of March. The leaves which appeared along with the scape were kept growing, and weekly feeding with a chemical fertilizer was given. The plant was kept indoors at 70 to 80 degrees F. until March 21st when it was warm enough to transfer it from the pot to the open bed in the lath house. There was a solid ball of roots and soil, and the plant was merely dislodged from the pot and set in the ground intact. Growth continued luxuriously until the middle of June when it stopped sending up new leaves and seemed to want a rest. There were ten leaves thirty to forty inches long.

On July 1st the leaves were cut off six inches above the bulb and the bulb lifted from the ground. The original diameter of the bulb had been exceeded slightly. It was placed under a large clay pot to dry for a couple of weeks and then stored in a large oatmeal box packed with dry peat moss. The box was placed where it received full sunshine each day. Here it remained until September 10th. when it was potted up in hopes it would bloom by Thanksgiving, November 22nd. Some extra time was allowed because the nights are cool at this season of the year and it would probably require a little longer than average to bloom.

However, nature played a trick and gave a week of unusual heat two days of which broke heat records for early November by going to 96 degrees. As a result the scape matured rapidly, and since cold storage was not resorted to the flowers opened on November 12th, ten days ahead of schedule. There were no leaves with the first scape. The tip of the second scape and the leaves were just showing at the time the first scape was in full bloom. The first scape was shorter than normal and the flower size smaller than the standard for 'Red Master'. This could be due to the fact that the heat and drying in the storage process destroyed most of the roots. Red master forms new roots readily and the second scape was normal in size and height, the bulb separating from the pot with a solid soil ball at that time.

'Red Master' has been described as temperamental in behavior but this bulb has proven quite flexible so long as it is given plenty of heat, food and water. The potting soil used was one part good loam, one part sand, one part oak leaf mold with a liberal supply of bone meal added. While the plant was potted up a chemical fertilizer was added, and while in the soil a top dressing of composted manure was used.

Ample growth must be obtained before allowing a bulb to go dormant. This means at least four pairs of leaves are produced since the last flowering. This bulb was flowered less than ten weeks after the last previous bloom, and it is hoped to move it up again in the future, eventually holding its flowering time at near the mid off-season. It would seem that hybrid amaryllis can be brought into flower at any time following sufficient growth by forcing them into a warm dormant period of at least ten weeks duration.

CULTURE OF **SPREKELIA FORMOSISSIMA**

MRS. B. E. SEALE, *Dallas, Texas*

Sprekelia formosissima of the Tribe Zephyrantheae is a cousin of Amaryllis. It is also known as the AZTEC LILY, JACOBEAN LILY and the ST. JAMES LILY. The botanical name Sprekelia formosissima was given to the plant in honor of the German botanist, J. H. von Sprekelen.

It is native to Mexico and South America. Quantities of them were seen in Peru by the early Spanish explorers and the color reminded them of the color worn by the Knights of St. James, so they called them the St. James Lily. These explorers took some of the bulbs back to Spain and from there they spread and were cultivated over the continent. They have been grown in England since 1658, however, they are little known or grown in American gardens.

Sprekelia is a sturdy bulb, and may be planted in the garden in early Spring and to the middle of May. It is quite rewarding as a spring and summer flowering plant.

The bulbs are planted five inches deep in rich sandy loam; they do not grow well in heavy soil. A cushion of sand is placed at the bottom of the hole where the bulb is set, after mixing ½ cup of bone meal in the soil under the cushion of sand. Good drainage should be provided, and also an abundance of water all of the time that the foliage is green. They are gross feeders and should be fed a good balanced fertilizer every month during the growing season.

Sprekelia grows best in full sun, but will tolerate partial shade. They bloom in a few weeks after planting. They grow very readily from seeds, and to secure a good heavy crop of seeds, the flowers should be hand-pollinated.

They are easily grown in the house, if placed in a sunny window; they may be grown in pebbles or fiber in a hyacinth jar with water. In the spring the house-grown plants may be transferred to the garden—putting them in the ground or leaving them in the pot. If left in the pot, remove the top soil from the pot and fill in fresh soil, water and put in a protected place, on the north side of the house for a few days to keep them from wilting.

When the bulbs are planted in the garden and lifted in the fall; bulbs that are carefully lifted, dried, stored in sand, sawdust, peat-moss or vermiculite over winter, may be planted again next spring in the

garden. However, they may be left in the ground all winter in Southern States. They are hardy as far north as Washington, D. C.

They multiply very rapidly, forming fine clumps with many offset bulbs around the parent bulb. They are divided—in fall or early spring —only when the clumps seem to be very crowded, which is usually in three or four years.

The foliage is similar to *Habranthus* foliage; green and strap-like. The plants grow about 14 to 18 inches tall, depending upon location, proper planting, feeding, watering and general care.

The curious fleur-de-lis-like flowers are a rich velvety crimson or brilliant scarlet color. They are almost shaped like a butterfly and resemble a butterfly in flight, even suggestive of Cattelya orchids; they are "Tailored Flowers" with a sculptured look. They may be used as a corsage, in fact sometimes, they are referred to as the "RED ORCHID". They are most exotic when made into any type of corsage and arouse a bit of interest and comment when so used, whether with formal or informal costume.

A beautiful arrangement of *Sprekelia* blossoms was exhibited at a Flower Show in Dallas last Spring. It was most unusual and received much attention and several awards. It provoked much questioning by those who attended the Show, especially those who desire to grow them. Besides the enjoyment of the brilliant splash of red color in the garden when *Sprekelia* is in bloom, there is the accent of fresh green foliage in the garden after the blooming season is over. Do plant some of these exotic plants and they will reward you for your "Garden Hospitality."

SOME NEW HYBRID HEMEROCALLIS

GEORGE GILMER, *Virginia*

I have two decidedly interesting novelties: (1) 'Quartet' by Milliken. Its flowers have eight tepalsegs instead of the customary six. I have only had it bloom on a small plant, but it looks like it will be good even without the novelty of the extra tepalsegs. (2) I bought 'Tuday' as a forty-eight hour bloomer. The first year its flower did not last forty-eight hours. This year they are open as early as I have gone into my garden, and have been open at the close of the second day. It is very fragrant and blooms twice. Except for the durability of its flowers I wouldn't keep it. It should be worthwhile for breeding.

Armstrong & Bemer's 'Howdy' is the most eye-catching bi-color daylily I know. Quinn Buck's 'Anne Dodson' is a fine pastel predominantly yellow. His 'Gold Antique' is one of my favorites. It has wide petals. 'Miss Arcadia' has rather small yellow flowers and good quality and blooms freely through August and early September.

Tom Craig's 'Valesca' is a fine late yellow for a very attractive and slightly different color. His 'Wonder' and 'Wide-Eyed' are eye patterns that bloom three times here. They are not one hundred per cent sunfast everyday.

Charles W. Culpeper's 'Addred' is a brilliant late mid-season red

freely produced. Howard M. Hill's 'Harriet Hill' is one of the brownest. I like his 'Deep Velvet'—a dark red with some brown. His 'Bright' is an August blooming rose. J. E. Bass's 'Bright Taylor' is a new outstanding brilliant red. E. J. Kraus's 'Aten' is the purest and brightest orange. 'August Pink' is a late blooming deep rose. 'Autumn Daffodil' is a small yellow, late and free flowering. 'Double Value' is perhaps the best double. 'Margaret Fuller' is large and unexcelled as a late yellow. 'Neyron Rose' is large and I know of no better rose. 'Ringlets' is a fine small yellow.

Mrs. Hugh W. Lester's 'Black Friar' is my finest dark red. 'Fairy Wings' and 'Sweet Mystery' are lovely blends predominantly yellow. 'Port Royal' is a red, distinctly different in color from any other I know. 'Gene Wild' is a fine really yellow blend. 'Picture' is a fine rose pink.

Fig. 31. *Ammocharis tinneana* (Kotschy et Peyritsch) Milne-Redhead et Schweickerdt. Photo by L. S. Hannibal.

D. R. McKeithan's 'Oklahoma' is a later and better 'Painted Lady'. Milliken's 'Brass Band' and 'Hazel Saunders' are excellent repeaters. 'Cosette', 'Gold Strike' and 'Fond Caress' are all very good. His 'Black Absolute' is the darkest red I know. H. M. Russell's 'Captain Russell' is the loveliest bi-color I know—lavender and light yellow. 'Mrs. H. M. Russell', 'Jake Russell', 'Marsha Russell' and 'Bette Russell' and 'Helen Hull' are all top quality.

