PLANT LIFE

AMARYLLIS YEAR BOOK

1968

Amaryllis aulica

THE AMERICAN PLANT LIFE SOCIETY

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All editorial correspondence should be addressed to: Hamilton P. Traub, *Editor, The American Plant Life Society*, 5804 Camino de la Costa, La Jolla, Calif.

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HAMILTON P. TRAUB
HAROLD N. MOLDENKE

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SUPPLEMENT—REVIEW OF THE GENUS NERINE

Page 3, text, 13th line, delete "it" after replaced.
4th par. 2nd line, change "Table 1" to "Tables 1 & 2"
Page 6, under CARYOLOGY, 5th line, change Table 2 to "Table 3". Change table heading "Table 2" to "Table 3."
Page 10, under 23b., 2nd line, change "*N. alata*" to "*N. alta*" under 29b, change "11. *alata*" to "*N. alta*"
Page 14, 9 lines from bottom, change "2c." to "2e."
Page 17, under 4g., Notes, 2nd line, change "species" to "variety"
Page 21, change "11. *alata*" to "11. *alta*"
Under "Notes", change "*Nerine alata*" to "*Nerine alta*"

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DRIFTWOOD MINIATURES, by Florence M. Schaffer. Hearthside Press, 381 Park Av. S., New York, N. Y. 10016. 1967. This charming book on creating driftwood miniatures represents a widening viewpoint in this field. The topics discussed include rocks, cones, nuts, hulls, pods, seeds, seed heads, roots, spathes, bracts, tendrils, coral, fungi, seaweed, coral and shells. It is written for a wide audience, including four-year olds, teenagers, young adults and senior citizens. This beautifully illustrated book is very highly recommended.

NEW IDEAS FOR CHRISTMAS DECORATIONS, by Nora Fields. Hearthside Press, 381 Park Av. S., New York, N. Y. 10016. 1967. Pp. 160. Illus. $4.95. This fascinating book on new ideas for Christmas decorations with greens, pods and cones by an authority in the field of education fills a definite need. It provides creative work for the members of the family in celebrating the Holiday season. Highly recommended.

HOW TO PLAN & PLANT YOUR OWN PROPERTY, by Alice R. Ireys. William Morrow & Co., 425 Park Av. S., New York, N. Y. 10016. 1967. Pp. 182. Illus. $7.95. This is an outstanding new type of book on landscape design which provides practical directions. The beautiful and practical illustrations alone are worth the price of the book, which is divided into three parts: (a) fundamentals, planting design, etc., (b) plans for landscaping various types of property; and (c) gardening details. This delightful and useful text is very highly recommended.

FLOWERS FOR YOUR CHURCH, by Adelaide B., and Lois Wilson. William Morrow & Co., 425 Park Av. S., New York 10016. 1967. Pp. 148. Illus. $6.95. This is the first complete guide for the arrangement of flowers in traditional and modern church buildings. This profusely illustrated text by two outstanding authorities is very highly recommended.

GREENHOUSE GARDENING FOR FUN, by Claire L. Blake. M. Barrows & Co., 425 Park Av. S., New York, N. Y. 10016. 1967. Pp. 256. Illus. $6.95. This book has been planned as a complete guide to greenhouse gardening for the amateur and sub-professional. The book is divided into four parts: (a) the program of plants to grow; (b) the first year-program, and more advanced plans; (c) plants to grow in the greenhouse; and (d) useful lists and guides. Highly recommended.

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PLANT LIFE, VOL. 24, NO. 1, January, 1968

AMARYLLIS
YEAR BOOK
1968

Year Book of
The American Amaryllis Society
35th Issue

GENERAL AMARYLLID EDITION

EDITED BY
HAMILTON P. TRAUB
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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[THE AMERICAN AMARYLLIS SOCIETY—continued on page 167.]

PREFACE

The cover design, by Prof. Penrith B. Goff, of the University of Kentucky, represents *Amaryllis aulica* as grown by Sam Caldwell in Tennessee from bulbs imported by Robert D. Goedert from South America. Prof. Goff is to be congratulated again on another beautiful cover.

This thirty-fifth edition of the AMARYLLIS YEAR BOOK is dedicated to Dr. Robert P. Kahn, the noted pathologist in the United States Department of Agriculture, who received the 1968 WILLIAM HERBERT MEDAL in recognition of his outstanding contributions toward the advancement of the amaryllids. He demonstrated the mosaic virus disease in *Amaryllis* L., for the first time. This opens the path for its eventual control and eradication. Dr. Kahn contributes a charming autobiography and a review of the researches on *Amaryllis* mosaic virus disease from 1960 to 1967 in the present issue. The HERBERT MEDAL is presented to him with the congratulations of all the members.

It is our sad duty to report the death of prominent members of the Society.

Mrs. Mary G. Henry, of Gladwyne, Penna., an outstanding worker in the field of the amaryllids, died on April 16, 1967, while on a collecting trip in the Wilmington, North Carolina area. The readers should look up the autobiography which she contributed to Plant Life 1950 on the occasion when the HERBERT MEDAL was awarded to her. Her article on *Agapanthus africanus* var. *henryae* Traub, in the present issue is perhaps the last contribution which she wrote. It is fitting for all of the members in the North, South and elsewhere to grow this fine gem, the *pure white* miniature *Agapanthus africanus* var. *henryae*, to keep the memory of Mrs. Henry fresh in the years to come. The plant is hardy as far north as central Pennsylvania, is of easy culture, and can be increased from seeds and offsets. Material will be furnished to Prof. Claude W. Davis, University Hills Nursery, 470 Delgado Drive, Baton Rouge, La. 70808, so that members will be able to obtain it. However, they should give Prof. Davis a little time to work up a stock.

Mr. Morris W. Clint, the husband of Mrs. Katherine Clint, who together introduced many amaryllids from Mexico, died on April 8, 1967. Mr. Edward F. Authement, our efficient and beloved Registrar of Amaryllis names, died on July 20, 1967; and Mrs. Charlotte M. Hoak, well known to all amaryllid enthusiasts for her work with amaryllids, died on Sept. 3, 1967. In Memoriam notices appear in the present issue.

Again, Mr. Goedert reports on the 1966-1967 Amaryllis Season. Dr. Joseph C. Smith writes about new Amaryllis species collected by Dr. Ruppel in South America. Sam Caldwell reports on *Amaryllis aulica;* Mr. Mertzweiller, Buchmann and Fesmire discuss their Amaryllis breeding projects. Mr. Tisch writes on his experiences with amaryllids; Mr. Doran reports on *Amaryllis reginae* and *Crinum erubescens* in South America; and Mr. Buck writes about the appropriate use of Amaryllis blooms at a spring wedding. Mr. Beckwith D. Smith shares his enthusiasm on acquiring the Blue Amaryllis, *Worsleya rayneri.*

Mr Buck writes about his Daylily trip to Chicago, Hemerocallis breeding and the rare Bahama Islands *Hymenocallis*. Mr. Paul H. Williams examines the possibilities of various *Rhodophiala* species; Mr. Hannibal reports on *Crinum schmidtii;* and Mr. Corbett considers the asexual propagation of *Lycoris squamigera*. Dr. Zorbach has found that the honey of *Crinum asiaticum* is mainly sugar (sucrose). Prof. Ravenna contributes *Nothoscordum* notes. Mr. Caldwell provides valuable *Lycoris* notes, and give us the first *Lycoris* blooming chart.

Dr. Howard writes about his plant exploration trips into Guatemala and Mexico. There are reports on the 1967 Official Amaryllis Shows; contributions on Amaryllis show schedules, and the staging of Amaryllis shows by Mrs. Pickard and Mr. Mahan. There are still other contributions as shown by the table of contents.

Contributors to the 1969 issue of the AMARYLLIS YEAR BOOK are requested to send in their articles by August 1, 1968, 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 publication 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, 1967,
5804 Camino de la Costa,
La Jolla, California 92037

Hamilton P. Traub
Harold N. Moldenke

HERBERT'S "AMARYLLIDACEAE" (1837) REPRINTED

In the 1966 issue, the firm Verlag Von Cramer, 694 Weinheim, West Germany, reported that Herbert's "Amaryllidaceae" (1837), with an introduction by H. P. Traub, would be reprinted. Due to unavoidable circumstances, the publication has been delayed, but word has been received (December 1967) that the book will be available in the spring of 1968. Pre-publication or subscription price is $30.00; after publication the price will be $40.00. Send orders directly to the publisher.

PLANT LIFE LIBRARY—continued from page vi.

THE FRAGRANT YEAR, by Helen Van Pelt Wilson and Leonie Bell. M. Barrows & Co., 425 Park Av. S., New York, N. Y. 10016. 1967. Pp. 306. Illus. $10.00. This comprehensive book on fragrant plants by two outstanding authorities will be welcomed. The topics discussed include classification of scents; fragrant plants for the winter garden; for spring, early summer, mid-summer, and autumn; and cool window gardens. Highly recommended.

NEW TRENDS IN DRIED ARRANGEMENTS & DECORATIONS, by Mabel Squires. M. Barrows & Co., 425 Park Av. S., New York, N. Y. 10016. 1967. Pp. 128. Illus. $3.95. This text by an outstanding authority will be welcomed. The topics covered include contemporary arrangements; still life; collage; assemblage; abstract design; new variations for Christmas; sources of plants, and ways to dry them. Highly recommended.

PLANT LIFE LIBRARY—continued on page 20.

Dedicated to
Robert Phillip Kahn

HERBERT MEDALIST—ROBERT PHILLIP KAHN

ROBERT PHILLIP KAHN

An Autobiography

I first became interested in plants as a senior in high school during weekend exposure in a relative's florist business. However, since my favorite subject in school was economics, I enrolled at Northwestern University, planning to major in some area of commerce. During my first semester, since I found a course in botany more to my liking, I transferred to the College of Agriculture, University of Illinois. I took all the required plant courses but deferred until a later date all required animal courses. In 1943, after 2½ years of college I entered the Army, and in 1949 I graduated from Officer's Candidate School. After 3½ years service including one year in Japan, I returned to the University of Illinois. I had no interest in the animal science courses so I transferred to the Department of Botany, receiving the B.A. degree with honors in botany in 1948 and a Ph. D. degree in plant pathology in 1951.

This explains how a "city boy" became interested in agriculture—an accounting I'm frequently called upon to submit.

I was born in Chicago on April 20, 1924, the son of Charles S. Kahn, a dentist, and Edith K. Kahn. I was raised near Lake Michigan in apartments surrounded by a maze of concrete and asphalt with plant life only to be found in the city parks and conservatories with an occasional privet hedge in front of buildings.

I married Judith Aronson, an art major at the University of Wisconsin in 1947, shortly after she received her B.A. degree. Our four boys, Charles, James, Andrew, and Jeff were born in 1951, 1953, 1956, and 1960.

I have been employed by the U. S. Government as a plant pathologist since 1952. During the past 10 years I have been with the Plant Quarantine Division, Agriculture Research Service, U. S. Department of Agriculture. I am presently responsible for detecting obscure plant pathogens, particularly viruses in vegetatively-propagated plants imported by the Department for research purposes. Many genera imported from foreign countries are prohibited by quarantine regulations because of hazardous pests or pathogens that do not occur in this country. The only exception is that prohibited plants such as potato, cherry, and many ornamentals may be imported under proper safeguard by the Department of Agriculture for research or educational purposes. The safeguards we use are based on growing the imported plants under strict quarantine for at least 2 years during which time they are checked for pests and pathogens. Most pests and pathogens can be detected by observation of symptoms or signs. However, observation is not satisfactory for detecting viruses. Neither the presence nor the absence of virus-like symptoms is indicative of the presence or absence of virus in plants. Many varieties of plants can be infected with virus without

showing symptoms. Thus, like "Typhoid Mary", they act as carriers and could serve as sources for the infection of susceptible varieties. Many virus-like symptoms are not necessarily incited by viruses. For example, chlorosis might be incited by genetic factors, nutritional imbalance, or by virus infection. Similarly, variegation could be virus induced or of genetic origin, or even caused by spray injury.

I am therefore, a specialist in the detection and identification of viruses, particularly latent viruses and in addition, I conduct research in methodology to improve methods for detecting and characterizing viruses. Such research may lead to the description of new strains of already described viruses (such as the *Eucharis* mottle strain of tobacco ringspot virus) or to new undescribed viruses.

In addition to the virus detection program and conducting research to support this project, I am also interested in plant quarantine pathology. I have been fortunate in being able to participate in international symposia on this subject at the Glasshouse Crops Research Institute, Littlehampton, England in 1963; the Plant Virology Institute at Wageningen in the Netherlands in 1965; at the Escuela Agricola Pan Americana in Honduras in 1966, and most recently in an FAO-International Biological Program Symposium in Italy in September 1967.

It was as a specialist in virus detection and in plant quarantine that I first encountered Amaryllids. The Louisiana Society for Horticultural Research, through the late Dr. Ira Nelson, asked the Department of Agriculture to send a specialist to advise on quarantine matters in connection with a collection of imported amaryllids maintained at the Southwestern Louisiana Institute, West Lafayette. The Louisiana Society for Horticultural Research sponsored a trip for me to observe Dr. Nelson's collection and to make phytosanitary recommendations.

Since then I have maintained a small collection of foreign and domestic amaryllids, many of which were submitted by readers of this journal. From this collection I isolated 4 viruses:

(1) *Eucharis* mottle strain of the tobacco ringspot virus—a previously unreported and undescribed strain isolated from *Eucharis candida* from Peru.
(2) An as yet unidentified virus isolated from a domestic plant of *E. grandiflora.*
(3) Amaryllis mosaic virus.
(4) Cucumber mosaic virus.

As an outgrowth of investigations within this group, I published 4 papers, 3 of which were in collaboration with other colleagues:

1. Kahn, R. P. 1960. The present status of the amaryllis mosaic disease in the United States. Louisiana Society for Horticultural Research, Bull. No. 5, pages 24-30.
2. Kahn, R. P. and F. F. Smith. 1963. Transmission of a virus inciting amaryllis mosaic symptoms. Plant Life 19:133-143.

3. Kahn, R. P. and H. A. Scott. 1964. Serological relationships of cucumber mosaic virus and certain virus isolates that incite amaryllis mosaic symptoms. Phytopathology 54:360-362.

4. Kahn, R. P., H. A. Scott, and R. L. Monroe. 1962. *Eucharis* mottle strain of tobacco ringspot virus. Phytopathology 52:1211-1216.

In the first paper, I reviewed the literature and status of amaryllis mosaic in the U. S., and suggested control measures. In the second, we reported isolation of 2 mechanically transmissible viruses from amaryllids. We identified one of the viruses as cucumber mosaic virus and confirmed its transmission by aphids. In the third paper, we confirmed this identification on the basis of serological tests. In the fourth paper, we described a new strain of the tobacco ringspot virus isolated from *Eucharis*. The new strain was of academic interest to other plant pathologists because it did not incite ringspot symptoms in tobacco, yet serological relationships showed it was, indeed, a strain of the tobacco ringspot virus.

I wish to thank the members of the American Plant Life Society for awarding me the William Herbert Medal for 1968.

AMARYLLIS VIRUS RESEARCH—1960-1967

ROBERT P. KAHN

Plant Quarantine Division, Agricultural Research Service, USDA, Glenn Dale, Maryland

When the author reviewed the status of *Amaryllis*[1] mosaic disease as of 1960 (3), he recommended control measures that were based on insecticides, resistant or tolerant species or varieties, and phytosanitation. These recommendations followed the concept that control of virus diseases is generally based on prevention rather than cure.

This 1960 review was concluded with the following statements concerning future research: "A survey of the published literature of *Amaryllis* mosaic and its causal virus suggests to the author that *Amaryllis* enthusiasts may have to learn to co-exist with the *Amaryllis* mosaic disease, especially under field conditions. The situation may be alleviated if future research can develop virus-resistant or tolerant lines, provide a virus indexing program, or ascertain the mode of transmission. More information concerning transmission is essential to place virus-control measures on a more specific basis than may now be recommended." This missing information is now available as a result of reports that have appeared since 1960.

It is the objective of this paper (1) to review these reports and thus to bring amaryllid growers up-to-date with respect to *Amaryllis* virus research and (2) to suggest areas of future research and a means by which such research might be stimulated.

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1 **Amaryllis** L. (1753), first typified by Herbert, 1819; (syn.—**Hippeastrum** Herb. 1821).

RESEARCH 1960-1967

As of 1960, we knew that the tomato spotted wilt virus (TSWV) infected amaryllids and we suspected that the *Amaryllis* mosaic was incited by a virus. A virus was implicated because of virus-like symptoms, the presence of microscopic inclusion bodies in cells, and natural spread under field conditions but there was no actual proof of a virus. No one had reported that an infectious agent could be isolated from a plant with mosaic symptoms and then be transmitted to a healthy plant which would subsequently develop the same mosaic symptoms. TSWV was known to be transmitted by thrips and mechanically (rubbing sap from an infected plant onto a healthy plant). The method of transmission of the incitant of *Amaryllis* mosaic was unknown although insects were suspected. Reports of seed transmission were conflicting. The earlier work on amaryllid virus has already been reviewed (1, 3, 4, 7).

In 1966 the author and Dr. F. F. Smith reported the isolation of 2 viruses from *Amaryllis* with mosaic symptoms (4). One virus which could be transmitted to healthy *Amaryllis* as well as other plants such as tobacco was identified as cucumber mosaic virus (CMV). We showed that the CMV was aphid- and mechanically-transmitted from *Amaryllis* to *Amaryllis* and other test plants but the virus was not seed transmitted. Isolation of CMV from amaryllids by other workers has been reported (See Literature Cited 1, 2, 3). Under an electron microscope CMV is characterized by spherical particles. A second virus was isolated which could be mechanically-transmitted from *Amaryllis* to *Amaryllis* with the production of typical mosaic symptoms but the virus could not be transmitted to other plants. The second virus was not CMV.

In 1967, Brants and van den Heuvel (1) isolated a virus from *Amaryllis* plants with mosaic symptoms which showed a characteristic flexuous rod shape under the electron microscope. The virus was not transmitted by aphids but was transmitted through a low percentage of the seed. The virus of Brants and van den Heuvel was not CMV or TSWV.

Dr. D. H. M. van Slogteren, Jr., at the Flower Bulb Laboratory, Lisse, the Netherlands (unpublished data) has also isolated a rod-shaped virus from amaryllids and has developed an antiserum which is useful in serological testing. This antiserum reacts with the second virus isolated by Kahn and Smith showing that both van Slogteren's and the Kahn and Smith virus are related. Dr. M. K. Corbett, University of Maryland (unpublished data) has also purified a rod-shaped virus from sap obtained from mosaic infected plants. After purification, a procedure whereby the virus as separated from other components of the cell sap by chemical and physical means, the virus would infect other non-amaryllid test plants suggesting that some amaryllid sap extracts contain a virus inhibitor which may interfere with mechanical transmission.

Three viruses found in *Amaryllis* and some of their characteristics are indicated in Table 1.

Table 1. Some characteristics observed in viruses found in **Amaryllis** L.

CHARACTERISTICS	VIRUSES		
	Tomato Spotted Wilt	Cucumber Mosaic	Amaryllis Mosaic Virus
Symptoms	yellow spots 1	mosaic	mosaic
Particle shape in electron microscope	spherical	spherical	flexuous rod
Insect transmission	thrips	aphids	not demonstrated
Mechanical transmission	yes	yes	yes
Seed transmission	not demonstrated	not demonstrated	reported (low percentage)

1 Plus mosaic symptoms reported by Brants and van den Heuvel.

These characteristics suggest that the recommendations for control as described previously for both greenhouse and field-grown amaryllids (3) should be retained.

FUTURE RESEARCH

Virus-free propagations have been obtained from virus-infected plants as a result of heat therapy. Virus-infected plants are grown under continuous temperature of 97°-100°F in plant growth chambers with artificial lights or in greenhouses for 1 to 6 months depending on the ability of the plant to withstand high temperature. Under these conditions, virus may not move up into growing points as new growth develops. The meristems or growing points about 0-2 mm in length are aseptically removed and cultured on nutrient medium containing sugar, vitamins, growth regulators, and mineral elements and sometimes cocoanut milk. The meristems develop into plants which are then transplanted to soil. If meristems are not used, tip cuttings or buds are removed and propagated. Each meristematic bud or cutting propagation is then tested for virus in order to locate the small percentage that might come through free of virus.

Heat-treatment therapy has already been successfully used to free virus-infected cherries, chrysanthemums, carnations, strawberries, grapes, potatoes, and several other plants. Orchids have been freed of virus by meristem tip culture even without heat therapy.

Another application of meristem tip culture and of other forms of tissue culture is in vegetative propagation. Using these techniques one can increase valuable clones such as show orchids or difficult-to-propagate plants such as certain lily varieties.

As far as the author is aware, no one has reported the application of heat therapy techniques to produce virus-free plants or tissue culture to multiply valuable clones of amaryllids. The nearest approach was that of Dr. F. O. Holmes who used a specialized form of propagation and succeeded in developing virus-free plants from infected plants (4). He found some virus-free bulblets among those that were regenerated when stem pieces (free of leaves) were placed on sand under mist.

STIMULATING RESEARCH ON AMARYLLID VIRUSES

The host-virus combinations that have been investigated in heat-therapy projects have been economically important crops for the most

part. Apparently, amaryllids despite their beauty and the enthusiasm of amaryllid growers, are not economically important enough to stimulate research in this area if left to their own merits.

One method that has been used to stimulate research at state or private universities is the setting up of a graduate fellowship or assistantship or grant. Under this procedure the student receives credit for half-time on the project and support towards his education for the remaining half-time. Thus, he works full time on the project.

Other groups of growers such as orchid or rose growers have contributed money in the form of outright grants or assistantships to various institutions. These funds are ear-marked for research in the crop of interest to the contributors.

It is my suggestion that amaryllid growers give some thought towards establishing a grant or assistantship at a university where heat-treatment facilities have been established. The grants or fellowship should be set up specifically to investigate the application of heat treatment and tissue culture techniques towards the production of virus-free amaryllid plants and the multiplication of clones that are difficult to propagate by standard vegetative means.

If the techniques can be successfully applied to amaryllids, many important clones could be rendered virus-free. This is especially important where the clone is universally infected—a situation which develops when a new hybrid seedling becomes virus-infected since all vegetative propagations of the clone would also be virus-infected.

The advantage of developing virus-free stocks is that the buyer of amaryllids would be assured at the time of purchase that the bulb is virus-free.

However, it should be understood by both the commercial supplier of bulbs and the buyer that virus-free clones could be re-infected particularly under field conditions. Virus-free plants that are derived from infected plants are not immune to re-infection. Consequently, commercial growers and buyers would still need to apply preventative control measures.

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JET FLIGHT TO SEE DAYLILIES IN CHICAGO—1967

W. Quinn Buck, *Chairman, Daylily Committee,*
The American Plant Life Society

A suggestion that the exceptionally good season of 1967 would make it an ideal time to visit Chicago, coupled with an invitation and an offer to be guided by Mr. Clarence J. Blocher, caused your chairman to decide to make the trip and see the gardens from which have come so many important daylilies in recent years.

After an exhilarating flight, our plane reached O'Hare Airport shortly before 4 P. M. on July 19, and Mr. Blocher met us and took us immediately to Mission Gardens in Techny, where we met Bro. Charles and some of his prominent visitors, including Dr. Robert A. Griesbach, Dr. George M. Darrow, Mrs. W. T. Hardy from Alabama, and others. Bro. Charles' tetraploid daylily seedlings were quite overwhelmingly wonderful, as we had been told that they would be. From here we hurried to Northbrook to have a brief look at the Orville W. Fay garden before it got too dark. We were pleased to get to meet Mr. and Mrs. Fay and their guests and to get to visit for a while after seeing the daylilies, which we found extremely exciting because of the wider color range included in the Fay tetraploids. When poor light drove us in, we had a chance to see Mr. Fay's collection of Dykes Medals and Stout Medals, and other treasured possessions.

At our motel in Wheaton we found that R. W. Munson, Jr., and his mother Mrs. Munson, Sr., and a young niece had arrived from Florida in the afternoon. More daylily talk was in order, until quite late.

On Thursday the whole party went first to Mission Gardens for a longer and better look at Bro. Charles' incredible melon seedlings, and we found many more new ones open. Steve Moldovan had arrived from Ohio and was in the field studying the seedlings. We went next to Mr. Fay's for a good look at his field in the hot, bright sun. The delightful thing to see again was the color range, as well as the unexpected colors to be gotten from crosses of 'Crestwood Lucy' and 'Gertrude Smith' with other clones.

The next stop was at the Nathan H. Rudolph garden in Aurora, where we found disappointingly little in bloom as yet. Then after seeing Mr. Blocher's gardens in Wheaton, we had a buffet luncheon in their home. We found Mrs. Blocher to be one of those very important wives who do much of the pollinating.

Our next stop was the too small back yard of Dr. Robert A. Griesbach in Park Ridge. The color spectrum of the tetraploid seedlings here was very wide, with impressive numbers of good reds, roses, and pinks; high quality yellows, golds, and melons were here also, but they were in the minority. Our visit had to be unsatisfactorily short as this garden warranted extended close study.

The last garden of the afternoon was the James E. Marsh garden in Chicago, famous for both iris and daylilies. The whole backyard was

a mass of bright color as all the various beds seemed to be in full bloom. Nearer the house the beds contained a large number of named clones and superbly grown clumps of the Marsh daylily introductions. Further back the beds contained seedlings, both diploid and tetraploid. We got to see other beds of seedlings being grown in the yards of good neighbors. Our regret here, too, was that we had had so little time in which to try to see so much.

Friday was spent mainly in close study of the plants at Mission Gardens, where many new seedlings were opening each day. In the afternoon there was another visit to the Fay garden, which needed rain.

Saturday morning was likewise spent taking notes on Bro. Charles' fine display. Among visitors at Mission Gardens were old acquaintances, Mr. George Gilmer from Virginia, and Mr. George P. Watts from New York. Mr. Watts was kind enough to take me along for a brief visit with the David F. Halls in Wilmette. It was a privilege to meet Mr. Hall and see his garden full of favorite varieties, many of which looked very different in a rain-watered garden in Illinois as compared with how they grow in irrigated California. 'Lady Inara', which has long been a favorite, was completely different in growth and stature, for example. 'May Hall', 'Wilmette', 'New Light', and many other fine clumps sparkled in this jewel garden among the old elms.

After our return to Mission Gardens a heavy thunderstorm ruined many of the flowers for the day. Mr. and Mrs. Blocher returned soon after from picking up their younger daughter at camp, and we spent much of the afternoon in the Blocher garden, ending with a final visit to Mr. Fay's and a last look at 'Beautiful Lady' and many others in his field. Sunday morning saw me at O'Hare Airport early and at home in Arcadia before noon.

In retrospect and from studying my notes, certain things stand out: Bro. Charles had many of the finest melon tetraploids so far developed, and some of his yellows were quite wonderful. One could not help wishing for more of other colors in his tetraploids, but it was especially interesting to be able to see several generations of great progress in the melons, with many of the finest 1967 seedlings coming from 'Heavenly Harp' ('Crestwood Ann' x 'Changing Times'). A few of these fine offspring would include T67-31; T67-2; T67-66, in beautiful scale; T67-51, a lovely greenish yellow of nice height and excellent branching. Other very attractive seedlings of the new crop included T67-50; T67-79, T67-43, a gold-edged melon; T67-53, a yellow; T67-47, a round, ruffled melon; T67-36, yellow; T67-38, an especially beautiful, round, deep melon; T67-60, very sunfast; T67-67, very sunfast pink melon of magnificent substance; T67-80, well branched, flaring ruffled yellow-melon with very pink midribs; T67-45, lovely pie-crust edged, flat, medium sized round melon; T67-37, an ardent apricot melon; T67-28, a lovely bright pink-and-green melon; T67-62, flat tangerine melon. Among Bro. Charles' diploids there were some nice creamy yellow such as 'Ascending Angel', to be released, and 'Crystal Sunshine'; or such

fine clones as 'Butter Curls', 'Little Rainbow', 'Cub Scout', and 'Toyland', this group being good miniatures. The truth is, however, that everything else was overshadowed by the tetraploids, no matter how good the diploids.

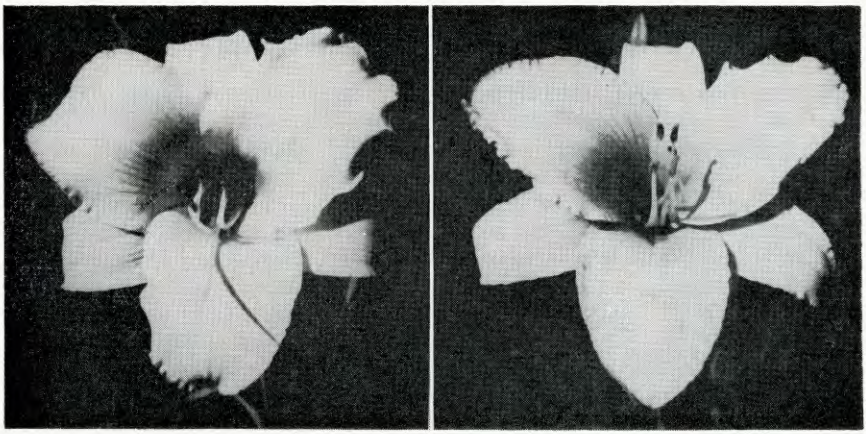

Fig. 2. Fay tetraploid daylily introductions: **left,** 'Kathleen Elsie Randall' (1965), and **right,** 'Lady Cynthia' (1966). Photos by Wallace D. Mulliken, M.D.

These two Fay tetraploid introductions are reported to be doing well in various sections of the country. In Arcadia the green-throated cream 'Kathleen Elsie Randall' may have been a bit more attractive than its sibling 'Lady Cynthia', but 'Lady Cynthia' set many more seed pods in 1967. These two of the very finest of the Fay introductions from the Northbrook garden which has been contributing some of our most important tetraploid daylily parents in recent years.

The Fay seedlings could not be studied so closely as Bro. Charles', but there were many delights among them, such as the 1967 releases, 'Mary Todd', which Mr. Fay considers his finest yellow to date, and 'Golden Surrey', which should be an interesting parent because of the fringed edges of its tepalsegs. A few of the good new yellows were T67-36, T67-12, T67-18, and T67-22. T67-6 was a nice creamy melon, and T67-19 was a fine small apricot melon. From previous seasons, FT65-10 and FT65-32 were fine yellow parents; T65-9, T65-41, and T65-55 were fine rose colors; FT65-23 was a somewhat narrow petaled rose that showed promising color for breeding. T66-13 was an especially beautiful salmon; T64-17 was a beautiful pink; FT66-38 was a good red, showing less sunburn than many of the seedlings in this difficult color.

Everywhere were evidences of Mr. Fay's meticulous care and strict evaluations. Among his diploid seedlings were many, such as 'Beautiful Lady' and many of her offspring, that were amazingly fine not to have been released at all, and they merited further attempts at polyploidizing them so that they could be used in widening Mr. Fay's breeding program.

The tetraploids of Dr. Griesbach will gain real attention when they are disseminated and can be seen.

The really great progress of the tetraploid daylily and a promise of further and snowballing progress were the main conclusions drawn from this first trip to Chicago.

IN MEMORIAM—MORRIS WALKER CLINT, 1903—1967

It is with profound sadness that I must report the death of Morris W. Clint to readers of PLANT LIFE, on April 8th, 1967. Morris was the husband of Katherine Lamberton Clint, the "other half" of the man-wife team of plant enthusiasts, lovingly known to our readers as "The Clints". Readers of PLANT LIFE will recall the many plant exploration trips that he and his wife, Kitty, shared in Mexico the past decade or more and which actually began in 1946 when Morris accompanied a friend on an orchid collecting trip. Morris was bitten by the "collecting bug" and returned home to infect Kitty. They never recovered. Their joint efforts resulted in a vast collection of plants that would do justice to a botanical garden, and visitors were usually stunned speechless upon seeing it for the first time. Kitty always seemed to be calmly amused by this reaction, but Morris seemed to capture the enthusiasm, seeming to be as delighted with it all as if it were he seeing it for the first time. Few visitors ever left the Clint estates empty handed. While Kitty continued conducting the tour, Morris would slip silently away, returning with samples of plants that the visitor might have been raving over a few minutes earlier.

Morris died at the age of 64, after several years of living with a circulatory problem that had greatly curtailed his garden activities, and had stopped any further ventures of plant explorations in Mexico. His survivors include his wife, Kitty; two sons, Morris, Jr. and Alan M. Clint, both of Brownsville; a daughter, Mrs. Marcia Wilson of Galveston; and seven grandchildren.

The APLS and the plant world in general have been left poorer with his passing, and he will be sorely missed, but those who knew and loved him will be richer for the experience.—*T. M. Howard*

IN MEMORIAM—CHARLOTTE MILLIKEN HOAK, 1874—1967

Miss Charlotte Milliken Hoak died Sept. 3, 1967, in Pasadena, Calif., after seeming to be recovering from pneumonia. She would have been 93 on Oct. 24, 1967. She was buried in Evergreen Cemetery in Mendecino on Sept. 8. Miss Hoak was born in Comptche in Mendecino County, Calif., and grew up there. After attending the University of California in San Francisco, where she received a Master's degree, she moved to Los Angeles, where she taught botany and horticulture in the public schools for over 50 years.

Miss Hoak was particularly interested in the *Amaryllidaceae* and bulbs of all kinds, and many of her botanical, gardening, and horticul-

tural writings dealt with them. She was a regular contributor to certain publications for many years, and she remained quite active in many areas of horticulture and garden club work up until just a few years ago. Miss Hoak is to be remembered as one of the real pioneers of California horticulture, along with Cecil Houdyshel, Carl Purdy, Theodore Paine, Kate Sessions, and a few others like them.—*W. Quinn Buck*

IN MEMORIAM—EDWARD FRANCIS AUTHEMENT, 1909—1967

Edward Francis Authement, our registrar of Amaryllis names, died suddenly on Sunday, July 20, 1967 at the age of 58 years. He had been hospitalized for quite some time and was apparently progressing nicely when he contracted pneumonia in mid-July which proved to be a load he was unable to cope with.

Fig. 3. Edward Francis Authement, 1909-1967

Mr. Authement was born in Cut Off, Louisiana, on March 12, 1909 where he attended local elementary schools and then attended La Rose High School in La Rose, Louisiana. Shortly after graduation, he moved to New Orleans and was employed by the Lone Star Cement Corporation in the capacity of diesel engineer.

On December 7, 1929 he married Miriam Gouget and three children were born of the marriage. He remained with the Lone Star Cement Corporation until December 1960, when he retired from that position. In October 1964 he accepted a position with the Sewerage and Water Board of New Orleans and held that position until his final illness caused his retirement therefrom in March 1967.

Fig. 4. Mr. Thomas I. Dickson, the American Vice Consul at Cochabamba, Bolivia, presenting the 1967 William Herbert Medal to Dr. Martin Cardenas on behalf of the American Plant Life Society, September 22, 1967. Photo *Los Tiempos,* Cochabamba, Bolivia.

For the past several years Mr. Authement had held the important office of Registrar of Amaryllis Names in the American Plant Life Society which he administered with efficiency and to the satisfaction of all the members. It was largely through his efforts that the "Catalog of Hybrid Amaryllis Cultivars, 1799-1963" was published in 1964. He reformed the exhibition schedule for the staging of Amaryllis shows.

He was a member of the Men's Amaryllis Club of New Orleans, having joined the organization shortly after its inception. He had held

various offices in the Club and was a member of the Board of Directors. He had served once as Show Chairman at the annual show, and also served for a number of years as Chairman of the Classification Committee. In connection with his position as Registrar of the American Plant Life Society, he had given numerous lectures and was always happy to oblige any organization that requested any information or services concerning Amaryllis. He also held membership in the Louisiana Society for Horticultural Research and had attended many of the annual meetings of that Society conducted by the late Ira S. Nelson.

Needless to say, he was held in high regard and esteem by all who knew him and his passing will mean a great loss to the Men's Amaryllis Club of New Orleans, and also to the officers and members of the American Plant Life Society.

Mr. Authement is survived by his wife, Mrs. Miriam Gouget Authement, two daughters, one son, two sisters, two brothers, and twelve grandchildren.—*James E. Mahan*

HERBERT MEDAL PRESENTATION TO DR. MARTIN CARDENAS

In a ceremony at the *Centro Boliviano Americano,* the American Vice Consul Mr. Thomas I. Dickson, presented the 1967 WILLIAM HERBERT MEDAL to Dr. Martin Cardenas, September 22, 1967, on behalf of the American Plant Life Society. The event was covered by the United States Information and Cultural Services, and the newspaper, *Los Tiempos,* of Cochabamba, Bolivia. The readers are referred to the 1967 issue of the Amaryllis Year Book for the autobiography of Dr. Martin Cardenas. See Fig. 4.

TRAUB—**AMARYLLIS NOTES,** continued from page 50.

Haemanthus magnificus forma *gumbletonii* (Bak.) Traub, *comb. nov.* Syn.—*Haemanthus magnificus* var. *gumbletonii* Bak. Amaryll. 66 1888.

Haemanthus magnificus forma *insignis* (Hook.) Traub, *comb. nov.* Syn.—*Haemanthus insignis* Hook. Bot. Mag. pl. 4745. 1875.

Haemanthus magnificus subsp. *superbus* (Bak.) Traub, *comb. nov.* Syn.—*Haemanthus magnificus* var. *superbus* Bak. Amaryll. 66. 1888.

Haemanthus puniceus subsp. *membranaceus* (Bak.) Traub, *comb. nov.* Syn.—*Haemanthus membranaceus* Bak. Amaryll. 66. 1888.

PLANT LIFE LIBRARY—continued from page 4.

TREES AND SHRUBS OF MILLS COLLEGE, by Baki Kasaphigil. Mills College Publ. Office, Oakland, Calif. 94613. 1967. Pp. 56. Illus.-map. Paper, $1.95. This book lists with brief descriptions, 449 species or varieties of trees and shrubs, grouped under 236 genera, and 93 families, growing on the 127 acre campus of Mills College. Highly recommended.

EVOLUTIONARY BIOLOGY, VOL. I., edited by Th. Dobzhansky, M. K. Hecht and Wm. C. Steere. Appleton-Century-Crofts, 440 Park Av. S., New York, N. Y. 10016. 1967. Pp. 444. Illus. $14.00. Since evolutionary biology represents a unifying principle in the life sciences, the subjects covered in this series draw on various disciplines. In the first volume the subjects include chemical evolution; evolution of brain achievements; variation and taxonomy of the early hominids; adaptive radiation and trends of evolution in higher plants; permanent heterozygosity; use of computers in studies of taxonomy and evolution; chemical systematics; and genetic loads in maize and other cross-fertilized plants and animals. This stimulating volume is required reading for all biologists.

THE PHYSIOLOGICAL CLOCK, 2nd revised edition, by Erwin Buenning. Springer-Verlag New York, 175 5th Av., New York, N. Y. 10010. 1967. Pp. viii; 168. Illus. paper, $3.00. This series is designed for the scientist and also for interested laymen with some basic understanding of the sciences. In the first volume, the biological measurement of time by unicellular organisms, higher plants and animals, including man, which utilize periods of approximately 24 hours, is covered. The author discusses the present state of our knowledge of the physiological nature of this clock and the many means by which organisms use this mechanism.

SUNSET WESTERN GARDEN BOOK, by the Editors of Sunset Magazine, and Sunset Books. New Edition. 1967. Lane Books, Willow Rd., at Middlefield Rd., Menlo Park, Calif. 94025. Pp. 448. Illus. $5.95. This new edition of an outstanding practical gardening manual for the West will be welcomed. It outlines the West's 24 climatic zones; indicates how to grow and select plants for particular situations, garden color, and special effects. A gardener's glossary, an encyclopedia of 5,000 plants, and a subject index complete the book. Highly recommended to all gardeners.

GARDENING IN CONTAINERS, by the Editors of Sunset Magazine and Sunset Books. Lane Books, Willow Rd., at Middlefield Rd., Menlo Park, Calif. 94025. 1967. Pp. 96. Illus. Paper, $1.95. This attractive and profusely illustrated manual for growing plants in containers will be welcomed by all gardeners. The subject matter is grouped under four headings: (a) what is container gardening; (b) how to garden in containers; (c) what plants thrive in containers and (d) where to put them and how to use them. Highly recommended to all gardeners.

ADVENTURES WITH FLOWERS, by Elizabeth T. Billington. Frederick Ware & Co., 101 5th Av., New York, N. Y. 10003. 1967. Pp. 60. Illus. $2.95. This attractive book introduces children to an appreciation of flowers by giving brief historical notes; points for recognition of flowers, flower families, and managing a flower show; and brief references to flower myths, legends, etc. Highly recommended as a gift book for children.

NEW TRENDS IN FLOWER ARRANGEMENTS, by Rae L. Goldson. Hearthside Press, 381 Park Av. S., New York, N. Y. 10016. 1966. Pp. 122. Illus. $4.95. This profusely illustrated text on the new way for making flower arrangements by an outstanding authority will be welcomed by all interested in this subject. The topics discussed include good design; texture; variety, function; abstraction; simplicity, etc. Highly recommended.

CREATIVITY IN FLOWER ARRANGEMENT, by Frances Bode. Hearthside Press, 381 Park Av. S., New York, N. Y. 10016. 1967. Pp. 160. Illus. $5.95. This book recognizes the trend which demands that the floral arrangement has to be a creative work of art. The topics discussed include craftsmanship; bases and stands; plant materials; accessories; the art of observation, and personal expression. This beautifully illustrated book is very highly recommended.

PLANT LIFE LIBRARY—continued on page 32.

1. REGIONAL ACTIVITY AND EXHIBITIONS

THE 1967 AMARYLLIS SHOWS

The Official Amaryllis Shows for the year 1967 began on April 8-9 with the New Orleans Men's Amaryllis Club Show. The Garden Circle Amaryllis Club of New Orleans Show was held on April 15-16. Then followed the Greater Houston Amaryllis Show on April 16; the Hattiesburg (Miss.) Amaryllis Show on April 22; the Corpus Christi (Tex.) Amaryllis Show on May 3; and the Southern California Amaryllis Show at Arcadia on May 22-23. Mrs. Pickard reports that the peak of bloom was reached too early for the scheduled date of the Houston Amaryllis Society Official show, but fine blooms won high honors in some of the local flower shows, and individual gardens of members were opened to the public where many fine specimens were displayed. No report was received from the Greater Gulf Amaryllis Show (Mobile, Ala.), and it is assumed that this show was not held in 1967.

