PLANT LIFE

AMARYLLIS
YEAR BOOK

1974

Amaryllis leopoldii T. Moore (1870) with the most regular flower in the genus; first collected by Richard W. Pearce, who referred it to Peru; lost under cultivation; rediscovered by the late Dr. Martin Cardenas in the mid-1960's to 1971 in Bolivia, its true natural habitat.

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

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

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All editorial correspondence should be addressed to: Dr. Hamilton P. Traub, *Editor, The American Plant Life Society, 2678 Prestwick Court, La Jolla, Calif. 92037.*

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DR. THOMAS W. WHITAKER, *Executive Secretary*
The American Plant Life Society
Box 150, La Jolla, California 92037

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HAMILTON P. TRAUB
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REGISTRATION OF NEW HYBRID **NERINE** CLONE

Registered by Hamilton P. Traub, La Jolla, Calif.

Nerine clone 'Scarlet O'Hara' (Traub, 1973), leaves produced after the flowers; scape 10″ high; umbel 10 or more-flowered; fls. upright, color intense scarlet (HCC-19) self, floret 4.5 cm. across face, tepals 2.5 cm. long, very slightly ruffled, otherwise regular, stamens 4.5 cm. long.

AMARYLLIS JUDGE'S CERTIFICATES—continued from page 28.

No. 197. Mrs. Enoch Johnstone, 1016 Maxey Road, Houston, Texas 77015. Horticulture only.

No. 198. Mrs. C. E. Keener, 610 E. Wilkins Street, Angleton, Texas 77515. Horticulture only.

KEEPING UP WITH LATEST DEVELOPMENTS.—Current progress in the judging of Amaryllis is recorded in the Amaryllis Year Book. In order to insure that those holding Amaryllis Judge's Certificates keep up with these new developments, all certificates issued are valid only when presented with the current membership card of the American Plant Life Society which includes membership in the affiliated American Amaryllis Society. After several years a refresher course is recommended.

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BIOGEOGRAPHY: AN ECOLOGICAL AND EVOLUTIONARY APPROACH, by C. Barry Cox, Ian N. Healey and Peter D. Moore. Halstead Press, Div. John Wiley & Sons, 605 3rd Av., New York, N.Y. 10016. **1973.** Pp. viii + 184. Illus. Biogeography is concerned with the distribution of organisms in space and time. "This book outlines the basic principles and interactions of ecological and evolutionary biology and geography in such a way that students whose main study lies within either subject will readily understand them—even if they have had little or no previous biological knowledge. Throughout the emphasis is placed on the role of man as an increasingly dominant influence on the ultimate fate of the rest of the fauna and flora. The particular lessons to be learned from island faunas and floras are outlined. A brief account is given of the process of continental drift, and of the way in which the present patterns of life have gradually evolved. Finally, attention is drawn to the necessity of conserving our environment and the genetic resources of the world's faunas and floras. Very highly recommended to all interested in ecology, and the conservation of national resources.

PLANT ECOLOGY: PLANTS, THE SOIL AND MAN, by M. G. Stafelt. Translated from the Swedish by Margaret S. Jarvis and Paul G. Jarvis. Halsted Press, Div. John Wiley & Sons, 605 3rd Av., New York, N.Y. 10016. **1973.** Pp. xi + 592. Illus. Paperback $17.50. The late Prof. Stafelt was one of the pioneers in ecological research, and "he was acutely conscious of the delicate balance of nature and how easily man can upset it . . . . The central theme of the book is the balance between the production of vegetation and the crops taken from it by mankind. Starting with a general discussion of the plant environment, it leads through descriptions of the various environmental factors, soil, water, litter, etc., to discussions of their interrelationships and interactions with vegetation. Finally, in a discourse on the influence of man on all these things, Stafelt puts forward a strong plea for urgent conservation measures not only for plant life of this planet but also for soil on which it depends." Very highly recommended to all interested in ecology and the conservation of natural resources.

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AMARYLLIS
YEAR BOOK
1974

Year Book of

The American Amaryllis Society

41st Issue

GENERAL AMARYLLID EDITION

EDITED BY

HAMILTON P. TRAUB

THOMAS W. WHITAKER

HAROLD N. MOLDENKE

THE AMERICAN PLANT LIFE SOCIETY

Box 150, La Jolla, California 92037

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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A Committee of the American Plant Life Society

DR. THOMAS W. WHITAKER, Executive Secretary

Box 150, La Jolla, Calif. 92037

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Correspondence about auxiliary membership of regional and local societies in the Society should be addressed to: Dr. Thomas W. Whitaker, Executive Secretary, Box 150, La Jolla, Calif.

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The Amaryllis Society of Baton Rouge, Louisiana, Dr. Joseph K. Mertzweiller, 9266 **N.** Parkview Dr., Baton Rouge, La. 70815.

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Chile—Prof. Pedro F. Ravenna, Santiago

PREFACE

We are indebted to Prof. Penrith B. Goff of Wayne State University, Detroit, Michigan, for the beautiful cover design featuring *Amaryllis leopoldii* recently re-discovered in Bolivia, its true habitat, and not native to Peru as alleged by Pearce in 1865.

This 41st annual edition of HERBERTIA, THE AMARYLLIS YEAR BOOK, is dedicated to Sr. Pierfelice Ravenna of Santiago, Chile for his outstanding contributions toward the advancement of the Amaryllidaceae and Iridaceae. Since the mid-1950's he has consistently labored in this field making plant collecting trips in South America. He has interpreted the plants collected leading to the discovery of many new species and some genera which he has published in scientific journals in South America, and in PLANT LIFE in North America. In the present issue of PLANT LIFE, he contributes an excellent article, the 6th in a series, on "Contributions to South American Amaryllidaceae". For his outstanding contributions to science he has received the WILLIAM HERBERT MEDAL of the American Plant Life Society.

In the present issue of the Amaryllis Year Book, Sr. Ravenna favors us with an interesting autobiography.

Various important articles on Amaryllis appear in the present edition. The confusion about the habitat of *Amaryllis leopoldii* is cleared up. Dr. Cage reports on true-breeding *Amaryllis* lines; Dr. Bell reports on stomatal size and polyploidy in *Amaryllis,* and tetraploid *Amaryllis evansiae.* Mr. Narin contributes a review of *Amaryllis* chromosomes; and Dr. Nowicki and colleagues contribute articles on mosaic virus disease, and its elimination in *Amaryllis.* Mr. Allan Rogers and the Shannons write about their interest in *Amaryllis.* Mr. Kendall reports on his Amaryllid experiences in Kansas.

Mr. Manning reports on a possible Amaryllis-Sprekelia cross. Mr. Ellenbecker writes about *Hymenocallis azteciana* and the propagation of *Haemanthus* by cuttage. Mr. Hardman reports on the repotting of the Greenoaks Nerines, and presents his annual report as Chairman of the Nerine Committee for 1973. Mr. Tisch gives the annual report of the Zephyrantheae Committee, and Mr. Buck presents his yearly report of the Daylily Committee. There are reports on the regional Amaryllis shows, and still other important articles as shown in the table of contents.

The members of the Society were saddened by the death of Dr. Martin Cardenas Hermosa of Cochabamba, Bolivia in 1972, and Mr. Aleck Korsakoff in 1973. They will be missed by all. Appropriate In Memoriam notices appear in the present issue.

Contributors to the 1975 issue of the AMARYLLIS YEAR BOOK are requested to send their articles by August 1, 1974, in order to insure earlier publication of this edition. Unless articles are received on time, publication will again be delayed to June or July or even later as with some issues in the past. Your cooperation toward earlier publica-

tion will be greatly appreciated. *Those having color slides or transparencies which they wish to use as the basis of illustrations, are requested to have black-and-white prints made, and to submit these with their articles.*

December 15, 1973,
2678 Prestwick Court,
La Jolla, California 92037

Hamilton P. Traub
Thomas W. Whitaker
Harold N. Moldenke

PLANT LIFE LIBRARY—continued from page vi.

NEW YORK TIMES BOOK OF HOUSE PLANTS, by Joan Lee Faust. Quadrangle Books, 330 Madison Av., New York, N.Y. 10017. **1973.** Pp. vi + 274. Illus. $9.95. This outstanding new book on house plants will be welcomed by indoor gardeners generally. After a brief introduction, the care of house plants is discussed, including the requirements, for light, moisture, air, temperature and humidity requirements, soil and fertilizers, potting and pruning. These discussions are followed by a garden calendar, indicating the gardening operations for each month of the year. This is not all—a section is developed to "Plants to Grow," from **Achimenes** to **Wax Plant (Hoya)**, and with an added selection of unusual plants. Then, digging deeper into house plants, the author discusses gardening under lights, indoor gardens, office plants, bottle gardens and terrariums, hanging plants, topiary art, standards, forcing bulbs, fun for children, and propagation. An appendix about house plant societies, plant suppliers and a glossary, list of Latin and common names, and an index complete the volume. Highly recommended to all gardeners.

HOUSE PLANT IDENTIFIER, by Helmut Bechtel. Sterling Publ. Co., 419 Park Av. So., New York, N.Y. 10016. **1973.** Pp. 256. Illus. Trade Ed. $3.50; Library Ed. $3.69. The author, a well-known nature photographer, shows how to identify 47 important plants, and besides each, provides a full-page illustration from a color photograph. The reader has but to page through the book to locate the illustration which matches his living plant. In each case he provides the scientific, name description, and cultural directions. Highly recommended.

TINY LIVING THINGS, by Edouard Cauvin. Sterling Publ. Co., 419 Park Av. So., New York, N.Y. 10016. **1973.** Pp. 104. Illus. Trade ed. $3.50; Library ed. $3.69. This is one of the volumes in the Sterling Nature Series and is intended for young readers, and also for older folk who wish to study nature. The use of the microscope brings the "unusual, rare, beguiling, magical out of the wing of the moth, the eye of the dragon fly, or a spider's web" and so on, and in this way one may explore a world in miniature with journeys indoors and outdoors. This fascinating, easy to read text together with 100 full and half page close-up photographs makes this an outstanding nature book. Highly recommended.

ECOLOGY: CYCLE AND RECYCLE, by Grace Holden Kolbas. Sterling Publ. Co., 419 Park Av. So., New York, N.Y. 10016. **1972.** Pp. 168. Illus. $7.95. This is the 5th volume in the Basic Biology in Color Series. The book is profusely illustrated in color, and is calculated to unfold gradually the role of ecology in the life cycle of living things. The chapters are devoted to food chains, producers and consumers, secondary consumers, decomposers, food webs, pyramids, habitat, niche and heredity, plant successors, ecosystems and biogeography, the future of agriculture, and conservation and pollution. This fascinating text was prepared for use in high school biology departments with new ecology courses. Highly recommended.

PLANT LIFE LIBRARY—continued on page 5.

DEDICATED TO

PIERFELICE RAVENNA

PLANT LIFE LIBRARY—continued from page 4.

VEGETATION OF NEW JERSEY: A STUDY OF LANDSCAPE DIVERSITY, by Beryl Robihaud and Murray F. Buell. Rutgers University Press, 30 College Av., New Brunswick, N.J. 08903. **1973.** Pp. xii + 340. Illus. $12.50. This timely informative and adequately illustrated book by two outstanding authorities on the ecology of New Jersey is based on a sound scientific basis and is in addition a delightful volume to read. "The book begins with a description of New Jersey as an ecosystem—its geology, topography and soil, climate, plant-plant and plant animal relationships, and the influence of man on the environment. Maps show geologic, soil, and climatic zones of the state, and the impact of man's settlement on forest cover. Vegetation—the total plant cover—is composed of different types of species of plants that grow together in groups called plant communities. Twelve types of plant habitats are distinguished in New Jersey and the plant communities in each are described. Photographs illustrate plant life in related groups and as individual specimens. The authors warn that it will not be easy to conserve for future generations the diverse natural vegetation that exists today." It is highly desirable to have similar studies for each of the remaining 49 states. It is hoped that this timely book will serve as a model. Very highly recommended to all citizens in the hope that this will contribute toward the conservation of our natural resources.

PLANT LIFE LIBRARY—continued on page 14.

HERBERT MEDALIST—PIERFELICE RAVENNA

PIERFELICE RAVENNA

An autobiography

According to my father, I was born on a beautiful spring morning on March 8, 1938 at eight o'clock in the ancient City of Bologna, Italy. I am the second child, after my elder sister, Grazio Enrico Ravenna, and Luciana Sonino Ravenna.

The first years of my life were endured under conditions of injustice and persecution against people of the Jewish faith. It was the beginning of the War . . . In 1941, since the humiliations were no longer endurable, my parents decided to immigrate. Argentina was the country chosen, and thus I spent the rest of my childhood there, and there carried on my regular school studies.

During the years of the elementary studies, I used to say that I would be an engineer. In fact, in my walks to school and return, I often stopped fascinated at any building under construction and talked with the bricklayers regarding the details of building. However, while studying botany in the first year of the secondary school, I discovered the wonderful world of plant life. Prof. Pinto used to encourage his pupils to observe and collect living plants. These greatly impressed me since I always looked for beauty. I was thirteen years old. In subsequent years, my interest in plants became so intensive that it even displaced the pleasure of hearing classic music.

I began then to collect seeds of any interesting plants along the railroad tracks or in gardens, and to grow them. Sometimes I even missed classes at school in order to go far afield to find wild *Iridaceae.* This plant family became my chief interest ever since I saw for the first time the charming flowers of *Iris japonica.* It was on one of these occasions that I "played hookey" in order to search the Paranà Delta for the beautiful *Cypella herbertii.* This desideratum was fortunately found and introduced in my plant collection. It was only later that I also became interested in the *Amaryllidaceae.*

When I was fifteen, I discovered by chance the Faculty of Agronomy and its small Botanical Garden. The latter was scientifically arranged in order to serve for the purpose of teaching. This was a lucky event! I entered and then looked up the collection of the *Iridaceae,* but was greatly dissapointed—most of the plants there were not labeled to show their identity. Looking around, I saw a man wearing a white apron who was pruning shrubs. "Why", I asked, "are these plants not named?" His reply: "Bulbous plants are generally difficult to identify when dry, and for this reason no botanist wants to study them." He brought me to his office and we had a delightful discussion on botany. This man was the late distinguished Professor Lorenzo R. Parodi. Since that time I had often visited with him, and I began the systematic study of the *Iridaceae,* especially the genus *Sisyrinchium.* Prof. Parodi indicated to me the Institute de Botánica Darwinion as the best place for the improvement of my knowledge about the last named genus. Since

that time I became a frequent visitor to that Institute, which has the richest botanical library in Latin America.

In 1955, during a trip to Italy, I visited several botanic gardens and had the opportunity of collecting some European Irids. On the way back, at the seaport of Salvador, Brazil, I was impressed by the beauty of *Neomarica sabinii* and *N. coerulea,* commonly grown in gardens there.

The next year I entered as a student in the Faculty of Agronomy of the University of Buenos Aires. When I was in second year of my studies, Prof. Parodi encouraged me to present my first discovery at the Meeting of the "4as Jornadas Argentinas de Botánica". This paper was entitled, "*Catillandra* génere nueve de Iridáceas". This was an unforgettable experience since I became acquainted with several botanists, including some from other countries.

Later, in 1959, I obtained a scholarship at the Institute de Botánica Agrícola (I.N.T.A.) and worked for a year in the Herbarium of the Argentine Museum of Natural History. The access to large collections of Herbarium specimens and a valuable library at this institution, provided the opportunity for increasing my knowledge of the *Iridaceae.* This experience convinced me that only the examination of living plants, in the wild or under cultivation, would provide information on the generic limits and the proper evaluation of the morphological characters in this family. With this idea in mind, I undertook some short trips to the Province of Misiones, in the northeast, and the Uruguay Republic; and I planned my first long trip to the Andes. I was twenty-one years old and had an ardent enthusiasm. Unfortunately, no aid could be obtained for this purpose from the botanical institutions. In spite of this, I decided to pursue the project with my own limited means.

Previously, I had the opportunity of knowing Mr. Salvador Magno, a fine artist, whose speciality is the illustration of native animals and plants. He is also a distinguished collaborator in the natural sciences. Insects and plants have been named in his honor (e. g., *Habranthus magnoii*). Since that time a mutual cooperation and a close friendship has existed between us. Actually a large part of my own studies on plants was stimulated by his encouragement and help. Other friends that collaborated by collecting bulbs in the field were Dr. John Christie, an enthusiastic amateur, and the enthomologist Antonio Martínez (see *Habranthus martinezii*), both from Buenos Aires.

In January 1960, I left Buenos Aires on a trip to the North. The explorations began in the Province of Córdoba, Argentina, and ended in the Department of Piura, Peru, nine months later! The bulbs collected were sent to Mr. Magno, who cared for them during my absence. In Peru, I was impressed by the beauty and amazing diversity of the *Amaryllidaceae,* and since that time my interest in this great group has greatly increased. Many species of *Iridaceae* and *Amaryllidaceae* were collected and introduced for further study. The Irids flowered wonderfully in culture the same year and in 1961, but gradually died out in successive years. Some observations made on this trip still remain to be published.

In December 1961, I journeyed again to northwestern Argentina and northern Chile. On this trip I collected several new *Habranthi-H, niveus, H. andalgensis, H. catamarcensis, Famatina saxatilis;* and *Tigridia philippiana.*

In November 1962, I again left Buenos Aires, this time for a twenty days' journey to Brazil, but only returned after thirteen months! The great, rich flora of the marvelous country detained me for about eight months and a half. On the same trip I explored Ecuador, Columbia, Costa Rica, Guatemala, and Mexico. Many new species of the genera *Trimezia, Pseudotrimezia, Calydorea, Alophia, Tigridia, Nemastylis,* as well as several new genera in the *Iridaceae,* and species of *Griffinia, Amaryllis* and others, in the *Amaryllidaceae,* were discovered during that trip. About ten additional short trips to Brazil to new areas were made in six subsequent years. In this latter country, I was assisted in several occasions by Mr. Guido F. J. Pabst, Director, Herbarium Bradeanum, Río de Janeiro.

One of the main objectives of these trips was to collect in their original habitats as many species as possible. This would fix the habitats of the species collected in order to correct misinformation in the literature due to carelessness in making records in the past. It has been necessary to follow the routes of several plant explorers of the last century, such as Gardner, Mandon, Martinus, Mathews, Pringle, Spruce, and others, and attempt to find the present day successors of the populations that they found.

My first article was printed in 1964, and was entitled "Notas sobre Iridaceae". Twelve new species from different parts of Latin America, and a number of new combinations were published in that work. Some of the most attractive new species described were *Cipura flava* (Brazil, Venezuela), *Mastigostyla mirabilis,* (Argentina), *M. major* (Peru), and *Tigridia tepoxtlana* (Mexico).

In 1965, I received a first letter from Dr. Traub inquiring about my Amaryllid collection, and my intention concerning it. He was apparently informed by the late Wyndham Hayward, who had been my previous correspondent, that I had some interesting species under experimental culture. Since that time, a steady exchange of information has been maintained. Dr. Traub encouraged me to publish on the *Amaryllidaceae* by offering space in PLANT LIFE for this purpose. He has greatly stimulated my research in the latter family by sharing his wide knowledge of this great group. I also appreciate very much his human quality and his friendship.

The first article of my own that was published in *PLANT LIFE* was entitled "*Nothoscordum felipponei,* its status and chromosomes", which appeared in 1967. In the same year the first of my "Contributions . . ." was published in *Sellowia,* the Brazilian journal. The latter article included descriptions of several new species. Some of these are *Amaryllis aviflora, Hieronymiella aurea, Zephyranthes flavissima,* and *Z. stellaris.*

In 1969, I entered the Servicio Nac. de Parques Nacionales in order to collaborate on the "Flora de la Región Andino-Patagónica", which is edited by Prof. M. J. Dimitri. I was then intrusted with the monography of the Cruciferae for that work. In this capacity I needed to examine the type-material of the late great R. A. Philippi deposited in the Natural History Museum of Santiago, Chile. My initial stay at the Museum was to be a month and a half in length. However, this was long enough to meet and become acquainted with Senorita Cleo Valenzuela. We were married in August 1970, and make our home in the City of Santiago, Chile. I obtained a teaching position in the Universidad de Chile.

Casilla 21128, Sucursal 21,
Santiago, Chile,
June 11, 1973

MARTIN CARDENAS HERMOSA*
BOTANIST EXTRA-ORDINARY
1899—1973

This morning I have chosen to present to you an outline of the achievements of a remarkable individual, an outstanding botanist, a prolific contributor to our understanding of the Amaryllidaceae, and one of the most distinguished scientists yet produced in Latin America. I am speaking of Martin Cardenas Hermosa, (dropping of the mother's name is usual for Latin Americans with contacts in Europe and the United States). Dr. Cardenas was born of Indian parents in the city of Cochabamba, Bolivia, on November 12, 1899. He died February 14, 1973 at the age of 73, a victim of a malignancy of the prostate. Cardenas was a strong, active, ruggedly handsome man, much larger, more active, and younger appearing for his age than most Bolivians. Although, he enjoyed the company of attractive women, he never married.

Botanically speaking, Martin Cardenas was truly a man for All Seasons. He made important contributions to the taxonomy and systematics of such diverse groups as mushrooms, succulents, cacti, and *Solanum,* particularly potatoes. In addition, he became *the* authority on the Flora of Bolivia. While his interest in the Amaryllidaceae was not aroused until the later years of his life, he collected and identified approximately one dozen new species of *Amaryllis.*

Dr. Cardenas was the author of many technical and popular articles about his specialities. On his own and in collaboration with colleagues, he was also the author of several books. One of the best known is the "Manual of the Economic Plants of Bolivia", published in 1969. According to his good friend Sr. Jose Marquez, a lawyer, Cardenas had

* Substance of a lecture delivered to the Southern California Amaryllis and Hemerocallis Club on October 20, 1973, at the Los Angeles State and County Arboretum, Arcadia, California.

just completed a manuscript at the time of death with the title, "Recollection of a Naturalist; Travels in the Andes, Argentina, United States and Europe". This account of his travels, research, and cooperation with other scientists has just been published in Cochabamba, Bolivia. He had made plans or actually commenced work on monographs of the Bolivian species of *Amaryllis* and the Bolivian species of wild potatoes.

Cardenas as a youngster made normal progress thru the primary and secondary schools of his native city, graduating in 1917. In 1918, he entered the Universidad de San Andres, in La Paz, Bolivia. Here he enrolled in the Instituto Normal Superior, choosing the section of the Biological Sciences for his major. In 1921, just 4 months prior to graduation from this University he was ordered by the Bolivian Government to join the Mulford Biological Expedition whose purpose was to explore the Northeast corner of Bolivia. This vast and still poorly known territory includes the headwaters and drainage basin of the Rio Beni, an important tributary of the Amazon. This opportunity to join and work with the personnel of the prestigious Mulford Expedition in a botanical exploration of a portion of the Amazon Basin had profound effect on the career of this young Bolivian botanist. In fact, it seemed to be a turning point, adding purpose, and direction to his life.

The goal of the Mulford Expedition, which was in the field from 1921 thru the greater part of 1922, was to explore the drainage area of the Rio Beni, primarily for plants of potential importance for the pharamaceutical industry. The Mulford Expedition was probably the most famous of the plant hunting expeditions sent to Latin America during this century. Certainly it received the most publicity both before it departed, and after it returned, of any comparable endeavor. The data concerning the collections, observations, and experiences of the Expedition have been recorded in numerous technical reports, and several books. Of the books, "Black Waters and White", must have sold as many as ten thousand copies or more.

The personnel of the Expedition included some well-known scientists, notably Professor H. H. Rusby, the Leader, who was an experienced Latin American explorer, and was Dean of the School of Pharmacy, Columbia University; Dr. William Mann, a brilliant entomologist, who later became director of the National Zoo, Washington, D.C.; Dr. O. E. White, botanist and geneticist, and future Director of the Blandy Experimental Farm, University of Virginia; and several others. Cardenas made the most of these contracts, and these people were the source of a number of lifetime friendships.

On his return from the Amazon with the Mulford Expedition, Cardenas was awarded the degree of Professor of Biological Sciences, and was immediately made Lecturer in this Department at the Instituto Normal Superior at La Paz, where he served until 1930. His main task in this position was to familiarize students with the rich Bolivian flora. From 1932 to 1933 he was Professor and Director of Natural Sciences at the Colegio Nacional in the city of Potosi. Potosi is located in the high Andes. This assignment provided an opportunity to study and collect

plants at high altitudes, an opportunity that was eagerly seized upon by the young botanist. From 1934 to 1935, he served with the Sanitary Corps of the Bolivian Armed Forces engaged in the Chaco War.

In 1935, Cardenas was sent by the Bolivian Government to Washington, D.C. to study the possibility of improving the culture of *Chinchona* specias (quinine) in Bolivia. Cardenas had considerable experience with *Chinchona* while exploring the forests of the Lower Amazon Basin. With this background, he was the logical choice to investigate quinine production and processing for his government.

In 1937, Cardenas was elected to the position of Rector (President) of the Universidad de San Simon, now called the Autonmous University of Cochabamba, in Cochabamba. He held this position until he resigned in 1946, but he continued with his teaching duties at the University, lecturing in botany, economic botany, genetics and plant pathology. He retired from the University about 1969. Thereafter, he devoted himself exclusively to botanical activities and travel abroad.

Cardenas was a widely traveled individual, not only in Latin America, but in the United States and Europe as well. He visited most of the countries of Latin America in pursuit of his botanical specialties. He represented Bolivia at three Latin American Botanical Congresses, and he made several trips to the USA, once as the guest of our Department of State. Three trips were made to Europe to study in herbaria, and to work with specialists with similiar interests. In 1966, he attended and presented a paper at the 37th Congress of Americanists at Mar del Plata, Argentina. It was at this Congress that I first met Cardenas. He urged me to return with him to Bolivia for the purpose of collecting *Amaryllis*. As it turned out I should have accepted the invitation because circumstances prevented me from returning to South America until 1970. At this late date Dr. Cardenas was in declining health, and he was not able to accompany us on all of our collecting trips. He did, however, send with us his student and assistant, Ing. Elias Meneses.

Dr. Cardenas received many honors. He was designated Doctor in Sciences, "*Honoris causa*" by his University in 1937. He was the first recipient of the Interamerican Agricultural Medal awarded by the Interamerican Institute of Agricultural Sciences at Turrialba, Costa Rica. He received the Mary Soper Pope Medal, awarded by the Cranbrook Institutes of Sciences, Bloomfield Hills, Michigan. He was elected a Corresponding Member of the Botanical Society of America, a Life Member of the Potato Association of America, and a Foreign Member of the Linnean Society of London. One of the honors in which he took the most pride was the William Herbert Medal awarded to him by the American Plant Life Society in 1967 for his work with *Amaryllis*.

It was a curious fact that Cardenas was first stimulated to take a serious interest in *Amaryllis* by a visit from the late Professor Ira S. Nelson of Southwestern Louisiana State University, Lafayette, in 1954. Nelson was an experienced plantsman, and he had the knack of making Horticulture an exciting experience for anyone with whom he came in

contact. Nelson and Cardenas made three trips, one in the vicinity of Cochabamba in 1954, and in October 1958, a short trip to San Ignacio de Velasco, and in November, 1958 a more extensive trip thru the Bolivian yungas. Much material of value for American gardens was collected on these trips. Our own J. L. Doran, along with H. L. Bush collected *Amaryllis* with Dr. Cardenas on the new road which borders on the river Bopi in the south yungas of Bolivia in September of 1970.

Considering his multitude of other activities, Cardenas' taxonomic achievements are truly prodigious judged by any set of standards. He published 4 new genera and 120 new species of the Cactaceae of Bolivia, 20 new species of wild potato *(Solanum)*, along with about a dozen new species of *Amaryllis* mentioned earlier. He collected about 6500 numbers of Bolivian plants for his Herbarium Gardenasianum, as he called his private collection.

Martin Cardenas served American horticulture well, and indeed the entire world, by enhancing our gardens with a generous sample of the rich and varied flora of Bolivia. Thru his efforts we know that Bolivia is copiously endowed with species of *Amaryllis*, and is probably the geographic center of distribution for the genus. Unfortunately, there is no one in Bolivia with the talent, energy, ability, and experience to carry on his work. He willed his herbarium, books and botanical records to the University of Tucuman, located at Tucuman in Northern Argentina.

Martin Cardenas was friend and advisor to innumerable horticulturists, and botanists of all persuasions and from many countries. The world of plant sciences will be the poorer for his passing.

Acknowledgements: In preparing this article I have received invaluable help from several individuals, notably Dr. Hugh C. Cutler, Missouri Botanical Garden, St. Louis, Missouri; Sr. Jose Marquez, Cochabamba, Bolivia; and Mr. L. J. Doran, Burbank, California. Without the assistance of my daughter, Mrs. Gilbert Rogers, who translated Sr. Marquez's notes and other materials, this account of the life and work of Martin Cardenas would not have been possible. I am much indebted to all of these people for their unselfish assistance.—*Thomas W. Whitaker*

IN MEMORIAM—ALEK KORSAKOFF, 1894-1973

Some years ago, an article on Alek Korsakoff in the Fairchild Garden Bulletin described him as "wonderfully extroverted, like a character in a Dostoyevsky novel." True—but more than that he was a fine horticulturist, a generous human being and a deeply religious man.

One may find it difficult to understand, after reading Alek's autobiography in the 1969 issue of Plant Life, how he could settle down to the comparatively quiet life of a horticulturist. But to him the growing and blooming of plants was a happy adventure. When he was sexton of the Miami City Cemetery, he converted it into a beautiful botanical garden of rare shrubs and trees. Botanists visited it and garden clubs held their meetings there.

When Fairchild Garden (in Miami) was established, he became an active member, contributing not only plants but also a large sum of

money in life memberships.

His years in Jacksonville were especially happy. He shared a large greenhouse with his wife Meta. In his half he grew thousands of plants, including the Amaryllids which were his favorites.

Alek kept up a vast correspondence with friends in all parts of the world. One had only to express an interest in horticulture and instantly there would be a warm, friendly letter, followed by boxes of plants. Alek produced an enormous number of hybrids, particularly among the Amaryllis and rain lilies, and periodically he would send boxes of bulbs and plants to his friends. He believed, too, that friends should be shared and took great delight in having them meet, via letters or in person.

A devout Christian, his faith never wavered even when he learned that he had terminal cancer. I am sure he would not wish me to dwell on his illness. Rather, I think he would wish me to pay tribute to his wife Meta for her devotion and care, and to thank his many friends who continued to write to him during the long months when he was helpless and unable to communicate with them.

Many of us will miss his exuberant letters. Only a year ago he wrote "My half of the greenhouse is 'ablooming' ". May his plants bloom for us too.—*Mrs. F. J. Pahls*

PLANT LIFE LIBRARY—continued from page 5.

LECTURES ON PHOTOMORPHOGENESIS, by H. Mohr. Springer Verlag, 175 5th Av., New York, N.Y. 10010. **1972.** Pp. xii + 237. Illus. Paperback $14.80. The auther points out that the discovery of the reversible red far-red control of plant growth and development and subsequent **in vivo** identification and isolation of the photoreceptor pigment, **phytochrome,** constitutes one of the great achievements in modern biology. This important book presents a summary of the present state of the phytochrome concept in so far as it is required to understand developmental plant physiology (photomorphogenesis). This book is must reading for all plant physiologists. Very highly recommended.

RESIDUE REVIEWS: RESIDUES OF PESTICIDES AND OTHER CONTAMINANTS IN THE TOTAL ENVIRONMENT, edited by Francis A. Gunther and Jane Davies Gunther. Vol. 44 (1972, Pp. vii + 192); Vol. 45 (1973, Pp. vii + 168); Vol. 47 (Pp. vii + 198); Vol. 48 (1973, Pp. vii + 168). Springer Verlag, 175 5th Av., New York, N.Y. 10010. $16.50 per volume. These volumes are devoted to the study of residues of pesticides and other contaminants in the total environment and are of importance to everyone on planet earth. Since pest-control chemicals and food additive chemicals are essential to adequate food production, manufacture, marketing and storage, it is evident that without surveillance and intelligent control some of these persist in our foodstuffs. These residues could at times conceivably endanger the public health. In these four volumes contributions on the residue of pesticides and other food contaminants are published in the order in which they are received, and the mass of information is indispensible to all who are concerned with problems caused by the use of pesticides. These volumes are highly recommended to all who are engaged in the production, storage, marketing, regulation and consumption of foodstuffs.

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1973 HERBERT MEDAL PRESENTED TO DR. CESAR VARGAS CALDERON

Paul Ferree, Agricultural Attaché, Foreign Agricultural Service, U.S. Dept. Agric., at Lima, writes under date of Oct. 10, 1973, that at a municipal civic ceremony in the ancient capital of the Inca Empire, the 1973 WILLIAM HERBERT MEDAL was presented to Dr. César Vargas Calderón by the Lord Mayor of Cuzco, Peru, Senior Humberto Muñiz Polo in behalf of the American Plant Life Society. The arrangements in Cuzco were made through the Instuto Cultural Norteamericano with the actual presentation being made at an appropriate ceremony on Aug. 3, 1973.

Dr. Vargas is Emeritus Professor of Botany, University of Cuzco, and Director of the Herbario Vargas. He received the HERBERT MEDAL for his outstanding contributions in the field of plant science, particularly the Amaryllidaceae.

Fig. 2. Presentation of the 1973 HERBERT MEDAL to Dr. César Vargas Calderón at a civic municipal ceremony at Cuzco, Peru, Aug. 3, 1973.
Upper, The Lord Mayor of Cuzco, Senor Humberto Muñiz Polo is shown presenting the HERBERT MEDAL to Dr. Vargas.
Lower, Dr. Vargas is reading his responding speech.

EDITOR'S MAIL BAG

We have received the sad news that Alek Korsakoff of Jacksonville, Fla., passed away at 11:40 a.m. July 26, 1973. His many friends will miss him. The members are referred to a brief biography which he contributed to the 1969 PLANT LIFE (Vol. 25: 14-21. 1969), and the In Memoriam notice in the present issue.

Mr. James M. Weinstock, 10331 Independence, Chatsworth, Calif. 91311 has been appointed Registrar of amaryllid names to succeed the late Mr. James Edward Mahan, of New Orleans, who passed away in 1972.

Good news has been received from Holland! The firm of Ludwig & Co., Heemstede and Leo Berbee, Lisse, have merged and the combined firm plans to resume the selling of Amaryllis bulbs directly to gardeners in the United States *at retail* in the fall. Those interested should write directly to Ludwig & Co., Heemstede, Holland.

Mrs. A. C. Pickard, writes under date of July 7, 1973, that she has moved to 1909 Alta Vista, Alvin, Texas 77511 which is only 26 miles from my former home in Houston. "The city has grown so rapidly and traffic is a problem; so I decided to move out to a suburban home where I have a nice place to grow my Amaryllis collection away from the smog of the city."

Mr. Allan L. Rogers, Director, Department of Animal Care, University of Oregon Medical School, 3181 S.W. Sam Jackson Park Road, Portland, Oregon has been appointed to the vacant position of Northwest Regional Vice-President. He contributes a brief note about his interest in Amaryllis to the present issue.

Mr. Beckwith D. Smith, 2036 Post Street, Jacksonville, Florida 32204 writes under date of September 27 that he had meningitis in April and May of this year, and subsequently had to go back to the hospital for appendix removal, but that he is now on the mend, though quite weak. His many friends will be praying for his speedy and full recovery.

Mr. W. D. Morton, Jr., Emeritus Registrar of Amaryllis Names, has recently moved to the new address, 819 7th Av., Prospect Park, Pa. 19076. He has recently had cataract operations on both his eyes; his sight will be somewhat impaired, but he will not go blind. Mr. Morton still has a keen interest in Amaryllis, and has ordered Amaryllis bulbs and will show the blooms to all his friends at his new home.

1. REGIONAL ACTIVITY AND EXHIBITIONS

THE 1973 AMARYLLIS SHOW SEASON

The 1973 Amaryllis show season began with the New Orleans Intra-Club Amaryllis all horticulture Amaryllis Show on March 31. This was followed in April by the Corpus Christi 1973 Amaryllis Show on April 7 and 8; the 1973 Houston Amaryllis Society Show on April 8; the Greater New Orleans Official All-Horticulture Amaryllis Show on April 14-15; the 1973 Greater Houston Amaryllis Show, on April 15; the 1973 Amaryllis Society of Alabama Show on April 21-22, and the 1973 Southern California Amaryllis Show on April 29-30. No reports were received from the Hattiesburg, Miss., Amaryllis Society, and the Baton Rouge, Ala. Amaryllis Society, but reports from these societies are expected for the 1974 season.

NOTE TO AMARYLLIS SHOW ORGANIZERS

It is important to designate some one to write a *brief* review of the official show, and to send this promptly to Dr. Hamilton P. Traub, Editor, Amaryllis Year Book, 2678 Prestwick Court, La Jolla, Calif. 92037. *Your plans are not complete until this appointment has been made.* Only in this way is a permanent international record of your show assured.

1973 NEW ORLEANS INTRA-CLUB AMARYLLIS SHOW

L. W. Mazzeno, Jr.
944 Beverley Gardens Drive, Metairie, Louisiana

An added highlight to the Men's Amaryllis Club 1973 activities was the staging of our first Intra-club all horticulture Amaryllis Show on March 31, 1973 at the City Park Backer Room. Trophies were awarded to the two most outstanding plants. These were a 'Zenith', exhibited by Mr. L. W. Mazzeno, Jr. and an 'Apple Blossom', exhibited by Mr. A. T. Diermayer. Because of the success of this initial show, the members agreed to make it an annual affair.

This show was in addition to the regular show staged on April 14-15, 1973, which is reported separately below.

1973 CORPUS CHRISTI AMARYLLIS SHOW

Mrs. Carl C. Henny, *Corresponding Secretary,*
P.O. Box 3054, Corpus Christi, Texas 78404

I am glad to report that our Coastal Bend Amaryllis Society was able to have an Amaryllis Exhibit again this spring, in conjunction with

the "Festival of Flowers" show which was held in our City Coliseum on April 7th and 8th, 1973. We had a display of 67 entries despite the fact that our city experienced one of its worst winters in many years. We received light snow and sleet during both January and February, but very little rain during the month of March. Therefore, many of our amaryllis bulbs failed to bloom until after our show date.

Registered and named Amaryllis entered were 'Picotee Red Lining', 'Bouquet', 'Winter Carnival', 'Maria Goretti', 'Apple Blossom', 'Sight Show', 'White Christmas', 'Margaret Rose', 'Dawning', 'Royal Dutch', 'Firefly' and 'Little Sweetheart'.

Mrs. Roy Hornberger received the Silver Bowl Award for her entry of 'Picotee Red Lining' which scored 97 points and for her entry of 'Margaret Rose' which scored 94 points and also received an Award of Merit from the American Amaryllis Society for her entry of these two specimens. She also received the greatest number of blue ribbons given in the Ludwig Registered and Named Amaryllis Sections.

Mrs. Bill M. Miller, non-member, received a Special Trophy for her entry of 'Royal Dutch' which scored 96 points; also an Award of Merit from the American Amaryllis Society for this same entry.

Mr. R. L. Retallack, club member, received a Special Trophy for his entry in the Breeders Class, Leopoldii type, which scored 97 points.

Mrs. Carl Henny, club member, received the "Achievement Trophy" for receiving the next greatest number of blue ribbons in the Ludwig Registered and Named Amaryllis classes.

Preliminary Commendation Awards, given by the American Amaryllis Society, were awarded to Mr. R. L. Retallack, Mrs. R. E. Marburger —for her entry in the "Breeders Class" which scored 96 points, and to Mr. E. P. Adams for his new cross-pollinated Leopoldii type amaryllis which scored 95 points.

Thirty-two blue ribbons, 11 red ribbons and 1 yellow ribbon were awarded entries in the exhibit. Mrs. E. T. Story, Mrs. R. H. Parkinson, and Mrs. Robert Arnold, National Accredited Amaryllis Judges, from San Antonio, Texas were here to judge our Exhibit.

1973 HOUSTON AMARYLLIS SOCIETY AMARYLLIS SHOW

Mrs. A. C. Pickard, *Official Show Chairman and Judging Instructor for Amaryllis Judging Schools*

The Houston Amaryllis Society presented its annual Amaryllis Show April 8, 1973. Regardless of adverse weather conditions, such as

the extremely hard down pour of daily rain and cool days with late frost, we were fortunate to even be able to stage a flower show. therefore the show was void of the many tables of cut specimens in former years.

The annual presentation of the Houston Amaryllis Society show in this area in April for fifteen years makes it something many people talk to their friends about, the best publicity ever.

A show that consists of several parts always is more difficult to stage, but is more interesting. So it is with our show, which is planned with sections presenting the professional floral arrangements as a distinctive entry featuring the lovely Amaryllis florets.

Fig. 3. Houston Amaryllis Show, April 8, 1973. **Left,** Mrs. Clem Smith standing beside her exhibit of Amaryllis hybrid, 'Bouquet' (Ludwig) which received an award of Merit. **Right,** Mr. and Mrs. E. E. Koon at one table of their outstanding Educational Exhibit.

We are very fortunate to again have a well known professional leader in this section. This year Mrs. Ada Blankenship, a club member and Amaryllis Judge served as chairman of this division. As usual the educational exhibit under the leadership of Mr. and Mrs. E. E. Koon "real King and Queen of the set up", gave demonstrations on hybridizing, and culture of Amaryllis, and featured a large display of other members of the Amaryllis family.

It was amazing to see some beautiful potted specimens exhibited by the new members and to receive the awards and blue ribbons. Mrs. Clem Smith received the Award of Merit with potted plant, 'Ludwig's Bouquet'. Mrs. Vivian Johnstone received the high grade with cut speci-

men 'Ludwig Dazzler'.

Mrs. Ward Blair, president, and Mrs. A. F. Lagatski, vice-president and chairman, of the show and the whole Society feel that the show was very gratifying in spite of the inclemental spring weather.

The question often asked, how do you as a Society, sixteen years old, continue to put on the most interesting spectacle in the state? Well, the answer is—you have to grow quality, and have devoted members determined to set up the show in conformance to the American Amaryllis Society requirements. This makes it your show. Do you doubt it? Come and visit us next year; we'll be right back with the same old annual goal. Knowing—Growing—Showing and Sharing.

Fig 4. New Orleans 1973 Amaryllis Show. Three top winners—Dr. T. A. Calamari, Jr. **(left)**; Mr. A. T. Diermayer **(center)**, and Mr. H. H. Bowers, Jr., Show Chairman is holding the Ludwig Cup, and his prize winning 'Picotee Red Lining'. Photo courtesy **New Orleans The Times-Picayune.**

1973 GREATER NEW ORLEANS OFFICIAL ALL-HORTICULTURE AMARYLLIS SHOW

Mr. L. W. Mazzeno, Jr., *944 Beverly Gardens Dr., Metairie, Louisiana*

The Men's Amaryllis Club of New Orleans staged its fourteenth

annual all-horticulture amaryllis show over the weekend of April 14 and 15, 1973 at the Lakeside Shopping Center Mall in Metairie, La. The total display was striking and quite beautiful. The show was viewed by over a thousand people. Again, interest and enthusiasm ran high as evidenced by the fact that there were nearly 400 entries. Competion was open to the public who responded with about twenty percent of the entries, winning 56 ribbons and one Sweepstakes Award.

Mr. A. T. Diermayer, with a spectacular specimen of 'Picotee Red Lining' won the "Best in Show" rosette, the Ludwig Challenge Cup, the James E. Mahan Memorial Trophy, the Men's Amaryllis Club Trophy, and an Award of Merit.

Winner of the most awards was Dr. T. A. Calamari, Jr. He won the Robert Diermayer Memorial Trophy for the best specimen in the Breeder's Section (a 'Golden Triumphator' Seedling); The Amaryllis Incorporated Trophy for the best species amaryllis (an *A. evansiae*); the President's Trophy for the most blue ribbons won by a Club member; the Amaryllis Society of Baton Rouge Trophy for the best unnamed, unregistered single floret; the Laurence W. Mazzeno, Jr. Award for the outstanding gracilis specimen ('Fire Fly') and a Sweepstakes ribbon for the most blue ribbons in the named and registered sections.

Mr. E. M. Beckhan received the TAC Construction Co. Award and an Award for the best two-floret specimen.

Mr. Walter R. Latapie was awarded the Southern Seed and Popcorn Co. Trophy for the runner-up in the Breeder's Section and the Lester Laine Trophy for the best double flowered specimen—one of his own hybrids.

Other trophies were won by Mr. H. H. Bowers, Jr.—the D. H. Holmes Co., Inc. Award for the runner-up in the registered section; Mr. Emile P. J. Flauss—the Reuter Seed Co., Inc. Trophy for the best cut specimen; Mr. L. W. Mazzeno, Sr.—the Edward F. Authement Memorial Trophy for runner-up in the unnamed and unregistered section; and Mr. L. W. Mazzeno, Jr.—The Club Trophy for the named and registered Best Single Floret.

The show was ably planned and coordinated by the Show Chairman, Mr. H. H. Bowers, Jr. and Co-Chairman Mr. Robert Luckett, with generous assistance of all Club members. Mr. Al Diermayer handled the publicity in his usual superlative fashion. Included in the pre-show activities were the appearances by Club members on TV at five different times. Our thanks go to all who participated in the show and a special note of thanks to our Show judges and the members of the Amaryllis Society of Baton Rouge for their assistance.