Sass's 'Jessie Shambaugh' has pink edging distinctively different in pattern. 'Buttercup Lane', 'Capitol Dome' and 'Butter-scotch' are all tops. Mrs. Taylor's 'Golden Dewdrop' is the finest miniature I've seen. It blooms three times for me. 'Adelaide Neiland' and 'Quincy' are fine lavender blends. 'Citation' is an excellent color red. 'Norma Borland' is a very attractive brownish yellow. 'Whitfield Palmer' is a fine large yellow. Watch for Taylor's 4235—a lovely light pink.

AMMOCHARIS TINNEANA

L. S. Hannibal, *California*

This bulb was received from the late Miss Stanford along with *Brunsvigia* species. It was in the garden some ten years before it decided to flower. Until it threw the second summer scape, which is typical of the *Ammocharis* (and *Crinum),* the writer was particularly puzzled as to its identity. However, upon consulting Milne-Redhead & Schweickerdt's report in the Journal of the Linnean Society (P. 159-197, 1939) the unanticipated identity was at once apparent.

Ammocharis tinneana [Fig. 31] has a wide distribution through south and central Africa, and obviously considerable variability can be anticipated. This clone has pale pink blossoms which appear in September, and the foliage appears in winter. It is definitely quite hardy here at Fair Oaks, and apparently has several offsets developing. Most *Ammocharis* are not so hardy this far north, and rarely if ever produce offsets. I would presume the bulb well adapted to the southern California climate. Seed was not obtained here, but should be obtained under milder temperature conditions.

CULTURE OF CRINUM AMERICANUM

Crinum americanum L., the type of the genus *Crinum,* grows by the millions in the Everglades of Florida, and also elsewhere in Florida through coastal Alabama, Mississippi, Louisiana, and Texas. Up to the present it has not been extensively cultivated which is apparently due to lack of information about its culture.

1. OUTDOOR CULTURE IN CALIFORNIA

Crinum Americanum requires a moist sunny location where it can root deeply. By withholding water during July and August, then soaking heavily, blooms can be had in mid September or early October [Fig. 32]. Seed set readily but are slow to grow unless given a great deal of root room. A five gallon paint pail is the smallest size of 'pot' recommended.—*L. S. Hannibal*

2. POT CULTURE INDOORS AND OUTDOORS

The writer has had experience in growing *Crinum americanum* under pot culture, first at Beltsville, Maryland, and later at Arcadia and La Jolla, California.

At Beltsville, the plants were grown, 3 bulbs per 6-inch pot, with an over large drainage saucer beneath the pot. The saucer was kept filled with water during the growing season. The plants, in the regular amaryllis potting medium, were given a complete fertilizer such as Vigoro, a tablespoonful for each 6-inch pot, every 6 weeks during the growing season. Under these conditions the plants flowered regularly. During the winter resting season, the saucers were removed and water

was applied sparingly, and fertilizer was omitted. Under similar culture in the greenhouse at Arcadia, California, the plants flowered regularly.

Fig. 32. *Crinum americanum* L., as grown at Fair Oaks, Calif. Photo by L. S. Hannibal.

At La Jolla, Calif., outdoor culture was first attempted with poor results due to the low natural rainfall, and failure to supply water abundantly. The bulbs have now been potted and are doing very well.—*Hamilton P. Traub*

3. AQUARIUM CULTURE IN CALIFORNIA

Some aquarium dealers in California sell *Crinum americanum* as a pool plant, but the writer has not had time to check on the cultural methods employed. Perhaps some of the readers have used it for this purpose. Reports on this type of culture will be welcomed for publication in HERBERTIA.—*Hamilton P. Traub*

[PLANT LIFE LIBRARY—continued from page 100.]

INTRODUCTORY ORGANIC CHEMISTRY; WITH CERTAIN CHAPTERS ON BIOCHEMISTRY, by E. Wertheim, and H. Jeskey. 3rd. ed. McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. 1956. Pp. 476. Illus. $5.50. The purpose of this revised edition of a standard text is to equip students of home economics, veterinary science, nutrition, pre-medicine, dentistry and pharmacy with a foundation in organic chemistry. Highly recommended.

SUCCULENT PLANTS, by H. Jacobsen. English ed., translated by Vera Higgins. John de Graff, Inc., 31 East 10th St., New York 3, N. Y. 1955. Pp. 293. Illus. $9.00. This is the standard book on succulents, now available in an English edition. It lists 151 genera and 1,078 species which include most of the succulents, except cacti, met with in cultivation at present. The characters of each plant are enumerated for purposes of identification. Brief cultural notes for the genera are included. A must for all interested in succulents.

THE CULTIVATION OF SUCCULENTS, by H. Jacobsen. English translation by Vera Higgins. John de Graff, Inc., 31 East 10th St., New York 3, N. Y. 1955. Pp. 108. Illus. $2.50. The purpose of this book is to provide information about the chief genera of succulents that require special treatment for best results. Thus this book is a companion volume to Dr. Jacobsen's larger one, Succulent Plants, in which a larger number of species are included. Highly recommended.

THE MAGIC WORLD OF FLOWER ARRANGING, by M. J. Brooks, and M. A. & J. P. Roche. M. Barrows & Co., 425 4th Av., New York 16, N. Y. Pp. 192. Illus. $10.00. This lavishly and beautifully illustrated new book cannot be too highly praised. It emphasizes that the arrangements part of the flower show is an art exhibit. The three parts of the book each give detailed directions for a general theme of a flower show. In fact, each of the sub-themes of a general theme may furnish the theme for a show. It is rarely that one has the opportunity of reviewing such a book as this one which is without a fault. Highly recommended.

GERANIUMS; PELARGONIUMS FOR WINDOWS AND GARDENS. 3rd ed., by H. Van Pelt Wilson. M. Barrows & Co., 425 4th Av., New York 16, N. Y. 1957. Pp. 240. Illus. $4.50. This is the third revision of the standard American text on the subject. Historical notes, detailed cultural directions, suggestions for use in the home and garden, and descriptive lists of varieties are given in clear concise language. It is a must for the beginning and advanced grower of these charming plants.

HOW TO MAKE CUT FLOWERS LAST, by V. R. Kasperski. M. Barrows & Co., 425 4th Av., New York 16, N. Y. 1956. Pp. 191. Illus. $2.95. The author gives practical directions on extending the life, or usefulness of dead material, of a great variety of material used in bouquets and arrangements. The chapters are devoted to general directions, special treatments for groups, detailed directions for plants from *Acacia* through Zinnia, and drying, pressing, dyeing, forcing, and making potpourri.

THE NEW GREENHOUSE GARDENING FOR EVERYONE, by E. Chabot. M. Barrows & Co., 425 4th Av., New York 16, N. Y. 1955. Pp. 252. Illus. $4.75. This charming new book on greenhouse gardening from coldframes to the practical-purpose greenhouse, is by an outstanding authority. The culture of no less than 569 varieties of plants, including ornamentals, vegetables and fruits, is detailed in non-technical language. Highly recommended.

[PLANT LIFE LIBRARY—continued on page 4.]

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GENERAL EDITION

EDITED BY
HAMILTON P. TRAUB
HAROLD N. MOLDENKE

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

PREFACE

This GENERAL EDITION of PLANT LIFE includes a number of interesting articles. Mr. James contributes a timely article on the Maidenhair tree which is being widely planted. Mr. Sayler tells how to grow *Achimenes* from seeds, and Dr. Smith reports on *Agave virginica.* Dr. Gertrude Earl contributes a valuable article on the chromosomes and speciation of the Calla Lily, *Zantedeschia.* There is a report on a hybrid *Zoysia,* a fine lawn grass for subtropical climates. The Plant Life Library—reviews of current books—completes the issue.

April 15, 1957,
5804 Camino de la Costa,
La Jolla, California.

Hamilton P. Traub
Harold N. Moldenke

DR. CORLISS GARDEN TOUR

Dr. Philip G. Corliss will conduct a Garden and Photography Tour of Europe, sailing Aug. 21 and returning Oct. 5, 1957. Those interested should write to Arnold Tours, 79 Newberry St., Boston 16, Mass.