MEN'S AMARYLLIS CLUB OF NEW ORLEANS OFFICAL SHOW, 1967

James E. Mahan, *Show Standards Chairman,*

3028 Palmyra Street, New Orleans, Louisiana 70119

The Edward Hynes School, 990 Harrison Avenue, was again the scene of the official Amaryllis Show held by the Men's Amaryllis Club of New Orleans, Inc., on April 8 and 9, 1967. The winter was considerably milder than those of the past several years which contributed, perhaps, towards the increased number of entries received for the show, 185 in all. An increase was also noted in the number of visitors to the show.

As in the previous year, the show schedule was formulated to accommodate the nine Amaryllis divisions set forth by the American Amaryllis Society and to satisfy their requirements for an official show. Members of the Men's Amaryllis Club of New Orleans, Inc., accounted for a total of 118 ribbons, comprised of 32 blue, 35 red, 32 yellow and 19 white. The following trophies were given: the Walter Latapie award for the best registered and named specimen to Edward Beckham; the Norman Clements award for the best unregistered and unnamed specimen to Edward Beckham; the James Mahan award for sweepstakes winner in named and registered section to Milo Virgin; the Reuter Seed Company award for sweepstakes winner in unregistered and unnamed section to Milo Virgin; the Alatex Construction Service, Inc., award for the best home-bred, developed and grown specimen to Milo Virgin; the Swetman Amaryllis Garden award for sweepstakes winner in the registered and named sections, potted and cut specimens, to Milo Virgin; the President's trophy for most blue ribbons won by a club member to

Milo Virgin; and a club trophy for the winner of the best single floret specimen to Edward Beckham (open to club members only). A section was initiated this year to receive plants bearing scapes with two florets, which falls under the arrangements category. Special ribbons were awarded where deserving.

Through the courtesy of Mr. Emile Malbrough a display of rex begonias was set up in the foyer of the school and was very well received by the visitors to the show, estimated to be between 400 and 500. The heartfelt thanks of the club go to Mr. Malbrough for his kindness.

Messrs. Norman Clements and W. J. Perrin acted as show chairman and co-chairman, respectively, and the club's thanks go to them and to all others participating in the show for helping to make it the great success that it was.

1967 OFFICIAL GARDEN CIRCLE AMARYLLIS CLUB SHOW

Mrs. A. J. Haydel, *Chairman,*

516 Gordon Ave., New Orleans, La. 70123

The sixteenth Official Amaryllis Show of the Garden Circle Amaryllis Club was held on Saturday and Sunday, April 15-16 with Mrs. A. J. Haydel as Chairman and Mrs. A. R. Oddo, President and Honorary Chairman.

This show was held in conjunction with the Federated Council of New Orleans Garden Clubs Show at the Club House of the picturesque Fair Grounds and attendance was very large. Early Spring weather, along with a late date, however, held down entries in the Amaryllis section of the show.

Trophy winners were Milo Virgin, Mrs. Edna Dopp and Mrs. W. J. Perrin. Preliminary Commendations were awarded to Mrs. A. J. Haydel and Milo Virgin.

GREATER HOUSTON OFFICIAL AMARYLLIS SHOW, 1967

Mrs. Sally Fox, *1527 Castle Court,*

Houston, Texas 77006

"Birds and bees" spelled out the theme of The Greater Houston Amaryllis Club's fifth official show, "Amaryllis Romance", in the Garden Center on Sunday, April 16, 1967. An overflow crowd showed interest in viewing over 100 various type amaryllids, with the point of interest being the table with the silver trophies, along with Awards of Merit, for the best of each division in the show. Winners were:

Mr. Kermit L. Warnasch, 4018 Drummond—Ludwig Challenge Cup for Royal Dutch. Mrs. Chas. H. Pease, 11059 Timberline—Greater Hous-

ton Amaryllis Club trophy for Helen Hull, a double amaryllis. Mrs. Clint R. Black, 1832 Forest Hill—Covered dish for Sparkling Gem, a miniature. The above three were also awarded Awards of Merit from the American Plant Life Society.

Mrs. John Ellett, 7531 Satsuma—Silver plate for Seminole Red, an American hybrid. Mr. Kermit L. Warnasch, 4018 Drummond—Wagner tray for Sweepstakes Award. Mr. Kermit L. Warnasch, 4018 Drummond—Silver shell for best Dutch Seedling he hybridized, plus Preliminary Commendation from American Plant Life Society. Mr. John Ellett, 7531 Satsuma—Silver plate for best in Invitational Class—Queen Superiora.

Fig. 5. Greater Houston Amaryllis Show, 1967. Mr. Kermit L. Warnasch, winner of Ludwig Challenge Cup with 'Royal Dutch' along with Award of Merit.

Mrs. Clint R. Black, winner of silver trophy for 'Sparkling Gem', a miniature along with Award of Merit.

Mrs. R. H. Haase was Staging Chairman, and was assisted by Mrs. Glen Melton. Their interpretation of the theme added a whimsical note to the show. The focal point was a large tree decorated with white birds, while the busy bees and colorful butterflies perched on the amaryllis blossoms in the garden in the center of the auditorium.

Mrs. Chas. H. Pease prepared the Educational Exhibit which was a very popular part of the show. She had containers on the table, each with the correct portions of ingredients to make a good loamy soil for planting the seeds. She explained they were heavy feeders and as soon as they were established in the pot to feed at regular intervals. Other containers, to which the seedlings had been transferred at various stages of growth showed the progress through approximately two to three years growth, when they were developed sufficiently to produce a bloom, adding that some seedlings bloom as early as eighteen months, while

others take longer. On the table was a specimen of a cross between a Dutch and a Mead, which the public could evaluate for beauty of the Dutch parent and sturdiness of the American parent. She also had a pure Dutch seedling as well as a species and a Miniature. All in all, the public was quite interested in producing some of these glamorous blossoms from seed and asked many pertinent questions.

Mrs. Sally Fox and Mrs. J. F. Denison, in charge of Entries, felt that it is very evident that members are striving for something new in amaryllis, as the register revealed there were 12 Dutch seedlings and 3 American seedlings competing for the silver trophy and Preliminary Commendation from the American Plant Life Society. Also, visitors were able to see amaryllis grown commercially in Africa and India in this show. Incidentally, the seedlings received unusually high grades from the judges, with the winner, Mr. Warnasch getting 97 points for his very large pink blend seedling. The second highest score of 96 was given to the darkest black-red blossom any of us have seen, which was hybridized by Mrs. R. A. Fawcett, who was awarded a Preliminary Commendation certificate.

Arrangements, showing the effectiveness of amaryllis, made by the members, were placed on pedestals on each side of the stage. These were not judged and merely added beauty to the show.

Mrs. W. S. Wheeler, 4506 Bellaire Blvd., is President of the Club, and assisted the Show Chairman, Mrs. Clint R. Black.

The members felt they gained many new amaryllis fans who will add these bold, colorful blossoms to their gardens. Our Invitational Class held twice as many specimens this year which is an indication that last year's show was successful in getting some new growers who wanted to compete for the silver trophy.

OFFICIAL HATTIESBURG AMARYLLIS SHOW, 1967

Mrs. Sam Forbert, *1910 Evergreen Lane, Hattiesburg, Miss. 39401*

The Hattiesburg Amaryllis Society held its seventh Annual Show April 22, 1967 in the beautiful and spacious home of Mrs. Lloyd Bond on Memorial Drive. The show which was open to the public from 3 p.m. to 8 p.m. attracted several hundred Amaryllis fans.

The exhibit was in the form of a Placement Show, the first of its kind for our Society. This type show, which is used extensively by garden clubs, proved most successful, as it afforded visitors to the show an opportunity to note the adaptability of the Amaryllis to the interior decor as well as to the garden. Near the entrance to the Bond home was a miniature cornice with draped curtains announcing the theme of the show, Curtain Call For Amaryllis. Both potted and cut scapes of many varieties of amaryllis were exhibited in the carport and on the patio. Blooms were classed according to division instead of country of origin as done in previous shows.

Seedlings exhibited were of the finest quality and won many Preliminary Commendations. The Amaryllis judged best in the show was

a seedling grown by Mrs. Gladys Coursey of Moss, Mississippi, a Member of the Society. Mrs. Leonard T. Brown was Sweepstakes Award winner with twenty three blue ribbons. Three Award of Merit Certificates were placed on her 'Red Coral', 'Flora Queen' and 'Picotee Red Lining'.

Mrs. Brown also won the Swetman silver tray, a Traveling Trophy, awarded by Swetmans' Amaryllis Nursery of Gautier, Mississippi. Door prizes were Dutch bulbs donated by Mr. Robert D. Goedert, bulb dealer of Jacksonville, Florida. Throughout the home there were many competitive artistic designs made by members of the Society. Each room had a theme, in keeping with the general show theme. Magnificent Obsession was the theme in the foyer. Mrs. Sam Forbert made the design here which won the Tri-Color Award. Mrs. J. O. Mayo won the Creativity Award. This design in the den of the home had as its theme, South Pacific.

Punch and cookies were served on the patio during the afternoon and evening.

Judges for the Horticulture Division of the show were: Dewey W. Hardy, Mr. & Mrs. Jeff Brown and Mrs. H. A. Allen of Mobile, Mrs. Mittie Young, Wilma H. Smith and Betty Hardy of Chickasaw, Alabama. Artistic Designs Judges were Mesdames Curtis Knight, Tom Mayfield and S. K. Ward of Taylorsville, Mississippi. Show Chairmen were Mrs. Charlie Bell and Mrs. R. A. Fowler.

1967 OFFICIAL CORPUS CHRISTI AMARYLLIS SHOW

Mrs. Carl C. Henny, *Vice-President*
P. O. Box 3054, Corpus Christi, Texas 78404

The Coastal Bend Amaryllis Society held it's annual Amaryllis Exhibit in conjunction with the Lola Forrester Flower show which was held in the Exposition Hall on April 15th and 16th, 1967. We are pleased to report that our weather conditions were much milder this year but rain is needed very badly in this area of Texas. However we were fortunate in having 67 entries of Amaryllis, mostly cut scapes, as our potted plants had bloomed ahead of time. In fact we had only four Pot Grown Registered Leopoldii Type Amaryllis in the Exhibit—namely, 'The Alamo', 'Indian Orange', 'American Express' and 'Picotee'.

Among the Registered garden grown Leopoldii Type Amaryllis were: (cut scapes) :—'American Express', 'Apple Blossom', 'Beautiful Lady', 'Cardinal', 'Daintiness', 'Goliath', 'Ludwig's Dazzler', 'Margaret Rose', 'Royal Dutch', 'Peppermint', 'Picotee Square Dance', and 'Spring Dream'. Among the Miniature Gracilis type were: 'Constant Comment' and 'Firefly'.

Mrs. Levi Materne received a blue ribbon on her entry of Picotee, pot grown, which scored 96 points. She was also given an American Plant Life Society Award of Merit for this specimen, and received a Preliminary Commendation Award on her entry of *Amaryllis belladonna* which scored 95 points. Mrs. Materne is a club member.

Mrs. Carl Henny received the "Ludwig Challenge Cup" for her entry of "garden grown" Leopoldii "Picotee Square Dance" cut scape which scored 95 points—a blue ribbon winner; and received a blue ribbon also on her 'Spring Dream' garden grown registered cut scape, which gave her the most blue ribbons in this section of the exhibit. Mrs. Henny also received the American Plant Life Society Award of Merit for her 'Picotee Square Dance' entry. Mrs. Henny is a club member.

Fig. 6. Corpus Christi Amaryllis Show, 1967. Mrs Carl C. Henny, winner of Ludwig Challenge Cup for her garden grown Leopoldii "Picotee Square Dance" cut scape which scored 95 points.

Mrs. Charles W. Sanders, a non-member, received the Award of Merit for the most outstanding entry within the Amaryllis Section, which was 'Apple Blossom', scoring 97 points; also a Special Trophy given by our Amaryllis Society to a non-member who receives the most blue ribbons in the registered and named amaryllis classes. She also received the American Plant Life Society Award of Merit for her cutscape—'Apple Blossom'.

Mr. Fred B. Jones, club member, received the American Plant Life Society Preliminary Commendation Award for his cut-scape entry in the Breeder's Class Seedling, which scored 95 points.

Thirty blue ribbons were awarded specimens entered. Three Accredited National Amaryllis Judges from San Antonio,—Mrs. E. T. Storey, Mrs. Robert E. Herold, and Mrs. R. H. Parkinson, judged our Exhibit.

1967 SOUTHERN CALIFORNIA OFFICIAL AMARYLLIS SHOW

V. Roger Fesmire, *Show Chairman*

The third Amaryllis Show of the Southern California Hemerocallis and Amaryllis Society was held on May 22 and 23, 1967, at the Los Angeles State and County Arboretum, 301 N. Baldwin Ave., Arcadia, California. The most remarkable aspect of this show was the fact that we even had one, since the majority of our Amaryllis are grown outside. After an unusually cold spring, the week preceding the show was filled with wind, rain, hail, and cloudiness. The show was convincing proof that Amaryllis flowers can weather the storms and still look presentable.

Fig. 7. Southern California Amaryllis Show, 1967. A portion of the exhibits. Photo by Margie Sellers.

The Cecil Houdyshel Memorial Trophy, which is the sweepstake prize, was won by Mr. W. Quinn Buck of Arcadia, with the runner-up being Mrs. Flores Foster of Long Beach. Many hundreds of visitors viewed the exhibits during the two days, and by an overwhelming majority selected as the most outstanding exhibit a beautiful double Amaryllis raised from seed by Mr. J. Leonard Doran of Burbank. This was a pure white flower edged and spotted lightly with crimson, and it was the highlight of the show without any question, receiving the President's Award. An American Amaryllis Society Award of Merit was given to a hugh plant of 'Piccardy', having four magnificent blooms, which was grown by Mr. W. Quinn Buck in his greenhouse.

A table of miniature Amaryllis attracted much attention, making it apparent that the public is beginning to appreciate the smaller-flowered Amaryllis. One well-known nurseryman remarked that this table was "the dessert" of the show. One particularly beautiful plant in this miniature section was a hybrid between 'Tangerine' and *A. striata fulgida*, having a perfect Leopoldii type flower with a ruffled edge; it was raised from seed by Mrs. Bert Williams of South San Gabriel. Another table attracting much interest was an educational exhibit, showing how to cross pollinate the flowers and raise Amaryllis from seed.

Special Awards were given to Mrs. Bert Williams, Mr. Walter Horsey, and Mr. John A Moromarco for the large quantity of cut specimens which each entered in the show, thus contributing materially to its success. A Special Award was also given to Mr. E. A. Angell, who was a show visitor and exhibitor, in recognition of his more than thirty years of Amaryllis breeding in Southern California. Special mention should also be made of one of our members, Mrs. Eleanor McCown, who came more than 200 miles to enter her exhibits. Among her other entries, she prepared and entered three arrangements of Amaryllis, all of which received ribbons.

A Special Award was also given to the Chadwick Gardens of Redondo Beach for their non-competitive exhibits. In addition to some superb cut specimens and potted plants, they entered eight beautiful arrangements, demonstrating how Amaryllis blooms can be used by the florist in every type of floral design work. The bouquets to be carried by a bride and her attendants attracted particular attention. Our Society wishes to publicly express its appreciation to the Chadwicks for helping each year to make the show a success.

HOUSTON AMARYLLIS SOCIETY—HOUSTON, TEXAS

Mrs. A. C. Pickard

Nine years have now rolled into history since the day the Houston Amaryllis Society was organized. Yet, today there is greater enthusiasm, rapture and there are thrills without bounds as new hybrids are grown in the garden.

Fig. 8. Country garden of Dr. E. M. Yeats, Member of Houston Amaryllis Society, showing view of part of a thousand plants in bloom, 1967.

Every tint, shade and tone is reflected in modern day hybrids and every blend has a charm of its own to bring joy and excitement wherever the Amaryllis is known.

The gardens reached their peak much too early for the scheduled date of the official show. The membership felt we would not lower our standards by staging blooms that were not exhibition quality. However, nice cultivars won high honors in some few local flower shows.

Individual gardens of members were opened with many fine specimens. By re-visiting the gardens, we were able to see many prime blooms that were not open on previous visits. Amaryllis enthusiasts and garden lovers came to study and admire the colorful flowers and extensive experimenting under way.

So many fine Dutch Amaryllis seedlings of first quality bloomed this spring that it is difficult to select those which are worthy of being introduced. Some of the gardens contained many of the older Dutch hybrids still as lovely as when they were planted more than twenty years ago.

The most important feature was the effort to encourage the *garden growing* of Amaryllis and to increase garden programs as well as garden judging. The effectiveness and value of growing quality Amaryllis in this manner also helps to raise the floricultural standards of the community.

A bird's eye view of the country garden of one Houston Amaryllis Society member, Dr. E. M. Yeats, boasts of more than one thousand blooms and in a small corner of the city garden of Mrs. A. C. Pickard, several hundred fat buds nestled in deep shining foliage, soon to put on a show all their own.

We hope many of you will plan to be our guests in the coming years when we again try to reach the peak of perfection with a wealth of material to choose from. These beautiful blossoms seem to whisper, "God's presence is near".

BASIC INFORMATION FOR THE AMARYLLIS SHOW SCHEDULE

Mrs. A. C. Pickard,
Official Amaryllis Judging Instructor

It is appropriate to outline a pattern of organization and method of procedure that may be helpful to all local committees in conducting Amaryllis Shows in the future. The actual schedule should have the approval of the American Amaryllis Society itself and should not be changed from year to year in any way except as certain features related to the local situation might be added or deleted.

The following material is meant to be suggestive of most of the details to which show officials and exhibitors must give attention.

CULTURAL PERFECTION, CONDITION, GROOMING AND SUITABLE CONTAINERS

The beauty of horticulture should depend upon cultural perfection and natural appearance at the time of judging. Foliage, if present, should be clean and fresh, but not artificially polished. Spent florets and scapes should have been carefully removed. Any necessary staking should be done as inconspicuously as possible and related in color. No stakes should protrude above the florets.

Containers may be either clay pots or wooden planters, although clay pots are preferred in relation to the good culture of the plant. Clashing colors, such as brilliant glazed pots, shiny foil, etc. detract from the plants' color and should be eliminated. The light reflection of shiny, unsuitable material is also a great hindrance in photography Cultural malpractice is often concealed in a covered pot and reflected in a plant's appearance. Suitable, clean containers are allowed 10-15% of the cultural perfection points.

The size of containers should be proportioned to plant size and should not look overpotted so as to seem lost in the container.

Containers for cut specimens should be provided by Flower Show Committee and be of uniform size.

Artistic Divisions Classes, although not compulsory, add to the appearance of the show. The situation will vary greatly from place to place. Remember—the judging of these classes requires a different panel of judges.

EDITOR'S MAIL BAG

The new address of Sydney Percy-Lancaster as of January 1, 1967, is *Indian Botanic Garden, P. O. Botanic Garden, Sibpur, Howrah, near Calcutta, India.* He writes, "I had already spent 61 years there before I went to the National Botanic Garden Lucknow, so will be among old friends."

Dr. W. W. Zorbach, formerly of Kensington, Maryland, writes under date of July 25, 1967, "I dug up all my bulbs in June and packed them in vermiculite; they were shipped with our furniture and arrived intact. I have been struggling with a suitable bed for them, but have been hampered lately by heavy rains, so they are not planted yet. Hopefully, in about a week I can get to the job before they expend *all* their energy in growth. . . . My new address is *4109 Walnut Drive, New Iberia, Louisiana 70560.*"

The January 11, 1967 issue of Farmer's Weekly, Bloemfontein, South Africa, features a color plate of Mr. Leon Boshoff-Mostert's new Hybrid *Amaryllis* clone which he plans to use in his breeding operations. The issue also contains a tribute to Mr. Boshoff-Mostert on receiving the Herbert Medal, and an article about his hybrid *Amaryllis* which is profusely illustrated in color. The same issue also includes a

color plate of *Haemanthus brevifolius* (=*Haemanthus carneus* (Ker.-Gawl.) Salisb.), and *Cyrtanthus sanguineus.*

AMARYLLIS JUDGES CERTIFICATES

Since the last report in the 1967 Amaryllis Year Book (pages 31 and 32), the following numbered Amaryllis Judges Certificates have been issued by the American Amaryllis Society:

167. Mr. E. M. Yeats, 7911 Baltimore Av., Houston, Tex. 77012 (Horticulture only)

168. Mr. V. Roger Fesmire, 16938 Elgar Av., Terrance, Calif. 90504 (Horticulture only)

169. Mrs. Kenneth B. (Polly) Anderson, 4810 Palm Drive, La Canada, Calif. 91011 (Horticulture only)

CATALOGS RECEIVED

KLEINSKUUR, 1966-67, 28-PAGE CATALOG, with 4 color plates, and other illustrations, featuring Hybrid **Amaryllis, Hemerocallis,** Tall Bearded **Iris,** and other **Iris;** and some miscellaneous plants and bulbs. Address: Leon & Frieda Boshoff-Mostert, Kleinskuur, P. O. Box 84, Balfour, Transvaal, Republic of South Africa.

UNIVERSITY HILLS NURSERY, 1967-68 SEASON CATALOG, Claude W. Davis, Proprietor, 470 Delgado Drive, Baton Rouge, Louisiana 70808, 23 pages listing **Amaryllis, Iris, Hemerocallis,** Crinums, Crinodonnas, **Zephyranthes, Kniphofia,** native trees and shrubs. Future catalogs will be ready for distribution about August 1 of each year, but will no longer be sent to the permanent mailing list. A free copy will be sent on request.

HYBRID AMARYLLIS CATALOG, Aug 1967. Robert D. Goedert, P. O. Box 6534, Jacksonville, Fla. 32205. (A) Dutch Strain Amaryllis seed; special crosses; (B) South African grown Hybrid Amaryllis; (C) Dutch Grown Hybrid Amaryllis—Van Meeuwen Strain; and (D) Imported Dutch grown hybrid Amaryllis—Super-Brand.

LUDWIG AMARYLLIS (17th EDITION), Ludwig & Co. N.V., P. O. Box 18, Hillegom, Holland. (received August 21, 1967); 32 pages and cover, profusely illustrated in color; listing the current offerings of hybrid named registered Amaryllis clones, and **Cyrtanthus purpureus** (syn.- **Vallota speciosa**).

AMARYLLIS LECTURES & JUDGES CERTIFICATE SCHOOLS

Local Amaryllis Clubs and Societies interested in having lectures on Amaryllis Culture, and schools for the Amaryllis Judges Certificate, should communicate with Mrs. A. C. Pickard, 1702 North Blvd., Houston, Texas 77006.

PLANT LIFE LIBRARY—continued from page 20.

ADVANCES IN MORPHOGENESIS, Vol. 6, edited by M. Abercrombie and Jean Brachet. Academic Press, 111 5th Av., New York, N. Y. 10003. 1967. Pp. 331. Illus. $15.00. This 6th volume in the series contains papers by seven outstanding authorities, including the biology of teratomas; the development of patterns in the integument of insects; the control of embryonic hemoglobin synthesis; heteroblastic development in vascular plants; ultrastructure of the nucleus of the developing amphibian egg; artificial parthenogenesis; polyploidy; gynogenesis and androgenesis in silkworms; and developments in sexual organogenesis. Highly recommended.

PHAGE AND THE ORIGINS OF MOLECULAR BIOLOGY, edited by John Cairns, G. S. Stent and J. D. Watson. Cold Spring Harbor Laboratory of Quantative Biology, Cold Spring Harbor, L. I., New York 11724. 1966. Pp. 340. Illus. $12.50. This stimulating book is concerned with the history of creative thinking and practice as exemplified in the recent development of molecular biology. After a delightful preface on the origins of molecular biology, the papers are grouped under (a) the phage renaissance; (b) phage genetics; (c) bacterial genetics; (d) DNA, and (e) ramifications of molecular biology. This is required reading for all biologists. Highly recommended.

PLANT PHYSIOLOGY, by Henrik Lundegardh, transl. by F. M. Irvine and W. O. James. American Elsevier Publ. Co., 52 Vanderbilt Av., New York, N. Y. 10017. 1966. Pp. 549. Illus. $37.50. This stimulating book incorporates the matured views of Prof. Lundegardh. The ten chapters deal with the cell and protoplasm; development of the cell; photosynthesis and the formation of carbohydrates; respiration; fermentation, and enzyme chemistry; plant nutrition; water balance; and plant growth and mocement. Highly recommended.

ROCKY MOUNTAIN FLORA, 3rd Edition, by William A. Weber. University of Colorado Press, Regent Hall, Boulder, Colo. 80304. 1967. Pp. 437. Illus. $9.40. This book specifically covers the central Colorado region, but it may be used throughout Wyoming, Colorado, and New Mexico, to good advantage because of a general similarity of the floras of the three states. Over 1,500 kinds of plants are keyed and classified, and there are 340 illustrations. The keys have been tested over a period of years, and the plant families are arranged alphabetically for the convenience of the non-professional users. Highly recommended.

PHYLOGENY AND FORM IN THE PLANT KINGDOM, by Howard J. Dittmer. D. Van Nostrand Co., 120 Alexander St., Princeton, N. J. 1964. Pp. xiii; 642. Illus. This book provides a survey of the Plant Kingdom with special reference to the descriptions of the structure, reproductive processes and phylogenetic relationships of the principal plant groups—bacteria, algae, higher green plants and fungi. The text is adequately illustrated, and the subject matter is sufficient for a full year's course. This attractive text is highly recommended.

CHEMOTAXONOMIE DER PFLANZEN, VOL. 4. DICOTYLENONEAE: DAPHNIPHYLLACEAE—LYTHRACEAE, by R. Hegnauer. Birkhaeuser Verlag, 4000 Basel 10, Switzerland. 1966. Pp. 551. Illus. sFr. 106. In the 1966 Plant Life, volume 3 of this series was reviewed, ending with Dicotyledones—*Cryillaceae.* In volume 4, the chemical compounds reported for the families *Daphniphyllaceae* to *Lythraceae,* are listed and discussed. The addenda and an index complete the volume. This valuable reference work belongs in the library of every taxonomist.

GERMANIUM, by V. I. Davydov, P. Rudenko and L. V. Kovtun. Transl. by Adam Peiperl. Gordon & Breach, Publ., 150 5th Av., New York, N. Y. 10011. 1967. Pp. 316. Illus. $18.00. After detailing the importance and uses of germanium in technology, the authors consider the raw material sources and methods of production of germanium, and the physiochemical properties of germanium and its compounds. The radioactive isotopes of germanium are discussed in an addendum. Highly recommended.

PLANT LIFE LIBRARY—continued on page 62.

2. LINEAGICS

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

NOTES ON **AMARYLLIS** SPECIES 1967

JOSEPH C. SMITH, *M. D.*

8939 La Mesa Blvd., La Mesa, Calif. 92041

Everyone loves a surprise and that is just what you are in for when you are growing a new species of *Amaryllis* for the first time. Thanks to our good friend D. C. G. Ruppel of Mendoza, Argentina, who supplied the bulbs, I have once again had this very pleasant experience.

Fig. 9. **Amaryllis** sp. "Red Cochuna", collected by Dr. C. G. Ruppel on the Cochuna River near Conception, Argentina, October 1966.

In October of 1966 Dr. Ruppel sent bulbs of what he thought might be a new species of *Amaryllis* that he had collected on the Cochuna river near Conception, Argentina. The temporary name of this species is "Red Cochuna". When these bulbs were planted they quickly sent up slender flower scapes that bore two to four flowers of an orange red color similar to that seen in some of the deeper toned striatas. The

form of the flowers resembled that of *A. aglaiae* so much that my first thought was that this was possibly a red form of *A. aglaiae*. However, on closer observation of the stigma it was easy to see that "Red Cochuna" (Fig. 9) belongs with the subgenus *Lais* and is therefore separated from *A. aglaiae*. The foliage also closely resembles that of *A. aglaiae* by being about an inch in width for most of its length and by having an obtuse, rounded tip. The bulbs are different; being more globose. None of the species has such beautifully shaped bulbs as *A. aglaiae* with its perfect oval shape.

The new species, "Red Cochuna", blooms early in the season with or without foliage but with plenty of foliage on younger non-flowering bulbs in the same clump. A very distinctive characteristic of this species is its rapid growth in spring and early summer with complete flagging of its foliage in mid summer and reappearance in fall; lasting until cut down by winter. The flowers come with the early spring growth and do not repeat with the fall foliage. This characteristic distinguishes it from all other *Amaryllis* species known in this part of Argentina.

It is suggested, should this prove to be an entirely new species of *Amaryllis* that it be named for Dr. Ruppel who discovered it. However, Dr. Ruppel might do well to wait before having his name applied to a species until another of his discoveries can be identified. This one (see Fig. 11) is a beautiful brownish-red *aulica* type from Brazil. It has a green center and white petal margin and is pretty enough to do honor to anyone's name.

Dr. Ruppel has described so many interesting amaryllids which he has collected in his travels about South America that one can hardly keep from being greedy when requesting bulbs from him. To mention a few—there is the fertile form of *Amaryllis ambigua,* the greenish-yellow long-trumpeted fragrant species, the possible *A. petiolata* from Uruguay, and *A. parodii,* to say nothing about the many *Rhodophiala, Habranthus, Zephranthes,* etc., species he has collected.

It is certainly hoped that Dr. Ruppel will have many more years of good health in his now retired life so that he may continue his travels and collections of amaryllids. It is understood that certain groups in this country are contributing to the financial success of his collecting trips. He is certainly a man who knows amaryllids and is in a position to do much toward the advancement of knowledge of these most interesting plants. He deserves all our support.

THE RHODOPHIALAS ARE COMING!

Paul H. Williams, Jr., *6128 Sundown Drive, Fort Worth, Texas 76114*

For several years I have been amazed that most of the known species of the family *Amaryllidaceae,* until very recently, were first discovered and described during the 18th and 19th centuries and relatively nothing in between. Consider the difficulties and expense involved during those periods as compared to our own times. And most of the species

have to be rediscovered to be enjoyed by us! All that lost time to be made up! Without the original descriptions we wouldn't even know of the existence of large sections of the family. Are they really that rare in their native lands or is it that most people just don't care?

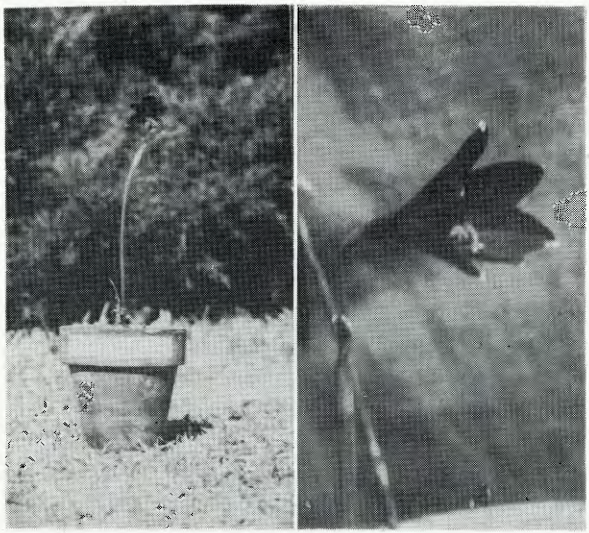

Fig. 10. Amaryllid imported as **Rhodophiala rosea: left,** potted plant photographed at 3 ft. by Paul H. Williams, Jr. at Fort Worth, Texas. Photo by Dr. C. G. Ruppel. **right,** the same from a color slide taken by Dr. C. G. Ruppel, Mendoza, Argentina.

My addiction to the family *Amaryllidaceae* became certain in the late 1950s and since that time I have done my best to make up for lost time and prior ignorance. For instance, in the Tribe *Zephyrantheae,* which, incidentally, seems to fit into the variable climates of Texas, there is the genus *Rhodophiala* which contains 31 species native to Chile, Bolivia, Argentina, and Uruguay. In Fort Worth you see the one called "Ox-blood Lily". Fairly common, thriving, and beautiful in the fall. Why not any others? I want to see all 31 of them! So I went to Argentina—by mail, of course! And there I found Santa Claus! He really exists! In the person of Dr. C. Gomez Ruppel. Thanks to the generous efforts of that worthy addict we now have, to my knowledge, in various stages of development, 14 species of *Rhodophiala.* Only one has bloomed so I will tell only about it.

During the first week of November 1966 I received a parcel of amaryllid bulbs from Dr. Ruppel. Among these treasures was a packet labeled "A. bifida Sehnem" which contained two marble sized, marble shaped bulbs and a litter of bulblets. The two bulbs were planted in a 4-inch bulb pan and watched for developments—and watched—and watched. In January 1967 curiosity overcame caution and one was eased out of the soil. No roots were evident but the ring of bulblets

formed reminded one of a setting hen and chickens. Everything was carefully replaced.

One day in late January, a bud was spotted nosing out of one of the bulbs so water was immediately applied to help the delivery. During the time the scape was emerging, Dr. Ruppel's letter was referred to again for possible enlightenment. His description read: "Father Aloysio Sehnem, a good friend and botanist from Sao Paulo, South Brazil, gave me this very nice bright red, miniature of the subgenus *Chilanthe*. Evergreen in Mendoza. Flowers in late spring. Rich black, fibrous soil."

When the scape had reached a length of 16 cm., the single bud opened to a beautiful brilliant red. (Fig. 10) The bloom was selfed with crossed fingers, but it did no good. The ovary didn't even pretend to swell and a later letter from Dr. Ruppel confirmed what I had dreaded—it was self-sterile. In spite of this, it should become popular, as offsets form about as fast as those of *Nordoscordum inodorum*.

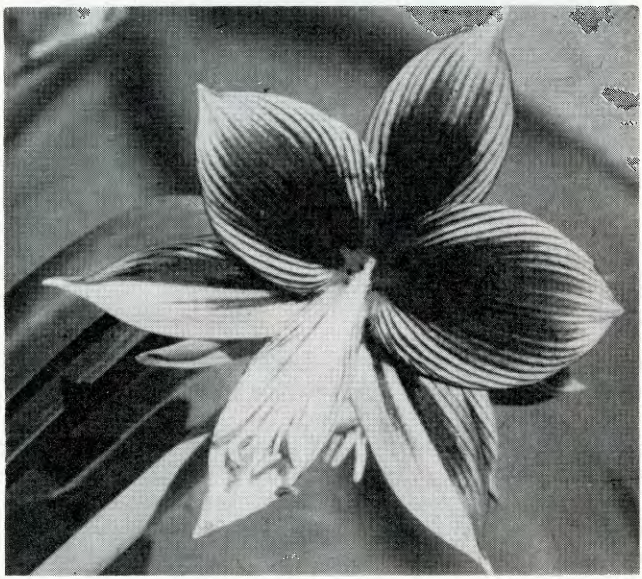

Fig. 11. Brownish-red aulica type Amaryllis discovered by Dr. C. G. Ruppel in Brasil. Photo by Dr. Ruppel.

Careful measurements were taken and the key to genus *Rhodophiala* in 1956 PLANT LIFE was consulted. Through the process of elimination, I arrived at *Rhodophiala rosea* (Sweet) Traub, which, in turn, led me to *Amaryllis barlowii* in AMARYLLIDACEAE: TRIBE AMARYLLEAE for the description. Yes, it checked! In my lay opinion we now have the long lost species first introduced in England in 1831 and now known as *Rhodophiala rosea*. A bulb has been forwarded to Dr. Traub for verification which should allow us to scratch off another member from the missing list.

Of the remaining 13 species of *Rhodophiala* in my possession some may bloom this year (1967) and will be reported on later, but most were received as seed and only time will tell.

Fig. 11 shows a beautiful brownish-red *aulica* type Amaryllis discovered by Dr. C. G. Ruppel in Brasil.

References: page 72, 1956 PLANT LIFE; page 122, HERBERTIA 1938; page 35, HERBERTIA 1934, and page 97, Amaryllidaceae: Tribe Amarylleae, 1949.

AMARYLLIS AULICA KER-GAWL.

Sam Caldwell

The following is a report on SA 63-10 received from Robt. D. Goedert, Dec. 15, 1963 who imported the bulbs from South America. The bulb flowered in December 1966 when the fine flower scape in Fig. 12 was photographed. The species was identified by Dr. Hamilton P. Traub as *Amaryllis aulica* Ker-Gawl.

Dec. 15, 1963—4 very dry bulbs, 7/8″ to 1″ in diameter, pear-shaped without roots, all planted together in a 7″ azalea pot. Interim note: Bulbs grew strongly from the first. New leaves start in late summer or fall, grow through winter in cool greenhouse and tend to die away before hottest summer comes again. Foliage appearance and growth habits are so exactly like those of *A. aulica* var. *stenopetala* that I felt sure that is what it would turn out to be. Bulbs have remained for 3 years in the same pot with same soil, in perfect health and vigor, but they now completely fill the pot and are crowding each other.

Dec. 1, 1966—One bulb, now 2⅝″ in diameter, has a fine flowering scape (Fig. 12). Another bulb, 2 5/16″ in diameter, has a scape with buds nearly ready to open. A third bulb is considerably larger than these, with larger and longer leaves (3⅜″ bulb diameter) and may be different; it has never bloomed. The fourth bulb is smaller and has not bloomed, either.

Scape is 18″ tall; pedicels, 1⅞″. It has 2 flowers, each 6″ across, 6½″ top to bottom, and approximately 3¾″ deep. Upper inner segments 1¾″ wide; lower, outer segments ⅞″ wide. Stamens shorter than segments; pistil about as long as segments. Stigma split deeply in 3 parts. Segments are a strong red color with deeper red veining blending into a deeper reddish maroon shading toward the throat, though a part of the deeper appearance is due to a surface sheen that is quite attractive. Base of all segments is strong green, inside and out, giving the flower a distinctive green throat. Dec. 12, 1966—The second budded scape, mentioned above, has now bloomed. Though undoubtedly the same species, it is not absolutely identical to the first. Segments are not quite as wide. Basic coloring is the same, but the green throat is not as deep as in the first flowers; also, on each segment a narrow, irregular line of the red-maroon coloring near the base runs along the middle of the segment right through the green area, back to the very base.

I consider the second individual a little inferior to the first, though both are beautiful amaryllis, the distinctive red-and-green pattern giving a sort of "Christmasy" effect. This, apparently, is the normal blooming season for this species. Its vigor and health and ease of growth, together

Fig. 12. **Amaryllis aulica** Ker-Gawl., imported by Mr. Robert D. Goedert (SA 63-10), from South America in 1966. Plant grown and photographed by Mr. Sam Caldwell, Nashville, Tenn.

with the attractive bloom, make it certainly one of the best of the unidentified species that I have flowered. I've marked the bulb with the better bloom and will try to build up a stock of it. Would this be simply the typical *A. aulica?* Later identified by Dr. Traub as *Amaryllis aulica* Ker-Gawl. with relatively wider tepalsegs.

CRINUM SCHMIDTII REGEL

L. S. HANNIBAL, *4008 Villa Court,*

Fair Oaks, Calif. 95628

During the past ten years the writer has picked up a number of *Crinum moorei* variants and hybrids. One outstanding white form passes under the name of 'Herald' or 'Drysdale White'. The identity became puzzling when it was found that a bulb from Saint Catherine Island off the coast of Brazil, and another from Adelaide, Australia

Fig. 13. **Crinum schmidtii** Regel as grown by Mr. L. S. Hannibal, Fair Oaks, Calif.

were similar. William Drysdale then reported that the bulb he was growing came from Mrs. E. M. Foster's garden, an early member of the American Amaryllis Society.

Two conditions were apparent, first that source of the bulb was undoubtedly from van Tubergen, and second that no hybrid would produce such uniformity in seedlings. Quite a search was instigated but *C. schmidtii* was excluded for some time since another *C. morrei* clone has been passing for *schmidtii* in California for more than 35 years. However, an examination of the Gartenflora description of *C. schmidtii* clarified the confusion. *Crinum schmidtii* Regel (syn.-*C. moorei* var. *schmidtii*) is significantly more robust than the common *C. moorei* with broader, sturdier foliage. The blossoms open widely and have a great deal more substance. These are snow white, no pigmentation is evident even in the filaments. The identifying factor is the bified stigmas with branches near 2 mm. long; a unique feature in *Crinum* and one of the causes justifying a separate species status.

It is to be noted that *C. schmidtii* is very slow growing, produces few offsets and does not seed freely. The bulb is better adapted to the humid Gulf climate than inland California. *C. powelli album* and 'White Stranger' are *C. schmidtii* seedlings which suggests it has good breeding characteristics.

AMARYLLID GENERA AND SPECIES

Harold N. Moldenke

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

Allium Scaposum Benth, in Pl. Hartweg, 26. 1840. Leaves radical, linear-terete, long-sheathed at the base, shorter than the terete scape; spathe broad, bifid, shorter than the pedicels; umbel many-flowered, loose when capsule-bearing; perigonium [segments —omitted probably by error] lanceolate, acuminate, rather acute; stamens subequaling the perigonium; filaments subulate, dilated at the base. — Scape 12 or more inches long, slender; pedicels an inch long; perigonium segments 6 mm. long, white when dry, red-keeled in the center. Along small streams, Aguas Calientes.

Callithauma viridiflorum Herb. in Amaryll. 225. 1837. Bulb 6 inches long, cylindric; leaves about ¾ [inch] wide, green, almost flat; scape green, double; spathe marcescently deciduous; peduncles short, subequal; ovary oblong, trigonous, about ¾ inch [long]; [perianth-] tube 1¾ to 1⅞ inches [long], ¼ inch wide above, pale-green, the limb green, about an inch [long], the corona equal, paler, 12-lobed along the margin; filaments inserted in the upper region of the corona, connivet, included; anthers versatile; style shorter than the corona; stigma obtuse. C. angustifolium [has] the leaves half as wide, the [perianth-] limb surpassing the corona by ¼ inch, the style exceeding the perianth and the stigma dilated and 3-lobed.