1973 GREATER HOUSTON AMARYLLIS CLUB SHOW

Mrs. Sally Fox, *Corresponding Secretary*

1527 Castle Court, Houston, Texas 77006

Amaryllis Rainbow was a perfect theme for the Greater Houston Amaryllis Club's show held at the Houston Garden Center on April 15, 1973 since there were intermittent showers all during the show. However, we were pleased that those interested in amaryllis braved the elements and came to view the nice display of rainbow colors.

The show was judged by accredited amaryllis judges who selected: 'Mars' shown by Mrs. W. J. Snow to win the Greater Houston Amaryllis Club silver tray.

The Ludwig Challenge Cup was won by Mrs. P. A. Froebel for an exceptionally nice Picotee.

Mrs. A. O. Aschenbeck entered a beautiful American hybrid and was awarded a silver plate.

Seedlings entered in the show were outstanding with the best shown by Mrs. R. A. Fawcett. A silver shell was her prize.

Mrs. P. A. Froebel and Mrs. G. D. Everett tied for Sweepstakes, and each was presented a silver trophy.

Other divisions in the schedule did not have sufficient entries for competition, so no other silver trophies were given out.

Due to a very cool and wet two weeks preceeding the show date some blossoms were not show quality; however, these were brought to the garden Center and placed on a "display only" table and the visitors were glad of this as they were able to view a nice variety, some of which they will want to add to their gardens.

Our shows are principally staged to interest the public in growing amaryllis and we are happy to report that we feel our goal was accomplished due to the many questions asked the hostesses as well as the fact we were able to recruit four of those expressing the most interest. They wanted to join our club in order to learn more about growing amaryllis and we certainly hope to satisfy their wishes.

Mrs. Aschenbeck, the Club's President and Mrs. Snow, the Show Chairman were well pleased with the interest shown in the Education Exhibit and wish good blossoming to the novice hybridizers.

AMARYLLIS SOCIETY OF ALABAMA SHOW—1973

Dewey E. Hardy, *President,*

Rt. 9, Box 55, Eight Mile, Ala., 36613

The Amaryllis Society of Alabama, Inc., held its sixth annual spring show at the Chickasaw Civic Center on Grant Street in Chickasaw, Alabama on April 21st and 22nd, 1973. The theme of the show was "Come See Our Fairyland". There was much interest shown in both the horti-

culture and artistic arrangements divisions. Mrs. Velma Thompson of Mt. Vernon was the show chairman this year.

Mrs. Velma Thompson of Mt. Vernon, Alabama won the AMERICAN NATIONAL BANK TROPHY for the best named Dutch Potted specimen in the show. In addition, Mrs. Thompson won the following trophies: MR. & MRS. H. P. WHEAT MEMORIAL TROPHY, Awarded to the winner of the most blue ribbons in the potted and cut seedling divisions. Divisions VII and VIII. Large silver tray with handles. CLAUDE H. MOORE MEMORIAL TROPHY, Awarded for the most outstanding horticultural specimen of potted Dutch Amaryllis in the show. Division III. Silver tray. FIRST NATIONAL BANK OF MOBILE TROPHY, Awarded to the best specimen in Division VII. Silver Paul Revere Bowl. AMERICAN NATIONAL BANK TROPHY, Awarded for the best named Dutch potted specimen in show. Silver tray. THE WILMER SMITH TROPHY, Awarded for the most outstanding potted bulb specimen in the show. Silver pitcher. FABRICS UNLIMITED AWARD, Awarded for the most outstanding cut miniature of Dutch amaryllis. Silver dish.

Mr. Dewey Hardy of Eight Mile, Alabama received the CECIL BATES TROPHY for the Educational Display.

Mrs. Claudine Pierce of Mt. Vernon, Alabama won the following trophies: MARTHA BURDETTE MEMORIAL TROPHY, Awarded for the most blue ribbons in Division V and VI. Silver tray.

Mr. C. E. Tagert of Mobile won the following trophies: PRESIDENT'S AWARD—Awarded for the most outstanding Dutch seedling hybridized and brought into bloom by exhibitor and being shown for first time Division VIII. Large silver tray with handles. DEPOSIT NATIONAL BANK TROPHY, Awarded for the most blue ribbons in the American potted Amaryllis, Division I. Silver tray. EMILE SCHEUERMANN, SR. MEMORIAL TROPHY, Awarded to the winner of the most blue ribbons in combined horticulture and artistic arrangement divisions. Silver champaigne cooler. THE AMARYLLIS SOCIETY OF ALA. INC. TROPHY, Awarded to the winner of the most blue ribbons in the cut Dutch division. Division IV. Silver tray. THE VINCENT KILBORN, SR. MEMORIAL TROPHY, Awarded for most blue ribbons in Division IV. Silver bowl. THE C. E. TAGERT, SR. TROPHY, Awarded for the most blue ribbons in the single bloom named division. Small silver bowl. THE C. E. TAGERT, SR. TROPHY, Awarded for the most blue ribbons in the single bloom un-named division. Small silver bowl. CLAUDINE PIERCE TROPHY, for most outstanding collection of three (3) scapes in Division X. Ceramic Pitcher.

Mrs. Marie Cantrell of Chickasaw, Alabama won the following trophies: CHAVIS FURNITURE COMPANY TROPHY, Awarded to the winner of the most blue ribbons in horticulture, Divisions I-VIII. Large silver tray with handles. MERCHANTS NATIONAL BANK TROPHY, Awarded for the most blue ribbons in horticulture Divisions

I—VII. Silver tray. THE T. J. SWETMAN TROPHY, Awarded for the most blue ribbons in Divisions III. Large ceramic tray.

Mrs. Mae Allen of Chickasaw, Alabama won the following trophies: AMARYLLIS SOCIETY OF ALABAMA INC. TROPHY, Awarded for the most outstanding potted miniature Dutch amaryllis. Silver dish. ALABAMA FURNITURE COMPANY TROPHY, Awarded for the most blue ribbons in the potted miniature named Dutch division. Silver dish. MITTIE YOUNG TROPHY, for corsage.

Mrs. Irene Massingill of Chickasaw, Alabama won the following trophies: SULLY'S DRIVE-IN TROPHY, Awarded to the winner of the most blue ribbons in artistic arrangement division. Silver bread tray. WEST DEPARTMENT STORE AWARD, Awarded for the most blue ribbons in artistic arrangements. Division XII. Canister set. ELLEN "JACK" CROPP TROPHY, Awarded for the most artistic design of amaryllis with elements other than fresh plant material predominating. Silver award. MT. VERNON TROPHY, Awarded for the most outstanding artistic arrangement in show. Relish dish.

In the non-member class, Mrs. Lois Koontz of Mobile, Alabama, won the AMARYLLIS SOCIETY OF ALABAMA INC., TROPHY for the most outstanding potted amaryllis, and also the AMARYLLIS SOCIETY OF ALABAMA INC., TROPHY, for the most outstanding cut amaryllis.

The horticulture judges, all from Hattiesburgh, Mississippi, were: Mrs. Charlie Bell, Mrs. E. R. Trussell, Mrs. R. A. Fowler, Mrs. F. T. Newton, Mrs. Lillie Wilson, Mrs. C. E. Woods and Mrs. Dolphis Gaucher.

Artistic arrangement judges were: Mrs. J. T. Barfield, Pensacola, Florida, Mrs. H. W. Davis, Gonzalez, Florida and Mrs. F. A. Meloy, Milton, Florida.

After the judging of the show, the judges were guests of the Amaryllis Society of Alabama, Inc., at a luncheon at a Mobile Restaurant.

1973 SOUTHERN CALIFORNIA AMARYLLIS SHOW

JAMES M. WEINSTOCK, *Show Chairman*
10031 Independence, Chatsworth, Calif. 91311

"Amaryllis in April," the Southern California Hemerocallis and Amaryllis Society's ninth annual show was presented April 29 and 30 at the Los Angeles State and County Arboretum in Arcadia.

The two-day run, thanks to a favorable, last-minute bit of cooperation from the weatherman, attracted 109 entries—both potted specimens and cut scapes—from 19 exhibitors. A large number of non-competitive exhibits pushed the number of flowers on display well past the 1000 mark.

Among special features were a display of species *Amaryllis,* a selection of blooming other amaryllids, educational exhibits, a show award section, and arrangements featuring amaryllis as the major flower.

A show highlight was a case honoring the Society's two Herbert Medal recipients, W. Quinn Buck and John Leonard Doran. The medals, the citations detailing circumstances and accomplishments which led to presentation of the medals flanked some general history of the medal.

When award time came, John Cage was at the head of the line. He had carefully packed nearly two-dozen blooming plants and then transported them some 400 miles from his home in Los Altos.

Mr. Cage, with his impressive entries, refuted Robert Louis Stevenson, who once said, "To travel hopefully is a better thing than to arrive."

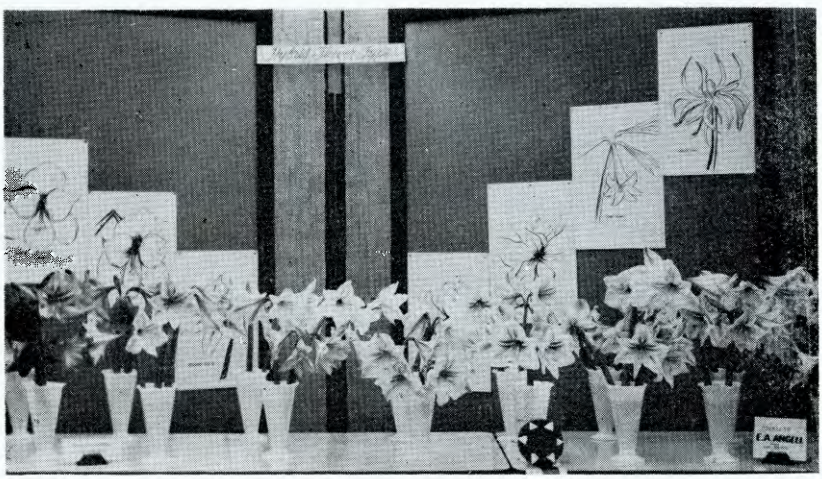

Fig. 5. 1973 Southern California Amaryllis Show. Part of educational display of Hybrid Amaryllis Flower types, in background, and award-winning display of massed Amaryllis cut flowers by Mr. E. A. Angell in **foreground.** Photo by Ken Weinstock

If well travelled, his plants were also well grown—so well, in fact, that when judges results had been tallied, Mr. Cage had walked off with the following:—The Cecil Houdyshel Memorial Trophy, a sweepstakes award for the largest number of blue ribbons won by a single exhibitor; The Southern California Hemerocallis and Amaryllis Society's award for best flower in the show for his 'Happy Memory'; the Society's award for best overall seedling in the hybridizers' division for his 'Big Tex'; the award for the best gracilis in the hybridizers' division; the popularity poll winner based on votes of show visitors, again for 'Big Tex'.

Mr. Cage also was the recipient of American Amaryllis Society Awards of Merit for Ludwig's 'It' and 'Happy Memory'.

In Awards of Preliminary Commendation from the American Amaryllis Society, Henry Myers and C. D. Cothran shared honors with Mr. Cage.

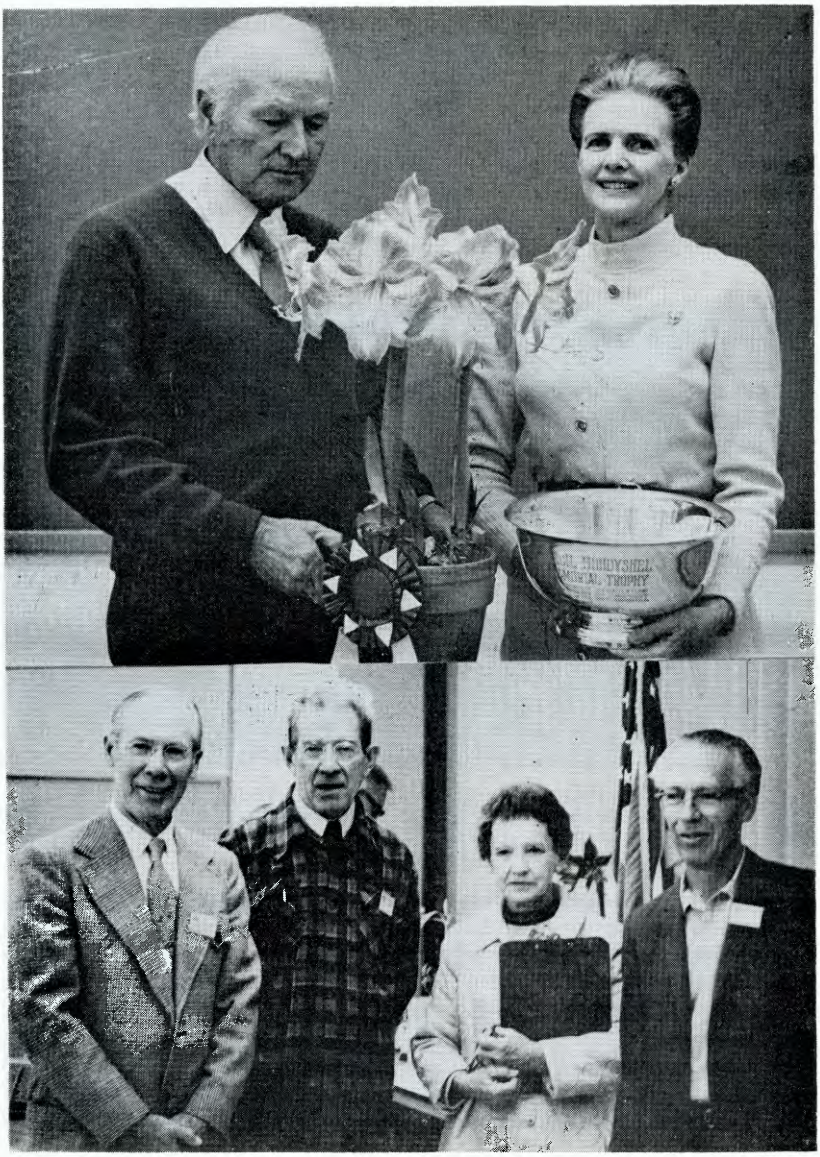

Fig. 6. Southern California 1973 Amaryllis Show. **Upper,** Dr. John Cage, show's big winner, holding top winning 'Happy Memory'; and Mrs. Mildred Cage, holding Cecil Houdyshel Memorial Trophy awarded for most blue ribbons.

Caption continued on upper page 27.

Lower, Behind a successful show are people. Among them, left to right, are Mr. C. D. Cothran, Pres., Southern Calif Hemerocallis and Amaryllis Society; Mr. Quinn Buck, HERBERT MEDALIST and judge; Mrs. Bert Williams, show standards chairman, and head judge; and Mr. J. L. Doran, HERBERT MEDALIST and hard working show committeeman. Photos by Ken Weinstock.

A final recognition for Mr. Cage came in the form of a special ribbon award from the judges.

To prevent a complete sweep by Mr. Cage, Leonard Doran garnered enough blue ribbons to stand as runner-up for sweepstakes honors. Mr. Doran also was recognized with a special judges ribbon for his many species hybrids.

Ladd Seekins and C. D. Cothran also got into the winner's circle with special judges ribbons for their well-grown specimens.

For their outstanding contributions of potted specimens and cut scapes displayed on a non-competitive basis, A. E. Angell, Bruce Claflin, and Ed Pencall were awarded rosettes.

The capable and hard-working panel of certified judges was led by Mrs. Bert Williams. Her co-workers were Mrs. Polly Anderson, Mr. Quinn Buck, and Mr. Jack McCaskill.

While many members helped make the show a successful one, the work of several deserves special note. Sterling Harshbarger prepared and submitted advance publicity for the show. For much of the unglamourous but essential, behind-the-scenes work—the many chores in setting up and closing down the show, handling hospitality, manning information desks, providing general and cultural information for show visitors, and conducting the popularity poll—the following merit commendation for service above and beyond the call of duty: Mrs. Gladys Williams, Mr. Quinn Buck, Mr. John Cage, Mrs. John Cage, Mr. C. D. Cothran, Mrs. C. D. Cothran, Mrs. Cora Doran, Mr. Leonard Doran, Mrs. Dougald MacDonald, Mr. Phil Rosoff, and Mrs. Phil Rosoff.

AMARYLLIDS AND THE FLOWER ARRANGER

MARGARET MACDONALD, *501 W. Coolidge Drive, San Gabriel, California 91775*

Which blossoms won the top awards at the Southern California Amaryllis Show in April of 1973? Those that were ten to twelve inches across. That's enough to frighten this flower arranger right out of the Society!

For some reason, men (and most of the flower judges are men) have equated "biggest" with "best". If they don't get over this mania (or should I say "man"-ia) soon, there won't be any amaryllids left that flower arrangers can use.

I have watched this emphasis on "bigness" affect the Orchid and Camellia Societies, as well. Cattleya orchids have become so large and vulgar that no respectable woman would be caught wearing a corsage

of them. Camellia growers have now resorted to using hypodermic needles to inject gibberellic acid into their flowers to force them into monstrous proportions. (The drug-age has come to the flower kingdom!) Again, these unnaturally large blooms are awarded top honors.

In April of 1973 I was asked to make some arrangements for the Southern California Amaryllis Show. I could choose any cut blooms among the hundreds there, for my use. It was difficult to find any small enough in scale to fit the largest containers I had brought.

When the hybridizer of amaryllis works for larger flowers, he may not realize that to be in proper scale, a ten inch flower would normally have a three to four foot scape. Such a cut flower would require a container of such heroic proportions that it would only be suitable in a castle or a civic auditorium.

Now Mother Nature rarely plans her flowers in this dimension. (I don't know what "Father" Nature would have done. I'm only glad he didn't get on the planning committee!) When Mother Nature grows a monstrous flower, such as a giant sunflower, she has the good sense to put it on a twelve foot stalk.

Fortunately, daylilies still delights the flower arranger. The wiry stems of daylilies make them more graceful and usuable in flower arrangements than do amaryllis. But daylily hybridizers seem to be working for larger flowers, too. The day will come soon when the grower comes up with a twelve inch daylily. At that point, I won't "arrange" them. I will EAT them—as the Orientals do now.

Back to the Amaryllis. When scapes are cut for arrangements, I have found that the base of the stem splits after being immersed in water or impaled on a pin-type frog. I have overcome this tendency by wrapping the bottom inch or two with dull surfaced Scotch tape. (This won't show even in a glass container.) I also use a florist type compound, such as "Stay Bloom" to prolong the freshness and vigor of both scape and bloom.

In the years to come, the flower arranger is going to have to turn more and more to the species Amaryllis in order to have a good scale and proportion in an arrangement. I think even the hybridizer is going to realize that small flowers can be just as beautiful as large ones, and more useful when cut and brought into his home. Perhaps then he will turn his attention and talents to growing more of them. (I will rejoice on that day!)

Please don't misunderstand me. I appreciate the hard working hobbyist, grower, judge and hybridizer. I just think we have enough Amaryllis Gigantea crossed with Amaryllis "Super-Duper Collossal".

AMARYLLIS JUDGE'S CERTIFICATES

Since the last report in the 1973 AMARYLLIS YEAR BOOK (p. vi), the following numbered Amaryllis Judge's Certificates have been issued.

AMARYLLIS JUDGE'S CERTIFICATES—Continued page vi.

2. LINEAGICS

[BIOEVOLUTION, DESCRIPTION, DETERMINING RELATIONSHIPS, GROUPING INTO LINEAGES]

CONTRIBUTIONS TO SOUTH AMERICAN AMARYLLIDACEAE VI.*

PIERFELICE RAVENNA

Universidad de Chile

The present series of studies deal with several genera from Argentina, Bolivia, Brazil, Chile, Peru, and Uruguay. The characters and relationships of the genus *Traubia* are elucidated. A new tribe Griffiniae, is proposed to accommodate the genus *Griffinia*. The genus *Castellanoa* is reduced to the synonymy of *Chlidanthus*. A new subgenus, *Fulgituba,* within *Stenomesson,* is erected for the group of species allied to *S. incarnatum*. *Clitanthes* Herb., hitherto considered as a synonym of *Stenomesson,* is validated as an additional subgenus of the latter. Moreover, descriptions of new species in the genera *Amaryllis, Griffinia, Habranthus, Stenomesson,* and *Zephyranthes,* as well as several miscellaneous notes, are included.

I wish to express my gratitude to Dr. Vincent Santilli, Faculty of Sciences, University of Chile, for correcting the English manuscript, and to the following institutions, or owners of private herbaria, for their cooperation: B, BA, BAB, BHMG, E, K, LIL, NY, P, PACA, R, RB, SGO, SI, U, UP, Herb. Hatschbach (Curitiba, Brazil), Herb. Ruiz Leal (Mendoza, Argentina), Herb. Zoellner (Quilpué, Chile).

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IX. Genus **Castellanoa** reduced to synonymy of **Chlidanthus**
X. Studies in the Genus **Stenomesson**

I. THE GENUS **TRAUBIA**

Although imperfectly described by Moldenke (1963), the genus *Traubia* proved to be a distinct entity. Therefore, in order to clear up some misinterpretations of characters, an emended description is given here. *Rhodophiala modesta* Phil. is transferred to this genus.

* Series V of this work was publ. in Notic. Mens. Mus. Nac. Hist. Nat. Chile, 189, Sept. 1972.

TRAUBIA Moldenke, emend

Moldenke, Pl. Life 19:55. 1963.

Flowers slightly zygomorphic, pedicellate, cernuous or ascending. Ovary almost quadrate, obtusely trigonous, subtricoccous, with minute purplish lines. Tepals linear-oblong, spreading horizontally, shortly connate at the base, white or whitish, with two narrow purple veins on the adaxial face, and a dark purple (wine-red) streak on the abaxial face, very rarely completely white. Filaments fasciculate, ascending, 4-seriate, but differences in length not easily perceptible, very slightly or not incurved at the apex; upper episepal the shorter, lower epipetal the longer, episepal and epipetal pairs intermediate. Anthers oblong-elliptical before dehiscence or sometimes ovate, dorsifixed, becoming recurved or imperfecty versatile after dehiscense. Pollen fusiform, unisulcate. Style almost always declined below the stamen fascicle, but not lying on the lower inner tepal, filiform. Stigma capitate. Capsule depressed, markedly tricoccous, a brownish-gray marked with minute dark brown or reddish-brown lines or points. Seeds semiovate of semielliptic, black, shiny, with membranous edges.

Dwarf bulbous plants. Bulb ovoid, small, covered with brown, membranous coats, produced into a pseudo-neck. Leaves linear, narrow, ascending, somewhat fleshy, green, moderately channelled or sometimes flat, obtuse or subacute. Scape quite narrow (about 0.9-1.3 mm), very strictly fistulose or sometimes apparently subsolid, marked with minute reddish-brown lines. Inflorescence umbellate, 1-5-flowered. Spathe bivalved; valves narrowly lanceolate, marcescent, free to the base or very rarely connated by one of their margins and splitting on one side.

Type-species: *Traubia chilensis* (F. Phil.) Mold. (*Lapiedra chilensis* F. Philippi) = *Traubia modesta* (R.A. Phil.) Rav.

A single species from the provinces of Coquimbo and Aconcagua, Chile.

According to F. Philippi (1896), the illustration which accompanies the orginal description of *Lapiedra chilensis*, was made from the type—specimen. The figure shows details of two anthers; one of these appears as basifixed and hastate. This feature is mentioned in the description: "antheris basi sagittati dimidium filamenti aequantibus luteis".

Having had some experience in examining fresh and dried material of the species, I am convinced that the *sagittate character* of the anthers was probably a consequence of the process of boiling and dissecting. In fact, tissue which connects both anther lobes, below the insertion of the filament, is rather fragile and breakable in dissection. In the living and pressed plants from the type-locality and other places, that I have studied, anthers were decidely not sagittate. Although not versatile before dehiscence, anthers show a clear tendency to become so after pollen shedding. Sometimes they are recurved only in the upper half, but often can be defined as versatile. The former condition is due, in part, to the fact that the filaments are very slightly or not incurved at the apex. In *Rhodophiala* and *Placea* they are incurved. In the latter

genus anthers are often similar in shape to those of *Traubia*. *Rhodophiala* has linear-oblong anthers which are versatile even in the bud.

Since the flowering stem was described as "solid", it is necessary to review this point. The scape is so slender that the hollow portion is almost imperceptible. However, the latter can be seen under a microscope. Therefore, the scape must be defined as *hollow*.

Rhodophiala modesta R.A. Phil. (1873), is the same species as *Lapiedra chilensis* F. Phil. (1896). This had been discovered earlier by F. Johow and published postumally in his "Flora de las plantas vasculares de Zapallar" (see Johow 1948, pp. 63-64). At that time, however, a suitable generic name for this species had not been published. A new combination in *Traubia* is proposed here.

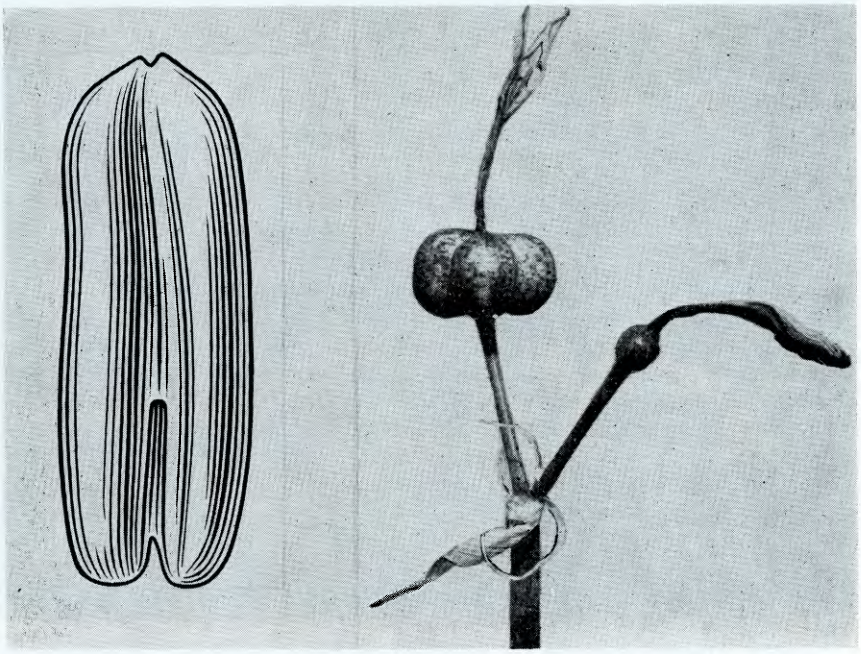

Fig. 7. **Traubia modesta** (R. A. Phil,) Ravenna. **Left,** back view of an anther before dehiscence; (x38.9), note insertion area of filament in lower third. Drawing by Pierfelice Ravenna.
Right, capsule. Approx X 1.3. Photos by Pierfelice Ravenna.

Traubia modesta (R.A. Phil.) Rav., **comb. nov.**
(Figs. 7 and 8)

Rhodophiala modesta R. A. Philippi, Anal. Univ. Chile 43: 544. 1873; Pl. Life 12: 73-74. 1961.—*Hippeastrum modestum* (Phil.) Baker, Journ. Bot. 16:83. 1878.—*Lapiedra chilensis* F. Philippi, Anal. Univ. Chile 93: 144. 1896.—*Amaryllis modesta* (Phil.) Traub et Uphof, Her-

bertia 5: 123. 1938.—*Traubia chilensis* (Phil.) Moldenke Plant Life 19 :55. 1963.

Plant 4-6 cm high. *Bulb ovoid,* covered by dark brown coats, about 15-18 mm long, 8-12 mm wide, prolonged for 18-30 mm into a pseudoneck. *Leaves* vernal, absent at anthesis, spreading upwards, linear, bright green, rather fleshy, moderately channelled to almost flat, with an obtuse or subacute apex, to 8-12 cm long, 1.9-2.9 mm broad. *Scape* cylindri-

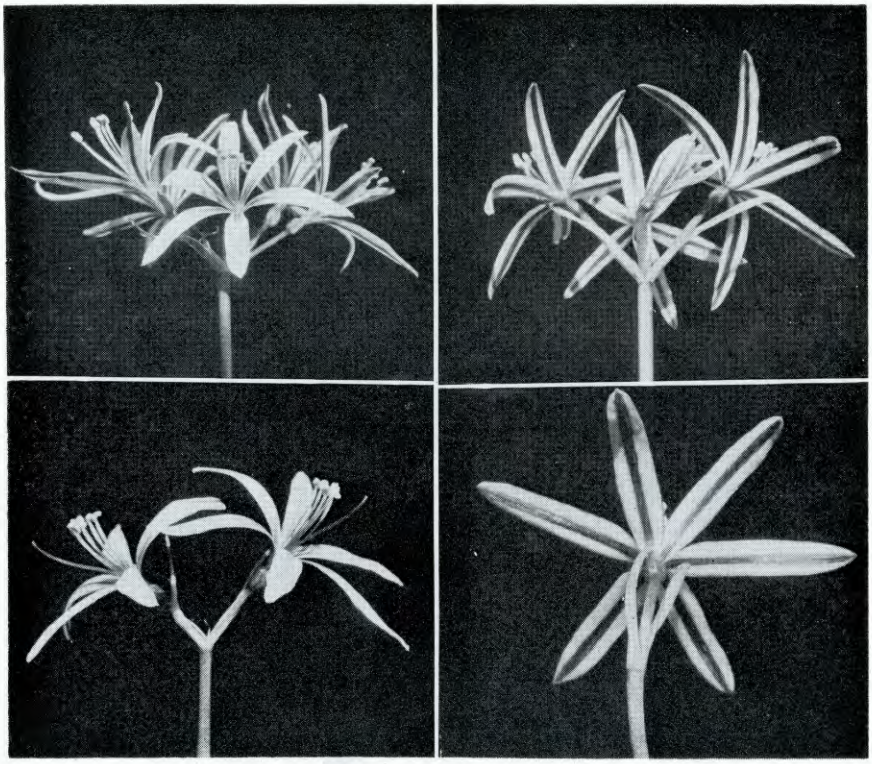

Fig. 8. **Traubia modesta** (R. A. Phil.) Ravenna, umbellate inflorescence: **Upper left**, 5-flowered umbel; **Upper right**, 4-flowered umbel, back side; **Lower left**, 2-flowered umbel; and 1-flowered umbel, back side. See text for exact flower size. Photos by Pierfelice Ravenna.

cal, yellowish brown flushed by diminutive purple-brown lines, to 23-50 mm long, 0.9-1.2 mm broad. *Spathe* membranous, bivalved or rarely 1-valved and splitting on one side, dull whitish, often purple streaked; valves free to the base, narrowly lanceolate, 12-15 mm long; inner bracts almost filiform, about the length of the pedicels or slightly longer. *Inflorescence* 1-5-flowered. *Pedicels* stiff, spreading upright, about 7-10 mm long, of the same color as the scape. *Flowers* star-shaped, white,

often palely purple-tinged at the center, about 29-40 mm in diameter. *Ovary* almost squarely triquetrous to almost tricoccous, the same color as the pedicels, about 1.9-2.3 mm long, 1.9-2.3 mm in diameter. *Tepals* oblong or linear-oblong, whitish with two, pale, purple streaks near the base, and a larger, dark purple streak, from base to top, on the abaxial face, connate below for 1.9-2.2 mm, about 15-20 mm long; the outer 3-4 mm broad, with a 0.25-0.3 mm long purple apicule; the inner 2.8-3.9 mm broad, acute. *Filaments* often closely fascicled, erecto-patent, whitish, flushed with purple-pink in the lower half; the upper episepal 7-7.5 mm long, lateral episepal 7.2-8 mm long, lateral epipetal 7.8-10 mm long, lower epipetal 8-11 mm long. *Anthers* oval-oblong before dehiscence, attached to the filament in the lower third or half, at the upper end of a channel, about 2.5-3.2 mm long, 0.95 mm broad, ending at the base in two lobes ca. 0.2-0.5 mm long; almost reniform after dehiscence, 1.7-1.9 mm long. *Pollen* fusiform, one-furrowed, yellow. *Style* purple-pink, flesh-pink or whitish-pink, to 13-14 mm long. *Stigma* minutely capitate. *Capsule* markedly tricoccous, grayish-brown or yellowish-brown flushed by diminutive brown points and streaks, about 7.8-8.8 mm in diam. *Seeds* semioval or semielliptic, black, shiny, with membranous edges, about 4.3-4.5 mm long, 2.4-2.5 mm broad.

Habitat.—Hills and plains in the South of the province of Coquimbo and north of Aconcagua; it is often found not far from the sea. At Pichidangui, it grows near *Leucocoryne violascens, Sisyrinchium gramifolium* ssp., *Conanthera campanulata, Tecophilea violaeflora, Oxalis* sp., and other herbs; near Salamanca, it grows near *Placea ornata, Miersia myoides,* and others.

Specimens: Chile, province of Aconcagua, Cuesta de Los Molles; leg. F. Philippi (SGO 47179, type of **Rhodophiala modesta** R. A. Phil.). Idem ibidem; leg. ipse (SGO 47179, isotype of **Rhodophiala modesta**). Idem, Yerbas Buenas; leg. F. Philippi?, III-1894 (SGO 37999). Sine data; leg. F. Albert, II-1890 (SGO 47188 & 38035). Province of Coquimbo, in praedio Chuchiñí pr. Illapel; leg. Geisse, II (SGO 46914, type of **Lapiedra** chilensis F. Phil.). Idem Salamanca, Cuesta Chalinga; leg. Geisse, I-1895 (SGO 72932). Idem, Pichidangui; leg. Ravenna 1780, IV-1970 (Herb. Rav., SGO). Idem in praedio Vallecite prope Población Halcones; leg. Ravenna 2020, V-1972 (Herb. Rav., SGO).

II. STUDIES IN THE GENUS **PYROLIRION**

1. An important character for the separation of **Pyrolirion** from **Zephyranthes**

The genus *Pyrolirion* was erected by Herbert (1821), in order to accommodate *Amaryllis aurea* Ruiz et Pav., *A. flammea* R. et P., and a third species which he named *P. flavum.* Herbert separates this genus from *Zephyranthes,* on account of the "filaments erect, nearly equal". Baker (1888) reduced this group to a subgenus of *Zephyranthes,* adding *Zephyranthes boliviensis* Bak. Sealy (1837) restored *Pyrolirion* to generic rank, incorporating a new feature: the apparent existence of "two opposite segments quite free from one another" in the upper part of the spathes. According to this author, this character, along with the almost

tubular perigone below, and the sub-equal stamens, is a useful character which distinguish *Pyrolirion.* Notwithstanding this, Sealy refers to this genus *Z. boliviensis* Bak. (and its synonyms), a species which does not have any of the three stated features. In the latter species, the spathe is monophyllous, the perigone clearly infundibulate, and the stamens are quite dissimilar in length (see Ravenna 1971, p. 68, under *Zephyranthes boliviensis*).

Recently, I had the opportunity to examine, in North Chile (inedit datum), fresh flowers of *Pyrolirion tubiflorum.* Years ago, I also collected it near Mala, in the Lima dept., Peru. In this species the stigmatic area is placed at the emarginate apex of true style divisions. This distinctive mark, although not properly evaluated, had been previously observed by Lindley (1834); when distinguishing *Pyrolirion* from *Zephyranthes,* he says: "it differs, however, from that genus in its sessile flowers, which we incline to consider a character of much importance, and in the dilation of the points of its stigma into little spoons". A careful examination shows that this kind of style branches are conduplicate and flattened.

In *Zephyranthes,* the stigmatic area occupies the whole adaxial part of three, not flattened divisions. Thus, they are defined as parts of a trifid (or capitate-trilobed) stigma.

In Traub's "The genera of the Amaryllidaceae" (1963), *Pyrolirion* is described as having a "stigma deeply trifid or capitate". This author states that "ten species are tentatively recognized . . . ". In my opinion, the mention of a capitate stigma, and of such a number of species are conditions not to be assigned to *Pyrolirion.* Both statements were probably written on account of Sealy's suggestions (1937, p. 208) that *Z. bricketii* Macbr., *Z. parvula* Kill., *Z. pseudocolchicum* Kraenzl., and *Z. beustii* Schinz., should be referable to this genus. *Pyrolirion flammeum* and *P. flavum* are probably identical to *P. tubiflorum.* The spathe of the latter species can be either bifid or entire. *Pyrolirion* seems to have, in my opinion, not more than two species.

2. The leaves of **Pyrolirion boliviense**

In March, 1970, I was for the second time in the valley of Sorata, Bolivia. I was able to collect again several bulbous plants, that I found in 1960, such as *Amaryllis scopulorum* and *Pyrolirion boliviense.* I was unable to locate the latter again in the upper river Challasuyo, but found a few bulbs near the top of the Cerro del Iminapi, and also near Incachaca, on the plateau.

Cárdenas (1971) publishes a description of the species (as *P. xiphopetalum*) and a photograph of a few plants cultivated in pots. Nevertheless, this author says nothing about leaves. Traub (1972, page 66) amplifies the description by giving the measures of them, after a communication from Dr. Cárdenas. Notwithstanding, it seems necessary to give a complete description of the leaves of this species.

Descr.—Leaves hyteranthous, about two or three each year, linear, fleshy but not flaccid, moderately channelled, nervose, to 8-15 cm (rare-

ly more) long, 2-3 mm broad, ash-green, slightly pruinose.

Specimens: Bolivia, prov. Larecaja, near Sorata, Cerro del Iminapi, about 2800 m; leg. Ravenna 1350, III-1971 (Herb. Rav.), sterile.

III. STUDIES IN THE GENUS **ZEPHYRANTHES**

1. New species from Brazil and Bolivia,

Zephyranthes capivarina sp. nov. (Fig. 9)

Species floribus utrinque luteis instructa. *A. Zephyranthes flavissima* qui etiam Paranaensi et *Z. citrina* foliis saepe subplanis circ. 3-8 mm latis stigmate trifido cum lobis linearibus differt.

Fig. 9. **Zephyranthes capivarina** Ravenna, **Center**, side view of flower. **Right**, upper view of flower. **Left**, androecium (stamens) and gynoecium (pistil). Photos by Pierfelice Ravenna.

Plant about 20 cm high. *Bulb* almost globose, 20-26 mm in diameter, covered by dark brown coats; *pseudo-neck* 30-45 mm long. *Leaves* 2-4, present at anthesis, linear, almost flat, a bright green, to 8-15 cm long, 3-8 mm broad, almost obtuse. *Scape* 10-15 cm long, a pale green in the upper half, reddish below, not pruinose. *Spathe* one flowered, membranous, slightly compresses, often reddish, with a fenestrate apex, or bifid for 7 mm. *Pedicel* ca 27 mm long, 2.8 mm broad, a pale green. *Ovary* obovate or shortly elliptic, a dark green, 4-5.2 mm long, 3.8-4.3 mm broad. *Perigone* widely funnel-shaped, bright yellow, about 30-34 mm long, 45-55 mm in diameter. *Tepals* oblanceolate, joined at the base

for 2.4 mm 36-39 mm long; the outer about 10.5 mm broad, with a diminutive thickened apicule; the inner ca. 10 mm broad, almost obtuse. *Filaments* spreading upwards, yellow, somewhat paler; episepal 10-11 mm long, epipetal 13-14 mm long. *Anthers* linear-oblong, often some-

Fig. 10. **Zephyranthes paranaensis** Ravenna. **Left,** side view of flower from back. **Right,** Androecium (stamens) and gynoecium (pistil). Photos by Pierfelice Ravenna.

what flexuose, 4-5 mm long after dehiscence. Style curved, ascending, yellow, 21-23 mm long. *Stigma* trifid, its divisions spreading, 2.2-4 mm long. *Capsule* depressed globose, marketedly tricoccous, a bright, sometimes reddish, green, about 14-16 mm in diameter. *Seeds* oval or semicircular, ca. 5-6 mm long.

Hab.—Among rocks on the banks of the rivers Capivarí and Jangada, in the State of Paraná, Brazil. In the former river, it was found in a very small spot, closely associated with *Nothoscordum capivarinum* sp. nov. (inedit), whose leaves are undistinguishable from those of this species. Plants were growing in a frankly sandy soil. The circundant vegetation, out of the rocks, is the much modified rain forest.

Specimens: Sesmarías ad ripas fluminis Capivarí mun. Bocaiuva do Sul civitatis Paraná Brasiliae; leg. Ravenna 1010 et G. Hatschbach, XI-1969 (typus in Herbario Ravennae). Mun. Bocaiuva do Sul. Río Capivarí, Sesmarias; leg. G. Hatschbach 20232, 11-XI-1968. Mun. Gral. Carneiro, Río Jangada; leg. G. Hatschbach 22723, 27-X-1969 (Herb. Hatschbach, Herb. Rav.).

This pretty species is remarkable for its broad almost flat leaves. Due to its trifid stigma, it is placed in subgenus *Zephyranthes,* along with the next species here described.

Zephyranthes capivarina lives in a very restricted habitat, among exposed rocks on the banks of the above mentioned rivers. These outcrops are not frequent, since the woody vegetation often reaches the banks. Hence, the species is very rare and difficult to find.

The species deserves cultivation. The bulbs are hardy when planted in full sun using river sand. Under these conditions, plants will flower and reproduce easily. Seeds have been sent to Kew Gardens and to Florida (U.S.A.).

Zephyranthes paranaensis sp. nov. (Fig 10)

A *Zephyranthe capivarina* valde affinis sed habitu graciliore foliis angustissimis canaliculatis et flore minore recedit.

Planta usque 8-13 cm alta. Bulbus globosus circ. 15-20 mm latus. Folia ad anthesin praesentia vel incipientia anguste linearia canaliculata fusco-viridia circ. 0.95-2.2 mm lata. Scapus 6-10.5 cm longus. Perigonium luteus ad 16-24 mm longum circ. 26-30 mm latum. Filamenta lutea, sepalina ad 10 mm longa, petalina circ. 13 mm longa. Antherae lunulate leviter flexuosae post dehiscentiam usque 4.6 mm longae. Stylus to 18 mm longus. Stigma trifidus lobis erecto-patentibus circ. 2 mm longis. Capsula circ. 11.3 mm lata. Semina usque 3 mm longa valde complanata.

Plant 8-13 cm high. *Bulb* globose, 15-20 mm in diam., covered with dark brown coats and produced into a 15-30 mm long *pseudo-neck. Leaves* present or incipient at anthesis, often about 7 or less, narrowly linear, channelled but not carinate, a bright green, to 12-45.4 cm long, 0.95-2.2 mm broad. *Scape* cylindrical, 6-10.5 cm long, a pale green. *Spathe* rufescent, about 25 mm long, tubulose for 14 mm, with a fenestrate apex. *Pedicel* ca. 16-19 mm long, 1.9 mm broad. *Perigone* yellow, 16-24 mm long, 26-30 mm in diam. *Tepals* oblanceolate, ca. 20 mm long; the outer 5-7 mm broad, shortly apiculate, the inner acute, 3.7-5 mm broad. Filaments upright, slightly curved, yellow; episepal to 10 mm long; epipetal 13 mm long; basal ring diminutive, fimbriate-lacerate. *Anthers* narrowly semilunate after dehiscence, slightly flexuose, yellow,

about 4.6 mm long. Style curved, ascending, yellow, to 18 mm long. *Stigma* trifid, its divisions spreading upright, slightly curved, about 2 mm long. *Capsule* globose-subtrigonous, tricoccous, ca. 11.3 mm in diameter. *Seeds* small, black, about 3 mm long, much flattened.

Hab.—In stony, apparently basaltic, fields, of the second plateau of the State of Paraná, in Brazil. It has been found at Canta Galo, municipe of Guarapuava, and near Leroville, mun. Londrina. It grows, in the former location, near *Nothoscordum exile* sp. nov., *Sisyrinchium* sp., and other herbs.

Specimens: In campis glareosis ad Canta Galo mun. Guarapuavae civit. Paraná Brasiliae; leg. Ravenna 1015 et G. Hatschbach, 4-XII-1969 (typus in Herbario Ravennae). Mun. Guarapuava, Canta Galo; leg. G. Hatschbach 19865, 26-IX-1968 (Herb. Hatschbach, Herb. Rav.). Mun. Londrinia, Leroville, Campo das Pedras; leg. Hatschbach 22897, 17-XI-1969 (Herb. Hatschbach, Herb. Rav.).

This interesting species is related to *Z. capivarina*, and it also belongs in the subgenus *Zephyranthes*. It is readily distinguished by the slenderness of all its parts.

Zephyranthes paranaensis grows easily when cultivated in pots with neutral sandy soil. It should be a worthy object for rock gardens. Bulbs produce offsets in a short time.

Zephyranthes rosalensis Rav. sp. nov.

Species a *Zephyranthe mesochloa* proxima sed folis ad anthesin absentes flore majore apicem versus roseo inferne pallidiore vel alboroseo. Planta 21.5-30 cm alta. Scapus 14-19.5 cm longus circ. 3mm crassus. Ovarium obovatum. Perigonium infundibulatum sursum roseum deorsum pallidiore vel albus roseo suffusum ad 40-42 mm longus. Tepala oblanceolata. Filamenta arquata erecto-patentia, sepalina 8-10 mm longa, petalina 13-16 mm longa. Antherae lunulatae ad 3.5-6 mm longae. Stylus 19-21 mm longus; stigma trifidus lobis 2.5-4 mm longis instructus.