DR. TRAUB'S "THE AMARYLLIS MANUAL"

The Macmillan Company, 60 Fifth Ave., New York 11, N. Y. announces that "THE AMARYLLIS MANUAL" by Dr. Hamilton P. Traub will be published in June 1957. This is a complete book on Amaryllis including the history, parts of the plant, the cultivated species, the divisions of hybrid amaryllis, breeding, propagation, culture, control of pests, marketing, amaryllis shows, and amaryllis as a cultural asset. The appendices deal with nomenclature, the descriptions of the 46 *amaryllis* species, the amaryllis organizations, amaryllis dealers, and garden supply dealers.

P. S.—Since the above was written, word has been received that the publication date has been postponed for several months. However, copies will be available by December 1957, and at the very latest by January 1958.

THE MAIDENHAIR TREE, **GINKGO BILOBA**

W. McD. JAMES, *California*

This tree, either as a single specimen, in a group of several, or in rows bordering along roadsides, presents a picture both when it is green in the summer or colored in the fall, that will last a long time in the memory of those who see it. The silver-green leaves change to a bright golden yellow almost over the whole tree at the same time, and they retain this color for awhile after they have fallen. At one time the tree was widely distributed over the world, but changing conditions caused it to die until probably the only living ones left were those cared for by man in private gardens and temple grounds in a comparatively limited geographic area. Because of its adaptability and attractiveness, man is gradually redistributing it over much of the world. *Ginkgo biloba* is probably one of the most interesting examples of a cultivated plant which recalls the very ancient past in a realistic way. It is a member of a genus which had several species of which all but one are now extinct.

The Sequoias are often called "living fossils", but fossil records of these trees go back only to the Tertiary period in the Cenozoic Era. *Ginkgo* fossils are found in the rocks of the Cretaceous period of the Mesozoic Era, which is up to sixty million years older. Two species from several of the Sequoias are still growing in a natural state, although they have been reduced to relatively small areas almost entirely in California from rather widely distributed places in the northern hemisphere.

It is doubtful if there are any of these *Ginkgo* trees growing in a natural state today. In 1899 Mrs. Bishop reports seeing fine specimens in the forests which surround the sources of the Gold River and the smaller Min River in western China. But there seems to be no record of any confirmation. Dr. Ernest Wilson, the plant explorer and botanist, spent some time searching Chinese records and had others help him, in an attempt to find some data on when and where these trees were last known to be growing in a natural state. But the only trees mentioned in even very ancient records were growing in private gardens or temple grounds. Apparently there are no data showing how long *Ginkgo* has been cultivated as a sacred free. The first one of these trees to reach Europe is said to have come to Holland from Japan in 1712. A tree was planted in what is now the Royal Botanic Gardens at Kew about 1762. This proved to be a staminate tree. Pistilate scions grafted to it bore fruit in 1919. Today *Ginkgo biloba* has world-wide cultivation even where winter temperatures occasionally reach twenty degrees F. below zero.

In European literature this tree was first mentioned by Kaempfer in 1712. His term "Ginkgo" was adopted by Linnaeus in his Mantissa Plantarum of 1771. In 1797 Smith referred it to the Coniferae, substituting the designation *Salisburia adiantifolia* for the "uncouth generic name *Ginkgo* and the incorrect specific term *biloba*".

Fossil remains from several million years ago (the Mesozoic) demon-

starte both the antiquity and former wide geographical range of *Ginkgo biloba.* There are some petrified *Ginkgo* trees in the State of Washington, and fossils are found in several places in Washington, Idaho and other parts of the world. The similarity of these widely distributed fossils to those of extinct related forms caused bitter disagreement among taxonomists for some time as to the systemic position of the genus.

In 1897 Engler adopted a new subdivision of the *Gymnospermae,* the *Ginkgoaceae,* with a single genus *Ginkgo,* "because it was distinguished from the true Coniferae by the possession of motile male cells and other characteristics of more or less importance." This classification

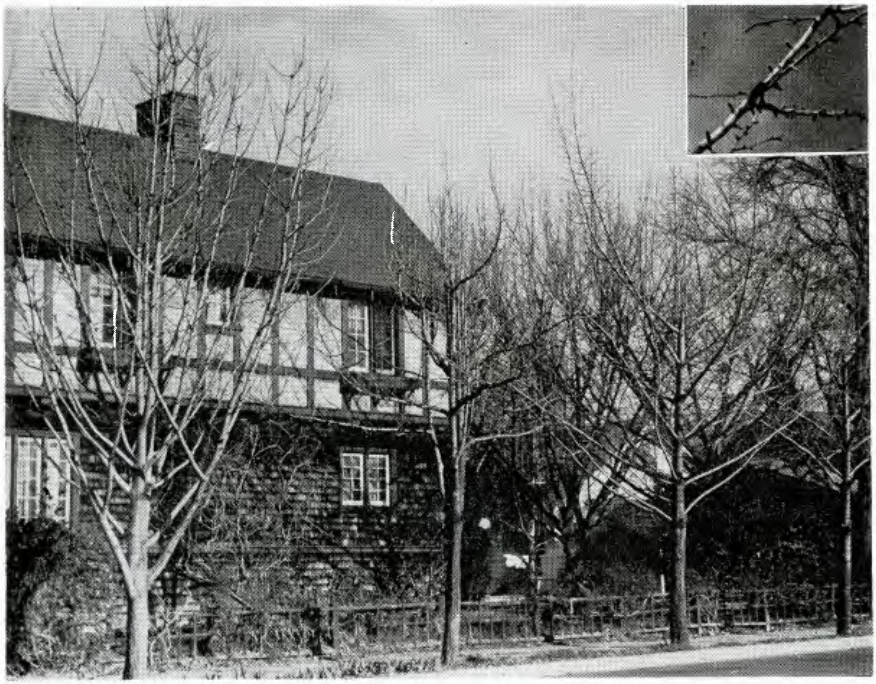

Fig. 33. *Ginkgo biloba;* trees showing variety of growth habit. Upper right corner, detail showing short and long growth. Photo by W. M. James.

seems to be very generally accepted at the present time.

Ginkgo biloba is one of the few deciduous Gymnosperms. It apparently attains a height of ninety feet and a diameter of four and one-half feet. Growth is relatively slow, especially where adverse conditions prevail. There seems to be little data as to the ultimate age. Seedlings vary somewhat in shape and habit of growth, from those with widely spread rounding top to those with a strongly excurrent (undivided) trunk and a steeply pryamidal outline. Records show that even the more slender appearing trees tend to broaden and become rounding at the top after fifty or sixty years. It takes fifteen to twenty years for them to reach fruiting age.

There are two kinds of growth in these trees; long shoots characterized by elongated internodes and relatively small pith and thin cortex (bark), and short shoots or spurs, with much abbreviated internodes and comparatively large pith and thick cortical regions. [Fig. 33]. The long

Fig. 34. *Ginkgo biloba.* Upper, staminate flowers; lower, pistillate flowers. Photo by W. M. James.

shoot grows first and is somewhat similar in appearance to a seedling, having scattered single leaves with a bud in the axil of each petiole. Sometimes the same season (in California) and sometimes not until the next year a whorl-like group of leaves emerges from the axillary buds. This is the start of the short shoots. They elongate very slowly, with the

flowering stems of the male tree and the fruiting stems of the female tree emerging each year with the whorl-like group of leaves on the tip. Leaf scars are left, year after year, but they are too irregular to indicate any age. Trees up to sixty years old observed by the writer, have these short shoots scattered thickly throughout the inside of the tree, even on the larger branches. And leaves and fruit seem to grow as well in the reduced light inside the tree as they do in full light on the outside.

These two kinds of shoots are not morphologically fixed in character. The apex of a short shoot may suddenly elongate and become a long shoot, or the apex of a long shoot may fail to elongate and become a short shoot. Observations in the San Jose area indicate environment may have some influence on the "mutability and periodicity" of short and long shoots. Long shoots are generally rather short and not extensive on trees growing under adverse conditions. Trees in good soil and receiving plenty of water produced much more annual growth. Pruning has a tendency to make short shoots near the cut elongate enough to nearly equal the part removed.

Ginkgo leaves with their symmetrical dichotomous (forked regullarly in pairs) venation are very attractive. On the seedlings and the new long shoots the leaves are deeply lobed in the center and often have secondary lobes on each side. The first leaves which grow from the new axillary buds are generally bilobed and uniform. The leaves on the older short shoots are generally smaller, with a nearly entire margin, and resemble the leaves of *Adiantum* fern so closely as to suggest and warrant the common name of Maidenhair Tree. The color of the foliage is a pleasing shade of pale green which turns to a bright golden yellow in the fall.