REGISTRATION OF NEW AMARYLLID CLONES

Mr. W. D. Morton, Jr., *Emeritus Registrar*

Mr. James E. Mahan, *Registrar*

Mrs. Emma D. Menninger, *Associate Registrar*

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. This may be obtained at $5.00 prepaid from: Dr. Thomas W. Whitaker, Executive Secy., The American Plant Life Society, Box 150, La Jolla, Calif. Catalog of Hybrid Nerine Clones, 1882-1958, by Emma D. Menninger; and Catalog of Brunsvigia Cultivars, 1837-1959, by Hamilton P. Traub and L. S. Hannibal, were published in 1960 Plant Life, with additions to both in Plant Life 1961. In Plant Life 1961, the first edition of The Genus X Crinodonna was published which serves also as a catalog of cultivars. In Plant Life 1964, the first edition, of "Catalog of Hybrid Amaryllis Cultivars, 1799 to Dec. 31, 1963" was published. Other catalogs of cultivated amaryllids are scheduled for publication in future issues.

The registration activity of the American Plant Life Society was recognized when at the XVIIth International Horticultural Congress in 1966 the Council of the International Society for Horticultural Science designated the American Plant Life Society as the Official International Registration Authority for *Amaryllidaceae* cultivars excepting *Narcissus* and *Hemerocallis*.

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 addressed to Mr. James E. Mahan, Registrar, 3028 Palmyra St., New Orleans, Louisiana 70119. The registration fee is $2.00 for each clone to be registered. Make checks payable to American Plant Life Society.

REGISTRATION OF NEW AMARYLLID CLONES

Mr. W. D. Morton, Jr., *Emeritus Registrar*

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Mrs. Emma D. Menninger, *Associate Registrar*

Registered by Ludwig & Co., Hillegom, Holland

'Bellina' (Lud.-1967) R; A-856, D-5A; U-4 fld.; 22″-24″ h; fls. 9″-10″ diam.; Solid Porcelain Rose (RHS 620/1), slightly deeper shade in throat; spr.

'Courtesy' (Lud.-1967), R; A-857, D-5A; U-4 fld.; 22″-24″ h; fls. 8″-9″ diam; Apple green throat shading into white stripes contrasted with white Neyron Rose (RHS 623) changing into lighter rosy salmon and rosy salmon white towards ends of petals; spr.

'Eastern Dream' (Lud.-1967), R; A-858, D-5A; U-3 or 4 fld.; 26″-28″ h; fls. 8½″-9″ diam.; Carmine Rose (RHS 621/1); with darker throat (RHS 621); spr.

'Fairyland' (Lud.-1967), R; A-859; D-5A; U-4 fld.; 25″-27″ h; fls. 8″-9″ diam.; solid Neyron Rose (RHS 623), accentuated in throat.

'Fantastica' (Lud.-1967), R; A-860; D-5A; U-4 fld.; 22″-24″ h; fls. 9″-10″ diam.; Mandarin Red (RHS 17) with a white star springing from an apple green throat ending in white edge contouring each petal.

'Ludwig's Striped' (Lud.-1967), R; A-861; D-5A; U-4 fld.; 26″-28″ h; fls. 8″-10″ diam.; Poppy Red (RHS 16) edged in white similar to picotee red edging with distinct white line (abt. ½″) from throat fading toward tip of petal.

'Ludwig's Red' (Lud.-1967), R; A-862; D-5A; U-4 fld.; 22″-24″ h; fls. 7″-8″ diam.; Glossy Blood Red (RHS 820), darker throat, flowers perfectly round.

'Red Heron' (Lud.-1967), R; A-863; D-5A; U-4 fld.; 35″-40″ h; fls. 8″-9″ diam.; Capsicum Red (RHS 715) with darker throat.

'Carina' (Lud.-1967), R; A-864, D-8; U-4 to 5 fld.; 16″-18″ h; fls. 4″-5″ diam.; Mandarin Red (RHS 17/17/1); with darker throat with suggestion of green.

'Pretty Pal' (Lud.-1967), R; A-865; D-8; U-4 fld.; 24″-26″ h; fls. 4″-5″ diam.; Capsicum Red (RHS 715), with white striped throat.

'Rubina' (Lud.-1967), R; A-866; D-8; U-4 to 5 fld.; 16″-18″ h; fls. 4″ diam.; dark blood red with darker throat (RHS 820).

'Table Decoration' (Lud.-1967), R; A-867; D-8; U-4 to 5 fld.; 22″-24″ h; fls. 5″-6″ diam.; Mandarin red (RHS 17) with star in throat.

Registered by Mr. Alek Korsakoff, Jacksonville, Florida.

'Green Senorita' (Kors.1967), R; A-855; D-8; U-2 fld.; 55 cm. h; fls. 11 cm. diam.; Chartreuse green (RHS 66 3/1), pea green in throat; spr. - win.; semi-ev. Parentage: A. Striata x A. Evansiae.

Registered by Mr. Frederick B. Schmitz, Port Sulphur, Louisiana.

'Edward Authement' (Schm.-1967), R; A-868; D-7; U-3-4 fld.; 18″ h; fls. 6″ diam.; Cardinal red (RHS 822/1 to 822); spr.

SUGGESTIONS ON STAGING AMARYLLIS SHOWS

James E. Mahan

The keynote of any successful amaryllis show is advance planning, not only generalized planning but planning well in advance, down to the

last and most minute detail. Any club contemplating staging an amaryllis show should appoint a forceful show chairman, one who has the ability to work with others and inspire them to get their jobs done with dispatch. The chairman should pick his co-chairman immediately so that he will have help with the many details that inevitably crop up. Next the various committees should be appointed, such as registration, classification, placement, publicity, judges, clerks, hospitality and dismantling.

The show date should be decided at the earliest possible moment. It should be set to coincide with the time that the amaryllis are at the height of their bloom. This can be difficult as many factors enter into this decision such as the weather throughout the winter and the ensuing early spring or a conflict with other shows previously announced. It can be seen that by announcing the date of the show as early as possible other garden clubs will respect such a choice and not schedule their shows on that date. In connection with the date, the place where the show will be held also has to be decided. Consideration should be given to the accessibility of the site chosen through public transportation and parking facilities for the visitors who come in their own automobiles. Next, the hours when the show will be open to the public should be decided and once these things have been resolved all the information should be given to the publicity committee so work can be begun on calling to the attention of the public that a show is going to be held. Of great help to the publicity committee are such media as newspapers (garden editors in particular), radio, transportation company bulletins, national gardening magazines (which demand that notices be sent months in advance in order to be published) and television stations. Do not overlook the television stations, especially when an educational station is located in your area. Usually they are more than willing to cooperate and perhaps you can even get your county agent to give you some help in arranging a presentation over a television station. Be sure to include in your publicity an announcement whether the show is open to competition by the public or is a closed show and whether there is any admission charge. The final duty of the publicity committee is the preparation of a report of the results of the judging in the show for publication by the newspapers along with pictures of the top prize winners.

A show schedule should be formulated by the show chairman as soon as possible and distributed to the club members and, in particular, to the various other committee members. A certain degree of latitude is allowed in setting up a schedule but care must be exercised that it meets all the requirements of an official show. In my estimation it is certainly easier and more convenient to set up a schedule according to whether registered and named or not and then subdivided into the nine divisions defined by the American Amaryllis Society rather than segregate the entires according to country of origin. It is becoming increasingly difficult to define what a "Dutch" hybrid is or what and "American" hybrid is and the former method obviates this difficulty.

Then, too, if using the latter classifications we run into the problem of what to do with the South African hybrids, or the Indian Hybrids, etc. Due thought should be given to the inclusion in the schedule of a special amateur breeder's competition in order to encourage hybridization and development by the local amateur grower.

Next in line will be arranging well in advance for the various trophies that will be awarded. Outside sponsors usually are willing to furnish some of the trophies with the club furnishing the balance that has been determined to be necessary. Arrange for the engraving, the ribbons, entry cards and programs so that when the morning of the show arrives everything is on hand at the site of the show. Entry cards can be given to all members before the show so that they can be filled out in advance thus speeding up operations on the morning entries are received. Have sufficient on hand for all anticipated entries from the public. Enough programs should be printed for each visitor to have one.

It will be necessary to make arrangements to have a sufficient number of accredited amaryllis judges on hand for judging the show. Contact them as soon as possible after the date of the show has been determined so that they can be engaged before making other commitments. The show chairman or someone he designates should meet with the judges on the morning of the show before the judging starts so that he can discuss with them the point scale to be used in judging, the number of points required for each ribbon awarded, and the higher trophies and awards that they are expected to determine. In setting the point scale care and good judgment should be exercised, taking into account the number of entries, the weather and any other factors so that when the scale is set the entrants will be encouraged and not discouraged; nevertheless, standards of excellence should not be compromised merely to allow a greater number of ribbons to be given out. It is a good idea to have someone familiar with judging meet with the judges for discussion of these points. If a member of your club is an accredited amaryllis judge, he would be an excellent choice for the assignment.

Clerks to assist the judges and to record their decisions must be chosen in advance and instructed in their duties and deportment during the judging. A short sheet of instructions to the clerks comes in very handy and can be issued to them weeks before the show so that they will know what is expected of them on the morning of the show. Before going onto the floor with the judges a short refresher talk by the show chairman or his designee should be addressed to the clerks.

The physical set-up of the show is a very important facet of any show. The placing of the tables on which the entries rest will be largely determined by space limitations but it should be done in a logical arrangement and yet not overlooking the aesthetic aspects. Tables can be arranged in a straight line or can be placed in a broken straight line with each individual table or groups of tables placed at an angle, say 45 degrees, for an effect that is very gratifying, making it seem that

there are an even greater number of entries on the floor than are actually there. Space should be alloted to the various sections and divisions in accordance with the anticipated number of entries in each from past experience but be certain that it is flexible enough so that each can be expanded (or contracted) to accommodate an unforeseen increase (or decrease)in the number of entries. A loose or bad arrangement of the tables can detract from the effectiveness of the show and even cause embarrassment. A diagram of the physical set-up of the tables on the floor, showing the space alloted to each section and its subdivisions, is very helpful to the placement committee, in fact almost indispensable, Printed signs should be placed on the tables identifying each section and subdivision for the guidance of the placement committee and also for the public. Markers should be placed between subdivisions to clearly delineate the physical space limits of each. Identification markers, printed cards or such, should be furnished for named varieties and placed alongside of the group as an aid to identification to the viewer.

The flow of the entries on the morning that they are being accepted is extremely important in order to speed up operations and meet the deadline that has been set for judging to commence. A table or tables should be set up to register the entries by filling out the entry card, showing the name of the owner and the name of the plant. The plant is then taken to the classification section where the entry card is completed to show whether the plant is registered or not and to what Section and Division it belongs. In order to determine whether an entry is registered or not it is necessary to have on hand the 1964 Plant Life and succeeding issues which list all registrations to date. The entry is then transferred to the placement committee for removal to its place on the proper table on the floor for ultimate judging in its own section. Be careful that entries are not misplaced which could possibly cause judges to disqualify the entry. As a final precaution, before the judges come onto the floor, a check should be made by the show chairman and the classification committee to detect and correct any errors that may have been made in placement of the entry. This will avoid any embarrassment to all concerned. Once judging commences, no one but the judges and clerks are to be allowed on the floor. However, the show chairman should be on the scene to resolve any questions that may arise, if called upon to do so.

Containers for cut specimens must be furnished by the club sponsoring the show and should be uniform. Bottles have been used but are generally unsatisfactory. On the other hand, cans that are rather tall, such as those used for luncheon meats by grocers or institutions, can be had and sprayed on the outside with aluminum paint to present a very pleasing and uniform appearance. Covering each pot in which an entry is growing, with aluminum foil from the bottom to the upper rim will also present a uniform appearance when they are placed on the tables and at the same time mask any soiled spots or identifying marks present on the pot. The show chairman should make arrangements to have on hand at the registration desk a supply of aluminum foil in the event en-

tries appear without the proper wrapping and also a supply of supports for the scapes if needed and wire "twistems" for use in tying. It is a good idea to make these things available to the entrant but he should be directed to make the necessary support of the scape himself.

In general the above remarks are directed to the horticulture section of the show. If arrangements featuring amaryllis are to be a part of the show, invitations to garden clubs or groups must be issued in ample time for them to accept and notify the show chairman of their acceptance. A theme is agreed upon and appropriate pedestals and/or niches with the proper background must be supplied for these arrangements. Judges qualified to judge arrangements must be present to take care of that part of the judging. It is certainly a nice gesture on the part of the club sponsoring a show to furnish refreshments for the judges before they start their chores and some token of appreciation to be taken home with them is always in order.

As set forth in the opening remarks any successful show is dependent on advance planning but chances are that no matter how many pains are taken to plan ahead, when the show finally is in progress it will be discovered that some little detail has been slighted or overlooked. Let me tell you from personal experience that this should not discourage you but should serve to reinforce your determination to make the next one an even better one! Good luck in your endeavors.

RECOMMENDED SHOW SCHEDULE—OFFICIAL AMARYLLIS SHOWS

The following schedule has been adapted from the 1967 schedule worked out by Mr. Mahan, Registrar, and Show Chairman, Men's Amaryllis Club of New Orleans. Mrs. A. C. Pickard of the Houston Amaryllis Society has suggested the addition of numbered new *Amaryllis* species under Section III and this has been adopted. Under Floral Arrangements Sections, "Section XI.—Floral Arrangements featuring Amaryllis" has been added to complete the Official schedule.

Other local societies may use this as a model in working out their own schedules.

A. HORTICULTURAL SECTIONS—POTTED SPECIMENS

SECTION I—Registered and Named Hybrids

Div. 2—Long Trumpet Hybrids	By	Name
Div. 3—Belladonna Type Hybrids	"	"
Div. 4—Reginae Type Hybrids		
A. Markedly Imbricated Type	"	"
B. Less Imbricated Type	"	"
Div. 5—Leopoldii Type Hybrids		
A. Markedly Imbricated Type	"	"
B. Less Imbricated Type	"	"
Div. 6—Orchid-flowering Hybrids	"	"
Div. 7—Double Hybrids	"	"
Div. 8—Miniature Hybrids	"	"
Div. 9—Unclassified Hybrids	"	"

SECTION II—Non Registered and Un-Named Hybrids

Div. 2—Long Trumpet Hybrids	By Color
Div. 3—Belladonna Type Hybrids	" "
Div. 4—Reginae Type Hybrids	
A. Markedly Imbricated Type	" "
B. Less Imbricated Type	" "
Div. 5—Leopoldii Type Hybrids	
A. Markedly Imbricated Type	" "
B. Less Imbricated Type	" "
Div. 6—Orchid-flowering Type Hybrids	" "
Div. 7—Double Hybrids	" "
Div. 8—Miniature Hybrids	" "
Div. 9—Unclassified Hybrids	" "

SECTION III—Cultivated Wild Species

By Name or number

SECTION IV—Non Registered and Named Hybrids

Div. 2—Long Trumpet Hybrids	By Name
Div. 3—Belladonna Type Hybrids	" "
Div. 4—Reginae Type Hybrids	
A. Markedly Imbricated Type	" "
B. Less Imbricated Type	" "
Div. 5—Leopoldii Type Hybrids	
A. Markedly Imbricated Type	" "
B. Less Imbricated Type	" "
Div. 6—Orchid-flowering Hybrids	
Div. 7—Double Hybrids	" "
Div. 8—Miniature Hybrids	" "
Div. 9—Unclassified Hybrids	" "

B. HORTICULTURAL SECTIONS—CUT SPECIMENS

SECTION V—REGISTERED AND NAMED HYBRIDS — **By Name**
Same subdivisions as Section I

SECTION VI—Non-Registered and Un-Named Hybrids — **By Color**
Same subdivisions as Section II

SECTION VII—Cultivated Wild Species — **By Name**

SECTION VIII—Non-Registered and Named Hybrids — **By Name**
Same subdivisions as Section IV

COLOR CATEGORIES:

Solid White	* White with other color
Solid Pink	* Pink with other color
Solid Salmon	* Salmon with other color
Solid Rose	* Rose with other color
Solid Orange	* Orange with other color
Solid Light Red	* Light Red with other color
Solid Dark Red	* Dark Red with other color

* The named color shall be the predominating color.

C. FLORAL ARRANGEMENTS SECTIONS

SECTION IX—Single Floret Specimens

Registered and named only—by name. Competition in this section is open only to members of the Men's Amaryllis Club of New Orleans,

Inc.,** and limited to three entries per member, grown and bloomed by the member-owner.

SECTION X—Two-floret Specimens

Scapes with two florets, Registered or Non-Registered, Named or unnamed, potted or cut specimens. Not to be judged in competition against any entry in horticulture sections and will be awarded special ribbons of appreciation where deserving.

SECTION XI—Floral Arrangements featuring Amaryllis

No awards or ribbons in Sections IV, VIII, IX, and X can be counted toward any higher award or toward any of the sweepstakes awards.

** The local Amaryllis society can insert its name in place of the Men's Amaryllis Club of New Orleans, Inc.

APPLICATION PROCEDURE FOR TAKING THE OFFICIAL AMARYLLIS JUDGES EXAMINATION

The following application form has been prepared by Mrs. Bert Williams and W. Quinn Buck, and has been approved by the Southern California Amaryllis and Hemerocallis Society, and the American Amaryllis Society (affiliated with the American Plant Life Society). This procedure applies only to the Southern California area.

APPLICATION BLANK FOR TAKING THE OFFICIAL AMARYLLIS JUDGES' EXAMINATION OF THE AMERICAN AMARYILLS SOCIETY (AFFILIATED WITH THE AMERICAN PLANT LIFE SOCIETY).

The requirements for becoming an Official Amaryllis Judge:

1. Current membership in The American Plant Life Society (The American Amaryllis Society), and in the affiliated local society giving the Official Judges' examination.
2. Growing of at least 15 named hybrid Amaryllis clones. (This requirement can be waived **only** if the Examining Judges know of the applicant's experience over a period of years, and believe him to be qualified to take the examination because of his experience).
3. At least 3 years' experience in growing hybrid Amaryllis clones and species.
4. Applicant must pass a preliminary examination satisfying the Examining Judges of his appreciation and understanding of the elements of a good Amaryllis.
5. Applicant must pass the Official Judges' examination. After grading by the examining Judges, who must agree unanimously that the applicant has answered the questions correctly, the examination paper will then be sent to the Officers of the American Amaryllis Society (affiliated with the American Plant Life Society), who have the duty to do the final grading and the accrediting of the new Judge. Thereafter, the Official Judge will be eligible to judge in any Official Show of the American Amaryllis Society, when invited to judge by the appropriate Show Chairman, who should consult the Senior Judge of the area or check the lists of accredited Official Judges as published in PLANT LIFE annually.
6. All Official Judges must attend regular Judges' Council meetings in order to keep informed about new developments.

.....

Applicant's name .....

Address .....

City ..... State ..... Zip Code .....

Number of named clones grown ..... Years of Experience .....

AMARYLLIS NOTES, 1968

Hamilton P. Traub

Hymenocallis amancaes subsp. *herbertiana* Traub, *subsp. nov.* Syn.- *Ismene amancaes* var. 2, Herb. Amaryll. 222. 1837.

Poculo staminali in lobos non fisso; odore jucundiore.

Tepalsegs spreading, staminal cup not cleft into lobes, but including the filaments and projecting 6.5 mm. beyond their insertion; scent more agreeable. Peru. It is hoped that some one will re-collect this plant.

Milleae Traub, *tribus nov., (Amaryllidac.).* Rhizoma cormosa; perigonium regulare; ovarium ad apicem gynophorii positum. Typus: Genus *Milla* Cav.

Brodiaeeae Traub, *tribus nov.,* Perigonium regulare, inferne tubulosum, superne in segmentis 6 divisum; rhizoma cormosa; pedicelli ad apicem saepe articulati. Typus: genus *Brodiaea* J. E. Smith.

Tristagma narcissoides (R. A. Phil.) Traub, *comb. nov.* Syn.- *Stemmatium narcissoides* R. A. Phil., Anal. Univ. Chile 43: 551-552. 1873.

Nothoscordum graminifolium (R. A. Phil.) Traub, *comb. nov.* Syn.- *Steinmannia graminifolia* R. A. Phil. Anal. Univ. Chile p. 10. 1884.

Narcissus x *perezlaraii* Traub, *nom. nov.* Syn.—*Carregnoa dubia* perez-lara, Anal. Soc. Esp. Hist. Nat. 11: 399.1882, non *Narcissus dubia* Gouan, Illustr. et Obs. Bot. 22. 1773.

Amaryllis starkii Nelson & Traub, *sp.* nov., Plant Life 19: 37-40, Figs. 7 & 8. 1963. *Holonomenifer:* Ira S. Nelson, n. 1134, Univ. S.W. La. Herbarium: *isonomenifers*: Ira S. Nelson, s. n. (=nos. 1081 & 1082 TRA). Nomenifer specimens not cited originally in 1963 due to an oversight.

Narcissus loiseleuri (Rouy) Traub, *comb. nov.* Syn.—*Narcissus triandrus* var. *loiseleuri* Rouy, in Flore de France. 1908.

Narcissus radiiflorus var. *exsertus* clone 'Poetarum', Traub, *clone nov.* Syn.- *Narcissus poetarum* Haw., Mon. Narciss. 14. 1831; Pugsley, Jour. Bot. Vol. 53, Suppl. 2. page 42. 1915.

Pancratium landesii Traub, *sp. nov. (Amaryllidac.).*—Foliis oblongis, parte inferiori angustatis; umbella uniflora; segmentis tepalorum linearibus acutis; poculo staminali segmentis tepalorum dimidio breviore. (Fig. 14). On coast near Salahah, Zufur Region, Sultanate of Muscat and Oman.

Fig. 14. Pancratium landesii Traub, **sp. nov.** Collected and photographed by Hugh C. Landes, in 1963, on the coast near Salahah, Zufur region, Sultinate of Muscat and Oman. Mr. Landes was then engaged as food consultant in Muscat and Oman.

Tribe *Hesperocalleae* Traub, *tribus nov.,* subfam. *Allioideae* (Amaryllidac.) Odora plantae alliacea; rhizoma bulbosa; foliis linearibus; inflorescentiis terminalibus racemiformibus; floribus fragrantibus per bracteis subtentibus. Typus: genus *Hesperocallis.* A. Gray.

Infrafamily *Allioidinae* Traub, *infrafam. nov.,* subfam. *Allioideae* (Amaryllidac.). Rhizoma rhizomatosa vel bulbosa; floribus regularibus vel irregularibus; staminibus certis 6 vel 3. Typus: genus *Allium* L.

Infrafamily *Brodiaeoidinae* Traub, *infrafam. nov.,* subfam. *Allioideae* (Amaryllidac.) Rhizoma cormiformi; floribus regularibus; ovario ad apicem pedicelli vel in gynophoro gerente; staminibus certis 6 vel 3. Typus: genus *Brodiaea* J. E. Smith.

TRAUB—**AMARYLLIS NOTES,** continued on page 19.

IMPROVEMENTS IN THE CLASSIFICATION OF THE GENUS **NARCISSUS** L.

ABÍLIO FERNANDES
Botanical Institute, University of Coimbra, Portugal

Some caryological studies accomplished recently on the genus *Narcissus* L. have led us to a somewhat different classification from that which we published in 1951. This classification is outlined here with reference to the caryological data.[1]

GENUS **NARCISSUS** L.

Sp. Pl. *1*: 289 (1753); Gen. Pl. ed. 5: 141 (1754).

Subgen. I. **Hermione** (Haw.) Spach, Hist. Vég. Phan. **12**: 443 (1846)

$x=5$, $x_2=10$, 11 (5+6); $x_3=11$. Chromosome complements always with cephalobrachial elements, rarely with one long only, often with several (6-8) long and short. Polyploidy frequent.

Sect. I. **Serotini** Parl., Fl. Ital. **3**: 157 (1858) p.p. excl. **N. elegans** Spach.

x=5=1 LL+1 'Ll+1 LP+1 L.+1 li, or x=15=2 LL+2 LP+3 Lp+1 L.+2 li+1 P.'+4 P.

1. *N. serotinus* L.
   var. *serotinus* (2x, 6x)
   var. *emarginatus* Chabert *
   var. *deficiens* (Herb.) Baker *

Sect. II. **Hermione**
$x_2=10$; $x_3=11$.
Subsect. I. **Angustifoliae** A. Fernandes in Bol. Soc. Brot. sér. 2, **40**: 309 (1966).
2. *N. elegans* (Haw.) Spach
   var. *elegans*, $x_2=10=2$ Lp+2 L.+1 li+1 lp+1 P.'+3 P.
   var. *intermedius* J. Gay, Idem
   var. *flavescens* Maire *
   var. *fallax* Font-Quer, $x_2=10=3$ Lp+2 L.+1 P.'+3 P.+1 pp
Subsect. II. **Hermione**
Ser. I. **Hermione**
$x_2=10=2$ Lp+2 L.+1 li+1 lp+1 P.'+3 P.
3. *N. corsyrensis* (Herb.) Nym.*
4. *N. tazetta* L. (2x)
5. *N. ochroleucus* Lois.*
6. *N. patulus* Lois. (2x)
7. *N. cypri* Sweet (3x)
Ser. II. **Luteiflorae** Rouy, Fl. Fr. **13**: 42 (1912).
$x_3=11=1$ Lp+2 L.+1 li+1 l.+2 P.'+3 P.+1 pp
8. *N. italicus* Ker-Gawl. (2x)
9. *N. Bertolonii* Parl.
   var. *Bertolonii* (2x)

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1 In this report, x, x_2 and x_3 mean, respectively, primary, secondary and tertiary basic chromosome numbers; the chromosomes in the haploid formulae (haploid chromosome complements) are represented by the symbols devised in our works of 1931 and 1934 (see bibliographical list); the degree of polyploidy of the taxa is indicated by 2x, 3x, 4x, etc.; an asterisk following the name of a taxon indicates that it has not yet been studied caryologically.

var. *algericus* (Roem.) Maire & Weiller *
var. *primulinus* Maire *
var. *discolor* Batt.*
10. *N. aureus* Lois. (2x)
11. *N. cupularis* (Salisb.) Bertol. ex Schultes f.*
Ser. III. Albiflorae Rouy, Fl. Fr. **13:** 49 (1912).[2]
$x_3 = 11 = 1$ Lp + 2 L. + 1 li + 1 l. + 2 P.' + 3 P. + 1 pp
12. *N. pachybolbus* Dur. (2x)
13. *N. canariensis* Herb. (2x)
14. *N. panizzianus* Parl. (2x)
15. *N. barlae* Parl. (2x)
16. *N. polyanthos* Lois. (2x)
17. *N. papyraceus* Ker-Gawl. (2x)

Sect. III. **Aurelia** (J. Gay) Baker, Hand. Amaryll.: 12 (1888).
$x_2 = 11$ (5+6) = 1 LL + 1 Lp + 2 L. + 1 l. + 1 P.' + 4 P. + 1 pp
18. *N. broussonetii* Lag.
f. *broussonetii* (2x)
f. *grandiflorus* (Batt. & Trab.) Maire (4x)

Subgen. II. **Narcissus**
x = 7; $x_2 = 13$. Chromosome complements usually without cephalobrachial elements, rarely with one short (*N. gaditanus, N. minutiflorus, N. obesus* and some tetraploid derivatives of *N. fernandesii*). Polyploidy present in certain sections, absent in others.

Sect. I. **Jonquilla** DC., Fl. Fr. **6:** 325 (1815); in Redouté, Liliac. **8:** Adnot. t. 486 (1816) p.p.
Subsect. I. Jonquilla
x = 7 = 2 Ll + 1 Lm + 1 Lp + 1 li + 1 lp + 1 lp'. Polyploidy present in some species.
19. *N. jonquilla* L.
var. *jonquilla* (2x)
var. *henriquesii* Samp. (2x)
var. *minor* (Haw.) Baker *
var. *stellaris* Baker *
20. *N. fernandesii* Gomes Pedro
var. *fernandesii* (2x)
var. *major* A. Fernandes (4x)
21. *N. willkommii* (Samp.) A. Fernandes (2x)
22. *N. viridiflorus* Schousb. (4x)
Subsect. II. Juncifoliae, subsect. nov.[3]
x = 7. Polyploidy unknown.
23. *N. requienii* Roem.
var. *requienii,* x = 7 = 2 Ll + 2 Lp + 1 li + 1 Pp + 1 Pp'
var. *pallens* (Freyn. ex Willk.) A. Fernandes *
24. *N. gaditanus* Boiss. & Reut., x = 7 = 2 Ll + 1 Lp + 1 Lp' + 1 li + 1 Pp + 1 P.
25. *N. minutiflorus* Willk, Idem

Sect. II. **Apodanthae** A. Fernandes in Bol. Soc. Brot ser. 2, **40:** 241 (1966).
x = 7 = 1 LL + 2 Ll + 1 Lp + 1 li + 1 lp + 1 Pp'. Polyploidy unknown.
26. *N. rupicola* Duf.
ssp. *rupicola* (2x)

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2 **N. dubius** Gouan, a hybrid between a tetraploid form of **N. Requienii** Roem. and a diploid form of a species of the Ser. **Albiflorae,** with 2n=50 (28 R+ +22 A), may be placed in this series.

3 Plantae graciles; folia viridia, valde angusta, supra leviter canaliculata, infra convexa et leviter striata; perigonii tubus interdum incurvatus; flores fragrantes.

ssp. *pedunculatus* (Cuatr.) Laínz *
ssp. *marvieri* (Jah. & Maire) Maire & Weiller *
27. *N. watieri* Maire (2x)
28. *N. scaberulus* Henriq. (2x)
29. *N. calcicola* Mendonça (2x)

Sect. III. **Ganymedes** (Haw.) Schultes f. in Syst. Veg. **7,** 2: 933 (1830). x=7=3 Lp+1 li+2 PP+1 Pp'. Polyploidy unknown.
30. *N. triandrus* L.
var. *triandrus* (2x)
var. *cernuus* (Salisb.) Baker (2x)
31. *N. concolor* (Haw.) Link (2x)

Sect. IV. **Bulbocodium** DC., Fl. Fr. **6:** 319 (1815); in Redouté, Liliac. **8:** Adnot. t. 486 (1816).
x=7; x_2=13. Polyploidy very frequent.
32. *N. bulbocodium* L.
var. *bulbocodium,* x=7=3 Lp+1 li+2 PP+1 Pp' (2x, 3x, 4x, 6x)
var. *nivalis* (Graells) Baker, Idem (2x)
var. *graellsii* (Webb) Baker *
var. *conspicuus* (Haw.) Baker (4x, 6x)
var. *serotinus* (Haw.) A. Fernandes (4x, 6x, 7x, 8x)
var. *citrinus* Baker (2x)
ssp. *praecox* Gatt. & Weiller
var. *praecox* *
var. *paucinervis* Maire *
33. *N. obesus* Salisb., x_2=13=1 Ll+4 Lp+1 'Lp+1 li+4 PP+1 Pp+1 P. (2x, 3x)
34. *N. hedraeanthus* (Webb & Heldr.) Colmeiro *
35. *N. romieuxii* Br.-Bl. & Maire, x_2=14=5 Lp+2 li+1 lp'+5 PP+1 Pp'
ssp. *romieuxii*
var. *romieuxii*
var. *rifanus* (Emb. & Maire) A. Fernandes
ssp. *albidus* (Emb. & Maire) A. Fernandes
var. *albidus*
var. *zaianicus* (Maire, Weiller & Wilczek) A. Fernandes
36. *N. cantabricus* DC., x=7=2 Lp+1 li+1 lp'+3 PP
ssp. *cantabricus*
var. *cantabricus* *
var. *foliosus* (Maire) A. Fernandes (4x)
var. *Kesticus* (Maire & Wilczek) A. Fernandes (4x)
var. *petunioides* A. Fernandes *
ssp. *monophyllus* (Dur.) A. Fernandes (2x)
ssp. *tananicus* (Maire) A. Fernandes (4x)

Sect. V. **Pseudonarcissus** DC., Fl. Fr. **6:** 319 (1815); in Redouté, Liliac **8:** Adnot. t. 486 (1816).
x=7=1 Ll+1 LP+1 Lp+2 li+1 lp+1 Pp'. Polyploidy frequent.
37. *N. longispathus* Pugsley (2x)
38. *N. nevadensis* Pugsley *
39. *N. hispanicus* Gouan
var. *hispanicus* (2x, 3x, 6x)
var. *propinquus* (Herb.) Pugsley (2x)
var. *spurius* (Haw.) Pugsley *
var. *concolor* (Jord.) Pugsley *
40. *N. confusus* Pugsley *
41. *N. obvallaris* Salisb. (2x)
42. *N. portensis* Pugsley (2x)
43. *N. pseudonarcissus* L.
var. *pseudonarcissus* (2x)
var. *platilobus* (Jord.) Pugsley *
var. *insignis* Pugsley *

var. *pisanus* (Pugsley) A. Fernandes *
var. *montinus* (Jord.) Pugsley *
var. *minoriformis* Pugsley *
var. *humilis* Pugsley *
var. *festinus* (Jord.) Pugsley *
var. *porrigens* (Jord.) Pugsley *
44. *N. pallidiflorus* Pugsley
var. *pallidiflorus* (2x)
var. *intermedius* Pugsley (2x)
45. *N. macrolobus* (Jord.) Pugsley *
46. *N. gayi* (Hénon) Pugsley (2x)
47. *N. nobilis* (Haw.) Schultes f.
var. *nobilis* (4x, 6x)
var. *leonensis* (Pugsley) A. Fernandes (6x)
48. *N. moschatus* L. (2x)
49. *N. alpestris* Pugsley (2x)
50. *N. tortuosus* Haw. (2x, 4x)
51. *N. albescens* Pugsley *
52. *N. bicolor* L.
var. *bicolor* *
var. *lorifolius* (2x)
53. *N. abscissus* (Haw.) Schultes f.
var. *abscissus* (2x)
var. *serotinus* (Jord.) Pugsley *
var. *graciliflorus* Pugsley *
var. *tubulosus* (Jord.) Pugsley *
54. *N. minor* L. (2x)
55. *N. provincialis* Pugsley *
56. *N. pumilus* Salisb. (2x)
57. *N. nanus* Spach (2x)
58. *N. parviflorus* (Jord.) Pugsley *
59. *N. asturiensis* (Jord.) Pugsley (2x)
60. *N. cyclamineus* DC. (2x)

Sect. VI. **Narcissus** . .
x=7=1 Ll+1 LP+1 Lp+2 li+1 lp+1 Pp'. Polyploidy present.
61. *N. poeticus* L.
var. *poeticus* (2x, 3x)
var. *verbanensis* Herb.*
var. *bellenicus* (Pugsley) A. Fernandes *
var. *recurvus* (Haw.) A. Fernandes (3x)
var. *majalis* (Curtis) A. Fernandes *
62. *N. radiiflorus* Salisb.
var. *radiiflorus* (2x)
var. *stellaris* (Haw.) A. Fernandes *
var. *exsertus* (Haw.) A. Fernandes *

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NOTHOSCORDUM NOTES, 1967

Pedro Felix Ravenna, *Buenos Aires, Argentina*

In the 1967 PLANT LIFE (vol. 23, page 50), the name *Nothoscordum lloydiflorum* Beauv. was restored, but further study has revealed that the correct name of this species is:

Nothoscordum vittatum (Griseb.) Rav. *comb. nov.* Syn.—*Milla vittata* Grisebach, Goett, Abhandl. 24:318. 1879.- *Nothoscordum lloydiflorum* Beauverd, Bull. Herb. Boiss. ser. 2, 8:998, f. 2. 1908.-*Beauverdia vittata* (Griseb.) Herter, Boissiera 7:511. 1943.-*Beauverdia lloydiflora* (Beauv.) Herter. 1. c.: 510.- *Ipheion vittatum* (Griseb.) Traub, Pl. Life 5:50. 1949.- *Ipheion lloydiflorum* (Beauv.) Traub, 1 c.- *Tristagma vittatum* (Griseb.) Traub, 1.c. 19: 61. 1963.- *Tristagma lloydiflora* (Beauv.) Traub, 1.c.

Specimens: Uruguay, Canelones, Independencia, in campis; leg. C. Osten 5222, 3-V-1908 (iso-type of *N. lloydiflorum* S1). Argentina Entre Ríos, Concepción del Uruguay, en el campo entre las gramas, fl. blanca; leg. Lorentz 968, 1-V-1877 (isotype of *Milla vittata* BAF).

This species possibly is not distinct from *Nothoscordum setaceum* (Bak.) Rav. (see below), of which unfortunately I had access only to a phototype. *Nothoscordum lloydiflorum* Beauv. differs from it mainly by the more papillose and narrower leaves; these characters are variable and are of doubtful significance in characterizing species.

Nothoscordum setaceum (Bak.) comb. nov.- *Milla setacea* Baker, Journ. Linn. Soc. London 11:385. 1871.- *Tristagma setaceum* (Bak.) Traub, Pl. Life 19:61. 1963.

Owing to the fact that this species was never recollected in the province of Tucumán, I feel reluctant in stating place of origin. Possibly it is a native of the province of Santa Fe, which was on Tweedie's route, or may be even to Entre Ríos. It is known that some specimens from that collector were wrongly labelled by him or by persons who received them.

Specimen: Argentina, Tucumán; leg. Tweedie (phototype from K).

SUCROSE AS THE SOLE CONSTITUENT OF THE HONEY OF **CRINUM ASIATICUM**

Judy L. Zorbach and William W. Zorbach

Early in the summer of 1964, the writers obtained two magnificent specimens of *Crinum asiaticum* L. from Mr. Wyndham Hayward; these were planted in a small, but well-prepared bed in their garden in Washington. Although it is possible to winter over this species in the Washington area with a great deal of protection, the results are not satisfactory, especially if arrival of spring is delayed.

To avoid risk of loss or damage to the newly acquired specimens, each was removed from the yard in early fall, and replanted in 16-inch redwood tubs in "gritty" (sandy) soil. Before the first frost arrived the tubs were brought inside the writers' conservatory, the construction of which had just been completed. Under these conditions, the two crinums thrived and bloomed well during the winter months, and around May 1 of the following year they were brought outside and exposed to full sun, and cared for in this way until cold weather arrived, after which they were returned to the conservatory. By June of this year (1967), the bulbs had attained a diameter of about 7 inches; they were at this time cut back severely and carefully removed from the tubs preparatory to shipping to the writers' new location in New Iberia, Louisiana. They were subsequently replanted outside and have already made good growth at this writing.

It was during the winter months in Washington in the conservatory when the honey production of *C. asiaticum* was acutely noted, for, under these conditions, the leaves were not washed clean by the rain, and an opportunity for the careful observation of the behavior of the flowers was provided. It will be disclosed later on that the sole constituent of the honey is sucrose, but this is not at all surprising, inasmuch as the sugar occurs almost universally throughout the plant kingdom in the

juices, seeds, leaves, fruits, flowers, and roots of plants; sucrose was reported in all of the 281 species of phanerogams studied by Bourquelot and his associates *(1)*.

What is remarkable is that, in light of our somewhat limited experience, *C. asiaticum* produces *copious* quantities of honey. As the individual flowers wilt, a clear, colorless sirup exudes from the throats of each, forming drops which frequently fall upon the leaves. The sirup is a very concentrated solution, as evidenced by the fact that the drops do not run down the leaves in watery fashion, and also because the sirup thus collected becomes completely crystalline in a few days It is estimated that each flower produces 2-3 drops of sirup, accounting for 250-500 mg. of sugar, and, from an average of 15 blooms per umbel, this would amount to 3.75-7.5 grams! Of the various other amaryllids, and, in particular, of several other crinums grown by the writer, such a profuse exudate of honey has not been noted.

Although it is unlikely that the constitution of the honey of *C. asiaticum* has been previously reported, an exhaustive literative search was not made. Regardless of possible priority, the authors set about independently to perform constitutional studies in an effort to identify the "new" sugar, with a view to preparing an article of possible interest to amaryllid enthusiasts.

Collection of the crystallized honey was made by carefully scraping it from the leaves. Although contaminated by some dust, the crystals had m.p. 191-196° [this is an excellent value for sucrose, which does not have a definite melting point *(1)*. The range varies, depending upon the medium used for purification.] The crystals were then dissolved in methanol, the solution was decolorized and filtered, and a large volume of acetone was added. After two days, the beautifully crystalline sugar was collected by filtration, and had m.p. 188-192°. When admixed with a sample of authentic sucrose (table sugar) of m.p. 186-190°, no depression was observed. The recrystallized unknown sugar failed to give a positive "silver mirror" test with ammoniacal silver nitrate, and did not form a phenylhydrazone; therefore, it was either a non-reducing disaccharide or oligosaccharide. It gave a positive diazouracil test, strongly suggestive of sucrose. Acetylation of the sugar in pyridine gave, after processing, a sirup which crystallized readily from ethanol-pentane after seeding with an authentic specimen[1] of octa-*O*-acetylsucrose. The acetylated derivative had m.p. 85-87°, undepressed when admixed with an authentic sample[1] of octa-*O*-acetylsucrose of m.p. 84.5-86°. The original sugar was homogeneous on thin-layer chromatograms and had an *Rf* value corresponding to that of sucrose. Its optical rotation was $[\alpha]_d + 66°$ in water (lit. *(1)* $[\alpha]_d + 66.53°$ in water). The honey of *C. asiaticum* is, therefore, composed of pure sucrose.

[1] From a sample in the authors' collection, originally prepared by the late Prof. Geza Zemplén, Hungarian carbohydrate chemist and discoverer of the widely used Zemplén method for the saponification of esters, during his brief tenure as visiting professor at Georgetown University, Washington, D. C.

The authors gratefully acknowledge the technical assistance of Dr. and Mrs. K. Venkatramana Bhat.

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(1) W. Z. Hassid and C. E. Ballou, in W. Pigman (ed.), *The Carbohydrates,* Academic Press, Inc., New York, N. Y., 1957, pp. 501-502.