Plant 21.5-32 cm high. *Bulb* and *leaves* not seen. *Scape* apparently cylindrical, to 14-19.5 cm long, 3 mm broad. *Spathe* one-flowered, membranous, pale, tubular for 15-20 mm, bifid ca. 12-15 mm. *Pedicel* 25-75 mm long. *Ovary* obovate. *Perigone* erect, funnel-shaped, pink in the upper half, paler below, or white pink tinged, about 40-42 mm long. *Tepals* oblanceolate, joined at the base for 2.5-3 mm; the outer 35-42 mm long, 7.5-10 mm broad, bearing a 0.4-0.8 mm long apicule; inner 35-38 mm long, 6-7 mm broad. *Filaments* curved, ascending; episepal 8-10 mm long, epipetal 13-16 mm long. *Anthers* semilunate, ca. 3.5-6 mm long. *Style* 19-21 mm long. *Stigma* trifid, its divisions recurvedly spreading, 2.5-4 mm long.

Hab.—It grows wedged between rocks, on sunny, rocky slopes near Rosal, in the dept. of Chuquisaca, Bolivia.

Specimens: Bolivia, Chukuisaca, Rosal; leg. Miss W. M. A. Brooke 5428, 30-IX-1949 (type U).

Allied to *Z. mesochloa,* but differing from it in the serotine leaves, and in the larger, mostly pink or pink-tinged flowers. The above is the only place where the plant was found.

Zephyranthes challensis Rav. sp. nov. (Fig. 11)

Species a *Zephyranthe andina* proxima sed bulbis valde minoribus foliis gracilioribus fusco-veridis haud glaucescentibus floribus pallidioribus subalbis.

Fig. 11. **Zephyranthes challensis** Ravenna. **Left,** side view of plant in flower with partially developed flower stem. **Right,** Upper view of flower, as cultivated at Santiago, Chile. Photos by Pierfelice Ravenna.

Plant 40-62 mm high when in flower. *Bulb* ovoid, 24-26 mm long, 17-20 mm wide, covered by brown tunics and prolonged into a 15-40 mm long pseudo-neck. *Leaves* in summer and autumn, linear, somewhat fleshy, slightly channelled, dark green, about 10-20 mm long, 2-2.5 mm broad. *Scape* 0-11 mm above the soil, slightly compressed, pale green, 2.7-2.8 mm broad. *Spathe* membranous, whitish, often partially buried, about 22 mm long, tubular for 14 mm, then bifid and dirty greenish.

Inflorescence one-flowered. *Pedicel* obsolete, 1.5 mm long. *Ovary* oblong-subcylindrical, 3.3-5 mm long, 2.6-2.8 mm wide. *Perigone* internally white, excepting the yellowish-greenish throat, to 37-45 mm long, 30-42 mm in diameter. *Perigone-tube* 16-30 mm long. Tepals oblanceolate, spreading, externally a very pale pink or lilac-pink, internally white or whitish; the outer 22-29 mm long, 9-12.8 mm broad, with a diminutive and pennicillate apicule; the inner 19-27 mm long, 6.5-10.5 mm broad, obtuse or subacute. *Filaments* filiform, whitish, attached to the base of tepals; the episepal 8.8 mm long, the epipetal 6.8 mm long. *Anthers* falcate, 3-3.5 mm long; pollen yellow. *Style* filiform, slightly curved, whitish, about 26-34 mm long. *Stigma* lobes spreading, 1.3-1.4 mm long.

Habitat.—Dry slopes about 200 m north from Challa, dept. of Cochabamba, Bolivia, about 3500 m of altitude.

Specimens: Culta in Santiago Chiliae ex bulbis in decliviis pr. Challa civit. Cochabamba Boliviae collectis; leg. Ravenna 2022, IX-1972 (typus in Herb. Ravennae, isotype TRA).

Zephyranthes challensis is closly related with *Z. andina,* within subgenus *Haylockia,* differing in the smaller bulbs, slender, dark-green leaves, and the paler flower color. Plants of the latter species were received from Mr. J. Fernández, of Mina Aguilar, province of Jujuy, Argentina; the bulbs were about 4-5 cm long, 28-33 mm wide, and the leaves glaucescent and broader that those of *Z. challensis.*

The first plant of *Zephyranthes challensis,* that flowered with me, bore a 11 mm long scape; in the second plant flowered, the scape was completely included in the pseudo-neck.

2. **Zephyranthes bakeriana** and other binomials reduced to synonymy of **Zephyranthes mesochloa** (Fig. 12)

The report of *Zephyranthes bakeriana* Morong in the floras of Argentina and Brazil, respectively, in two different articles signed by A. T. Hunziker (1969 & 1971), makes necessary a critical treatment.

Zephyranthes bakeriana Morong (1893) had been based on dry specimens collected at "Gran Campo", 5 miles east from Asunción, in Paraguay. This location is found not far from the place where the type of *Amaryllis hassleriana* Chod. et Lendn. (1901) had been gathered. I have not seen the respective type-specimens; nevertheless, it seems obvious from the descriptions that both binomials represent a single species.

In February, 1965, I made a collecting trip to Paraguay and Brazil and was able to explore the fields of Asunción, Caacupé, San Bernardino, Villa Rica and other regions. In these places, which are not very far from each other, a white *Zephyranthes* was found to be very common. The species was readily identified as the widely distributed *Z. mesochloa* Herb. On the way back through Brazil to Buenos Aires, the plant was collected once more near Cacapava do Sul (State of Río Grande do Sul). The species was well known to me, since I already had it in my experimental collection from bulbs gathered several years

before at Villa El Alto(province of Santiago del Estero), and near Trancas, (Tucumán), in Argentina. On the other hand, Herbert's original description is accompanied by an excellent color illustration, which hardly leaves any doubt about its identity. By the facts presented we can easily reach the conclusion that *Zephyranthes bakeriana* and *Amaryllis hassleriana* are conspecific with *Z. mesochloa.* Therefore,

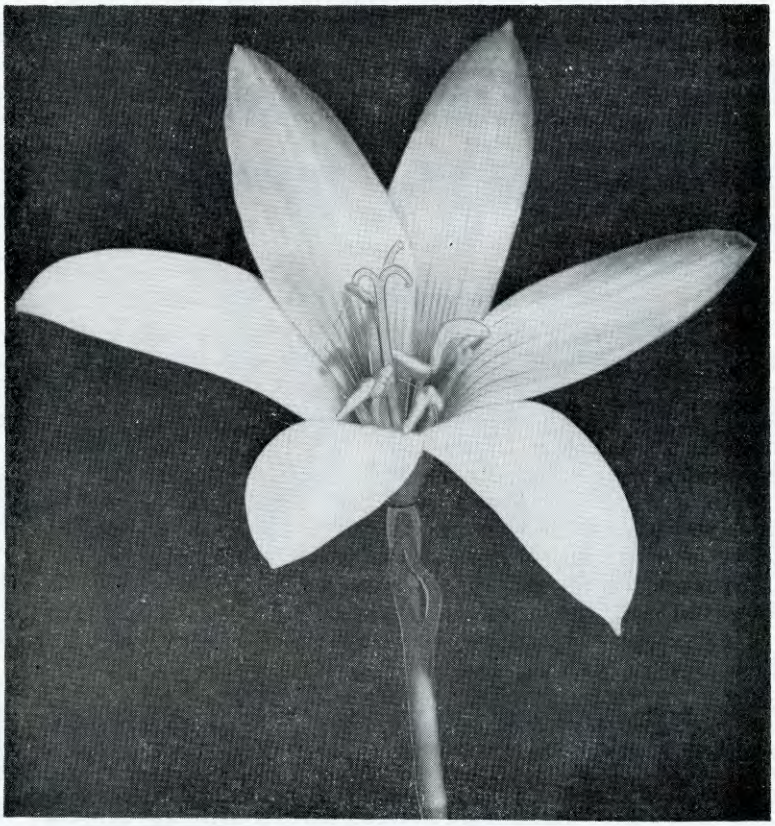

Fig. 12. **Zephyranthes mesochloa** Herb.; cultivated from bulb collected in South Brazil. Photo by Pierfelice Ravenna.

Hunziker's lack of information concerning *Z. mesochloa,* a well known species already recorded in Argentina and Brazil, seems difficult to explain.

Zephyranthes stenopetala Bak. (1898) had been described from specimens collected by Cantera on the banks of the Santa Lucía river, near Montevideo, Uruguay. Some time ago, I received a photograph of the type-sheet by courtesy of Kew Gradens. This revealed that *Z.*

stenopetala is an additional synonym of *Z. mesochloa*. The shape of tepals varies in the species from oblanceolate to almost linear; their breadth being also somewhat variable. It seems also that the flowers in the type-sheet of *Z. stenopetala* had been improperly dried, or it may have been that the plants were not pressed immediately after being gathered. This caused the tepals to become convolute, looking narrower than they actually are.

Zephyranthes timida Holmberg (1903), and *Z. oxypetala* Speg. (1917), had both been described from material from the province of Misiones (Argentina), the former from Santa Ana and the latter from the neighborhood of Posadas. These specimens have never been located and they are surely lost. Nevertheless, the orginal descriptions of both entities fit reasonably with that af *Z. mesochloa*. In December, 1969, I found *Z. mesochloa* in the fields of the Zaimán Agricultural Farm, which is near Posadas. The species is quite frequent southwards through Corrientes to Entre Ríos, and also in Córdoba, Santiago del Estero and Tucumán, in Argentina.

Zephyranthes mesochloa Herb. (Fig. 12)

Herbert, Edward's Bot. Reg. 16: sub tab 1345 et tab. 1361. 1830.—*Zephyranthes acuminata* Herbert, *loc. cit.* 16: sub tab. 1345. 1830.—*Z. flavescens* Herbert, loc. cit.—*Amaryllis mesochloa* (Herb.) Grisebach, Abhandl. Königl. Gesell. Wissensch. Götting. 19: 221. 1874.—*Amaryllis entreriana* Hoffmansegg, Linnaea 43: 137. 1880-82.—*Zephyranthes entreriana* (Hoffmsgg.) Pax, Engler Bot. Jahrb. 11: 320. 1890.—*Z. bakeriana* Morong, Ann. N.Y. Acad. Sci. 7: 239. 1893.—*Amaryllis hassleriana* Chodat et Lendner, Bull. Herb. Boiss. ser. II, 1:422 1901.—*Zephyranthes timida* Holmberg, An. Mus. Hist. Nat. Buenos Aires, ser III, 2: 77. 1903.—*Z.oxypetala* Spegazzini, Physis 2: 41. 1917.—*Z. stenopetala* Baker, Kew Bull. 1898: 226.—*Z. hassleriana* (Chod. et Lendn.) Traub, Pl. Life 6: 60. 1950.—Pro syn.: *Zephyranthes kurtzii* Hunziker, Kurtziana 5: 361, fig. 5. 1969.

Selected specimens: Argentina, prov. of Tucumán, dept. Tafí Siambón, 1200 m; leg. S. Venturi 3930, 28-X-1925 (LIL). Idem ibid., 1300 m; leg. Schreiter 6767, XII-1931 (LIL). Idem ibid. Puerta de San Javier; leg. Schreiter 1709, 20-XI-1921 (LIL). Idem, Sierra de San Javier, Alto San Pablo, 1200 m; leg. Lillo 4589, 15-X-1905 (LIL). Idem, La Ciénaga, 2600 m; leg. Lillo (LIL 96279). Idem, dept. Trancas, Raco, 1500 m; leg. Schreiter 1406, 27-XI-1920 (LIL). Idem ibid., 1000 m (flowered in Tucumán); leg. Schreiter 6755, XII-1931 (LIL). Idem, Trancas, 900 m, among rocks; leg. Venturi 1968, 13-XI-1922 (LIL). Idem, Boca Quebrada de Gualinchay (S. Pedro de Colalao); leg. Lillo, X-1915 (LIL 30760). Dept. Burruyacu, Cerro del Campo, 1400 m; leg. Hueck 1007, 30-XI-1950 (LIL). Idem, Trapunco, 1700 m; leg. Schreiter 5494, 7-II-1927 (LIL). Dept. Leales, Chañar Pozo, 300 m; leg. Venturi 622, XI-1919 (LIL). Province of Córdoba, raro inter frutices ad Las Peñas; leg. Lorentz, 1872 (BA 37827, BA).

Paraguay, San Bernardino, in campo; leg. Hassler 3471, XI (P, practically a topotype of **Amaryllis hassleriana** Chod. et Lendn.).

Brazil, Santa Catarina, São Joaquím, Invernadinha; leg. P.B. Rambo, 20-I-1958 (PACA 64306).

Zephyranthes kurtzii Hunz. does not seem to differ materially from *Z. mesochloa*. A plant which I observed at Cerro de los Mudaderos, Sierra de Catamarca, Arg.), is unquestionably the same as Hunziker's plant. This author found *Z. kurtzii* on the Sierra de Ambato, a branch of the same mountain system as the Sierra de Catamarca. I did not find any special feature to distinguish it, at least in the specific rank.

IV. STUDIES IN THE GENUS **HABRANTHUS**

1. New species from Argentina, Brazil and Uruguay

Habranthus guachipensis sp. nov.

A *Habrantho salinarum* affinis sed flore valde majore lobis stigmae leviter longiores recedit.

Bulbus 25-30mm longus, 21-27 mm latus. Folia linearia crassiuscula ad 0.6-1.5 mm lata. Spatha 27-30 mm longa usque 8-11 mm longa fenestrata vel integra. Inflorescentia 1-flora. Flos albus 45-50 mm longus. Filamenta stricte fasciculata. Stylus declinato-ascendens ad 33-34 mm longus. Stigmae lobi recurvati circ. 2 mm longi.

Plant 18-20 cm high. *Bulb* almost globose or broadly ovoid, 25-30 mm long, 21-27 mm in diam., produced for 20-50 mm long into a *pseudoneck*. *Leaves* present at anthesis, linear, somewhat fleshy, 12-22 cm long, 0.6-1.5 mm broad, narrowly channelled. *Scape* about 11-12 cm long, 1.8-2.7 mm broad. *Spathe* one-flowered, 27-30 mm long, tubulose for 8-11 mm, with a fenestrate or rarely entire apex. *Pedicel* 18-22 mm long. *Ovary* obtusely trigonous, ca 4.5 mm long, 2.2 mm broad. *Perigone* narrowly funnel-shaped, white, 45-50 mm long. *Tepals* oblanceolate, joined for 3-3.5 mm at the base, about 44.5-49 mm long, 9 mm broad. *Filaments* closely fascicled; upper episepal ca 12 mm long, lateral episepal 15-16 long, lower epipetal ca. 19 mm long, lateral epipetal about 22 mm long. *Anthers* semilunate, 2-2.5 mm long. *Style* declined-ascending, 33-34 mm long. *Stigma* lobes markedly recurved, ca. 2 mm long.

Specimens: Argentina, prov. of Salta, Quebrada de Guachipas; leg. Castellanos, 23-I-1943 (type BA 46672).

Habranthus guachipensis is not likely to be confused for any other known species, except for *H. salinarum* Rav. The latter, a native of the province of Córdoba, has a smaller flower with shorter stigma divisions. The collection listed above, is the only one known for the species.

Habranthus catamarcensis Rav. sp. nov.

A *Habrantho tubispatho* balde affinis sed foliis angustioribus linearibus-subteretibus fusco-viridis flore fusco-aurantiaco differt.

Folia dua ad anthesin praesentia anguste linearia-semiteretia levissime canaliculata fusco-viridia haud pruinosa crassiuscula, ad 12-15 cm longa circ. 1-1.7 mm lata. Spatha 20-40 mm longa ad 10-30 mm tubulosa. Perigonium late infundibulatus fusco auranthiacus circ. 18-20 mm latum.

Plant about 10-12 cm high. *Bulb* almost globose, 17-20 mm in diam., produced into a pseudoneck. *Leaves* synanthious, about two, narrowly

linear-semicylindrical, very slightly channelled, a dark green, not pruinose, almost fleshy, 12-15 cm long, 1-1.7 mm broad. *Spathe* 20-40 mm long, tubular for 10-30 mm. *Perigone* widely infundibulate, a dark orange, about 18-20 mm in diameter.

Hab.—Sandy exerophytic plateau, at foot of the Andes, in the province of Catamarca, Argentina. The writer has found it some kilometers south from the village of Londres. The plant was growing in an open area with *Opuntia ficus-indica* or a similar type, as dominant. Other common elements in the environment were *Trichocereus pasacana* and *Tephrocactus* sp., along with bushes of several families.

Specimens: Inter Londres and La Aguada in provincia Catamarca Argentinae; leg. Ravenna 10, 11-1960 (typus in Herbario Ravennae).

A single specimen of this apparently very rare species was collected by me a long time ago. Due to this circumstance, the dissection of the flower was not undertaken. Nevertheless, the characters in the description above distinguish the species well. At the time when the plant was found, it was thought to be a form of *H. tubispathus.*

Habranthus ruizlealii Rav. sp. nov.

Species a *Habrantho riojano* semilis sed inflorescentia interdum 2-flora lobis stigmae brevioribus 1.5-2.4 mm longis differt.

Plant 16-24 cm high. *Bulb* ovoid 45-47 mm long, 33-35 mm in diameter, covered with brown coats and produced into a 45-50 mm long *pseudo-neck. Leaves* at anthesis incipient, linear, 2-2.5 mm broad. *Scape* 10-16 cm long, 2.5 mm broad. *Spathe* 1-2-flowered, slightly reddish, membranous, tubulose for 20.5-28.5 mm, bifid for 13-20 mm. *Pedicels* 28-38 mm long. *Flowers* white or pink, 38-45 mm long. *Ovary* club-shaped, obstusely trigonous, ca. 6.5 mm long, 1.5 mm broad. *Tepals* oblanceolate, connate at the base for 2.8 mm, about 39-47 mm long, 8-10 mm broad; the outer apiculate, the inner acute. *Filaments* declined; the upper episepal ca. 8 mm long, lateral episepal 9.5 mm long, lower epipetal 17.5-25 mm long, lateral epipetal 19-30 mm long. *Style* declined 28-35 mm long. *Stigma* divisions recurved, 1.5-2.4 mm long.

Specimens: Argentina, prov. of La Rioja, between Chaña and Castro Barros; leg. A Ruiz Leal 16571, 20-I-1955 (type in Herb. Ruiz Leal, Mendoza).

Closely related to *Habranthus riojanus* Rav.; differing however, in the often two-flowered inflorescence, and in the much shorter stigma divisions. It gives me great pleasure to dedicate this species to Prof. A. Ruiz Leal, the distinguished botanist of the University of Mendoza.

Habranthus duarteanus Rav. sp. nov.

A *Habrantho irwiniano* planta robustiora et flore valde majore pariter ventricoso, a *H. tubispatho* qui valde simili folia angustiora et perigonii colore differt.

Plant 12-15 cm high. *Bulb* subglobose or ovoid, 20-24 mm long, 13-20 mm in diam., produced into a 15-22 mm long pseudo-neck. *Leaves* incipient at anthesis, narrowly linear, somewhat thickened, about 1 mm broad. *Scape* cylindrical, to 8 cm long, 2-2.5 mm in transverse section. *Spathe* one-flowered, membranous, 24-30 mm long, tubular for 15-18 mm, bifid for 6-9 mm. Pedicel 17-22 mm long. *Ovary* almost ellyptic 4-5 mm long, 2-2.2 mm in transverse diameter. *Perigone* slightly ventricose below, 32-38 mm long, 15-18 mm in diam. *Filaments* declined, lower episepal 13-14 mm long, lateral episepal 15-16 mm long, lower epipetal 19-20 mm long, 20-22 mm long. *Style* declined, curved, 21-23 mm long. *Stigma* trifid, its lobes recurved, 1.5-2 mm long.

Hab.—Mountains of Central Minas Gerais, Brazil; known only from the type-locality.

Specimens: Brazil, Minas Gerais, mun. Agua Limpa, próxima á Cervejaría Mineira, BR 3; leg. A.P. Duarte 10595, 16-X-1967 (typus Herb. Ravennae, isotypus RB).

This is the second *Habranthus* species which is recognized in the State of Minas Gerais; the first was *H. irwinianus* Rav., a native of the Southeastern part of the Serra do Espinhaco. Both species are easily distinguished by the size and shape of the flower. *H. duarteanus* has been named in honor of its collector, the distinguished botanist Prof. Apparício Pereira Duarte.

Habranthus goianus Rav. sp. nov.

A *Habrantho sylvatico* valde affinis sed foliis latioribus pallidioribus floribus roseis concoloribus recedit.

Plant about 23 cm high. *Bulb* ovoid, 28-32 mm long, 20-24 mm wide, produced into a 40-45 mm long pseudo-neck; outer coats dark. *Leaves* none at anthesis. *Scape* 13-25 cm long. *Spathe* 22-28 mm long, bifid for 9-11 mm, rarely almost entire. *Flower* solitary, pedicelled, pink, 48-64 mm long, 30-35 mm in diam. *Pedicel* 33-37 mm long. *Ovary* obovate, 3.9-4.9 mm long, 2.4-2.8 mm in transverse section. *Tepals* oblanceolate, joined for 3.5-4 mm at the base, 48-64 mm long, 9-10 mm broad, the outer apiculate, the inner acute. *Filaments* declined; lateral episepal 21-26 mm long, upper episepal 23-32 mm long, lower epipetal 28-34 mm long, lateral epipetal 32-37 mm long. *Anthers* versatile 3.8-4 mm long. *Style* 44-51 mm long. Stigma shortly trifid, its lobes recurved 1.5-2 mm long.

Specimens: Brazil, Goiás, Belem-Brasilia highway, 5 km north of Nova Colinas, "cerrado"; leg. G. T. Prance & N. T. Silva 58502, 31-VII-1964 (typus UB, isotypus N.Y.).

This species is closely related with *Habranthus sylvaticus* Mart. ex Roem. et Schult., differing in the flower pattern and in the leaves. In

1966 Eng. E. P. Heringer of the University of Brasilia, showed me a living plant of this species in his garden. The bulb was collected in the vicinity of the City. The leaves were rather board and of a light green. I have gathered *H. sylvaticus* in the "caatinga", about 8 km north from Petrolina (Pernambuco), not far from the San Francisco river. The leaves in the latter are narrower and somewhat darker.

Habranthus estensis Rav. sp. nov. (Fig. 13)

Habranthus inflorescentia biflora raro uniflora floribus valde apertis pulchre roseis instructus. A *H. concordiae* species valde proxima est

Fig. 13. **Habranthus estensis** Ravenna. Inflorescence, approx. natural size. Drawing by Pierfelice Ravenna.

sed foliis paullo angustioribus fusco viridis haud pruinosis floribus brevioribus magis apertis, a *H. pedunculoso* et *gracilifolio* quibus inflorescentian saepe bifloram habent foliis linearibus marginibus attenuatis differt.

Plant 20-30 cm high. *Bulb* subglobose or depressed-globose, 25-30 mm in diam., covered by dark membranous coats, and with a 25-35 mm

long pseudo-neck. *Leaves* absent at anthesis or rarely a single present, often serotine, linear, channeled, flaccid, a dark green, not pruinose, 13-20 cm long, 3-4 mm broad. *Scape* often of the same length as the longer leaf, a pale ocher-green, often purplish in the lower third. *Inflorescence* two flowered or, less frequently, one-flowered. Spathe 20-47 mm long, bifid for 6-15 mm, a pale brownish-pink or greenish. *Pedicels* 26-30 mm long. *Flowers* 24-34 mm long, 45 mm in diameter when fully expanded, with a small greenish star at the throat. *Ovary* obovate or elliptical, 4-5 mm long, 2-2.2 mm broad. *Tepals* oblanceolate, joined for 2.5 mm at the base, about 25-27 mm long, the outer 9 mm broad; lateral inner series 8 mm broad, lower-inner 6.7-7 mm broad. *Filaments* declined; the upper episepal to 6 mm long, lateral episepal about 7 mm long, lateral epipetal 8-9 mm long, lower epipetal 10-12 mm long. *Anthers* reniform, yellow, 2.5-3 mm long. *Style* declined, 16-18 mm long. *Stigma* divisions about 2.5 mm long. *Capsule* obovate, moderately tricoccous, about 15 mm long, 12.5 mm in diameter. Seeds semicircular rarely almost circular, somewhat thickened, black, shiny, thinner or membranous at the margins, 3.4-5.4 mm long, 3.4-4 mm broad.

Hab.—Stony or sandy places at Punta Ballena, and near Punta del Este, in the Uruguay Republic. In the former location it is found near *Nothoscordum balaenese* Rav., *Habranthus gracilifolius, Tristagma recurvifolium, T. uniflorum, Nothoscordum bonariense, Stenandrium trinerve, Oxalis machin,* and others.

Specimens: Culta in Bonaria ex bulbis a doctore John Christie ad Punta-Ballenam Pruguriae collectis; leg. Ravenna 1031, IV-1969 (typus in Herbario Ravennae). In arenosis prope Punta del Este Uruguariae; leg. Ravenna 1380, IV-1971 (Herb. Rav.).

This handsome species might be confused with *Habranthus gracilifolius* Herb., which grows in the same ecological niche. *H. estensis* differs from the latter in the texture and thin margins of leaves, and in the widely expanded flowers. *H. concordiae* Rav., from Entre Ríos (Argentina), and *H. longipes,* from Uruguay, have longer flowers with narrower tepals; in the latter the inflorescence is one-flowered. *H. pedunculosus* Herb., from Argentina, Brazil, Uruguay (?) and Paraguay, has cylindrical, fistulose, leaves.

There is a specimen from the vicinity of Mar del Plata (prov. of Buenos Aires), in the Argentine Museum of Natural History, which seems to agree with this species. Nevertheless, further studies with living plants from this locality are needed in order to verify this point.

Bulbs of *H. estensis* were brought from Punta Ballena, Uruguay, Dr. John Christie, along with other interesting plants, such as the recently classified *Nothoscordum balaenense* Rav. (1971). The former species was found by me also in sandy places near Punta del Este.

Fig. 14. Habranthus **barrosianus** Hunziker et Di Fulv. **Left** side view of flower as cultivated at Santiago, Chile. **Right,** upper view of flower. **Photos by Pierfelice Ravenna.**

2. Habranthus barrosianus Hunz, et Di Fulv. (Fig. 14)

Descr. ampl., Hunziker & Di Fulvio, Kurziana .7: **133.1973**

Plant 15-25 cm high. *Bulb* ovoid or subglobose, about 18-22 mm wide, covered by dark brown coats and prolonged into a 18-25 mm long pseudo-neck. *Leaves* vernal, absent at anthesis, prostrate, markedly channelled to almost flat, a pale green, often glaucescent, to 14-20 cm long, 2.7-5 mm broad. *Scape* cylindrical, a pale green and reddish below, or a pale reddish-brown from base to top, about 8-15 cm long. *Spathe* 27-35 mm long, bifid for 9-13 mm, a pale brownish-red except at the greenish apex. *Inflorescence* one-flowered. *Pedicel* 37-60 mm long, a pale brownish-red, or a dirty greenish. Ovary claviform to cylindric, brownish-green, about 6-7 mm long, 2.8 mm wide. *Perigone* inclined, funnel-shaped, brownish or reddish-brown for 17-21 mm, below, a pale pink above, about 40-55 mm long, 40-50 mm in diam. *Tepals* broadly oblanceolate, joined at the base for 2.5 mm; the outer 43-53 mm long, the upper 11-21.8 mm broad, the lateral 9.5-17.5 mm broad, the apiculum 1-1.5 mm long; the inner 40-52 mm long, the lateral 8.5-17.3 mm broad, the lower 8.5-11.8 mm broad. *Filaments* whitish or sometimes whitish-pink; the lateral episepal 9-12.5 mm long, upper episepal 13-16.5 mm long, lower epipetal 16-23.5 mm long, lateral epipetal 21-26.5 mm long. *Anthers* semilunate, yellow, about 2.9-4 mm long. *Style* whitish or a very pale pink except the whitish apex, about 30-35 mm long. *Stigma* whitish, its lobes recurved, about 2.6-2.8 mm long.

Habitat.—A native of the Tandilia orographic belt of the province of Buenos Aires (Argentina), and also, apparently, in Uruguay. It has been found on a "table hill" at estate "La Pelegrina", between Mar del Plata and Balcarce, growing among stones close to *Habranthus tubispathus, Anemone decapetala,* and *Gymnocalycium* sp.

Specimens: Culta in Santiago Chiliae ex bulbis in praedio "La Pelegrina" prov. Bonaria Argentinae collectis; leg. Ravenna 2048, XII-1972 (in Herb. Ravennae, TRA, LP). Uruguay.

Habranthus barrosianus resembles *Habranthus martinezii* Rav. mainly in the flower color. It differs, however, in the leaf morphology, the perigone size and shape, and the much broader tepals. The specimen from Uruguay, cited above, is tentatively referred to this species.

3. Habranthus variabilis (Rav.) comb. nov.

Habranthus tubispathus (L'Her.) Traub ssp. *variabilis* Ravenna, Pl. Life 26: 102. 1970.—*H. tubispathus* ssp. *variabilis* Rav. var. *roseus* Ravenna, *loc. cit.* 26: 103. 1970.— *H. tubispathus* ssp. *variabilis* Rav. var. *bicolor* Rav., *loc. cit.* 26: 103. 1970.—Pro syn.: *Habranthus andersonianus* Herb. var. *parvula* Herbert, Amaryll.: 168, pl. 26, fig. 4. 1837.

Having examined additional material of this entity, I feel convinced now, that it deserves species rank. The varieties *roseus* and *bicolor,*

both proposed by me, seem to have little taxonomic importance. Similarly, the flowers of *Rhodophiala chilensis,* in the same population can be scarlet, purple or yellowish.

Habranthus andersonianus var. *parvula* Herb., seems to be the same as *H. variabilis.* The species is here reported in the flora of Paraguay.

Specimens: Ad viam ferream inter Paso de los Libres et Monte Caseros prov. Corrientes Argentinae; leg. Ravenna 446, III-1965 (Herb. Rav., typus) Prov. Santa Fé, dept. Reconquista, Ocampo; leg. S. Venturi 182, 25-III-1904 (BA 16728), in swamps.

Paraguay, Ibiaty; leg. Joergensen 3876, III (BA 28/1675), common in the fields.

4. On the identity, synonymy, and distribution area of **Habranthus pedunculosus** Herb.

Habranthus pedunculosus Herb. (1837), has been considered by authors as a synonym of *Rhodophiala bifida,* until Ravenna (1970, p. 103) demonstrated that it is a valid *Habranthus* species in the present restricted sense of the genus. At that time, however, the identity of the species was somewhat obscure.

In January, 1971, I attempted to solve the problem concerning the plant that was reported in the flora of Buenos Aires as *Habranthus robustus* (see Cabrera 1953). With this purpose I explored the gentle slopes ("Barrancas") above the Paraná banks, between Zárate and the Las Palmas estate. The latter was the location where "Habranthus robustus" had been supposedly found.

At first the only Amaryllid that was seen, growing under shade of *Bauhinia candicans* and among bushes of *Lantana montevidensis,* was *Rhodophiala bifida.* It seemed unlikely that this could have been confused with *Habranthus robustus* by Cabrera (1953). After searching several hours in the difficult ground of the "barranca", I reached the upper part and came out from the close vegetation. Here, a second Amaryllid was found: *Habranthus teretifolius* (C.H.Wr.) Traub (sensu Hunziker 1967). Apparently this was the plant that had been misidentified with *Habranthus robustus* by Cabrera, and included with the latter name in the "Flora de la Provincia de Buenos Aires" by Fabris (1969).

While the population was being examined, an interesting fact was observed: in the soft soil under bushes plants were stout; whereas, in the nude, hard soil, plants showed a very short scape, sometimes two centimetres or less long. I remembered that almost the same phenomenon happened at the Botanic Garden of Castelar, where the species often spread naturally from the collection. This occasional condition contrasted with the comparatively long pedicels. These plants were identifiable with the early and until recently not recognized *Habranthus pedunculosus* Herb.

Due to the facts of above, the report of *Habranthus teretifolius* "for the first time" in Argentina (Corrientes) by Hunziker (1967) is probably invalid. *Habranthus pedunculosus,* a much early binomial, has been

recorded in Buenos Aires since its publication by Herbert in 1837. The "barrancas" of the Paraná river were probably the original location where Tweedie found the plant. On the other hand, the species has already been reported in the province of Corrientes under the synonym *Habranthus juncifolius* Traub & Hayward. The flowers in the type-specimen of *H. pedunculosus* (after which Herbert's illustration was made) show rather narrow tepals, but this circumstance is due probably to the fact that they become convolute as a result of being allowed to wither before they were pressed.

I feel considerable reluctance in associating the binomial *H. teretifolius (C.H.Wr.)* Traub with *H. pedunculosus*. According to Wright it had been raised at Kew from seeds collected by Cantera at Montevideo. Unfortunately, he did not prepare a dry specimen. I made several collecting trips to different parts of Uruguay, including the Capital region, but have never seen the latter species. Moreover, it is not represented in the Herbaria of that Country. There might be, in my opinion, two possibilities on this matter:

(1) The seeds were not actually collected near Montevideo. This leaves ground to conjecture that they could have been collected in the North-West region of Uruguay, near the border with Corrientes and Entre Ríos; the species is quite frequent in the latter provinces of Argentina.

(2) *Habranthus teretifolius* is a synonym of *H. gracilifolius* Herb., a native of Montevideo, which has thickened leaves with rounded sides that could be defined as "foliis teretibus"; these sometimes reach 3 mm in breadth. The flowers in *H. gracilifolius* are variable in size and not infrequently they agree with the measurements given by Wright in his description of *H. teretifolius*. In *H. gracilifolius* the inflorescence is 1-2 (3)-flowered

Both of the above possibilities are valid, but impossible to verify, since Wright's description is deficient in details, and since there is no type-specimen for comparison. Due to the lack of Uruguayan material of *Habranthus pedunculosus*. I feel inclined to the second hypothesis. The synonymy and distribution of the species follows.

Habranthus pedunculosus Herb.

Herbert, Amaryll.: 161, pl. 26, fig. 3. 1837.—*Hippeastrum pedunculosus* (Herb.) Baker, Trimen Journ. Bot. 16: 83. 1878.—*Hippeastrum teretifolium* C. H. Wright (?), Gard. Chron. 28 (2): 142. 1900.— *Habranthus juncifolius* Traub & Hayward, Herbertia 7: 40. 1947.—*Habranthus tereifolius* Traub & Moldenke, Amaryllidaceae tribe Amaryll.: 145. 1949.

The specimens that appear below, are the only ones that I am able to list now. They are not representative of the range of the species.

Hab.—Buenos Aires, Argentinan Mesopotamia (Entre Ríos, Corrientes and Misiones), Santa Fé, Chaco (near Resistencia), in Argentina, Brazil, Paraguay and Uruguay (?).

Specimens: Argentina, prov. of Buenos Aires, between Zárate and the Las Palmas estate, on the upper part of the "barrancas"; leg. Ravenna 1974, I-1971 (Herb. Ravenna). Culta in Horto Botanico Castelarensi; leg. Ravenna 811, III-1966 (Herb. Rav., BAB). Culta in Bonaria ex Bulbis a A. Schulz pr. Resistencia provinciae Chaco Argentinae collectis; leg. S. Magno, III-1972 (Herb. Rav.).

Brazil, Río Grande do Sul; leg. B. Rambo? (PACA 63639).

5. **Zephyranthes taubertii** reduced to synonymy of **Habranthus robustus,** and additional notes on this species

Herbert ex Sweet, Brit. Fl. Gard. ser. II, 4: tab. 14. 1831.—*Amaryllis robusta* (Herb. ex Sw.) Spach, Opera Hist. Nat. Pl. Phan. 1834.—*Amaryllis berterii* Sprengel, Linn. Syst. Veg. 2: 49. 1825.—*Zephyranthes taubertii* Harms, Gartenfl. 43: 281, tab. 1487. 1896.

The original description and illustration of *Zephyranthes taubertii* show that this binomial is a synonym of *Habranthus robustus.* The latter has been collected in the State of Paraná (Brazil) by Prof. Hatschbach, but apparently not as a true native. During the trips we made together in 1969, it has been observed by us growing freely in the modified fields, and always not far from places inhabited by man. Since the plant is often cultivated, we reach the conclusion that it might be a ruderal, at least in Paraná. In the vicinity of Posadas, prov. of Misiones (Argentina), I had the opportunity of seeing that the species tends to escape from gardens.

6. Notes on **Habranthus jamesonii**

Recently I have been asked how a plant with "red" flowers as Baker's *Hippeastrum jamesonii,* could be the same as the "white" *Zephyranthes melanopotamica* Speg. A retrospective survey of both binomials is therefore needed.

The original description of *Hippeastrum jamesonii* Bak. (1878), stated that the flowers are "pale red", which means *pink.* Nevertheless, in *Handbook of the Amaryllideae* (1888), this author transcribed, probably by oversight, the color as "red".

Sealy (1937, p. 196), stated that: "On the other hand H. jamesoni, like a number of other species that have been placed in Habranthus was found to have a spathe like that characteristic of Hippeastrum, to which genus Baker had referred these species, and to which they undoubtedly belong". In spite of Sealy's viewpoint, which relied exclusively on the examination of the type-sheet, the spathe is actually not bivalved. Although almost always deeply bifid, it clearly shows below a definite tubular portion. This feature can be observed in the four specimens of the type-sheet.

I have studied living plants brought from the province of Río Negro by Dr. Allan Murray, a distinguished amateur from Buenos Aires. These were collected in the type-region of *Zephyranthes melanopotamica.* Some of them had pink flowers with darker veins, others white. As was verified later, they agreed with the type of *Hippeastrum jamesonii.* I also received dry specimens and bulbs from Dr. E. Cano, (I.N.T.A.),

collecter in the province of La Pampa, and from Dr. A. Ruiz Leal from Mendoza. Plants from these sources flowered in my experimental collection. Dr. David Lee Anderson sent me dry specimens from the vicinity of Mercedes, in the province of San Luis (Argentina). The flowers in this species are heliophile: they expand well only in full sun, while only imperfectly when the sky is cloudy. This is an important feature which is not found in *Rhodophiala*.

Selected specimens: Argentina, Province of San Juan, ravines near Jáchal; leg. Jameson (photograph from the type of **Hippeastrum jamesonii**, courtesy of K.) Province of Mendoza, Cacheuta; leg. W. Díaz (SGO 46879). Idem, vicinities of Cerro Chiuiu, 35° 40′ lat. S, 69° 34′ long. W; leg. C.A. Menéndez, 12-XII-1949 (BA 54337). Idem, Tupungato; leg. Ruíz 251, XII-1916 (BA 25/1873). Idem, Dept. Luján, between Cacheuta and Potrerillos; leg. Ruíz Leal 6426, 19-XI-1939 (Herb. Ruíz Leal), "flor color rosado-cárneo". Idem, Dept. Las Heras, on arid hills near Villa Hipódromo; leg. Ruïz Leal 6362, 12-XI-1939 (Herb. Ruîz Leal), "muy abundante, flor color rosado-cárneo." Lower Rio Negro; leg. Hauman, II-1912 (BA 16757). Province of La Pampa, between General Acha and Chacharramendi; leg. O. Solbrig 184, 17-XII-1951 (BAB). Idem, between Victoria and Telen; leg. D. O King 82, 4-II-1928 (BAB).

7. Report of **Habranthus coeruleus** in South Brazil

Amaryllis coerulea Gris. (1879), basonym of *Habranthus coeruleus* (Gris.) Traub, had been originally collected by Lorentz in the fields of Concepción del Uruguay, province of Entre Ríos, Argentina. The species has been found again only recently at the Experimental Farm of Concepción del Uruguay. Actually, it seems that the species is quite rare in Argentina. Therefore, the recognition of *Habranthus coeruleus* among dry material from the Brazilian States of Paraná and Santa Catarina seems to be an interesting event.

Specimens: Argentina, prov. Entre Rïos, Concepción del Uruguay; leg. Lorentz 877, 21-III-1877 (isotype BAF), in sandy soil, after the first rains. Idem, Estación Experimental Agrícola, "potrero 64"; leg. S.B. Sorarú, 13-IV-1965 (Herb. Est. Exp. C. Urug., SI, Herb. Rav.).

Brazil, Paraná, Municipe of Lapa, Río Passa Dois; leg. Hatschbach 19722, 15-IX-1968 (Herb. Hatschb., Herb. Ravenna). Idem, Munic. Piraquara, 930 m; leg. Hatschbach 549, 24-XI-1946 (Mus. Bot. Munic. Curitiba). Idem, Munic. Ponta Grossa, Río Verde, Capao da Onca; leg. Hatschbach 17417, 11-X-1967 (Mus. Bot. Munic. Curitiba). Idem, Munic. S. José dos Pinhaes, Río Pequeno, gassy field on the slope of the "morro"; leg. Hatschbach 23195, 12-XII-1969 (Mus. Bot. Munic. Curitiba). Santa Catarina, Munic. Lajes, campo N of Lajes (along road BR-2); leg. Lindemann & Haas 3670, 15-XII-1966 (U).

8. On **Habranthus saltensis (Fig. 15)**

Habranthus saltensis Ravenna, Notic. Mens. Mus. Nac. Hist. Nat. Chile 173: 6. 1970; Plant Life 28: 125. 1972.

The species was orginally published without illustration; this is given here.

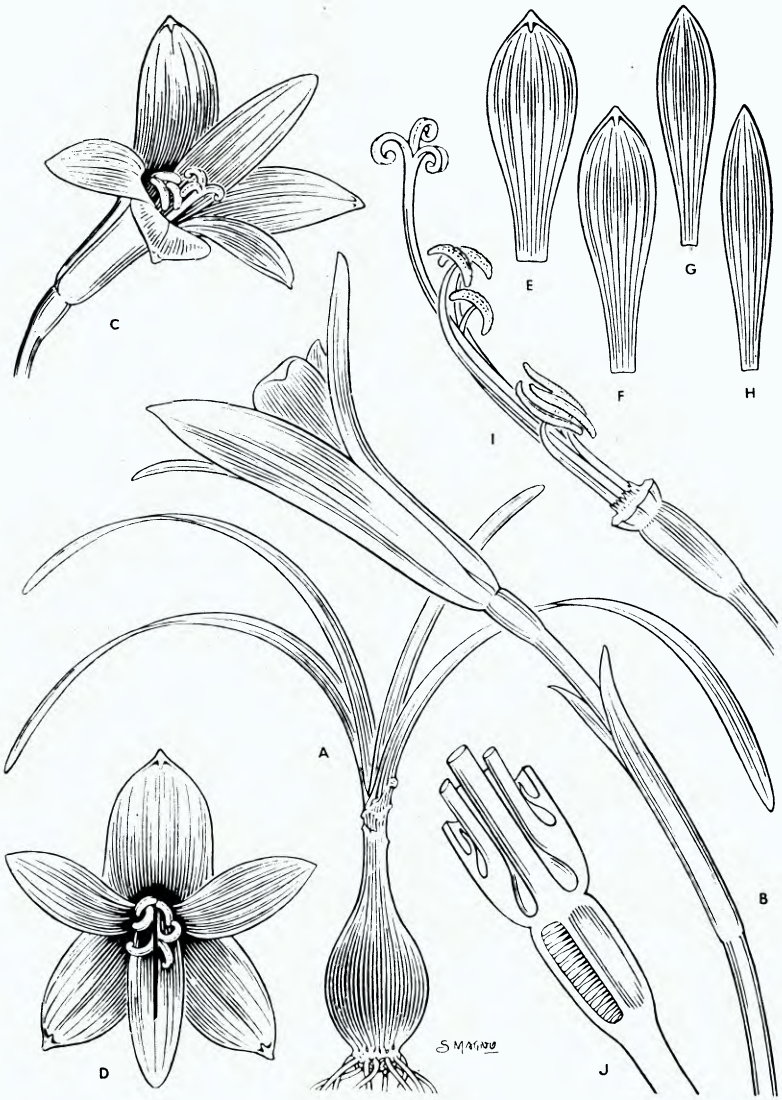

Fig. 15. **Habranthus saltensis** Ravenna. **A,** a plant with leaves (X 0.3); **B,** side view of inflorescence (X 1.1); **C,** side view of flower (X 1.1); **D,** upper view of flower (X 1.1); **E,** upper outer tepal (X 0.6); **F,** lateral outer tepal (X 0.6); **G,** lateral inner tepal (X 0.6), **H,** lower inner tepal (X 0.6); **I,** androecium (stamens) and gynoecium (pistil); note anther dimorphism (X 1.4); **J,** longitudinal section of lower part of a flower, showing ovules and insertoon of stamens, paraperigone and style (X 2.1). Drawing by S. Magno.

V. NOTES ON THE GENUS **FAMATINA**

Ravenna (1972) proposed the new genus *Famatina,* an inhabitant of the Andes of Argentina and Chile. The genus has been defined with three species: *F. saxatilis* Rav. (the type), *F. herbertiana* (Lindl.) Rav., and *F. maulensis* Rav. Due to a *lapsus calami,* the genus was included in tribe "Habrantheae", instead of *Zephyrantheae.*

Famatina maulensis Rav. (Fig. 16)

Ravenna, Pl. Life 28: 58, fig. 19. 1972.

Fig. 16. **Left, Famatina herbertiana** (Lindl.) Ravenna, showing mature capsule with seeds. **Right, Famatina maulensis** Ravenna, inflorescence, as photographed in its native habitat. Photos by Pierfelice Ravenna.

Since the publication, living plants of *Famatina maulensis* and *F. herbertiana* were examined. Therefore, it is necessary to review their characters. Additionally, I give the complete synonymy and range of the latter.