The staminate inflorescence [Fig. 34] is borne in loose, catkin-like clusters from the axils of the whorl-like cluster of leaves on the tip of the short shoots. The dried flowers often remain on the trees for several weeks.

The pistillate flowers [Fig. 34] are borne in groups on the tips of the short shoots. Individuals consist of a long stalk bearing at its apex mostly two ovules. In the San Jose area a large percentage of these stalks mature two identical appearing fruits—but the ovary of one generally aborts. Pollination takes place in mid-spring. The motile male cells, similar to those of the Cycads, enter the ovule to complete fertilization in late summer or early fall. The fruit is a drupe [Fig. 35], consisting of an acrid, foul-smelling pulp surrounding a smooth, angular oval, cream to yellow colored, thin-shelled, sweet-kerneled nut.

The writer had a bad case of poisoning (dermatitis) from cleaning the seeds. Later, handling mature wood in the winter produced some discomfort. The effect on the skin is worse than from "poison-oak" *(Rhus diversiloba)*. Poison-oak causes watery pustules or blisters, and is accompanied by swelling and itching at intervals. In *Ginkgo* poisoning the pustules are smaller, with little swelling. The skin turns reddish and there is an almost continuous burning sensation. It took a month for recovery as against two weeks for poison-oak.

It has been suggested that the active agent in *Ginkgo* poisoning may be butyric acid. This is an organic compound and there are several saponifying agents. Washing the skin with commercial ethyl ether must be used cautiously, as it can saponify natural oils in the skin and cause so-called ether burns. Fortunately few people seem to be allergic to *Ginkgo* poisoning. San Jose doctors had never heard of it and had nothing about it in their literature.

The MAIDENHAIR TREE is peculiar in that when the fruit containing the nut-like seed is apparently mature, the embryo is an undifferentiated

Fig. 35. *Ginkgo biloba.* Fruits. Photo by W. M. James.

mass of cells. "After fertilization there is a period of free nuclear division with generally eight taking place and giving rise to a possible two hundred fifty six free nuclei. Walls are then formed simultaneously throughout the embryo, enclosing cells which are approximately the same size. Then embryo organization and development takes place with maturity sometime during the winter". Temperature is apparently a factor in embryo development. Seed held in moist storage (damp sand) at room temperature germinates sooner than when held in cooler moist storage. But the seeds in the warmer storage germinate more unevenly! Seeds held in dry storage during fall germinate unevenly over a period of several months after planting. The problem apparently is to find a

way of handling or storing the seeds that will favor embryo development and retard germination until the embryo has matured.

The seed is medium-sized and nut-like with a relatively thin shell filled mostly by endosperm. The cotyledons are hypogeal (underground or hidden) and remain inside the shell, developing a definite hook on the end.

The MAIDENHAIR TREE can be propagated vegetatively in several ways. Half-ripe wood taken in mid-summer or ripe wood taken in winter roots well. Cleft grafting in late winter gives good results. Chip budding (or bud grafting) is very satisfactory, either in the spring with "current growth" buds placed in storage at the beginning of dormancy or with current or second year buds used in late summer direct from the trees.

Plants grown from cuttings do not seem to develop as fast as those grafted on seedlings. Some nurserymen grow seedlings in the field and dig them bare root after several years. The few plants seen by the writer which were handled this way have not started as vigorously when replanted as have those grown in containers. Each grower will probably have to determine which propagation method is best suited to his environment and requirements.

Study of *Ginkgo* anatomy is intensely interesting. It, along with most of the other Gymnosperms, differs in many ways from that of the Angiosperms. Apparently a cambium cell is the same, or an equivalent of a cell of the apical meristem or shoot apex in both Gymnosperms and Angiosperms. However, there seems to be agreement that Angiosperms have two plus cells on the outside growing zone in the tip and some of the Gymnosperms have only one layer. For instance, the apple has six layers of cells in the apex, hence six in the cambium. The inside cells of the cambium differentiate into xylem tissue which gradually changes into irregular channels for translocation from the roots to the upper parts of the plant. The outside cells differentiate into phloem tissue arranged so that it provides a means of moving the photosynthates from the leaves to the other parts of the plant. Obviously the factors governing or influencing growth and differentiation in the single-celled cambium of the *Ginkgo* would be different from those in a multiple-celled cambium of an Angiosperm. This brief reference to *Ginkgo* anatomy shows one more item which makes it a fascinating plant to study and observe.

The Chinese use the nut-like part of the seed in a dish prepared with several other ingredients during their New Year celebrations. A Chinese acquaintance in Honolulu mentions "roast duck with ginkgo seeds in the dressing" in correspondence with the writer. The Japanese roast the seeds much like Americans roast peanuts and the people in Thailand eat them prepared as a paste.

There seems to be little information on the use of the wood. It is rather soft for lumber and too slow growing for firewood. Beautifully hand-carved and attractively finished trays and novelties are being made from *Ginkgo* wood to some extent in Japan. However, the MAIDENHAIR TREE is very valuable for ornamental purposes. It is not too particular

about the kind of soil it grows in or the amount of water it receives. Of course it grows much better in good soil and with plenty of water. It is apparently indifferent to the smoke, dust and fumes accompanying the industrial age in the cities. *Ginkgo biloba*, the MAIDENHAIR TREE, is paying fully in an aesthetic way for any effort expended by man in its redistribution in many places.

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GROWING ACHIMENES FROM SEEDS

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In 1955 I decided to try my luck at growing *Achimenes* from seeds. I have about 20 named clones to work with, and many crosses were made. The seed ripened and were gathered in October. Achimenes are strictly warm weather plants, and therefore the seeds were planted in early April, 1956.

Two quart pickle jars were cleaned and placed on one side. About ¾ inch of damp spaghnum moss was placed in the jars on the side of the bottom. Seeds were dusted on the spaghnum and the lids were screwed on the jars which were placed under azalea plants in the garden. They were left closed until the seedlings were about ¼ inch tall and ready for transplanting. Some were planted in pots, cans and flats. Those in the flats made the most rapid growth. The potting soil consisted of 1 part garden soil, ¼ part spaghnum peat and 1 part coarse sand. Good drainage is necessary, but the soil must be kept moist. An occasional feeding with a good soluble plant fertilizer is needed. Achimenes grow best in shade.

By August 1956, these plants were all in bloom, and brought many pleasant surprises. Now in September they are as large as those grown from tubers. I am trying to obtain better pink clones, and a yellow, if possible.

AGAVE VIRGINICA

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

This is an interesting little plant with glabrous leaves and long exserted stamens previously known as *Manfreda virginica* but more recently classified as *Agave virginica* L. It is found growing in the Southeastern States extending as far north as southern Ohio, Indiana and Illinois. This is the most northly distribution of any member of the *Manfreda*

group, the other members being warmer climate plants extending from Texas into Mexico and Central America.

Agave virginica forms the typical *Agave* rosette of leaves which in this species is deciduous. The smooth leaves are green or purple mottled in the form tigrina, slightly undulated, and may be entire or denticulate diminishing in size to bracts on the upper scape. They grow from a tuberous rootstock with long thick roots. The solid scape is one to two meters tall with the forty to fifty florets scattered in a loose spike. The individual flowers are not conspicuous except for their long exserted stamens and narrow tube which is twice longer than the erect lobes. The color is greenish yellow and at night they give off a fragrance described as similar to that of mace. In this species the anthers drop before the stigma is ready for pollination, a mechanism which insures cross pollination. Flowering extends over a three to four week period in July and August as the singularly placed florets open a few at a time up the long scape. Propagation is accomplished by both seed and offsets which are formed on the parent tuber in a manner similar to that in the tuberose.

Agave virginica transfers readily from its native habitat into cultivation. It is usually found growing in dry woods, thickets and on open slopes. My specimens came from Barren and Hart counties of Kentucky. In that region near the Mammoth Cave National Park limestone rock is not far from the soil surface even when not seen to be actually outcropping. So far it seems to tolerate the neutral to alkaline soil condition of southern California and has not proved difficult to handle in cultivation. Wetness during the dormant season is not a problem and in its northern range it is occasionally exposed to subzero temperatures.