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BAHAMA ISLANDS **HYMENOCALLIS** SPECIES

W. Quinn Buck

In July of 1964 Dr. Hamilton P. Traub sent to me at the Los Angeles State and County Arboretum, Arcadia, Calif., a group of bulbs which included the very rare *Hymenocallis sp.,* 'Man-o'-War' Cay. (T-

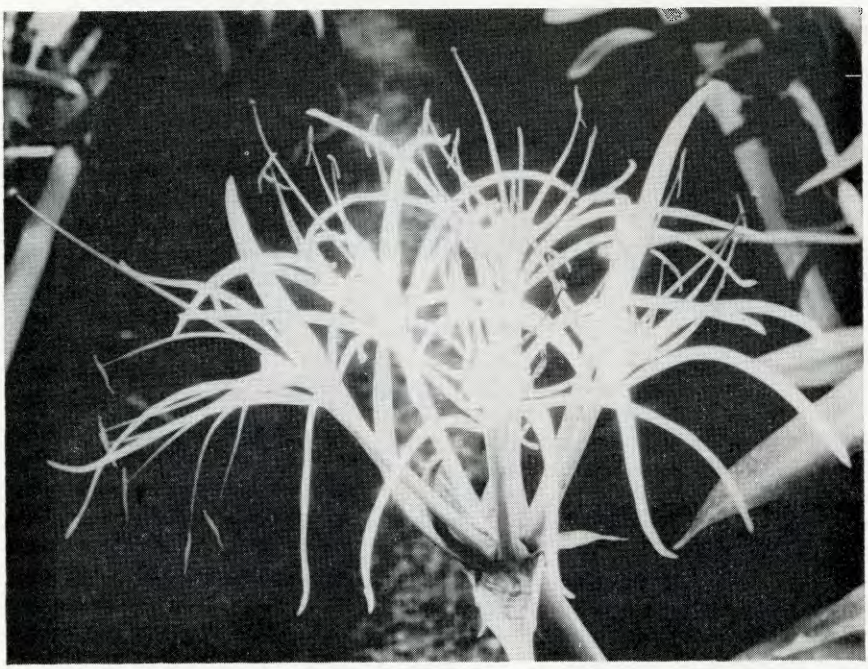

Fig. 15. **Hymenocallis** sp. T-775, collected by Mr. Henry C. Gibson, Jr., on Man-O-War, Abaco, Bahama Islands, in sandy soil. Close up of an umbel as grown by W. Quinn Buck, Arcadia, Calif., in 1967. See also Fig. 16. Photo by Jack V. McCaskill.

775) from Abaco, Bahama Islands. This small bulb was started in a six-inch pot in a mixture of siltsand and peat in equal volume. Early in 1965 it was shifted into a 10-inch fern pot. Since my retirement from the Arboretum in 1965 this species has been growing in the greenhouse at my home, where it has seemed to be quite happy.

Fig. 16. **Hymenocallis** sp. T-775, collected by Mr. Henry C. Gibson, Jr., on Man-O-War Cay, Abaco, Bahama Islands, in sandy soil 1964. Plant as grown in W. Quinn Buck's greenhouse, Arcadia, Calif., the second scape with umbel and the fading first umbel produced in 1967. Photo by Jack V. McCaskill.

Growth has been very good in the bright, warm south half of the greenhouse, where it has received abundant water at all seasons. In 1966 there were two handsome flower spikes, and in 1967 there have been three in succession during August and September, the first from the large center bulb, and then one from each of the large offsets in turn. The 38-inch spike was topped by a widespread 12-inch umbel of clear white, spicy scented flowers. It has so far proved to be a very satisfactory greenhouse plant.

The full-length picture (Fig. 16) shows the second scape with umbel and the fading first scape with umbel of 1967. A third scape with umbel bloomed in late September. The close-up (Fig. 15) shows the handsome umbel.

PLANT LIFE LIBRARY—continued from page 32.

TAXONOMY, by R. E. Blackwelder. John Wiley & Sons, 605 3rd Av., New York, N. Y. 10016. Subtitled, "A Text and Reference Book", it is in the main "concerned with the practical tasks of the taxonomist." The book is intended for a beginning course, and an advanced one, on the theory of taxonomy, embracing six parts: (a) introduction, (b) elements of practice, (c) animal diversity and the major problems of grouping, (d) advanced practice, (e) theoretical aspects, and (f) special requirements of zoological nomenclature.

MEMORIALS OF JOHN BARTRAM AND HUMPHREY MARSHALL, by William Darlington. Hafner Publ. Co., 31 E. 10th St., New York, N. Y. 10003. 1967. Pp. 585. Illus. $20.00. This reprint of a frequently cited book, first published 117 years ago, will be welcomed by all plant scientists, horticulturists and gardeners. The book is prefaced with chronologies in the lives of John Bartram and Humphrey Marshall, and revised indices to the personal names, ship captains and plant names. This charming book, dealing with 18th century botanical history in the American Colonies, is highly recommended.

THE WILD GARDENER IN THE WILD LANDSCAPE, by Warren G. Kenfield. Hafner Publ. Co., 31 E. 10th St., New York, N. Y. 10003. 1966. Pp. 232. Illus. $7.50. Subtitled, "The Art of Naturalistic Landscaping", this stimulating book provides a new outlook on the subject. The topics covered include five modes of landscape appreciation, revolution in land-use, the art of eliminating, perpetuating, and adding plants. This outstanding new book is highly recommended.

POLLEN MORPHOLOGY AND PLANT TAXONOMY: ANGIOSPERMS, by G. Erdtman. Hafner Publ. Co., 31 E. 10th St., New York, N. Y. 10003. Reprint Edition, 1966. Pp. 553. Illus. $14.00. This reprint of the 1954 Edition, with corrections and an addendum, will be welcomed by all plant scientists. The topics covered include pollen preparations, pollen and spore morphology, and pollen descriptions of representatives of the plant families. A glossary, bibliography, index and addendum, complete the book. Highly recommended.

BIOCHEMISTRY OF CHLOROPLASTS. Vols. I and II, edited by T. W. Goodwin. Academic Press, Berkeley Square House, Berkeley Sq., London, W. 1.; and 111 5th Av., New York, N. Y. 10003. Vol. 1. 1966. Pp. 476. Illus. 115s; $18.00; Vol. II. 1967. Pp. 776. Illus., 160s; $29.00. The first and second volumes of this outstanding new series contain contributions from many authorities. Volume I includes papers on the structure and morphogenesis of chloroplasts; and chloroplast components.—lipids, proteins, lipoproteins, nucleic acids, pigments. Volume II, includes papers on the biogenesis in chloroplasts,—CO_2 fixation, carbohydrates, lipids, proteins and nucleic acids, pigments, photosynthetic phosphorylation; and biosynthetic mechanism in relation to morphogenesis. Highly recommended.

INTERNATIONAL REVIEW OF FORESTRY RESEARCH. Vol. 2, edited by J. A. Romberger and P. Mikola. Academic Press, 111 5th Av., New York, N. Y. 10003. 1967. Pp. 316. Illus. $15.00. This 2nd volume in the series contains contributions from seven outstanding authorities, including the history of forestry research in East Asia; influence of spacing on growth of conifers; influence of sylvicultural practice on wood properties; the forest energy balance; growth rates and growth perodicity of tree roots; and succession of organisms in discoloration and decay of wood. Highly recommended.

SYMBIOSIS. Vol. II, edited by S. Mark Henry. Academic Press, 111 5th Av., New York, N. Y. 10003. 1967. Pp. 443. Illus. $17.50. This 2nd volume in the series contains contributions from six outstanding authorities, including papers on insects and their endosymbionts; insect ectosymbiosis; ectosymbiosis in woodland-inhabiting insects; ectosymbiosis ofaquatic insects; avian symbiosis; and intestinal microorganisms of ruminants and other vertebrates. Highly recommended.

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3. GENETICS AND BREEDING

AN AMARYLLIS BREEDING PROJECT—1967 REPORT

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To one interested in using the *Amaryllis* species in breeding to produce new and different hybrids the 1967 season was, as usual, a mixture of limited successes and many failures. The limited successes provide the incentive to keep working at a challenging but sometimes frustrating hobby. I will describe some of the successes and omit most of the failures, except in a few cases where the information may be of help to those with similar interests in growing and hybridizing *Amaryllis* species.

First, I would like to make a few general observations in regard to setting seed with *Amaryllis* species and F-1 hybrids. The ability to set seed with the species is certainly much less than for most of the modern hybrid groups (e.g. the Dutch hybrids). Three reasons generally given for inability to set seed with the species are: (1) incompatibility due to differences in chromosome number, (2) incompatibility due to unknown differences which exist between divisions (subgenera) of the species and (3) sterility of one or both of the species being used. The point I want to make is that although a species may be known to be fertile, this does not mean that every clone of that species will be fertile. To cite a few examples: For four years I have tried to set seed, using a wide variety of pollen parents, on a clone of *A. evansiae* and several of its vegetative offsets. Over thirty pollinations were uniformly unsuccessful. Yet the fertility of *A. evansiae* as a pod parent was thoroughly demonstrated by the late Prof. Ira Nelson. Mr. Keith Brown (PLANT LIFE, 1967) reports on his inability to obtain seed using a 'Senorita' hybrid as a pod or pollen parent. I have had no such difficulty with my 'Senorita' hybrid, although it does perform better as a pollen parent. Some years back several individuals reported that *A. forgetii* collected by Dr. Goodspeed (PLANT LIFE, 1956) failed to set seed. *A. forgetii* collected by Dr. Vargas is reported to have set seed with the pollen of *A. reticulata stratifolia*. Two years ago Fred Buchmann and I both obtained *A. forgetii* collected by Dr. Cardenas in Bolivia. Although my plant has not bloomed, Fred has set seed on his and reports on his experiences in this issue.

About the only firm conclusion that can be drawn from these experiences is that some clones of *A. evansiae, A. forgetii* and 'Senorita' hybrids will set seed and others will not. If one finds that a certain species will not set seed he should try to obtain the species from another source and the problem may be solved.

I never cease to be amazed by the unique beauty and ease of culture of the 'Senorita' hybrids. Although outdoor culture has not been successful, planting three or four blooming size bulbs to an 8-10 inch pot

gives a spectacular display. During spring, summer and early fall the pots are kept outdoors and monthly applications of liquid fertilizer promote the foliage growth necessary for heavy bloom. The pots are brought indoors early in November (into a glass-enclosed patio) and water applied sparingly. Bloom scapes appear by mid December and I have had bloom at Christmas. Each bulb normally makes two scapes (a few make three) with four to five flowers per scape. The creamy pink flowers are 4-4½ inches across, have a green throat and a wax-like sheen. Because of light conditions on my patio the scapes reach a height of 36-40 inches. In January, 1967 I counted 17 blooms open at one time on four bulbs in a single pot (see Figure 17). The scapes seem to be produced in two groups such that the blooming display lasts about six weeks. As though this were not sufficient, one or two out-of-season bloom scapes may appear during the summer.

'Senorita' performs better as a pollen parent than as a pod parent for me. I have seedlings from 'Senorita' crossed with a wide variety of Dutch hybrids including 'Royal Dutch', 'Christmas Gift', 'Marie Goretti', 'Little Diamond' and 'Golden Triumphator'. Most of these are growing well in outdoor beds, although some are grown in pots. Two (2 year old) seedlings bloomed this past season. One ('Christmas Gift' X 'Senorita') was pale pink, 6-6½ inches across and leopoldii type. Another ('Royal Dutch' X 'Senorita'), was a beautiful light rose. It appears that many of these hybrids produce offsets almost as freely as does 'Senorita', particularly in pot culture. More extensive bloom is anticipated for the 1968 season.

Four years ago I obtained from Prof. Claude Davis a small seedling bulb from the cross *(A. evansiae* x *A. agliae)* x *A. evansiae.* This hybrid has grown very well in pot culture and has bloomed for the past two seasons. In color and form it is almost indistinguishable from *A. evansiae.* About 3½ inches across, it is light cream yellow and of fairly full form. Its culture is easier than *A. evansiae,* not being nearly so critical regarding moisture and tendency to rot. When it first bloomed in 1966 no seed was set. This past season several seed pods were obtained from the original bulb and two of its offsets. Three pods resulted from 'White Christmas' as the pollen parent; only two of about fifty seed germinated. These are growing well and the possibility of large yellow hybrids is an incentive for the future. About a dozen seedlings were obtained by using the pollen of a fine specimen of the Davis hybrid *(A. evansiae* x *A. agliae).* These should give some interesting small yellow hybrids and they appear to be vigorous growers.

Early in 1966 I was able to obtain blooming size bulbs of *A. starkii* and *A. yungacensis.* These bulbs were collected by Dr. Cardenas in Bolivia and sent to Prof. Davis for distribution. *A. starkii* was originally collected by the late Prof. Ira Nelson in Bolivia in 1958 and named as a new species by Nelson and Traub (PLANT LIFE, 1963). This is a very distinctive species, principally because of the almost vertical posture of the perigone. A few weeks after potting my bulb of *A. starkii,* and before any leaf development, a bloom scape appeared. The scape was

two flowered, the flowers being more pink than orange in color and very regular in form. In order to achieve maximum variation of progeny mixed pollen was used on both blooms. Pollen parents included *A. belladonna,* a white Dutch hybrid, the *A. evansiae* hybrid

Fig. 17. **Amaryllis** grown by Mr. Joseph K. Mertzweiller, Baton Rouge, La. Upper left, Hybrid, 'Marie Goretti' x **A. evansiae;** upper right, picotee type from 'Nivalis' x 'Apple Blossom'; lower left, unidentified species Goedert SA 63-20; and lower right, 'Senorita' hybrid, 17 blooms open on 4 bulbs in 10-inch pot.

described previously and two unidentified species. Two pods were set and germination was excellent. At this writing more than fifty seedlings are in their second growing season and there is keen anticipation as to the characteristics of these hybrids. After maturing the seed

pods the parent bulb remained dormant until the spring of 1967. It appears to be a rather weak grower.

A. yungacensis (Cardenas and Nelson, PLANT LIFE, 1965) also bloomed within a few weeks after the bulb was received. This very striking species is noted for its bold color pattern in greenish white and red. One bloom was pollinated using pollen from another clone of *A. yungacensis* and the other was pollinated with pollen from *A. forgetii*. Both pods set and reasonable germination was obtained. The seedlings grew well during the summer and fall, and in March both groups of seedlings were re-potted to give them more room. Almost immediately all went dormant and remained dormant for several months until the pots were moved to a cooler, more shaded location. It is concluded from this experience that *A. yungacensis* and its F-1 hybrids do best when maintained under cool, somewhat shaded conditions. The parent bulb of *A. yungacensis* has shown fairly vigorous growth but it did not bloom in 1967.

A. forgetii was received at the same time as *A. yungacensis,* but has not yet bloomed for me. It is an extremely vigorous grower. Probably the reason for its failure to bloom is that it did not get a thoroughly dry rest period. This fall I plan to withhold water completely from both *A. forgetii* and *A. yungacensis.*

A. pseudopardina is another species which has not bloomed and has been somewhat of a disappointment. The bulb made good growth and three offsets in two years and had become crowded in the pot. In May, 1967 the main bulb was re-potted and the three offsets planted in another pot. Two of the offset rotted almost immediately. At present the original bulb and the remaining offset are showing new growth. It appears that the culture I have provided is not right for this species. If reasonable growth is made prior to late fall I plan to subject it to a dry rest period.

With respect to *A. pseudopardina (= A. leopoldii)* I have a few comments I wish to offer. In 1964 I obtained from Mr. Goedert a blooming size amaryllis bulb under the name 'leopardina hybrid', the name inferring the possibility of it being a hybrid of *A. leopoldii* and *A. pardina.* I believe Mr. Goedert obtained these bulbs from Hawaii. Of course there is no guarantee that the proposed parentage for this hybrid is correct. This amaryllis has bloomed very consistently in pot culture. It is fairly large, about seven inches across, very regular in form and with white throat markings not inconsistent with an F-1 hybrid of a species fitting the AMARYLLIS MANUAL description of *A. leopoldii.* It has been my intention to "breed back" by repeated self pollination. Unfortunately no seed could be obtained. Early in 1967, while the bulb was still dormant, I took it out of the pot and planted it in an outdoor bed. It bloomed in April and seed was obtained by selfing. A dozen seedlings are now growing. It will probably be three or more years before these seedlings bloom, and it will be very interesting to see if there are types resembling *A. pesudopardina* or the originally described *A. leopoldii.*

Two other species, *A. umabisana* and *A. mollevillquensis* have not bloomed. They do not grow well in the humid climate of south Louisiana, but are holding their own. *A. umabisana* has two large blue-green leaves and *A. mollevillquensis* has only one leaf at this time. These species are native to high elevations where the climate is cool and dry and it is a great challenge to try to grow them under Louisiana conditions. If they can be induced to bloom but one time it may be possible to cross them with other species or hybrids better adapted to a humid climate and thus introduce new characteristics.

An interesting F-1 hybrid which is proving useful in my breeding program is derived from *A. belladonna* (var. belladonna) X *A. striata* (probably var. fulgida). The plant was obtained as a seedling bulb from Prof. Davis several years ago. Flowers show typical *belladonna* form, are orange red in color and about six inches across. This hybrid sets seed very readily. I have seen many seedlings raised by Prof. Davis from crosses of this hybrid with Dutch clones. The most notable features are (1) very vigorous growth and (2) plentiful offset formation. Some of my own two year old seedlings are the most vigorous growers in my outdoor planting.

A hybrid which bloomed for me for the first time in 1967 was derived from 'Marie Goretti' X (*A. evansiae* x *A. pardina*). The pollen was given to me by the late Prof. Nelson in 1964. Only four seedlings were obtained. In pot culture these vary from very vigorous to almost totally lacking in vigor. The most vigorous plant produced a three flowered scape, leopoldii-type flowers, about seven inches across with nicely ruffled edges. The ground color is light pink with a lacy network of orange veining. Texture and substance are outstanding; in bright light the blooms show a diamond-like sparkle. This hybrid is considered encouraging evidence that beautiful and different varieties can be produced by use of the species or F-1 hybrids with the white Dutch hybrids and is pictured in Figure 17. No seed was set in 1967.

Regarding the white Dutch hybrids, these are a very highly inbred group and may be regarded as species in crossing with other species or even with other Dutch hybrids. A cross made many years ago 'Nivalis' X 'Apple Blossom', was repeated in 1964 and several of these seedlings bloomed in 1967. These were very similar to the earlier progeny from this cross. All are large, full leopoldii types. The base color is white. About 60% have a distinctive picote edge. All have red line or red spotted markings, or both, varying from very slight to fairly pronounced. As a group they are very vigorous growers and very dependable bloomers. One of the more pronounced picote types is shown in Figure 17.

Another group of hybrids showing promising performance in outdoor culture was obtained by using the pollen of *A. striata* (var. *fulgida*, light salmon pink in color) on the white Dutch hybrid 'Marie Goretti'. Five seedlings bloomed in 1967. All were very similar, five to six inch flowers, salmon pink ground color with some orange veining and green throats. Each bulb has produced five or six offsets. I consider these

among the best "different" amaryllis for outdoor culture on the basis of their initial performance.

Finally I would like to offer a few comments on some of the unidentified species imported by Mr. Goedert. I have previously mentioned the species I obtained under number SA 63-20 (PLANT LIFE, 1967). A picture of this species is shown in Figure 17. I consider it to be a form of *A. belladonna* because of its growth habits and capitate stigma. It is the most dependable bloomer among those I have obtained from Mr. Goedert. Selfed seedlings of SA 63-20 are three years old and are growing very slowly and are at least two years from blooming size. Blooming of these selfs should determine whether SA 63-20 is a true species or a natural hybrid. Many seedlings from SA 63-20 X (*A. evansiae* x *A. aglaiae*) should bloom in 1968. Seedlings from 'Royal Dutch' X SA 63-20 are perhaps two years from bloom. Several attempts have been made using the pollen of white Dutch hybrids on SA 63-20. Seed pods were always obtained, but the seed were always devoid of embryos. This past spring I obtained a good crop of seedlings from the cross SA 63-20 X *A. cybister*. The original bulb of SA 63-20 rotted after maturing seed pods this year, but two offsets and the selfed seedlings remain.

Species SA 63-22 has bloomed for the past two seasons and this is definitely a form of *A. striata* (probably var. *striata*). Another species, said to be *A. striata* (var. *acuminata*), also blooms well. I can detect very little if any differences between these two plants. A large number of seedlings were obtained by crossing these two.

Unidentified species which have not bloomed include SA 62-1, SA 62-5, SA 63-10, SA 63-16, LM 63-1 and one said to be *A. maracasa.*

HYBRIDIZING WITH AMARYLLIS SPECIES

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In recent years there has been a return to growing and hybridizing amaryllis species and first-generation hybrids as reported by Nelson (1955, 1960), Smith (1961), Morris (1964), Fesmire (1967) and many others. In view of the many, very beautiful hybrids that are readily available, there must be logical reasons for working with species. The reasons seem clear. (1) New species have been discovered which can add new and distinctive characteristics to the present hybrids. (2) Quite a few previously discovered species, which have been lost to cultivation, have been reintroduced. (3) It seems probable that the presently available species can be combined to produce new and significantly different types either in form, color, color pattern or size. (4) In creating new types, *being able to leave out some species,* with dominant characteristics which went into the first hybrids, may be almost as important as which species are included in the new hybrids.

Since the availability of species (especially to the amateur) is almost completely dependent on others, it seems proper to give credit to

the persons and organizations that have been largely responsible for my progress thus far.

1. Probably the late Prof. Ira S. Nelson at the University of Southwestern Louisiana helped to initiate this latest surge in species hybridizing in connection with the Louisiana Society for Horticultural Research and as a result of his collecting trips to South America in 1954 and 1958. Three new species were discovered (one jointly with Dr. Martin Cardenas), several previously described species were reintroduced, and a number of species and F1 hybrids were made available through the Louisiana Society for Horticultural Research.

2. More recently Dr. Martin Cardenas (Herbert Medalist for 1967) of Cochabomba has collected and Prof. Claude W. Davis of Baton Rouge has imported and distributed a number of Bolivian species which hold great promise to the hybridizer (Davis, 1967).

3. Recently, also, Mr. Robert Goedert (Herbert Medalist for 1965) has imported and distributed a number of unidentified species collected for him in South America.

4. Also, other individual efforts have been most helpful. Prof. Davis has propagated releases from the Louisiana Society for Horticultural Research and also made further crosses with these species or varieties and made these plants widely available. Further, there has been a considerable exchange of plants and pollen between individuals and I feel that this should be encouraged as suggested by Mr. Fesmire (1967).

In the discussion of the individual crosses below, the cross will be identified followed by the year (in parentheses) that the cross was made and in turn (second parentheses) by the number of seedlings now growing (July, 1967). An attempt will be made to discuss consecutively those crosses where a common objective exists or where the species are closely related.

THE QUEST FOR YELLOW HYBRIDS

Many hybridizers are working toward yellow hybrids both in large (leopoldii) and miniature (gracilis) sizes. As will be indicated in later descriptions, one fallout from this effort may be light pink or pink and yellow hybrids which will also extend the color range of present-day hybrids.

Some seedlings from crosses of *A. evansiae* X white dutch described by Nelson (1960) are pink but as pointed out this color probably is genetically unstable since it originated from light yellow and white. Pollen from one of these seedlings was used with 'Maria Goretti' (1965) (30) and 'Winter Carnival' (1965) (15). When these seedlings bloom, many possibilities exist for selfing and sibling the best individuals.

One clone of (*A. evansiae* X *A. aglaiae*) X *A. evansiae* is pale yellow in color and frequently has four florets per scape. One of its siblings (sterile as a pod parent thus far) has a similar pale yellow background but also has many tiny reddish-orange veins giving an orange-pink appearance from a few feet away. A clone of *A. evansiae* X (*A. evansiae* X *A. belladonna*) is a pink-yellow bicolor with predominantly light

pink petsegs and predominantly pale yellow setsegs. As is frequently the case with the progeny of *A. evansiae,* their colors defy adequate description. The following crosses have been made.

(1) [(*A. evansiae* X *A. aglaiae*) X *A. evansiae*] X 'Maria Goretti' (1966)(11). The reverse cross failed.

(2) [(*A. evansiae* X *A. aglaiae*) X *A. evansiae*] X Sib (1966)(9).

(3) [(*A. evansiae* X *A. aglaiae*) X *A. evansiae*] X [*A. evansiae* X (*A. evansiae* X *A. belladonna*)] (1966)(15).

(4) 'Maria Goretti' X [*A. evansiae* X (*A. evansiae* X *A. belladonna*)] (1966)(24).

Another interesting hybrid known as 'Morris Yellow' is from an unrecorded cross made by Mrs. Lloyd Morris of Baton Rouge. One parent may be either *A. evansiae* or 'Senorita' (*A. evansiae* X *A. striata*) and the other parent either 'Nivalis' or 'White Giant'. The 5½ inch florets (four per scape) are full and fairly flat with a slight upward tilt. The color is pale yellow with darker yellow highlights starting in the throat and extending out into the center of the segments and with pale pink lines radiating out from the inner parts of the segments. The following crosses have been made.

(1) 'Maria Goretti' X 'Morris Yellow' (1966) (18).
Reciprocal (1967)(8).

(2) 'Nivalis' X 'Morris Yellow' (1966 and 1967)(58).
Reciprocal (1967)(15).

'Morris Yellow' has also been used as the pollen parent with the following: 'Senorita' (1966)(3); 'Pamela' (1966)(25); a clone from an orange *reginae* hybrid X 'Senorita' (1966) (10); a white gracilis (1967) (7); *A. belladonna major* (1967) (4) and a pink-orange form of *A. striata* (1967) (12).

A clone of [*A. evansiae* X (*A. evansiae* X *A. aglaiae*)] X [(*A. evansiae* X White Dutch) X sib] is an intermediate sized, pink blush on white with a yellow star in the center. It has been used as the pollen parent in 1967 with 'Maria Goretti' (10 seedlings), 'Nivalis' (12), 'Senorita' (2), and the pink-orange form of *A. striata* (25).

In addition to the above and the crosses with 'Senorita' described below, about 200 other seedlings related in some way to *A. evansiae* are in various stages of growth. It is impossible to guess which of these may be most likely to aid in producing yellow amaryllis.

HYBRIDIZING WITH SENORITA

Almost everyone who has written about 'Senorita' has pointed out that words and even pictures fail to adequately describe the beauty of this lovely group of flowers. (Fig. 18) This combined with their vigorous growth and easy blooming seem to strongly recommend 'Senorita' as a parent. Depending on the choice of the other parent, either small or large-flowered hybrids appear possible. 'Senorita' sets seed sparingly, usually on the first one or two florets (out of four) per scape and generally produces 8 to 20 seed about one-half of which are viable. This may vary from one clone of 'Senorita' to another. Using

'Senorita' as the pod parent, three to eight seedlings are in various stages of growth (many very vigorous) from crosses with the following pollen parents: 'Prima Donna', 'Rosaline', 'Golden Triumphator', 'Maria Goretti', 'Picotee Petticoat', 'Constant Comment' and a white gracilis. A plant of 'Senorita' X 'Apple Blossom' has bloomed. It is intermediate in size and has a very light pink background contrasted with a bright green throat and with darker pink lines radiating outward on the segments. It has been crossed with several white dutch hybrids.

Fig. 18. **Amaryllis** hybrid, 'Senorita' as grown by Fred J. Buchmann, Baton Rouge, La.

The pollen from 'Senorita' sets viable seed easily on a wide variety of both leopoldii and gracilis hybrids. One seedling that is especially interesting is from a cross of 'Constant Comment' X 'Senorita.' (Fig. 19) The gracilis type flowers are light pink shading to tomato red at the outer edges of the segments. However, the most outstanding feature is a dark yellow band (¼ to ⅜ inch wide) extending from the throat about one-third of the length of each of the top three segments. Each band is surrounded by an area about ¼ inch wide of darker reddish-orange, much darker than the background color. This gives an appearance similar to that of the "eye" in some clones of hemerocallis. Possibly this "eye" can be improved and passed on to other colors and sizes of amaryllis. This eyed-clone was the pod parent for a cross with 'Morris Yellow' (1967)(20).

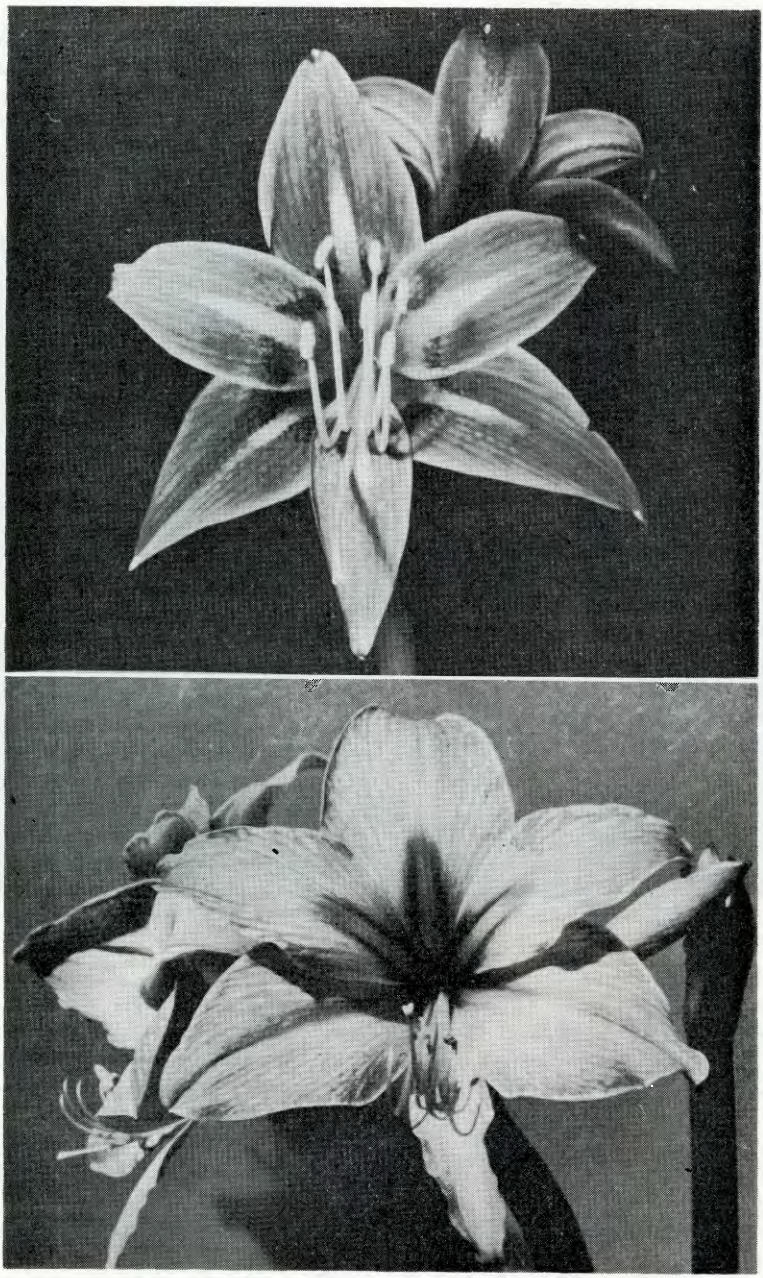

Fig. 19. **Amaryllis** grown by Fred J. Buchmann, Baton Rouge, La. **Upper, Amaryllis forgetii** (Worsley) Traub & Uphof, and lower, eyed clone from a cross of 'Constant Comment' and 'Senorita'.

A. FORGETII, A. YUNGACENSIS, A. AULICA

A. forgetii has been a real joy. It was received on January 8, 1966 and bloomed on March 20, 1966. (Fig. 19) It was kept watered and bloomed again on December 10, 1966. It is not clear whether this latter date will be more nearly its normal blooming time. Pollen from *A. forgetii* set seed on *A. aulica* (var. *stenopetala*?) (30 vigorous seedlings) and also on *A. yungacensis*. This latter cross was made by Joseph Mertzweiller of Baton Rouge and also gave vigorous seedlings. However, all other attempts to use *A. forgetii* pollen were unsuccessful on species, either in the *striata* or *belladonna* groups, dutch hybrids or *gracilis* (all known to set seed easily). On the other hand, *A. forgetii* set seed each time it was pollenated. On December 10 no other fresh pollen was available, so it was selfed and ten not so vigorous seedlings are just now putting on their second leaves; they appeared to go dormant after putting on the first leaf. From the March blooming, eight vigorous seedlings resulted from mixed pollen of 'Maria Goretti' and 'Christmas Gift' (the reverse cross with 'Maria Goretti' failed) and about 40 somewhat slower growing seedlings resulted from mixed pollen of *A. striata, A. evansiae* and *A. yungacensis*. In this latter cross it was hoped that three groups of seedlings would be produced. However, careful examination of the seedlings (now about one year old) suggests that fertilization occurred with pollen from only one species. In view of the incompatibilities indicated above for *A. forgetii* pollen, this cross may be from the *A. yungacensis* pollen and be the reciprocal of the cross made by Joseph Mertzweiller. My experience with pollen from *A. yungacensis* has been similar thus far; no seed have resulted with either species in the *striata* and *belladonna* groups or with known seed-setting dutch hybrids with one exception. A small pod was set on 'White Christmas' (1966) and four seedlings are growing moderately well. Crosses failed with 'Nivalis and 'Maria Goretti' which set seed very consistently.

The implication is that the *Aulica* group is somewhat further removed from the *striata* and *belladonna* groups and also from white dutch hybrids than either of these latter three are from each other. It will be interesting to see if further crosses bear out this implication. Also, it will be interesting to see if the above hybrids involving *A. forgetii, A. aulica, A. yungacensis* and white dutch will produce large, full flowers with four florets per scape. They should be in various combinations of red, white and green and bloom at Christmas time. Because of this potential blooming (and probably growing) time, these hybrids will have to be handled as pot plants in the Baton Rouge area but should do well in areas with a warmer winter climate.

AMARYLLIS PSEUDOPARDINA

A. pseudopardina (*A. leopoldii*—see Plant Life, vol. 21, pages 55-57 and 60-63) has been a horticultural success but a disappointment in hybridizing. Received in October, 1964, it has grown vigorously and

bloomed twice. However, as a pod parent no viable seed have been set with mixed pollen from species in the striata and belladonna groups and from white leopoldii hybrids. Pollen from *A. pseudopardina* was used on everything available—species (again in the striata and belladonna groups), various leopoldii hybrids and several striped "yard flowers" in the reginae division. Result—no seed. If this species should bloom again next year and other plants cooperate, crosses will be attempted with species in the aulica group.

SUMMER-FLOWERING AMARYLLIS

This is an area where absolutely no success has been achieved. *A. aulica* var. *platypetala*, a plant obtained as *A. correiensis* and a plant obtained as *Amaryllis* X *acramanii* all bloomed in July, 1966, but I was unable to get any seed to set.

AMARYLLIS STARKII

A. starkii appears to hold considerable promise for producing pastel, miniature hybrids. Three seed pods have been set resulting in about 100 seedlings. Mixed pollen was used in all cases and involved *A. striata*, (*A. evansiae* X *A. aglaiae*) X *A. evansiae*, *A. belladonna major*, two tiny *A. belladonna* hybrids, 'Senorita', a white gracilis and 'Daintiness'.

UNIDENTIFIED SOUTH AMERICAN SPECIES

An interesting experience occurred in the Spring of 1967 in connection with bulbs imported by Mr. Goedert. Bulbs designated as SA 62-3 and SA 63-16 bloomed about two weeks apart for the first time. They appeared to be the same species but do not fit the description given by the collector for either. They are fairly close to *A. espiritensis* and could possibly be this species. Neither of these set seed to self pollenation but a cross was obtained of SA 63-16 X SA 62-3 and 30 tiny seedlings are now growing slowly.

AMARYLLIS STRIATA

Several forms of *A. striata* are being grown and cross easily with large-flowered hybrids giving very vigorous seedlings. In those that have bloomed thus far, the striata color pattern is strongly dominant and I have been told that this probably will be true for several future generations. Lack of space prevents any very large effort in this direction.

AMARYLLIS BELLADONNA

The Bolivian form of *A. belladonna* collected by Prof. Nelson has many desirable characteristics. It is vigorous, persists when mulched outdoors during our very wet and sometimes cold winters (which none of the forms of *A. striata* will do), blooms easily with four florets per scape and sets seed readily. It has been crossed with leopoldii hybrids and their progeny are being selfed to see if this is a reasonable route to small flowered hybrids in pastel colors. A rose pink form of *A. bella-*

donna collected by Prof. Nelson in 1958 has given a number of light pink hybrids and pollen from some of these has been used with a number of pod parents hoping for light pink in both large and small sizes.

WHAT NEXT?

The plants already growing should provide a seemingly unending succession of potential self pollenations, sib crosses, back crosses and even out crosses. However, there are two other areas which are most inviting.

1. *Long Trumpet Hybrids.* *A. fragrantissima* is growing well and it probably will bloom in 1968. Hopefully, pollen will be available from some suitable long trumpet species when this happens. However, a plant indicated to be *A. elegans* is growing slowly and appears to need several years yet before flowering *A. umabisana* is barely existing and may never bloom in Baton Rouge; Dr. Cardenas has reported that it has failed to bloom even in Cochabomba.

2. *Orchid-Flowered Hybrids.* *A. cybister* and a plant thought to be *A. maracasa* have just about finished reversing their growing seasons and may bloom in a year or two. Possibly other species with tendencies toward orchid-type flowers can be added.

So, growing and hybridizing amaryllis species is a very enthralling avocation. Don't let anyone kid you, there is a moderate amount of hard work involved but the results are more than amply rewarding.

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1967 AMARYLLIS BREEDING REPORT

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In a previous article, the writer mentioned that he was constructing benches with plastic hoods over them, intending to grow his potted bulbs upon these benches. A year of use has confirmed their value. A check of the bulbs this past spring revealed scarcely a trace of the red virus disease which was so prevalent the previous spring, and most of the seedlings continued to grow slowly all through the winter months. In fact, bulbs of all sizes displayed better growth this past year than ever before, and the credit for this must be given partly to the protection offered by

these hoods from rainfall and the condensation on cold nights, and partly to a program of continual feeding. Every time the bulbs are watered (except during the winter months), they are watered with a weak solution of a soluble fertilizer, such as Fish Emulsion. This program of feeding was adopted after observing the results of its use at a commercial garden nearby, and it paid dividends this spring in the finest blooms the writer has yet had.

The last bulbs of two crosses made between the Houdyshel orange-scarlet hybrids and *A. striata fulgida,* using each as the seed parent, bloomed this past spring, and some observations can be recorded. In the first place, a marked difference in hardiness between the two crosses has become apparent. The hybrids having *A. striata* for the seed parent are very tender; they lose their leaves in the fall, and are prone to decay during the winter months if kept outside. But the hybrids having the Houdyshel Hybrid as the seed parent are quite hardy; the leaves are dark green with a heavy texture, and remain green all winter. In the second place, these evergreen hybrids have much more attractive flowers than the others, being of the Reginae type but only four to five inches in size. In color, they are a salmon orange fading to rose with a touch of green on the reverse side. Thus it paid to make this cross both ways, since one cross was so much superior to the other one. However, the only one showing a recurrent blooming tendency was from the tender cross. This year, a number of very interesting crosses were made with these flowers, including crosses with a *belladonna* X *evansiae* Hybrid, a *vittata* X Dutch hybrid, and with the Peruvian miniature hybrids.

Another example of the value of making a cross both ways can be given, for two crosses between an Indian miniature hybrid and *A. striata fulgida* also gave quite different results. In this case the hybrids having *A. striata* as the seed parent are the ones that are doing very well, being evergreen, while those having the Indian miniature as the seed parent are doing very poorly, several bulbs having decayed completely this past winter. However, after observing some twenty *striata* crosses, it can be concluded that crosses with *A. striata* as the pollen parent will usually be much more vigorous in growth than those using *A. striata* as the seed parent. Typical of many *striata* hybrids having had *A. striata* as the seed bearer is a cross between *A. striata fulgida* and *Skildway,* made by a friend in Pasadena; when kept inside it grows vigorously all winter but when kept outside it goes dormant until spring, and even then grows rather poorly. The species *A. striata* and many of its hybrids seem to require considerable heat at all times for successful growth.

One of the writer's first *A. striata* crosses was between *A. striata fulgida* and a rose-colored South African hybrid. The resulting hybrids were in all shades of pink with flowers averaging 5½″ in diameter, but were very sensitive to any low temperatures, definitely requiring greenhouse care. However, one of these pinks was self-pollinated, and the resulting seedlings have grown quite vigorously here in California, even though kept outside all winter with temperatures close to freezing on

some nights. These should bloom very soon, and the first flowers are being eagerly awaited. Another of these pink hybrids was crossed with a Van Meeuwen white Dutch hybrid, and the first bulb of this cross recently bloomed, producing quite a surprise. The flowers were not a pink in color, but a pale red, edged in darker red, and with a wide streak of pale lavender through the center of each tepalseg. This flower was crossed with a Ludwig recurrent-blooming white Dutch hybrid and with a salmon blend from Van Tubergen.

A number of other *A. striata* crosses with interesting possibilities are also doing very well outside here, but have not yet reached blooming size. Among these are crosses with both Peruvian and Indian miniature hybrids and also with larger types. One cross of particular interest was between a Houdyshel-Dutch hybrid and a miniature form of *A. striata* from Hawaii; the resulting plants are evidently going to be true miniatures, although they are growing very slowly.

In the spring of 1962, a cross was made between the Houdyshel orange-scarlet hybrid and an unnamed Ludwig pink Dutch. The resulting hybrids have been close to my ideal of a "window sill" *Amaryllis*. They are vigorous in growth, with rather short, wide, deep green leaves which remain evergreen until new growth appears in the spring, even when kept outside all winter. The flowers, averaging 6″ in diameter, have been beautiful both in shape and color. The tepalsegs are wide, overlapping, slightly reflexed, and of very heavy substance. The colors have varied from light salmon pink through dark rose to a light red and also white marked with red; a touch of green in the throat and on the reverse adds to their beauty. The scapes, from 14″ to 19″ in height, have carried three or four flowers. Unfortunately, these hybrids have not displayed any recurrent-blooming tendency, but they have been crossed with several *striata* hybrids, and with a recurrent-blooming Peruvian miniature. The first of these crosses should soon bloom.

The Peruvian miniature hybrids mentioned here were raised from seed purchased from R. D. Goedert. Although some of the plants became a little too large to be classified as true miniatures, they are very satisfactory, since they have wide, evergreen leaves and well-formed flowers about 4½″ in diameter of either red or white marked with red. These have also been used considerably in the writer's breeding program. One such cross with the Houdyshel orange-scarlet hybrid has produced seedlings with dark, gray-green leaves of extremely heavy texture, which apparently are evergreen and more tolerant of low temperatures than any other seedlings being raised by the writer. Since all of his seedlings are being raised outside, he has come to realize that the factor of hardiness in the modern hybrid Amaryllis needs more emphasis; and so this has become another of his goals.