Plant 20-35 cm high. *Bulb* ovoid, 36-47 mm long, 21-28 mm in diameter, covered with dark brown coats and produced into a 26-65 mm long pseudo-neck. *Leaves* 2-3, synanthious, subfistulose, with rounded margins, internally with thin, longitudinal, connected walls (as in *Placea*), a bright green, 22-30 cm long, 4-6 mm broad. *Scape* a pale reddish-brown in the upper half, reddish downwards, 22-30 cm long, 4.5-6.3 mm broad near the base, narrowing gradually toward the apex. *Spathe* valves lanceolate, purple, marcescent, about 34-64 mm long. inner bracts as much as flowers, linear-lanceolate, 14-20 mm long. *Inflorescence* 2-3-flowered. *Pedicels* a pale brownish-green or reddish, 19-30 mm long. *Ovary* obovoid, a brownish green, 4.5-5.2 mm long, 3.4-4 mm broad. *Perigone* almost tubular throughout, ascending, intesely red, 32-35 mm long, 9-12 mm in diam. at the apex. *Tepals* connate for 6-7 mm; the outer series 24-30 mm long, 4.3-6 mm broad, internally with a white streak except in the upper forth; inner series 25.8-29 mm long, 4.5-6.3 mm broad, internally with a yellowish-white streak. *Filaments* filiform, free to the base, red in the upper half, clearing downwards to a salmon-yellowish; the upper episepal 18 mm long, lateral episepal 18.6-20 mm long, lower epipetal 21 mm long, lateral epipetal 22-23 mm long. *Anthers* yellow, versatile, 2mm long. *Paraperigone* absent. *Style* filiform, 28 mm long. Stigma capitate.

Hab.—Known at present only from the upper part of the Cuesta de los Cóndores, not far from the Maule lake, in the province of Talca, Chile. Altitude about 1500 m over the sea.

Specimens: Chile, prov. of Talca, on the way to the Maule Lake, Cuesta de los Cóndores, near the "Monjes Blancos"; leg. Ravenna 1999, XI-1971 (Herb. Rav., SGO). Idem, near Laguna del Maule; leg. Zoellner, XII-1969 (type Herb. Rav., isotype Herb. Zoellner).

In December, 1971 I explored the native area of *Famatina maulensis*, and was able to find it near the upper part of the "Cuesta de los Cóndores", at a lower altitude than the Maule lake (prov. of Talca). Prof. Zoellner, who was the first collector of the plant, communicated (verbally) that actually he found the species in the upper part of the Cuesta, and that the annotation "Laguna del Maule" in the type-sheet was a mere reference to the region, and not as to the exact location.

The living plants that I have studied *in situ* showed discrepancies from the original description, because of some misinterpretations in the study of the dry specimen. These concern the leaf morphology, the position of the flower in the inflorescence, and the non-existence of a paraperigone. A new key is therefore necessary.

1a. Leaves fistulose or almost so, with rounded edges ..... 1. **F. maulensis**
1b. Leaves not fistulose, with thin edges:
2a. Flowers horizontal or sometimes declined; scape 15-35 cm long ..... 2. **F. herbertiana**
2b. Flowers ascending. Scape 1-8 cm long ..... 3. **F. saxatilis**

Famatina herbertiana Rav. (Figs. 16 and 17)

Ravenna, Pl. Life 28: 60. 1972.—*Phycella herbertiana* Lindley, Edwards Bot. Reg. 16: tab. 1341. 1830.—*Phycella graciliflora* Herbert Amaryll.: 152, 1837.—*Habranthus gladioloides* Hieronymus, Bol. Acad. Cienc. Córdoba 4: 70. 1881.—*Hippeastrum herbertianum* (Lindl.) Baker,

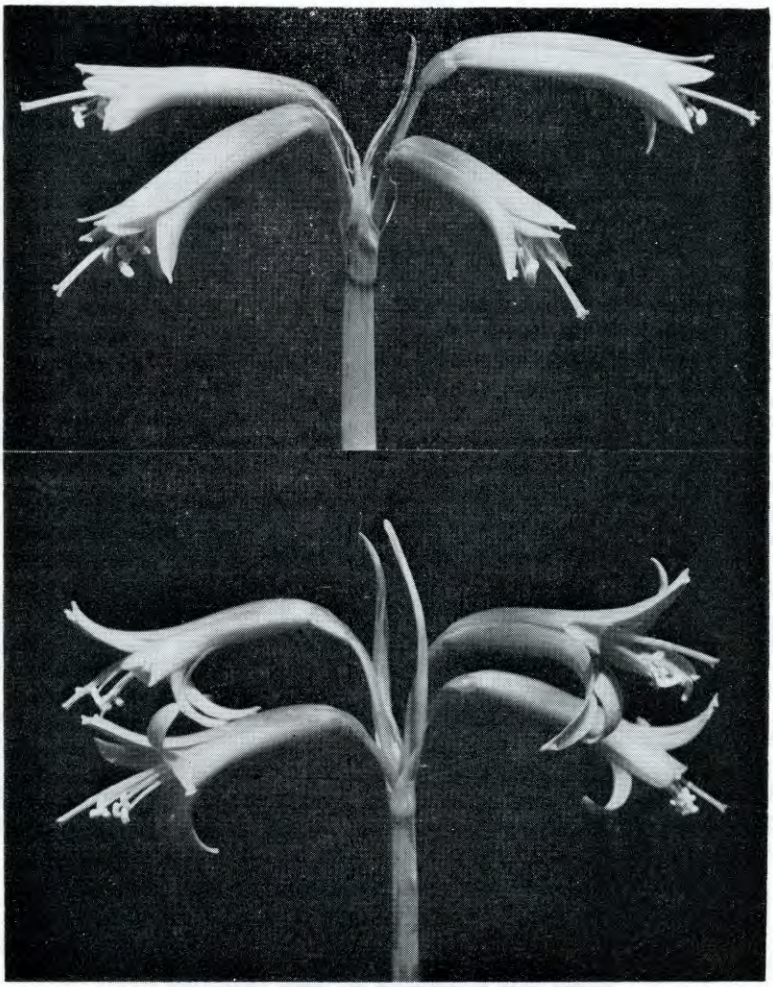

Fig. 17. **Famatina herbertiana** (Lindl.) Ravenna, inflorescence, showing two flower types of the species; note variation in the stigma shape. Photographed by Pierfelice Ravenna in their native habitat.

Handb. Amaryll.: 45. 1888.—*Hippeastrum gladiolodes* (Hieron.) Pax, Engler Bot. Jahrb. 11: 321. 1890.—*Amaryllis gladioloides* (Hieron.)

Traub et Uphof, Herbertia 5: 121. 1938.—*Amaryllis herbertiana* (Lindl.) T. & U., loc. cit.: 121. 1938.

Plant 15-30 cm high. *Bulb* ovoid, 55-64 mm long, 31-50 mm in diam., covered by dark brown coats, and prolonged into a 7-13 cm long pseudoneck. *Leaves* linear, channelled, flaccid, with thin margins, green, slightly pruinose, about 15-45 cm long, 7-10 mm broad. *Scape* 10-30 cm long, yellowish-green, green, or purplish-green, about 5.9-11.5 mm broad near the base, and 5-8 mm broad at the apex. *Spathe* bivalved, reddish-green or reddish; valves lanceolate, joined at the base, then 31-53 mm long. *Inflorescence* 3-8-flowered. *Pedicels* 10.5-43 mm long. *Ovary* obovid, obtusely trigonous, greenish-red or almost green, about 5-7 mm long, 3.7-4.5 mm broad. *Perigone* red, often ventricose near the base and constricted at the middle, otherwise almost tubular, frequently markedly bilabiate, the upper inner tepals often embracing the stamen fascicle and style, about 30-53 mm long, 14-29 mm in diameter. *Tepals* oblanceolate, connate for 3.5-7 mm, often very imbricate, the upper inner pair approximate or imbricately contiguous, embraced by the upper one; outer series with a whitish streak on the inner face, about 30-44.5 mm long, 6.3-8.3 mm broad, the apicule 0.8-1 mm long, with a penniciled tubercle at the base; inner series 31-47.5 mm long, 5.5-9 mm broad. *Paraperigone* annullar, fimbriate, about 1.3-3 mm long. *Filaments* ascending, whitish in the lower half, reddish toward the apex; upper episepal 24-39 mm long, lateral episepal 26-41 mm long, lower epipetal 28-44.5 mm long, lateral epipetal 31-39 mm long. *Anthers* 2.9-3.5 mm long; pollen yellow. *Capsule* tricoccous, pale green, 11-13 mm long, 19-21 mm in diam. *Seeds* black, shiny, semielliptical, 5-6 mm long.

Specimens: Chile, prov. of Aconcagua, Río Blanco; leg. Zoellner, XI-1969 (Herb. Zoellner). Prov. of Santiago, valley of the Yeso river, between Romeral and the dam, 1900 m; leg. Ravenna 2052, XI-1972 (Herb. Ravenna, SGO, TRA, et caet.). Prov. of Colchagua, near Termas de San Fernando, 2000 m; leg. Ravenna 2055, XII-1972 (Herb. Ravenna, SGO, TRA, et caet.). Prov. of Curicó, Laguna del Teno; leg. F. Behn, II-1967 (CONC 32662).

The stigma, in the fresh flowers that I have examined, revealed to be capitate, or capitate-trilobed, to shortly trifid. The latter eventual feature has to be included in the genus description. Recent collections disclosed that this species ranges, in Chile, from the valley of the Aconcagua river to the Teno Lake, in the province of Curicó, at the altitude of 1800-2500 m.

VI. STUDIES IN THE GENUS **AMARYLLIS**

1. Four new species and a new subspecies from Argentina and Brazil

Amaryllis arboricola sp. nov. (Fig. 18)

A *Amaryllide striata* proxima sed habitu arboreo bulbo ebulbillifero differt.

Planta arboricola circ. 45-55 cm alta. Inflorescentia 2-flora. Flores coccinei ventricose deflexi (ut in *Amaryllide belladonna*) ad 10-11 cm longi circ. 12-13 mm lati.

Plant 45-55 cm high. *Bulb* ovoid, not producing bublets, about 8 cm long, 6 cm in diameter; the outer coats brown, the pseudo-neck short. *Scape* green, 40-45 cm long, 14 mm broad near the base. *Spathe-valves* lanceolate, marcescent, about 60 mm long. *Inflorescence* two-flowered. *Flowers* red with a greenish-yellow star at the throat, ventricose-deflexed below (as in *A. belladonna*) about 10-11 cm long, 12-13 mm in diameter. The rest as in *A. striata*.

Fig. 18. **Amaryllis arboricola** Ravenna, as cultivated by Dr. Gómez, from bulb collected on fallen trees at El Dorado, Misiones, Argentina. Photo by Pierfelice Ravenna.

Hab.—An epiphyte of the high trees in the Northwestern part of the province of Misiones, Argentina. It was found near El Dorado.

Specimens: Culta a Doctore Gómez Ruppel ex bulbis in arboribus sylvis prope El Dorado Missionum: Argentinae collectis; leg; Ravenna 1951, XII-1971 (typus in Herb. Ravennae).

This handsome species is closely related to *A. striata* Lam., from which it mainly differs in its epiphytic habit and in the fact that the bulbs do not produce the characteristic bulblets. It is noted that, although belonging to a different ecological niche, this is an inhabitant of the same province as *A. petiolata* (see Ravenna 1970, pp. 73-78). The latter, an apparent natural hybrid, has still its parents not elucidated. Both *A. petiolata* and *A. arboricola* belong to the series *Striatae,* which means that they are allied. A chromosomical study in the latter is therefore needed.

Amaryllis guarapuavica Rav. sp. nov.

See PLANT LIFE 27:66, Fig. 20-B. 1971

A *Amaryllide vittata* affinis sed floribus longioribus decinatis, ab *A. ambigua* qui hybridum artificialem est perigonii diametro majore differt.

Plant 50-60 cm high. *Bulb* broadly ovoid about 8 cm in diam. covered with dark brown coats; pseudo-neck short. *Leaves* lorate, green, ascending, firm in texture, rather channelled, 25-42 cm long, 45-50 mm broad, almost obtuse. *Scapes* often two, 42-60 cm long, 16-30 mm broad. *Inflorescence* 2-4-flowered. *Spathe* valves subequal, marcescent, 9-10.8 mm long, 20-33 mm broad; inner bracts about 7, narrowly lanceolate, to linear. *Pedicels* 6-7 mm long. *Ovary* obtusely oblong, obtusely trigonous, a dark-green, 15-16 mm long, 5.5-8.3 mm broad. *Flower* very fragrant, about 18 cm. long, 11-12 cm in diameter; the *perigone-tube* brownish green in the lower half. *Tepals* oblanceolate, rather undulate, uncinate, white with two purple streaks on the adaxial face, about 12.7 cm long; the outer 30-31 mm broad, its apicule 4 mm long; inner 23 mm broad, acute. *Filaments* closely faccicled, white for most of the length, pink at the incurved apex; lateral episepal about 79 mm long, upper episepal 80-81 mm long, lower epipetal 83 mm long, lateral epipetal 91-93 mm long. Anthers reniform, 3-4 mm long. *Style* white, about 16 cm long (from the ovary). *Stigma* trifid, its lobes 3 mm long.

Hab.—In almost all open places with remnants of woody vegetation, in South-Western Paraná, Brazil. Also in the province of Misiones, Argentina.

Specimens: Prope Km 127 mun. Laranjeiras do Sul civitatis Paraná Brasiliae; leg. Ravenna 1038 cum G. Hatschbach 23129, 5-XII-1969 (typus in Herb. Ravennae, isotypus in Herb. Hatschbach). Mun. Guarapuava, Candoi; leg. Hatschbach 15184 (Herb. Rav., Herb. Hatschbach). Mun. Imbituva; leg. Hatschbach 7495, 23-X-1960 (Herb. Rav., Herb. Hatschb.). Argentina, prov. Misiones, Bonpland; leg. P. Joergensen Hanssen, 19-I-1930 (SI,BAB). Idem, floruit in Bonaria 24-XI-1901 in Horto Zoologico ex Misiones Santa Ana (?); leg. A. De Llamas (?), 1899 (SI).

In the 1971 edition of Plant Life (p. 66), I published *Amaryllis vittata* L' Her. ssp. *guarapuavae* Rav. Unfortunately, due to the omission in print of the specimens paragraph, this was illegitimate. At present, however, I feel convinced that the entity must be regarded as a species. The declined and larger flowers, are sharp features which separates *guarapuavica* from *vittata*. Both species are close allies, within subgenus *Macropodastrum*. *A. vittata* had hitherto been placed in subgenus *Lais*.

Amaryllis gertiana sp. nov.

A *Amaryllide petiolata* valde affinis sed bulbis ebulbilliferis folii ensiformibus acutioris tepalis angustioribus recedit.

Planta usque 37-46 cm alta. Bulbus subglobosus ad 50-58 mm latus. Folad anthesin 3-4 ensiformia acuta flaccida ad 17-30 cm longa circ 18-25 mm lata. Inflorescentia 3-flora. Flores rubri prope basin virides-centes ad 6-8.4 cm longi, circ. 4.5-7 cm lati. Perigonii tubus 10-19 mm longus. Tepala anguste oblanceolata recurvata ad 65-70 mm longa circ. 9-12 mm lata; tepalum interiori-inferius brevius et angustius. Filamenta ad apicem incurvata ad 32-47 mm longa. Antherae oblongo reniformes. Stylus usque 70-74 mm longus. Stigma trifidus lobis 3-4 mm longis.

Plant 37-46 cm high. *Bulb* subglobose 50-58 mm wide, produced into a 35 mm long pseudo-neck. *Leaves* 3-4 at anthesis, ensiform, acute, flaccid, a dark green (?), paler in the abaxial face, 17-30 cm long, 18-25 mm broad. *Scape* 26-44 cm long about 11 mm broad near the base, narrowing gradually toward the apex. *Spathe-valves* marcescent, subequal, about 43 mm long; inner bracts three, the outer 32 mm long, lanceolate, rather large, the other two shorter, linear-lanceolate. *Inflorescence* 3-flowered, *Pedicels* 13-21 mm long. *Ovary* obvoid or elliptic, obtusely trigonous, 4.5-6 mm long, 25 mm in transverse diameter. *Flowers* red, greenish toward the base, 6-8.4 cm long (when fully expanded), 4.5-7 cm in diameter. *Perigone* tube 10-19 mm long. *Tepals* narrowly oblanceolate, recurved, 65-70 mm long, 9-12 mm broad, except the lower inner which is shorter, narrower and prominent; outer series apiculate, apicules 1.4-1.5 mm long; *filaments* declined, incurved at the apex, the upper episepal 32-35 mm long, lateral episepal, 34-38 mm long, lower epipetal 36-38 mm long, lateral epipetal 45-47 mm long. *Anthers* oblong reniform, 4-4.7 mm long; pollen yellow. *Style* declined, curved, 70-74 mm long. *Stigma* trifid, its divisions spreading obliquely, 3-4 mm long.

Hab.—States of Paraná and Santa Catarina, Brazil.

Specimens: Brazil, Paraná, Municipe Bocaiuva do Sul, Santa Ana; leg. Hatschbach 27082, 4-X-1971 (type Herbarium Ravenna, isotype HH).

Similar to *Amaryllis petiolata,* but the bulb not bulbilliferous and the leaves gradually narrowed toward the apex. I have examined a specimen of this species from the State of Santa Catarina (HBR), but

this is at present not with me.

The species is properly dedicated to Prof. Gert Hatschbach, the distinguished botanist of the State of Paraná, Brazil.

Amaryllis goiana Rav. sp. nov. (Fig. 19)

Ab *Amaryllide solandraeflora* proxima sed floribus multo minoribus (circ. 10.8 cm longis) erecto-patentibus tepalis anguste oblanceolatis differt.

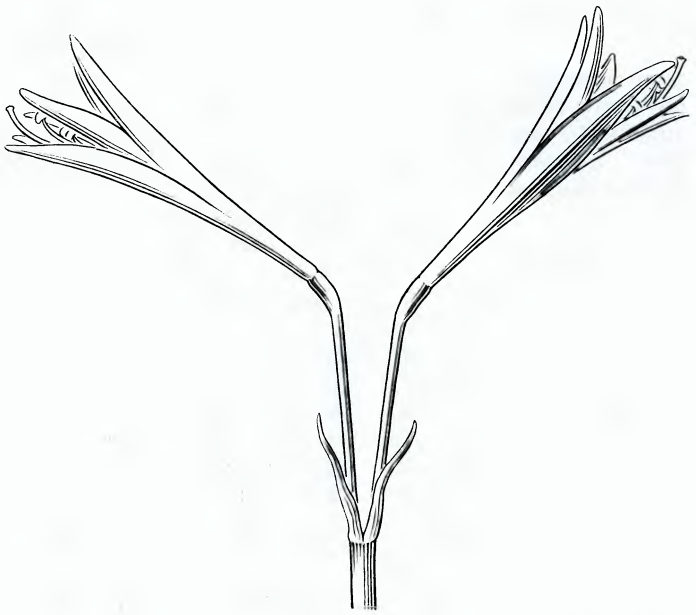

Fig. 19. **Amaryllis goiana** Ravenna, showing inflorescence (X 0.02) from living plant flowered in Buenos Aires. Drawing by Pierfelice Ravenna.

Plant 30-40 cm high (to the inflorescence apex). *Bulb* depressed-globose, ca. 6 cm in diameter; *pseudo-neck* short. *Leaves* hysteranthious, about 2-4, ascending, lorate, channelled or often almost flat above, a pale green, slightly pruinose, purplish below, with cartilaginous margins, sometimes with a pale, yellowish-green streak throughout at the middle, 40-70 cm long, 15-25 mm broad. *Scape* rather compressed, a pale green, ca. 18.5 cm long, 12 mm broad. *Spathe* two-flowered; valves lanceolate, marcescent, about 46 mm long, a greenish-ocher. *Pedicels* 37-73 mm long. *Flowers* obliquely ascending. *Ovary* pandurate-cylindrical, obtusely trigonous, green, rather striate with purplish-brown, 11-14.5 mm long, 4-4.4 mm broad. *Perigone* narrowly funnel-shaped a greenish-yellow, 10.8-15 cm long, 60-65 mm in diameter, with a few

purple streaks below. Perigone-tube 35-54 mm long. *Tepals* narrowly oblanceolate, 75-90 mm long; the outer 10.5-17.5 mm broad, bearing a green, 1.5-2 mm long, apicule; the lateral-inner ca. 17.5 mm broad; lower-inner 12.4 mm broad. *Filaments* closely fascicled, whitish; the upper episepal 45-50 mm long, lateral episepal 52-54 mm long, lower epipetal 61-65 mm long, lateral epipetal 63-68 mm long. *Anthers* yellow, 5-5.8 mm long. *Style* declinate, 10.5-14.4 hh long. *Stigma* capitate, obscurely trilobed.

Hab.—In sandy lateritic soil near the city of Brasilia; also northwards as far as to the Chapada dos Veadeiros. In the latter region it grows in sandy quartzitic soil.

Specimens: Culta in Bonaria ex bulbis at Papuda pr. urbem Brasiliae collectis; leg. Ravenna 977, X-1968 (typus in Herb. Ravennae). Brazil, D.F., Papuda; leg. E. P. Heringer 8759, 5-IX-1961 (UB). Goiás, 200 km N of Brasilia, 800 m; leg. A. de Haas 170, 22-IX-1967 (U).

This species is closely related with *Amaryllis solandraeflora* Lindl. Bulbs and leaves are so similar in both, as to be undistinguishable. Notwithstanding, the much smaller, obliquely ascending flower, and the much narrower tepals, in *A. goiana,* are features which disagree with that species.

Amaryllis heuseriana (Karst.) Rav. comb. nov.

Hippeastrum heuserianum Karsten, Fl. Columb. 2(3): tab. 102. 1858-59.-*Amaryllis aulica* Ker var. *platypetala* Lindley, Edwards's Bot. Reg. 12: tab. 1038. 1827.-*Aulica platypetala* (Lindl.) Rafinesque, Fl. Tellur. 4: 10. 1836.

Hab.—An inhabitant of the States of Sao Paulo, Paraná and Santa Catarina, in Brazil. It often forms dense cespitose populations among rocks or along the sandy banks of some rivers.

Amaryllis aulica Ker var. *platypetala* had been not recognized as a species until Rafinesque (1836) proposed the new combination *Aulica platypetala.* Unfortunately, this epithet cannot be used because of the previous existence of *Amaryllis platypetala* Lindl. ex Bury (1831-34). The next available name is *Hippeastrum heuserianum* Karst., therefore the transference is made here.

Amaryllis heuseriana differs from *A. aulica* in its weak bulb covered by few, pale, membranous coats; the flaccid, bright green, narrowly oblanceolate leaves; and in the different size of tepals. *A. aulica* is an epiphytic, at least in nature, whereas *A. heuseriana* is terrestial.

The specimens already examined are, at present, not with me. They shall be published in due course along with the description and illustradition. Living plants were distributed among horticulturists of Curitiba (Brazil), Buenos Aires, Mendoza (Argentina), and other countries.

Amaryllis heuseriana (Karst.) Rav. forma **campanulata** Rav. f. nov

A forma *heuseriana* floribus campanulatis recedit.
It differs from the form *heuseriana,* in its bell-shaped flowers.
Hab.—Same places as the typical form.

Specimens: Culta in Bonaria ex bulbis ad ripas fluminis Tres Barras Munic. São Francisco do Sul civit. Santa Catarinae Brasiliae collectis; leg. Ravenna 1950, XI-1967 (typus in Herb. Ravenna).

Plants of this and the form *heuseriana,* growing together in nature, were selected and planted separately. After they flowered several times, the permanence of their distinctive features has been verified. The form *campanulata* has been pressed in several places of the State of Paraná by Prof. Hatschbach.

2. On the original location of **Amaryllis araripina**

In Plant Life 1970 (p.84), the description of *Amaryllis araripina* Rav., was published. In the reference to the epithet origin, it had been written: "The name commemorates the Araripe indians, who were the original inhabitants where the plant grows." This information was obtained from native people.

Recently, however, I had the opportunity of consulting K. F. von Martius' Glossaria linguarum Brasiliensum or "Glossarios de diversas língoas e dialectos que fallao os indios no imperio do Brazil" (1863). In page 491 we found:

"ARARIPE, de arára e ypé, habitação ou lugar de aráras." This means: place of "arara" parrots. The town of Araripina has its origin in the near Chapada do Araripe (plateau of Araripe).

Amaryllis araripina also inhabits the State of Ceará; the following specimen proves it: Brazil, Ceará; leg. Fr. Allemão e Cisneiros 1530, I-1861 (R).

VII. STUDIES IN THE GENUS **GRIFFINIA**

1. A new tribe in order to accommodate the genus **Griffinia**

Griffinia was first placed by Herbert (1837) near *Lycoris* and *Brunsvigia.* In this he was followed by Bentham & Hooker f. (1885), and by Baker (1888). Traub & Moldenke (1949), include this genus in the tribe *Amaryllideae.* Recently, Traub (1963), transfers it to tribe *Eucharideae.*

Although filaments can be, very rarely, slightly connate at the base, the perigone shape disagrees with the members of the tribe *Urceolineae* (formerly *Eucharideae,* see p.). Actually, the flower shows much similarity, even in the bud stage, with some species of the genus *Crinum* (subgenus *Codocrinum*). Seeds of some *Griffinia* species, such as *G. ornata,* are often very large. Sometimes, the fruit has only two locules, and one of these is occupied by a single seed. Scape is tumbling and pedicels recurved in fructification.

From the above facts, it seems obvious that *Griffinia* has some affinity with the tribe *Crineae.* However, its habit and leaf morphology, including the lack of foliar mucilage (latex?), which in the members of the tribe *Crineae* turns into a kind of fibers when it dries, are reasons for excluding *Griffinia* from that tribe. A new tribe is therefore proposed.

GRIFFINIAE Rav. **tribus nova**

Plantae staturae mediocris vel pumilae. Folia semper petiolata: petiolus plus minusve longus; lamina saepe lata oblanceolata vel aellyptica. Scapus solidus marginatus compressus vel cylindraceus in fructificatio de cumbens. Inflorescentia multiflora rarius pauciflora. Valvae spathae membranaceae delicatae translucidae basin versus connatae vel liberae. Flores zygomorphi pedicellati vel subsessiles coeruleo-lilacei lilacei vel albi. Perigonii tubus brevis seu valde productus. Tepalum infero-interius a caeteris tepalorum distante. Stamina 4-seriata tota declinata seu sepalinum superius ascendente vel absente. Antherae parvae versatiles vel imperfecte versatiles. Ovarium ovula dua basalia collateralia seu usque sex superposita per loculum gerente. Stylus declinatus. Stigma punctatus vel minute capitatus. Pedicelli fructiferi quam floriferi haud robustiores deflexi vel recurvati. Fructus saepe durabilis deinde marcescens. Semina saepe magna ovata funiculum saepe conspicuum conduplicatum desiliente gerentia.

Plants of medium or small size. *Leaves* always petiolate; petiole variable in length; blade oblanceolate or elliptic. *Scape* solid, edged, compressed or cylindrical tumbling or inclinate with fructification. *Inflorescence* many or few-flowered. *Spathe-valves* membranous hyaline joined below or free to the base. *Flowers* zygamorphic pedicelled or subsessile, lilac-blue, lilac or white. *Perigone-tube* very short or long. Lower inner tepal distant from the other five. *Filaments* of four different lengths, all of them declined, or frequently the upper episepal ascending or suppressed. *Anthers* small, versatile or imperfectly versatile. *Ovary* with two, basal, collateral, ovules; rarely about six, superposed. *Style* declined. *Stigma* punctiform or pinutely capitate. *Pedicels* not stouter or elongating with fructification, deflexed or recurved. *Fruit* often long-lasting, marcescent. *Seeds* often large ovid or rounded with an almost flat side, with a large, not persistent, conduplicate funiculum.

Type: genus *Griffinia* Ker.

This tribe is an intermediate between the *Amaryllideae* and the *Crineae,* but closer to the latter. *Worsleya* seems to be the genus of the *Amaryllideae,* which connects the tribe to *Griffinieae.*

2. **Libonianae** series nova (subgeneris **Griffinia**)

A Series typica stamine episepalo superiori absente caeteris quinque declinatis differt.

It differs from the typical Series in the lack of the upper episepal stamen, the other five being declined.

Type-species: *Griffinia liboniana* Morren (Fig. 21, 22)

Traub & Moldenke (1949), p. 157, proposed the subgenus *Libonanthe,* upon the same species as above. Morel (1960), see also PLANT LIFE 17: 4. 1961, described *Griffinia rochae* (see Fig 20) a species from the vicinity of Río de Janeiro, which, as *G. liboniana,* bears only

Fig. 20. **Griffinia rochae** Marel; as cultivated in Jardim Boânico de Rio de Janeiro. Photo by Pierfelice Ravenna.

five stamens. In 1969, I reduced *Hyline* Herb. to subgenus of *Griffinia;* in the meantime I gave a key for distinguishing the subgenera. The characters employed were the six declined stamens, and the existence of several ("many", sphalm.), not more than six, ovules per locule. Sub-

genus *Libonanthe* was not considered, since it seemed to be a synonym of subgenus *Griffinia.*

3. Rediscovery of **Griffinia liboniana**

In 1969 I visited once more the Instituto Agronomico of Belo Horizonte, Minas Gerais (Brazil). In the occasion, Prof. Apparício P.

Fig. 21. **Griffinia liboniana** Lem., as cultivated by Pierfelice Ravenna at Buenos Aires. Photo by Pierfelice Ravenna.

Duarte, of that Institute, showed me some *Griffinia* plants, which were cultivated in a stove. The bulbs were gathered by Prof. Duarte at Cerca Grande, municipe of Pedro Leopoldo, Minas Gerais. Some fresh plants

were presented to me for study. The species proved lately to be *Griffinia liboniana* Morren.

Griffinia liboniana Morren (Figs. 21 and 22)

Morren, Ann. Soc. roy. Agr. Bot. Gand 1: tab. 13, 1845.—Lemaire, Jard. Fleur. 3. tab. 290. 1853.

Plant 15-25 cm high. *Leaves* broadly oblanceolate, petiolate, flaccid; petiole 20-45 mm long; blade 12-16 cm long, 35-55 mm broad, a dark green, almost marmorate with grayish-white. *Scape* 12-20 cm long, 3-6 mm broad, compressed, marginate. *Spathe* 1-valved or bivalved (?), shortly tubulose at the base, membranous, hyaline, about 18 mm long,

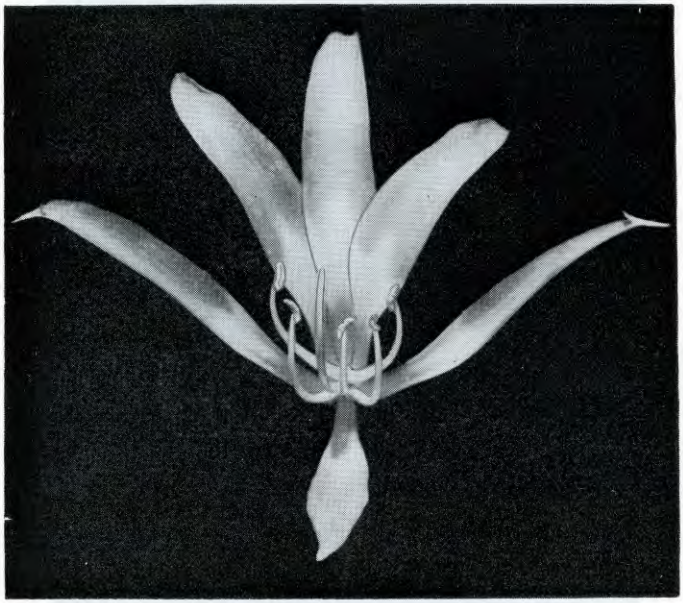

Fig. 22. **Griffinia liboniana** Lem., front view of flower. Photo by Pierfelice Ravenna.

bifid for 13 mm; inner bracts few. Inflorescence 4-7-flowered. *Pedicels* 6-12 mm long, green. *Ovary* elliptic, a bright green. *Perigone* lilac or a pale violet in the upper half, whitish below or sometimes greenish near the base, about 35 mm in its vertical diameter, and 28 mm in its horizontal diameter. *Perigone* tube 2mm long. *Tepals* oblanceolate-unguiculate; the upper outer channelled, ca. 31 mm long, 6 mm broad; lateral outer often greenish in the lower forth, then white, and bluish-lilac or lilac in the upper half, ca. 3 mm broad; inner tepals about 29 mm long, 6 mm broad, convolutely unguiculate for 10 mm; lower inner prominent, somewhat curved, whitish-lilac, ca. 26 mm longum, 3 mm

broad. *Stamens* five, declinate, slightly diverging, the upper episepal suppressed; filaments white, the lateral episepal about 20 mm long; inner lateral 18 mm long; lower inner ca. 15 mm long. *Style* declined, filiform, about 28 mm long; *Stigma minutely* capitate-punctate.

Hab.—Under shade, in dark soil, near calcareous rocks, at Cerca Grande, municipe of Pedro Leopoldo, in the State of Minas Gerais, Brazil. Originally found by M. Libon at Serra de Lapa Vermelha (the now-called Serra do Cipó?), a few miles from Lagoa Santa, Minas Gerais.

Specimens: Culta in Horto Agronomico Belo-Horizontino (BHMG) ex bulbis ab A. P. Duarte in loco supra dicto collectis; leg. Ravenna 1016, XI-1969 (Herb. Rav.). Culta in Bonaria ex Horto Agronomico Belo-Horizontino; leg. Ravenna 1081, X-1970 (Herb. Rav.).

Lemaire (1853), describes the leaves of this species as "absolument sessiles et non petiolées". This was one of the two characters, which gave reason to Traub and Moldenke (1949) for erecting the subgenus *Libonanthe*. Although petioles could sometimes partially subterranean (as in *G. gardneri*), or closely clasping, leaves are distinctly petioled. Blades show, very often, grayish-white irregular spots. The writer removed the epidermis, in order to disclose the nature of these spots. They dissapeared in the process of detaching. Examination under microscope, of both epidermis and parenchyma, did not reveal any particular feature, except that the cell walls of the former are quite sinuose. Apparently, spots are produced by air or empty spaces beneath the epidermis. Anthers were described, by Lemaire, as "non versatile". Since the anthers in the fresh flowers studied by me were decidedly versatile, I think that Lemaire's observation could have been made before anther dehiscence.

The region where the plant was discovered, by M. Libon, is at present much modified by man. Possibly it has already disappeared from that place, as also apparently did *Griffinia concinna* (Mart. ex Schult.) Rav.

These plants grow well in the green-house, but decay soon if exposed outdoors. The species was distributed among horticulturists of Florida (U.S.A.) and Buenos Aires (Arg.).

4. Two new **Griffinia** species from Minas Gerais, Brazil

Griffinia aracensis Rav. sp. nov.

A *Griffinia parviflora* qui specie Bahiensis foliis angustioribus cinereo-maculatis differt. *G. liboniana* et rochae ad speciem nostram valde similes sed staminibus quinque habent.

Plant about 15 cm high or less. *Leaves* six, oblanceolate-petiolate, 7-18 cm long, 7.5-25 mm broad; petioles 5-9 cm long; blades a dark green, variously spotted with grayish white or grayish-green, acute. *Scape* 7.2-12 cm long. *Spathe* bivalved, membranous, hyaline, 4-7-flowered; valves often unequal broadly lanceolate, ventricose, 11-23 mm long, connate toward the base for 3-5 mm, abruptly narrowed upwards. *Pedicels* 10-17 mm long. *Perigone* horizontal, white in the low-

er half, lilac above, 13-25 mm long, 22-30 mm in diam. *Tepals* narrowly oblanceolate, 19-22 mm long, 2.5-2.8 mm broad, excepting the lower inner, which is narrower; the outer series distinctly apiculate; apicule ca. 0.8 mm long, puberulent on the inner half.

Griffinia itambensis Rav., sp. nov.

Species a *Griffinia aracensi* valde affinis sed foliis haud maculatis floribus saepe minoribus differt.

Planta 10-17 cm alta. Folia oblanceolata fusco-viridia haud maculata ad 12-25 mm longa circ. 15-22 mm lata. Scapus usque 9-19 mm longus. Ovarium veride vel viridescente. Perigonium cernuus 13-16 mm longum circ. 13-15 mm latum. Tepala anguste oblanceolata ad apicem recurvata inferne alba suprene lilacea. Filamenta sex, sepalinum superius ascendente usque 10-11 mm longum, caetera declinata 7.5-11 mm longa. Stylus declinatus filiformis ad 16-17 mm longus. Capsula irregulariter blobosa vel late obvata ad 9.5-13 mm longa. Semina ovato-oblonga ad 6-6.5 mm longa.

Plant 10-17 cm high. *Bulb* subglobose, about 25-30 mm in diameter, the pseudo-neck almost obsolete. *Leaves* petiolate, the blade lanceolate or oblanceolate, spreading, dark green, not speckled, to 12-25 cm long, 15-22 mm broad, distinctly sheathed below, acute. *Stem* erect weak, 9-19 cm long. *Spathe* bivalved, membranous, thin and breakable, apparently whitish; valves ventricose, joined and tubular below, about 10 mm long. Inflorescence 7-11-flowered. *Pedicels* 13-19 mm long, fruiting somewhat stouter. *Ovary* oblong-elliptical, apparently green or greenish, 2.5-3 mm long, 1.5-1.8 mm broad. *Perigone* cernuous, 13-16 mm long, 13-15 mm in diam. *Tepals* oblanceolate, white below, lilac and recurved toward the apex, about 14-16 mm long, 2-2.6 mm broad; the outer series with a 0.8 mm long apicule. *Filaments* six; the upper episepal ascending, 10-11 mm long, the rest declined: lateral episepal 7.5-8 mm long, lateral epipetal 8.5-9 mm long, lower epipetal 10-11 mm long. *Anthers* versatile, sightly twisted, 1-1.5 mm long; pollen dirty yellow. *Style* declined, filiform, 16-17 mm long. *Stigma* punctate. *Capsule* irregularly globose or widely obovoid, about 9.5-13 mm long. *Seeds* oblong-ovoid, one or two in each locule, 6-6.5 mm long.

Habitat.—Hill-sides with second growth forest and bracken-covered "campo", sloping down to river with blocky sandstone and sandy soil at sonth-eastern drainage of Pico de Itambé, municipe of Itambé, State of Minas Gerais, Brazil. It grows in wet sand on shaded river banks (according to the collectors); altitude: 950 m.

Specimens: Brazil, Minas Gerais, mun. Itambé, about 5 km directly west and north of Santo Antonio do Itambé, south-eastern drainage of Pico de Itambé; leg. W. R. Anderson et al., 9-II-1972 (typus Herb. Ravennae, isotype NY).

Allied to *Griffinia aracensis,* but the leaves not spotted and the flowers smaller.

VIII. A NEW NAME TO TRIBE **EUCHARIDEAE**

Since the type of the tribe Eucharideae was reduced to synonymy of *Urceolina* (see Traub 1971), the tribe name must be changed accordingly:

Tribe URCEOLINEAE nom. nov.—Syn.: subtribe Eucharidinae Pax, Engl. & Prantl Natur. Pflanzenfam. ed. I, 2 (5): 110. 1887.—Tribe Eucharideae (Pax) Traub, Gen. Amaryll.: 73. 1963 (as Euchareae).—Type: genus *Urceolina* Reichenbach (nom. cons.)

IX. GENUS **CASTELLANOA** REDUCED TO SYNONYMY OF **CHLIDANTHUS**

In 1967 (see Sellowia 19, p. 34) I recorded the genus *Castellanoa* in Bolivia for the first time. This report was based on a dry specimen collected by Dr. Cárdenas at San José, Province of Quechisla, which had been compared with an isotype (BAF). At that time is was stated that *Castellanoa* is "A monotypic genus placed not far from *Chlidanthus* and from *Stenomesson* (subgen. *Clinanthus*)". A key for the purpose of separating *Castellanoa* from *Chlidanthus* has been published (Ravenna 1969, p. 56). The only apparently firm characters to distinguish them lay in the slightly zygomorphic, cernuous to pendulous, red flowers of *Castellanoa* as to the actinomorphic, upright, yellow flowers of *Chlidanthus.*

Recently, Traub (1970, p. 63) publishes *Chlidanthus cardenasii,* as a new species from Bolivia; he describes its flowers as horizontal and quite similar in shape to those of *Castellanoa marginata* (Fries) Tr. The color of the former is green with pink streaks and the apex of tepals purple lilac. Ravenna (1971, pp. 72-73) gave description of a new *Castellanoa, C. yaviensis* Rav. In this species the perigone resembles that of *C. marginata,* but the androceium shows substantial differences: filaments are toothed and connected at the base by a membrane; the first character causes the filaments to resemble those in *Eustephia.*

Herbert (Amaryll., p. 191) states that *Chlidanthus* " . . . was represented and described by Professor Lindley, who discovered a slight membranous connection at the base of the filaments, and irregular half-abortive dentate wings to the shorter or sepaline filaments, which I did not perceive in the specimen on which I founded the genus . . . ". Furthermore, Herbert says: "I find a fine six toothed membrane, in which the filaments are inserted, adhering to the tube and lower part of the petals, the petaline teeth being prolonged. This membrane while the flower is fresh is partible, separating from the perianth like acuminate wings to the decurrent filaments, by taking hold of the point of the filament and pulling it. Those points are very short and ultimately curved". Baker (1888) defines the filaments of *Chlidanthus* as "short, subulate from a deltoid base", in apparent contradiction to Herbert's remarks.

A specimen of *Chlidanthus fragrans,* which I found in the Museum of Santiago (SGO 24363), proves that both Herbert and Baker were right in their observations. In fact, although filaments are mostly

simple, some of them show irregular lobes near the base; obviously this is a variable condition. Moreover they are definitely connected by a membrane at the base.

The information of above shows that there is no effective feature for distinguishing *Castellanoa* from *Chlidanthus*. The former genus is therefore a synonym of the latter.

CHLIDANTHUS Herb.

Herbert, Append.: 46. 1821.—*Sanmartina* Traub, Pl. Life 7: 41. 1951; not *Sanmartinia* Buch. (1949).—*Castellanoa* Traub, loc. cit. 9: 63. 1953.

Flowers trumpet-shaped, actinomorphic or very slightly zygomorphic, upright, ascending, horizontal, or sometimes declined, yellow, red, orange-red, or green striped with pink and tinged purple. *Perigone-tube* well developed. *Tepals* much shorter than the perigone-tube, lanceolate, often moderately spreading. *Filaments* variable in engths but not exceeding the perigone, flattened and winged below, sometimes with a pair of teeth in the upper part of the wings, often connected at the base by a thin membrane which is adnate to the tube. *Anthers* versatile or almost straight, dorsifixed, yellow. *Style* filiform, straight, surpassing or not the perigone. *Stigma* trifid. *Capsule* globose-tricoccus. *Seeds* flat, a dark brown, often winged or with membranous edges.—Bulbous plants. *Bulb* ovoid often large, produced into a pseudo-neck. *Leaves* linear, chanelled, a grayish green, often pruinose, obtuse or subacute, with minutely papilose scabrous margins. *Scape* solid, compressed, margined. *Spathe* bivalved; valves marcescent, free to the base. *Inflorescence* 2-several-flowered. *Pedicels* very short or well developed.

Type-species: *Chlidanthus fragrans* Herb.

DISTRIBUTION OF THE GENUS.—Recently I have been asked about the presence of *Chlidanthus fragrans* in Chile. Herbert (1837, p. 192), gave the first report on this matter. In a discussion of the possible origin of plants which were at that time being cultivated in England and that were thought to have come from Argentina or Chile, he said the following: "Mr. Brookes's bulbs were said to have come from Chile, but I have some reason for doubting the fact. Bulbs of Chlid. fragrans were sent to my brother from Buenos Aires, about the same time, I believe at the same time precisely; but it may have been an inhabitant of gardens there . . .". Kunth (1850, p. 653), on the basis of this ambiguous information, reported *Ch. fragrans* in Chile and Buenos Aires. This distribution was accepted by Gay (1855, p. 74-76), F. Philippi (1881), Bentham & Hooker f. (1880, p. 723), and others. Baker (1888) refers to a specimen from Argentina (Catamarca, Lorentz!) as *Chlidanthus fragrans*. This specimen might be identified with the type-sheet of *Hieronymiella chlidanthoides* Pax. Kuntze (1898) records *Ch. fragrans* from Paso Cruz (also known as Paso de la Cruz de Piedra), Mendoza, but this probably is a misidentification of some dry specimen. The only one Amaryllid that can be found so high in the Andes of Mendoza is *Famatina herbertiana*. No true *Chlidanthus* species, belonging

to this genus, has been recorded in the flora of Argentina; therefore, the species previously known as *Castellanoa* represent the only real entities of that genus which occurs in Argentina.

As can be seen, the record of *Chlidanthus fragrans* in Argentina and Chile can not be confirmed by data. In my opinion, the species is native exclusively to South Peru.

The range of *Chlidanthus* extends from the porthern plateau of Argentina through Bolivia to Peru.