Other relatives of *Agave virginica* are *A. maculata* from south Mexico, *A. maculosa* from Texas, *A. brachystachis* from Mexico and Guatamala, *A. variegata* from Texas and Mexico, and *A. gutatta* from Mexico and Central America. Other closely allied species include the *Runyoniae*. The relationship of these to the other branches of the *Agavaceae* should be studied by attempting crossing experiments.

CHROMOSOME NUMBERS AND SPECIATION IN THE GENUS **ZANTEDESCHIA**

GERTRUDE EARL

INTRODUCTION

The genus *Zantedeschia,* a small genus in the family Araceae limited to South and Tropical Africa, is commonly known as the calla lily genus. There is still some confusion as to the proper generic name, but as Traub (1948) has traced the history of the nomenclature, it seems *Zantedeschia* must be considered the correct designation. In the first edition of *Species Plantarum* (1753) Linnaeus listed two species in the genus *Calla* L., *C. palustris* L. and *C. aethiopica* L. The former, considered as the type, is an aquatic species native to the northern hemisphere. Kunth (1818) recognized the dissimilarity of the two species and proposed the generic name *Richardia* for the taxon *Calla aethiopica. Richardia* had already

been applied to a genus in the Rubiaceae and could not validly be used; hence Sprengel (1826) introduced the generic name *Zantedeschia* which should be accepted.

In addition to the type species, *Zantedeschia aethiopica,* some ten others have been proposed. Traub (1948) in the most recent monograph of the genus recognized eight species as valid but conceded that further study will be necessary before that number can be accepted as definite. The species accepted by Traub are as follows: *Z. aethiopica* (L.) Sprengel, *Z. albomaculata* (Hook. f.) Baillon, *Z. angustiloba* (Schott) Engler, *Z. hastata* (Hook. f.) Engler, *Z. Elliottiana* (Knight ex Watson) Engler, *Z. melanoleuca* (Hook. f.) Engler, *Z. Sprengeri* (Comes) Burtt Davy, and *Z. Rehmannii* Engler.

These species are found in various habitats in the range in South and Tropical Africa (Engler 1908, Brown 1868, 1894). *Zantedeschia aethiopica,* the white calla of the florists, is common on the humid meadows around Capetown and generally in southwest Capeland, and the limits of the species extend eastward to Natal. The spathe is milk-white, and the anthers are bright yellow. The green, unspotted leaves are cordate or hastate. *Zantedeschia albomaculata* is also native to the Cape of Good Hope but prefers higher elevations. It is found on the Witte Bergen up to a height of 5000-6000 feet and has also been collected in Tembuland at a height of 2000-2500 feet. The spathe is milk-white but bears a dark purple-brown blotch inside at the base. The leaves are hastate or saggitate with numerous elongated semi-transparent white spots.

Zantedeschia melanoleuca occurs in Natal and also in Tropical Africa in the Mozambique district. Here the spathe is light yellow or greenish-yellow with a dark purple-brown blotch at the base inside. The leaves are deltoid or ovate-deltoid also with numerous semi-transparent white spots. *Zantedeschia angustiloba* has the most widespread distribution of any of the species and is native to both coasts around the Kalahari desert. On the east coast its range extends from Transvaal into Tropical Africa. On the west coast the species is native to Lower Guinea in Angola and is frequent in deep stagnant places in swamps near rivers. The spathe is of a clear deep gamboge-yellow color with a dark purple-brown blotch at the base inside. The leaves are unspotted and elongate-deltoid or elongate-oblong.

Zantedeschia hastata has been collected in Natal in swamps, and its range extends into Basutoland and Transvaal and into Tropical Africa around Lake Nyassa. Its spathe is a light greenish-yellow with a dark blotch at the base inside, and the hastate, green leaves are unspotted. *Zantedeschia Elliottiana* is a tropical species and is found in the Mozambique district and in tropical Transvaal. The spathe is of a bright golden-yellow color without a blotch. This is the "Golden Calla" of the florists. The bright green ovate leaves are marked with numerous transparent white elongated spots. *Zantedeschia Sprengeri* is found in Transvaal, and the spathe of this species is yellow also.

Zantedeschia Rehmannii has been collected on steep stony hills up to elevations of 4500 feet in Natal. The spathe of this is light rosy-purple,

darker but not blotched within at the base. The lanceolate leaves are quite distinctive from the leaves of the other species and are marked with short, linear semitransparent white spots.

Although many of the species have been common horticultural plants in Europe and this country for over two centuries, there has been little cytological investigation in this genus. In fact the chromosome number of only a single species, *Z. aethiopica,* has been listed previously in the literature. Overton (1909) found a n number of 16 in the pollen mother cells of this species, and Michell (1916) who was studying the development of the embryo sac reported 12 bivalents in the megaspore mother cells. Kurabubo (1940) listed a 2n number of 32 for an unidentified species of *Zantedeschia.* Mookerjea (1955) reported a 2n number of 32 for a plant she has listed as *Richardia aethiopica* and a 2n of 28 for *R.* "Golden Calla" which she has called a "horticultural type."

MATERIALS AND METHODS

In this study mitotic chromosome numbers were determined from root tips taken from plants grown in pots in the greenhouse. For studying meiosis, anthers were collected from plants grown in the field. The plants were grown mainly from corms and occasionally from seed secured from commercial houses in this country. Material of several species and a hybrid was furnished to Dr. W. S. Flory by Dr. H. P. Traub, and the Brown Bulb Ranch of Capitola, California, also donated material. Two lots of plants of *Z. albomaculata* were grown from seed from the Botanic Garden in Essen, Germany.

The root tips were pretreated from two to three hours in a saturated solution of paradichlorobenzene (Meyer 1945). They were then fixed in Craf solution and dehydrated in n-butyl alcohol according to Randolph's technique (1935), sectioned at 10 to 15 microns, and stained in crystal violet. The anthers were smeared directly in aceto-orcein. The pollen mother cells undergo meiosis while the spadix and spathe are still hidden at the base of the leaves. The spadix is quite small at this point, less than two cm. in length, and the anthers are scarcely one mm. wide.

Drawings were made with the aid of a camera lucids at a magnification of x3500.

RESULTS

Six of the eight recognized species as well as four varieties and three hybrids were examined cytologically. The identity of the variety New Cream, or more properly clone New Cream, according to Traub, is still uncertain. Traub has suggested it is most probably a sport of *Z. albomaculata.* In the root tips a 2n number of 32 has been found in all the material with a single exception (table 1, fig. 1-8). The exception was a seedling plant of *Z. Elliottiana* in which an anueploid number of 33 occurred (fig. 9). Since the plant died before reaching maturity it was impossible to study meiosis in it. In other plants of *Z. Elliottiana* a 2n number of 32 was found.

The mitotic chromosomes are from one to three microns in length. It is difficult to observe many morophological details of chromosomes of