It has been suggested that if new flower forms and colors are to be introduced into the Amaryllis hybrids, it will be necessary to utilize in our breeding programs some of the more-recently discovered species. If so, there may be something new appear eventually here in Southern California, since many members of the Southern California Hemero-

callis and Amaryllis Society are now engaged in hybridizing activities, and many of these newer Amaryllis species can be found here in various collections. The writer is cooperating with a member in Long Beach in a project to build up a species collection that can be used in breeding work, and many additional species, primarily in the form of seedlings or small bulbs, have been added to this collection the past year, including two yellow-flowered species from Argentina. Some of these acquisitions represent species not yet identified, and were received directly from a friend in South America; it is anticipated that more new species will be received from this same source. Pollen of various species was also received from this friend, but most attempts to use it were unsuccessful, although two crosses were successful. In addition, seeds from a number of direct crosses with such newer species as *A. forgetii, A. starkii, A. evansiae,* and *A. cybister,* have been received from fellow members of our local society. Crosses with the 'Senorita' hybrids are not often successful, but last year one cross, using the 'Senorita' pollen on a Striata hybrid, was successful for the writer. This year, a friend has secured several successful crosses between Dutch hybrids and a 'Senorita' hybrid. Likewise, several crosses have apparently been successful using pollen from a Calyptrata hybrid.

One of the writer's goals is to develop a group of summer and fall-blooming hybrids, and finally a start has been made on this project. When his *A. aulica* X 'Floriade' hybrid bloomed in July of 1965, all crosses with it resulted in failure, but when it bloomed in July of 1966, all crosses using its pollen were successful, although no seed would set on the bulb itself. A flower scape is now coming on this bulb again, and when it blooms in July, perhaps more crosses will be successful. Last year's successes at least furnished the encouragement to keep trying with these difficult hybrids.

An unidentified species received from a friend in Burbank has just bloomed. It has small, pale red flowers with a greenish yellow throat, and is evidently either an inferior form of *A. striata fulgida,* or else *A. striata,* var. *striata.* However, its value lies in the fact that it bloomed in July, and it is the only form of *A. striata* that wants to grow and bloom for the writer here in California. Most of his other varieties of *striata,* which grew fine in a greenhouse in Colorado, simply sulk here in California, even when kept in the house, probably because of the cool temperature along the coast.

Bulbs of *A. reticulata* and the hybrid 'Mrs. Garfield' have been obtained, and seeds or bulbs of several more Aulica crosses have been received from friends. One of these gifts has an interesting history: when the species LM63-1 bloomed last August, the writer could not use the pollen; so it was given to a friend, who in turn sent it on to another friend in South Carolina, who used it successfully in a cross with *A. aulica.* And recently, to complete the circle, a small bulb of this cross finally arrived for the writer.

EXPERIENCES WITH AMARYLLIDS

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General. My experimental programs with Amaryllids are limited in scope to suit a restricted time availability. I have nevertheless tried to make meaningful progress with small facilities in a small space. In my study there are two commercially available small plastic greenhouses, with thermostatically controlled bottom heat, under 24-inch double-lamp Gro-Lux fixtures. In the garage there are two home-made plastic-sheeted greenhouses with controlled bottom heat and Gro-Lux lighting. To the southeast of the house is a home-made A-frame with controlled bottom heat available, and with hinged roof panels of framed hardware cloth which can be covered with solid sheeting or woven shade cloth according to the season. In other areas of the yard there are flush and raised beds, pockets and corners, pots and tubs, and a coldframe with hinged cover panels. The basic essential element is an understanding and helpful wife.

Basic Program. The long range program is composed of four coordinated lesser programs, each adaptable enough to follow the trend and pace of overall results and specific advances. No. 1 is aimed at development of a strain of hybrid Amaryllis to serve as a basic breeding stock. The characteristics sought are high seed production, high germination rate, high survival rate under adverse growing conditions, fast maturation, repeat flowering, disease resistance and—as a bonus—*fragrance.* No. 2 is the development of optimum procedures for controlling flower production, affecting crosses, germination of seeds, seedling survival and accelerated maturation. No. 3 is the development of optimum procedures for making bi-generic crosses. No. 4 is the investigation of special techniques of chemical, gas and electrical treatment of seeds, plants and bulbs.

Breeding Stock. The source "mother" was a common backyard hybrid Amaryllis selected because it survives the standard types of mistreatment exercised by the average homeowner in this area. It is evergreen, flowers readily, sets seed readily, and resists disease. It has survived the digging and replanting that goes along with gardeners' irrepressible generosity with mediocre plants, seems to thrive in almost any type of soil or drainage or exposure, and multiplies rapidly. It has the basic *Amaryllis leopoldii—A. vittata* blend of characteristics and coloration. Onto this was crossed a hybrid Amaryllis of Japanese origin which had a pure white blossom with a limited amount of green in the throat, had a graceful shape approaching that of *A. belladonna* on a tall, slender, straight scape, and was *sweetly fragrant.* This white parent would not set the reverse cross, and did not survive its first winter outdoors.

Also crossed onto the mother plant was a large, brilliant orange-red unnamed hybrid Amaryllis with a flat-faced perigone of round-tipped petals with a heavy, coarse texture. Its throat was a deeper red, with

almost no green. Since a cut scape was used, no reverse cross was tried. From the seedlings of these two crosses, selections have been made of the more desirable combinations of characteristics. Of a few hundred seedlings, thus far twenty-two first generation plants have been selected as breeding stock. Some of this original batch, from crosses made in 1960, have not flowered yet. However, in spite of this slow maturation, they will all be kept growing on until they flower because some of the best did not flower until 1966 and 1967. Those which were the earliest to produce strong flowers were crossed, regardless of other characteristics. From these there were several which produced very strong flower scapes early in the third year. Of these only four have so far been adjudged worth preserving. On some of those four, because of their vigor and early maturation, bi-generic crosses were tried. These specimens and some of the first generation specimens displayed marked differences in their useability as parents for bi-generic crosses.

Growing Procedures Developed. The only particularly special procedure has been the use of deep plastic juice pitchers instead of clay pots. The number of control specimens is small, which results in certain reservations regarding the reliability of the data which were recorded. My primarily subjective judgment, based on leaf production, increase in bulb size and root condition, is that the deep containers are generally better. Furthermore, those which matured and flowered first were in the deep pitchers. In both the plastic pitchers, in the standard square plastic pots and in the standard clay pots I start with a layer of ¾ inch crushed rock, then the roots of the plant in a generally used soil about one inch from the rim. Fine sand is sprinkled around and under the base of the bulb and gently packed in. Then quarter-inch crushed rock fills the pot to the rim. There is a reduced incidence of red spot and rotting during the cold, wet season, far below that of bulbs planted deeper in the soil mix. Best germination has been achieved from seeds whose black papery covering has been carefully peeled off before sowing. Seeds thus peeled are laid flat in shallow drills in dampened Terralite which is about two inches thick over a four-inch deep base of half potting mix, half Terralite. The smaller seedlings are grown in a greenhouse under Gro-Lux lights controlled for 16 hours of light, with continuous bottom heat of 70 to 80 degrees F.

Bi-Generic Crosses. Reports will be made as these come into flower.

Special Techniques. When seeds are soaked in colchicine solution, my criterion for "too long" is stunted root growth. By soaking a large batch of seeds, of which a specified number is planted each succeeding day, I derive my private optimum soak times for the different kinds of seeds. For hybrid Amaryllis, less than 24 hours seems to have had little effect on the resultant plants, and more than 48 hours has resulted invariably in plants which dwindled and died. Rubbing a mixture of lanolin and colchicine has not yet been successfully done on any of the plants on which it was tried; all seed pods softened and withered. I have not had any success with rubbing a mixture of lanolin and naphthalene-acetamide into scarfed or scratched seed pods to make them hang

on and mature. Spraying foliage with commercially available gibberellic acid in aerosol containers has had no noticeable effect on any of the Amaryllids. Injection of gibberellic acid (sprayed from the can into a glass and permitted to evaporate for several hours) into resting hybrid Amaryllis bulbs by hypodermic syringe started leaf growth in advance of untreated bulbs, but this seemed to deter their flowering. Exposure of hybrid Amaryllis foliage to carbon monoxide wilted the foliage immediately, but in a few weeks new leaf growth was vigorous and on several plants so treated there was vigorous flower stalk production along with new leaf growth. Exposure of foliage to ethylene gas stimulated flower stalk production, which was useful in bringing selected plants into flower out of their regular season. Passing electrical current through plants has not yet produced any noticeable change; variations of voltage and amperage combinations may be tried later.

Miscellaneous Observations and Random Musings. One *Amaryllis striata* flower in an umbel of three had four parts instead of six; it set no seed when selfed. My experience verifies that reported by other Amaryllid growers: *Chlidanthus fragrans* is reluctant to flower. One of my first generation hybrid Amaryllis seedlings had an umbel of closely grouped flowers of almost equal length tepalsegs which faced nearly upright in the manner of *Brunsvigia rosea.* The stigma did not recurve its styles when mature; and the plant rotted during the cold, wet season. This, plus the way that seedlings can be grouped into sets of almost identical characteristic combinations, raises some interesting conjecture about the lineage of the plain old garden variety of local Amaryllis plants: by careful selection, could one cause a reversion to the individual species types which had a part in the development of our present-day "hybrid"? Growing *Narcissus* from seeds has been rewarding. 'King Alfred' sets seed readily, and 'Soleil d'Or' sets seed occasionally. If a new batch of seed is sown each year, after the fourth year there is a constant procession of distinctly varying flowers each spring. I have no outstanding ones, but several have been good enough to name unofficially after our grandchildren so that each will have his "own" Daffodil. *Tristogma uniflorum violaceum* (the exact identity is questionable) is an excellent source of easy-to-grow bright blue. With development for size, height and brightness of the blue tones, it could be a valuable addition to the color range of the Amaryllids.

1967 HEMEROCALLIS REPORT

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American Plant Life Society

The year 1967 was full of the usual variations from the normal in weather and season in most parts of the country. On the West Coast our blooming season was generally much later than usual, and this was reflected in the lack of bloom in the Stockton, Calif., area, where the regional meeting for Region 7 of the American Hemerocallis Society was

held at Melrose Gardens on June 10. In the evening the Northern California Hemerocallis Society held its annual meeting and dinner at the home of Jack S. Romine in Walnut Creek, following the afternoon garden tours. Mr. Romine had 'Tetra Forty-niner' in bloom in his greenhouse, as well as a chimeric clump of 'Alan' in the garden, both from his efforts at polyploidizing clonal material, and there were a number of very promising spikes on other treated plants. An unflowered treated plant of 'Cartwheels' was sending up a wonderful spike that seemed tetraploid and was the center of interest for certain people. The diploids in this garden also were much behind because of the cool weather, and few were yet in bloom.

On June 12th, on the return to Southern California, we were able to visit three very delightful gardens in Bakersfield, where their heat had done a good job of making the daylilies bloom well and normally. The first garden was that of Mrs. Beulah Stuteville, who had many of her own numbered seedlings in bloom, in addition to the new crop of seedlings and her collection of named varieties. There was a beautiful clump of her 'Peach Brocade', as well as her 'Summer Dream' and 'Red Tiger'. An especially promising seedling was S66-34 ('Flat Top' X 'Pres. Rice'), a flat, nicely shaped buff yellow; S66-339 was an eye-catching red. Plants of his R60-19 treated by Mr. Romine were growing in this garden, and they seemed to be tetraploid.

Mrs. Frances Kuhs was growing a number of varieties in large wooden tubs that could be shifted to take advantage of shade, the most spectacular being 'Raspberry Frills' (Williamson—1964) with its wonderful bright clean color and darker eye. Superbly grown also were 'July 4' (Wynne), an ryed red; 'Love That Pink' (Hall), a fine large pink of good shape; and 'Cherry Blossom' (Pittard), a very handsome darker pink.

Some of these same varieties appeared in the garden of Mrs. Donald McDonald, whose large collection left little room for her seedlings. Mrs. McDonald was testing a delightful group of sibling miniatures from Mrs. Olen W. Sheets of North Carolina, including 'Baron', 'Beth', and 'Thelma Griffin' ('Ringlets' x 'Fairy Wings'). The nicely shaped eyed 'Burlesque' (Lambert) was most attractive with its pie-crust edging. Another eye-catching variety from the same breeder was 'Trafalgar', a bright red which seemed to be enjoying the heat.

The Southern California Hemerocallis and Amaryllis Society had its annual daylily meeting at the Arboretum in Arcadia on June 17, with Mr. Robert J. Hixson, Jr., of Reedley, Calif., as the speaker. In the afternoon out-of-town visitors found much to look at in the Buck garden in Arcadia. Many tetraploid seedlings were at their height, and many named varieties were in good bloom. A colchicine-induced tetraploid form of 'Little Emily' (Hardy) attracted more attention than almost any other plant, perhaps because of the exciting possibilities it seemed to offer as a parent for tiny ruffled miniatures.

Now it can be reported that 'Tetra Little Emily' proved to be a very good pod parent and set many seed from a whole series of combinations

with pinks, lavenders, eyeds, melons. Another colchicine-treated parent was the strongly eyed 'Borgia' (Wynne); it proved to be fertile in some very interesting crosses. Treated plants of 'Lady of Northbrook', 'Lavender Parade', 'Cartwheels', 'Blue Jay', 'Grace Lenington', 'Shining Plumage', 'Pink Venus', 'Petite Pink', and many others contributed to giving a fairly adequate seed crop in spite of almost no seed from some normally heavy seed setters. Among the new Buck seedlings some lavenders and purples aroused the most interest and gave the best possibilities for both treating and breeding. Prospects for lavenders and pinks from the new seed crop seem much better after getting to study the 1967 seedlings.

'Bonnie Barbara Allen' was the most satisfactory of Dr. Virginia Peck's five 1966 tetraploid releases, none of which set any pods here. The flowers from the Peck clones most of the time seemed to resent our climate. By contrast, the beautiful Fay clones, 'Kathleen Elsie Randall', 'Lady Cynthia', and 'Gertrude Smith', bloomed very satisfactorily from plants set out at approximately the same time as the Peck varieties. 'Lady Cynthia' set the most pods this season, but all three set pods and had fertile pollen.

Dr. Hamilton P. Traub's work is now entirely with medium height plants or miniatures. Many interesting new seedlings bloomed in his garden, despite the erratic season. His 'White Cloud' was released in August, and Dr. Traub's insistence on sun-fastness should make it an important clone in tetraploid breeding. It was developed by complex selective breeding over a number of generations, including 'Tetra Duchess of Windsor', 'Tetra Winged Victory', 'Magdalena Luethi', some near white tetraploid seedlings, and others. It carries huge, wide open flowers which may have slight coloring on the margins on opening and in the sun changes quickly to a wholly light color which is still at its best by the end of the day.

Among the diploids blooming for the first time in the Buck garden this year was the exquisite 'Prairie Melody' (Marsh), 'Diamond Anniversary' (Childs), 'Childscraft' (Childs), 'Marty Simon' (Simon), 'Eburnean' (Munson), and 'Sleeping Beauty' (Munson) were particularly beautiful this year. The new clone 'Marguerite Lloyd' (Lloyd), which will be released as soon as stock is sufficient, besides being an extremely beautiful eyed variety, has proven to be the most everblooming thing in the whole garden. Two miniatures to warm the heart were the wonderful pink 'Dreamlet' (Childs), and the bright, dark lavender-purple 'Little Wart' (Spalding).

Even bad seasons do not keep us daylily growers from having some things to enjoy!

"STAMEN-EMBRACING PETEPALSEGS" HERITABLE DEFECT IN HEMEROCALLIS

Hamilton P. Traub

Those who are engaged in *Hemerocallis* breeding have encountered a heritable defect which disfigures the flower. When present, one, two or all three of the petepalsegs become stiffly erect, each affected one embracing a stamen. This heritable character has been named "stamen-embracing petepalsegs", and it may occur in diploids and tetraploids. It was not considered seriously, until the notorious example of it in 'Crestwood Lucy' was encountered. In this example often most of its flowers are so disfigured. When used in breeding, the seedlings often inherit the defect.

The defect often occurs in seedlings with excellent color values which makes it necessary to try to eliminate it by crossing the defective plant with normal seedlings, and destroying that part of the progeny which shows the defect over a period of three or more generations.

It has not been determined if the defect is due to a single gene or to multiple genes. There is the puzzling situation in which the defect may disfigure part or all of a flower, part of the flowers or all the flowers on a scape. Sometimes all of the flowers are normal. It was also noted that plants which normally are not affected, sometimes may produce a flower or two which show the defect.

CHROMOSOME NUMBERS IN **HEMEROCALLIS WASHINGTONIA** "STATIC DWARF" PLANTS

Walter S. Flory and Ruth P. Phillips
Wake Forest University

The basic chromosome number of *Hemerocallis* taxa is 11, with the cells of most species regularly having 22 somatic chromosomes, while the widely desseminated Europa daylily (*H. fulva*) has a 2n of 33 (Stout, 1932; Chandler, 1940; etc.). Traub (1949; 1951; 1959-60) using colchicine on hybrid *Hemerocallis* diploids (2n = 22), induced allotetraploids (2n = 44). He named this colchicine-induced species *Hemerocallis washingtonia.* In additional work Traub found (1967) that among seedlings of the tetraploids there were three groups: (1) about 99% are normal growing plants which are cross-fertile, and more or less self-fertile; (2) less than 1% are normal growing but cross-sterile; and, (3) less than 1% are slow-growing, delayed-flowering dwarfs. Dr. Traub has supplied us with several dozen seedling plants of the third group—the slow-growing plants which he has termed "static dwarfs." The present note offers a preliminary report on the somatic chromosome numbers encountered in root-tip cells of some of these dwarf plants.

OBSERVATIONS

In 1966 somatic chromosome counts were made or attempted with a number of plants. Exact numbers, or exact ranges of numbers, from

these studies are presented for 9 plants, in Table 1. It may be noted that apparently one plant had 38, one plant had 44, 2 plants had 40, 3 plants had 42, and 2 plants had from 38 to 42 somatic chromosomes. As the study proceeded, however, it became increasingly evident that the number of chromosomes per plant probably fell within a definite range, rather than usually being an exact number. Accordingly, it was determined that in future studies attempts would be made to secure numbers, where possible, from a larger number of cells per plant.

Table 1. Chromosome numbers in some dwarf seedlings of **Hemerocallis washingtonia,** 1966.

Seedling number	2n	Seedling number	2n
H-1	42	H-7	44
H-2	40	H-9	40
H-4	38	H-12	42
H-5	38-42	H-13	42
H-6	38-42		

In Table 2 the data secured on 16 additional plants in 1967 are arranged. One of the plants (H-7) studied in 1966 was also restudied (Table 2). With the 17 plants analyzed in 1967 the chromosome numbers 40 and 42 were encountered most frequently. In one plant 36, and in another 38, were the most frequent numbers observed. In one plant 46 seemed to be the predominating number, while the euploid number 44 was most often encountered in 3 plants. Lower numbers were encountered in single cells in several cases.

DISCUSSION

It is clear from the data that in most cells, and plants, there has been a loss of from two to six chromosomes. Most often there has been a loss of either two or of four chromosomes. Very occasionally there is the gain of a pair of chromosomes. Also, it seems apparent that the range of chromosome numbers from cell to cell, within a given individual is greater here than is usually encountered in species.

The Notes column of Table 2 indicates that complete cells with 21, 22 and 23 chromosomes were observed. In one case what clearly appeared to be a complete cell, with wall intact, just as clearly showed only 7 chromosomes. Unprovable suppositions accounting for such numbers may be made. The 21, 22 and 23 chromosome numbers approximate the diploid number for the genus, and may represent a breakdown from the induced tetraploid, to the original diploid, number. In the second case perhaps a tetraploid ($2n = 44$) cell divided 37 and 7, with the $2n = 7$ cell not being immediately lost, but surviving for one or more cell generations.

There is considerable difference in vigor among the various static dwarf plants. So far we have not been able to correlate this with any specific chromosome number. It is possible that the loss of certain chromosomes—and genes—affects vigor and adaptability more than the loss of others. It also seems likely that where one, or a few, chromosomes are lost that these are not always the same ones.

Table 2. Chromosome numbers in some dwarf seedlings of **Hemerocallis washingtonia**, 1967.

Seedling number	2n usual	2n range	Cells counted	Notes (Nos.: 1st no. of cells; 2nd—2n)
H201	38	36-43	8	3, **38**; 2, **36**; 1 each **37**, **42**, **43**
H202	40	40-46	30	10, **40**; 6, **42**; 6, **43**; 5, **44**; 1, **45**; 2, **46** (also 1 each: **21**; **22**; **23**)
H203	40	40-42	7	6, **40**; 1, **42**
H204	44	36-44	7	3, **44**; 1 each **36**; **38**; **42**; **43**
H205		40-44	2	1 each **40**; **44** (also 1, apparently complete, **7**)
H206	36	34-42	11	4, **36**; 3, **34**; 1 each **38**; **40**; **41**; **42**
H208	42	40-43	5	3, **42**; 1 each **40**; **43**
H209	44		1	1, **44**
H210	44	40-44	6	3, **44**; 2, **42**; 1, **40**
H211	42	40-44	4	2, **42**; 1 each **40**; **44**
H213	42	40-42	5	3, **42**; 2, **40**
H214	40, 42	38-44	8	3, **40**; 3, **42**; 1 each **38**; **44**
H215	40		1	1, **40**
H216	40, 42	40-42	2	1, **40**; 1, **42**; (+1, **22**)
H218	42	42-44	7	4, **42**; 3, **44**
H220	40	36-44	14	5, **40**; 4, **44**; 3, **42**; 2, **36**
H7	46	44-46	6	3, **46**; 2, **44**; 1, **45**

The loss, or gain, of chromosomes—and perhaps of particular chromosomes, would seem—plausibly—to be ultimately responsible for the abnormal growth habits of the plants studied. It seems clear that the analysis of other plants, as well as the more careful study of some of the plants already dealt with, offers the promise of throwing additional light on the factors involved. Such work is planned.

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4. AMARYLLID CULTURE

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

1967 LYCORIS REPORT

SAM CALDWELL, *Nashville, Tennessee 37211*

Developments are slow in the lycoris world. Since my last report, for 1964 (Plant Life 1965), I have continued to maintain a large collection of these bulb flowers and have kept at my hybridizing efforts. Bloom seasons have brought exciting moments and disappointments. Erratic performances by some of the species have left me befuddled at times But I find altogether fascinating the strange growth habits and sometimes sensationally beautiful flowers.

Insofar as flower production is concerned, "good" and "bad" lycoris seasons have alternated here for the past four years. 1964 and 1966 brought very fine floral displays. In 1965 there were fewer scapes but still enough to sustain interest. The past season—1967—has been most baffling. Bloom was light on most species and failed entirely on *L. caldwellii, L. chinensis* and *L. haywardii.* There was one scape instead of the usual dozens on *L. sprengeri.* On the other hand, *L.* x *jacksoniana* bloomed fairly well and the fertile *radiatas* came in great profusion.

Normally a poor lycoris season in this area follows a severe winter, but it was not so this time. Our last winter was relatively mild. We did, however, have a cool, rainy summer which kept grass and trees beautifully green and most flowers in fine condition. Apparently this was not to the liking of some of the lycoris bulbs which need an early summer drying-off period to trigger their bloom mechanism.

BLOOM CHART

A bloom chart showing dates and duration of bloom on various lycorises has been one of my projects for a long time. Ideally it would be based on data recorded over ten or more years on plantings which include a substantial number of bulbs of each species.

The accompanying chart falls short of my ideal—it simply shows bloom as it occurred during one good year, 1966, in my own Middle Tennessee area. It does not give a true picture of bloom duration on all kinds. Some of the rare sorts are represented by only two or three bulbs. while the *squamigeras* and *radiatas* grow by the hundreds in several different locations; naturally there is bloom for a longer time on the latter.

Each line on the chart following a named species extends from the date that species had its first fully developed scape, with all flowers in the umbel open, to the date when the last scape began to fade. Regrettably, I have not kept detailed records on blooming dates through many other years. But fragmentary notes show that blooming seasons of a given species may vary from year to year by two weeks or more from the dates shown for 1966. Correspondence with other growers indicates, as might be expected, that farther south, blooms come earlier.

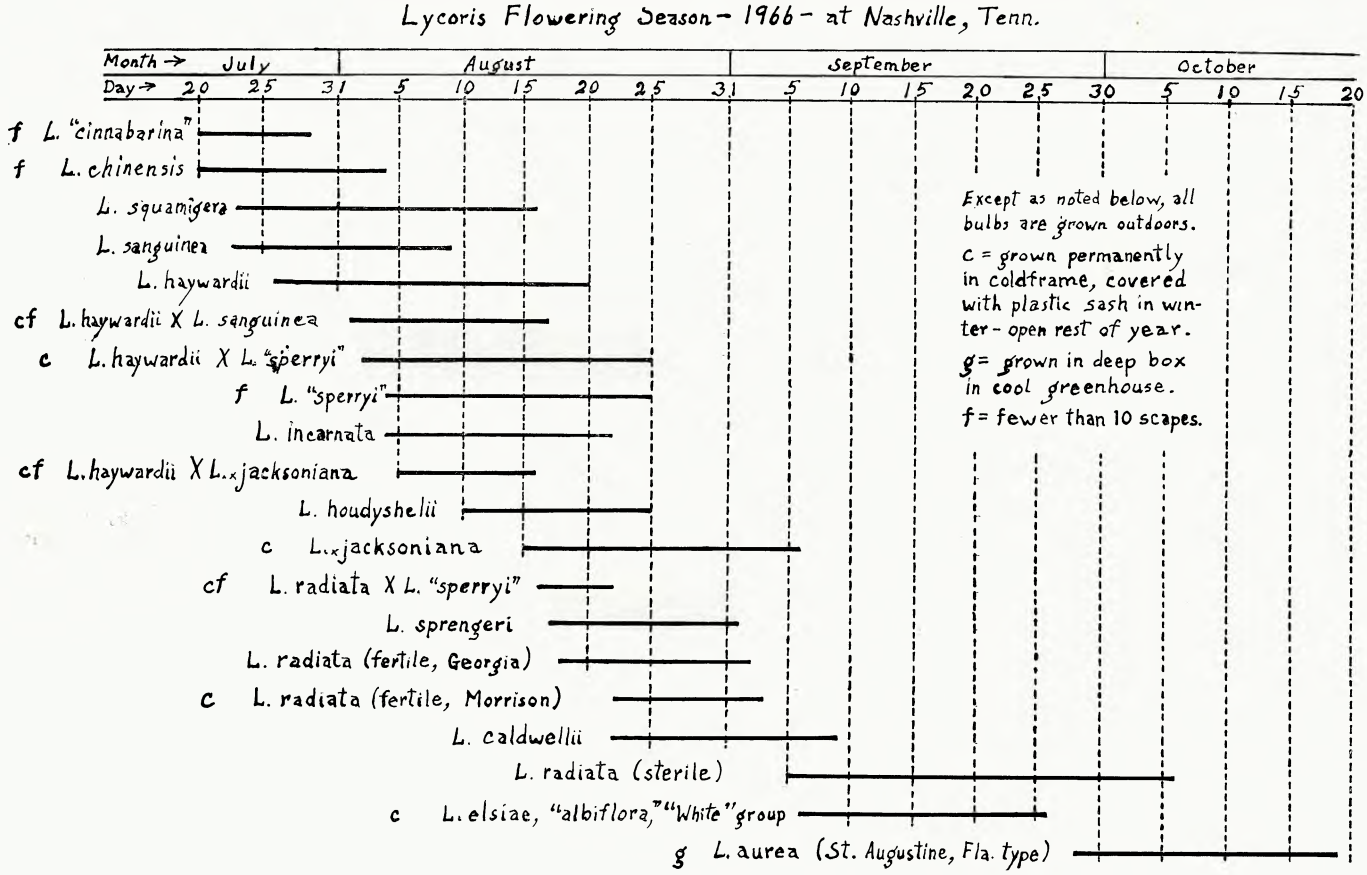

Fig. 20. **Lycoris** blooming chart showing dates and duration of flowering period for various **Lycoris** species and hybrids at Nashville, Tenn. in 1966. See text for further explanation.

With all of these qualifications, the chart will prove of interest, I hope—especially in showing that it is possible to have lycorises blooming continuously through two and a half months.

HYBRIDS

L. x *jacksoniana,* the *sprengeri-radiata* cross that first flowered in 1961, continues to be best of a number of hybrids that have now bloomed. Light pink through many rosy shades to deep purple-red in different individuals, these bulbs bring a new look to the lycoris genus. They flower well and bulb increase is good. Neither parent is a large lycoris, and so these hybrids are of modest size, but their color is wonderful.

As previously reported, one fault is the susceptibility of their fall produced foliage to cold weather injury. I have to grow them permanently in large coldframes which are covered with plastic sash in winter. Outdoor trial plantings in northern Mississippi and southward, however, appear to be performing satisfactorily.

From a cross of *L. radiata* by *L. haywardii* made in 1959, I have five bulbs. Two of them bloomed for the first time in 1967. The nearly identical scapes were at peak stage on July 20, 16 inches tall, with umbels 6½ to 7 inches across, one having six and the other seven flowers. Color was a soft medium rose, with violet streaks from segment tips inward. Actually, these could be mistaken for *L.* x *jacksoniana;* they bloomed, however, about two weeks before any of my *jacksoniana* bulbs.

In 1961 I used *jacksoniana* pollen on *L. haywardii* flowers. Of several resulting seedlings, one flowered in August, 1966 and another in '67. These were my first hybrids combining three different species—*L. sprengeri, L. radiata* and *L. haywardii.* While pretty, these were a bit disappointing in that, except for a litte stronger bluish-violet tinting, they, too, looked just like some of the *jacksonianas.*

More exciting was a 1967 scape of *L.* x *jacksoniana* crossed back on one of its own parents, *L. sprengeri.* Flower form was similar to *jacksoniana* but coloring was unique—very pale pastel tints of salmon and lavender. I will watch with special interest additional bulbs of this cross and of *jacksoniana* crossed with the other parent, *L. radiata.* There is much difference in foliage of these seedling bulbs, and flowers may be equally varied.

My 1964 report included descriptions and pictures of first bloom on the *L. haywardii—L.* "Sperryi" and *L. haywardii—L. sanguinea* crosses. Since then a number of additional seedlings of each cross have bloomed, but with no significant variations from the first flowers.

The 1964 report also carried a picture and notes on a cross of *L. radiata* and *L. chinensis* made by Dr. John Creech. In 1959 I used pollen of the big hardy yellow *L.* "Sperryi," which is similar to *L. chinensis,* on *L. radiata,* and got about a dozen seedlings started. One of these bloomed in August, 1966 and another this year. Not surprisingly, they are much like the Creech hybrid—"spiderlily" form and very soft yellow coloring. Aging flowers acquire pinkish tints. These are

extremely pretty flowers. Thus far I have not been able to get seed on them or on the Creech hybrid, which has bloomed again. Most of the other hybrids seed freely, and I have small bulbs of many new crosses coming along.

NEW ACQUISITIONS

The late B. Y. Morrison, Pass Christian, Mississippi, used to buy "white" lycorises in quantity—100 bulbs at a time—from dealers listing them as "Albiflora," "Radiata alba," "Albiflora carnea" and the like. Many of these turned out to be the pastel tinted *L. elsiae*, but there were usually variants in each lot. He delighted in watching the bloom for distinctive and superior individuals, and he sent a number of these along to me. The last ones came in 1964, labeled "L. albiflora Light Rose Pink." A letter explained that these had shown up in a shipment of "Albiflora" bulbs from the Walter Guille wholesale bulb dealers, Long Island, N. Y., and he thought they were an outstanding "find."

I was happy to concur in his judgment when a beautiful scape of silvery-pink flowers appeared in early September, 1966. Foliage and growth habits are like others in the big, confusing "Albiflora" group; it is the color that is unusual. Incidentally, in Plant Life 1964, Mr. William Lanier Hunt, Chapel Hill, N. C., reported finding in 1962 a new porcelain pink lycoris in a shipment of *L. elsiae* bulbs. My guess is that when we are able to compare these two, we shall find them identical. We have needed a pink lycoris of this type, and it is good to know that one does exist.

For several years Mr. James Giridlian has been offering a "Lycoris cinnibarinum" in his Oakhurst Gardens catalog. Thinking they must be the same as "L. cinnabarina" bulbs I already grew, I haven't ordered any. This year a young lycoris enthusiast, Philip Adams, of Marks, Mississippi, sent me one of several "cinnibarinum" bulbs he had from Oakhurst, and reported that he had flowered one on August 20 at his home in northwest Mississippi. Foliage, he said, is like that of *L. traubii*. The 17-inch scape carried seven flowers, making an umbel 8 inches across. In form the flowers are much like *L. incarnata* but color is a blend of light mandarin orange-red with strong suffusions of deep gold-yellow, strongest along center of segments. General effect from a distance is a warm apricot color.

I have flowered "L. cinnabarina" a few times, and it is clearly related to the early blooming, orange-red *L. sanguinea*. This new "cinnibarinum" has a different foliage habit and a different bloom season. As I viewed it in Mr. Adams' color slides, it appears to be quite distinctive—perhaps an entirely new species.

In July, 1965, Dr. Traub sent me two bulbs of the newly named *L. josephinae*. One bloomed in September of this year. It is a beautiful lycoris but in this locality it seems to be identical to the widely grown triploid form of *L. radiata*, which blooms at the same time. I cannot tell them apart either in flower or foliage.

UNSTABLE COLOR IN L. HOUDYSHELII

Since original publication of its name (Plant Life 1957) *L. houdyshelii* has been described as a "white" lycoris. Bulbs had been received from China in 1948 by Mr. Wyndham Hayward as "L. alba," indicating that the Chinese considered it white. My own early notes, based on observation of the first few scapes that appeared, state, "flowers open with a cream-white tint and then turn clear white; pistils are white, tipped pink, and the anthers carry yellow pollen." Color photographs made at the time confirm the description. Mr. Hayward wrote, "it is clear milky white, almost an oyster white, with sparkling brilliance in full sunlight."

There was no reason to suspect that those blooms in the early 1950's were other than typical. However, with additional observation of this species we learn that under some conditions the flowers are substantially suffused with pink. A bulb that I sent to Mr. B. Y. Morrison flowered with so much pink evident that he thought it was a mutation from the original type. Miss Edna Spalding, noted daylily breeder of Iowa, Louisiana, sent me a color slide showing bloom on a bulb I had supplied, and it was decidedly pink flushed. In 1964 I moved some of my bulbs from a garden location into a protected coldframe, facing south. Eleven fine scapes appeared in 1966, with flowers opening a rich cream and within a day beginning to show blush and pink suffusions which gradually deepened. Meanwhile, other bulbs remaining at the earlier location under a dogwood tree, had white blooms. And Mrs. U. B. Evans wrote from Ferriday, Louisiana that her *houdyshelii* was white.

The pink markings, as I have seen them, follow no set pattern but develop irregularly as faint to deep rosy tints over the creamy segments. Filaments and styles turn pink on the upper side only, remaining white underneath. I noted this color change in aging flowers of *L. houdyshelii* in the 1957 published description, but it appears now that the pinkish marks are sometimes present almost from the opening.

I feel sure that there has been no genetic change in the bulbs. Light, temperature, moisture, soil or other environmental factors apparently affect the color. Pink suffusions make the flowers no less beautiful; indeed, some think the pinkish blooms are prettier. But this information about the coloring should be publicized; otherwise people acquiring the supposedly white lycoris may be disappointed.

After observing *L. houdyshelii* flowering most years since 1951, it seems to me that the basic color is cream-white; certainly that is the way it opens. Under different conditions it may become quite snowy or definitely rosy. In any event it remains one of the most beautiful species known in cultivation. I only wish the bulbs multiplied faster.

Somehow, discovery of this changeable characteristic in one of my favorite lycorises reminds me of the slightly ribald description of a young coed I heard away back in college days: "She was pure as the snow but she drifted."

MISCELLANEOUS NOTES

In the 1964 Plant Life, I wrote of "A New Yellow—Perhaps." This concerned bulbs from Japan distributed in this country in the fall of 1962 by at least one large wholesaler, under the label, "New Import —Hardy Golden Spiderlily." The wooden bulb cases were stenciled, "L. aurea" and "Grown in Japan." Enticed by an attached color picture and the "Hardy" claim, I bought an entire case—some 700 bulbs about 1⅝ inches in diameter. I planted over 500 of them for myself and in good faith sent out small trial lots to friends all over the country. Now it can be told that the whole deal was a hoax. About 5% of the bulbs proved to be *L. traubii,* which is yellow but far from hardy. The rest were just half-grown bulbs of common *L. squamigera.*

I still occasionally see "Hardy Yellow Spiderlilies" offered on plant counters of some of the variety stores. Bulbs appear to be *L. traubii*—a good lycoris but hardy only in Mid-South and milder areas.

Another batch of bulbs bought as "L. purpurea" has bloomed for me, and as always in the past, they turned out to be *L. sprengeri.*

Growing hundreds of seedling lycoris bulbs in ground beds (coldframes), I have a tedious weeding problem. New herbicides which inhibit the germination of seeds in the surface layer of soil are proving helpful. Treflan and Dymid (Elanco Products Co., Indianapolis, Ind.) are giving complete control of nuisance grasses and of many weeds, though there are certain winter weeds and an oxalis species still troublesome. Nurserymen and other commercial plantsmen currently use many chemical weed controls. Used with proper precautions, some of these are real labor savers for bulb growers.

AGAPANTHUS AFRICANUS VAR. HENRYAE

Mary G. Henry, *Gladwyne, Penna.*

Agapanthus africanus has been living out of doors at Gladwyne, Pennsylvania for over 25 years. Always it gives me its exquisite blue flowers just at a time when I need them most, for they are at their lovely best in mid to late July. This is usually a season when our spirits are somewhat bedraggled by the intensest heat of summer.

Mostly all our winters have some days of sub-zero temperatures and sometimes the ground freezes deeply. Once in a while, when I happen to think of it, I place a few evergreen boughs over them. Many winters they have had no protection whatsoever. Their situation with a photo was described in HERBERTIA 1961.

It was in 1960 that the idea came to me to try and raise some seedlings in order to see if I could get some improved ones. So on October 30, 1960, I gathered some plump seeds and planted them in a seed box, 12 inches by 24 inches and about 5 inches deep. The seeds germinated fairly promptly and the box was wintered in a sunny glassed in porch

Fig. 21. **Agapanthus africanus** var. **henryae** Traub, as grown in a 6-inch pot at Gladwyne, Penna.

that had sufficient heat to keep the temperature above freezing. The following summer the box was placed outside in nearly full sun.

When the seedlings were two years of age, five of them flowered and one of them bore a beautiful head of pure white flowers. This one was removed from the seed box and I potted it separately in rich soil. It grew apace, and I was able to distribute it as follows:

On May 16, 1963, I sent several divisions to Dr. Hamilton P. Traub, La Jolla, California, who described and named it *Agapanthus africanus* var. *henryae.*

On April 1, 1964, I took and gave to Callaway Gardens, Pine Mountain, Georgia, a blooming sized plant.

On September 28, 1964, I sent several more divisions to the late Dr. Ira Nelson, Louisiana Society for Horticultural Research, Lafayette, La.

Last winter 1965-66, I was brave enough to plant out of doors in a permanent position, twenty-eight seedlings of *A. africanus,* including the white *A. africanus* var. *henryae.* This was done late in the year, October, which was not too favorable a time to plant them.

However, I had a carefully prepared bed made. It was dug about 1 foot deep and the soil was well mixed with ¾ inch crushed road stone and peat called "Maryland Peat", the latter from near Betterton, Maryland. The bed is surrounded by rather large, naturally placed boulders. They are shaded in summer for about a quarter of the day by old, deciduous trees. Dr. Walter Hodge, on a recent visit, said that they were native in just such a situation in Africa, which I had surmised.

Everyone survived the winter and came up well in the summer of 1966. Even the small plant of *A. africanus henryae,* freshly removed from the original pot, survived and made two flowering stalks, this past summer.

Not only as a pot plant, but also as an out of doors garden plant for a choice situation from Pennsylvania and Long Island southwards. *A. africanus henryae* has a bright and useful future ahead of it in our gardens. The accompanying photograph, depicting eleven spikes of flowers, shows its vigor in spite of the many pieces removed from it during its short life.

The remainder of the seedlings, twenty-eight blues, will be tested for form, size of flower and hardiness.

It has been an interesting adventure in breeding and I feel the reward for the time and trouble has been very great.

Aug. 30, 1966,
Gladwyne, Penna.

PLANT LIFE LIBRARY—continued from page 62.

THE NATURE OF BIOCHEMISTRY, by Ernest Baldwin. Cambridge Univ. Press, 32 E. 57th St., New York, N. Y. 10022. 1967. Pp. 111. Illus. Cloth, $3.50; paper, $1.65. This stimulating text is meant to be read rather than studied as an introductory course in biochemistry for high school and university students. The subject matter is concerned with the constancy of the internal environment, the function of the blood, proteins, enzymes, amino acid and nitrogen, carbohydrates, fat, the power-house of the cell, nucleic acids and nucleoproteins. Highly recommended.

A DICTIONARY OF THE FLOWERING PLANTS AND FERNS, by J. C. Willis, 7th Edition, revised by H. K. Airy Shaw. Cambridge Univ. Press, 32 E. 57th St., New York, N. Y. 10022. 1967. Pp. xxii; 1214; liii. $18.50. This 7th edition of Wills' Dictionary has been thoroughly revised. In order to achieve a moderate-sized volume, some matter that is dealt with more suitably in other works has been omitted. The main body of the book is devoted to a dictionary of the genera, families, orders and groups of higher rank of flowering plants and ferns arranged alphabetically. This is followed by a key to the families of flowering plants; a synopsis of the system Bentham & Hooker, 1862-93, and an index to the orders and groups of higher ranks. Highly recommended to all plant scientists.

TAXONOMY OF FLOWERING PLANTS, by C. L. Porter. W. H. Freeman & Co., 660 Market St., San Francisco, Calif. 94104. 2nd Edition. 1967. Pp. 472. Illus. 399. $7.75. This text on the basic principles of taxonomy is intended as a beginning course. The subject is reinforced with illustrated descriptions of more than a hundred families of flowering plants. Highly recommended.