1a. Flowers upright or nearly so:
  2a. Pedicels obsolete or very short ..... 1. **Ch. fragrans**
  2b. Pedicels well developed, 17-21 mm long:
    3a. Perigone tube about 75 mm long ..... **3. Ch. soratensis**
    3b. Perigone tube about 67 mm long ..... **3. Ch. boliviensis**
1b. Flowers horizontal to declined:
  4a. Flowers red, sometimes with yellow stripes, or orange-pink:
    5a. Filaments toothed at the apex of the winged portion, connected at the very base by a thin membrane ..... **4. Ch. yaviensis**
    5b. Filaments not toothed nor connate at the base ..... **5. Ch. marginatus**
  4b. Flowers green with pink streaks; the apex of tepals tinged purple lilac **6. Ch. cardenasii**

Notes.—The reader should observe the slight difference which separates *Ch. boliviensis* from *Ch. soratensis,* which suggests an identity of species; but, due to the lack of evidences, the former is tentatively accepted.—*Ch. ehrenbergii* (Klotzsch) Kunth (*Coleophyllum ehrenbergii* Klotzsch, is apparently a further synonym for *Ch. fragrans;* the geographic area of the former, Mexico, is probably wrong, since its description was seemingly based upon cultivated plants.— *Hippeastrum marginatum* Fries and *Castellanoa yaviensis* Rav. are transferred to *Chlidanthus.*

Chlidanthus marginatus (Fries) Rav. **comb. nov.**

Hippeastrum marginatum Fries, Nov. Act. Reg. Soc. Scient. Upsal. Ser. IV, 1(1) : 161. 1905.—*Amaryllis marginata* (Fries) Traub et Uphof, Herbertia 5 : 12. 1938.—*Sanmartina marginata* (Fries) Traub, Pl. Life 7 : 41. 1951.—*Castellanoa martinata* (Fries) Traub, Pl. Life 9 : 63. 1953.

Specimens: Argentina, province of Jujuy, Santa Catalina, El Angosto; leg. Fritz Claren, 1-II-1901, Herb. Kurtz 11559 (isotype BAF). Bolivia, Quechisla, San José; leg. Martin Cárdenas 99, I-1932 (SI).

The original illustration of *Hippeastrum marginatum* Fries (basonym of *Chlidanthus marginatus*), shows the filaments inserted at the same level. This detail is incorrect. A dissection in the isotype (BAF), reveals that the episepal filaments are placed somewhat below the epipetal series.

Chlidanthus yaviensis (Rav.) **comb. nov.**

Castellanoa yaviensis Ravenna, Pl. Life 27 : 72. 1971.

Specimens: Argentina, Jujuy, dept. of Yaví, downward ravine from Yaví, to Bolivia, 3380 m of altitude; leg. D. Werner 877, 25-X-1967 (type LP, isotype Herb. Rav.).

X. STUDIES IN THE GENUS **STENOMESSON**

New species and transferences are proposed. Moreover the genus *Clitanthes* Herb. is recognized under subgeneric rank; and further notes on *Stenomesson flavum* (Ruiz et Pav.) Herb. and its synonymy, are included. In addition, the illustration of *S. campodense* Rav. (1971) is given.

On the presence of **Stenomesson** in Chile, and recognition of **Clitanthes** Herb. under subgenus rank.

During explorations in North Chile, a new species of *Stenomesson* was found. This is closely related with *Stenomesson humile* (Herb,)

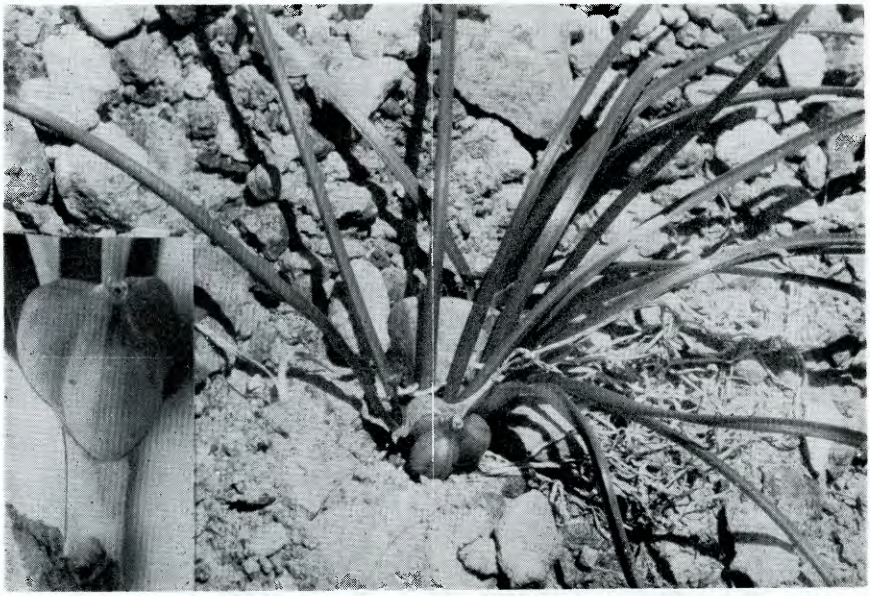

Fig. 23. **Stenomesson chilense** Ravenna. **Right Stenomesson chilense** Ravenna, in fruit, in its wild state. **Left,** close-up of capsule and upper part of pseudo-neck. Photos by Pierfelice Ravenna.

Bak. In order to accommodate both species, the genus *Clitanthes* Herb. (1839) is revalidated in the subgenus level.

CLITANTHES (Herb.) stat. nov. (**Stenomessii** subgenus)

Genus *Clitanthes* Herbert, Edwards' Bot. Reg. Misc. 87. 1839.

Scapus subterraneus in pseudocollo bulbi inclusus; ovarium subterraneus; fructus supra solum situs.

Scape subterranean hidden in the pseudo-neck; ovary subterranean; fruit placed above the soil level. Type species: *Stenomesson humile* (Herb.) Bak. (*Clitanthes humilis* Herb.).

Baker (1888), placed *Stenomesson humile* in subgenus *Stenomesson,* but the plant shows, in my opinion, enough distinctness to be placed in another group. The related species which follows, gives strength to this position.

Stenomesson chilense Rav. **sp. nov.** (subgen. **Clitanthes) (Fig. 23)**

A *Stenomesso humili* foliis flaccidis canaliculatis haud crassiusculis differt.

Planta circ. 4-6 cm alta. Bulbus ovatus ad 35-45 cm longus circ. 23-30 latus. Folia linearia canaliculata flaccida fusco-viridia haud pruinosa prostrata circ. 2-2.5 mm lata. Scapus subterraneus. Perigonium cernuus usque 44-58 mm longus; tubus leviter curvatus 30-45 mm longus. Filamenta biseriata inferne circ, 3 mm concrescentia edentata ad partem libera lineárisubulata. Stylus perigonium valde excedens. Capsula globoso-subtricocca circ. 17-22 mm lata. Semina cum testa excurrenti subcircularia brunneo-ochracea.

Plant 4-6 cm high. *Bulb* ovoid 35-45 mm long, 23-30 mm in diam. covered with few, a pale brown or grayish-brown coats; pseudo-neck 5-7 cm long. *Leaves* synanthious (?), prostrate, linear, channelled, a dark green, not pruinose, 10-15 (-20) cm long, 23-30 mm broad. *Scape* subterranean, growing a little in fructification in order to permit the development of the fruit just above the soil level. *Perigone* cernuous, 44-58 mm long. *Perigone-tube* rather curved, 30-45 mm long, 3-4 mm broad at the apex. *Tepals* narrowly oblanceolate, 20-28 mm long, 2-5 mm broad in the upper third. *Filaments* biseriate, joined below in a 3 mm long, not toothed, *staminal cup;* free part linear-subulate; the episepal about 8.5 mm long, the epipetal ca. 9.5 mm long. *Anthers* oblongreniform, 3.8-4.4 mm long. *Style* much exceeding the perigone. *Stigma* capitate-trilobed. *Capsule* globose, subtricoccous, 17-22 mm in diam., often conserving the dry remnant of the perigone. *Seeds* brownish-black, the testa being excurrent, resulting in a semilunar brownish-yellow wing; hence the outline is circular, 6.5-8 mm in diam.

Hab.—Gentle rocky slopes, 3200 m above the sea, 4 Km west from Zapahuira, in the province of Tarapacá, Chile. It grows near *Mastigostyla cyrtophylla* Johnst. (*Iridaceae,* inedit record in the Chilean flora), *Portulaca* sp., *Plantago* sp., *Myosotis* sp., *Calandrinia* sp. (2 species), and other short-living herbs; several small bushes and cacti were also inhabiting the same place.

Specimens: In decliviis petrosis 4 km ad occidentem Zapahuirae provinciae Tarapacá Chiliae; leg. Ravenna 1310, III-1971 (typus in Herbario Ravennae).

The present species represents the first genuine record of the genus in the Chilean flora. *Stenomesson recurvatum* was previously quoted in this country (see Baker 1888), but this is, in my opinion, a mistake. The latter inhabits the region of Canta and Obrajillo, in the Lima dept., Peru. Herbert (1837, p. 198), cites *Coburgia discolor,* which apparent-

ly is a synonym of *S. recurvatum,* as "found on mountains of Chile and in 17° 39′ South lat. which must be in La Paz of Peru". Obviously, Herbert's vague knowledge concerning the boundry between Chile and Peru, caused these confusions.

Although already withered when plants were found, some flowers served for description. Bulbs and seeds were distributed for cultivation.

Stenomesson caracense Rav. **sp. nov.** (subgen. **Stenomesson**)

Species a *Stenomesso glareoso* proxima sed pocula staminali breviora et latiora.

Plant 8-8.5 cm high. *Bulb* not seen. *Scape* about 45 mm long, 2.5 mm broad. *Spathe* membranous greenish-white; valves lanceolate, free to the base, subequal ca. 20 mm long. *Pedicels* 6-8 mm long. *Ovary* ellipsoid, obtusely trigonous, about 4.5 mm long, 1.8 mm broad. *Perigone* green, about 44 mm long. Perigone tube 31 mm long, constricted at the middle, 1-1.2 mm broad below the constriction, 4-4.2 mm above. *Tepals* obliquely spreading, lanceolate, about 13.2 mm long; the outer 3.1-3.5 mm broad, the inner 3.5 mm broad, subacute. Staminal cup short. *Filaments* 6.5-7 mm long. *Anthers* elliptical, 3.1 mm long. *Style* scarcely surpassing the perigone.

Specimens: Perú, dept. of Ancash, Caráz, E of Pueblo Libre, 3000 m; leg. W. Colaris 1340, 28-VII-1969 (type U).

Closely related with *Stenomesson blareosum* Rav. (1971), but differing in the shorter, wider, staminal cup. The new species was recognized among a large number of specimens received from the Utrecht Museum for identification.

Stenomesson callacallense Rav. **sp. nov.** (subgen. **Stenomesson**)

A *Stenomesso flammido* foliis lanceolatis in prefoliatioi cum marginibus revolutis dentibus paraperigonii integris, a *S. caracense* colore floris, a *S. flavo* forma perigonii et magnitudine paraperigonii differt.

Plant about 55 cm high *Bulb ovoid*, 45-50 mm long, 37-40 mm wide, covered with dark brown coats and produced into a 40-45 mm long pseudo-neck. *Leaves* absent or incipient at anthesis, lanceolate, with revolute margins in prefoliation. *Scape* 48-50 cm long. *Inflorescence* 3-5-flowered. *Pedicels* 13-18 mm long. *Flowers* cernous to decined (?), orange, about 64 mm long. *Perigone-tube* slightly curved, 40-42 mm long, 5-6 mm wide at the apex, narrowing gradually toward the base. *Tepals* broadly lanceolate, erecto-patent, about 18 mm long, the outer series 8mm broad, apiculate, the inner acute 7.8 mm broad; apiculum 1.8 mm long, with the thickened velutinous base. *Staminal* cup short, 3 mm long (to the insertion of stamens), toothed; teeth six, placed between the filaments, entire, oval-oblong, 1.6-2 mm long. *Filaments* filiform, the episepal series 6.5-7 mm long, epipetal about 8 mm long. *Anthers* versatile, yellow, 6.5-7.2 mm long before dehiscence. *Style* reaching the length of the perigone, about 6.4 mm long. *Stigma* capi-

tate, obscurely trilobed. Immature capsule globose-tricoccous, almost rostrate, 16-17 mm in diameter.

Hab.—On rocky slopes between Leimebamba and Balsas, near the place called Jalca de Calla-Calla, 2800 m over the sea, in the dept. of Amazonas (province Chachapoyas), Peru.

Specimens: Peru, Dept. of Amazonas, Province of Chachapoyas, Jalca de Calla-Calla (Leimebamba-Balsas); leg. A. Sagástegui, 23-X-1965 (type HUT 6054).

This species is easily separable from all the known species of North Peru. *S. aurantiacum* and *S. flavum,* are the only species with orange flowers from that region. The former has a shorter flower and no teeth between the filaments; the latter, a native of the costal elevations, has a shorter perigone and a larger staminal cup. *S. flammidum,* which is found not far from the present species, has linear leaves, intensely red flowers, and bifid teeth between the filaments. *Stenomesson callacallense* is a pretty plant and merits cultivation.

FULGITUBA, Stenomessii subgen. nov.

A subgeneribus *Stenomesso* et *Clitanthe* habitu robusto et scapo ancipiti a subgenero *Callithauma* filaments in margine paraperigonii inserta differt.

Distinguishable from the subgenera *Stenomesson* and *Clitanthes* on account of its robust habit and the compressed, margined scape; it differs from subgenus *Callithauma* in the filaments attached at the margin of the paraperigone.

Type-species: *Stenomesson incarnatum* (H.B.K.) Bak. (*Pancratium incarnatum* H.B.K.).

Species at present recognized: *Stenomesson incarnatum* (H.B.K.) Bak., *S. variegatum* (Ruiz et Pav.) Macbr., *S. fulvum* (Herb.) Rav., *S. imasumacc* Vargas, and *S. luteoviride* Bak. (?).

A tentative key of the species in this subgenus has been postponed due to the present impossibility of separating *S. imasumacc* from *S. variegatum.* If the illustration of *S. recurvatum* in Ruiz & Pavón "Flora Peruviana et Chilensis" is correct, its flower shape should bar its future placement in this subgenus. The same case if found in *S. discolor* (Herb.) Bak., a probable synonym of *S. recurvatum.*

Stenomesson campodense Rav. (Fig. 24)

Ravenna, Pl. Life 27: 75. 1971.

Stenomesson campodense Rav. had been originally described without a figure; this is provided here.

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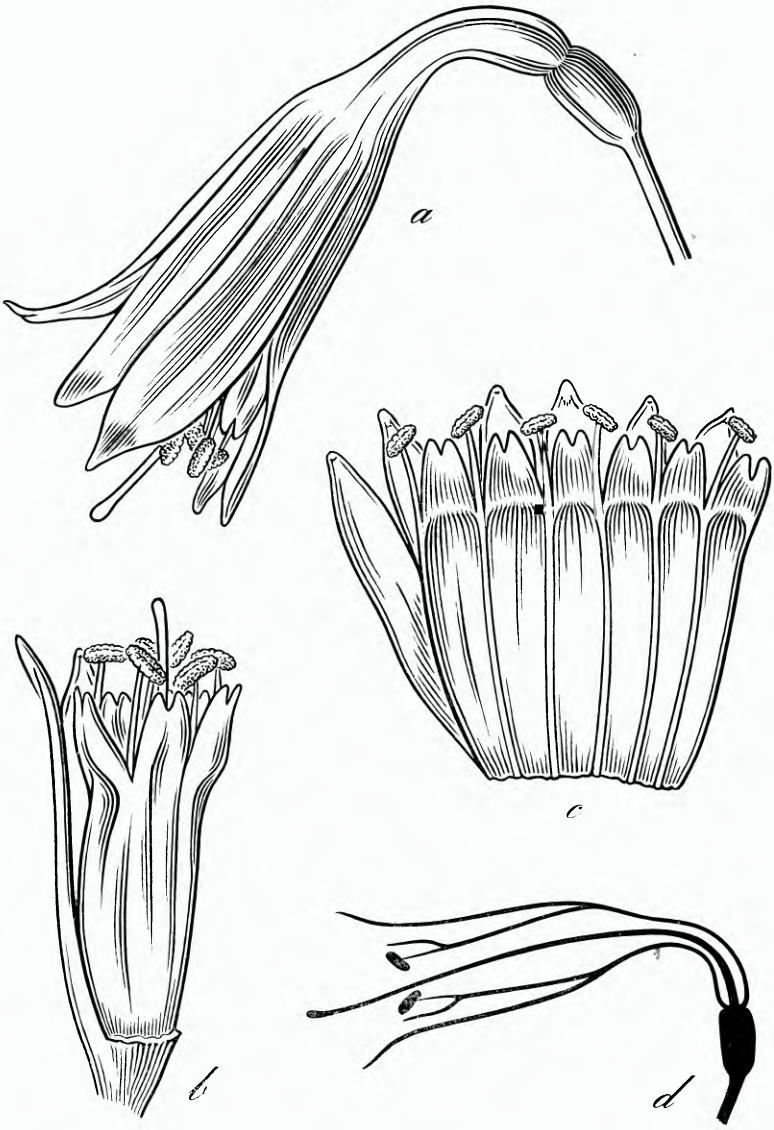

Fig. 24. **Stenomesson campodense** Ravenna. **a** flower (X2.1); **b** flower with some tepals removed, showing staminal cup (X 2.1); **c,** staminal cup opened, inside view (X 1.9); **d,** scheme of a longitudinal cut of flower. Photo by Pierfelice Ravenna.

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HERB MAGIC AND GARDEN CRAFT, by Louise Evans Doole. Sterling Publ. Co., 419 Park Av. So., New York, N.Y. 10016. **1973.** Pp. 192. Illus. Trade Ed. $3.95. Part I of this interesting book is concerned with the growing of herbs—basic herbs, descriptive list of herbs, outdoor herb garden, propagation of herbs, harvesting, storing, and the indoor herb garden. Part II is devoted to the use of herbs and Part III. is concerned with garden crafting. Recommended to all interested in herbs.

HOUSE PLANTS FOR THE PURPLE THUMB, by Maggie Baylis. 101 Productions, 834 Mission St., San Francisco, Calif. 94103. **1973.** Pp. 192. Illus. Paperback, $3.95; hard cover $7.95. Humorously written and profusely illustrated with 220 line drawings, this book gives directions for the care of over 200 common and exotic indoor plants. There are also sections on terrarariums, unusual containers, dry bouquets, cut flowers, moving and vacation care, buying plants, propagation, potting, repotting, watering and feeding. Highly recommended to all gardeners.

THE COMPLETE A-Z OF GARDENING, by Douglas Close. British Book Centre, Inc., 996 Lexington Av., New York, N.Y. 10021. **1973.** Pp. 319. Illus. $14.95. This is a catalog of over 1,000 ornamental plants arranged alphabetically by genera. In each case brief cultural directions are given. At the end a comprehensive cross-index is provided so that a plant can be traced by whatever name you may know. Recommended to gardeners generally.

VEGETABLES AND FRUITS, edited by James Underwood Crockett & Richard Crist. Time-Life Books; retail distribution: Little, Brown & Co., Boston, Mass. Library & school editions: General Learning Corp., 250 James St., Morristown, N.J. 07960. Time-Life Publications, Rockefeller Center, New York, N.Y. 10020. **1973.** Pp. 160. Illus. This is the 12th volume in the Time-Life Encyclopedia of Gardening. It comes up to the very high standard set by the previous volumes. The book is profusely illustrated in color, including the reproduction of 98 water color drawings by Richard Crist. Section 1 is devoted to the topic of the joys of growing your own. Section 2 is concerned with the planning and planting of vegetables: choosing your crops, preparing the soil, starting seeds, using the cold frame, controlling weeds, and using mulch, and ending with an expert's vegetable garden. Section 3 is devoted to the raising of fruits, nuts and berries: the fruits—strawberries and bush fruits. Section 4 is concerned with practical and pleasing herbs: culture, preservation, drying seeds and bulbs, growing as house plants. Section 5 presents an encyclopedia of vegetables, fruits, nuts and herbs. Very highly recommended.

JAPANESE GARDENS REVISED, by Kiichi Asano and Gisei Takakuwa. English adaptation by Frank Davies and Hirokuni Kobataka. Charles Tuttle Co., Rutland, Vt. 05701. **1973.** Pp. ix + 165. Illus. $17.50. This is a very wonderful book with 110 breath-taking, utterly beautiful color illustrations of Japanese gardens of various historical periods. These alone are worth much more than the price of the book. These are followed by a brief history of Japanese gardens, and discussions of garden planning as an art, materials and sense of beauty, and an alphabetical list of gardens. Words fail the reviewer in describing the utter enchantment provided by this book offering. Recommended without reservations at all.

TROPICAL FLOWER ARRANGING: A PRACTICAL GUIDE, by Nancy Aldrich Inman. Charles E. Tuttle Co., Rutland, Vt. 05701. **1973.** Pp. 116. Illus. $8.25. This unique book on flower arranging in the tropics fills a definite need. It details the joys and frustrations when working with tropical materials. The six chapters are devoted to natural containers, colorful foliage, dried materials, the ubiquitous coconut, fruit and flowers, and poisonous plants. Very highly recommended to all interested in flower arranging.

AMARYLLIS LEOPOLDII T. MOORE, EMEND.

HAMILTON P. TRAUB

The *Amaryllis* flower is typically irregular with the tepalsegs of four different shapes and sizes and it seemed impossible to breed for wide open flowers with tepalsegs more or less of the same shape and size until Richard William Pearce in 1865 collected what was later named

Fig. 25. **Amaryllis leopoldii** T. Moore, the species with the most regular flower in the genus. Reproduced from a black and white print made from a color slide. Compare **COVER design** which was made after the color slide in which the hair-line of red on the edges of the segs is visible. Photo by Thomas W. Whitaker.

Amaryllis leopoldii T. Moore for Messrs. James Veitch & Son, renowned English *Amaryllis* breeders. Pearce indicated that this species was collected in Peru. Messrs. Veitch and other breeders developed from this species the large-flowered hybrids with wide-open flowers with fairly regular tepalsegs known today as the Leopoldii hybrids. As time passed the stock from the wild was lost under cultivation. With the revival of interest in *Amaryllis* in America during the 1930's, a search was made for *Amaryllis leopoldii* in the supposed native habitat in Peru but with-

out any success.

This stalemate was broken recently when the late Dr. Martin Cardenas solved the riddle of the missing *Amaryllis leopoldii* by showing that it is native to Bolivia.

According to Cardenas, "Really, with the exception of the white bifid bar appearing in the throat of *A. leopoldii,* my new species has all the floral morphology of *A. leopoldii.* Pearce, as well as the other early collectors of ornamental plants were obliged for business reasons to avoid the mention of the right places where they found the most valuable plants. Accordingly Pearce indicated that *A. leopoldii* and also *A. pardina* are from Peru. However, to my knowledge they have not been re-collected in that country. On the contrary, at least *A. pardina,* in two varieties, has been found by Prof. Nelson and me as true wild plants in Bolivia . . . *Amaryllis pseudopardina* [=*A. leopoldii* T. Moore] comes from Yungas de Corani [in Bolivia]."

Cardenas collected three forms of *Amaryllis leopoldii,* giving them new names (see Cardenas, 1965, 1972 and 1973, under synonyms below).

The illustration (Fig. 25), which has been designated as the lectonomenifer illustration, shows a form collected by Dr. Cardenas which is near to the type illustration, but which latter Gard Chron. I (1870) 733, Fig. 140) is recognized as surely "idealized".

Thus, thanks to the late Dr. Cardenas, our long search comes happily to an end. It is hoped that this plant will not be allowed again to die out under culture as in the past, but will be treasured in cultivation as an insurance that it will not become extinct.

Amaryllis leopoldii T. Moore, **emend.**

Gard. Chron. i(1870) 733, Fig. 140; Traub & Moldenke, Amaryll. 118. 1949; Traub, Amaryllis Manual, 276-277, Fig. 7, middle right. 1958.

*Lectonomenifer*s Thos. W. Whitaker s. n. (No. 1123 TRA), Apr. 5, 1973, cult. Burbank, Calif. from bulbs collected by Martin Cardenas in Bolivia, Prov. Chapare, Dept. Cochamamba, Yungas of Corani, alt. 1,500 m. in 1959.

Paranomenifers (1) J. L. Doran s. n. (No. 1124 TRA), May 23, 1971, Cult. Burbank, Calif. from bulbs collected by Martin Cardenas in Bolivia, Prov. Chapare, Dept. Cochabamba, Yungas of Corani, Bolivia, alt. 1,500 m.

(2) J. L. Doran s. n. (No. 1125 TRA), Febr. 15, 1973, from same source as above.

(3) M. Cardenas No. 6094, Herb. Cardenasianum, Febr. 1, 1959, Prov. Chapare, Dept. Cochabamba, Yungas of Corani, Bolivia, alt. 1,500 m.

(4) M. Cardenas, No. 6331, Herb. Cardenasianum, July 1971, Prov. Chapare, Dept. Cochabamba, Peñon de San Julian, Bolivia, alt. 2,000 m.

Syn.—Hippeastrum leopoldii Dombrain, Floral Mag. 9: pl. 475-476. 1870; *Amaryllis pseudopardina* Cardenas, Plant Life 21: 55-57; 60-63, Fig. 9. 1965; Plant Life 23: 35, Fig. 16. 1967; *Amaryllis neoleopoldii*

Cardenas, Plant Life 28: 52-54, Fig. 17-B. 1972; *Amaryllis leopoldii* forma *whitakeri* Cardenas, Plant Life 29: 36, Fig. 10. 1973.

The description given by T. Moore (1870) is incorrect in certain parts, particularly the omission of the description of the paraperigone; this is short, closed in at the throat. This fact removes this species from the Subgenus AMARYLLIS, and places it in the Subgenus OMPHALISSA (Salisb.) Baker.

This species is somewhat variable in the regularity of the segs and the color pattern. The following description is based primarily on the lectonomenifer specimen plant. In making identifications this should be taken into consideration. The species is related to *A. pardina* Hook f. and some minute dotting in red may be present but it never predominates.

Lectonomenifer description.—Bulb globose, 5-6 cm high. *Leaves* 4, strap-shaled, apex acute, 30-35-41 cm long, 2.5-4 cm wide. *Scape* hollow, dull green, slightly compressed, 22-28 cm long, 1.7 cm diam. (base), narrowing gradually to 1 cm. in diam. at the apex. *Spathe* 2-valved, reddish at anthesis, upright, 7-7.5 cm. long. *Umbel* 2-flowered, flowers in nomenifer plant wide open with 5-pointed greenish star in throat, crimson (HCC 824/3) in center, bordered whitish, and a hair line of reddish on edges, whitish on underside. However the color pattern is somewhat variable in some of the other collections. *Pedicals* upright, dull green, 3.5-3.7 cm. long. *Ovary* oblong, dull green, 1.5 cm long, 0.8 cm. in diam. Tepaltube broadly funnel-shaped, 1 cm. long. *Paraperigone* closing in the throat, short whitish bristles on the border. *Tepalsegs* oblanceolate; top seg, 10 cm. long, 4.5 cm. wide, bluntly apiculate; 2 side setsegs 10 cm long, 4.2 cm wide, bluntly apiculate; 2 side petsegs 10.4 cm long, 5 cm wide, bluntly acute; bottom petseg 10 cm long, 4 cm wide, bluntly acute. *Stamens*—filaments whitish greenish in lower ½, red above, shorter than the segs; anthers 7 mm. long, pollen creamy to light yellow. *Style* subequaling the stamens or little longer, colored the same as the stamen-filaments; stigma shortly 3-lobed. *Capsule* deeply 3-lobed, 3 cm. long, 3 cm. in diam., dark green. *Seeds* flat, D-shaped, dark brown, 1.8 cm. long, 1.4 cm. wide.

Range.—Bolivia: Privince Chaparę, Dept. Cochabamba: (1) Yungas of Corani, alt. 1,500 m.; and (2) Peñon de San Julian, alt. 2,000 m.

AMARYLLIS ANGUSTIFOLIA, AN AQUATIC SPECIES

HAMILTON P. TRAUB

In the 1969 PLANT LIFE (see page 33), Prof. Gomez C. Ruppel reported on the collection of *Amaryllis angustifolia* (Pax) Traub at Santo Tomé, Corrientes, Argentina. He sent bulbs of this to Mr. Paul H. Williams, 6128 Subdown Drive, Fort Worth, Texas 76114.

Some of these bulbs made 6 leaves and flowered for Mr. Williams in 1969 (see PLANT LIFE 1970, page 65). The flowers were similar

to those of "*Sprekelia* but not quite so full in appearance."

Bulbs of *Amaryllis angustifolia* were received by the writer from Mr. Paul H. Williams on May 11, 1968. They flowered for him in May 1969. The bulbs were oblong, 5 cm. long, 3 cm. in diam., neck 12 cm. long, 2 cm. in diam., leaves strap-shaped, umbel 4-flowered. The flowers were somewhat irregular and similar to those of *Sprekelia*. A specimen has been preserved in the herbarium.

Mr. Russell H. Manning, of Spring Valley, Minn., writes under date

Fig. 26. **Sprekelia formosissima** forma **williamsii,** a very robust form that thrives out of doors in northern states; bulbs are stored in cellar or basement over winter. From color photo by Paul H. Williams.

of Nov. 4, 1973, that he has had *Amaryllis angustifolia* for some years. His bulbs produced flower scapes but the buds aborted due to not keeping the plants in wet enough soil.

On March 6, 1973, Mr. Sterling S. Harshbarger, 161 S. Virginia Ave., Pasadena, Calif. 91107, sent the writer specimen material consisting of one floret and a strap-shaped leaf of *Amaryllis angustifolia* which was dried and mounted for preservation in the herbarium.

Thus, this species is becoming established in the United States and it is hoped that others will report on their experiences with this most interesting plant.

Since this is an aquatic *Amaryllis* species it should be well adapted to Florida conditions and could be naturalized in swampy regions.

SPREKELIA FORMOSISSIMA FORMA WILLIAMSII

HAMILTON P. TRAUB

Mr. Paul H. Williams, Jr., of Forth Worth, Texas, under date of October 29, 1973, writes that the robust form of *Sprekelia formosissima* (Fig. 26) was obtained from the Grower's Exchange (in Michigan) in 1959. The flower color has a mahogany cast, and some refer to it as brown-red. This robust form is distinct with reference to size, and it is named *Sprekelia formosissima* forma *williamsii** (see Fig. 26).

Mr. Williams crossed forma *williamsii* with *Sprekelia formosissima* var. *superba* as pollen parent in 1960. One bulb of this cross was much larger than the seed parent, but the segs were not as wide as those of the pollen parent. The flower was distorted and the scape was too weak to stand upright.

Mr. Russell H. Manning of Spring Valley, Minnesota received seeds of this cross, but the plants obtained from these are apparently pure forma *williamsii* since they are robust like the pod or seed parent. This indicates that these progeny are apparently parthenocarpic in origin.

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* **Sprekelia formosissima** forma **williamsii** Traub, **forma nov.** Typus: No. 1126 (TRA). Cult.

SPREKELIA-AMARYLLIS CROSS?

RUSSELL H. MANNING,
Spring Valley, Minnesota 55975

The writer has several times in the past attempted to cross species in the genera *Amaryllis* and *Sprekelia* for it had been reportedly done by Luther Burbank who is said to have some outstanding hybrids from such a cross. However, Burbank's work has never been verified. With the report in the 1970 PLANT LIFE, page 117, with photo of a cross of "Sprekelia x Amaryllis?" in mind, the attempt was again made here this year (1973).

The *Sprekelia* plants trace back to Mr. Paul H. Williams, Jr. of Fort Worth, Texas, who in 1967 sent *8 seeds* which were listed as a cross between *Sprekelia formosissima* forma *williamsii* (see article by Traub in the present issue of PLANT LIFE) and *Sprekelia formosissima* var. *superba*. As indicated in the previous article, these seedlings are apparently pure *Sprekelia formosissima* forma *williamsii*. The seedlings have long necks similar to those of common Sprekelias but thicker and longer.

In 1973, the forma *williamsii* was crossed with a very vigorous Dutch type hybrid *Amaryllis* (pod parent) obtained from the Begonia Society's Seed Fund. The *Amaryllis* had been received by this Society from Mr. Don Horton in 1959.

Both of these lots of bulbs were grown out of doors in summer and stored in a cellar in winter here in Minnesota.

Six crosses were made; pollen was applied repeatedly, with foil

on the stigmas as the weather was cold, wet, windy and rather continuously nasty. Five seed-pods set, but one was broken off when a bird lighted on it. Thus, only four filled out fully. The seeds from the first pod were panted here, and two seedlings were obtained. After calling Dr. Traub by phone, the next pod was sent to Dr. Bell in Florida to culture the seeds (see 1972 PLANT LIFE pp. 72-76), since it was not yet known whether any would survive by the usual sprouting on top of water technique (floating seeds on water in good light) and at last report he had some success. The third pod was sent to Dr. Traub in California who wrote later that he had six seedlings from eleven seeds. The seeds from the fourth pod gave eight seedlings here in Minnesota.

We will not know if we have a true cross between *Amaryllis* and *Sprekelia* until the seedings flower. There is a possibility that the seeds from the *Amaryllis* stimulated by the *Sprekelia* pollen may be parthenocarpic. The results will be awaited with the greatest interest.

ADDED NOTE.—The use of *Lavoris* in the water used for sprouting Amaryllis seeds keeps down the mould. Dr. Traub used *Lavoris* also at my suggestion and he reports success with it.

AMARYLLID NOTES, 1973

Hamilton P. Traub

Bulb of *Nothoscordum mahuii.*—In the description of this species on page 34, 1973 PLANT LIFE, the bulb was not described in detail. This information is now furnished: *Bulb* ellipsoid in long-section, almost corm-like with a single, very thin light brownish bulb coat, 2.3 cm. long, 1.2 cm. in diam. Roots absent during dormant period. When stock of this species becomes generally available, it should lend itself to pot culture. A number of bulbs should be planted in a 3-inch (7.6 cm.) diameter pot in order to make a good showing. The plant is tiny, and the flowers relatively large in comparison. Two to three flower scapes have been observed issuing successively from the same bulb.

CLASS LILIIDA OF SUPERCLASS **MONOCOTYIDRA**

Hamilton P. Traub

This article will be published in TAXON, journal of the International Association for Plant Taxonomy in 1974 or in a subsequent volume of that journal.

REGISTRATION OF NEW AMARYLLID CLONES

MR. W. D. MORTON, JR., *Emeritus Registrar*

MR. JAMES M. WEINSTOCK, *Registrar*
10331 Independence, Chatsworth, Calif. 91331

This department has been included since 1934 to provide a place for the registration of names of cultivated **Amaryllis** and other amaryllids on an international basis. The procedure is in harmony with the International Code of Botanical Nomenclature (edition publ. 1961) and the International Code of Nomenclature for Cultivated Plants (edition publ. 1958). Catalogs of registered names, as well as unregistered validly published names, will be published from time to time as the need arises. The first one, **"Descriptive Catalog of Hemerocallis Clones, 1893-1948"** by Norton, Stuntz and Ballard was published in 1949. Additional catalogs of cultivars have been published since 1949: **Catalog of Brunsvigia Cultivars, 1837-1959,** by Hamilton P. Traub and L. S. Hannibal, PLANT LIFE 16: 36-62, 1960; Addendum. PLANT LIFE 17: 63-64. 1961; **Catalog of Hybrid Nerine Clones, 1882-1958,** by Emma D. Menninger, PLANT LIFE 16: 63-74. 1960; Addendum, PLANT LIFE 17: 61-62. 1961; **The Genus X Crinadonna,** by Hamilton P. Traub, PLANT LIFE 17: 65-74. 1961: **Catalog of Hybrid Amaryllis Cultivars,** 1799-1963, by Hamilton P. Traub, W. R. Ballard, La Forest Morton and E. Authement, PLANT LIFE. **Appendix** i-ii + 1-42. 1964. Other catalogs of cultivated amaryllids are scheduled for publication in future issues. These may be obtained at $5.00 prepaid from: Dr. Thomas W. Whitaker, Executive Secy., The American Plant Life Society, Box 150, La Polla, Calif. 92037.

The registration activity of the American Plant Life Society was recognized when at the XVIth International Horticultural Congress, Brussels, 1962, the Council of the International Society for Horticultural Science designated the American Plant Life Society as the Official International Registration Authority for the cultivars of **Nerine;** and this was extended to include all the **Amaryllidaceae** cultivars, excepting **Narcissus** and **Hemerocallis,** at the XVIIth International Horticultural Congress, 1966.

Only registered named clones of **Amaryllis** and other amaryllids are eligible for awards and honors of the American Amaryllis Society at Official Amaryllis Shows.

Correspondence regarding registration of all amaryllids such as **Amaryllis, Lycoris, Brunsvigia, Clivia, Crinum, Hymenocallis,** and so on, should be sent to Mr. Weinstock at the above address. The registration fee is $2.00 for each clone to be registered. Make checks payable to American Plant Life Society.

REGISTRATION OF NEW AMARYLLIS CLONES, 1973

Registered by Dr. John M. Cage, 740 Arroyo Rd., Los Altos, Calif

Amaryllis clone 'Mildred' (Cage, 1973) R; A-999; U-4 fld.; Spr. on earlier if forced; 20"h; perigone 2¾" long, 7½" across face, scarlet (HCC19) except for striking ⅜" white band from throat almost to tip of each seg.; formal shape, small bulb.

Amaryllis clone 'Big Tex' (Cage, 1973) R; A-1000; U-4-5 fls on each of 2-3 sequential scapes; 28"h; spr and W; 3" long, 12" across face; solid dark red (RHS46B) front and reverse. Heavy substance.

REGISTRATION OF AMARYLLID CLONES—continued on page v.

EVALUATION OF HYBRID NERINE CLONES

HAMILTON P. TRAUB

The evaluation of hybrid *Nerine* clones for horticultural purposes is practically non-existant, or is rather in a chaotic state. Hybrid *Nerine* seedlings are produced very easily, and at present apparently most of these are named and propagated so that growers have long lists of hybrid clones which are not classified as to *blooming season, flower color, cultural requirements, etc.* This condition has retarded progress toward the popularization of this important group of plants. Thus, it was necessary for the Board of Directors to request the NERINE COMMITTEE to undertake as soon as possible the evaluation of the many existing named hybrid *Nerine* clones, and to require that new hybrid named clones be placed in a classification to be adopted as soon as practicable.

The first project is to be concerned with the grouping of the presently known hybrid clones into color classes, and then to single out the best 10, 25, 50 and 100. In making such lists, the available color charts or fans are to be utilized: (a) the well-known *Horticultural Colour Chart,* (b) the *Nickerson Color Fan,* distributed by the American Horticultural Council (Address, Donald Wyman, Arnold Arboretum, Jamaica Plain 30, Mass.), and (c) the *British Colour Fan.*

Ultimately, a complete classification of hybrid Nerine clones is to be produced, and the known 30 plus natural Species of *Nerine* are to be popularized for their appreciation and utilization in breeding (see PLANT LIFE Vol. 23, 1967, Supplement: Review of the Genus *Nerine*).

The following is a suggestion toward a beginning of a *Nerine* classification for horticultural purposes:

GROUP A. SPECIES

CLASS 1. 30 plus natural species.

GROUP B. PRESENTLY GROWN STANDARD HYBRID NERINES; REQUIRING A DISTINCT RESTING PERIOD

CLASSES: To be worked out on the basis of cultural requirements, flowering season, flower color, etc.

GROUP C. EVERGREEN HYBRIDS, NOT NEEDING A DISTINCT RESTING PERIOD

CLASS. Traubianthe Hybrids (N. x traubianthe Mold., *Nerine filifolia* x Hybrids of group B); evergreen hybrids, see PLANT LIFE 25: 45-46. 1969; PLANT LIFE 24: 102-103. 1968; and PLANT LIFE 23: Vol. 23, 1967, Supplement, Review of Genus Nerine, p. 61.

It is realized that such a classification cannot be produced over night, but it is important to make a beginning as soon as possible.

3. GENETICS AND BREEDING

STOMATAL SIZE AS AN INDICATION OF **AMARYLLIS** POLYPLOIDY

WILLIAM D. BELL AND HERBERT D. STILES*
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Application of clear nail polish (lacquer) to leaf surfaces and subsequent examination microscopically of the resulting impression is a technique often employed in biology teaching. Epidermal imprint methods have been used for more than a generaton (Sax and Sax, 1937). Nevertheless, this continues as a valuable tool for preliminary determinations of ploidy. The relationship of cell size or volume to ploidy has also been reported (Kimber and Riley, 1963).

The lacquer was applied to the upper (adaxial) leaf surface and allowed to dry for about 15 minutes. Hardened lacquer films were then stripped from the leaves for examination. Usually, there was little or no damage to the leaf after removal of the lacquer. Photomicrographs of leaf impressions were made at a magnification of 400X on Kodak Panatomic X film. Further enlargement in printing resulted in a final magnification of 1500X and this was reduced to X765 in Fig. 27; representative stomata at the magnification were chosen for illustration here. For definitive classification, use of fine-grain film with photomicrographs made at 100X is suggested. Average measurements of length and width of a population of stomata can then be determined from enlargements or projections of the photomicrographs. Standardization of leaf maturity, position of somata, and environmental conditions would reduce errors in such determinations (Meidner and Mansfield, 1968).

Examination of the samples shown here indicates that a meaningful relationship may exist between stomatal size and ploidy in the genus *Amaryllis*. Two apparent tetraploids, the cultivars 'Superba' and 'Ludwig's Dazzler' showed larger stomates than those found in *A. evansiae, A. starkii, A. belladonna minor, A. iguazuana* and the hybrid *A. evansiae* x *starkii* (see fig.). Stomates of one of the 'Senorita' hybrids appeared intermediate in size suggesting the triploid condition of this hybrid.

* Mr. Stiles is presently a graduate student at the University of Florida.

This technique may be of particular interest in evaluating plants treated with colchicine or where a spontaneous doubling of chromosomes is suspected. Treatment with colchicine may affect only a portion of the shoot meristem and produce sectorial or periclinal chimeras. The colchicine treatment may also induce doubling in root primordia without an influence on the shoot. In the latter case, an examination of root

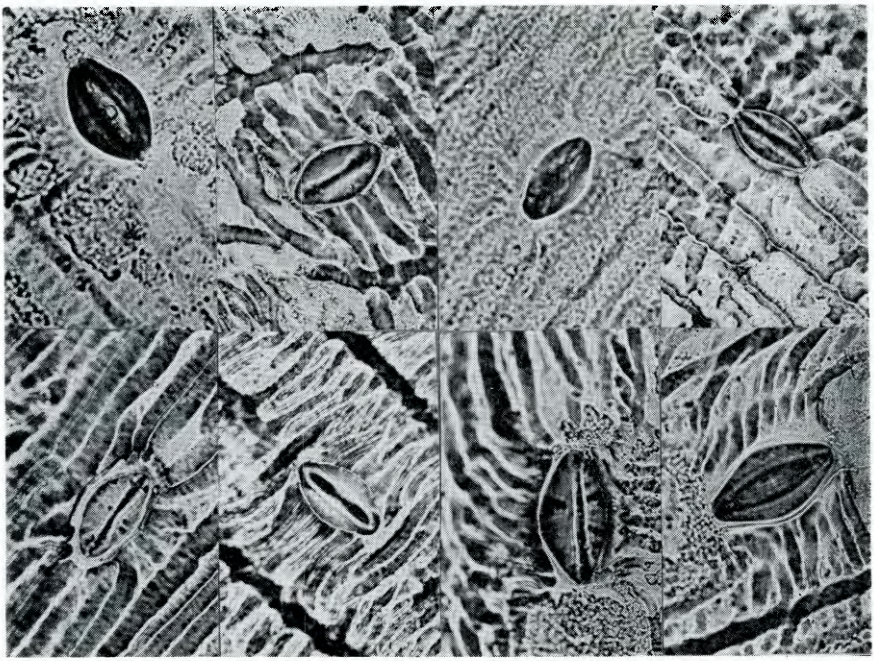

Fig. 27. **Amaryllis** stomata, X765. Reading from **left** to **right: UPPER** clone 'Superba', 'Ludwig Dazzler'; **Amaryllis evansiae;** and **Amaryllis starkii. LOWER, Amaryllis belladonna minor, Amaryllis iquazuana, Amaryllis evansiae** x **A. starkii** and clone 'Senorita'. Photos by Bell and Stiles.

tips alone would give misleading information on the ploidy of the shoot and the consequent breeding potential of a plant.

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TETRAPLOID **AMARYLLIS EVANSIAE**

WILLIAM D. BELL,
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Amaryllis evansiae was among the first of the species utilized with the idea of breeding large-flowered yellow hybrids. Unfortunately, many hybrids have been produced by pollinating *A. evansiae* with the pollen of large tetraploid hybrids, usually those described as "white Dutch." Resulting progeny, triploids of low fertility, were more often than not a disappointment. Backcrosses to other tetraploid hybrids further diluted the germ plasm rapidly. Crosses of *A. evansiae* with other diploids such as *A. aglaiae* and/or *A. parodii* produced hybrids more easily grown than the species and in some cases more yellow in appearance. However, the diploid hybrids present the same problems in attempting to combine desired traits where such traits are found in plants differing in ploidy level. Thus, it seemed desirable to attempt to produce tetraploids from existing diploids to facilitate this breeding venture.

METHODS

Several capsules of sibling-pollinated *A. evansiae* were harvested about 4 weeks after pollination. The immature seeds were placed in sterile culture on a mineral-sucrose aqueous medium (Bell, 1972) but agar was omitted. One to 2 weeks later, when some had begun to germinate, all were transferred to aqueous 0.2% colchicine with 2% sucrose for 24 hours. Treated seedlings were in some cases punctured with a sterile needle to facilitate entrance of the colchicine. Plantlets were then washed in sterile water and transferred to the mineral-sucrose medium which in this case was solidified with 1% agar. Crosses of *A. evansiae* with other diploid species and hybrids were treated similarly.