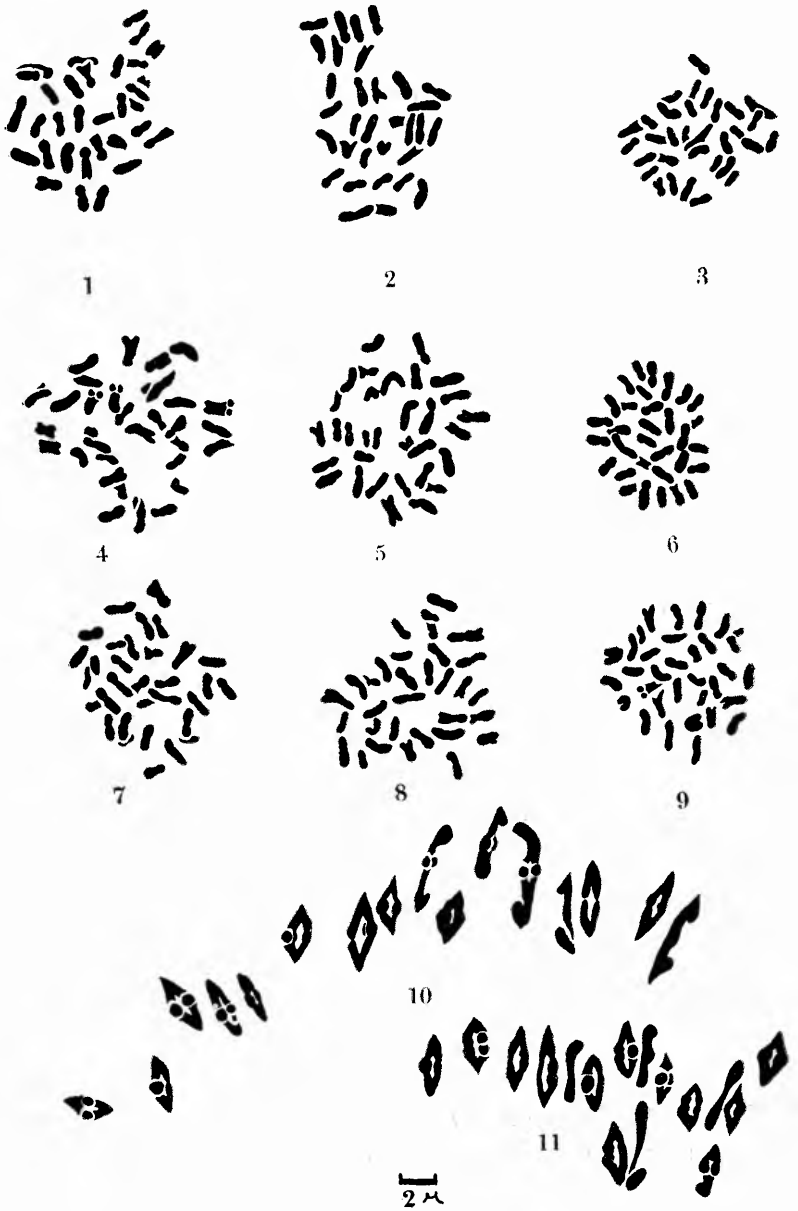

Fig. 1-11.—Fig. 1. **Zantedeschia aethiopica** cl. Burbank Baby 2n = 32. Fig. 2. **Z. angustiloba** 2n = 32. Fig. 3. **Z. melanoleuca** 2n = 32. Fig. 4. **Z. albomaculata x Z. Rehmannii** 2n = 32. Fig. 5. **Z. Elliottiana** 2n = 32. Fig. 6. **Z. New Cream x melanoleuca** 2n = 32. Fig. 7. **Z. albomaculata** 2n = 32. Fig. 8. **Z. Rehmannii** 2n = 32. Fig. 9. **Z. Elliottiana** 2n = 33. Fig. 10. **Z. albomaculata x Z. Rehmannii** n = 16. Fig. 11. **Z. albomaculata** n = 16. Fig. 1-9 mitotic divisions from root tips stained with crystal violet. Fig. 10, 11 meiotic divisions from pollen mother cells stained with aceto-orcein. Magnification x3500 and reduced approximately one-third.
Plate 6

this size. Centromeres appear to be at a medium to sub-median location. There is a similarity of chromosomes complements among the species, varieties, and hybrids. Meiosis was examined in three species, *Z. Elliottiana Z. albomaculata* (fig. 11) and *Z. Rehmannii*. Meiosis in one hybrid, *Z. albomaculata* x *Z. Rehmannii* (fig. 10) was also examined. In both species and hybrids 16 bivalents have been found to be formed regularly.

DISCUSSION

Although there has been no account of naturally occurring hybrids, artificial hybridization has been fairly extensive in this genus. According to Traub (1948) hybridization is possible among all the species with the exception of *Z. aethiopica*. This latter species has a ramifying root stock

Table 1. Chromosome numbers in **Zantedeschia**

Species and Hybrids	Accession Number	Source	n	2n	Figure in Plate 6	Author
Z. aethiopica	13006-54-2	Brown Bulb Ranch Capitola, Calif.		32		Earl
Z. aethiopica	S13146-53-1	Rex Pearce Moorestown, N. J.		32		Earl
Z. aethiopica cl. 'Godfrey' calla	13007-54-b	Brown Bulb Ranch		32		Earl
Z. aethiopica cl. 'Burbank Baby'	13144-53-5	Len Mirzwick Healdsburg, Calif.		32	1	Earl
Z. aethiopica [1]			16			Overton (1909)
Z. aethiopica [1]			12			Michell (1916)
Z. aethiopica [2]				32		Mookerjea (1955)
Z. albomaculata	S13134-53	Botanischer Garten Essen		32		Earl
Z. albomaculata	S13148-53	Pearce		32		Earl
Z. albomaculata	13004-53	Brown Bulb Ranch	16	32	11,7	Earl
Z. albomaculata cl. 'New Cream'	13137-53	Mirzwick		32		Earl
Z. angustiloba	13034-53	Len Woefle Cincinnati, Ohio		32	2	Earl
Z. Elliottiana	39-53	Pearce		33	9	Earl
Z. Elliottiana	13002-53	Brown Bulb Ranch	16	32	5	Earl
Z. Elliottiana [3]				32		Mookerjea (1955)
Z. melanoleuca	13136-53	Mirzwick		32		Earl
Z. melanoleuca	13030-53	Woefle		32	3	Earl
Z. Rehmannii	S13147-53	Pearce		32		Earl
Z. Rehmannii	13003-54	Brown Bulb Ranch	16	32	8	Earl
Z. Rehmannii cl. 'Superba'	13035-53	Woefle		32		Earl
Z. New Cream x **Z. melanoleuca**	13138-53	Mirzwick		32	6	Earl
Z. melanoleuca x **Z. Rehmannii** = **Z. cantabrigiensis** cl. 'Mrs. Roosevelt'	13031-53	Woefle		32		Earl
Z. albomaculata x **Z. Rehmannii**	11453-47	Traub	16	32	10,4	Earl

[1] Designated **Richardia africana Kth.** by authors.
[2] Designated **Richardia aethiopica** by author.
[3] Designated **Richardia** "Golden Calla" by author.

and does not require a resting period as opposed to the remaining species which have compact corms and require a resting period. Traub stated that seed set in crosses involving *Z. aethiopica* but that these do not germinate and eventually rot.

The similar chromosomes complements, the ease of hybridization within the compact corm group, and the behavior of the meiotic chromosomes in the hybrids are all factors suggesting that speciation in the

genus has proceeded chiefly by gene change. Mookerjea (1955) who found a 2n number of 28 for *Richardia* "Golden Calla" was possibly examining *Z. Elliottiana* since this species is sometimes sold in the trade as "Golden Calla." This variation in chromosome number, unless it is a unique occurrence, is somewhat difficult to understand in view of the constancy of the chromosome number in mitosis and meiosis in the material examined here. If such variation in chromosome number were common, then an additional factor would be reponsible for speciation in this genus. Mookerjea also differentiated the small chromosomes to a fairly high degree. She describes ten satellites or secondary constrictions in ten of the small chromosomes of *Richardia aethiopica* and six in the 28 chromosomes of *R.* "Golden Calla." If such variation occurs then a third factor of chromosomal change would have to be considered in a discussion of speciation.

These changes whether they be at the gene or chromosome level, have brought about variations in the original type of the genus which have become adapted to different niches in the range. The result will be an external ecogeographical isolation or ecological separation of sympatric types (Stebbins 1950, pp. 196-200). This applies to the species in the compact corm group. The barriers between *Z. aethiopica* and the latter group are greater than isolation or separation. Traub (1948) suggests there may be a distinct gap from the standpoint of gene exchange. Given time and continued isolation similar barriers could possibly arise within the compact corm group.

The writer wishes to thank Dr. Walter S. Flory who suggested this problem for advice and encouragement and for his invaluable help in securing material.

SUMMARY

1. The chromosome number of six species, four varieties, and three hybrids in the genus *Zantedeschia* has been found to be 32. At meiosis in three species and one hybrid examined 16 bivalents are regularly formed.

2. Speciation in this genus seems chiefly a result of mutation at the gene or chromosome level.

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ZOYSIA X FORBESIANA HYBR. NOV.

HAMILTON P. TRAUB, *California*

During the years 1948-49, Dr. Ian Forbes, Jr., Research Agronomist, U. S. Dept. of Agric., at Beltsville, Maryland, made several hybrids between species of the genus *Zoysia* Willd. (Forbes, 1952). The work was carried on cooperatively by the U. S. Dept. of Agric., the University of Georgia, Coastal Plain Experiment Station, and the U. S. Golf Assoc., Greens Section. The most successful of these hybrids for southern California is the cross between *Z. japonica* Steud. and *Z. tenuifolia* Willd. A clone of this hybrid has recently been introduced by the cooperating organizations under the fancy name, 'Emerald'.