SOURCEBOOK OF LABORATORY EXERCISES IN PLANT PATHOLOGY, by Arthur Kelman, et al. W. H. Freeman & Co., 660 Market St., San Francisco, Calif. 94104. 1967. Pp. 387. Illus. $8.50. Prepared by the American Phytopathological Society Sourcebook Committee, this book includes 227 exercises based on major subjects,-(a) principles of plant pathology; (2) physiological processes or functions affected; (c) biotic causes of diseases; and (d) types of crops affected. This book is indispensable for all teachers and students in plant pathology. Highly recommended.

PLANTS AS ORGANISMS, by Robert M. Page. W. H. Freeman & Co., 660 Market St., San Francisco, Calif. 94104. 1967. Pp. 87. Illus. 10. Paper bound manual, $2.75; individual studies, 20 cents each. The objective of the 18 exercises in this course is to present the beginning student with opportunities to acquire factual information about the structure, functioning and reproduction of green plants and fungi; and to encourage the student to develop useful skills and an attitude of inquiry. Highly recommended.

SYSTEMATIC EMBYOLOGY OF THE ANGIOSPERMS, by Gwenda L. Davis. John Wiley & Sons, 605 3rd Av., New York, N. Y. 10016. 1966. Pp. 528. $19.75. This book breaks new ground in bringing together those details of angiosperm reproduction which are not generally known. The introduction is concerned with (a) systematic and taxonomic characters, (b) taxonomic evaluation of embryological characters, (d) the anther, and (e) the ovule. The main body of the text is concerned with the embryological details of the plant families. The monumental bibliography of 215 pages on plant embryology alone is worth the price of the book. Highly recommended.

GENERAL VIROLOGY, 2nd Edition, by S. E. Luria and J. E. Darnell, Jr. John Wiley & Sons, 605 3rd Av., New York, N. Y. 10016. 1967. Pp. 512. Illus. $12.50. This second edition of a widely used text by outstanding authorities will be welcomed by all biologists. The introductory part outlines the basic measurements, physical, chemical and biological techniques necessary for the presentation of virology as a modern biological subject. The main body of the text is devoted to discussion of the accumulated knowledge on viruses, particularly bacteriophage physiology, and the biochemistry of animal virus multiplication. This new edition belongs in the library of all biologists. Very highly recommended.

Fig. 22. Bouquet of bright Amaryllis blooms carried by the Maid of Honor at the Costa Mesa, Calif. spring wedding in 1967. Photo by Turville Studio, Santa Ana, Calif.

AMARYLLIS BLOOMS APPROPRIATELY USED AT A WEDDING

W. Quinn Buck

At a beautiful early spring wedding in Costa Mesa, Calif., Chadwick Gardens, Redondo Beach florists, used their fine white amaryllis very effectively for the decorations of the church as well as for the bouquets of the bridesmaids. Our picture (Fig. 23) shows the bride under a large arch of the hugh amaryllis. The other picture shows the bouquet (Fig. 22) carried by the maid of honor.

Chadwick Gardens has found that by allowing the first bud on a spike to open in the greenhouse, the pot can then be stored for as long as three weeks in their cold room; the other buds will then open normally in the greenhouse, allowing for the use of large numbers of flowers at one time. Some of the exhibitors at amaryllis shows might be able to take advantage of this if they have access to a cold storage room.

Fig. 23. The bride under the large arch of brilliant **Amaryllis** blooms at the Costa Mesa, Calif., spring wedding in 1967. Photo by Turville Studio, Santa Ana, Calif.

AMARYLLIS REGINAE AND CRINUM ERUBESCENS

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In 1964 we made a trip through Peru, where we collected a bulb or two from every group of amaryllis we found in the areas of Huanaco, Tinga Maria, Tournavista and down the Rio Huallaga (and some of its tributaries) toward Terapoto. Most of these bulbs were not in bloom when collected.

One of these bulbs bloomed in early 1966. The scape, just as the first flower was starting to open, was cut, along with one mature leaf, and packed in a long cardboard box. Crumpled tissue paper was placed around the scape and the flower to support them during transit. These were sent to Dr. H. P. Traub for identification, who wrote: ". . . is the finest type of *Amaryllis reginae L.* that I have seen, and it would be worthwhile to propagate it since many others would be pleased to have it in their collections". We selfed it and from about forty flowers obtained nearly a thousand seed, which were distributed in the United States.

In a swamp area about five miles east of Tinga Maria, growing near the banks of the Rio Huallaga, was found *Crinum erubescens.* The plant has channelled foliage (typical of the Americanum Alliance) and is stoliniferous, and usually has seven white reflexing flowers which open all at once. It loses its foliage at 32° but has grown vigorously and flowers regularly in Burbank, California.

NOTES ON WORSLEYA RAYNERI (BLUE AMARYLLIS)

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My association with *Worsleya rayneri* (Syn. *Amaryllis procera*), the "BLUE AMARYLLIS", actually began taking shape in 1940 when I read the article by Harry Blossfeld in Herbertia on his successfully collecting bulbs of this rare plant from the slopes of the Organ Mountains in Brazil, followed by another article by E. J. Anderson in connection with growing the plant in the West Palm Beach, Florida area. In the 1942 issue of Herbertia, there was another article on growing the "BLUE AMARYLLIS" in California. In the 1966 issue of Herbertia there was a follow-up article by Mr. Blossfeld which was most illuminative on the natural habitat and growing conditions, and further enhanced by most provocative illustrations of these magnificent plants growing, blooming and seeding on the mountainside. In the 1967 issue of Herbertia, Mr. Burr Clouette of Columbia, South Carolina showed a picture of his "BLUE AMARYLLIS" growing from seed.

At this juncture my nebulous dream of owning one or more of the bulbs became an obsession, and I began trying to locate a source from which I might procure some as soon as possible. I found a source of

supply soon thereafter in Charles L. Harris of Griffin, Georgia, who informed me that he was importing a supply of the bulbs from Brazil. I made arrangements with Mr. Harris in February and March of 1967 to receive eight plants. After feverishly waiting for my bulbs all through April and May, I was finally rewarded by the bus depot calling me one Sunday morning in June saying that a carton of flower bulbs had arrived for me. I immediately went down and obtained my shipment. The bulbs were in excellent condition.

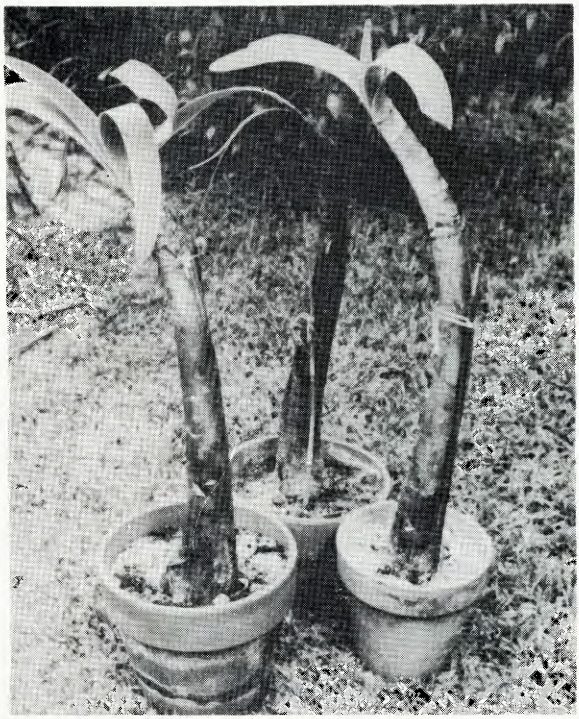

Fig. 24. The Blue Amaryllis, **Worsleya rayneri** bulbs in pots in the garden of Mr. Beckwith D. Smith, Jacksonville, Florida.

I made a mental note: "Happiness is having a BLUE AMARYLLIS!!" And up to the present, indeed it has turned out to be so. All during the period of waiting for the bulbs to arrive I had been reading everything I could lay hands on about the cultivation of this most rare Amaryllis, had prepared my soil, filling extra large pots and watering them copiously to be sure the mixture would drain properly. Upon opening the carton the big bulbs were found to have only a few stubs of roots on some, and on others no roots at all. The bulbs can best be described as "club shaped". There is no definition of neck from basal plate, the basal plate being from three to five inches thick, immediately

joining the base of the bulb; and counting from the bottom of the basal plate to the upper end of the neck, where the leaves emerged, they averaged from 36 inches to 48 inches in length. Six bulbs had a curved neck, and two were almost straight. The leaves are glaucous, approximately 2 inches wide, and with a very narrow reddish strip on each edge. Lifting up the top leaf one finds another shorter leaf underneath, and lifting up this leaf there is another shorter leaf, so that finally the shortest leaf is only just coming out of the center of the neck. Their weight is approximately 5 pounds per bulb. A potting soil mixture was made of granulated peat, sphagnum moss, some clean sand and a little bit of rotted dairy manure. The bulbs were set in this with the basal plate just under the surface of the soil. Stakes were attached to each bulb to hold them upright.

This record is being written in August, 1967, so the BLUE AMARYLLIS have been planted for two months. Each day the pots are flooded with water, which slowly but surely drains away, and it is easy to see that the bulbs are making good leaf growth, all but two, and these seem reluctant to make a start, but perhaps they will in time. Also, these slow fellows are shorter in stature than the others. I only hope they are making a root growth. When winter comes, I may have to transfer them to a large flat container in the greenhouse, and apply bottom heat through the use of soil heating cable with thermostat. But if they make root and leaf growth prior to cold weather, it may be they will be content just to be moved inside the greenhouse. Figure 24 shows three of the BLUE AMARYLLIS, placed in pots and set in the center of the garden in order to get a good picture, but they regularly stay just at the edge of a Chinese Elm tree to get the morning sun, and thereafter be lightly shaded for the balance of the day. Here they receive ample humidity and good air circulation and I am humbly and prayerfully waiting for their blooming, and this will be a happiness which I will endeavor to share with all who want to see them at that time. Color pictures will also be taken. The bulbs I have are reported to be more than fifteen years old. Every attempt will be made to successfully grow them and a future report as to success or failure will be made.

ASEXUAL PROPAGATION OF **LYCORIS SQUAMIGERA** MAXIM.

EDWARD G. CORBETT [1]

In an earlier report on asexual propagation of *Lycoris,* preliminary results of a greenhouse experiment with the techniques frequently used in the propagation of *Amaryllis* and *Narcissus* were reported for *L. radiata* and *L. sanguinea* (1). Since that experiment was conducted in a greenhouse, a second experiment was set up to test the most promising techniques under field conditions.

The earlier experiment had indicated that rotting of the bulbs after cutting might be a serious drawback, especially in the field where the

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dangers of infection would probably be much greater. It was felt, therefore, that the amount of rotting that might be expected should be determined under field conditions. The need to study the efficacy of these propagation techniques on other species of *Lycoris* was also considered in setting up this experiment.

MATERIALS AND METHODS

Bulbs of *Lycoris squamigera* Maxim., which produce its leaves in the spring, were dug on June 14, 1965 and allowed to dry over night. The bulbs were then graded by size and prorated to each treatment to assure a reasonably even distribution of sizes in each treatment. The treatments were: cross-cutting the basal plate into 4 equal segments about two-thirds of the depth of the plate, sectioning the bulbs into halves, and no treatment. The bulbs were dusted on the cut surfaces or basal plate with a 2:1 mixture of Hormodin #1 and Fermate. The dusted bulbs were allowed to dry for 2 days to promote suberization of the wounded surfaces and then planted about 4 inches deep in sand in a cold frame. The sand was construction grade. The bed received no supplemental irrigation during the experiment. Records were maintained at intervals on the appearance, growth, and senescence of the leaves. The bulbs were removed from the cold frame on June 8, 1966 and the results tabulated.

In order to further evaluate the treatments, 75 bulbs from each of the 2 wounding treatments were measured with a Vernier Caliper. A single measurement in the plane with the greatest diameter was made on each bulb and the results were tabulated. Length of the bulb was not determined, because this measurement appeared to be more closely related to depth of planting than to any other factor.

RESULTS

The number of young bulbs produced and the number of propagules which rotted are shown in Table I. As noted in the earlier experiment, there is a very marked increase in bulb production when the basal plate is cut. As had also been shown earlier, sectioning the bulbs gave a much greater degree of rotting such that the total yield of bulbs was reduced in comparison with simply cutting into the basal plate. However, rotting of the propagules was not a particularly serious problem in the field experiment.

The leaves began to push above the ground early in March at approximately the same time that the leaves were appearing on other nearby plantings of *L. squamigera*. There appeared to be no striking difference in the leaves other than their smaller size, although failure of some leaves to appear did serve as an indicator of the losses to rot. The leaves were starting to die at the tips on May 17 and were almost completely dried by June 1, somewhat ahead of the other *L. squamigera* plantings. The early senescence of the leaves can probably be attributed to the low fertility and relative aridity in the sand bed.

Table I. Results obtained from propagation treatments with bulbs of **L. squamigera.**

Treatment	No. of Bulbs	Propagules	Propagules Rotted	Propagations	Percent Increase of Bulbs
No treatment	22	22	0	23	4.6
Basal Plate Cut	21	21	0	110	523.8
Sectioned ½	21	42	12	83	395.5

Table II. Relative sizes of new bulbs produced by cutting the basal plate or sectioning the bulbs of **L. squamigera.**

Treatment	Diameter (mm)			Size Classes						
	Least	Greatest	Average	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Basal Plate Cut	12.7	36.8	23.6	0	7	16	21	19	9	3
Sectioned ½	8.2	33.2	19.7	1	11	32	19	8	4	0

The relative sizes of the bulbs produced by wounding are shown in Table II. It can be readily seen that cutting the basal plate produced larger bulbs than sectioning. The average size of the bulbs produced by cutting the basal plate was almost 4 mm greater than that of the bulbs produced by the sectioned propagules. The smallest and greatest diameters noted on the bulbs from the basal plate cut treatment were larger than the corresponding measurements obtained on the bulbs resulting from sectioning. When the bulbs are placed in size classes, a very definite shift to larger sized bulbs with the basal cut treatment can be seen.

The results reported here show quite clearly that *L. squamigera* can be easily propagated by cutting the basal plate and setting the bulbs in a sand bed in the open. An increase of 5 to 1, with no evidence of rotting, as well as bulbs that are larger than the other treatment tested, offers a great potential for the rapid increase of this plant.

Further experiments on fertilization of the plants in the propagating bed, timing of treatments, response of other species to the treatments, and methods of reducing rotting will be made as time, space, and supply of bulbs permit.

Literature Cited

1. Corbett, E. G. 1967. Asexual Propagation of *Lycoris*. Plant Life 23: 140-143. 1967.

VERTICAL BULB CUTTAGE IN NERINE

Hamilton P. Traub

In the case of the two clones of *Nerine* x *traubianthe* Moldk., one a cross of *Nerine filifolia* x 'Rosabla', multiplies rather rapidly by producing bulb offsets so that it was possible to send some of these to others interested in hybrid nerines. However, the cross, *Nerine filifolia* x 'Inchmery Kate' gave a clone with a rather thick scape, and which produced no offsets. In order to distribute this clone, it was necessary to

resort to vertical bulb cuttage (see summary, Traub, 1958). Bulbs are cut vertically into quarters and these are planted in coarse sand, kept watered until sprouts appear, when they are planted in a suitable soil mixture. As a preliminary experiment one bulb of each of the clones was cut vertically into quarters and the results are summarized in Table 1.

Table 1. Results from vertical bulb cuttage in hybrid **Nerine.** Bulbs cut November 1966; data taken August 15, 1967.

Clone	number of bulbs cut	number of vertical bulb cuttings	Number of new bulblets	Remarks
Nerine filifolia x 'Rosalba'	1	1	1	
		1	1	
		1	1	
		1	1	
Nerine filifolia x 'Inchmery Kate'	1	1	2	2 from same cutting
		1	2	ditto
		1	1	
		1	0	cutting decayed

The table shows that in all but one case at least one new bulblet was obtained. In two cases the cutting produced 2 bulblets.

It is hoped that others interested in Nerines will report on their results with bulb cuttage.

LITERATURE CITED

Traub, Hamilton P. The Amaryllis Manual. 1958 pp. 121-134.

—— Review of the Genus Nerine, in Plant Life 23, 1967.

THE 1966-67 AMARYLLIS SEASON

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Another amaryllis season has passed with more outstanding flowers in evidence than in many years. In the south the mild winters have been kind to the amaryllis the past few seasons. Also the last two summers have been favorable to amaryllis growth and still more important is the fact that our interest in amaryllis returns. So we probably have given them more care during the growing season. If we will see that our amaryllis have a constant supply of food by watering them each ten days to two weeks with a weak solution of plant food we will be more than rewarded with a fine crop of blossoms in the spring. We must always remember that if our amaryllis are in pots that are set outside each rain may leach out the plant food. It is important to replenish this food after each rain. I find pressing business, pure laziness and other attractive nuisances often cause me to neglect fertilizing and spraying my amaryllis as often as I should. This year I have done a little

better and I am sure next spring I will be rewarded with much nicer blooms. The little additional care you give your amaryllis surely pays off in flowers.

In the past several years I have made a number of tables to set a large number of my potted plants on. This gives them better air circulation and is a lot less wear on the back taking care of them: I would like to suggest that you will find you will have more success with your amaryllis if you put some of the money you might otherwise use to buy bulbs into equipment to make it easier to take care of them. If it is easier to take care of them you will not be as apt to neglect them and the following season I feel sure you will have more beautiful flowers than you would have had if you had put all your money into buying bulbs. Having a lot of bulbs does not in itself assure you of flowers. While you can brag to your neighbors all summer about how many varieties you have if you do not take care of them you may be embarassed when you have only a few small flowers to show him in the spring. One well grown bulb is worth a dozen that do not flower. Of course there are those who do not try to carry bulbs over from year to year but just buy a few prime bulbs to flower each season. They figure they get their money's worth when the bulbs flower. They throw the bulb over the back fence after they have flowered. They do not bother with the fuss of taking care of them during the summer. But for those who like the challenge of growing amaryllis much satisfaction can be found in taking care of their plants all summer. I can not quarrel with either method. But I am the type who can go out in my amaryllis patch and admire the bulbs during the summer. Good foliage and a plump bulb even looks pretty to me when they are growing well.

SIZE OF BULB TO BUY

I am often asked which size bulb is best to buy. This is a hard question to answer but I will try as best I can. Generally speaking there are about three sizes commercially available. These are basicly 24/26 cm., 28/30 cm., and 32/up cm. size. I really think that one gets about the same value regardless of the size he buys. It is more the end use to which you will put the bulb. If I were buying to make a bed of them in the south I would purchase the 24/26 cm. size or smaller. I would have in mind getting the most amaryllis for my money and that I would give them the care they needed to make proper growth. The 24/26 cm. size usually will make one or two flower scapes and those with a modest income can get a wealth of enjoyment from two or three of these bulbs planted each year.

If the price of the bulbs is not a great factor to you then you might decide to purchase the 28/30 cm. size. This size, if the bulbs root well will give much larger flowers generally than the smaller size bulbs. The larger bulb, if it is well cared for, should recover for the next flowering season easier than a smaller bulb. You will find certain varieties in the 24/26 cm. size literally will flower themselves to death while others make a more modest spike it can support.

If one has the money to put into bulbs one might choose the larger size bulb. The largest bulbs usually make the largest flowers. If the bulb does not root well it still will make a better spike than the smaller bulb. Also the larger bulbs often make three spikes. If you want exhibition flowers get the largest bulb available. In this regard if you have ever seen an 'Apple Blossom' from a well rooted 32/up cm. bulb it is a gorgeous thing—much prettier than from a small bulb.

Generally speaking a person will be more satisfied if he puts his money in the largest bulbs he can buy. He will not have as many bulbs, but his chances of success are better and I feel he will be much more pleased with the results the first season. If you are a beginner I suggest the 28/30 cm. or the 32/up cm. size bulbs. But if you have mastered their culture you can surely have more varieties at less cost with the smaller size bulbs.

WHAT VARIETIES TO BUY

If you are a new fan do not just buy the variety you happened to see take the largest or best flower in the show. Normally I feel the new fancier is better off asking a reliable amaryllis dealer to send him several varieties he thinks would be easiest to flower. You might suggest the color but more than likely it would be best to leave the color to him. When the dealer receives your order he can pick good varieties that have made the best bulbs that year. The bulb dealer is interested in you having success and he never knows until he receives his bulbs which varieties will be in best condition. He will more than likely pick varieties which had held their roots when he received them. If you receive bulbs with roots your chances of success are much better provided you do not use too heavy a soil or over water them and rot the roots. If you prefer picking your amaryllis I might suggest a few that generally give good results each year.

White: 'White Christmas', 'White Giant'.
Pink and White: 'Floriade', 'Little Diamond', 'Rose Marie'.
Pink: 'Dutch Belle', 'Daintiness', 'Fritz Kriesler'.
Medium Rose: 'Rubia', 'Bella Vista', 'Queen of Pinks', 'Queen of Sheba'.
Dark Rose: 'Moreno', 'Bordeaux'.
Blend: 'Day Dream', 'Cupido'.
Salmon: 'Mozart', 'Beautiful Lady', 'Rilona'.
Orange Red: 'Orangedale', 'Tangerine', 'King Gustav Adolf IV'.
Medium Red: 'Scarlet Leader', 'Flamboyant', 'Rembrandt'.
Dark Red: 'Tarakan', 'Vintage', 'Purple Queen', 'Red Master'.
Red & White: 'Hellas', 'Thalia'.

Of course if you do not see a favorite of yours on this list, I possibly just forgot it. I could not list all but only a few that come to mind at this time. Of course there are many fine new clones that will prove most worthwhile.

TRENDS IN AMARYLLIS HYBRIDIZING

Several noteworthy trends in hybridizing are showing up in the newer varieties on the market. One factor results from the demand for amaryllis as cut flowers in Europe. The growers have given emphasis to getting two scapes of flowers at a time, better lasting quality of flower, less fragile flowers and up to six flowers per spike. The lasting quality of flower has possibly reached its highest degree in Van Meeuwen's 'Hellas'. It makes six flowers per spike and will last for weeks if the weather is cool. Van Meeuwen is placing more emphasis on six flowers per spike than any other grower and many of his new varieties make six flowers. He does not like the 6 flowers to open at once but two at a time so the first 2 may be picked off when the last two open thus giving a long season of flowers per spike. Most of these clones that give 6 flowers per spike last longer in flower than the older ones. The Van Meeuwen firm has made great strides in their hybridizing recently and they were awarded three gold medals in shows last season. This was more than any other Dutch Amaryllis Grower received.

The Van Meeuwen firm is striving to introduce more free flowering kinds also. You will find their newer bulbs are generally more free flowering, have more flowers per spike and last longer. For many years Van Meeuwen leaned heavily to the red varieties and still seems to favor this color but has in the last several years introduced some outstanding varieties in other colors, blends and bi-colors. They have several extremely late flower clones that were introduced last year. These reds are 'Donnar' and 'Etna'. They are fully two weeks later than most other clones and appear to have near kin-ship with *A. Aulica platypetala.*

Warmenhoven in the past several years has introduced some fine clones that have been a departure from the solid colors which were so popular when Dutch Amaryllis first became well known in this country. These are 'Floriade', 'Golden Triumphator', 'Florileen', 'Little Diamond' and 'Mt. Everest'. Warmenhoven's clones generally are very large flowering but do not all make four flowers per spike. His new clones generally are very vigorous and probably more adaptable to outdoor culture in the south than other Dutch clones. I am quite sure he has kept closer to the old Leopardii line which instills vigor.

I am told that Warmenhoven is interested in the cut flower trade and is developing clones that are more useful in this respect. One orange clone I received last year in some quantity made two spikes at once with four open on each spike. This group of clones were probably sent to me by accident for another clone but although the flowers were not as large as most of Warmenhoven's clones they were excellent pot flowers for the florist trade.

Ludwig and Co. are best known for their pink varieties. They are still the only firm that offers such clones generally to the public. They have made great strides in improving these and have a number of light pink and medium rose pink clones on the market. 'Dutch Belle' is possibly the best formed pink they have and flowers rather freely. 'Flora Queen' generally flowers rather poorly for me the first year; however I

find it the easiest to maintain and generally after the first year I can get wonderful flowers from it. It often makes six flowers per spike. 'Trixie' is a fine medium dark rose from Ludwig and Co.

Generally the Dutch hybridizers have increased the color range considerably in the past several years and particularly in the bi-tones and blends. They have constantly increased the number of flowers per spike, increased the free flowering habits and are striving to perfect amaryllis that will become popular for the florist trade.

NAMED CLONES

The most popular and most widely grown clone today and possibly the first amaryllis to be established as a commercial variety is 'Apple Blossom'. Most growers cultivate it as it is in great demand and fills the requirement as a commercial clone. It does not decline in vigor as many others do. Possibly the next most cultivated clone is 'Ludwig's Dazzler'. This clone can make extra large bulbs which makes it a most desirable commercial clone. 'White Giant' is also a fine commercial clone. The shrimp and white colored clones, 'Margaret Rose', 'Sweet Seventeen' and 'Day Dream', which are very similar, are very popular and are fine commercial types. The White flushed pink clones have become very popular also in the past few years and are generally easy to flower. The most sought after type however are the picotees which are always scarce.

I have lost my interest for trying every new clone that is introduced each year. I seem to become more interested in them after I have seen them for several seasons; so if I do not mention your favorite new clone do not be disappointed.

WHITE CLONES

'White Christmas', 'White Giant', 'Flying Cloud' and 'Oasis' are fine free flowering clones and each season restore my faith in them. There are a number of other good whites which I will not mention. We all have our favorites. One I would like to mention is C. Warmenhoven's white. These generally are not named. They have an ivory white color when first open as with 'Oasis'. I feel they are a little different and worthy of note especially as I consider they have more Leopoldii genes in them and this should make them more suitable for outside planting in the south. Do not feel I am selling other old clones like 'Maria Goretti' short. It and other clones such as 'White Giant' do well planted out in the south.

NEAR WHITE

The whites penciled or flecked slightly with red are striking. Two clones, 'Marion' and 'Peppermint', are most noteworthy in this particular color. I am sure there will be others. The picotee type, white edged red is still extremely popular, flowers easily the first season, but some have trouble maintaining it after the first year. It does bloom from small sizes so try a smaller pot and do not try to make too large a bulb. There

will be newer clones in Picotee types that will be improved. Picotee is surely one of my favorites and a most beautiful type.

BI-TONES AND STRIPED CLONES

Ludwig's 'United Nations' and 'Carousel' are still very popular and make nice large flowers. For sheer beauty 'Florilien' is exceptional. It is an immaculate white veined heavily with bright red. It is outstanding. 'Hellas' is a fine new red and white bi-tone which makes six flowers per spike and keeps for weeks. 'Orion' is a fine new white striped red that grows vigorously and should prove to be a fine show flower as it gets large.

PINK & WHITE

A very popular group with many good clones to choose from. Possibly the largest is 'Floriade'. 'Apple Blossom', however, will make a huge flower from large bulbs as the size of the flower in this clone varies remarkably with the bulb size. If you can obtain the true 'Little Diamond' it is one of the most beautiful amaryllis I know. It will make two spikes at once with four flowers each of perfectly round flat form. 'Pygmalion', 'Rose Marie', 'Rosy Dawn' and 'Love's Desire' are all fine white and pink clones. Possibly I should mention 'Thalia' here. This new one from Van Meeuwen, more rose or red and white than pink and white, is a most beautiful and free flowering clone especially when given a little shade.

BLENDED COLORS

'Day Dream', 'Margaret Rose' and 'Sweet Seventeen' in shrimp pink and white are the most popular still. 'Catherine Valenti' is a very large frost rose and white that is exceptional. 'Golden Triumphator' and 'Cupido' are extra fine golden orange and white clones.

PINK CLONES

Ludwig and Company is the only firm that offers any number of these clones. 'Dutch Belle', 'Heaven Sent' and 'Flora Queen' are all beautiful.

ROSE CLONES

In soft rose the new African clone, 'Coral Seas' is exceptionally beautiful. 'La Forest Morton' in medium rose is still a leader. 'Trixie' is fine in the darker shades along with 'Rubra' and 'Rosedale'. 'Elvira Armayo' and 'Muscotel' are similar color having a lavender tone. Both these have their admirers. In dark rose 'Moreno' and 'Bordeaux' along with 'Mystery' fill the bill.

BRIGHT RED AND LIGHT RED

Often when one talks about bright red or light red the two get confused. I assume bright red has more fluorescence and light red leans toward pink but often the lighter reds are the brighter. This is a color

tone that is being neglected but I feel some progress is being made. Like 'Barbarossa' which was a nice bright red these clones tend to degenerate to orange red. 'Red Rover' is a nice light vermilion variety. 'Donnar' is a light bright scarlet of note. The new clone, 'Etna', is still lighter and brighter. These two should be a welcome addition. Both are extremely late varieties and have slightly different texture and color from the other reds.

SCARLET

'Scarlet Leader' is possibly the best all round scarlet I know. 'Scarlet Triumph', 'Red Champion' and 'Clone 65' are all good scarlets.

MEDIUM RED

I think the 'Flamboyant' and 'President Kennedy' are possibly the leaders in this particular color. Both are fine reds of different form. I personally like the open face of 'President Kennedy'. The petals do not tend to roll back in this one as with other clones. 'Rembrandt' is a fine medium red that should not be overlooked.

DARK RED

The list of good dark reds is growing very fast. Van Meeuwen has introduced several good ones in this color recently. 'Belinda', 'Bernice', 'Mars', 'Pandion' and 'Tarakan' are a few. All are too new to be properly evaluated but so far 'Tarakan' has impressed me most. It is free flowering and is an exceptionally fine clone. In the African amaryllis several new dark reds are available. They are also too new to comment on but should not be forgotten. 'Purple Queen' and 'Red Master' are fine wine reds. My 'Purple Queen' plants last season made huge blooms, possibly the largest flowers I had. 'Ludwig's It' is a fine dark red. 'Vintage', another African amaryllis, has won many friends these past several years. And we must not forget Ludwig's 'Franklin Roosevelt'.

SALMON & ORANGE CLONES

In this color it is hard to find clones that do not degenerate to orange red. Ludwig's 'Beautiful Lady' is one of the leading salmons. 'Mozart' is a fine new salmon. 'Rilona' is the lightest salmon available and 'Hecuba' is a fine deep salmon. Many still favor 'Queen Page'. In true orange there are few. 'Orange Orchid' has flowered more red the past few years. It was wonderful for several seasons but tends to bloom red. 'Orange Wonder' still remains orange and possibly this is why it is called orange wonder. Few stay in this color. 'Delilah' is a fine tangerine orange and 'Orangedale' is a similar color.

ORANGE RED

I feel the leading one in this color is possibly the African clone, 'El Toro'. However it gets redder each year. 'Cavalier' and 'Cherokee' are fine orange reds. The new clone, 'Nitora', might be classed as an orange red. It, however, is possibly more a medium red with a fiery orange overtone. This makes it especially beautiful.

AFRICAN AMARYLLIS

I would like to mention particularly the Hadeco Strain of African amaryllis as these are generally grown from offsets rather than cutting and apparently do well here in the south. There are a number of fine clones introduced by this firm particularly in the white and rose bitones, dark reds, orange reds, and rose colors. These clones are shipped from South Africa in late August or early September and are available in early October. The first year they flower in the fall in about 5 to 6 weeks after they are planted. Many people have the mistaken idea that these amaryllis will flower in the fall each year but this is wrong. They are no different from the Dutch hybrids in this respect and will revert to spring flowering in the northern hemisphere.

AMARYLLIS SPECIES

My interest in these rises and falls very sharply from time to time. I have spent several thousand dollars having them gathered in South America. Then I took orders and had great expectations only to be disappointed myself and to have to disappoint my customers. I have discontinued trying to sell them.

I would like to comment on several of the species, however, particularly from the standpoint of developing new hybrids.

Amaryllis leopoldii This species has been lost to cultivation which in itself is a mystery. I believe the Warmenhoven strain is more nearly developed around this species or genes than any other hybrids. I have one hybrid clone from Guatemala that when selfed produces seedlings with pure white, white striped, picotee types and 'Beacon' type flowers along with many other seedlings that nearly resemble *Amaryllis leopoldii*. Time has not permitted me to investigate selfing these offsprings but I feel this hybrid has a great deal of *A. leopoldii* in it. The offspring generally do well in this location and this gene line, I feel, is possibly best for outside planting in the south.

Amaryllis aulica. Generally the form of *A. aulica* I have does well here, but they have to be given winter protection when temperatures fall below 30° F. They grow well in peat with a little lime and cow manure added. They require some shade for best results. It is generally the most robust and vigorous species I have.

Amaryllis aulica stenopetala This is exceptionally robust and vigorous. It, however, needs to be kept dry during June and July to get a good number of flowers. It can be expected to bloom from September to November.

Amaryllis aulica platypetala This species grows well here and is possibly more adapted to this region than *A. aulica stenopetala* as it flowers in July and August and tends to go dormant in the winter. It makes sufficient growth in summer to maintain itself in a flowering condition. I consider this one of the very best species for hybridizing to improve amaryllis hybrids for the south.

Amaryllis psittacina This species seems to just about hold its own here neither dying out or flowering very often. Possibly with a little special care it could be pot-cultivated here. As I have found *A. aulica* requires more shade than I suspected this is possibly the case with *A. psittacina* also.

Amaryllis elegans This species fails to respond here as I feel the climate is too wet and hot for it. A more airy, cooler climate possibly would be better.

Amaryllis striata This species will grow like a weed during the summer here only to rot during the winter. It appears to like a sandy soil but I do not think it likes it cooler than about 60° F. The bulbs are very fleshy making rapid growth and appear to be hard to store.

Amaryllis reginae I have only had fair success with this species here. It will grow like a weed for a while only to rot later. It, too, like *A. striata* appears not to be able to take cool temperatures. I fear I have also given it too much sun and it apparently requires more shade.

Amaryllis belladonna This species will naturalize in the Jacksonville area where it is well drained and where roots of trees and shrubbery take up enough water during the winter to protect it from getting too wet and cool.

Other species only do fairly here without special attention which I seldom have the time to give. Possibly in a year or so when I retire I may find that time. I do hope so for I feel there are possibilities in hybridizing for many colors and types of amaryllis not available on the market today. With more understanding of the requirements of these new hybrids I feel we can find much better pot plants for our northern fanciers that can be maintained year round year after year.

I would like to pass on to you a few tips which I hope will improve your flowers next season. First I feel the greatest cause for failure is insect damage to roots and under fertilization of plants. *One can help his amaryllis greatly if he will drench his potted amaryllis with a solution of Cygon and water each 6 to 8 weeks.* Be sure you have an open textured soil and that the plant has a plentiful supply of fertilizer at all times. Watering your plants regularly with a weak solution of liquid fertilizer will help. Remember if your potted amaryllis is set out doors during the summer months each heavy rain will wash most of the fertilizer out of the pot; so fertilize after each heavy rain.

AMARYLLIS STRIATA FOR RAPID INCREASE

Willis H. Wheeler
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While my primary plant interest during the past 20 years has been in the amaryllid genus *Narcissus,* I have also grown a few bulbs of the genus *Amaryllis.* I have been limited in that activity by my inadequate growing facilities for that rather tender bulb. (I should not have left my native home in southern California.)

About six summers ago a member of a local garden club gave me three small plants of a thing she said was an amaryllis. The largest of the three bulbs was not over an inch in diameter. I planted each in a pot and kept them outside until danger of frost when I took them in and kept them in a window until spring when they went out again for the summer. By autumn the plants had grown until they nearly filled the six inch pots with vigorously-growing offsets.

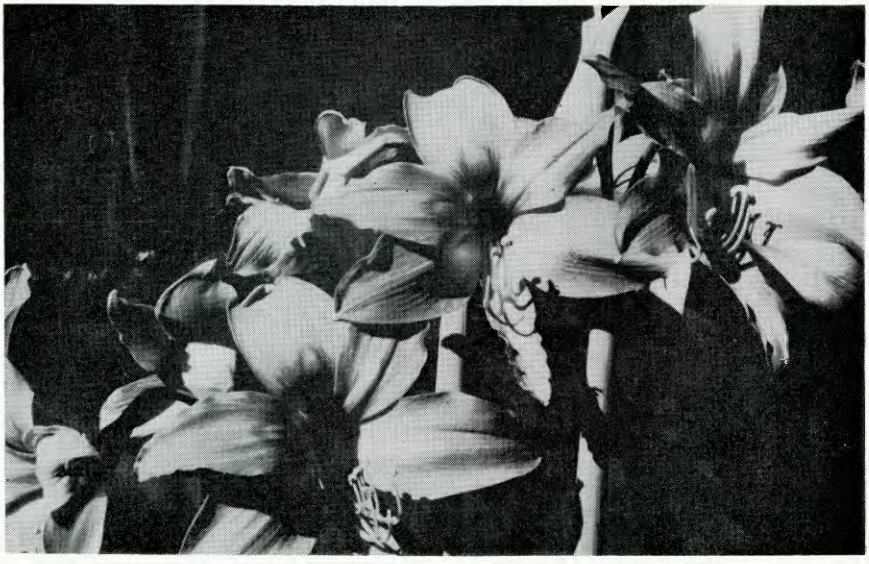

Fig. 25. **Amaryllis striata** Lamarck as grown by Willis H. Wheeler. Arlington, Virginia. Photo by W. H. Wheeler.

Growth continued inside during the autumn and winter. In February scapes pushed up quite tall. Each carried four florets. As one of my Japanese plant pathologist friends observed, they were not spectacular, being orange-red with a narrow white stripe along the middle of each narrow perianth segment. Since I have been an amateur plant breeder for many years I selfed the blooms and copious seed production resulted. Crossing with Dutch and South African hybrids also resulted in plentiful seed.

I have been interested in the vegetative increase of bulbs of the genus *Amaryllis* since the time some years ago when I discussed the matter with two raisers of that flower. They were hopeful that it might finally be possible to have good clones of amaryllis that would reproduce rapidly by bulb division. With that in mind I wondered if my amaryllis acquisition, tentatively identified by Dr. Traub as *A. striata*, might pass on to its offspring the ability to reproduce by the more rapid production of offsets.

WHEELER—**AMARYLLIS STRIATA**, continued on page 125.

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PLANT EXPLORATION IN MEXICO, 1966, 1967

T. M. Howard, *San Antonio, Texas*

In 1966 and again in 1967 the writer has continued making plant exploration expeditions into Mexico, for the purpose of introducing new bulbous material to science and the horticultural world. Mexico is especially rich in bulbous plants owing to its diverse geography and seasonal rainfall, which makes for a variety of climactic conditions. Bulbous plants of some kind are to be found nearly everywhere, whether in the deserts, the mountains, or the lower tropical regions. The *Amaryllidaceae* are represented by *Allium, Habranthus, Sprekelia, Crinum, Hymenocallis, Amaryllis L., Bessera, Milla, Dandya, Petronymphe,* and *Zephyranthes.* No doubt there are others as well, but we also find Irids growing from true tunicated bulbs of the *Tigridia* group and its allies, such as *Nemastylis, Rigidella, Cipura,* and *Eleutherine,* not to mention the many tuberous rooted *Sisyrinchiums* and the fibrous rooted *Orthosanthus. Oxalis* growing from truly scaly bulbs, as in the genus *Lilium,* are found in some form almost everywhere. The *Liliaceae* are represented in the many species of *Calochortus, Zygadenus, Anthericum,* and *Schoenocaulen,* to name but a few. The bulbous members of the *Agavaeae* are best seen in the many *Manfredas, Bravoa, Polianthes,* and *Runyonia.* Other families, such as Begonias, Gesneriads, Aroids, Gingers, Bromeliads, Marantaceae, Musaceae, Commelinaceae, and Orchidaceae, have their terrestrial bulbous representatives. Even some cacti are tuberous rooted as are the Dahlias.

I. 1966 EXPLORATION—JULY 10 THROUGH 26, 1966

In 1966 the writer was accompanied by James N. Giridlian of Oakhurst Gardens fame, and the trip covered much of Central and Southern Mexico, as well as Guatemala. Over 160 collections were made, but if one includes bromeliads and orchids, it is certain that the number of species was well in excess of two hundred.

Our trip enveloped 5000 miles and included the many adventures that such a trip normally accrues. James had traveled in Mexico before, so he was pretty well prepared for what was to follow, though he does not speak Spanish. His wide knowledge and keen interest in plant life of all kinds made the trip especially interesting for both of us and we found it mutually educational as well. Although the trip went quite smoothly, it was not without its pleasant and unpleasant aspects. There were the usual border delays, and while Mr. Giridlian remained hale and hearty, the writer, (who had never been seriously ill on the many trips over the past fifteen years) finally contacted the dreaded amebic dysentery just as we were returning home. This little souvenir literally "bugged" me for several months after returning home, but it has not discouraged me from continuing my field trips.

Although we had been very careful about locking our car, we slipped up the one time that we forgot to do so, and had two of our bags lifted

from our car in broad daylight in Mexico City while stopping for lunch on our way homeward. Unfortunately one of the bags contained James' camera equipment, as well as our tourist cards and car permit. As if the loss of some of our valuables was not enough, the loss of these necessary papers caused a delay of one day at Nuevo Laredo before they would allow us to re-enter our country, and we were fined sixteen dollars each as well for not having our papers with us. Our explanation that we had been robbed failed to create any sympathy. It is times like these when you can appreciate the good old USA, no matter how much it is criticized, either justly or unjustly.

James took it all in stride and never complained, although I must confess that I showed my impatience with the Mexican authorities while being detained so unnecessarily. I believe that they were finally as glad to be rid of me as I was to be rid of them!

While I won't go into the details of every collection made, I will try to point out some of the highlights. The first day of our trip found us driving from the City of San Luis Potosi, San Luis Potosi, to the city of Queretaro, in the state of Queretaro. Many stops were made, but since most of this area is on the dryer side in the central plateau country, few really new species were to be found. It mattered little to James though, as it was his first trip to go a-bulbing in Mexico (his previous trips had been in search of epiphytes in the southern tip of Mexico) and he was eager to collect any new plants that he found appealing. This included *Zephyranthes longifolia, Habranthus concolor,* and an unidentified white *Habranthus* species. The latter was collected along with many other interesting plants on a short side trip into the mountains East of the City of San Luis Potosi. Here too grew *Milla biflora, Zephyranthes Clintiae, Sprekelia formosissima,* a large *Tigridia* which we presumed to be *T. pavonia,* cliff hugging *Tillandsia* species, and a little insect eating plant, *Pinguicula caudata,* a member of the butterwort clan, with lovely purple flowers looking much like a small pansy, but with a "spur"-like affair similar to that of larkspurs. We decided to collect these on our way back home, but as things later developed, we were not able to do so. Fortunately for James, I was able to return to this area six months later and collect some of these odd carnivorous plants for him, since insect eating plants seem to be a very important part of his nursery business.