RESULTS AND DISCUSSION

Initially, plantlets began to display signs of colchicine injury within a week. Approximately 20% of the treated material failed to develop further on the medium although supplied with sucrose, minerals and illumination. Another 10-15% survived for several weeks but produced large, hypertrophied cells and eventually lost pigmentation. The latter also failed to survive leaving 70% or less of the initial population. Among the survivors were virtually all of the earliest germinating plantlets including those which had been perforated with a needle.

Distortions of growth patterns were common among the plantlets which remained—most showed irregularities in leaf development. Often, leaves tended to bend in a lateral direction. Newly produced leaves were usually curved in the same direction suggesting that such plants were actually chimeras made up of mixed cell sizes. As the plants continued to develop new leaves, longitudinal strips of thicker

leaf tissue were not rare. In fact, this proved to be the best clue so far that the plants were at least partially polyploid. When the thicker strips were near midribs, little bending was noticed.

One problem encountered was that root formation was often severely inhibited, particularly among the most stunted plants. However, I suspect that aseptic conditions favored the recovery of this group. As long as some leaf development continued, they were maintained and patience was rewarded by eventual rooting of most of these plants.

One year after the colchicine treatment, many of the plants had reached the 4-5 leaf stage. Those with the thickest or most distorted leaves tended to show slower growth than those showing no abnormalities, another indication of possible polyploidy in the slow-growing plants. Incidentally, there appeared to be no condition that might be interpreted as a simple overgrowth of diploid tissue. Thicker strips were found to be constant in the leaves which developed after a thick strip was first observed.

The most-likely candidates have been scored by a method suggested for this purpose (Bell and Stiles, 1974). Apparent success was indicated for one of several treated *A. evansiae* displaying uniformly thicker leaves. Guard cells on the upper leaf surface were approximately 50% longer than those of diploid *A. evansiae* leaves. Another which was visibly similar, on the other hand, was found to have guard cells of the same size of the untreated species.

Treatment of the diploid hybrid, *A. evansiae* x *cybister,* produced several candidates from a single capsule of treated seeds. One plant from this treated group is now growing with no visible abnormalities but with large guard and epidermal cells which can be distinguished microscopically at 100X when compared side by side with impressions made from untreated material of the same cross. Another appeared at an early stage that it would not survive, but finally initiated 3 shoot meristems. One of the latter is growing more rapidly than the others which are scored as probable tetraploids. Approximately 100 other plants from this and other diploid *A. evansiae* crosses remain to be scored. Some are still severely stunted. All are being maintained on the chance that additional sorting of polyploid tissue may occur such as when offsets are produced. Chromosome counts of root tips have not yet been made on those scored as probable tetraploids.

In inducing polyploids, only one layer of the growing point may be doubled by the colchicine treatment (Eigsti and Dustin, 1955). And, that layer may or may not give rise to the germ tissue. Therefore, proof of the success of this venture will be in the production of viable gametes with a chromosome count double that of gametes produced by diploid plants. Leaf impressions are a very useful method for preliminary screening, but could also be misleading if the plant were a chimera of diploid and polyploid tissue.

Other methods of polyploid induction should be tried, particularly for those who do not have access to facilities for aseptic culture. I suggest that those interested in attempting to induce polyploids use known diploid material or perhaps triploids. A natural hexaploid, *A. apartispatha,* is known (Traub, 1958). It would be interesting to learn if a diploid pollinated with a hexaploid would yield fertile tetraploid progeny. This would indeed be a shortcut, especially if the hexaploid had desirable qualities.

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TRUE-BREEDING AMARYLLIS LINES—PROGRESS REPORT

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In *Plant Life*, 1973, p. 53, the writer advocated the inbreeding of promising strains of Amaryllis until certain desirable traits have become stable. Once that has been accomplished, inbred strains can be crossed with other inbred strains to find combinations having good quality, uniformity, and hybrid vigor. *Complete* stability in an inbred strain can only be approached after many generations of close breeding, but only a *few* generations of selfing and/or sibling-crossing and/or back-crossing on parents has been found to produce superior breeding stock.

The writer's main work has been with true-breeding, large, solid-red Leopoldii types. About five lines have been tentatively selected for breeding stock, and these lines have been inbred from three to seven generations. Crosses between some of these lines produce uniform seedlings of exhibition quality and solid color without blemish. Obvious weaklings among the seedlings are rogued after about three true leaves are formed. Fewer weaklings are found among the "F:1" crosses in each generation.

Orange, pink, white, miniature red, and dotted strains are not as far advanced as the reds, but they show much promise.

A few observations on line breeding follow. A more complete discussion will be submitted next year.

1. Selfing is the most severe form of inbreeding. If a superior seedling can be derived from each selfed generation, selfing can

produce uniform stock in few generations, but so many very weak seedlings are produced that the breeder may find none worth saving in a whole batch. When the problems of selfiing become too frustrating, sibling crossing should be mixed into the program.

2. Blind alleys are sometimes found in inbreeding. Crossing a weak inbred seedling (having stability and some good qualities) back on a vigorous ancestor can break the deadlock and permit some more useful inbreeding.

3. Crosses between some stabilized inbred lines do not produce vigorous seedlings. One should suspect triploidy or anenploidy in this case, and special procedures are required to work further with the strain. See Bell's paper, The Role of Triploids in Amaryllis Hybridization, in the 1973 PLANT LIFE.

4. Crosses between red inbred lines and named red clones of mixed parentage seem to produce more outstanding seedlings than crosses between two named mixed parentage clones. The named clones may already be somewhat inbred.

5. When inbreeding is commenced on a strain, a few generations of experimentation may be required to find which genetic characters are tending to stabilize. Only those characters that are homozygous can readily be stabilized by inbreeding.

To digress from the main topic, the writer recommends a revision of show standards in regard to "throat green," for which no points are deducted at present by the judges. A green throat is not necessarily ugly in *Amaryllis*, and since most of the vigorous early American hybrids had some color break in the throat, it is easy to understand why the show standards were written as they exist. However, green streaks and blotches are unattractive in some plants by any artistic standard. Should not the show standards allow beautiful green throats and penalize ugly ones? Ludwig's 'Happy Memories' is a lovely bi-color with a green and white center, but 'Fire Dance' would not be merchandisable if it had irregular green streaks in its throat.

SUMMARY—**HYBRIDIZATION** AND POLYPLOIDY IN RELATION TO **AMARYLLIS** SPECIES AND CULTIVARS

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Out of the 47 or more species recorded in the genus *Amaryllis*, only 18 species were available to be studied cytologically. In the present investigation only 50 cultivars covering 5 elemental species (*A. vittata, A. belladonna, A. stylosa, A. reticulata* and *A. species*) were studied. Among the elemental species *A. stylosa, A. reticulata* and *A. species* are diploid, whereas *A. vittata* was found to be both diploid and tetraploid. *A. belladonna* occurs in 3 races, namely diploid, triploid and tetraploid. In cultivars, 30 are diploid, one is triploid and 14 are tetraploid.

Diploid taxa: The basikaryotype contain 2 median, 5 submedian and 4 subterminal chromosomes. There are only 2 satellited chromosomes in the somatic complement. While there is in general great homogeneity in the karyotypes of elemental species and cultivars, *Amaryllis* species and nearly 71% diploid cultivars differ karyotypically. This difference was in the location of centromeres in the VIII pair. In *A. vittata, belladonna, A. stylosa* and *A. reticulata.* VIII pair has median (V) to submedian (L) centromere position, while in *Amaryllis* species it has highly subterminal centromere (J). In the heterozygous cultivars number of V, L and J chromosome was found variable and the VIII pair always contained one V or L and other J chromosome.

The male meiosis of elemental species and diploid cultivars, was regular except in *A. stylosa* which is a structural heterozygote. The 11 bivalent have an average of 21.57 ± 0.34 *(A. vittata),* 25.3 +0.23 *(A. belladonna)* to 20.0 ± 0.26 *(A. species) chiasmata* per cell Anaphase I and tetrad formation are normal. Pollen fertility ranged from 20.0 to 64.0%. *Amaryllis* species were totally pollen sterile. Pollen grain mitosis has also revealed the occurrence of expected numbers and morphology of the chromosomes.

Polyploid taxa: The only one cultivar (cv. 110) was triploid with 2n = 33. The somatic complement of 33 chromosome is composed of 6V + 15L + 12J, which is an exact multiple of 2V + 5L + 4J. Male meiosis was characterised by presence of high number (6-8) of trivalents. The meiotic behaviour coupled with karotype similarities of the triploid cultivar show autoploid characters. The somatic complement of tetraploid taxa consist of 8V + 20L + 16J chromosomes which is an act multiple of 2V + 5L + 4J. The meiotic behaviour of the tetraploid species and majority of the tetraploid cultivars was characterised by the presence of high number of quadrivalents (5.6 ± 0.26 to 9.4 ± 0.61) and bivalents. However, on the other extreme, there are cultivars where the frequency of quadrivalent goes down to 2.8 ± 0.18 to 4.75 ± 0.32 per cell. This was also accompanied by 6.4 ± 0.40 to 4.0 ± 0.2 univalents. This shows that former has autoploid characters while latter may be segmental allotetraploid.

Heterozygosity in A. stylosa: In this heterozygote during male meiosis, rings or chain involving 4 chromosomes were regularly obtained. The interchange multiple is also karotypically detectable, because of the heteromorphic nature of 2 pairs of chromosomes. Though 92.59 percent interchange multiples show alternate disjunction, there is only 56% pollen fertility. The reduced fertility seems to result from the presence of an interstitial chiasma in the interchange multiples. However, vegetative reproduction not only conserves high level of heterozygosity but also circumvents high level of sterility.

Aneusomaty: During the course of cytological survey, aneusomaty was found in the root tip mitosis of cv. 'Andromeda', a tetraploid cultivar of hybrid origin. It contains 44 chromosomes in nearly 86.5% cells. In the remaining 13.5 of cells, chromosomes numbers range from 34-45. A comparison of karotype of the variant and normal cells

revealed that while all types of chromosomes are lost in different frequencies, the gain is confined only to smaller ones. Furthermore, chromosome type X is both lost and gained most frequently. The cellular basis of the origin of aberrant cells lies in the double plate metaphases and split anaphases.

It is concluded that polyploidy appears to be one of the chief cause of these aberrations. Aneusomaty may thus be looked as an attempt to regain the nucleo-cytoplasm ratio found at diploid level. This is followed by hybridity involving, incompatible genic and/or cytoplasmic combinations. In fact all the 3 factors are correlated. The role of aneusomaty in evolution and speciation is not very clear, at any rate it does not appear to be important in creating varietal diversity in *Amaryllis*.

Hybridization: Limited success has been achieved in raising interspecific hybrids. Only 2 combinations involving *A.* species X *belladonna* and *A. vittata* X *A. belladonna* were successful. The hybrids obtained from *A.* species (subgenus *Macropodastrum*) X *A. belladonna* (subgenus *Amaryllis*) is not only sterile but also had malformed anthers like *A. species*. The other interspecific hybrid *A. vittata* (subgenus *Lais*) X *A. belladonna* (subgenus *Amaryllis*) is fertile with perfect meiosis in the F_1 hybrid. This indicates that the two parents are genetically very close. In the absence of meiotic studies in *A.* species X *A. belladonna*. it is not possible to say anything about the nature of its sterility.

Nine intervarietal hybrids involving 2x X 2x and 4x X 4x levels and one from interploidal crossing (4x X 2x) were also obtained. These have been assessed for their horticultural characteristics.

The present results and those of the earlier authors on *Amaryllis* reveal that hybridization has been an important single factor involved in the origin of garden cultivars. All the important hybrids like *A.* X *johnsonii, A.* X *acramannii,* 'Acramannii Pulcherima', 'Gravena', 'Empress of India' and several Reginae (*A.* X gh. *reginaeoides*) and Leopoldii (*A.* X gh. *leopoldaeoides*) hybrids evolved through hybridization. Transgressive segregation seems to be one of the important ways by which flower size increased considerably over the species which show little variation. Regarding the elemental species relevant to the origin of garden amaryllis mention may be made of *A. belladonna, A. reginae, A. striata, A. reticulata, A. vittata, A. aulica, A. pardina, A. leopoldii, A. espiritensis* and *A. psittacina.* This is a reasonably wide base of germplasm from which appropriate gene combinations have been selected over the years.

Next to hybridization, polyploidy has played an important role. Majority of the large flowered types are tetraploid. Of particular interest are the triploid hybrids which are outstanding and surpass in all floral characters over their diploid and the tetraploid parents. While a basic karotype is recognizable, there is a good deal of karotypic heterozygosity which may be due to para-and pericentric inversions, interchanges etc. One clear evidence of interchange has been brought out in this work.

4. AMARYLLIS CULTURE

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

AMARYLLIS GROWING

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From correspondence and visits with growers in many parts of the world I have heard of many troubles and heard statements like: "I can't grow this species because it is too hot here—or too humid—or some other reason." Having grown, maintained, and bloomed over 125 variants and types of more than fifty species, along with many hybrids, I would like to discuss some growing practices that might be helpful.

The primary faults I have tried to overcome and observed also with other growers are:

1. Improper watering
2. Over fertilizing
3. Too much organic material in potting mix
4. Insufficient light
5. Lack of proper vernalization

1. SOIL MOISTURE

Material in a pot is not at all like the soil in a field. When a pot is saturated with water it remains saturated and does not drain out, a condition the plant never enounters in its habitat. An analogy would be a pot containing a sponge saturated with water. While soil in a field is rapidly reduced from the saturated condition by the "blotter" action of the surrounding soil and subsoil. This rapid reduction of water content after a rain or irrigation aerates the soil. For this reason watering practice becomes the most important aspect of culture of plants in a pot. My observations have been that most growers do not let the pot dry out sufficiently before watering. From a number of trials we have found the plant should go to 40 centibars or more before watering. I have run plants to 60 centibars with no problems. When using sandy soil, if one digs ½-1 in. deep, 40 centibars of tension appears barely moist, i.e., you can just tell that it is moist while the soil above is dry. For further discussion of this see Holly, W.D. and Baker, Ralph —"Carnation Production 1963", p.57-59, Wm. C. Brown Co., Inc. and "Soil, the Yearbook of Agriculture 1957," U.S. Printing Office, Washington, D.C., p. 49-60. Of course, the acquisition of a *tensiometer* would be the best way to teach oneself how to water. Tensiometers are available from many sources. Two are: Randolph Matson, 1954 Camino Loma Verde, Vista, California 92083; and, Irrometer Co., Inc. P.O. Box 2424, Riverside, California 92506. The electrical conductance instru-

ments are usually reliable if calibrated against a tensiometer in the same soil and fertilizer program.

It is important that when a pot is watered it should be thoroughly wet and enough water put in so a good quantity runs through. If water supply is in any way saline (don't overlook the fertilizer salts) the amount run through should be ample to insure no saline build up.

2. SOIL FERTILITY

We have over the past few years run a number of trials in an effort to determine the requirements of mature bulbs and seedlings. Seedlings of *A. fusca* were grown in 3″ pots and fed at every watering 90, 180, 250, 320, 390 p.p.M. N with 36 ppM P_2O_5, 72 p.p.M K_2O with no essential difference in size. The seedlings showed good growth. The ones on the higher nitrogen feeding showed no ill effects. These would seem to indicate that amaryllis are not sensitive to high nitrogen supply and also shows they do not require large quantities of nitrogen. Of course there is a possibility of other limiting factors. Many "Dutch hybrids" have been grown with leaves 8 cm. wide and 1¼ meters long which produced 30-40 cm. circ. bulbs with only 75 p.p.M N for May, June and July. The use of soil, effluent, and tissue analysis have indicated need for only mediocre amounts of phosphorus but large requirements for potash. The last couple of years I have used 75 ppM N, 40 ppM P_2O_5 and 50 ppM K_2O until about August 1st, then formula is changed to 50 ppM N, 25 ppM P_2O_5, 100 ppM K_2O. In early Sept. change to 100 ppM K_2O, in October clear water. For those who wish to compute their own liquid feed, multiply the percent of fertilizer by 75 to get ppM in 100 gallons for every ounce used. Example: Calcium nitrate is 15.5% N, .155x75=11.6 ppM N when one ounce is put in 100 gallons of water. Ozmocote 14-14-14 in ½, 1, & 2 teaspoon rates have been put in pots of hybrids to compare with liquid fed bulbs. These bulbs also received the same liquid feed. No increase in growth was noted, leading to the conclusion that the liquid feed supplied all the requirements of the plant. The source of NPK is all from inorganic salts: KNO_3, CA $(NO_3)_2$. $NH_4H_2PO_4$, and K_2SO_4. I do not like to use any organic material, as I believe this is a source of disease organisms which cause root and bulb rots. When these were eliminated from the program very noticeable improvement was shown. Also, I like to avoid the use of ammoniacals and urea as much as possible. Micro nutrients were added with fertilizers at the rate of: 2 B, .09 Mn, .02 Cu, .09Zn, .75 Fe, .03 Mo, .01 Co (all stated in ppM); Ca was maintained above 60 ppM and Mg above 5 ppM. Uusually with greenhouse crops 3-6 pounds of nitrogen per year per 100 sq. ft. is considered adequate. If 500 6″ pots are equivalent to 100 sq. ft. of bench and 1 quart a week is used for the 3 months period, this would equal one pound of nitrogen per 100 sq. ft.; however, with the leaching used in the program, I feel that actual available nitrogen is much less. Tissue analysis always showed an adequate supply. Phosphorus in the form of superphosphate is always

added to the mix and analysis never shows a deficiency but it was always added to the liquid feed to insure availability. Potash was always sufficient in tissue analysis but in effluent and soil analysis it was always low. The ratio to nitrogen was kept high and in the fall of the year it just seemed to disappear in the pot. For this reason potash was increased in the fall and the increase has not caused any problems but might require a check for salinity.

Observation of growing practice in Holland would at first seem that huge quantities of fertilizer are used; however, the near 100% organic growing medium combined with a watering procedure, which would rapidly leach the fertilizer salts, would indicate that the plant is lightly fed. When most people grow plants in pots and feed as heavily as has been observed, I believe that the plants are damaged both by excessive fertilizer and salinity. In my own program I believe that excessive amounts are still being used and in the future plan to reduce the amounts to about two thirds of what is presently being used. In observed programs where solid fertilizer materials are used there is always the feast or famine phenomena: too much when just applied and then none in a short time resulting in saline damage and then starvation periods. A condition of this kind certainly would not get the best growth response from the plant and in case of the more sensitive species might result in loss of bulbs. Constant liquid feed avoids this condition.

3. ORGANIC MATERIAL

The potting mixes that have been recommended are usually from ⅓ to ⅔ organic. When the organic material is very course and fibrous the mix has excellent aeration, but as decomposition takes place it becomes a slimy mass that is a "disaster area" for a root system. Bulbs have shown excellent growth when planted in sphagnum moss for the first few months, then the moss rots out and becomes a wet mess. To save the bulb it must be cleaned and replanted, with the anaerobic condition in the moss and the disturbance in cleaning and repotting the bulb suffers tremendously. Composts and manures are some of the poorest materials to use because they rapidly decompose into "jelly-like" anaerobic masses which destroy roots rapidly. Other than environment, the organics are regarded as sources of nutrition for the plant. This is a fallacy because they contain very little nutrition, release it too slowly, and do not give the grower any control. It is much easier to add the requirements to the water. The answer would seem to be in reducing the quantity of organic material to a low value. In this manner the mix would remain more constant over a long period of time, obviating disturbance of plant for several years.

Although "Dutch hybrids" can be grown in pure peat and many other mixes, in plastic pots and clay, I believe that using mixes that require the least care are best. After trying a couple dozen types, the following became a standard:

2 parts organic (fibrous)
3 parts sponge-rok #3 (coarse)
2 parts fine sand
1 part charcoal #10 (10 mesh)
2 parts vermiculite #3

Superphosphate and lime should be added in the amount of 2½# of each per yard (equal to about ½ teaspoon per 6″ pot). If very acid organics are used like sphagnum peat or redwood sawdust, a little more lime will be required to bring the pH into the 6-7 zone. One person told me he used a handful of lime per 6″ pot. This would undoubtedly be a very bad practice, because with such an excess of lime, the phosphorus, boron, iron and molybdenum would be "locked out".

Bulbs should not be overpotted. The pot size used should be such that the plant will use the moisture in 2-3 days; otherwise they will not prosper because they stay wet too long. Clay pots, because they disburse the excess moisture by evaporation, suffer the disadvantage of cooling the soil 8°-10°. If one is careful in watering and uses a very porus mix, the lack of cooling would make a plastic pot much better than clay.

4. LIGHT REQUIREMENTS

One will see pots crowded together in most glasshouses, and often with several offsets in the pot. All of these plants are a mass of leaves and none get enough light. The owner complains of poor bloom. To receive sufficient light, pots should be spaced so all leaves are well exposed to the light and small statured plants should not be shaded by large statured plants. Big plants like *A. parodii* require 300 sq. ins. while *A. anzaldoi* would only require 75 sq. inches; the "Dutch hybrids" need at least 100 sq. inches. Offsets should be continually removed or additional space should be allowed so plants get light. The glass in the greenhouse should be scrubbed a couple times a year. Old glass should be sprayed with an etchant to clear it up. Fibreglass houses should be thoroughly cleaned of all glass fibre and dirt and recoated per manufacturer's instructions about every two years.

Only a slight shading can be used in the few weeks of hot weather. The glass should be hosed off every week to remove the dust accumulation. Spring and fall months are critical because they receive only about ½ the gram-calories as mid summer. The same latitude as Chicago receives over 500 gram-calories per day in June, 200 in March, 260 in September, 29 in January. Note that the amount of light in January is ONLY 1/17th of that in June. Also remember that the bulk of the species grow between latitudes 10°S. and 20°S., and many at high altitudes. These areas are noted for their brilliant light. Although no gram-calorie counts are available, other indicators suggest values double those in the U:S. and winter brilliance is not diminished as in the U.S.

5. VERNALIZATION—REST PERIOD

With the exception of 2 or 3, the species are forced into some kind of vernalization in their native habitat. This is usually referred to as the so-called *rest period.* Several will stay green through the winter and grow well the second season, then if not forced into dormancy, will go into decline and the bulb is lost. My experiences have been "bitter medicine". I believe ALL amaryllis should be vernalized every year. Dutch hybrids handle easily—just withhold water for a month or two then moisten until new leaf growth is well started. If the greenhouse is cool and damp, re-moistening might not be necessary for several weeks.

Although they have a period when they do not grow *A. blumenavia* and *A. calyptrata* seem to require moisture throughout the year. I have been successful with growing *A. blumenavia* only in fine sand. Three bulbs in a 4″ pot will bloom every couple of weeks for several months. *A. calyptrata* requires a very porous mix—4 parts coarse sponge-rok, 2 parts coarse redwood sawdust, 1 part 10 mesh charcoal, 1 part vermiculite —has grown good plants. There should be enough lime to neutralize the sawdust. This plant is often found growing epiphytically.

A. aulica, bellanonna, blossfeldiae, ferreyrae, miniata, papilio, reginae, and *striata* need 1 or 2 months of rest. *A aulica* is often found as an epiphytic plant and in a cool moist area. *A. papilio,* which is just another form of *A. aulica,* needs the same treatment. *A. belladonna, ferreyrae, miniata* and *A. reginae* are from warm, humid areas.

A. caupolicanense, divijulianus, escobaruriae, forgetii (Bolivian form), *fragrantissima, lapasense, leopoldii, nelsonii, pardina, pseudopardina, vittata,* and *yungacensis* are Bolivian plants found at altitudes from 2000, to 6000′ where the dry season last for a couple months, then there is rain nearly every night during spring. They grow on slopes, lightly shaded by forest in a duff 1-2 inches thich, with roots barely covered and extending three feet or more from the bulb. In pots these species seem to need at least two months rest. Most will lose only a part of their leaves before blooming, then will give a "flush" of new leaves before the remaining leaves are lost.

A. corriensis, elegans, flammigera, moreliana, psittacina, starkii, traubii, rubrapicta, doraniae, mandonii, and *aglaiae* also need two months or more of rest. This group grows at low altitudes, except *mandonii.* All but *A. flammigera, starkii,* and *mandonii,* grow in humid, warm conditions. *A. flammigera* grows at 6000′-7000′ altitudes in cool, moist areas. *A. starkii* is from a desert area with a lengthy dry season. *A. mandonii* comes from about 10,000′ elevation with mild conditions. *A. doraniae* comes from a hot, humid, rainy area but goes dormant for 2-3 months in the winter. It is possible it gets too cold for it in California. It seems to prefer small pots and never makes big bulbs. *A. aglaiae* comes up in the spring, blooms, the leaves die back completely, then in 4-6 weeks it grows another flush of leaves which stay on for about 4 months. It stays dormant for 3 months. It always does this

both in the greenhouse and outside.

A. anzaldoi, cybister, evansiae, fosteri, fusca, mollevillquensis petiolata need 3 months or more rest. *A. anzaldoi* from east of Laganilles is found at slightly higher altitude than *evansiae* and in drier conditions. Both should have water withheld completely from late November till after bloom and new leaves are well started. *A. cybister* is from 7000-8000′ altitude where there is about 15 inches of rain in early spring, then none the rest of the year. It grows on rocky hillsides amongst cactus. *A. forteri* comes from hot, deserty area with probably 15 inches of rain in spring and a long season of completely free of rain. *A. fusca* is from 8000′ alt. My experience with this is insufficient to be specific. *A. mollevillquensis,* from a very dry area, grows in the steep canyon walls where moisture is retained for a greater length of time than the surrounding hillsides. When it grows leaves, water it; the rest of the time let it be dry. *A. petiolata* is nearly evergreen but needs to be left dry for a long time. A rule of thumb that works well for *A. cybister, fosteri, fusca,* and *mollevillquensis,* is when leaves get a good start, water. When leaves start to die back quit, and give no water until growth resumes. "Benlate" drenches once a month at 500 ppM seems to benefit them.

A. ambigua, immaculata, tucumana, parodii, need 4 months rest. *A. parodii, immaculata,* and *tucumana* will have normal appearing leaves for several weeks after watering has stopped, then will die back completely. When watered in early March the leaves pop out and are often 6″ long in a week. From an early March watering they bloom the last of May and in June. These bulbs occur in very rocky soil. *A. parodii* is from altitudes of about 2000 ft. in a hot, desert like area with rain only in late spring and early summer; while *A. immaculata* is found at altitudes of 4500-7000 feet. *A. tucumana* occurs at a lower altitude than *A. parodii* in hot, dry conditions. It is much hardier than *A. immaculata* and requires more severe conditions. *A. ambigua* is a hesitant starter and seems to benefit from a hot, dry baking during its rest period. Day periods of 90-95° F. seem to complete its vernalization. It should not be watered until 2-3 leaves are an inch high, then increase the moisture when it starts to grow. It doesn't bloom if not throughly dried out and given a long rest.

My experience does not allow much comment on several species. *A. angustifolia* seems to like more watering and wetter soil than most, but has a definite cycle and would appear to need a dry winter time. *A. reticulata* needs watering the year round with a late spring time of drier conditions. Bloom is usually in August or September. *A. ararapina* needs a long rest. *A. iguazuana* goes completely dormant and grows on near vertical cliffs in deposits of heavy soil but grows in the greenhouse about like most others. *A. kromeri* grows on top of low mountain peaks with bulbs deep in the clay soil. In the greenhouse it appears to want a couple months rest. *A. macbridei* occurs in a harsh hot area of long drought. I water it when in leaf and stop completely when it shows any sign of growth stoppage. So far it has taken long

rests and doesn't seem to adjust to North American time. *A. viridiflora* grows like *macbridei*—when it feels like it—occurs in hot, humid, high rainfall area.

In conclusion, the author wishes to qualify all statements in this article with the hope that the conclusions are correct and hopes that it will promote further experimentation and develop better growing methods.

MOSAIC DISEASE IN LEOPOLDII **AMARYLLIS** HYBRIDS

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SUMMARY

A mosaic disease of **Amaryllis** was investigated by electron microscopic examination of leaf sections and negatively stained crude sap. Numerous inclusion bodies were detected in thin sections, and virus particles were observed in both thin sections and crude sap. The inclusion bodies and virus particles were not present in the dark green areas of the mosaic tissue. Virus particles were between 5500 and 8000 A in length and 120 A in width.

The virus was transmitted to **Gomphrena globosa** and **Chenopodium quinoa** and produced local lesions in 7-10 days.

INTRODUCTION

Numerous authors have observed, investigated, and periodically brought up various aspects of the virus problems of *Amaryllis* (Dickson 1922, Hannibal 1942; Iwaki 1967, Johnson 1951, Kahn 1960, Kahn and Scott 1964, Kahn and Smith 1963, Procenko and Procenko 1962, Stauffer 1963, Townsend 1935; Traub 1958).

Inclusion bodies associated with a mosaic disease of *Amaryllis* were investigated and described by McKinney et al. (1923), Holmes (1928), Brierley (1948), Brants (1965) and Baur and Halliwell (1970).

Amaryllis mosaic is prevalent in the Baton Rouge area of Louisiana and is characterized by light yellow-green discoloration and dark-green spots on young leaves. These leaves develop yellowish striped patterns as they mature.

An investigation was undertaken to detect and identify the casual agent of this mosaic disease.

MATERIALS AND METHODS

Plants of *Amaryllis* gh. *leopoldaeoides,* Traub, commonly known as Leopoldii hybrids, with distinct mosaic symptoms were employed throughout the investigation.

A. ELECTRON MICROSCOPY. A direct negative straining method for rapid detection of virus particles in fresh preparations from infected plant tissue was used (Hitchborn and Hills 1965, Doi et al. 1969).

Thin sections from diseased and symptomless leaves were cut on a LKB ultra-microtome after fixation in 3% gluteraldehyde and osmium tetroxide. The sections were stained with uranyl acetate and lead citrate.

B. HOST RANGE. The following plant species were mechanically inoculated with sap expressed from mosaic diseased leaves, using 0.025M phosphate buffer (pH 7.2) and 600 mesh carborundum: *Capsicum frutescens, Capsicum annum, Cucumis sativus* cv. 'National Pickling',

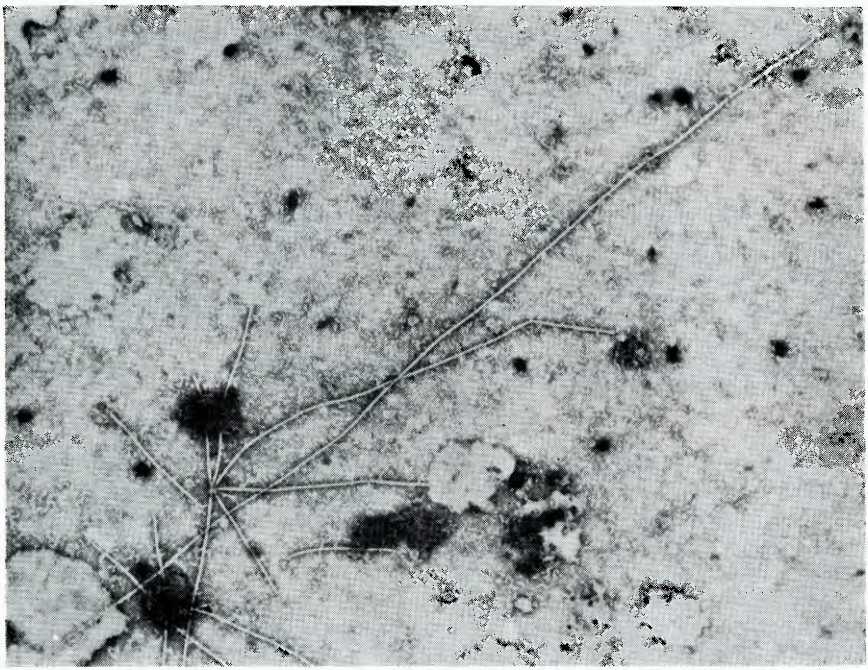

Fig. 28. **Amaryllis** mosaic disease. Negatively stained HMV particles in crude sap of **Amaryllis.** X 2800.

Chenopodium quinoa, Cucurbita pepo, Gomphrena globosa, Nicotiana glutinosa, Nicotiana tabacum var. Samsun, var. Gold Dollar, var. N.C. 95, var. Barley 21, var. Havana 425, *Petunia hybrida, Phaseolus vulgaris, Sorghum halpense, Sorghum vulgare, Saccharum* sp., *Vigna sinensis, zea mays.*

Aphid transmission was attempted using *Schizaphis graminum* and *Myzus persica* with feeding time ranging from 30 minutes to 24 hours.

RESULTS

Long flexuose particles were revealed under the electron microscope in negatively stained sap. The majority of these were between 5500 and 8000 A in length and 120 A in width. These were comparable to the particles described by Brants (1965), Iwaki (1967), Procenko

and Procenko (1962) and resemble virus particles observed by Johnson (1951). (see fig. 28.)

Thin sections contained similar virus particles which were present in the cytoplasm of epidermal cells. Fan-shaped to pinwheel-shaped inclusion bodies, similar to those described by Edwardson, et al. (1968), Fujisawa, et al. (1967), Arnott and Smith (1967), and Baur, et al. (1970) were also found in the cytoplasm. The occurrence of large numbers of vesicles in the cytoplasm was considered characteristic of infected tissue. No distinct changes were observed in the nucleus, chloroplasts, or mitochondria of virus containing cells as compared with thin sections from a symptomless leaf tissue, where no virus particles or inclusion bodies were detected. (See Figs. 29 and 30).

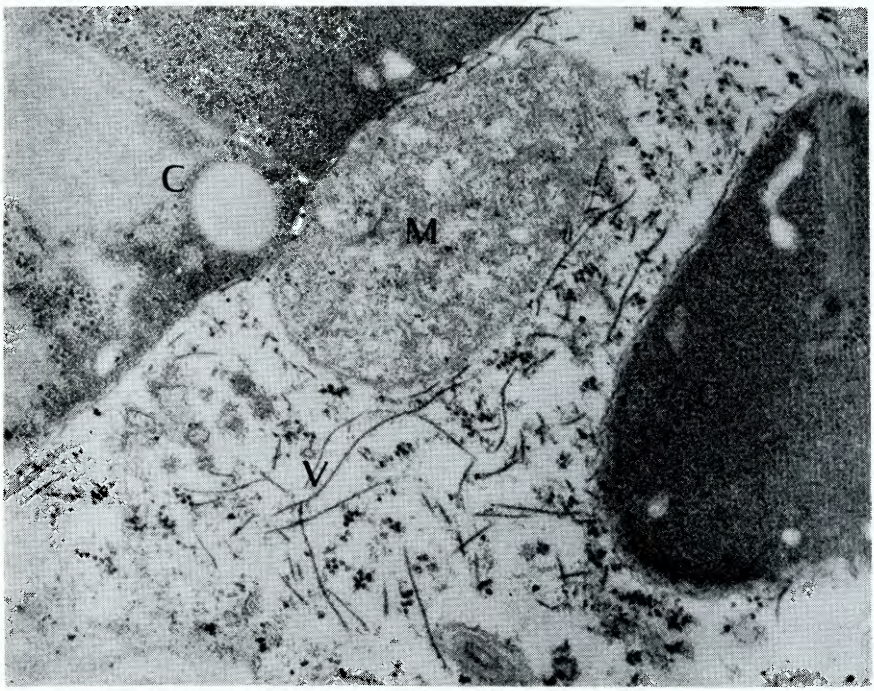

Fig. 29. **Amaryllis** mosaic disease. Thin section of leaf epidermis (light strip): **C**, chloroplast; **M**, mitrochondrion, and **V**, HMV particles. X 34,200.

In host range studies only *Gomphrena globosa* and *Chenopodium quinoa* proved to be good local lesion hosts. Both plant species developed numerous local lesions in 7-10 days after inoculation with virus-containing sap with no subsequent systemic infection.

The virus, due to its similarity to that described by the above cited authors, may be regarded as Hippeastrum mosaic virus.

At present, work is continuing toward obtaining highly purified

virus preparations for development of antiserum. Further investigations of physical properties of the virus are also under study.

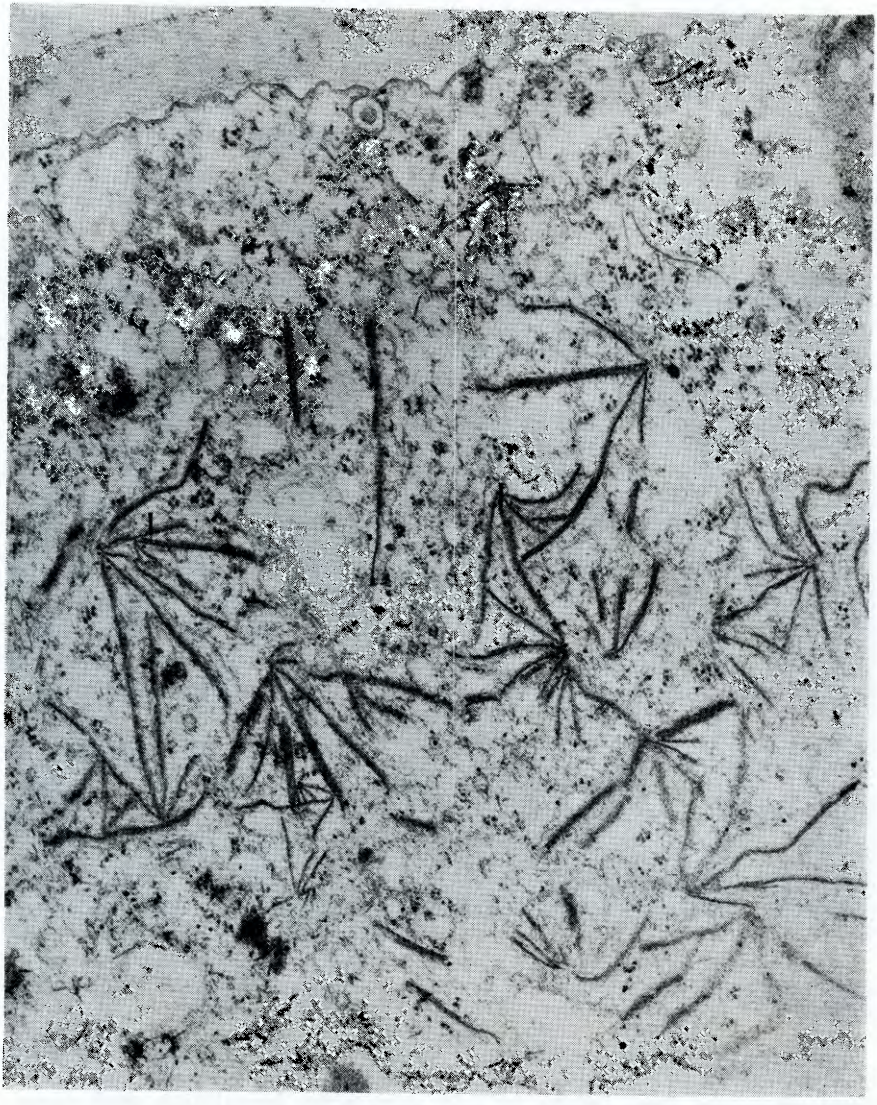

Fig. 30. Amaryllis mosaic disease. Numerous inclusion bodies visible in thin section of epidermis of mosaic infested (light green strips). **I,** inclusion body; X 33,990.

ACKNOWLEDGMENTS

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ON THE ELIMINATION OF AMARYLLIS MOSAIC VIRUS FROM LEOPOLDII AMARYLLIS HYBRIDS: PART I. SHOOT-APEX CULTURE

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SUMMARY

A two-stage method of aseptic shoot-apex culture of **Amaryllis gh. leopoldaeoides, Traub** [Leopoldii Hybrids] **cv. Wedding Bells** was employed in an attempt to recover virus-free plant material from virus infected bulbs.

Bulb cuttage was a source of shoot-apices which subsequently were cultured on liquid nutrient medium in tubes 25 x 150 mm size at a temperature c. 25° C., and light intensity of 1,000 ft. candles.

INTRODUCTION

Amaryllis hybrids grown in Louisiana and other Gulf States frequently show mosaic in the leaves. The symptoms are known to be caused by one of three viruses (Kahn 1968).

1. Amaryllis (syn. Hippeastrum) mosaic virus (HMV)
2. Tomato spotted wilt virus (TSWV)
3. Cucumber mosaic virus (CMV)

The mosaic developing in leaves of hybrids of Amaryllis impedes greatly any attempt to develop commercial bulb plantations in the Southern U.S., and brings about many disappointments to Amaryllis hobbyists.

Holmes (1965) expressed belief that it may be possible to obtain virus-free subclones from mosaic infected bulbs of *Hippeastrum*.

From other bulbs, virus-free plant material was produced from virus diseased freesia (Brants et al. 1965; McWhirter 1971), iris "Wedgwood" (Baruch and Quak 1966), dahlia (Morel and Martin

* This work is part of a project being conducted as partial fulfillment of requirements for the Ph.D. degree.

1952), and *Narcissus tazetta cv. Grand Soleil d'Or* (Stone 1973).

Also Brierley (1963) found up to 98 percent virus-free gladiolus cormels from an infected clone he studied, and that scale propagation of *Lilium longiflorum* eliminated fleck symptoms.

This paper gives details of a relatively simple method of rapid propagation of Amaryllis clones which serves as a source of shoot-apices, and of culturing these on liquid medium.

The method described here may serve as a rapid means of multiplication of virus-free bulbs.

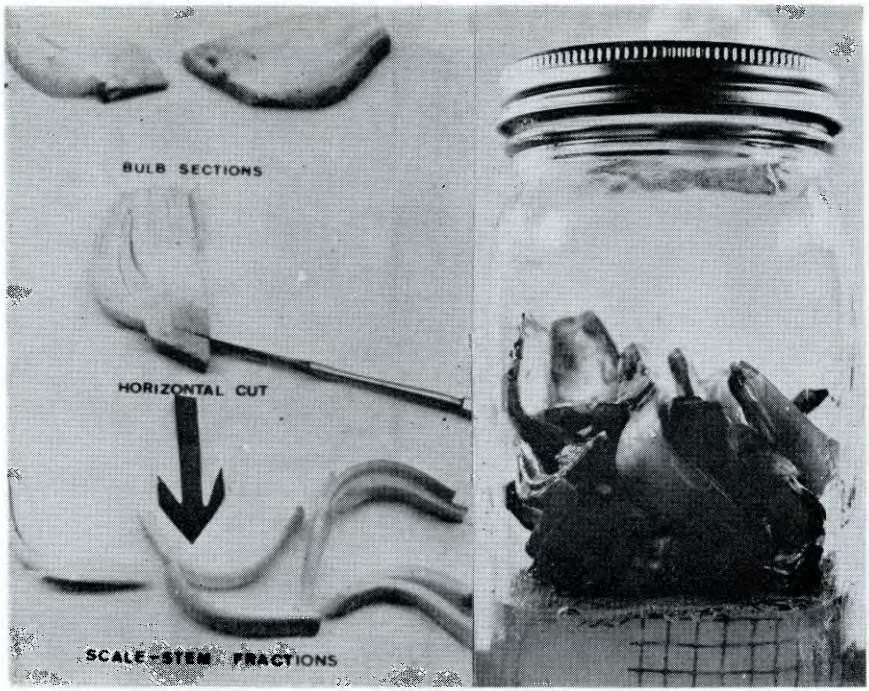

Fig. 31. Shoot-apex production of mosaic virus infested **Amaryllis: Left,** fractional scale-stem cuttage; **Right,** fruit jar with fractional scale-stem cuttings.

MATERIALS AND METHODS

Amaryllis bulbs with mosaic diseased leaves were obtained from the Baton Rouge area and checked for the presence of Hippeastrum mosaic virus-like particles under RCA type EMU-36 electron microscope, using a quick leaf-dip method (Hitchborn and Hills 1965, Doi et al. 1969).

The bulbs were washed, stripped of leaves and outer dry scales, bathed in Benomyl (1 tbsp./gal.) for 1 hour and left to dry in a

sterile container.

In the next step, the bulbs were cut completely into eight or more sectors about 10 mm wide at the circumference (Traub, 1933, 1934, 1935, 1958; Everett, 1954; Yusof 1971). Each sector was then chipped into pieces consisting of 2-3 bulb scales with a portion of basal plate attached (the 'fractional scale-stem cuttage' of Traub 1958), (See Fig. 31.)

A. SHOOT-APEX PRODUCTION

The bulb "chips" were placed in Benomyl for 10 minutes and into one-quart fruit jars containing about three centimeters of water with

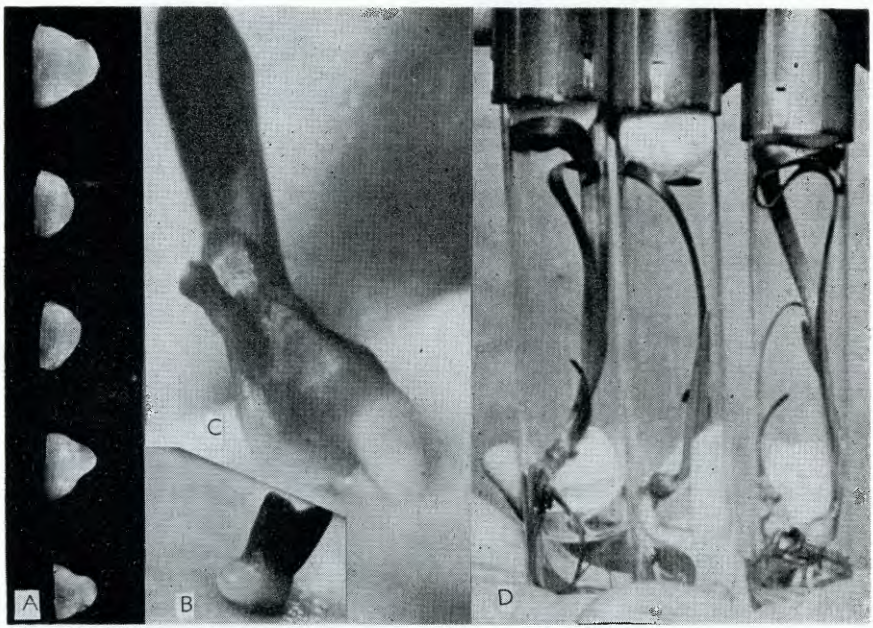

Fig. 32. Shoot-apex culture of mosaic virus infested **Amaryllis: A,** excised shoot-apices, X 3.9; **B,** explant, a characteristic swollen base, 8th day from excising, X 3.3; **C,** after 4 weeks of culture, X 3.3; and **D,** plantlets in 7th week from excising.

a hardware cloth framework serving as a support for bulb chips above the water level.