In San Diego County this clone under test has so far proved to be evergreen and is fairly rapidly growing. It is intermediate between the two parents, and is a short day plant, beginning to flower outdoors in October. Since this hybrid is a genuine biologic success as a lawn grass in this region, and further breeding work with it is being carried out by the writer, it needs to be referred to often and this makes it advisable to give it a two part name in honor of the scientist who made the original cross.

Zoysia x forbesiana Traub, **hybr. nov.**

Hybrida inter *Z. japonicam* et *Z. tenuifoliam* posita sed anthesis Octobri incipet.

Intermediate between the two parents, *Z. japonica* Steud., and *Z. tenuifolia* Willd. Begins to flower in October in California. Holotype: Traub No. 547 (TRA), cult. La Jolla, Calif., Oct. 15, 1956.

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PLANT LIFE LIBRARY

DARLINGTON'S "CHROMOSOME BOTANY" *

CHROMOSOME BOTANY has much to offer those with an interest in the origin of cultivated plants, particularly the ornamental plants. Professor Darlington points out that experimental breeding is concerned with a few hundred cultivated species, while chromosome studies are scattered over several thousand species, mostly wild. Each set of data acts as a check on the other and together they make it possible to combine our knowledge of wild and cultivated species with that of systematics and ecology. It is the purpose of the book to weave this information into a coherent picture.

On the whole, the author has done a remarkably competent job of synthesis with the vast amount of material at his disposal within a span of 180 pages. Darlington is particularly skillful at formulating new, bold and stimulating hypotheses, and in drawing attention to critical areas where our knowledge is weak or even non-existent. Many will disagree with some of his generalizations, mostly because present evidence is not decisive. However, his theories do provide a framework for focusing discussion, and a base from which further advances can be made. Darlington is never dull, but his book must be read with critical discrimination, for there are no well-labeled sign posts to warn the unwary.

Readers of Plant Life will be most interested in the last two chapters (V. Cultivated Plants, and VI. Ornamental Plants). In Darlington's words, "Cultivated plants, in general, have given us a clearer view of the principles at work in the evolution of wild plants. But there remain certain genetic problems on which their evidence is too remote to be certain. In order to settle these questions we must closely examine the best understood of all plants, those most recently introduced into cultivation, the ornamental plants".

In contrast to the staple cultivated plants, where the method of origin and subsequent history has often been blurred or erased by time and other factors, the ornamental plants are comparatively recent, and their origin and history is well-documented. From the immense number of species that could have been mentioned, Darlington has chosen 8 examples to illustrate the principles involved—*(Lathyrus odoratus*—Sweet Pea; *Primula sinensis*—Chinese Primrose; *Hyacinthus orientalis*—Hyacinths; *Narcissus; Iris*—Bearded Iris; *Rosa*—Roses; *Chryanthemum; Dahlia variabilis*—Dahlias).

The details of chromosome history of the individual examples cited above makes fascinating reading, and is well worth extended study. There is an index and about 130 literature references. The references are collected in the rear of the book under the pertinent chapter headings.—*Thomas W. Whitaker.*

* CHROMOSOME BOTANY, by C. D. Darlington. Allen & Unwin, London, and Macmillan Co., 60 5th Av., New York 11, N. Y. 1956. pp. 180. Illus. $2.75.

DARLINGTON & WYLIE'S "CHROMOSOME ATLAS OF FLOWERING PLANTS" WITH SPECIAL REFERENCE TO THE AMARYLLIDACEAE *

HAMILTON P. TRAUB

The readers will remember that in 1946, Darlington & Ammal's "Chromosome Atlas of Cultivated Plants" (1945) was reviewed in these columns. This important work was welcomed by many of the readers who have attested to its value by writing to the editor about it. It is now his pleasure to review a revised and enlarged Chromosome Atlas by Darlington & Wylie.

I. ENLARGED CHROMOSOME ATLAS

It is indicated that chromosome numbers have now been studied in some fifty thousand flowering plants belonging to nearly twenty thousand species. In order to make such information generally available, the scope of the book has been enlarged to include the chromosome data of all flowering plants. This has increased the size of the volume. The introductory essay in the 1945 volume has also been revised and enlarged in scope and it is now published as a separate volume, "Chromosome Botany", which is reviewed by your Executive Secretary, Dr. Whitaker, above. It remains for the writer to review the "Chromosome Atlas".

The plan of the new volume is similar to that followed in the earlier one. The somatic chromosome numbers are given for the species which are grouped under genera. The latter are grouped under tribes, if necessary, or directly under the families. The families are grouped under orders, except in the Gymnosperms, and the orders in the Dicotyledons and Monocotyledons, are placed in groups of orders.

Opposite the genera, the basic chromosome numbers are given. To the right of the somatic numbers of the species, the workers reporting the data, the year of publication, uses of the plants and distribution, are indicated.

II. THE ATLAS AND THE AMARYLLIDACEAE

In another paper (Traub, 1957a), the writer has presented a classification of the *Amaryllidaceae* down to the generic level. In this it is pointed out that although Darlington & Wylie include the tribes *Gilliesieae* and *Hemerocalleae* in the *Amaryllidaceae*, they have retained the tribes *Allieae* and *Agapantheae* in the *Liliaceae* in total disregard of morphological and chromosomal similarities. The severance of the *Allieae* and *Agapantheae* from the *Gilliesieae* ignores the fact that all three have apparently evolved from a common ancestral stock. The *Gilliesieae* [x=10(11)] are the most advanced with flowers usually zygomorphic as contrasted with actinomorphic flowers in the more primitive *Allieae* [x=5, 6, 7, 8, 9] and *Agapantheae* [x=6, 15]. Thus the horizontal decapitation made by Darlington & Wylie is artificial and arbitrary. These authors have failed to note that when the classification of the *Amaryllidaceae* (Traub, 1957a), which was originally based on morphological similarities, is reinforced with the chromosome data, it is evident that the original hypothesis is borne out. On this basis the *Allieae* and *Agapantheae* definitely belong with the *Amaryllidaceae* and are out of place in the *Liliaceae*.

In the Atlas, the diversified genera of *Liliaceae* are grouped under tribes, but the genera of *Amaryllidaceae*, also diversified, are treated as *one homogeneous group!* The order of arrangement follows their rule "which is to proceed from the lower to higher numbers". When homogeneous groups are concerned, this principle may work apparently, but it cannot be applied to *an entire diversified family*—the *Amaryllidaceae* in this case. In this instance it is obviously necessary to group the genera into tribes to reveal probable relationships according to the morphological similarities, and then test the hypothesis by adding the chromosome data (Traub, 1957a).

* C. D. Darlington & A. P. Wylie. Chromosome Atlas of Flowering Plants. The Macmillan Co., 60 Fifth Ave., New York 11, N. Y. 1956. pp. 519. $10.50.

Only in this manner may the objective enunciated in the Preface of the Atlas be achieved—"To show how chromosome numbers can be used as a basis of classification of species, genera and families."

What are the particulars in this instance? It should be noted for example that in the genera belonging in the tribe *Amarylleae* (Traub, 1957a), *Lycoris* is separated by four distantly related genera from *Ungernia,* and the latter is separated by nine such genera from *Amaryllis* L. 1753 (syn.—*Hippeastrum* Herb. 1821). Among genera that belong to the tribe *Galantheae, Galanthus* is separated by three distantly related genera from *Leucojum,* and the closely related *Lapiedra* is separated from it by seventeen distantly related genera. Among genera belonging to the tribe *Crineae,* the Cape Belladonna, *Brunsvigia rosea* (under a misapplied name, "Amaryllis belladonna"), a species, is separated from its genus, *Brunsvigia,* by two distantly related genera. These are only a few examples of the many that could be cited to show the utter chaos that reigns in the *Amaryllidaceae* as presented in the Atlas. All of this is due to the fact that the genera were not grouped under tribes.

In this connection it should be emphasized that the Cape Belladonna, *Brunsvigia rosea* is so closely related to other *Brunsvigia* species that fertile hybrids have been produced between them beginning over a century ago (Traub & Moldenke, 1949; Traub, 1954, 1957b; Hannibal, 1955, 1957). The available evidence shows beyond any doubt that the Cape Belladonna is a *Brunsvigia.* This is an excellent example showing the value of chromosome data and breeding experiments in solving a taxonomic problem, but Darlington and Wylie ignore the progress made and mark time.