North of the city of San Luis Potosi we had also collected a plant of the *Manfreda* clan with tunicated bulbs having a large basal plate and succulent purple spotted or striped leaves. It appeared very much like our Texas *Runyonia tubiflora* which grows along our lower Rio Grande, and it could perhaps be that species or a related one. We also collected *Oxalis* in several forms and a pretty pinkish little *Allium* with membranous coated bulbs which sent forth stolons.

The end of the first day found us properly tired, but cleaning our day's "haul" in a nice motel just outside the City of Queretaro, where we were able to dine in a nice restaurant and reflect over the many things we had seen that day. The second day, Monday July 11th, found

us on the road again, now on highway 55, with Toluca as our destination. The day was a busy one with many unusual plants being collected. All types of bulbous material were found, many of which we did not have the haziest idea as to their identity. James was very much impressed with a lovely colony of coral-red *Bravoa geminiflora* growing in grassy, rolling hillsides in the state of Mexico. Also growing with them was a beautiful golden yellow *Calochortus* species with the fragrance of honey. He was delighted with the beauty of the lovely yellow bells which enclosed those delicate hairs seen in many members of that genus. Mexican *Calochortus,* unlike their North American counterparts, grow and flower in the summer, during the rainy season, making them relatively easy to grow anywhere in cultivation. James also was enchanted with the many species of *Tradescantia* and *Commelina,* and collected the many kinds that grow with tuberous roots. Even the tuberous-rooted geraniums were fair game.

Toluca, as usual, was damp and cold, and our motel room was heated for us. The next morning found us still heading southward toward Taxco and the state of Guerrero. So rich was this country in interesting plant life that James was like "Alice in Wonderland". Tillandsias, Orchids, tuberous Begonias, *Oxalis* of all types as well as an endless variety of other bulbs kept us busy. A fine colony of *Oxalis deppeii* captured our attention. Not only were there the usual coppery-red forms, but also forms in deep rose and lavender as well. We began collecting those with more prettily marked foliage as well. Near the Guererro-Mexico state lines we found a large colony of small yellow flowered Tigridias in full flower. James photographed them while I dug some of the bulbs growing in very heavy clay soil that remained wet after rains. After getting all the pictures that he wanted, he helped me dig Tigridias, along with a terrestrial orchid of the *Spiranthes* group, and some other unidentified tuberous rooted things. A little later we dug a little *Milla* species just inside the Mexico State line. These were in full bloom on a limestone hillside. This proved to be the same as a collection that I had found in both 1964 and 65 in the state of Morelos, near Cuernavaca. I was pleased to find that it also grew here, near the Mexico-Guerrero state line. This little species, the smallest in the genus, has threadlike leaves, only 1 mm. broad, oddly fuzzy stems, and typical white flowers with green stripes on the reverse of each segment, as in *M. biflora.* We dug corms of this plant and added them to our growing collection. A few more miles southward and we were collecting another species of *Calochortus* which was not yet in flower, and *Tigridia meleagris,* that strange Irid that looks so much like a purple and gold *Fritillaria* when in flower. *Sprekelia formosissima,* various *Oxalis,* and a *Bomarea* were also found, along with various tuberous rooted Begonias and other odds and ends.

A few miles north of Taxco, James was to become acquainted with *Bessera elegans* and *Milla magnifica.* He was completely taken by the giant *Milla magnifica* and needed no invitation to add these to his growing collection of bulbs. A most unusual tuberous *Begonia* with a single flat

ground-hugging leaf almost stole the show, however. The leaf was often as large as a dinner plate, from the center which arose one or more tall stems bearing light pink Begonia flowers of typical form. Neither of us had ever seen such a *Begonia.* Though tempted, we did not tarry in Taxco, but decided to drive to Iguala to spend the night, in the interest of saving time. Iguala, at a much lower elevation, was uncomfortably warm and we were only too glad to be on the road the next morning. Below Iguala, I again stopped to collect that weird little member of the *Milla* group which I had previously thought to be the long lost *Diphalangium graminifolia.* These were not yet in bloom, but I dug some specimens anyway. Since then, I have flowered this in cultivation and it now appears to be a new species in the genus *Dandya.* The little flowers nod gracefully in the loose umbel, as in *Bessera,* but the flowers are white, with reflexing segments. The effect is similar to a *Dodecatheon,* or "Shooting Stars" of the primrose family. Indeed the name, "Shooting Star Lily" has been coined for this plant, and the name seems appropriate.

In this same region we again collected the rare little dwarf *Sprekelia* species that I have previously collected in the area around the Oaxaca-puebla state lines in previous trips. These were not in flower, but the tiny bulb and leaf, no larger than a small *Habranthus,* were instantly recognizable to me. I have been able to flower this tiny jewel only once, in a pot, and the small spidery flowers are of typical *Sprekelia* form, although the segments are no wider than that of any *Hymenocallis!* This plant is currently under study by Dr. Traub at La Jolla, and may perhaps be described as a new species if it can be flowered.

We saw many colonies of several species of *Hymenocallis* in Guerrero, but did not collect any, as I had adequate stock from collections made in previous years. These included *H. Choretis* (*H. glauca*), *H. riparia* growing in and along streams, and a species yet to be described.

That night was spent in Acapulco, temporarily giving us a taste of "civilization" and the faces of American tourists again. But it did not last long, for we returned northward towards Iguala once more, collecting plants with a vengeance. We made several stops in the vicinity of Chilpancingo, finding many bulbs and plants of interest. We found a lovely colony of *Bessera elegans* which included the full range of its colors. The scarlet and coral-red shades predominated but there were a few purple or violet shades, and quite a few "tricolor" forms that were red on the outside and red-and-white with blue tips within! Later I collected that stunning yellow flowered Irid that is presumably a *Nemastylis* of some sort. Near the little village of Acahuitzotla, which the newer, present road has bypassed, we stopped to search for *Petronymphe decora,* a rare gem allied to *Milla* and *Bessera.* We never could find the "rock nymph" but we did find a host of other interesting plants including a purple *Achimenes* and another Gesneriad that we could not identify, along with several terrestrial orchids, *Bommrea.* A pretty *Oxalis* with velvety leaves, Begonias, and a beautiful purple and gold form of *Tillandsia capitata* clinging to the cliffs.

Another uncomfortable night in Iguala once again and then westward on a gravel road leading to Teloloapam, about 35 miles westward. For several years I had been seeking a little-known region in the state of Guerrero known as District Mina, where two very rare *Milla* species have been reported. . . . *M. delicata* (pink) and *M. mortoniana* (blue), neither of which is in cultivation. District Mina is said to be west of Teloloapam, near the Guerrero-Michoacan state lines, but is not easily accessible by automobile, as there are no paved roads, and the existing gravel and earth roads are rough. The road to Teloloapam quickly bounced us up into the mountains and we found many interesting plants. *Milla magnifica* was fairly abundant and we found one specimen with leaves over five feet long, almost as tall as James. A *Tigridia* with yellow buds showing grew there too, and it appeared to be a yellow form of *T. pavonia.* It was accompanied by *Sprekelia formosissima,* and an *Anthericum* of some sort, along with a *Manfreda.* Farther down the road we found *Hymenocallis riparia* growing in a stream and in full bloom. We collected another tuberous *Begonia,* and some *Tillandsias.* We finally bounced into Teloloapam and found it to be a most enchanting little town, completely unspoiled, with cobblestone streets, and an air of long-ago about it.

I would like to have lingered and investigated, but our trip there had bounced our brains loose and we both agreed not to continue any further westward towards District Mina on THIS trip, since it looked like it would require more time than we had bargained for. We turned about and bounced back toward Iguala once more, and where there was PAVEMENT. We stopped at Iguala long enough to enjoy a milk shake and hamburgers at an American-type drive-in. Quite a jazzy contrast from Teloloapam! From there we drove to Cuernavaca and then eastward to the Pan American highway. By evening we were at Huajuapan, in the state of Oaxaca, where we spent the night. The next morning found us collecting a pretty, small brown-flowered *Tigridia* that is not described as yet, and a very attractive dwarf white flowered *Anthericum.* Later that morning we collected a small blue flowered *Commelina* and a very attractive small *Tradescantia* with bright purple flowers. Another stop yielded a lovely golden yellow flowered *Sisyrinchium,* a pretty little xerophytic *Tillandsia* related to *T. plumosa,* and an attractive *Echiveria* species.

Nearing the City of Oaxaca, we found another exciting group of plants. One particularly, a *Milla* species, proved to be another undescribed gem which I had overlooked in previous years. Like so many botanists before me, I had incorrectly assumed it to be *M. biflora* without looking it over more closely. Another of the night flowering kinds, this new species would be yet another in the growing list of undescribed species in the *Milla* group. My sudden enthusiasm infected James as well, and he helped me in digging specimens. We collected other odds and ends, including Tillandsias, and bulbous Irids before entering the City of Oaxaca for rest and relaxation.

The next morning we took a side trip from the City on the road to Puerto Angel and back, collecting many interesting plants in the mountains. Once again we left pavement behind us and bounced our way onward over the rutted washboard surface. James hung onto the grab-bar on the dashboard for dear life and vibrated like a milkshake.

Our collections were very good and we found many things to interest each of us. I found a new species of Irid with purplish brown flowers which turned out to be another addition to the new genus *Fosteria.* We also dug *Sprekelia formosissima, Calochortus,* and a small Amaryllid that we could not identify, as it was not in flower, but which may be a *Habranthus* or *Zephyranthes.* James was elated when I discovered a strange little plant with white flowers and narrow leaves with bulbous bases. It was a species of *Pinguicula* with which he was unfamiliar, and a plant which he assured me had made the entire trip worthwhile, if he could get them home alive. Continuing further, we came across a colony of *Zygadenus* of some sort, with branched panicles of small greenish white flowers. This was my first encounter with this member of the Lily family in Mexico. Nearby we found quite a number of *Bomareas,* a climbing plant, in full flower and we took both tubers and seeds, hoping that maybe we could get some to live, as they are very difficult to dig what with the tubers being so brittle. I am still batting zero where *Bomarea* is concerned. The seed failed to germinate and the tubers did not survive. We began to find few bulbous plants of interest and only Tillandsias to keep us occupied, so we decided to return to the City of Oaxaca as it was beginning to get late.

The next day we drove southward to the town of Tehuantepec, collecting a few Bromeliads, but little else. Tehuantepec, like Iguala, is at a low elevation, and therefore tropical and uncomfortable. We were glad to get away from there and continue down the coastal highway to Tapachula and entry into Guatemala, stopping only to collect a few *Tillandsia concolor,* and bulbs of *Eustylis purpurea* and a pretty rose flowered *Oxalis.* We also observed that our little night flowering *Milla* from Oaxaca, and the stoloniferous *Milla* of Chiapas and Guatemala overlapped in the area near the Oaxaca-Chiapas state lines. We ate supper at Tapachula and headed for the Guatemalan border.

Entry into Guatemala went smoothly for a change, no doubt due to the fact that I agreed to accept a young naval academy student who was the son of a Guatemala City official as a passenger to Guatemala City. James was a bit leery of taking a stranger along, but his fears proved unwarranted. Our new friend proved to be engaging company, and a helpful hand when we experienced a flat tire the next morning. When we arrived in Guatemala City, our friend took us to his home, where we were introduced to his mother and sister. They proved to be a most gracious trio of hosts and hostesses. After being fed we were then taken on a tour of the market downtown where we were able to buy some of the beautiful textiles that Guatemala is world-famed for. The entire episode left us with a warm glow as we drove northward toward Mexico again. This time we would return through "El Tapon", the dreaded

land-slide area that follows a river in a gorge between high mountains. But first we visited the lovely old Spanish city of Antigua, once ruined by a terrible earthquake, but now reconstructed and a "must" for tourists. The night was spent at Panajachel on the shores of famed Lake Atitlan. We observed several clumps of a very beautiful White flowered *Crinum* with large bowl-shaped flowers and chartreuse markings in the throat. Neither of us had ever seen this one before and I decided that I must have it. The Motel manager very graciously refused to accept any money for it and had an Indian, colorfully garbed in typical costume for that area, dig a few bulbs for us with a machete. Though we have not positively identified it, it seems that our new "find" is allied to *C. giganteum,* and might possibly be *C. virgineum,* a species rarely seen in cultivation, and not to be confused with the hybrid known as "Virginicum", which bears no resemblance to it.

Although Guatemala is a most beautiful country in every way, the parts that I have seen are no haven for bulbs, simply because of the excessive rainfall. The area around Huehuetenango is a bright spot though, as a very lovely *Milla* with nocturnal flowering habits and offsetting freely by underground stolons is to be found growing in grassy rolling pastures. This *Milla,* known as 64-95, will soon be described in a forthcoming monograph, which will include many new species.

Another Irid, *Orthosanthos,* with fibrous roots, and fan-like foliage topped by showy blue flowers, beckoned, and we took both seeds and plants. These failed to survive fumigation, and I am convinced that some of these things should be dipped rather than fumigated to prevent heavy losses. Our greatest surprise of the day came when we found a pretty pinkish flowered *Allium* in flower on a grassy slope. This was to be the first *Allium* reported from Central America, and has since been given the name of *Allium guatamalense* Traub. It is a fairly tall *Allium* with scapes over a foot high and numerous pinkish flowers with darker midribs in each segment.

The trip through El Tapon was uneventful, and it was obvious that the road was in far better condition than in 1964. I understand that it is now finally in the process of being paved, and should now be an easy trip for any motorist. The deep gorge abounds with Tillandsias and other epiphytic plants, and we stopped to collect *Tillandsia seleriana* and a few orchids. It was raining when we reached the Mexican border and we were rushed on through and before we knew it we were in Mexico again, heading towards Comitan for a night's rest. The next morning we drove a few miles South of the City to collect various odds and ends before driving northward again. A dazzling scarlet *Tigridia pavonia* with hugh 7″ flowers was sighted on the outskirts of a small village. I had never seen such large flowers in this *Tigridia* before, but James shattered my enthusiasm by stating that such large flowers in *Tigridia* were not unusual in cultivation in California! I was crushed.

Nearing the city of San Cristobal de las Casas, we stopped several times to collect several kinds of Tillandsias and epiphytic orchids, such as *Odontoglossum pulchellum,* as well as a *Tigridia* species with brown

flowers. North of the City we collected several kinds of Terrestrial orchids, a large *Vriesea, V. wreckleana,* growing on rocky outcroppings above the roadsides in the mountains, and the usual odds and ends of miscellaneous material. We did not spend any time in Tuxtla Gutierrez stopping only long enough to eat, and then continued northward to Tehuantepec once more and another uncomfortable night in the humid tropics.

Time was beginning to run out on us as we headed homeward from Southern Mexico, and we were covering a greater number of miles each day and spending less time collecting, other than the obvious things that could be spotted from the car while driving. We continued taking our toll in epiphytic plants, namely Tillandsias and orchids of various kinds as we drove from Tehuantepec to Oaxaca and then northward to Huajuapan de Leon, where we took the recently paved Mexico 125 to Tehuacan, Puebla. A few miles South of Tehuacan, in fabulous cactus country, I re-collected 62-44, a nocturnal flowering, stoloniferous *Milla* species that I had first found in 1962. These were not yet in flower and I was able to transplant them safely in my garden where they continued growing and flowered late that same summer. A species of *Schoenocaulen,* and a strange liliaceous plant with white bell-shaped flowers and tuberous roots were dug in the same general area.

The next morning, a few miles out of Tehuacan, I became aware that I had been hit by dysentery. At first I supposed that it was only the usual thing that seems to hit every neophyte-tourist . . . jokingly called "Turistas", "The Mexican Quick-step", or "Montezuma's Revenge". I was not at all worried, since these things generally last only a couple of days or less. We had lunch in Mexico City, at a nice sidewalk cafe in a busy suburban area where we could sit and watch our car, which we thought to be locked. A group of men and women casually strolled past and paused, while talking, by our car, and then casually continued down the street. We did not realize it at the time, but we had witnessed our bags being lifted from the front seat of our car! They did not get anything other than the two bags which they could easily reach without being noticed, but one of these bags contained James' photographic equipment, including film and special lenses. Luckily they did not get his camera. But unluckily the bag also contained our tourist cards and car permit! This was to result in a day's delay and a ridiculous fine at the border. My bag contained various pills, etc. in the event that one of us became sick. Now that I needed these drugs, they were gone! We finally arrived in San Antonio, still bitter about the events in Mexico City and at the border, but with a car load of plants, and already talking about plans for future trips. Such is the way with explorer-botanists and plantsmen interested in botanicals out-of-the-ordinary.

II. 1967 EXPLORATION—JULY 23 THROUGH AUGUST 7, 1967

The writer has made a series of botanical trips into Mexico, still looking for new and rare bulbous material. I was accompanied on my "big" annual trip in 1967 by Les Hannibal, long known in round-robin circles

and in the APLS as a breeder of Crinums and Brunsvegias, and an interested student of Amaryllids in general.

Mr. Hannibal arrived by jet, and we were off and away a couple of hours later towards the West coast of Mexico. Our first day was spent collecting plants in the state of Durango. I had made this phase of the trip twice before, earlier, in the summers of 1964 and 1965, so late-flowering things I might have missed before. I was on the look-out there was really very little new that I expected to find, other than a few for *Allium* species though, as the area seemed to be rich in them. Our first species was found East of the City of Durango and was the same plant I had collected in 1964 and 65, with underground stolons. These were all in the bud stage, but I knew the flowers to be pinkish. A few miles closer to Durango City, I spotted what looked like another *Allium* in full bloom, growing in wet roadside ditches. This was a new species to me and we dug bulbs and placed several flowering plants in the plant press that I had taken along with me for such an event. These Alliums grew in clumps, increasing only by division and had large umbels with white flowers with a faint pinkish midrib to each segment. The soil in which they grew was heavy greyish clay. This *Allium* was given the number 67-14 for identification purposes.

Milla biflora was in full bloom everywhere, and many fine specimens were collected for study. At kilometer 1054, I spotted a most unusual member of the *Manfreda* group and their allies, with brownish bell-shaped flower on tall wiry stems. Neither of us had the foggiest idea what it might be. Individually the flowers reminded us of the bells of some Fritillarias.

South of Mazatlan the following day, we found ourselves in lush rolling country where *Bessera elegans* is at its best, in all its colors which include the usual scarlets as well as carmines, rose-shades, and purples. Mosquitoes here were terrible and I was forced to wear a plastic raincoat and a towel over my head to keep from being bitten. This in spite of the fact that I had sprayed myself heavily with a repellent! Nearing Tepic, we found ourselves out of the mosquito area and we could make our collections in a more comfortable fashion. By evening we were in the eastern portion of the State of Nayarit, and I spotted *Hymenocallis horsmannii* in a cultivated *Agave* field among volcanic rocks. With it grew *Sprekelia formosissima* in the powdery black volcanic soil and we dug these, since some of them had foliage very heavily pigmented with red in the lower portions.

The following day we continued collecting plants into the state of Jalisco, stopping in Guadalajara for lunch before driving southward toward the coast. Poor Les had already suffered a short bout with the "Turistas" and I proclaimed him to be formally initiated. Little did either of us know that he was not to get off so lightly nor did we suspect that he would take a "souvenir" gastro-intestinal infection home with him.

Our morning collections had been very successful, what with finding another *Allium* species, 67-35, growing in a roadside ditch about

a mile west of Magdalena, Jalisco, along with a very fragrant pinkish white relative of our garden tuberose. We did not know if it was a *Polianthes* or perhaps a *Bravoa,* since *Bravoa* is sometimes given as a synonym for *Polianthes.* At any rate it seemed quite garden-worthy and since I could not identify the plant I took no chances that it might not be a new species. I have long since learned not to assume that a new plant can be identified every time. Many of them are still undescribed. which is why we continue collecting and making field trips.

Below Autlan, Jalisco, on Mexico 80, we stopped to collect *Bravoa geminiflora,* and found a stunning brown-and-gold *Calochortus* species in full bloom. The pendant bells were produced in amazing abundance from each plant, with many buds and flowers showing. It is noteworthy that many of the bulbous plants of Mexico have flower-forms or habits to protect their pollen from the frequent summer afternoon showers. Many flowers are nodding and bell shaped, as seen in some of the *Calochortus, Bessera, Petronymphe,* and some Tigridias that remain open in the afternoons. Others are nodding and tubular, such as seen in *Polianthes, Bravoa,* and *Manfreda.* Even the terrestrial orchids tend to surround their lips with their segments in order to protect their pollen. *Zephyranthes* solve the problem by closing when suddenly shaded by a cloud. *Hymenocallis* try to avoid the problem all together by waiting until the afternoon showers pass before opening in the late evening. Many *Milla* species simply remained closed during the day, reopening each night. *Hymenocallis, Sprekelias, Habranthus,* and *Zephyranthes* get their flowering done with the first rains of the season before the really heavier rains follow later. Some of the Irids flower early in the morning or late in the evenings when they are less likely to be rained on. Over and over again, these bulbous plants each develop habits or flower forms to insure that they will be able to protect their pollens, and therefore their futures.

We found *Hymenocallis azteciana* Traub, flowering below Autlan and dug a few of these along with a very large species of *Bravoa* with broad shiny green leaves and red flowers. By this time it was afternoon and raining, and we did little more collecting. The rains finally stopped and we had almost reached a little village known as La Huerta when it happened. A strange clatter in the engine told me that I had serious motor trouble and I stopped the car and waited for someone to come along to tow us. Someone did. We spent the next four days in La Huerta while our engine was removed, taken to Guadalajara, completely disassembled, parts machined and replaced, and then thoroughly cleaned. It was returned to La Huerta where our mechanic, a genius in my book, put all the little parts back together again and then returned the motor to the car. We still have a sneaking suspicion that he took it completely apart just to see what made the little Volkswagen engine "tick". But no matter, his services were only forty dollars American, not including the parts and machine work done in Guadalajara. In essence I had a new motor.

Meantime we had much time to kill, and nothing to do. The only cafe fit to eat in was filled with buzzing flies from morning until sundown. The menu left much to be desired for in the way of variety, though the food wasn't bad, if you are accustomed to Mexican food as I am. Les was not, and the pounds were dropping off him daily. A big man and hearty eater, he was eating so little that I had to goad him into eating lest he become weakened from fasting. The many miles, and strange foods were beginning to wear on him. He was terrifically bored from the many days of doing nothing. I did not blame him. Nothing is worse than being stranded in such an uncomfortable place and in such an uncomfortably hot climate, when one's days and funds are limited, and when one's plans are being altered. The last two days we managed to hire a man to take us into the mountains north and south of the village in his pickup truck to collect plants. It helped soften the grim situation and gave us something to do.

At last our car was ready, (about midnight), running like a Swiss watch, and we prepared to leave the next morning. It was with elation that we bade La Huerta farewell, and drove first to Manzanillo and then the city of Colima, Colima, where we ate lunch. The morning's collection had been very good, as we had found a *Hymenocallis* with glaucous leaves, which may or may not be anything new, and a colony of stunning fuchsia-purple *Bessera.* These were the finest that I have seen in this shade, and I was not certain if this was simply a variety of *B. elegans* or perhaps a new species, but I finally decided that it really was only a variety, since there were no physical characters that were unique enough to easily distinguish it from *B. elegans,* when seen as a dried specimen. I stopped again to collect a little *Milla* species that I had found in 1965. I have yet to see it in flower though I have collected it in different months. It is a new species, I feel sure, but it must flower very late. Other collections were made along the way, but nothing that was new from the 1965 trip.

We spent the night in Zamora, Michoacan, and the next morning the auto was giving us trouble again. I got a mechanic to check it and found that we needed new points and a new ignition coil. By noon we were on the road again, heading down Mexico 37 towards Uruapan and then the coast. Les was in better spirits and we made several collections before reaching a small cross-roads cafe and gas station know as Cuatro Caminos, and the road to the Michoacan coast, only half of which is yet paved. At kilometer 165, about 10 miles south of Cuatro Caminos, in gritty red volcanic soil on a dry hillside facing east, I found it. A lavender-blue flowered member of the *Milla* family, and obviously a species of *Dandya.* Indeed it resembled the line drawing of *D. purpusii* shown in Dr. Hal Moore's monograph on "The Genus *Milla* and its Allies", and which had been made from a dried specimen. It also greatly resembled the new little white *Dandya* species from Guererro, with the "shooting star" appearance, except that the flowers did not nod in the umbel, nor did the segments reflex. Corms were dug, though they were not plentiful, and specimens were placed in the plant press to dry.

Shortly after that our pavement ended, but we proceeded onward to the little town of Arteaga, about 45 miles from the coast. The little town was a delight, unspoiled by tourists, and charming in every way. Our hotel room was comfortable, and there were flowers everywhere. Things would have been great had Les not had another attack of the "turistas" during the night. This time he could not get rid of it. We drove back towards Cuatro Caminos the next morning, and stopped a few times to collect various Amaryllids along the way. One was a glaucous leaved *Hymenocallis* in leaf only, and a real find was *Sprekelia clintiae* with the glaucous blue-green leaves. Though known in cultivation, this plant was not known from the wilds, at least not officially. A somewhat similar *Sprekelia* had been collected near Morelia, Michoacan by Mr. and Mrs. Clint, Walter Flory and Ray Flagg, but these had coarse glaucescent foliage, and were most likely variants of *S. formosissima,* whereas this plant had pretty glaucous foliage and a rather dainty overall bearing.

Many miles of unpaved road later, found us back in civilization at Patzcuaro, Michoacan where we had supper, before driving on to Morelia for the night.

The next day we drove to Toluca, picking up more *Bravoa geminiflora* and a little stoloniferous *Allium* along the way, among other things. We were heading homeward again, and we spent the following night in Guanajuato. Les was still plagued with his gastro-intestinal problem, but he was learning to live with it and was eating more heartily. The next day we drove out of the states of Guanajuato and Jalisco, and into the state of San Luis Potosi, collecting a variety of bulbous plants enroute. These included a new *Milla* species, 67-64, *Habranthus,* two kinds of *Calochortus,* a most variable *Milla biflora* colony and an *Allium.* The next day we drove from the City of San Luis Potosi to Cd. Victoria, and collected yet more material and also stopping long enough to get our plants cleaned and in order.

We entered the United States through Brownsville, taking time to visit with Mrs. Morris Clint, Mrs. Helen Winans, and Mrs. Sulema Etchison, all extremely fine gardeners in their own right, and all interested in Amaryllids and bulbs of all kinds. These visits were a highlight of our trip and gave us time to unwind from the hectic pace in which we were once again reminded to expect the unexpected.

Wheeler—**AMARYLLIS STRIATA,** continued from page 112.

My pollinating activities have produced a lot of seeds during the past several years. Lacking both the time and facilities to plant them I have sent them to my correspondents in Japan, the Netherlands, and the Republic of South Africa, for whatever use they might be to those persons for the improvement of the genus. As yet I have heard of no blooms from the crosses but there should be reports in the not too distant future.

PLANT GROWTH, FLOWERING AND FRUITING IN GYPSOPHILA OLDHAMIANA L.,

FOLLOWING SEED TREATMENT WITH P^{32}

S. Bose and A. Hati

Dry seeds of *G. oldhamiana* (Sutton's) were treated for 24 hours with P^{32} solution the dosage being 0.2 uc per seed. Control seeds were kept in water for the same length of time.

Germination was noticed first in seeds treated with P^{32} and two days later in control. There was not much difference in the range of germination period of the control and treated seeds. The percentage of germination and the survival of plants till maturity was highest in control and lowest from P^{32} treatment. Mean of plant height in the plants originating from P^{32} treatment was much lower than in control. Mean number of branches were greater in the plants originating from P^{32} treatment and likewise there was increase in the number of leaves here. Flowering was noticed first in control and a week later in the plants originating from P^{32} treatment. Number of flowers per plant was also highest here. There was great variation in the size of pollen grains and pollen sterility was also highest in the plants originating from P^{32} treatment. The percentage of fruit set and the number of seeds per fruit was, however, lowest here (Table 1).

Table 1. Effect of P32 on **Gypsophila oldhamiana** L.

Observations; Treatment	Control	P32
No. of seeds per treatment	100	100
No. of seeds germinated	59	20
No. of plants surviving till maturity	55	13
Percent of control	100	25.6
Plant height (cm)	28	22.5
No. of branches per plant	9	12
No. of leaves per plant	43	55
No. of flowers per plant	32	36
Range of flowering period (days)	8	11
Percentage of pollen sterility	12.3	72.8
Percentage of fruit set	80	30
No. of seeds per fruit	9	2

Crosses attempted between treatment x control and the reciprocal showed no seed formation while control x control plants showed 50 per cent seed formation.

Sincere thanks are due to Prof. P. K. Sen, Khaira Professor and Head of the Department of Agriculture for his interest and for providing facilities during the course of this investigation, and to Dr. A. K. Sharma, Reader, Department of Botany, for kindly supplying P^{32}.

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NEW GUATEMALAN AND MEXICAN ALLIUMS

HAMILTON P. TRAUB

In the first report (Traub, 1967), *Allium howardii*, from Edwards County, Texas, was named, and plants which Dr. T. M. Howard had collected in the State of Hidalgo, Mexico, were identified as *Allium glandulosum* Link & Otto. This report was based on bulbs collected by Dr. Howard up to 1966 in southern Texas, Mexico and Guatemala, and were turned over to the writer for identification. In 1967, Dr. Howard made two trips into Mexico, and again brought back *Allium* bulbs. Some of these are identified, or are named as new, in the present report.

SECTION **RHOPHETOPRASON**, GENUS **ALLIUM** L.

Prior to 1967, the process of vegetative reproduction in the two Mexican species, *Allium glandulosum* Link & Otto, and *A. longifolium* (H.B.K.) Spreng, was not understood. In observations made at La Jolla, it was determined that flowering-sized bulbs are produced terminally on usually long rhizomes, *the old bulbs not persisting,* as shown in Fig. 26. On the basis of this very distinctive feature, the Section *Rhophetoprason* was proposed (see Traub, 1967, p. 110).

There are also two other species (*Allium bolanderi* and *A. unifolium*) which increase by a somewhat similar process, but these species have different bulb coat characters, and they are therefore retained under Subsection *Bolanderiana,* Section *Lophioprason,* at least for the present.

IDENTIFICATION OF PREVIOUSLY NAMED SPECIES

In the past, four *Allium* species had been named from Mexico:

(a) *Allium kunthii* G. Don (1827), syn.-*Schoenoprasum* lineare H.B.K. (1816)

(b) *Allium longifolium* (H.B.K.) Spreng. (1825) syn.-*Schoenoprasum longifolium* H.B.K. (1816)

(c) *Allium scaposum* Benth. (1840)

(d) *Allium glandulosum* Link & Otto (1841)

As already indicated, *Allium glandulosum* has been collected by Dr. Howard in the State of Hidalgo and thus this species has been verified. In 1966, he also collected a form of it in the State of San Luis Potosi (Howard 66-3B). This plant is within the species range.

This still leaves three formerly described species to be verified. In order to assist collectors, photocopies of three of the (name-bearing) specimens are reproduced in this article. Through the kindness of the Director, Herbarium, Museum of Natural History, Phaner. Paris (P), photocopies were obtained of the name-bearing specimens of *Allium kunthii* G. Don, and *A. longifolium* (H.B.K.) Spreng., and these are reproduced in Fig. 27. A photocopy of the nomenifer specimen of *Allium scaposum* Benth., was received through the kindness of Dr. George Taylor, Director, Royal Botanic Gardens, Kew, Herbarium (K), and this

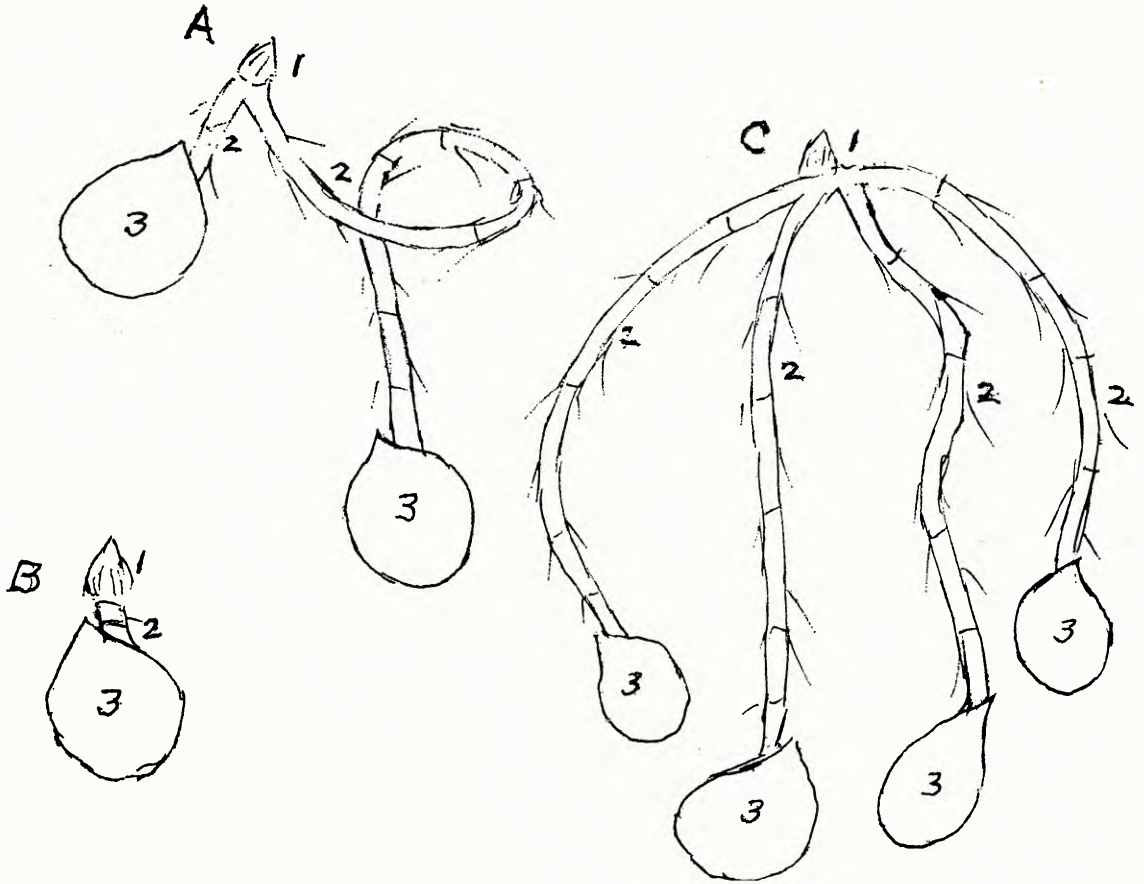

Fig. 26. Line drawings (approx. natural size) showing the type of asexual reproduction in **Allium longifolium** (H.B.K.) Spreng. **A,** self-fertile plant, **B,** male-sterile plant; and **C, Allium glandulosum** Link & Otto, self-fertile plant; pot grown plants.

A-1, B-1 and C-1, dead vestiges or remnants of the old bulbs. A-2, B-2 and C-2, rhizomes between the vestiges and the terminal bulbs, A-3, B-3 and C-3, which are flowering sized. Grown at La Jolla, Calif. 1966.

is reproduced in Fig. 28. In addition, we are indebted to Dr. William T. Stearn, Department of Botany, British Museum, Herbarium (BM), for a photocopy of an isonomenifer of *A. scaposum,* which is shown in Fig. 29. With these as a background, it is hoped that the three previously described species can be verified by comparison with living plants collected, or to be collected in Mexico by Dr. Howard.

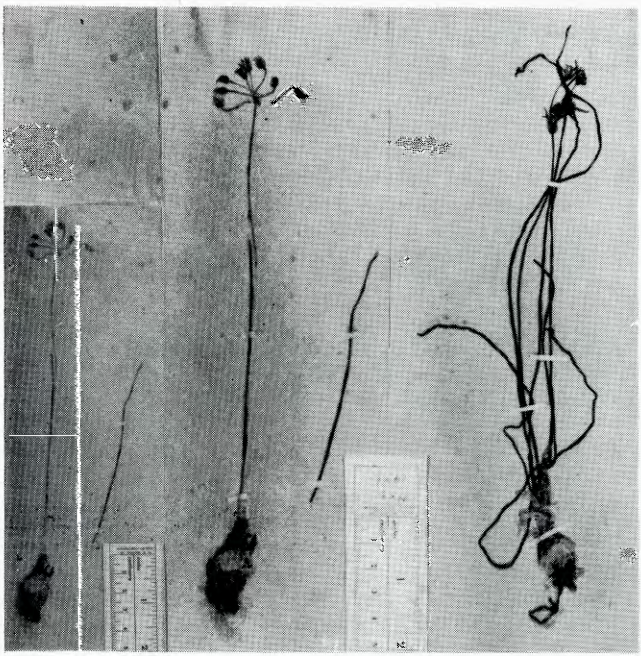

Fig. 27. Composite (note scales) from negatives furnished by courtesy of the Director, Herbarium, Mus. Nat. Hist. Phaner. Paris (P), Humboldt & Bonpland Herbanium. **Left, Allium kunthii** G. Don (syn.-**Schoenoprasum lineare** H.B.K.), the **holonomenifer specimen,** from contact print, note darkened background; **Middle,** the same, slightly enlarged, with background somewhat cleared up; plant approx. 18 cm. high. **Right, Allium longifolium** (H.B.K.) Spreng. (syn.-**Schoenoprasum longifolium** H.B.K.), the **lectonomenifer specimen.** Note **immature rhizome** protruding from bulb base; and **very long** leaves hard to manage on the herbarium sheet.

VERIFICATION OF **ALLIUM LONGIFOLIUM** (H.B.K.) SPRENG.

With the help of collections made by Dr. Howard, a second species, *Allium longifolium* (H.B.K) Spreng., has been verified during 1967.

An inspection of the lectonomenifer specimen of *Allium longifolium* (see Fig. 27) shows first of all that there is an *immature rhizome* protruding from the base of the bulb, and the leaves are very long and hard to manage on the herbarium sheet. Earlier American workers were thrown off the track by confusing this *immature rhizome* with a *root,*

not realizing that the roots of North American Alliums are not that thick; they are usually quite thin. In *Nothoscordum bivalve* (L.) Britton also they are always thin. Thus, the *immature rhizome* and the very long leaves were dismissed and the few-flowered umbel with pedicels of unequal length (see Fig. 27) were emphasized and confused with the umbel in *Nothoscordum bivalve*. This in spite of the fact that the pedicels of that species when in flower are not markedly unequal in length, but often elongate considerably *after anthesis* resulting in contrasting unequal pedicel length in fruit. But this feature is not always constant for sometimes the pedicels after elongation are subsimilar in length. Having thus gone astray, former American workers rejected the lectonomenifer specimen as shown in Fig. 27, and unrealistically hoped to locate a different specimen. Under the conditions, this was a hopeless wish, and it led to a stalemate from which we are only now extricating ourselves by recognizing the facts in the case.

Dr. Howard has collected specimens of *Allium longifolium* in two locations—Jalisco (H 67-35) and in Michoacan (H 57-11B and H 64-57A). The former is a plant which matches the holonomenifer in size, and the latter is a little larger plant, but apparently belongs to the same species. On the basis of these, an emended description has been made of *Allium longifolium* and is published in the present report. Thus, we can rest assured that this species has at long last been verified. This leaves only two previously described Mexican species to be verified—*A. kunthii* and *A. scaposum*.

ALLIUM KUNTHII AND A. SCAPOSUM

Up to the present, these two species have not been verified by means of living plants, but Dr. Howard is planning to collect in the nomenifer localities indicated by Humboldt & Bonpland for *A. kunthii* in the early 19th century in central Mexico; and in the indicated habitat of *A. scaposum* in the State of Aguascalientes. These explorations should yield plant material for clearing up this problem. In the past, *A. scaposum* (Figs. 28 and 29) has been considered as a synonym of *A. kunthii*, Fig. 27 (Ownbey, 1950; Traub, 1967) in spite of the fact that *A. scaposum* is a much larger plant, and quite different from *A. kunthii*.

REVISION OF SUBSECTION MEXICANA, SECTION AMERALLIUM, AND SECTION RHOPHETOPRASON

Up to very recently, only four *Allium* species had been described from Mexico, and none from Central America, and these four were usually grouped under only two recognized species names. With the present report, the number of recognized species has been markedly increased, and includes even one from Guatemala. This requires an explanation. [*Allium glandulosum* has been collected in Honduras.]

The *Allium* species of Mexico are in the most part summer and autumn flowering plants, and unless they are collected during these seasons, many of them may be missed. This explains why in the past, the Mexican Alliums have been neglected. Collectors usually made a single

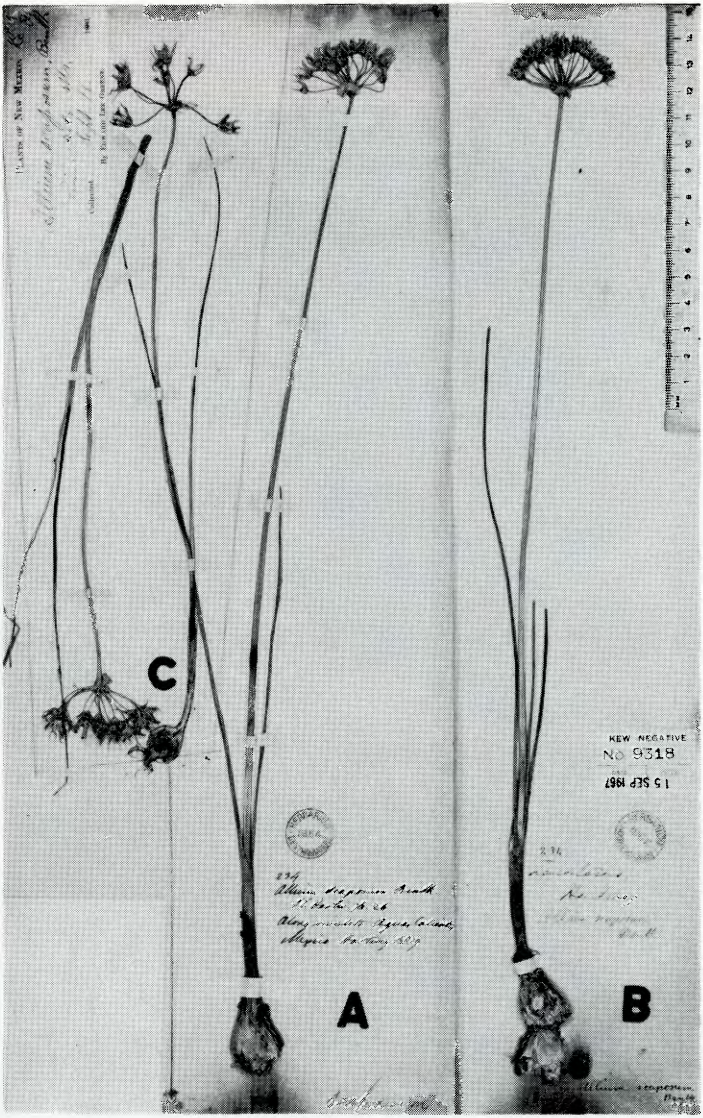

Fig. 28. Composite (note scale) from photo-print furnished by courtesy of Sir George Taylor, Director, Royal Botanic Gardens, Kew, Herbarium (K). (A) **Allium scaposum** Benth. in Herbarium Benthamiana, Hartweg no. 234, Aguascalientes, Mex., annotated in Bentham's handwriting, the **holonomenifer specimen;** plant approx. 64 cm. high. (B) **A. scaposum** Benth., in Herbarium Hookeriana, Hartweg, Zacatecas, Mex., tops of leaves missing. (C) **Allium** sp., not **A. scaposum** Benth.; Edward Lee Greene, Pinos Altos Mts., Grant County, New Mex., Sept. 16, 1880, a small plant with leaves subequaling or surpassing the scape; leaf at left spirally twisted (see under magnification); short, immature non-scaly rhizome at base of bulb; apparently **A. durangoense** Traub.