The chips were placed on a filter paper which, in the later experiments, was replaced by plastic screen-mesh. (See Fig. 31.)

The jar was closed with a metal screw-cap with a small hole in the middle plugged with a ball of non-absorbent cotton to allow some gas exchange and possible reduction of chance of fermentation of the chips. Thus, the jar atmosphere was kept saturated with water.

The temperature outside the jars was maintained at c. 25-28° C.,

and light of about 1,000 ft. candles, provided with a mixture of 'Cool White' and 'Gro-Lux' florescent tubes. (1:1)

Where some decay developed, chips were placed in a fresh jar after removal of decaying parts and Benomyl treatment.

Formation of shoot-apices in the form of small bulblets between scale axils was initiated in about 2 to 3 weeks time (Yusof 1971).

B. SHOOT-APEX CULTURE

Upon formation of shoot-apices, these together with parts of basal places were excised and surface sterilized by immersing them for 10 minutes in 0.5 percent water solution of calcium hypochlorite containing a wetting agent, then rinsed three times with autoclaved water.

Table 1. Nutrient medium composition for formation of plantlets from shoot apex explants of **Amaryllis**:

Ingredients	**Mg/1 medium**
Inorganic constituents	
NH_4NO_3	1,650.0
KNO_3	1,900.0
$CaCl_2.2H_2O$	440.0
$Mg\ So_4.7H_2O$	370.0
KH_2PO_4	170.0
Na_2EDTA	37.3
$FeSO_4 7H_2O$	27.8
H_3BO_3	6.2
$MnSO_4.4H_2O$	22.3
$ZnSO_4.4H_2O$	8.6
KI	0.83
$Na_2MoO_4.2H_2O$	0.25
$CuSO_4.5H_2O$	0.025
$CoCl_2./6H_2O$	0.025
Organic constituents	
NAA	0.3
Kinetin	0.1
Thiamin.HCl	1.0
Pyridoxin.HCl	5.0
Nicotinic acid	5.0
Myo-Inositol	100.0
Adenine sulfate.dihydrate	40.0
Sucrose	25,000.0
Other supplements	
Difco Bacto malt extract	500.0
$NaH_2PO_4.H_2O$	170.0
Difco Bacto agar	6,000.0

Subsequently, shoot-apices ranging in size from 1-3 mm diameter were excised in a Microvoid type transfer-case and placed on a filter-paper bridge in tubes (Pyrex 25 x 150 mm) containing 10 ml of the liquid nutrient medium. (see Fig. 32.)

The medium was identical to that of Murashige et al. (1972) used for propagation of asparagus shoot-apex culture.

The cultures were placed under 1,000 ft. candles of light supplied by 'Cool White' and 'Gro Lux Light' 1:1, and at a temperature of c. 25° C.

RESULTS

The survival of explants ranged between 30 and 70 percent depending on size of shoot-apices. There was a higher tendency to survival in a larger shoot apices.

The first signs of root initiation followed a swelling of the base of the explant which was observed at the 8th day; however, rapid leaf elongation in most cases was observed after transfer to fresh medium at the 4th week from excising. Fig. 32.

After three more weeks plantlets at various stages of development, with formed roots and leaves, were transferred to a plastic container and planted in vermiculite drenched with No. 2 Hoagland solution and covered to maintain high humidity.

The plantlets cultured this way developed bulbs up to 8 mm on cross-section and were further transferred in their 5th month of culture to 3″ clay pots with medium consisting of sand vermiculite 2:1 and watered with No. 2 Hoagland solution.

It was also experienced that plantlets with an initial leaf development (5-10 mm long) and only a swollen base can be transferred to vermiculite and expected to root and grow in about 75% of the cases.

From 115 obtained plants, 103 show no mosaic pattern in the leaves and after 7 months of growth in pots no virus particles were detected under electron microscope; however, before further work with test plants will be completed, no concluding remarks can be drawn.

Work now in progress involves heat treatment, transmission and observation of known indicator plants and attempts to develop antiserum for HMV aimed at rapid separation of virus diseased plants from healthy ones.

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HYMENOCALLIS AZTECIANA TRAUB

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From the first moment that the slender petals of each flower flared back, it became evident that this amaryllid was truly an exotic. I wonder if the bulb was known to the Aztecs when their civilization flourished in a vast part of Central America. I do not see how it could have escaped their attention.

The bulb I have of *Hymenocallis azteciana* is rather small, about 1½″ in diameter. This bulb has little or no neck to it and when I received it last summer the plant had already flowered. The four leaves remained until the middle of September, then quickly turned yellow and the plant went dormant. I watered it sparingly and often wondered if the bulb was still alive. It was not until March 28, 1973, that active growth commenced again, after a total dormancy of five and one-half months.

My description of *Hymenocallis azteciana* is from notes taken during the period that it flowered (June, 1973). A pseudo-neck encloses the petioles of the leaves. This sheathing is white to pale green in color and turns papery and brown as the growth matures. The leaves are narrowly elliptical and a medium green although the powdery surface gives them a blue cast. If this bloom is gently rubbed off the normally dull leaves are semi-glossy.

The flower stalk resembles a leaf so much that it was about 8″ tall before I identified it as such. It grew to be 22″ tall, originated from the center of the plant and was terete and twisted somewhat from

the base to the flowers.

The lone stalk bore three upright flowers that were at a 60-75° angle to the stalk. As the petals formed they changed from green to a pure white with green markings at the very tips of each petal. The hypanthium (staminal cup) resembles a hoop-skirt with the stamens attached to it. The filaments are white at the base becoming green at the tips where the orange-brown anthers are so delicately fixed. Likewise, the pistil is white at the base and changes to green at the tip (stigma). The first flower opened June 7, the next, June 9 and the last, June 11.

As each flower opens, the intense fragrance of this amaryllid fills the room. The fragrance is lost in a day's time and each flower lasts only 2 days. I wonder if the natural pollinator is a moth as the flowers always opened in the evening and were the most fragrant then. The spider-like form gives the flower its exotic appearance. The name spider-lily certainly seems appropriate.

One of the flowers was pollinated and fertilization occurred. The ovary developed rapidly and on June 14 the capsule split open exposing three seeds (?). According to Traub, *Hymenocallis* have a three-celled capsule that often ruptures prematurely due to the expanding seeds (3). One of the seeds dropped off on June 19, the second, June 24 and the last, June 25. These dark green seeds varied from 15 mm. wide to 18-20 mm. long and were hard and had longitudinal ridges. All three have been planted and remain green (August, 1973) though visable germination has not occurred. Are my seeds actually the cells enclosing the real seed? [Editorial note,—These are true seeds.] I do not know as I have never seen the seed before and must rely on observation and the literature (2,3). Herbert says in reference to the genus, "The seed of *Ismene* is large and round, and vegetates immediately in a remarkable manner, forming a bulb as big as itself (sometimes much bigger) far under ground without pushing any leaf. As soon as the seed rots, the young bulb must be left without water till the next spring. A person unaware of the peculiarity of this genus and *Choretis,* when he found the seed rotten, would be likely to throw away the earth without suspecting the formation of the bulb near the bottom of the pot." (3).

Hymenocallis azteciana responds well to pot culture for me and appears to have less demanding requirements than many other amaryllids. The bulb needs adequate water and occasional applications of soluble fertilizer while in active growth. I expose it to as much sun as possible though this may not be an advisable practice in other geographical locations. Bauml refers to *H. azteciana* as growing in peaty soil in shady spots in its native habitat (1). This species of *Hymenocallis* is not suitable as a display or conservatory ornamental because the flowers are so short-lived. However, it is of interest to the amaryllid enthusiast because to see the flowers unfold quickly, to partake of their heady fragrance and to watch the development of the seed is to witness the rhythm of life itself.

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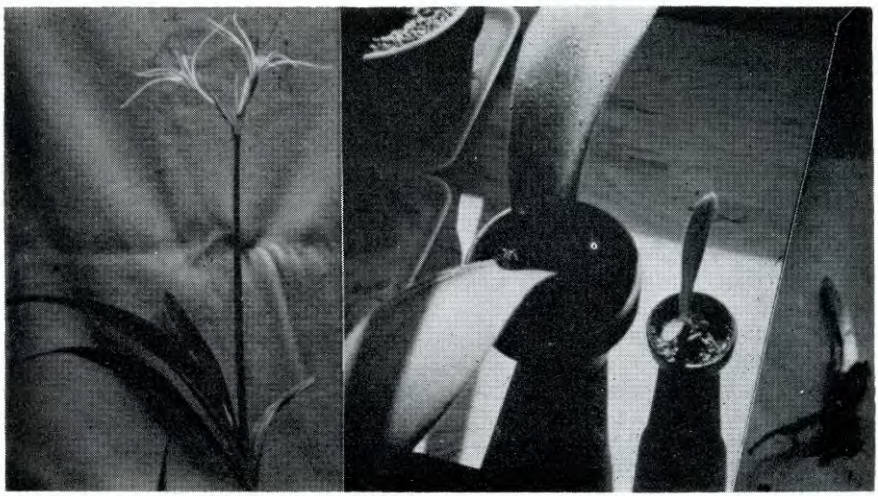

Fig. 33. **Left, Hymenocallis azteciana** Traub in flower June 1973 in Wisconsin.
Right, **Haemanthus hirsutus** Baker, from right to left, bulblet produced from bulb cuttage, young plant from bulb cuttage, and mature plant.

PROPAGATING HAEMANTHUS HIRSUTUS BY CUTTAGE

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Amaryllid enthusiasts are always anxious to learn about new ways of increasing the stock of a rare bulb in their collection. The following method of asexual propagation was used in a seminar course in which I was enrolled at the University of Wisconsin-Madison while earning my B.S. degree in horticulture.

The literature on propagating bulbs asexually dates back to 1933, (*6, 7, 8, 9, 1, 3*). Everett states that his experiments were conducted in August and suggests that work should also be done on bulbs at other times of the year (1).

The propagation method in the sources sounded not only simple

but also quite logical. Bulbs are specialized vegetative structures that consist of several bulb scales (which are continuous sheathing leaf bases) and have meristematic tissue in the axils of these scales that can produce miniature bulbs (bulblets). The bulblets derive their nutrients from the parent tissue until they are able to develop their own roots and carry on the same functions as the parent. The bulblet(s) becomes a prized offset that is an exact duplicate of its parent. Thus, if one cuts the mature bulb into pieces the formation of these bulblets should occur, and the stock is increased. This means of propagation is important for increasing species that are slow to produce offsets naturally or to set seed (1).

I had originally chosen to propagate *Urceolina miniata* for my experiment but at the last minute my supplier informed me that he could not obtain the bulbs from the Netherlands. He offered me two bulbs of *Haemanthus hirsutus* instead which I accepted. I must admit that I was loath to try the experiment on such rare bulbs and ended up with a compromise. One bulb would be used for propagation and the other would serve as a "control."

The two bulbs were received on March 30, 1972. Everett recommended that the cuttings be placed in a rooting medium of peat moss and sand (perlite) with the tips exposed and bottom heat applied to maintain a temperature 10° F. above the normal temperature for mature bulbs (1). I used a 6:1 mixture of sphagnum moss and perlite and a special tray with a heating coil that the horticulture department had for experimental purposes. The heat at which the tray was designed to operate was 72° F.

My first difficulty occurred in deciding how to cut up the *H. hirsutus* bulb. The bulb was oval shaped and about 3" in diameter. First the bulb was cut vertically in half (using a sterilized knife), then each piece was cut in half again. Each quarter must contain a portion of the stem (basal plate) as this is the meristematic tissue from which the bulblets will be produced under this technique. Further division is possible by inserting the knife between every 3-4 pairs of concentric scales; however, I could tell at a glance that *H. hirsutus* had so few bulb scales (a total of 4-6) that further division was not possible. So I could obtain only four bulb pieces for my propagation work. The bulb pieces were gently dusted with tersan, a mild fungicide, and placed in the moistened medium.

I departed for Milwaukee for the Easter recess and upon my return two weeks later discovered that the medium had dried out considerably. What was more serious is that the thermostat in the heating tray was malfunctioning and instead of 72° F., was registering 100° F! Needless to say the bulb cuttings were dehydrated but still had some firm tissue. The heating tray was removed and the cuttings were placed in a 1:1:1 mixture of peat, perlite and soil. *Haemanthus* are rather difficult subjects to work with anyway from sources I have read and *H. hirsutus* is no exception (5, 10). Three of the cuttings developed a fungal rot and had to be discarded. On April 26, 1972, I

had to report to my seminar group that the experiment to date appeared to be a failure. The "Amaryllis authority" as I was fondly called in the horticulture department had struck out.

On or about May 18, I removed the one remaining bulb cutting from the experiment plot to a 2″ pot, placing it in the same medium used in the experiment. I had been chosen to attend the Longwood Gardens Summer Student Program in Kennett Square, Pennsylvania for that summer so my mother was entrusted with *H. hirsutus*. My only instruction was to water the pot occasionally and see what happens. At the time I placed the cutting in the pot the bulb scales were still white and near the base of one of the scales a very minute "bump" could be detected. I noticed it and, though curious, was in a hurry to clean up the experiment as the school term was ending and student projects had to be cleaned up and removed from the greenhouses.

In late August when I returned from Pennsylvania my mother informed me that no sign of life had been evident from the "Blood-Lily" until the middle of August when a small leaf made its welcome debut. The little bulb was allowed to grow on in the 2″ pot until October when it was transferred to a slightly larger pot. At the date of this article (August, 1973) the small bulb has remained in active growth and measures about ½″ in diameter. How many years it will require to reach maturity is a question that I cannot answer nor can I find such information on this species in the literature.

In conclusion I should like to cite what I have learned about *H. hirsutus* and I invite comments from fellow *Haemanthus* enthusiasts to help in broadening our knowledge of this species. *H. hirsutus* is native to the Transvaal region of South Africa and was first introduced into cultivation (England) by Messrs. Veitch in 1878 (*2,5*). I should describe the bulb as having white scales with a pink or purple tinge. The two leaves are 6″ long and 8″ wide as reported in the literature (*2,5*). The two leaves on my control plant in the experiment measured 9″ long and 3″ wide. The leaves are dark green on the upper sides and paler on the undersides with both sides being pilose, i.e. covered with long, soft, straight hairs, hence the name *hirsutus* meaning "hairy." Martley says the leaves are closely pressed to the ground and the stout flower stalk is hairy with a 3″ umbel of dainty white flowers with golden stamens (4). Weathers claims the flowers may have a pinkish color with red bracts surrounding the umbel (11). Though my bulb has not favored me with flowers, its leaves are most unusual and have caused a good deal of comment from horticulture colleagues as well as other friends who cannot resist touching those lovely fuzzy tongue-like leaves.

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REPOTTING THE NERINES OF GREENOAKS

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The NERINES OF GREENOAKS continues to be the major collection of hybrid NERINES in the United States. As it had been three years, and in some cases four years, since the bulbs were last repotted, Mrs. Emma Menninger, owner of GREENOAKS felt that complete repotting during 1973 would benefit the bulbs. We discussed the matter, and I agreed I would be able to assist in the task if our efforts could be organized so that the job would be completed by no later than the end of August.

We reached agreement on our work schedules and began planning strategies during March over a pot of a delicious, delicate tea which Mrs. Menninger had purchased in Darjeeling, India on one of her visits there. The NERINES were still sporting lush, green foliage at this time, but we wanted our work to be well organized. In all, three planning meetings of two-hours duration were held during March and April. As there were in excess of 2,500 potsful of bulbs which had to be reworked, we felt that only by detailing all our plans well in advance could mistakes and unnecessary work be avoided.

Rather than wait until the bulbs went completely dormant during the frequently hot weather of June, we knew it would be to our ad-

vantage to enjoy the cooler, mild weather of May for our repotting work. Starting this early would not hurt the bulbs, we felt, nor upset their growth/dormant cycle, as they would be going into dormancy at that time, anyway.

On April 2nd, basic work plans completed, and armed with notebooks, cards, pencils, pens, labels, empty pots, sunglasses, clipboards, small tables, large stools, high hopes, and another pot of that wonderful Darjeeling tea, we set to work at Phase 1, "Listing and Cataloguing." None of this paraphernalia prepared us for the fierce winds which had developed from the morning's gentle breeze while we had been collecting our equipment.

These winds were to last during most of the two days it required to list and catalogue the collection. Their effects made the job uncomfortable at times, while at other times, the work became next to impossible to continue. But continue, we did.

Each pot was first listed by its row number and label information. This list was then taken into the office where Mrs. Menninger made a card on each item. The card file was to be kept as a permanent file record while the list was to be used in the work area as a "working list" during the second phase of the operation, "Repotting."

A month then passed before the actual work on the bulbs was begun. I took a week's vacation for the bulk of the task. May, usually one of our mild, pleasant months, produced a freak heat wave that week, in which the temperatures rode the high 90's much of the time for the first few days.

As the GREENOAKS Nerines have thrived for over 25 years on the crushed granite soil which forms the property, we felt it wise to continue to use the soil mixture which had been the basis of their previous repottings. This is chiefly the crushed granite soil, much of it pulverized into a dust-like sand, and about one-fourth the volume of oak-leaf mold dug from the bases of a fine stand of oak trees on the grounds. To this ¾ granite soil, ¼ oak-leaf mold mixture, we added enough bone meal to whiten the top (approximately two cupsful per bushel), and, after thorough mixing, potted the bulbs. (There is recent evidence to suggest that the N. sarniensis hybrids may like a soil high in calcium. I am trying a "sweeter" soil mixture for a few of the sarniensis hybrids, using crushed oyster shell in the mixture.)

The routine of making the soil mix, getting a flatful of potted bulbs, knocking out the contents of each pot, separating the soil from the bulbs, repotting the largest, setting aside the rest, and taking the repotted bulbs over to the benches for labelling and eventual setting into a permanent position in the growing area, became an automatic function after the first day. Such work has tedium built into it, and many frustrations as well. But it does not have to become boring. There are too many surprises for that.

It came as a surprise, for instance, to learn that the clone 'Rotherside' (H. Chapman) is capable of making such hugh bulbs. And that Mrs. Menninger has so many registered varieties. It was

a surprise to learn that certain clones 'Ben Hills' (Exbury) is one example, multiply prodigiously, while certain others seem to have difficulty multiplying at all.

I soon learned that only about 250 potsful of bulbs could be reworked during any one day. After that, the body tires and the spirits flag. Every day at noon, I was given a boost by being treated to a royal lunch prepared by Mrs. Menninger herself, and highlighted by a potful of that memorable tea from India.

The task extended through that first full week and into three weekends beyond. Half-days were necessitated occasionally, due to other demands on the time of each of us.

We finished reworking the last pot on the 26th of May, with eleven days and well in excess of 100 hours of work behind us.

The total number of pots was reduced from over 2500 to just in excess of 1500, making the collection more manageable. The bulbs were repotted into larger pots which will also help contribute to greater ease in their care.

Bulbs, 4,389 in number, ranging in size from large to tiny are being offered for sale. And the NERINES OF GREENOAKS will not have to be repotted for another three or four years.

For my help, Mrs. Menninger was extremely generous in giving me a large quantity of bulbs, including at least one of nearly every variety and seedling in her collection. And as a further gesture of her bountiful good will, as I was leaving one day she pressed into my hand a glass jar full of dried tea leaves, labelled "Darjeeling, Excellent Flowery Pekoe."

I BECOME AN AMARYLLISARIAN

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I recently became interested in *Amaryllis* hybrids, and other amaryllids. I have graduated from growing Fuchsias to *Amaryllis* and have completed an 18 x 11′ lean-to greenhouse last year. My wife gave me a few Ludwig and South African grown hybrid *Amaryllis* in 1972 and I was enchanted with the results. I then discovered that in the Medical School greenhouse there were hybrid *Amaryllis.* These were started by an employee six years ago from seeds. Some were properly handled and made large bulbs. Most however had been neglected and were left in 2½″ pots. Thirty large bulbs were retained in the greenhouse, and the rest of the bulbs were given to me. These ranged from 1½″ size bulblets to some as small as six month old seedlings.

I repotted these runts last March and have kept them growing in the greenhouse. About half have grown fairly well. Many have just started making side bulblets, a few have from 8 to 9 leaves, and are about 18″ high. I am looking forward to the time when these plants

will flower.

My objective now is to obtain an assortment of hybrids including the very best produced up to the present. I am also interested in a collection of species.

AMARYLLIS EXPERIENCES IN KANSAS

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My location in Kansas is 2200 feet above sea level and is blessed or scourged, as the case might be, with very changeable weather. Most of our growing seasons are extreme combinations of wet or dry, cool or hot, calm or windy. Sudden storms speed over the prairie that lash at the earth with furious lightning, dashing rains or devasting hail, Warm, moist air from the Gulf of Mexico may feed into out area, on the other hand, and soothe us with gentle rains for a week or more.

Our temperature range might be –32° F to +114° F, so growing *Amaryllis* in Kansas presents problems. Most of them are housed in a greenhouse to protect them from freezing, and large shade trees temper the hot summer sun, and a good supply of water for irrigation is needed during dry times.

My introduction to species *Amaryllis* began when I purchased some species and hybrids from Prof. William Adee. His advertisement of small, windowsill rebloomers was more than I could resist. I already had the interest as I had fallen heir to my mother's pot of *Amaryllis* (striata type) that she had blossomed regularly since I was a small child. I had purchased, of late years, some Dutch bulbs and out of curiosity, had crossed them with the "old Mother" bulb. I wasn't greatly impressed with the results. Though all were beautiful, there was always a sameness, as others have indicated from like experiences, they all looked much like *A. striata.*

When the bulbs I got from Prof. Adee started blooming, My temperature shot up into the danger zone and I was hooked. I cast about for a time looking for information on the *Amaryllis* family and sources of plants with which to further my collection and feed my interest. Alek Korsakoff furnished some bulbs and "drive" to work on the miniatures.

The American Plant Life Society came into the picture and Dr. Thomas Whitaker recommended back issues of Plant Life for my "education." This was good advice. Most of my pleasure and enlightenment have come from this material and the good members I have met.

Seeds and/or pollen from Prof. Adee, Russell Manning, John Cage and Sterling Harshbarger have added to my enjoyment and expectations. Many pots carry numbers that attest to the generosity. Their kindly advice in correspondence had aided me also.

Most of my *Amaryllis* are in pots. They stay there the year around. As I write this in early fall, they will soon be brought in from under the trees, to the greenhouse for further growth, in case of the seedlings and evergreen types. The deciduous types will be left a little longer,

then be brought in and stored for rest. Some of the leaves have not matured and these will be grown for a time in a cold frame. After our initial cool spell or frost, we often have mild weather with little frost up into November.

The warming and the sun in the greenhouse will trigger many of the rebloomers into blossom by November. There will be scarcely a time for the next ten months that some of these will not be in bloom. The deciduous types that rested early will be showing scapes which may be out by Christmas. Others will string along until the end of May. The peak bloom seems to be in February and March.

As long as the bulbs are doing well, repotting is done only as a last resort: to alleviate a crowded pot; to provide growing room for seedlings; or to mend accidents, broken pots etc. or to "doctor" sick plants. It has been a sad experience to see precious bulbs deteriorate from disturbing their habits, particularly while the plants were in the growing stage.

I have had a good degree of success with growing this year's seedlings by following the instructions as to environment, as nearly as I could, set down in Plant Life Volume 28, Page 91, by Mr. J. L. Doran. Correspondence with him also provided valuable assistance.

One lot of bulbs from Mr. Joe Sulen was bedded out for the summer. Growth has not been spectacular but they will be brought in soon and stored in peat moss per Russell Manning's instructions in Plant Life Volume 27, page 121.

My association with the American Plant Life Society has been a rewarding experience. It has given me goals and made me organize my efforts, for which I am most grateful to you all.

NEW FLORIDA AMARYLLIS GROWERS

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We purchased our first *Amaryllis* about twenty five years ago from an elderly gent living in this area, and raising Mead strain bulbs from seed. He had a plot of several hundred and we purchased a dozen. That was that so to speak for some fifteen years. These bulbs were moved to three different locations as we changed homes over the years.

About ten years ago a friend was growing *Amaryllis* and selling the blooming plants from her plot. These plants were of Dutch-Mead breeding. They were produced by using Mead as seed parents and 'White Christmas' as pollen parent. Selected offspring were used as seed parents and 'White Christmas' again pollen parent. From her plot of several hundred I purchased 18 plants as I saw blooms that appealed to me. We still have one or two of these old timers, one is red with white markings that we call 'Prolific Red', it is a fine seed parent and itself is very prolific. A large bulb has three and occasionally four scapes of bloom with four to six bloom per scape, the blooms are

medium size. The scapes are usually only 12″ to 16″ and with two scapes of bloom open at once it is a bouquet and especially nice in a pot. However 'Prolific Reds' offspring seldom have this short scape and its seedlings using large flowered dutch as pollen parent are larger but quite vigorous and prolific.

Our interest was growing by leaps and bounds and many named Dutch bulbs were purchased—Van Meeuwen, Ludwig and Warmenhoven. Also bulbs of the Harrison strain as well as all the various crosses Mr. Goedert in Jacksonville, Fla. offered. We bought bulbs and seeds from Mr. Angell in California. (Thanks to Dr. Whitaker for his address) Seed were purchased from Ludwig through a U.S. firm, and we were on our way.

Our most pleasant surprise of plants obtained from seed which have bloomed were from seed purchased from Mr. Goedert of the Harrison—Dutch cross. There are about six pinks from pale shell pink which are outstanding—real pink pinks without a hint of salmon.

We bloom several hundred seedlings each year from our various crosses looking for those exceptionally fine features that warrant trying them as seed or pollen parents or both.

Here is what we look for—*Size* at least eight inches across unless all other characteristics and color are superb then seven to eight might make it but rarely. *Quantity* of bloom—at least four blooms per scape and if the bulb is of fair size at least two scapes. *Bloom* must open uniformly, no three blooms then the fourth opening alone; opposite blooms must open together. Texture of bloom must be good for a soft thin blossom will not hold up well. *Quality* of the bloom must be outstanding in form. Broad overlapping petals, good open-faced bloom (we are not particular admirers of an overly deep trumpet) D-5A or D-5B.

Blooms should be held from a ninety degree angle to stem to somewhat upfacing. You should be able to admire a bloom without having to lift it with your hand to see its face, so any droopy bloomers go out quickly without further consideration.

I believe the finest bulb we bloomed this year was a seedling of 'Rilona' and I know not the pollen parent. The first scape had eight blooms with six open the last two opening as the first pair started to fade, the second scape had six and the third four for which we forgive since it was a three year old blooming the first time from approx. a 30 cm. bulb. The color was much deeper and brighter than 'Rilona', a clear salmon or salmon orange. All bloom on the first scape exceeded eight inches and the others were not much smaller. We ripened a pod of seed on this plant using pollen of a pure Dutch clone.

Other seedlings we thought that measured up were a pale clear pink; a deep rose; an outstanding white; and two reds, one a bright scarlet the other a very dark red almost appearing black in the throat and veins.

We grow our bulbs entirely in the ground. We usually start digging, dipping and drying before placing in cold storage around the

first of December and try to finish by the first of January. We begin potting bulbs the first of the year at the same time that we start shipping. We continue potting and shipping dry bulbs until the first of April or until we run out of bulbs which has happened the last two years.

All bulbs to be kept for growing another year (the two year olds) we try to get back in the ground the first part of March. It is about this time things get more than hectic and the "hurrier we go the behinder we get."

Bulbs are planted in the ground with about half of the neck exposed, and in pots with about a third of the bulb exposed. We pot in a peat, perlite vermiculite mixture with gravel in the bottom of six inch clay pots. We have used plastic pots but we do not get the root development in plastic we get in clay. Have had excellent results in styrofoam pots. I give the insulating factor the credit here. The pot never feels cold.

Fertilizing is done regularly as we can get to it, we use 8-8-8 about three or four times a season. We start the fertilizing program as soon as roots develop and blooming is finished with a light application of Ammonia Nitrate. Care is the word here—too much will burn. We use 35% nitrogen, and wind up the season in October with Potash to harden the bulb off.

EDITORIAL NOTE.—The *Shannon Amaryllis Gardens* are located in Belleview, a small community south of Ocala, Florida. They devote several acres to the breeding and growing of hybrid Amaryllis. Those interested in obtaining the Shannon Hybrid Amaryllis should write to Bill and Lois Shannon directly.

1973 ZEPHYRANTHEAE REPORT: INDUCED MUTATIONS WITH CHEMICALS

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I. INTRODUCTION

This report from your Zephyrantheae Committee is prepared from assorted technical reports and from the results of my own limited experiments. The latter are representative of what can be accomplished in a small back yard, during time stolen from the average householder's busy schedule, haphazardly supported by occasional funds for plants and supplies. My work has lately centered on the Zephyrantheae. The reasons for deciding on this program with this tribe are threefold: firstly, the Zephyrantheae exhibit a shorter time span from seed sowing to plant flowering than that of many other Amaryllids, they have relatively small space requirements, they have definitely separate periods of growth and dormancy, they do not react

adversely to being lifted and handled and replanted, most set seed readily, and some exhibit pronounced and habitual parthenogenesis; secondly, controlled "chemoalteration" of plant characteristics results in more dramatic and faster changes in plants than result from selection for several generations of untreated seedlings; and thirdly, our knowledge of plant functions will be enhanced by additional knowledge that will be provided while viewing them under abnormal conditions rarely encountered in the natural state.

Additionally, in my own case, my love affair with the Rain Lily tribe began many years ago when as a young boy I saw my first pot of flowering *Zephyranthes rosea* in a Michigan greenhouse. At that time I stood about eye-level with the blossoms. The good Dutch grower, noticing my fixation and my straining on tiptoe, hoisted me up so I could see them better, explained to me why their Dutch name was "West Wind Flowers", and told me how he had grown them and brought them into flower. Then and there I decided to grow some for myself and within one year had some flowering in a pot on my mother's kitchen window sill. I have grown them periodically ever since, but have come to know many other Rain Lilies. It is now difficult for me to affirm which I like best, the exotic styling and brilliant red of an Aztec Lily *Sprekelia,* the rose pink trumpet of *Habranthus,* the pristine white of *Cooperia,* the delicate hues of other *Zephyranthes,* or the deep ox-blood red of *Rhodophiala.* And since the bigeneric hybrids have begun to materialize in this tribe, a planting of *X Sydneya* sending up several glowing deep rose chalices at one time can hold one transfixed.

True, the Rain Lilies pop up without warning when you turn your back, and they last only a day or so, but like many other fleeting things, they are incredibly beautiful. My first attempts at "chemoalteration" were rudimentary and generally unsuccessful. Lately, however, study of my results, and additional reading of published material have been very helpful to me. To provide you with a summary perspective of this general subject, we'll next consider the history and methods of "chemoalteration" of plants—all plants—and then will discuss some results achieved with Zephyrantheae.

II. HISTORY

Several plant "chemoalteration" (induced mutation) techniques have progressed from crude experiments to a status of standardized methodology. Plant growers and breeders have for the past approximately fifty years used unusual chemicals in powder and liquid forms to improve the rooting of cuttings and bulblets, to reduce the drop of seed capsules (pods, berries, fruit) prior to maturation, and to induce changes in the chromosome numbers and arrangements in somatic and germ cells. Much work has been done with chemical mutations of grains, fruit trees and herbaceous perennials, as well as with decorative flowering biennials and annuals. Reports on techniques and results in these areas are plentiful. However, knowledge of "chemoalteration"

of bulbous plants is comparatively limited, and technical literature on this subject seems scarce. To try to review one aspect at a time, this report will be categorized to cover some of the accumulated knowledge of the general field mutations induced with colchicine, and then will extend into other areas where chemicals have been used in other ways for other purposes.

A. Mutations in General

Several excellent summaries of the fundamental character of mutations, both naturally occurring and chemically induced, are available for review. In addition, there is much literature available on specific aspects of the cytology of mutants, such as the characteristics used in evaluation of the degree and nature of mutations.

Dermen, who has been working in this field since 1938, has presented at least one comprehensive review, wherein he discusses mainly changes to the meristematic tissues of fruit sports and leaf variegations (10). It is interesting to note that he finds vegetative sports variable in permanence.

Briggs and Knowles discuss autoploidy, mainly in crop plants (8). They point out that autoploidy often does not significantly affect the morphology and physiology of a plant. However, plant organs (sepals, petals, anthers, fruits and seeds) may increase in size, and the chemical composition of a plant may be affected. Growth rate is generally less than that of diploids. Additionally, the ecological requirements, such as the heat or light-hours required for seed set, may be altered. Poor pollen production and sterility are cited as limiting factors frequently developed. But these generalizations are tempered by another: the effects of autoploidy on plant appearance or behavior cannot always be predicted, differing even with varieties within a species. The cytological behavior and genetics of autoploids are discussed, as is reversion to the diploid condition.

In summarizing the data and conclusions presented by these and other reviews, one is likely to be encouraged to try diligently to develop methods of inducing mutations in bulbous plants. There is also one last encouragement: inferior first generation polyploids do not indicate a failure of such aprogram, because an associated program of selective hybridization is likely to bring out potential improvements faster because of the "loosening up" of the plants' characteristics.

B. Colchicine-Induced Mutations

Avery, Johnson, Addams and Thomson summarize the history, methods and results of using colchicine to induce polyploidy (6). Methods which are usable on Zephyrantheae include seed or bulb treatment, seedling stem tip or root tip treatment, and injection into the bulb. Root growth retardation or serious damage is one of the results of direct exposure of growing tips to colchicine. The germination of treated seeds may be retarded or completely inhibited.

Traub reports on the results of his experiments with colchicine-

induced polyploidy in *Hemerocallis* (19), (20). He not only demonstrated that colchicine is effective as a mutagen, but he was also among the first in producing self-fertile and/or inter-fertile colchicine-induced tretraploid *Hemerocallis* (2N=44) in the 1940's, which he named *Hemerocallis washingtonia* (Traub, 1951), a species produced in the laboratory.

Arisumi reports on many experiments and studies of colchicine-induced polyploidy in *Hemerocallis* (1), (2), (5). In one report he discusses 'Garnet Robe' which was produced by normal means in 1943. At that time no tretraploids, natural or induced, were known, all cultivars being diploid. There were some triploids in *H. fulva* L. with poor seed set a common characteristic. Therefore, when this beautiful plant was sterile as a pollen parent in many crosses, polyploidy was not at first suspected. When it was determined that 'Garnet Robe' was triploid, different approaches were tried, and it became a good seed parent with certain crosses. Successful conversion of triploids into hexaploids is also discussed. It is emphasized that all presently known tetraploid *Hemerocallis* are man-made.

III. METHODS AND RESULTS

Since it is difficult to separate descriptions of techniques associated with "chemoalteration" from descriptions of the results, both will be combined herein. Some methods and refinements were developed after the results of previous experiments indicated their need. For example, it would have been helpful in the early years of "chemoalteration" experiments if more had been known about chromosome counts and characteristics. Many of these data, which are a valuable aid to the experimenter prior to "chemoalteration" work, were derived as a result of alteration verification studies. Furthermore, improvements in chromosome study techniques indicate that some historical data required, and still require, substantiation and/or correction.

A. Chromosome Analyses

Methods of preparing root tips for examination of chromosomes vary with the individual and the plant. Flagg describes the preparation of *Zephyranthes clintae* root tips (11). Flory describes the preparation of root tips of several Zephyrantheae (13). Arisumi describes methods of preparing Daylily root tip squashes (3). Some of the equipment required and its usuage are also described. In their descriptions of the results of their counts, they delineate their methods of evaluating and classifying the characteristics of chromosomes, and suggest linkage between some of these characteristics and visible plant features or growth habits.

Flory and Flagg discuss *Habranthus* chromosomes (15). Flory discusses the chromosomes of three *Zephyranthes* (12). Flory and Bose discuss varying *Sprekelia* chromosome counts; they state that the base number may be N=30 and that the great spread of counts which

they list may represent natural diploids, tetraploids, pentaploids and hexaploids. The *Zephyranthes* analyzed displayed apparent polyploidy, with N=6 probably the basic chromosome number for most species; therefore, there seem to be some octoploids occuring naturally. Cage reports that the chromosome count of the bigeneric hybrid *Sprekanthus cagei* is 2n=66 (9).

I am not qualified to recommend attempts by the average grower or breeder to perform chromosome counts. Judging by the fact that much of this work is done at the university or experimental laboratory level, it seems to require a thoroughly trained technician with precision equipment and closely controlled supplies and materials to produce valid analyses.

B. Colchicine Treatments

You may choose to pronounce colchicine as it is shown in botanical encyclopedias or by some science teachers (kahl-ke-seen), or as it is shown in some dictionaries and by most laymen (kohl-chi-seen). Either way, as a powder or solution, it is a strong alkaloid, dangerous in many ways to the human system—in short, a poison. It should not be allowed to remain on your skin—wash as soon as feasible after contacting it. In the eyes it will cause a violent inflammation and temporary blindness. Swallowed, it will cause severe internal disturbance, displaying symptoms similar to those of poisoning from arsenic. A large amount taken internally can cause a horrible death. It is extracted from the seeds and corms of *Colchicum autumnale,* the Meadow Saffron. Its chemical formula is $C_{22}H_{25}NO_6$. Historically it has been used in minute quantities to treat human gout, but it has been known since ancient times as a poison. I keep my supplies well stoppered and out of the reach of children. I employ eye droppers, syringe, long-nosed forceps or wooden chop sticks to apply the solution to seeds and bulbs. Everything is washed thoroughly after use.

Hannibal tried cutting into Amaryllid bulbs just superior to the basal plate, and treating subterminal buds with colchicine solution (17). Warping and swelling occurred in the subterminal area. On *Narcissus* the foliage warped and twisted. In two years, indications of larger cell structure or double chromosome behavior could not be detected.

Avery *et al* describe methods used to treat seeds, seedlings and older plants with colchicine (6). Seeds, before germination, were soaked in a 0.05 to 1.5 percent aqueous solution for a period of one to six days. Young seedlings were inverted so that their growing tips were immersed in a solution, and were sprayed while under a bell jar. Individual stem tips or entire young shoots of branching plants were immersed in or soaked with moistened cotton, or immersed in agar inside a capsule. A mix of colchicine and hydrous lanolin was smeared on growing tips. Also, a colchicine solution was injected into bulbs with a hypodermic syringe or into a cored hole with an eyedropper

The optimum concentration of the solution or the mix, and the optimum duration of treatment is stated to be determinable only by experiment. Nine experimental lots are suggested for treatment in solutions: 4, 6 and 24-hour treatments with 0.05, 0.1 and 0.2 percent aqueous solutions for each time period, so that at least one of these combinations might produce the desired results.

Results described are fairly well known by now: initial retarded growth or even mortality, then resumed growth that is distorted and malformed, then a gradual development of homogeneity, sometimes polyploidy. Polyploid parts display thicker stems, broader and thicker leaves, darker green leaf coloring, larger flowers and fruits, increased hairiness. The miscroscope must be used to detect the only truly reliable criteria of polyploidy: larger pollen grains, larger leaf and stem stomata, multiple chromosome counts. Many of the widely publicized developments in improved farm products and ornamental plants are listed. Uses of induced polyploids in plant breeding are described.

Traub worked with *Hemerocallis* ramets obtained by fractional stem cuttage (19). He soaked the roots for eight hours in a colchicine solution (7 AM to 3 PM), then rinsed them in running tap water and soaked them for 16 hours in tap water or a nutrient solution (3 PM to the next 7 AM); this was repeated for a total of from four to six such cycles. To determine the ploidy, in addition to stomata size, pollen size and root tip chromosome counts, he used pollen tube mitoses. He states his opinion that using the colchicine mutagen for severe treatments by absorption or hypodermic injections proved impractical on *Hemerocallis*. Some of the offspring were tetraploid. Permanency of the effects of the treatment was determinable only after two or more years.

Weil discusses the results of colchicine treatments on hybrid *Amaryllis* (22). All attempts made on flowering stems were ineffective. Injections of ¼ ml of 0.1% solution into the bud as it emerged caused aleration of the flowers: segs were thicker, with crinkled or ruffled edges. Buds which were dipped into the solution flowered on short scapes. When ¼ ml of 0.4% solution was injected in the bud, monstrosities were formed.

Traub reviews the first decade of *Hemerocallis washingtonia* (20). He found a very high mortality in tetraploids, even after maturity. Triploids were produced by crossing tetraploids with diploids.

Arisumi treated mature plants of Daylilies to induce polyploidy (1), (3), (4), (5). When analyzing polyploids he based his determinations on stomata size, pollen size and chromosome counts of roots tip cells. Triploids were converted into hexaploids, notably *Hemerocallis fulva* L. cv. 'Kwanso'. Each plant was treated six times; the treated shoot was not isolated but left to develop on the old crown; when its own roots were established, it was removed from the crown, and older roots which could have formed before the treatments were removed. He states his opinion that the probability of spontaneous polyploidy in *Hemerocallis* is very low. His studies over a period of years indicates

that very few changes occur in treated plants after two years. Tetraploid crosses were generally less fertile than comparative diploid crosses. Complete tetraploids reproduced themselves without change over many years.

Flory and Phillips discuss a relationship between dwarfing or abnormal growth of *Hemerocallis washingtonia* and chromosome conditions (16). There was an apparent loss of chromosomes, possibly particular chromosomes, which resulted in aneuploid counts of 2N=38 to 42 (normally, 2n=44).

Traub, Buck and Lloyd report on the second decade of *Hemerocallis washingtonia* (21). The development and introduction of clones of this colchicine-induced species has expanded. Papers on improved methods for tetraploidizing are cited. Named tetraploid clones are listed, 211 clones introduced by 24 hybridizers.

My own use of colchicine has followed closely the methods suggested by Avery *et al,* modified somewhat by data extracted from the reports of *Hemerocallis* experimentation cited above. I have not injected colchicine into Zephyrantheae bulbs, preferring a treatment which will more likely affect the entire plant rather than only a portion of it. I started out soaking seeds and bulbs in colchicine solutions. The solution I used most was ½ tsp colchicine Grade A powder in one litre of tap water. After a large batch of seeds was started soaking, each 24 hours one fifth of the seeds was planted. Bulbs were either completely immersed in the solution, or were propped up by a tripod arrangement of toothpicks stuck into the bulb so that only the basal plate was in the solution. Some bulbs were completely dormant, some had started root growth, and some had also started leaf growth.

Alerations were not always discernible by visual examination, but several times results were so severe as to be disastrous. Records show that the optimum soaking time for seeds is from 24 to 48 hours. Less than 24 hours had little effect on resultant plants; more than 48 hours usually resulted in seedlings which dwindled and died. There were no signs of dwarfing in the Zephyrantheae treated. When plants from treated seeds matured, and were in turn used as seed parents, their seedlings displayed high mortality rates, and the surviving seedlings grew very slowly. As pollen parents they produced generally healthy, strong seedlings, with no signs of abnormalities, and with an apparently faster growth than is shown by untreated seedlings. To date, none of them have shown uniformly increased size and strength indicative of polyploidy.

Several *Sprekelia formosissima* mature bulbs were positioned so that their basal plates were in a colchicine solution. Root tips and pink leaf tips started to grow. After 72 hours in the solution, they were removed, rinsed in tap water and potted. All grew slowly for nine months, then gradually resumed normal growth, with one producing larger and stronger leaves than the others. Blossoming did not start until four years later, and the plant with the strongest leaves did not flower until seven years later. All flowers seemed normal except on the

last plant: its scape spiralled through one complete turn in its length, the ovary was extra large, the peducle extra thick, and the flower was twisted and cocked on the scape. It would not set seed. Its pollen was used for crosses made this summer; results will be known in a few years.

Over 100 seeds each of *Habranthus andersonii* var. *roseus* and *Rhodophiala X huntiana* were soaked in a colchicine solution for five days. Germination started heavily, but the seedlings were drastically altered: instead of grassy leaves and slender roots, leaves were very short and thick, and roots were short and clubended. All died within six weeks after germination started.

Forty second-generation seeds of non-treated *Habranthus andersonii* var. *roseus* which had selfed, were soaked in solution for 3, 27, 51 and 76 hours. Only eight grew, and there were no signs of mutation. Later 35 seeds from another plant, also non-treated and selfed, were soaked for 3, 27 and 51 hours. Of the 27 which grew, none showed signs of mutation. The next generation, also selfed, has started to flower, and there are still no signs of alteration.