Another instance showing the necessity of grouping the genera under tribes is revealed in connection with *Leptochiton quitoensis* (= *Hymenocallis quitoensis)* x=12. This *nomenclatural* genus differs from the *biologic* genus *Hymenocallis* only in having whitish-colored seeds, and thus has to *remain* united with the latter. When arranged under tribes, *Leptochiton,* if retained as a nomenclatural genus, would appear next to *Hymenocallis,* for which x=23 is indicated as the basic number in the Atlas. However, in a proper arrangement, *Leptochiton* is conspecific with *Hymenocallis* and the basic number of the latter would be indicated as x=12 and not 23!

Since the data for the *Amaryllidaceae* in the Atlas is hopelessly scrambled, the classification by Traub (1957a), on the tribal and generic levels together with the somatic numbers of the species in the Atlas, should be used until the chaos can be cleared up in a later edition of the Atlas.

III. RECOMMENDATIONS

Although in section II of this review specific instances have been cited where the present text of the Atlas is deficient, this should not be interpreted as a condemnation but rather as a purely constructive criticism toward the end that the Atlas may be made even more valuable in future editions. On the whole, the criticisms do not apply to the data for the other plant families included. The Atlas as a whole is therefore highly recommended to the members, with the reservations indicated for the *Amaryllidaceae.* It is believed that the Atlas is indispensable to all who are seriously interested in plant science.

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Traub, Hamilton P. and Harold N. Moldenke. *Amaryllidaceae:* Tribe *Amarylleae.* 1949.

THE R. H. S. DICTIONARY OF GARDENING, A PRACTICAL AND SCIENTIFIC ENCYCLOPAEDIA OF HORTICULTURE, edited by F. C. Chittenden; 2nd ed. 4 vols. pp. 2316. illus. $55.00. 1956; and SUPPLEMENT, pp. 334. illus. $10.00. 1956, both edited by P. M. Synge. Published by Oxford University Press, 114 Fifth Ave., New York 11, N. Y.

The second edition of this monumental work, and the first supplement, constitute a mine of information about plants suitable for cultivation in the British Isles and other temperate climates, and many tropical and subtropical plants cultivated all over the world. The general account of each genus is followed by descriptions of individual species (many illustrated), and hybrids that are widely cultivated. There are also general articles on gardening technic and definitions of botanical terms.

The second edition of the main work has not been reset, but cross references have been corrected, some additional references to illustrations have been inserted, and other smaller alterations have been made.

The supplement contains lists of recommended varieties of flowers, fruits and vegetables. Over 200 pages are devoted to corrections to the first edition of the main work, and to new articles on subjects that were omitted from the first edition of the main work, or subjects which have developed since publication to such an extent as to need fresh treatment. Special emphasis is given to pest control.

This monumental work and the supplement are a must for all who are interested in horticulture.

PLANT PROPAGATION by J. P. Mahlstede and E. S. Haber. pp. 413. Illus. 1957. $7.50. John Wiley & Sons, 440 4th. Av., New York 16, N. Y. This new book on plant propagation for the beginning student, the experienced seedsman, and nurseryman fills a definite want. The parts of the book are devoted to the basic principles of propagation, sexual and asexual increase of higher plants, propagation structures and increase of specific plants. This is a new and refreshing treatment of an important subject, and the book is highly recommended.

In a later revised edition, it is hoped that the subject of increase of *Amaryllis, Allium, Crinum,* etc., by vertical bulb cuttage (See Traub—Amaryllis Manual, Macmillan. 1957) will be included.

EVOLUTION, GENETICS AND MAN, by T. Dobzhansky. John Wiley & Sons, 440 4th Av. New York 16, N. Y. 1955. Pp. 398. Illus. $5.50. The purpose of this new book is "to show to the student that biology is not only a craft which is interesting to technicians and devotees but also a part of the fabric of humanistic thought." The early chapters deal with elementary genetics and provide a foundation for understanding of the process of evolution that is elaborated in the rest of the book. This inspiring book is highly recommended to all.

SOIL PHYSICS, by L. D. Baver, 3rd ed. John Wiley & Sons, 440 4th Av., New York 16, N. Y. 1956. Pp. 489. Illus. $7.75. This revised edition of a standard work on soil physics is in many respects a new book which includes recent major contributions to the subject. It is designed primarily for advanced undergraduate and graduate college students. The book begins with a discussion of the fundamental make-up of the soil and progresses through physical properties of the various soil components. It is highly recommended.

BOTANY; AN INTRODUCTION TO PLANT SCIENCE, by W. W. Robbins, T. E. Weier and C. R. Stocking. 2nd ed. John Wiley & Sons, 440 4th Ave., New York 16, N. Y. 1957. Pp. 578. Illus. $6.95. This improved and modernized revision of an outstanding text on plant science, written in simple language, has been designed with the student in mind. It emphasizes "the plant as a whole as a living, functioning organism" with increased stress on plant physiology. The other phases of the subject receive adequate attention. It is highly recommended.

BOTANY; A LABORATORY MANUAL, by T. E. Weier, C. R. Stocking and J. M. Tucker. 2nd ed. John Wiley & Sons, 440 4th Av., New York 16, N. Y. 1957. Pp. 175. Illus. $2.95. This is an excellent laboratory manual. The revisions are concerned mostly with adding material to keep its subject matter in line with the

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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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[AMERICAN AMARYLLIS SOCIETY, continued from page 2.]

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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.

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second edition of Botany; An Introduction to Planr Science, which is reviewed above. The manual is also highly recommended.

HANDBOOK FOR VEGETABLE GROWERS, by J. E. Knott. John Wiley & Sons, 440 4th Av., New York 16, N. Y. 1957. Pp. 238. $3.95. This handbook brings together in concise tabular form much of the widely scattered information that relates to vegetable production. It is highly recommended to those engaged in vegetable growing.

SOIL STERILIZATION, by W. J. C. Lawrence. Macmillan Co., 60 5th Av., New York 11, N. Y. 1956. Pp. 169. Illus. $3.50. The purpose of this important new book is to bring the facts about soil sterilization under one roof with emphasis on new information and precision in soil sterilization. This is a must for all who grow plants.

AN INTRODUCTION TO PLANT TAXONOMY, by G. H. M. Lawrence, Macmillan Co., 60 5th Av., New York 11, N. Y. 1955. Pp. 179. Illus. $3.25. This is an abridged form of the author's longer work on Plant Taxonomy previously reviewed here. The present book was written "for the adult amateur botanist and the student of a local flora course at the college level", and is restricted in scope to vascular plants—ferns, gymosperms and flowering plants. This clearly and concisely written text is highly recommended.

CHEMISTRY AND USES OF PESTICIDES, 2nd ed., by E. R. de Ong. Reinhold Publ. Corp., 430 Park Av., New York 22, N. Y. 1956. Pp. 334. Illus. $8.75. In this second edition the entire text has been rewritten and brought up-to-date. It includes valuable information on insecticides, fungicides, herbicides, rodenticides, repellents and seed disinfectants. This excellent text is highly recommended to the college instructor, manufacturer, research worker and farmer who is concerned with pest control problems.

CHEMISTRY OF THE SOIL, edited by F. E. Bear. Reinhold Publ. Corp., 430 Park Av., New York 22, N. Y. 1954. Pp. 373, $8.75. This comprehensive coverage of the chemical aspects of soils in relation to their development, present constitution and uses, includes contributions from fourteen outstanding soil chemists. This handy volume of useful information is highly recommended for soil scientists, biochemists, food chemists, large-scale farmers, manufacturers of liming materials, fertilizers, soil conditioners, insecticides and other agricultural chemicals.

A NEW COURSE OF PLANTS AND ANIMALS; Book I, by M. A. Grigg. Cambridge Univ. Press., 32 E. 57th St., New York 22, N. Y. 1956. Pp. 216. Illus. $1.50. This clearly and concisely written book is intended as a guide during the first three years of grammar school. It includes chapters on the aquarium, small and larger animals in fresh water, animal life in gardens and countryside, flowers and seeds, and structure of a flowering plant. Highly recommended.

THE HISTORY OF THE BRITISH FLORA, by H. Godwin. Cambridge Univ. Press., 32 E. 57th St., New York 22, N. Y. 1956. Pp. 384. Illus. $16.50. On the basis of all available well-dated records of plant remains of the whole Quaternary Period, Dr. Godwin gives an outline of the course whereby the British flora reached

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PLANT LIFE

VOLUME 13

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HAMILTON P. TRAUB
HAROLD N. MOLDENKE

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