Of 66 *Zephyranthes citrina* seeds which were soaked in solution, none survived. Of five bulbs completely immersed in solution, only one had survived seven years later. While they were still alive, when used as seed parents, they all produced seedlings with high mortality rates. When used as a pollen parent the sole survivor produced strong offspring. One cross, onto Z. *'Kitty Clint'* produced seedlings taller and stronger than either parent, including two noticeably bright yellows which stay clear without the customary fading. They divided well, and their second generation seedlings (of which they are pollen parents) are now growing vigorously.

C. Other Chemicals

Avery *et al* also describe the usage of hormones for the rooting of cuttings, for the premature dropping of fruits, as aids to the setting of fruits without seeds, for improving seed germination and later plant growth, for weed killing, for altering the time of flowering, and for prolonging dormancy in buds (6). Other chemicals, not properly classified as hormones, were used to accelerate the breaking of dormancy in buds. The chemicals used are described, as well as techniques of application. That many of these practices can be directly useful in plant breeding is evidenced by cases cited. Bose and Flory report on treating ovaries of *Sprekelia* with 1% naphthalene acetic acid in lanolin (7). The ovary walls thickened, but seeds were few or non existent. I tried rubbing ovaries of Zephyrantheae with lanolin-naphthalene-acetamide, even into scarf-cuts and scratches; it had no visible effect on maturation of the pods.

When I sprayed ovaries with gibberellic acid aerosol solution, there was no noticeable effect on maturation of the seed pods. When I injected gibberellic acid into resting bulbs, leaf growth started in advance of untreated bulbs, but this seemed to deter flowering.

In a report by the National Advisory Cancer Council, it is stated that an abundant supply of folic acid is required by the developing human embryo, and that if this is lacking the embryo will die (23). For a portion of a year I dusted Zephyrantheae stigma lobes with folic acid powder and treated the ovaries with a wrap-around of cotton soaked with an aqueous suspension of folic acid powder, with aluminum foil over all to retard drying of the cotton. There were no apparent effects on seed development.

Link describes many studies of *Narcissus* pollen (18). The opinion is stated that pollen tube growth may be stimulated and seed set improved by applying a small amount of boric acid 100 ppm aqueous solution to the stigma before pollenating. To some Zephyrantheae stigmas I applied a few drops of boric acid aqueous solution prior to pollenating. For a portion of a year I also dusted powdered boric acid onto stigma lobes prior to, during and after the application of pollen. In some cases I brushed the boric acid directly onto the stigma. In other cases I held a brush dipped in the powder above the stigma and lightly tapped the brush so that a cloud of powder drifted downward. In no cases were there any apparent effects on seed development.

Because of information derived from private conversations relating to the use of chemicals to promote multiple production of seed cells by animals, I began conducting experiments in 1972 using a "fertility drug" made for use by human females. It is "Clomid," Clomiphene citrate, made by Merrell-National Laboratories, Cincinnati, Ohio. Its chemical designation is 2 - [p-(2-chloro-1,2-diphenylvinyl) phenoxy] triethylamine dihydrogen citrate. My starting and present solution is one 50 mg Clomid tablet in one-quarter litre of tap water. Potted indoor Zephyrantheae and plants in beds outdoors are treated when pollenated. From up to two days prior to applying pollen to the stigma until up to two days following the application, a piece of cotton or cleaning tissue paper is soaked with the solution and wrapped around the ovary, with a piece of aluminum foil overwrapped to retard drying.

I have also been watering a selected variety of types of Amaryllids, all potted at the start, with a solution of 300 mg Clomid (six tablets) dissolved in four litres of tap water, plus a small amount of fluid spreader. The plants on which I applied this solution, at normal watering times, were *Amaryllis petiolata, A. evansiae, A. belladonna, A. vittata, Chlidanthus fragrans,* a *Habranthus* identified as "Clint 3646," [Len Doran collection D-120 N. of General Guermes, Argentina; unbloomed 1970 seedlings.] and *Pyrolirion flammea.* When some of these were transplanted to outdoor beds, this treatment was discontinued because they were hose-watered along with all other plants in the beds. For approximately six months, during last year's low-watering season from August until March, all treatment with this solution was discontinued. It has been resumed since March 1973 on some of the plants listed above. The *Amaryllis petiolata,* which had

not flowered since its apparent maturity five years ago, sent up its first scape the spring after treatment was started. The *Amaryllis belladonna* flowered six weeks after treatment was started, and again three weeks later. There has been no sign of any effects on any of the other plants so treated. Seedlings from plants which have had their ovary soaked with cotton or paper will be flowering in the next few years, at which time they can be observed for any visible effects.

Whether or not there are any permanent alterations to the plants as a result of these Clomid applications, I have perceived enough of a general tendency for more positive seed set, more seeds and stronger germination to warrant my continuing the use of Clomid in this manner. The test lots on which Clomid has been used are small, so that I cannot tabulate results with acceptable validity.

IV. FUTURE OBJECTIVES

I plan to repeat some of my experiments which resulted in loss of seedlings, or which caused no visible alterations. My records are complete enough to enable me to vary the treatments in specific respects. For instance, the cited reports regarding *Hemerocallis* suggest that repeated treatments of growing plants with colchicine solution, alternated with water flushings, might produce entirely different results from those achieved by a single soaking of seeds or bulbs.

Injection of colchicine solution into bulbs should probably be tried more extensively. Possibly injection of a "fertility drug" such as Clomid might cause drastic alterations. Further, emphasis on carrying a plant's altered character on into its second and third generation will probably be justified, in view of the tetraploid *Hemerocallis* breeding results. I now feel that I may have to hastily rogued out seedlings which were not strikingly altered by colchicine treatments.

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Notice: This is the second annual report from your new Zephyrantheae Committee. A general progress report is planned for 1974 and we would welcome any suggestions, questions or information. There is still much to be learned about these small bulbs; so do not hesitate to express a difference of opinion. Please address all correspondence to the Zephyrantheae Committee Chairman listed in the back of each year book of APLS. Don't forget to check this report section for names and addresses of members who wish to be contacted by other members.

2719 Palm Circle West,
Galveston, Texas 77550
July 30, 1973

Mrs. Marcia C. Wilson, Chairman,
Zephrantheae Committee

NERINE COMMITTEE REPORT, 1973

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Here in Southern California, the harvest season of 1972 was especially bountiful. Grapes and late peaches outdid themselves with production, while many persimmon trees generated fruit beyond the endurance of their own branches. Nerines, too, must have been

caught up in this spirit of heavy seed-making, for those which bloomed set an abundant crop. Bloom itself was only fair, but subsequent seed set was generous.

My own efforts at producing seed were met with especially gratifying success. Throughout the blooming season, I was careful to collect and store in gelatin capsules, pollens from those plants I consider my best. Once again, I had cause to be thankful for the foresight granted me when I purchased a large refrigerator rather than a medium-sized model. Alongside the two one gallon bottles of stratifying Iris seeds, the one half-gallon bottle of stratifying Daylily seeds, the pint bottle of Colchicine solution, and the bottle of mixed genera pollens, my small jar of Nerine pollens almost became the final straw on that fabled camel's back. Grumbling around the household was kept to a minimum by frequent reminders that the period for keeping this extensive collection of gardening esoterica chilly, would "be ending soon, now." Even so, several sizeable hint balloons were launched to the effect that perhaps a refrigerator "just for gardening things" ought to be purchased. Fortunately, the stratifying Daylily seeds were removed from cold storage and planted just as the small jar of Nerine pollens became a large jar. The substitution was never noticed.

The routine of gathering the tiny pollen grains on a moistened artist's brush and dabbing them onto all the opened stigmas—and repeating the process day after day on each stigma—became a ritual which assumed precedence over all others. This discipline paid off, however, as soon as those first heavy-laden seed capsules began to split revealing numerous, plump, green seeds.

One of the pleasant surprises that fell the lot of several of us this last year, resulted from an offering which appeared on the surplus Nerine bulb list from Borde Hill Gardens of England. A listing had been made for "Old" hybrids and another for "New" hybrids. These were seedlings, I felt, but the prices in each case made it seem foolish not to try a few. So, I tried a few. Quite a few, in fact.

When these bulbs arrived and the first ones bloomed, I realized I had discovered one of those rarest of items in our modern world—a genuine bargain. Honest-to-goodness quality was evident among these seedlings.

A number of those listed as "New" hybrids, bloomed in shades of pink: rose-pink to salmon-pink, with all gradations in between. Several light reds showed up in this group as well. A few of the "New" hybrids were especially nice with plenty of head, good color, sheen, and ruffling (more about ruffling later).

The "Old" hybrids were, if anything, even better. Three which appeared to be identical, had flowers in an unique shade of red-purple with copper undertones that changed as two-toned fabrics will when viewed from different angles. Substance was good in these, and, along with their other fine characteristics, the ruffling was beautiful. These three came tall and would have been nice for cutting, had I not used

them for seed production.

One of the last of these "Old" hybrids to bloom, came out in late October with eighteen large flowers in a magnificently shaped umbel. This one also sported nice, wide segments and beautiful ruffling. Its color bridged salmon and red. Unfortunately, it faded badly. Nevertheless, it was used to set seed with pollen from several others which should tend to offset this undesirable characteristic. Pollen from this one was used generously, as well.

Other growers who ordered these mixed hybrids—including Mrs. Eva Turnquist and Mr. Quinn Buck—reported similar good results. I know of no one who was dissatisfied with these Borde Hill offerings.

Ruffling—we Americans tend to love it in our flowers. The more the better this side of the Atlantic. So it came as a surprise to learn from Mr. Stanley Foote, one of Southern California's finest Iris growers, that many overseas flower enthusiasts tend to be lukewarm on the subject. Seems they feel we Americans have gone overboard in our ruffling demands. "Excessive ruffling" in ornamental hybrids rubs against the grain of flower fanciers in England, for instance, where the "Classic" form is preferred. This is either unruffled or only slightly waved.

When Mr. Foote told me this, I hearkened back to my Gladiolus growing days. I remembered thinking at that time how very plain the hybrids of European origin seemed. Imagine my abashment, then, to learn at this late date that they weren't plain at all, but "Classic" in form.

A few days after my conversation with Mr. Foote, came the second blow to my callow concepts of worldwide, homogeneous beauty standards. Mrs. Emma Menninger, owner of the Greenoaks Nerine collection, informed me that the English Nerine growers feel we Americans demand too much ruffling in our Nerines, as well. It grieves me to report this bit of news, but apparently what is going on here, and only suspicioned until now, is a behind-the-scenes "War of the Ruffles."

Personal tastes being what they are, I doubt if either side is going to win this particular war. Frankly, I doubt if either side ought to win. There is plenty of room for both "Ruffled" and "Classic" forms in the world of Nerine growing and hybridizing. Those of us who find pleasure in both types are the true winners.

This past year, I paid several visits to Mrs. Menninger and her extensive collection of Nerines at GREENOAKS. What a sight those blossoms are! Each year I look forward to seeing them, row upon row, glistening and sparkling in the sunlight. A heart of stone would be quickened by such overwhelming beauty.

The variety 'Ben Hills' (Exbury) was at its best during one such visit. That color is incredible!: deep rose, warm and inviting, yet elusive, always just beyond a person's ability to catch and hold it in

memory. And, unlike certain varieties, bulbs of 'Ben Hills' are eager to bloom on an annual basis. To top things off, there's a regal quality about this one that sets it above the commoner sorts. If you haven't already guessed, it's one of my personal favorites.

That beautiful GREENOAKS red seedling mentioned in the 1972 Nerine Committee Report was blooming again this year, wonderful as ever. I trust this one will be named and registered before long.

'Cupid' (Exbury) was its usual charming self during the second week of October. Red and pink often seem to be at loggerheads when combined in a single Nerine flower. Not so here. The blend is right. And quite beautiful.

I caught sight of an especially charming blue seedling during one of my visits to GREENOAKS. Mrs. Menninger liked it as well, and christened it on the spot with the working name 'Blue Ruffles.' Unlike so many blue Nerines which acquire their blue coloration on aging, this one blooms blue to begin with. The hue does deepen a bit as the flowers age, but over all, the umbel is fairly consistent in color value. What I especially like about this cultivar,—apart from its size, width, umbel count, texture, color, height, . . . have I forgotten anything?—is its smoothness of color. The blues so often appear grainy, due to uneven placement of the pigment responsible for the blue color. But 'Blue Ruffles' is quite smooth. In fact, I could notice no graininess whatsoever. If one may judge from last year's performance, Mrs. Menninger has produced another fine variety.

The beautiful 'Inchmery Kate' (Exbury) was out in October, giving forth with all its usual glory. (Now here's a clone that doesn't have much ruffling, but nobody even notices much or cares at all that the frills are missing.) No hybrid Nerine collection is complete without this variety, for besides being the first recognized tetraploid, it is truly beautiful.

White Nerines are a specialty at GREENOAKS. Mrs. Menninger grows and hybridizes them in a small greenhouse set aside especially for that purpose. What a spectacle that corner of the growing area becomes when they bloom. The sparkle so often referred to which makes the surface of Nerine flowers glisten with gold and silver dust, makes the white Nerines appear to have been sprinkled with diamonds. It's no wonder so many white varieties have the word "snow" as part of their names: 'Snowfall', 'Snowflake', 'First Snow', 'Snow Man', 'Snow Maiden', 'Icicle' . . . 'Icicle'! Well, it's the same general idea, anyway.

The pure whites, those with cream and green sheaths, were spectacularly beautiful during their last blooming. And even though the subdued-color whites, those with pink or red coloring in the sheaths, did seem to exhibit a greater tendency to produce some pink down the center line than during cooler seasons, that appeared to be their only fault. It's more than likely that the excessive heat before and during their blooming period—temperatures in the 90's and 100's for days on

end—had something to do with the color development.

Is there a red variety any redder than 'Miss Willmott' (Clarke)? I have seen this one described as "orange," but it's certainly not orange here. Here, it is unmistakably red. Color saturation is so intense in this variety that the segments appear to be shaped out of pure red pigment. That same intensity of color saturation can also be claimed for 'Mrs. Cooper' (Clarke), although in this case, the color is an intense fuschia. Both of these are fine varieties showing that special combination of characteristics which makes for quality.

Mr. Lindsay J. Forbes has continued his most interesting communications from Australia. Mr. Forbes, an avid collector of bulbous plants, is to be commended for his success in locating, accumulating, and maintaining his impressive collection of Amaryllids and other plants, among which is the foundation of a Nerine collection anyone would be proud to display.

Much to my personal enrichment, Dr. Shuichi Hirao of Japan has written on several occasions during this past year. I sincerely hope that Dr. Hirao might honor a future edition of this yearbook with an article on the history and development of Nerines in his own country. The Japanese Nerines seem to have been developed somewhat differently from those in other parts of the worly. All who have seen them agree that they are quite good.

Mr. Zelimir K. Tvrtkovic Sahin continues to correspond, and it was an honor to meet with this knowledgeable young man on two occasions during the past year. His Nerine collection is growing rapidly, as is his storehouse of information on all aspects of plants and plant-growing.

My seedling Nerines continue to hold my fascination with the lure of their promises which can only be fulfilled in years yet to come. The seed harvest of 1970 netted me all of four seeds. I lost 25% of those, bringing the total down to three. One of these may flower for the first time this year.

By 1971, the collection had grown. And so had the seed harvest. My flowers yielded over a hundred seeds that year.

Last year's blooming season, left me with the memories of many lovely flowers, and seeds and subsequent seedlings in excess of 800.

So I'm getting near that 1,000-seedlings-a-year goal I've set for myself. And the bloom season coming due in another six weeks ought to see me well over the 1,000 seedlings mark. I shall have to use all my powers of discretion and judgment not to exceed that count by too many.

I wonder if another greenhouse could be fitted into the back yard.

1973 DAYLILY REPORT

W. Quinn Buck, *Chairman, Daylily Committee,*
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The year 1973 has to become a landmark in the history of the tetraploid daylilies because of several important developments: Dr. Virginia L. Peck in Tennessee had a white seedling to flower; Steve Moldovan in Ohio had picotees to flower this season; Wm. R. Munson, Jr., in Florida, had further color developments and progress in continuous blooming habit; Frank Childs in Georgia released continuous blooming clones in several colors, as well as a superlative near-white; and the whole Chicago area was reported as being simply full of amazing developments in color in the tetraploids. There probably were other major developments in other areas which have not been reported to us.

A real white has long been one of the goals of daylily breeders, and the appearance of Dr. Peck's seedling is most important. It came from a cross of a seedling Peck tetraploid with an induced tetraploid form of 'Catherine Woodberry' (Childs), fulfilling the anticipations of those who have been hoping to get white out of lavender breeding.

The appearance of narrow color borders on flower segments, in several colors, as reported by Steve Moldovan gives a new color pattern in daylilies that will be most significant in future breeding. Moldovan's Gardens also saw fine new colors and patterns in lavenders and purples derived from an induced form of 'Royal Watermark' (Moldovan).

The new purples and lavenders among James E. Marsh's seedlings in Chicago showed very great advances over those already introduced, as did also his red seedlings, most of which carried the influence of 'Douglas Dale' (Peck) added to the Marsh red lines. Clarence J. Blocher of Wheaton, Illinois, had fantastic color developments from his lines involving the lavender 'Caption' (Griesbach). Bro. Charles Reckamp at Mission Gardens flowered many more of his progressively superior melons. Similar reports came from other Chicago breeders.

Frank Childs, who has been doing line-breeding for a quarter century to get whites, this year released his diploid 'Serene Madonna', which he considers the peak of his efforts in this area; the beauty of his previous near-whites makes this an important release.

The country as a whole had a remarkably good season, although there were sporadic areas of drought scattered here and there, and certain important breeding programs were much affected. Southern California enjoyed an unusually cool season that will long be remembered for its benefits to plants and seed set, while inland Northern California had prolonged and devastating heat that ruined seed crops in some gardens and changed flowering seasons adversely. Jack S. Romine's polyploidized clones lost all their pods in Walnut Creek, Cal., while Dr. Hamilton P. Traub in coastal La Jolla, Cal., reported a fine season with many seedlings in new colors.

In the Buck garden in Arcadia, Cal., there were many new seedlings, the most interesting being "blues" derived from 'Little Wart' (Spalding), and some fine rose, pink, and wine shades from other lines.

New introductions flowered in the Buck garden in 1973 included 'Wine Bold' and 'Cherry Chin' (Peck), both very wonderful colors, but our cool nights made them open poorly. Dr. Peck's 'Highland Lass' and 'Green Glade' were delightful pastel bicolors of good form. The new Munson varieties included the lovely pink 'Queens Grace'; 'Knave', 'Chittagong', and their 'Kings Cloak' parent, all in varying shades of rose and wine; and 'Silent Spring', beautiful in shape and texture. The amazingly rapid succession of new spikes on these Munson clones is the characteristic that will be watched most carefully as the plants are in their second season and can be expected to perform even better. The bright red 'Johnny Ward' (Fay) opened well only after warm nights, and then it was good; the new pink 'Ruth Rees' (Fay) failed to bloom at all, suggesting that it may require more winter cold. 'Chicago Regal' (Marsh) was new to the Buck garden in 1973 and was amazingly handsome in size, shape, and bright bronzy purple color.

Among older varieties 'Mary Todd' (Fay) and 'Galena Moon' (Blocher) were the most outstanding performers in the yellow group; the branching of 'Galena Moon' was unsurpassed. 'Cherry Cheeks' and 'Jock Randall' (Peck) were again unrivalled in color and performance, and seedlings out of 'Jock Randall' showed inheritance of fine qualities from that super variety. 'Gypsy Laddie' (Peck) for the first time bloomed typically and normally, suggesting that the previous winter's frosts were to his liking. The established clump of 'Pink China' (Hardy) was the finest pink grown, followed closely by 'Chicago Silky' (Marsh) and 'Shell Pink' (Fay), two wonderful pink blends that performed outstandingly. A new plant of 'Douglas Dale' (Peck) did very well and set fine pods, along with 'Lusty Lealand' (Peck), probably the best of the Peck reds grown previously.

The best performing treated and induced lavender clones included 'Tai Pan' (Moldovan) and its parent 'Blue Jay' (Spalding), the shocking bright 'Fuchsia Flame' (Hardy), and heart-warming, 'Little Wart' (Spalding). 'Silver Shadows' (Munson), with its large greenish yellow throat and heavy substance, has become a very different lavender in its treated version. The best treated "whites" included two MacMillan clones, 'Robert Way Schlumpf' and 'WhCr-135-66'; treated 'Whie Frost' (Gore) performed extremely well and set seed easily. Treated 'Pres. Giles', 'Sholom', and 'William Munson', all MacMillan clones, were wonderful by comparison with untreated diploid forms.

And so, 1973 was truly another good year for those deeply interested in growing daylilies!

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THE GARDENER AND THE SWEATING DISEASE OF WRIST WATCHES

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I. INTRODUCTION

It is symptomatic of the times that a "wrist watch" is defined as "a small watch attached to a bracelet or strap to fasten about the wrist," and that the phrase "pocket watch" does not appear at all in the latest edition of the Merriam-Webster "New Collegiate Dictionary." History records that for the human male, the pocket watch was housed in a special pocket provided for it with an opening on the upper front rim of the trousers. However, since the late 1950's this pocket has disappeared and provision is no longer made for housing the time piece in the male clothing attire. He is expected to make use of the wrist watch only.

Unfortunately, manual labor, including many gardening operations—hoeing, weeding, fertilizing, etc., results in increased bodily perspiration, including the wrists, and thus the under side of the wrist watch band is excessively moistened. This is unsanitary to say the least, and if the truth is told, will in many cases cause an allergic reaction, "The wrist watch allergy of man," a very irritating rash or allergy under and near the wrist watch band. This allergic reaction is even caused in some cases without the increase of prespiration due to manual labor.

The retort will be made that the manual laborer should leave his wrist watch behind. But this is nonsense since there is need for keeping time even if one is engaged in manual labor. One is driven to the conclusion that it is fashionable to forget about manual labor, and design clothing only for those who will wear these effeminate wrist watches. The retort is also made that the wrist watch came into use so that the automobile driver could easily read the time. But riding in automobiles is not the healthy way for a human to use his time. It is obvious that he should get on his hind legs and function as nature intended. In other words, the wrist watch should be available for all who want it, but for normal activity, away from the automobile, the pocket watch, with watch pocket on the trousers to house it, should also be available.

II. CASE HISTORY

A case history will show the seriousness of this disease. A number of years ago, a well-known Swiss brand of wrist watch was purchased. It was guaranteed to be moisture-proof. The face of the watch was of a polished alloy of metals, containing some copper. It was soon noticed that the leather watch-band caused an allergic reaction under and on the sides of the band. The writer changed to a metal-mesh band, but this too was equally effective in causing the painful unsightly allergy.

It was also noted that when the wrist watch was worn as the writer worked in his garden, the space between the face of the watch and the crystal steamed with moisture, and this could be displcaed by hanging the watch over a lighted electric light bulb for several hours.

A little later, the face of the watch made of a metal alloy containing copper as already indicated, showed extensive greenish corrosion, greatly disfiguring the face of the watch. Still later, the watch stopped working. The watch repairman indicated that the moisture had gotten into the watch mechanism. He thoroughly cleaned the watch and it functioned for a time, but again the old sweating disease made its appearance. Thus, it was no longer possible to wear the wrist watch unless one refrained from all exercise and confined oneself to a milch-toast existence.

The remedy was clear. One had to go back to the pocket watch. Luckily, he was able to obtain a fine pocket watch which a local dealer had left over from the pre-wrist watch age. This has functioned normally ever since. He is looking out for another such find so as to have a spare in case of accident. Unfortunately, clothiers, thinking that the age of the pocket watch is over, stopped placing watch pockets on trousers several years ago which made it necessary for the writer to have the tailer add such pockets on trousers.

Since many men do not prefer a milch-toast existence and will exercise vigorously, and work in their gardens, the pocket watch should be re-introduced as an added, or second watch. Let those who want wrist watches have them. And in fairness, provide pocket watches as second watches for those who need them.

III. MARKET SHOULD NOT BE RESTRICTED

Watchmakers unfortunately seem to have overlooked the sweating disease of wrist watches, and its concommitant, in a number of cases, the wrist watch band allergy. This has made it impossible for those affected to wear wrist watches. Even those who can wear wrist watches would in many cases also want pocket watches as second watches when they perform manual labor.

Watchmakers have overlooked the fact that their market has been artificially restricted, and it would apparently be increased if *both* wrist-and pocket-watches were offered in the trade. Thus, a person could have not only one, but a second type of watch at the same time. Surely, the time has arrived when one should be able to purchase both types of watches. As already indicated, this would surely rebound to the benefit of all watchmakers.

A Fifth Summary of the **VERBENACEAE, AVICENNIACEAE, STILBACEAE, DICRASTYLIDACEAE, SYMPHOREMACEAE, NYCTANTHACEAE,** and **ERIOCAULACEAE,** of the world as to Valid Taxa, Geographic Distribution, and Synonymy, by Harold N. Moldenke, Ph.D., Department of Biological Sciences, The William Paterson College of New Jersey.

This 974-page work, in two volumes, represents 42 years of research by a recognized world specialist on these plant groups, based on extensive

field studies and the examination of more than 212,000 herbarium specimens deposited in 300 institutional and private collections.

5,146 specific and infraspecific taxa and hybrids are recognized in the 112 accepted genera of these 7 important plant families. A dichotomous key is provided for distinguishing the genera and the 248 subgroups. An alphabetic list of over 15,000 synonyms and other rejected scientific names, including variations in spelling and/or accreditation, forms an important part of the work. In all, 20,753 scientific names, with their proper authorities, are accounted for.

In the geographic section the known distribution of all members of these families is given by individual countries in geographic sequence. The groups being of worldwide distribution, every country of the modern world is thus treated, as well as 957 separate-islands. In all larger countries the distribution is given by states, departments, provinces, territories, counties, and/or parishes.

There is a section on the 675 species, varieties, and hybrids known to be in cultivation, the countries wherein they are cultivated, and on the 37 species known in fossil form, with their geologic horizon and location. An index is provided to all geographic areas treated, enabling the student quickly to find the area in which he is interested.

This work should be indispensable to every institution where botanical research is in progress. Price, $25.00 U.S.A. plus postage. Send orders to: MRS. HAROLD N. MOLDENKE, 303 Parkside Road, Plainfield, New Jersey 07060, U.S.A.

PLANT LIFE LIBRARY

THE COMPLETE BOOK OF HOUSEPLANTS, by Charles Marden Fitch. Hawthorn Books, Inc., New York. 1972. 308 pp., illus. $9.95 Charles Marden Fitch has come to the aid of the harassed home plant grower with an authoritative, attractive book of slightly over 300 pages, packed with much useful information about the tricky business of becoming successful with the culture of indoor plants. It is clear that Mr. Fitch is well equipped by training and experience to carry out the task he has assigned himself. His fascination with indoor plants originated in the man-made tropics of the New York Botanical Garden, which he visited many times during his formative years. Since then, he has traveled widely in the tropics, and has accumulated firsthand knowledge of tropical plants and the tropical environment. Fitch has had extensive experience in journalism and TV. This experience probably accounts for his easy, lucid style.

While the book contains specific instructions about most of the problems the neophyte houseplant buff is likely to encounter, it is much more than a cookbook. In fact, the book comes mighty close to being "the complete book of house plants" that the title implies. Fitch describes about 1000 species of plants suitable for indoor culture. The book is illustrated with over 170 black and white photographs, and 8 superb color plates Nearly all of the illustrations are the work of the author; evidently an excellent photographer.

The book commences with a discussion of the habitat of house plants, and continues with light, heat and humidity; soils and fertilizers; pots, potting and repotting; and propagation. Then follow chapters on the various species of plants used for houseplants such as bromeliads, geraniums, begonias, gesneriads, orchids, bulbs, succulents, cacti, etc. The chapter on orchids is outstanding. There is even a chapter on plants for public buildings, and a final chapter on "Keeping your plants healthy."

The book contains a short Bibliography in which a few of the standard

reference works are cited. Under a chapter with the title "Helpful Lists" there is a "calendar of flowers," "plants for cool locations," "plant societies," and "sources of plants and supplies." These lists should be of much assistance to the beginner and to the serious amateur. There is an Index of 14 pages.

One feature of the book annoys me, and may have the same effect on other users of the book. The illustrations are unnumbered, hence not correlated with the material in the text. For example, **Lantana montevidensis** is mentioned on page 106 under "Shrubs for baskets," but a photograph of the plant does not appear until page 115. This difficulty is somewhat alleviated by assembling the photographs at the terminal portion of each chapter.

The book is a bargain at $9.95, and should be on the shelf of all lovers of houseplants. It may even strike an effective blow at the makers of those horrible plastic plants and flowers by demonstrating that real plants are not all that hard to grow.—**Thomas W. Whitaker.**

FLORA EUROPAEA, VOL. 3. DIAPENSIACEAE TO MYOPORACEAE. Edited by T. C. Tutin, V. H. Heywood, N. A. Burges, D. M. Moore, D. H. Valentine, S. M. Walters & D. A. Webb. Cambridge University Press, American Branch, 32 E. 57th St., New York, N.Y. 10022. **1973.** Pp. xxix + 370 + 5 maps. $37.50. **FLORA EUROPAEA** is sponsored by the Linnean Society of London. The Editorial Committee is based in the British Isles and is supported by advisory Editors and Regional Advisers from all over Europe. In this project the national and regional floras of Europe are being synthesized for the first time. Volumes **One** and **Two** had been published in 1964 and 1969 respectively, and now Volume **Three** has appeared in 1973, and it too measures up to the very high standard set by the previous volumes. The order and circumscription of the families is that of Melchior in Engler, Syllabus der Pflanzenfamilien ed. 12 (1964).

Volume 3. **Dispensiaceae** through **Myoporaceae** is the first of two volumes on the Sympetalae. After the **Preface** and the informative **Introduction,** there follow lists of the basic and standard floras; synopsis of families **Diapensiaceae** through **Myoporaceae** included in Volume 3; key to the families of Angiospermae; explanatory notes on the text; detailed descriptions of the families, genera and species. Available evidence from morphology, geography, ecology and cyto-genetics has been taken into consideration in delimiting the species. The volume is completed with four appendices: (I) Key to the abbreviations of authors names, (II) titles of books, (III) titles of periodicals and anonymous works, cited in the text; (IV) glossary of technical terms; an Index, and five maps.

The editors and collaborators are to be congratulated on producing this outstanding example of effective international cooperation in giving to the world this reliable and exceedingly useful work. The example set has served as the model for similar cooperation in other parts of the World. Volume 4 is very highly recommended to all who are interested in vascular plants, including the professional plant scientist, the student of botany and the amateur plantsman.—Hamilton P. Traub

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FLORA OF THE PACIFIC NORTHWEST, by C. Leo Hitchcock and Arthur Cronquist. University of Washington Press, Seattle, Wash. 98105. **1973.** Pp. xix + 730. Illus. $25.00. The outstanding monumental **Vascular Plants of the Pacific Northwest** (Univ. Wash. Press, 1955-1969) in five volumes is familiar to all interested in the flora of this region. In the **Flora of the Pacific Northwest** (1973), subtitled "An illustrated Manual" the vast information in five volumes has been condensed into **a single volume** of 730 pages which surely presented an herculean task. The unique format adopted, with more than 10,000 illustrations in the

left margins, has undoubtedly facilitated the condensation. The volume contains a taxonomic treatment of all the species of ferns and fern-like plants, conifers, and flowering plants native to or established in Washington, northern Oregon and Idaho, western Montana and southern British Columbia. The dicotyledons are arranged in the traditional Englerian sequence, and the monocotyledons are grouped in accord with the system of Cronquist, **The Evolution and Classification of Flowering Plants** (1968). The genera within each family are arranged alphabetically, and the species are numbered. The sequence of the species reflects the way in which it was convenient to organize the key. There is a list of abbreviations and signs used throughout the book, a synoptical and an artificial key to the families. The volume is completed by an index of all Latin and common plant names. This handy manual is very highly recommended to all interested in the plants of the Pacific Northwest.

PHYSIOLOGY OF PLANTS AND THEIR CELLS, by James A. Goss. Pergamon Press, Inc., Maxwell House, Fairview Park, Elmsford, New York 10523. **1973.** Pp. xvi + 457. Illus. $15.00. Written as "an introduction to a vast and interesting field of science" this text will serve as a beginning course in plant physiology. It will also serve as a general reference for teachers, practicing scientists, and students of biology and agriculture. The subject is developed under the headings—plant cells and nutrition, water enters the plant, distribution and function of water within the plant, mineral nutrition, photosynthesis and carbon assimilation, and entrance of energy into the cell, energy storage, utilization and loss, amino acid synthesis and metabolism, plant proteins and enzymes, regulation of metobolism, phytochemistry, function of plant membranes, intercellular communication, cell division and enlargement, plant development, longevity, senescence and death, and the relevance of plant physiology. Highly recommended to all students of plant physiology.

PLANT SUCCESSION AND INDICATORS, by Frederic Clements. Facsimile of the 1928 Edition. Hafner Press, 866 3rd Av. New York, N.Y. 10022. **1973** Pp. xvi + 453. Illus. Subtitled, "A Definitive Edition of Plant Succession and Plant Indicators," by one of the major founders of the science of ecology, this reprint is welcomed. Now all students in the field of ecology may have ready access to this important source book. The subject is discussed under the following headings: concept and causes of succession, historical summary, initial and ecesic causes, reactions, stabilization and climax, structure and units of vegetation, direction of development, classification of seres, investigation of succession, concept and history, bases and criteria, kinds of indicators, agricultural, grazing, forest indicators. Very highly recommended to all students of the timely subject of plant ecology.

EVOLUTION OF SEX IN PLANTS, by John Merle Coulter. Facsimile of the 1914 Edition. Hafner Press, 866 3rd Av., New York, N.Y. 10022. **1973.** Pp. vii + 140. Illus. This reprint of one of the classic accounts of the evolution of sex in plants will be welcomed by all. It is clearly written for both botanists and laymen. The subject is discussed under the following headings: asexual reproduction, the origin of sex, differentiation of sex, evolution of sex organs, alternation of generations, differentiation of sexual individuals, parthenogenesis and a theory of sex. Very highly recommended to all interested in botany.

SIZE AND FORM IN PLANTS, by F. O. Bower. Facsimile of the 1930 Edition. Hafner Press, 866 3rd Av., New York, N.Y. 10022. **1973.** Pp. xiv + 232. Illus. This reprint of a classic text illustrating the subject of size and form in plants on the basis of cell-size will be generally welcomed. The subject is discussed under the headings—the problem of size, Psilotales and Psilophytales, living and fossil Lycopodiales, Sphenophyllales and Equisetales, Filicales, the shoot of seed plants, roots, and plasticity of form and structure in relation to size. Highly

recommended to all students of botany.

FLORA NEOTROPICA. MONOGRAPH NO. 12. CARYOCARACEAE, by Ghillean T. Prance & Marlene Freitas da Silva. Hafner Press, 866 3rd Av., New York, N.Y. 10022. **1973.** Pp. ii + 77. Illus. $8.50. This is one number of a periodical designed to present in monographic form taxonomic accounts of all plants growing within the Western Hemisphere Tropics. This number is devoted to the Caryocaraceae. Geographic, ecologic, cytologic, anatomic, morphologic, chemical and economic data available are presented as well as bibliographies, citations of species names and indices for each group treated. Monograph No. 12 is highly recommended to all who are interested in the flora of the New World Tropics.

BACTERIAL AND FUNGAL DISEASES OF PLANTS IN THE TROPICS, by George F. Weber. University of Florida Press, 15 NW 15th St., Gainesville, Fla. **1973.** Pp. xvii + 673. Illus. $22.50. This important guide to the bacterial and fungal diseases of crop plants in the tropics and subtropics by an outstanding authority will be welcomed. The text is arranged alphabetically by crop plants and includes no less than 94 economics crops. Under each crop entry the bacterial and fungus diseases are described as to symptoms and etiology together with citations to the literature. At the end of the book there is a bibliography; a list of useful periodicals; an index of host plants by common name, and by plant genus; an index of diseases arranged by crop plants, and an index to Bacteria and fungi. This very useful text is highly recommended to teachers, students, agricultural advisers, and crop growers.

PROCEEDINGS OF THE 6th BERKELEY SYMPOSIUM ON MATHEMATICAL STATISTICS AND PROBABILITY. VOL. V. 1972. DARWINIAN, NEO-DARWINIAN, AND NON-DARWINIAN EVOLUTION. Edited by Lucien M. LeCam, Jerzy Neyman & Elizabeth L. Scott. University of California Press, 2223 Fulton St., Berkeley, Calif. 94720. Pp. xvi + 269. Illus. $13.50. The purpose of this symposium is to promote research, and record the contemporary trends in thought and effort of mathematical statistics and probability with reference to Darwinian, Neo-Darwinian, and non-Darwinian evolution. The subject is developed under the following headings, Darwinian and non-Darwinian evolution theory; DNA, RNA, amino-acid sequences; population studies and evolution; and the role of theory in evolutionary studies. Very highly recommended to all who are interested in biological evolution.

BANANA DISEASES, by C. W. Wardlaw. 2nd Edition. Humanities Press, 303 Park Av. So., New York, N.Y. **1972.** Pp. xii + 878. Illus. $42.50. This second edition of a well known book by an outstanding authority is needed due to recent advances in the knowledge of banana diseases, including those of plantains and abaca. In Part I there is a full and critical account of what is known about banana and related crops diseases up to 1961, and the practical procedures for the effective control of these diseases. It is a reprint of the 1961 edition. In Part II the new material on banana diseases accumulated since 1961 is presented. The subject is treated under the headings—Botany, cultivation and non-infectious diseases; viral diseases; bacterial and fungal diseases of roots, rhizomes and pseudostems; leaf diseases; fruit diseases before and after harvesting; and the black-root complex. The new material in Part II has abundant cross references and a bibliography and index are integrated to apply to both Parts I and II. Highly recommended to all interested in the banana as a cultivated crop, and to plant pathologists and students of tropical agriculture.

PESTS OF COCOA, by P. F. Entwhistle. Humanities Press, 450 Park Av. So., New York, N.Y. 10016. **1972.** Pp. xvii + 779. Illus. $49.50. In this outstanding text all that is currently known about harmful pests in relation to a major economic tropical crop, **cocoa,** is detailed. Chapters 1 and 2 are concerned with the biology and economic importance of cocoa as a crop plant and a general consideration of insect pests.

Chapters 3 through 26 are concerned with the various pests in detail. These pests are various including **mainly insects**, but (1) virus diseases, (2) ants, termites, mites, myriapods, gastropods, (3) nematodes, and (4) birds, rodents and monkeys, also need attention. These pests are considered in detail with descriptions of the pests, their importance and control and a bibliography. Four appendices include a field guide to pest identification, conversion factors, insects affecting the Cocoa plant, and a supplementary bibliography. An author index and a general index complete the book. Highly recommended to all interested in tropical agriculture.

FUNGI IN AGRICULTURAL SOILS, by K. H. Domsch and W. Gams. Translated from the German by P. S. Hudson. Halstead Press, Div. of John Wiley & Sons, 605 3rd Av., New York, N.Y. 10016. **1973.** Pp. xii + 290. Illus. $19.75. This is an important guide to the "fungi of temperate soils, containing detailed descriptions of over two hundred soil fungi isolated by the authors themselves. The descriptions are arranged alphabetically for ease of reference, and consist of brief data on the ecological, physiological and taxonomic characteristics of each fungus. The comprehensive list of references at the end of the book numbers 1600, and each reference contains the full title of the paper cited. 140 of the species described including most of the lesser known ones are well illustrated with photomicrographs and/or line drawings." Highly recommended to all concerned with the soil, including mycologists, and workers in agriculture, soil science and plant pathology.

SYSTEMIC FUNGICIDES, edited by R. W. Marsh, R. J. W. Bryde & D. Woodcock. Halstead Press, Div. of John Wiley & Sons, 605 3rd Av., New York, N.Y. 10016. **1973.** Pp. xii + 321. Illus. Paperback $8.75. This timely book on **Systemic Fungicides,** including contributions from 12 outstanding authorities on the subject will be welcomed. "The development of systemic fungicides during the past decade has revolutionized one of the most important areas of agriculture—the protection of crops against plant diseases. The special feature of these fungicides is their ability to attact fungal parasites from within the plant tissues, through which they can pass without injurious effects. This mode of action has greatly increased the scope of crop protection over that provided by conventional fungicides." The book brings together and discusses the findings in 1174 scientific papers reporting recent research in many parts of the world. Very highly recommended to research workers in the field of fungicides, manufacturers of crop protection products, students of agriculture and horticulture.

PHOTOSYNTHESIS, 2nd Edition, by G. E. Fogg. American Elsevier Publ. Co., 52 Vanderbilt Av., New York. 10017. **1973.** Pp. xii + 116. Illus. Paperback $3.95. Written to meet the needs of "students just beginning the study of the subject," the author emphasizes "the integral part which photosynthesis plays in the life of plants and in the whole economy of the world." The subject is developed under the headings—background; the nature of photosynthesis, etc; supply of light, carbon dioxide and water; absorption of light; conversion of light energy; path of carbon assimilation; flexibility of photosynthesis and its interrelations with other processes; and photosynthesis and life—past, present and future. Highly recommended to students interested in plant physiology.

INSECT/PLANT RELATIONSHIP, edited by H. F. van Emden. Halsted Press, Div. John Wiley & Sons, 605 3rd Av., New York, N.Y. 10016. **1973.** Pp. viii + 215. Illus. The review papers in this interdisciplinary symposium held in 1971 in London on the insect/plant relationships have been included in this stimulating book. Botanists "and entomologists, representing taxonomy, physiology. ecology, behavior, paleontology and agricultural entomology all discussed the insect/plant relationship from their distinctive points of view." The papers have been grouped under introduction: an evolutionary perspective, variety

of the subject, plants and insect cycles, the evolution of the insect/plant relationship, and insect/plant relationship in population dynamics. A general discussion, and an index of contributors to discussions completes the volume. Very highly recommended to all botanists and entomologists.

TEXTBOOK OF THEORETICAL BOTANY, VOLUME 4. PLANT ECOLOGY, by R. C. McLean and W. R. Ivimey-Cook. Halsted Press, Div. John Wiley & Sons. 605 3rd Av., New York, N.Y. 10016. **1973.** Pp. viii + 595. Illus. $28.50. This timely text was written for "university students to bridge the gap between specialist treatises and purely elementary surveys." In the first part, **Principles of Plant Ecology,** Professor McLean starts with an historical review of the subject's development during the last hundred years, and in surveying the present aims, the scope and ideas of the science attempts to answer the question 'What is Ecology.' Sociological analysis of the natural plant communities raises numerous questions, including the vexed subject of the use of statistics in the analysis of such communities and populations. These questions are fully discussed. There follows a survey of the chief plant environments and their characteristics: the sub-aerial environment, soil, and the biotic environment—the complex interactions in the plant world, and between the plant and animal worlds. Professor McLean next discusses the aquatic environment in fresh and salt waters and lastly the littoral environment of the sea beach. He gives consideration to the productive capacity of the oceans. . . . In the second part, **The Principles of Plant Geography,** the groundwork is again theoretical, with a discussion of ideas, aims, and methods. This leads naturally to a consideration of the geological background, and how the present distribution of plants and vegetation evolved. The author continues with a general analysis of plant distributions, geographical types of distribution, plant migrations and their implications, discontinuous distributions, and lastly the concept of floristic elements of the different geographical origins in the complex floras of today. A look at the influence of man on plant distribution forms the closing chapter. Very highly recommended to all interested in plant ecology and plant geography.

MICROBIOLOGY OF THE ATMOSPHERE, 2nd Edition, by P. H. Gregory. Halsted Press, Div. John Wiley & Sons, 605 3rd Av., New York, N.Y. 10016. **1973.** Pp. xxi + 377. Illus. $27.50. "The wide relevance of aerobiology—geographical distribution of organisms, plant breeding, biological warfare, space research—has not been reflected in a number of books published on the subject . . . . Dr. Gregory has devoted some thirty years' work to aerobiology. The first edition of his book, which appeared in 1960, was accepted as the first work to treat this most important branch of biology as a world-wide phenomenon . . . this new edition, whilst retaining the basic structure of the earlier volume, contains all relevant material . . . Throughout, the author emphasizes the principles underlying the applications to plant pathology, hygiene, allergy and palynology. In this second edition new chapters have been included on rain-splash dispersal, inhaled microbes in relation to respiratory infection and allergy, and on survival in the atmosphere. Of particular note are the full color illustrations showing the morphology of typical components of the air spora at a uniform magnification of 1000 times." Very highly recommended to all who are interested in aerobiology and related sciences.

PLANT LIFE LIBRARY—continued on page vi.

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.

1. THE AMERICAN AMARYLLIS SOCIETY

[A Committee of the American Plant Life Society]

[AMERICAN AMARYLLIS SOCIETY, continued from page 2.]

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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. $5.00 postpaid.

3. THE GENERA OF AMARYLLIDACEAE, by Hamilton P. Traub. Includes a general introduction, a key to the subfamilies, infrafamilies, tribes, subtribes and genera of the Amaryllidaceae, and descriptions of all the genera. Every member of the Society should have this book for constant reference. Manila covers; publ. 1963; 85 pages. $5.00 postpaid.

4. LINEAGICS, by Hamilton P. Traub. This is the first outline text for the undergraduate student on the grouping of organisms into lineages. The text is divided into four parts: (a) the history of lineagics and lineagics as an integrated science; (b) basic lineagics, principles and procedures; (c) applied lineagics, principles and procedures; and (d) research methods in lineagics. Recommended for the student in biology. Publ. 1964. Manila covers, 163 pages, incl. 8 illus. $5.00 postpaid.

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