Fig. 29. Composite (note scales) from photoprints furnished by Courtesy of Dr. Wm. T. Stearn, Department of Botany, British Museum (BM); **Left, Allium scaposum** Benth. isonomenifer specimens. **Right,** umbel, enlarged.

trip in the spring or early summer and thus the Alliums were rarely found. Dr. T. M. Howard, who has collected bulbous plants in Mexico and Guatemala since 1957, has usually made more than one collecting trip in each year, and thus has found many undescribed plants in such a group as the Tribe *Milleae,* and incidentally also Alliums.

Although a goodly number of Mexican *Allium* species are now recognized in the present report, it is to be expected that still more will be found. Such regions as San Luis Potosi, with many mountain valleys, appears to be particularly rich in *Allium* species. Various other regions have not been explored for Alliums.

The present report is a continuation of the previous one (Traub, 1967, pp. 88-95; 110), and includes the species recognized since 1967. In the case of species previously described, references to the last best descriptions are given.

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KEY TO THE SPECIES OF SUBSECTION **MEXICANA,** SECTION **AMERALLIUM;** AND SECTION **RHOPHETOPRASON**

1a. Plants multiplying by means of seeds, bulb division, or bulblets on short, or longer rhizomes, the old bulbs persisting:

SUBSECTION **MEXICANA,** SECTION **AMERALLIUM**

2a. Plants multiplying by means of seeds only:
3a. Plants tall, robust, up to 90 cm. tall:
4a. Flowers broadly campanulate, tepals 9 mm. long, whitish with deep lavender mid-vein; pedicels thick, 2 mm. in diam., somewhat discoidally enlarged at the apex; leaves 4.5 mm. in diam. (Guatemala) ..... 1. **guatemalense**
4b. Flowers campanulate, tepals 6.5 mm. long, whitish with red mid-vein; leaves linear terete (Mexico: Aguascalientes) .. 2. **scaposum**
3b. Plants intermediate (to 18 cm. long) to small:
5a. Umbel more than 5-flowered; plants glabrous, leaves narrowly-linear:
6a. Spathe 7—9 mm. long; leaves narrowly-linear, straight; flowers whitish, red mid-vein (Central Mexico) ..... 3. **kunthii**
6b. Spathe 1.2—1.6 cm. long; leaves 2, spirally twisted; 2 mm. wide; pedicels **unequal** in length, 1.5—2.2 cm. long; flowers campanulate, tepals pink, deeper mid-vein (Durango) 4. **huntiae**
5b. Umbel 2—5-flowered:
7a. Umbel 5-flowered; leaves 2—3, spathe 1.7 cm. long; pedicels 1—1.4 cm. long (Mexico State of Puebla) ..... 5. **pueblanum**
7b. Umbel 2—3-flowered; leaves 2, spathe 7—8 mm. long; pedicels 6—10 mm. long (State of Mexico: Telapon) .... 6. **telaponense**
2b. Plants multiplying vegetatively by bulb division, or by means of bulbs produced terminally on rhizomes, the old bulbs persisting:
8a. Plants multiplying vegetatively by bulb splitting:
9a. Roots **coarse,** to 3 mm. thick; umbel 8—12-flowered; flowers

campanulate, tepals lavender, with deep purple or blackish mid-veins; bulbs long-oblong (Mexico: Tamaulipas) .... 7. **mexicanum**

9b. Roots fine:

10a. Leaves smooth, light green, not ridged on back:

11a. Flowers white, tepals spreading, leaves 4—6 (Texas: Edwards County) ..... 8. **howardii**

11b. Flowers white to pale pink, keeled green or purplish; leaves 2—3 (Mexico: Durango) ..... 9. **mannii**

10b. Leaves 3—, or more, ridged on the back:

12a. Plants not denticulate; 3-ridged on back (Mexico: Nuevo Leon, Chihuahua State line) ..... 10. **traubii**

13a. Umbel few-flowered, in autumn; leaves narrow, 2 mm. wide ..... 10a. **traubii** forma **traubii**

13b. Umbel many-flowered, in summer and autumn, leaves 3 mm. wide ..... 10b. **traubii** forma **liberflorens**

12b. Plant denticulate; leaves 5—6, 18 cm. long, 4.5 mm. wide, broadly canaliculate, 6—8-ridged on the back, denticulate on the ridges and leaf margins; scape flattish, denticulate on its ridges (Mexico Nuevo Leon) ..... 11. **ownbeyi**

8b. Plants multiplying vegetatively by means of terminal bulblets on very short or longer rhizomes, the old bulbs persisting:

14a. Rhizomes scaly, 2—3 cm. long; leaves 2—3 mm. wide, very finely serrulate (New Mexico: Gila Hot Springs) 12. **rhizomatum**

14b. Rhizomes not scaly:

15a. Bulblets borne on very short rhizomes; umbel 10—30-flowered in autumn; tepals pale with purplish or pinkish mid-vein; leaves 1—2 mm. wide (South Texas) ..... 13. **elmendorfii**

15b. Bulblets borne on longer rhizomes:

16a. Leaves not subterete:

17a. Leaves not spirally twisted:

18a. Leaves canaliculate:

19a. Bulbs very small, 6 mm. long, 4 mm. in diam; leaves 2—3, very narrow (Mexico: Michoacan) 14. **michoacanense**

19b. Bulbs larger, 1.5 cm. long, 1 cm. in diam.; leaves 4—5, green, 3—4 mm. wide (Mexico: San Luis Potosi, Valle de los Fantasmos) ..... 15. **fantasmosense**

18b. Leaves flat (San Luis Potosi) .... 16. sp. (H 67-87B)

17b. Leaves spirally twisted, 3—5, upright, 2—2.5 mm. wide, canaliculate; umbel 9—23-flowered; flowers broadly campanulate to almost stellate, tepals whitish, keeled reddish-brown, ovary pinkish (Mexico: Durango) 17. **durangoense**

16b. Leaves subterete, very long, light green, very slightly channeled on top (Mexico: San Luis Potosi) 18. **subteretefolium**

1b. Plants multiplying by means of seeds and bulbs produced terminally on long rhizomes, the old bulbs not persisting:

SECTION **RHOPHETOPRASON**

20a. Flowers brownish-red (mahogany), tepals spreading; leaves several sheathing below, upright, shallowly canaliculate, prominently striated on both sides; scape flattened, striated; umbel many-flowered (Mexico: Hidalgo, San Luis Potosi and Honduras) ..... 19. **glandulosum**

20b. Flowers campanulate, whitish to light lavender, tepals with deeper mid-vein; leaves smooth, thick, very long with tendency to lodging; umbel usually few-flowered in nature, but sometimes many-flowered under optimum culture; pedicels often unequal in length (Mexico: Michoacan & Jalisco) ..... 20. **longifolium**

SUBSECTION **MEXICANA**, SECTION **AMERALLIUM**

Subsection **Mexicana** Traub, **subsect. nov.,** Sect. **Amerallium,** genus **Allium** L.; in Plant Life 23: 90—95. 1967.
Tunicae bulborum membranaceae, fibris sparsis verticalibus; bulbis rhizomas terminantibus in reproducto diffissis; vel reproducto vegetativo nullo. Typus: **Allium mexicanum** Traub.

1. **Allium guatemalense Traub, sp. nov.,** Plant Life 23: 90. 1967, **anglise.**

Planta robusta, bulba globosa, tunicis membranaceis, per semines reproducta; foliis 6—7 longis rectis infra vaginatis; scapo subcomplanato, supra subterete; umbella multiflora; floribus pro ratione magnis late campanulatis; pedicellis crassis ad apicem paulo discoideo-turgidis; ovario 6-cristato; capsula perobscure cristata; seminibus globoso-angulatis 2.5 mm. diametro.

HOLONOMENIFER: Traub No. 1071(TRA), grown at La Jolla, Calif. July 27, 1967, from bulbs collected by Dr. T. M. Howard, No. 66-124, July 11, 1966, south of Huehuetenango, Guatemala.

Plant robust, to 30 cm. tall, or taller, in nature (to more than 90 tall with optimum culture at La Jolla, Calif.) *Bulb* globose, 2 cm. long, 1.9 cm. in diam in nature (and 3.2 cm. long, 3 cm. in diam, under optimum culture at La Jolla, Calif.), deeply seated in the soil (to 3.5 cm.), outer bulb coats membranous, very dark brown (almost black), inner bulb coats white, with widely separated vertical fibers; after the first set of leaves around the scape decline and fall away, a new sprout with 2—3 leaves, sheathing below, appears next to the scape from the base where the new bulb forms. *Leaves* 6—7, gray-green, upright, the older declining as new ones are formed, at flowering time most of the leaves have declined, and a new central sprout appears and persists into autumn (see under bulb above); the first set of leaves are rather thick, channeled above, rounded on under side (10—15) —21—30—36—40—50 cm. long, 4—5 mm. in diam., sheathing below to form a thick deciduous neck, purplish in lower half, 6—9 cm. above the ground, 8—9 mm. in diam. *Scape* central, flattish on one side, rounded on the other in lower half, subterete above, to 30 cm. or more tall in nature (to more than 90 cm. tall with optimum culture at La Jolla, Calif.), 5.75—6 mm. in diam. at the base, 3 mm. in diam. at the apex. *Spathe* monophyllous, closed at first, greenish-whitish with 9—10 dingy brownish-greenish vertical veins, changing to purplish, 2.6 cm. long, lanceolate, acute, soon bursting irregularly from the pressure of the expanding pedicels and flower buds. *Umbel* centripetal, 52—58- or more-flowered, (with sometimes a subumbel, 4—6-flowered, produced outside at the pedicel apex and setepal base of a flower, with smaller flowers having relatively shorter pedicels); normal flowers relatively large, broadly campanulate, light lavender in bud, opening whitish, with lavender mid-vein in each tepal. Flowers with an alliaceous scent. *Pedicels* green, stout, 3—3.5 cm. long, 2 mm. in diam., somewhat discoidally swollen at the apex. *Perigone:* tepals oblong, setepals 9 mm. long, 5 mm. wide, acute; petepals 9 mm. long, 4 mm. wide acute. *Stamens:* filaments purplish in upper ¾, 4.5 mm. long, filiform above, dilated below, united into a staminal cup at the base, with nectariferous tissue at the base between the 3 setepals and the base of the stamens; anthers purplish, oblong, 2.25 mm. long, shrinking to 1 mm. long at anthesis. *Ovary* 2 mm. high, 3 mm. in diam., ovules 2 per cell; 6-crested, 3 nectary pores appear on sides of ovary; style purplish, at first very short, elongating to 3.5 mm. after anthesis, then whitish; stigma undivided, minute. *Capsule* trigonous, 5 mm. high, 8 mm. in diam.; very obscurely 6-crested; seeds globose-angled, 2.5 mm. in diam.

RANGE.—South of Huehuetenango, Guatemala; low hillsides in grass between trees, growing singly, widely scattered.

NOTES.—A very distinct species, which apparently increases by seeds only. It resembles *A. glandulosum* and *A. longifolium* in the leaves sheathing below to form a relatively long deciduous neck, but otherwise is quite distinct—apexes of pedicels discoidally swollen, flowers broadly campanulate with an alliaceous scent, and other differences.

One male-sterile seedling (lacking viable pollen) has been observed. The plant is vigorous, but the pedicels of the umbel are rather shorter than in the self-fertile seedlings.

2. **Allium scaposum** Benth. in Pl. Hartweg. 26. 1840; Plant Life 24: 40. 1968.

HOLONOMENIFER: Hartweg no. 234, from Aguascalientes, Mexico, annotated in Bentham's handwriting, in Roy. Bot. Gard. Kew, Herbarium (K). Isonomenifer: Hartweg, in Dept. of Botany, British Museum, Herbarium (BM). See Figs. 28 and 29 for photo-copies.

Bulb ovoid. *Leaves* radical, linear-terete. long-sheathing below, shorter than the scape. *Scape* terete, slender, 30 cm. long or longer. *Spathe* bifid, broad, shorter than the pedicels. *Umbel* many-flowered; loose in fruit. *Pedicels* 2.5 cm. long. *Perigone:* tepals 6 cm. long, lanceolate, acuminate, rather acute, white when dry, red-keeled. *Stamens* subequaling the tepals, filaments subulate, dilated at the base.

RANGE.—Mexico: Aguascalientes, along small streams.

NOTES.—The nomenifer description is reproduced here to aid in matching-up the details with plants collected in the wild.

3. **Allium kunthii** G. Don, Mem. Wern. Soc. 6: 82. 1827; Plant Life 23: 59-60. 1967; Ownbey, Res. Stud. State Coll. Wash. 18: 221-222. 1950 (1951), in part; Traub, Plant Life 23: 94-95. 1967, in part.

Syn.- *Schoenoprasum lineare* H. B. K., Nov. Gen. et Sp. Pl. 1: 277. 1816.

HOLONOMENIFER: Humboldt & Bonpland [nr. 4286], Herbarium, Mus. Nat. Hist. Phaner., Paris (P). See Fig. 27 for photo-copy.

Bulb ovate, the size of a cherry, with numerous fibrous roots at the base. *Leaves* narrowly linear, flat, striate, glabrous, very thinly membranous at the base, sheathing to 10 cm.; shorter than the striate, terete scape. *Scape* erect, terete, striate, glabrous, 13—15 cm. long. *Spathe* ovate-lanceolate, withered, striate, glabrous, 7—9 mm. long, reflexed. Umbel 12—15-flowered; flowers whitish, tepals with a red mid-vein. *Pedicels* terete, glabrous, 1.4—1.8 cm. long. *Perigone:* tepals oblong, rather acute, spreading. *Stamens* as long as the tepals, filaments glabrous, subterete, anthers oblong, pollen gray. *Ovary* ovate, trigonous; style subequaling the stamens.

RANGE.—Mexico: between Santa Cruz de la Sierra and Mont El Gigante, alt. 2,346 m. Blooms in September.

NOTES.—The epithet *"lineare"* applied to this species by Kunth translates as "the long slender" or "linear". The name apparently refers to the long narrowly linear leaves. The species was formerly considered as similar to *Allium scaposum* Benth., and *A. longifolium* (H.B.K.)Spreng., which are quite different, larger species.

Up to the present it has not been matched up with living plants collected by Dr. Howard. However, he expects to search for it in the nomenifer locality in 1968.

4. **Allium huntiae Traub, sp. nov.**

HOLONOMENIFER: Howard 67-19B = Traub 1077 (TRA), July 22, 1967, west of Durango, Dur., Mexico; Mexican Highway 40, K. 1016.

Bulb ovoid, 1.5 cm. long, 1.2 cm. in diam.; outer coats dark brown, inner white, membranous, with sparse vertical fibers; not rhizomatous. Leaves 2, shorter leaf sometimes very short, 0.6—3.7—14.7 cm. long, about 2 mm. wide, apparently spirally twisted, channeled, acute, sheathing below to form a deciduous neck, 4.4—4.7—6 cm. long, 4 mm. in diam. *Scape* slender, 23—24—28 cm. long. *Spathe* 1.2—1.6 cm. long, membranous. *Umbel* lax, 11—13—18-flowered; flowers relatively small, campanulate, pink, keeled deeper pink. *Pedicels* slender, unequal in length, 1.5—1.8—2—

2.2 cm. long at anthesis. *Perigone:* tepals 7 mm. long 1.5 mm. wide. *Stamens* about 2 mm. shorter than the tepals; filaments 4 mm. long; anthers 1 mm. long at anthesis. *Ovary* globose, 1.75 mm. long, 1.5 mm. in diam.; appears to be slightly 6-crested; style 3 mm. long.

RANGE.—Collected by Dr. T. M. Howard (67-19B), west of Durango, Dur., Mexico; Mexican Highway 40, K. 1016; wooded hills, July 22, 1967.

NOTES.—*Allium huntiae* differs from *A. kunthii* in the spirally twisted leaves, the longer spathe, pedicels unequal in length, the pink campanulate flowers, and other particulars.

Named in honor of Miss Dora G. Hunt who ably assisted the late Dr. L. K. Mann with his researches in the genus *Allium*.

5. **Allium pueblanum Traub, sp. nov.**

Bulba ovoidea; foliis 2—3 anguste linearibus, infra vaginatis colla decidua formatis; scapo angustissimo; umbella 5-flora; floribus campanulatis albis; costis mediis tepalorum rubellis; pedicellis 1—1.4 cm. longis; tepalibus 6 mm. longis; staminibus quam tepalibus brevioribus; stylo in anthesin quam staminibus breviori; stigmate integro.

HOLONOMENIFER: Smith, Peterson & Narcisso Tejeda no. 3889 (=US 2397905), July 17, 1961, above Coxcatlan, between Apala and the top of Cerro Chichiltepec.

BULB 1.5—1.8 cm. long, 1.1—1.5 cm. in diam., ovoid, outer coats membranous, dark brown; roots fine. *Leaves* 2—3, narrowly linear, 17—19—24 cm. long, 1—2 mm. wide, sheathing below to form a deciduous neck, 3.5—5.5 cm. long, 3 mm. in diam., about half below the soil surface. *Scape* very slender, 9.5—11.5 cm. long, 1—1.5 mm. in diam. *Spathe* lanceolate, 1.7 cm. long, with sparse vertical veins. *Umbel* 5-flowered flowers campanulate, white, tepals with pink midveins. *Pedicels* very slender, 1—1.2 —1.4 cm. long. *Perigone:* tepals 6 mm. long, 1 mm. wide. *Stamens* slightly shorter than the tepals 3 mm. long, anthers less than 1 mm. long at anthesis. *Ovary:* style shorter than the stamens at anthesis, stigma undivided.

RANGE.—State of Puebla, Mexico, above Coxcatlan between Apala and the top of Cerro Chichiltepec; igneous and sedementary rock outcrops with dark soils, primarily oak-pine forest; alt. ca. 2000—2500 m. Flowering in July and August.

NOTES.—From the evidence at hand, it appears that this species increases only by means of seeds. *Allium pueblanum* differs from *A. telaponense* mainly in having usually more than 2 leaves, a shorter scape a 5-flowered umbel, longer spathe and pedicels.

6. **Allium telaponense Traub, sp. nov.**

Bulba parva globosa; foliis 2 anguste linearibus, infra vaginatis colla decidua formatis; scapo angustissimo; spatha 7—8 mm. longa; umbella 2—3-flora; floribus campanulatis; tepalibus albidis, costis mediis subpurpureis; pedicellis 6—10 mm. longis; staminibus quam tepalibus dimidio brevioribus; stylo 4 mm. longo.

HOLONOMENIFER: John H. Beaman no. 2430 (=US 2366057), Sept. 4, 1958; State of Mexico, Telapon, north of Iztaccihuatl, south side of mountain.

Bulb small, globose, 1.2 cm. long, 1 cm. in diam., outer bulb coats brownish, membranous, roots fine. *Leaves* 2, narrow linear, shorter leaf 3—5.5 cm. long, longer leaf, 13—15 cm. long, 1 mm. wide, bluntly acute, sheathing below to form a deciduous neck, 6.5—7.5 cm. long, about half underground, above ground half purplish. *Scape* very slender, 18—22 cm. long. *Spathe* membranous, 7—8 mm. long. *Umbel* 2—3-flowered; flowers campanulate, tepals whitish, with purplish midveins. *Pedicels* very slender 6—10 mm. long. *Perigone:* tepals oblong, 7 mm. long, 2 mm. wide, apex bluntly acute or roundish. *Stamens* about half the length of the tepals; filaments 4 mm. long, filiform; anthers 1.5 mm. long before anthesis. *Ovary* globose, 2 mm. long, 2 mm. in diam.; style 4 mm. long, capitate.

RANGE.—State of Mexico; Telapon, north of Iztaccihuatl, south side of mountain, alt. 3450—3650 m., in grassy meadow, under open *Pinus hartwegii* forest; frequent. Flowering in late September—October.

NOTES.—From the evidence available, it appears that this species increases only by means of seeds. The two narrow-linear leaves, 2—3-flowered umbel, flowers small, pedicels very short, characterize this species.

7. **Allium mexicanum** Traub, **sp. nov.**, in Plant Life 23: 89, 90. 1967, **anglise.**

Bulba elongato-oblonga, tunicis membranaceis, verticaliter fissa; radicibus subcrassiusculis usque ad 3 mm. diametro; foliis 3—4 breviusculis; scapo 21—23 cm. longo; umbella 8—12-flora; floribus campanulatis lilacinis, costis mediis atropurpureis; staminibus styloque quam tepalibus brevioribus.

HOLONOMENIFER: Stanford, Lauder & Taylor no. 2629 (=US 2219025), July 22, 1949, Tamaulipas, Mexico, between Marcella and Hermosa.

Bulb seated 3 cm. below soil surface, long-oblong, 3.5—3.8 cm. long, 1.1—1.5 cm. in diam.; bulb coats white, membranous, with sparse vertical veins, splitting vertically; roots *rather coarse*, to 3 mm. in diam. *Leaves* up to 4, upright, rather short, 10—14—15 cm. long, up to 3 mm. wide, bluntly acute to acute-rounded. *Scape* 21—23 cm. long. *Spathe* monophyllous, whitish, transparent, splitting to one side. *Umbel* 8—12-flowered; flowers campanulate, tepals lavender, with deep purple or blackish midveins. *Perigone:* tepals 8 mm. long, 2.5 mm. wide, oblong acute, withering, connivent in fruit. *Stamens* slightly shorter than the tepals; filaments 6 mm. long, anthers oblong, 2 mm. long, 2-lobed at the base. *Ovary* 2 mm. long, 2.5 mm. in diam.; style 3 mm. long, stigma undivided. *Capsule* 5 mm. high, 4 mm. in diam.; seeds 1 per locule, 4 mm. long, 2 mm. in diam., black.

RANGE.—Tamaulipas, Mexico, between Marcella and Hermosa, in burned over area.

NOTES.—*Allium mexicanum* is the only species in Subsection *Mexicana* with coarse roots. This feature, together with long-oblong bulbs, campanulate flowers having lavender tepals with deeper purplish midveins, and other characters, set it apart from the other species in the subsection that increase vegetatively by bulb-splitting vertically. Pedicels 1—2.2 cm. long.

8. **Allium howardii** Traub, in Plant Life 23: 90—91. 1967.

DESCRIPTION.—See Plant Life 23: 90—91. 1967.

RANGE.—Southeastern Edwards County, Texas.

NOTES.—This is a smaller plant than *A. mannii,* and differs from the latter in various particulars.

9. **Allium mannii** Traub & T. M. Howard.

Bulb oblong, 1.5 cm. long, 1 cm. in diam., coats membranous; increasing by vertical splitting of the bulbs; *leaves* 2—3, 20—35 cm. long, 3 mm. wide, canaliculate. *Scape* up to 55 cm. long; *spathe* 1.5 cm. long; *umbel* (15—) 25-flowered; *perigone:* tepals 10 mm. long, 1.5—2 mm. wide, white to pale pink, keeled green to purplish.

RANGE.—Collected by Dr. T. M. Howard (67—14), State of Durango, Mex. east of Durango City, on Mexican Highway 40; roadside, in low wet pastures and ditches, in heavy clay soil of volcanic origin, often growing in standing water after rains Alt. 1,829 m.

Named in honor of the late Dr. L. K. Mann, of the University of California, Davis, who made outstanding contributions toward the advancement of knowledge about the Alliums.

10. **Allium traubii** T. M. Howard, in Plant Life 23: 62; 91. 1967.

DESCRIPTION.—See Plant Life 23: 91. 1967.

RANGE.—State of Nuevo Leon, Mexico, near the Chihuahua State line.

NOTES.—This species differs from *Allium howardii* in the medium green, canaliculate leaves, 3-ridged on under side, 2 mm. wide, and in the few-flowered umbel, light lavender flowers, and other particulars.

Since the last report a free-flowering form with the umbel many-flowered, flowering in summer and autumn, is recognized here.

10a. **Allium traubii** forma **traubii.** The nomenifer form.

10b. **Allium traubii** forma **liberflorens** T. M. Howard, **f. nov.**

A typo in plerumque in culto sempervirens multiflorum et estive autumnaleque florens differt. Holonomenifer: #1078(TRA), 9-19-67. Umbel many-flowered, appearing in summer and autumn. Leaves 3 mm. wide.

11. **Allium ownbeyi** Traub, **sp. nov.**

Specimen: T. M. Howard s. n. = 1066 (TRA), Nov. 1966, Nuevo Leon, Cerro del Obispado, 30 mi. n. Monterrey, Mexico.

Bulb 2 cm. long, 1.2 cm. in diam.; outer coats membranous, dark brown, with sparse vertical fibers; bulbs splitting vertically into 2 bulbs. *Leaves* 5—6, broadly canaliculate, glabrous above, bluntly acute, 6—8 ridged on the back, denticulate on the ridges and on the leaf margins, to 18 cm. long, 4.5 mm. wide; sometimes slightly spirally twisted. *Scape* flattish, or angled, denticulate on the margins, 24—28 cm. long, 2mm. in diam. *Spathe* 1—1.2 cm. long, monophyllous, prominently vertically 5-nerved. *Umbel* 7—13-flowered; flowers light lavender, tepals spreading, with deeper mid-vein. *Pedicels* 1—1.3 cm. long, very slender. *Perigone:* tepals oblong-lanceolate, bluntly acute, 5—6 mm. long, 3 mm. wide. *Stamens:* filaments 6 mm. long, widening below and united into a short staminal cup; anthers less than 1 mm. long at anthesis. *Ovary* 3-lobed, 2 mm. long, 2 mm. in diam., 6-crested, style 4 mm. long; stigma undivided.

Range.—Mexico, State of Nuevo Leon, about 30 mi. north of Monterrey. Flowering in November.

Notes.—This species is named for Dr. Marion Ownbey, the well-known worker on the North American Alliums. It differs from all of the other species in the subsection *Mexicana* in the wider, shallowly canaliculate sometimes somewhat spirally twisted leaves which are denticulate on the margins, and on the ridges on the back; the flattish to angled scape, denticulate on the ridges, the late flowering period, and in other particulars.

12. **Allium rhizomatum** Wooton & Standley, in Contr. U. S. Nat. Herb. 16: 114. 1913; Traub, in Plant Life 23: 92. 1967.

Description.—See Plant Life 23: 92. 1967.

Notes.—This species differs from the other rhizome-bearing species in that the rhizomes are scaly.

13. **Allium elmendorfii** M. E. Jones ex Ownbey, in Res. Stud. State Coll. Wash. 18: 218—219. 1950; "Allium elmendorii" M. E. Jones, in Contrib. West. Bot. 18: 20. 1935, anglise; Traub, in Plant Life 23: 90. 1967.

Description.—See Plant Life 23: 90. 1967.

Range.—South Texas.

Notes.—Distinguished from all others in the subsection *Mexicana* by the short-stalked bulblets borne at the base of the bulb.

14. **Allium michoacanum** Traub.

Bulb very small; 6 mm. long, 4 mm. in diam.; coats membranous; increasing by bulblets borne terminally on slender rhizomes. *Leaves* 2—3, very narrow, sheathing below to form a narrow deciduous neck, to 4 cm. long, 2 mm. in diam.

Range.—Collected by Dr. T. M. Howard (H 67-74A) on Mexican Highway 15. K. 233, east of Morelia, Michoacan, in mountains.

Notes.—This is apparently among the smallest of the Mexican Alliums.

15. **Allium fantasmosense** Traub, **sp. nov.**

Bulba ovoidea, tunicis membranaceis, bulbellas terminales in rhizomis producta; foliis usque ad 5, usque ad 32 cm. longis et 4 cm. latis, infra usque ad 7 cm. vaginatis; scapo gracili 14—18 cm. longo; spatha lanceolata; umbella 9—11-flora; pedicellis angustissimis; tepalibus 5 mm. longis 2 mm. latis; staminibus 4 mm. longis; stylo 4 mm. longo.

Holonomenifer: Traub 1076 (TRA), 10-12-67, grown at La Jolla, Calif., from stock collected by Dr. T. M. Howard, Aug. 5, 1967 (Howard 67-87A), San Luis Potosi, Valle de los Fantasmos, Mexican Highway 85.

Bulb ovoid, 1.5 cm. long, 1 cm. in diam.; coats membranous with sparse vertical fibers, forming bulbs at the end of slender rhizomes. *Leaves* 4—5, linear, canaliculate, up to 32 cm. long, 3—4 mm. wide, sheathing below to form a deciduous neck, 4—7 cm. long, 2.5—3 mm. in diam. *Scape* slender, somewhat angled in lower half, subterete above, 14—18—(24—28) cm. long, 3 mm. in diam at the base, narrowing gradually above to 1 mm. in diam. *Spathe* monophyllous, membranous, 1.3 cm. long *Umbel* 11—16-flowered, flowers light brownish-red (mahogany). *Pedicels* very slender, 1.2—1.9—2.6 cm. long, 0.25 mm. in diam. *Perigone:* tepals spreading, lanceolate, 5.5 mm. long, 2 mm. wide, acute. *Stamens* as long as or slightly longer than the tepals; filaments filiform, 5.5 mm. long, widening below and united into a short staminal cup; anthers 0.5 mm. long at anthesis; pollen ash gray. *Ovary* 2.5 mm. long, 2 mm. in diam., very obscurely 6-crested, with nectary glands on the 3 sides of the ovary opposite the three petepals; style 2.5 mm. long after anthesis, stigma undivided.

Range.—Collected by Dr. T. M. Howard (67-87A), in the Valle de los Fantasmos San Luis Potosi, Mexico, Mexican Highway 85, alt. 2,896 m. Flowers in August-September.

Notes.—Named for its native habitat, the Valle de los Fantasmos. This species can be easily distinguished from *Allium glandulosum*, a much taller plant, by the narrow, canaliculate leaves, the somewhat angled to subterete scape, fewer-flowered umbel, the very slender pedicels, smaller flowers, and other features.

16. **Allium** sp. (Howard 67-87B).

Differs from the preceding species in having flat leaves, and in other particulars.
Range.—Mexico: San Lusi Potosi, Valle de los Fantasmos.

17. **Allium durangoense Traub, sp. nov.**

Bulba parva, tunicis membranaceis; foliis 3—5 angustis spiraliter contortis infra vaginatis; scapo centrali terete; spatha lanceolata; umbella centripetali 9—23-flora; floribus campanulatis usque ad substellatis albis, costa media rubella; pedicellis 1.8—2.5 cm. longis; staminibus styloque quam tepalibus brevioribus; ovario 6-cristato; capsula obscure cristata; seminibus pro ratione parvis nigris.

Holonomenifer: No. 1069 (TRA), grown at La Jolla, Calif. 7-14-67, from bulbs collected by Dr. T. M. Howard, (65-4), east of the City of Durango, Dur., Mex., July 11, 1965. Paranomenifer specimens: Traub Nos. 1070, 1072 and 1073 (TRA)

Plant slender, delicate, *bulb* globose to ovoid, 1.2—1.5 cm. long. 1—1.2 cm. in diam.; bulb coats white with sparse vertical fibers, producing flowering-sized bulbs on lateral rhizomes, up to 13 cm. long, 3 mm. in diam., the old bulbs persisting. *Leaves* 3—4—5, upright, narrow, canaliculate, rounded on the under side, spirally twisted, (4—12)—16—21—28 cm. long, 2—2.5 mm. wide, light green, acute, sheathing below to form a narrow deciduous neck, 7—7.5—8 cm. long, 2.5—3 mm. in diam., brownish in lower ⅓ to ½. *Scape* central, terete, very slender, 21—26—28 cm. long, from top of deciduous neck, 2—2.25—2.75 mm. in diam, green, ultimately overtopping the longest leaves. *Spathe* monophyllous, lanceolate, closed at first, whitish, translucent, with 4—5 vertical nerves, 1.7 cm. long, soon rupturing at one side by the pressure of the expanding pedicels and pedicels, finally disposed to one side. *Umbel* centripetal, loose, flattish on top, 9—21—23-flowered; perigone very broadly campanulate to almost stellate; tepals whitish, keeled reddish-brown; ovary pinkish, with slight alliaceous scent. *Pedicels* slender, 1.8—2—2.5 cm. long, mostly curved outward and upward, green, 1 mm. in diam. *Perigone:* tepals elliptic acute; setepals 8 mm. long, 3.5 mm. wide; petepals 8 mm. long, 3 mm. wide. *Stamens:* filaments 5 mm. long, white, filiform, slightly dilated at the base, and united into a short staminal cup; anthers introrse, purplish, 1 mm. long before anthesis, shrinking to 0.5 mm. long after anthesis, pollen dark grayish. *Ovary* pink, 3-lobed, 6-crested on top; style white, filiform, very short at first, elongating to 4 mm. after anthesis: stigma very minutely capitate. *Capsule* trigonous, 4 mm. high, 5 mm. in diam.: seeds relatively small, roundish on one side, angled on two sides, pointed at one end, 1.75 mm. long, 1.75 mm. in diam., dull black.

RANGE.—East of the City of Durango, Dur., Mexico, in the plateau, grassy pastures, Mexican Highway 40, K 855 and 870. Collected by Dr. T. M. Howard in 1965 and 1967.

NOTES.—*Allium durangoense* is a very distinct species; the plant is slender, delicate, with spirally twisted leaves; the scape ultimately overtopping the longest leaves, the flower is whitish with a contrasting pinkish ovary. In dried specimens the leaves are usually very much shrunken so that it is difficult to distinguish the spirally twisted leaves except by magnification.

18. **Allium subteretefolium** Traub.

Bulb ovoid, bearing bulblets terminally on long rhizomes. *Leaves* 3—4, very slightly channeled on top, rounded below, giving the appearance of being terete, 41—55 cm. long, 3.5 mm. in diam., light green, glabrous, sheathing below to 5 cm. to form a deciduous neck.

RANGE.—Collected by Dr. T. M. Howard (H 66-3A), San Luis Potosi, Mexico.

NOTES.—This species differs from all others in the subsection *Mexicana* in the very long subterete leaves.

SECTION **RHOPHETOPRASON** TRAUB

Section **Rhophetoprason** Traub, **Sect. nov.** genus **Allium** L. (Amaryllidac.); in Plant Life 23: 110. 1967, **anglise.**

Tunicae bulborum membranaceae, fibris sparsis verticalibus; plantae per semines et bulbas florentimodas in rhizomis lateralibus reproductae, bulbis vetustis non persistentibus; foliis 4—5 vel pluribus infra prominente vaginatis. Typus: Allium glandulosum Link & Otto

19. **Allium glandulosum** Link & Otto, Ic. Pl. Rar. Hort. Berol. 1: 33, pl. 17. 1841; Ownbey, Res. Stud. State Coll. Wash. 15: 224-225. 1947; ibid. 18: 219-220. 1950; Traub, Plant Life 23: 92-94. 1967.

Syn.—"Allium longifolium Lindl." (misapplied name), in Bot. Reg. 12: pl. 1031. 1826-27, non (H.B.K.) Spreng. 1825.

DESCRIPTION.—See Plant Life 23: 92-94. 1967.

RANGE.—Plants have been collected in the State of Hidalgo, Mexico; and in southern Honduras. In 1966, Dr. Howard collected a form of this species in the State of San Luis Potosi.

NOTES.—*Allium glandulosum* is related to *A. longifolium* in the method of vegetative reproduction (see Fig. 26), but differs from it in the relatively less thicker, and shorter leaves, the flattish, striated scape, and the usually many-flowered umbel of brownish-red (mahogany) sweet (honey) scented flowers, the copious nectar produced; the crestless ovary, and other particulars.

Under optimum culture, *A. glandulosum* may produce from 4 to 5 side sprouts, besides the main shoot, from 2—3 of the side sprouts may produce flower scapes. This is in addition to the 2—3 flower scapes produced from the main shoot. In nature, this apparently does not happen, but it may be that two central scapes may be produced from the main shoot. If plants approximating those in nature are desired under culture, it is advisable to apply fertilizer sparingly.

It is desirable to store the dormant bulbs in dry sand or sandy soil, and to plant them from mid-May to mid-June in a sandy, well-drained soil.

20. **Allium longifolium** (H.B.K.) Spreng. **emend.** Spreng., in Syst. Veg. 2: 38. 1825.

Syn.- *Schoenoprasum longifolium* H.B.K., Nov. Gen. et Sp. Pl. 1: 277. 1816; Plant Life 23: 60. 1967.

LECTONOMENIFER: Humboldt & Bonpland, without number, Herb. Mus. Nat. Hist. Phaner. Paris (P), near Queretaro, Aroyozarco and San Juan del Rio, Mex. alt. 1,856 m. flowering in Aug. (see Fig. 27 for photocopy).

Recent verifying specimens: T. M. Howard 67-35 (TRA 1073), 1 mi. w. Magdalena, Jalisco, Mex. July 26, 1967; and Traub 1075(TRA), grown at La Jolla,

Calif. Sept. 10, 1967, from bulbs collected by Dr. T. M. Howard, near Tuxpan, Michoacan, July 1, 1964 (Howard 64-57A).

Bulb ovoid, 2.5 cm. long, 1.5 cm. in diam.; bulb coats white, membranous, with sparse vertical fibers; producing 2 or more flowering-sized bulbs on lateral rhizomes, the old bulb not persisting. *Leaves* 3—4—5, very long, thick, 32—41—52 cm. long (to 49—64 cm. long under optimum culture), 3—4.5 mm. wide, deeply channeled, rounded on the back, vascular bundles in one row, gradually narrowing to the acute apex, sheathing below to form a long deciduous neck, 4—4.5 cm. long (7—25 cm. long under optimum culture), 8—10 mm. in diam. *Scape* central, terete, 40—47 cm. long (to 55 cm. long under optimum culture), 4 mm. in diam. where it emerges from the deciduous neck, gradually narrowing to 1.5 mm. in diam. at the apex. (Under optimum culture 1 or 2 side shoots with scapes somewhat smaller may be produced.) *Spathe* lanceolate, membranous, 1.5 cm. long, 5 mm. in diam., vertically 4-nerved. *Umbel* 6—12-flowered under optimum culture 8—16—28-flowered; perigone very pale lavender, almost white, tepals with lavender midribs, spreading to very broadly campanulate; stamens, filaments pale lavender, pollen light lavender, style light lavender; flowers with slight alliaceous scent. *Pedicels* slender, 1.5—1.7—2.5—3 cm. long (under optimum culture, 1.5—2—2.3—3.3 cm. long). *Perigone:* tepals oblong, acute, 9 mm. long, setepals 4 mm. wide, petepals 3 mm. wide. *Stamens:* slightly shorter than the style, filaments 7 mm. long, dilated below, and united into a short staminal cup; anthers 2 mm. long, shrinking to 1 mm. long at anthesis; pollen light lavender. *Ovary* 2 mm. long, 2 mm. in diam., obscurely 6-crested; style 5 mm. long, shorter than the tepals; stigma undivided; nectaries on the sides of the ovary opposite the 3 petepals, but nectar is sparse as compared with that in *A. glandulosum*. *Capsule* trigonous, 4 mm. long, 5 mm. in diam.

Range.—Living material collected by Dr. T. M. Howard in red clay soil, cornfield, by roadside, between Zitacuaro and Ciudad Hidalgo, near Tuxpan, Michoacan, Mexican Highway 15, July 2, 1957 and July 1, 1964 (Howard 57-11B And Howard 64-57A); and 1 mi. west of Magdalena, Jalisco, Mexican Highway 15, in heavy clay soil, July 25, 1967 (Howard 67-35).

Notes.—*Allium longifolium* is related to *A. glandulosum* in the method of vegetative reproduction, but differs from it in the very long leaves, the terete scape, the fewer flowers in the umbel, in the production of less nectar, the obscurely 6-crested ovary, the slight alliaceous scent of the flowers, and in other particulars.

One male-sterile seedling was observed under cultivation; the plant has shorter leaves, the umbel is 8-flowered; the flowers are purplish, with deeper tepal midribs, and do not open widely.

From the original description of *Allium longifolium* it appears that the species was collected near *Queretaro, Aroyozarco* and *Juan del Rio*. It is argued that there must have been at least two specimens. For no apparent valid reason, some American workers have *erroneously* referred the one known specimen (Fig. 27) to *Nothoscordum bivalve,* and would leave matters in this confused state for another century and a half in spite of the fact that the known specimen (Fig. 27) matches up with plants collected in the wild by Dr. Howard. Since H.B.K. did not indicate a holonomenifer, the known specimen is designated the lectonomenifer.

ORIENTATION OF VASCULAR BUNDLES IN **ALLIUM** LEAVES

HAMILTON P. TRAUB

For some time it has been recognized that data on the orientation of vascular bundles in the leaves might be of diagnostic value in the grouping of *Allium* species (Feinbrun, 1954; Mann, unpublished notes). To encourage research in this field, methods of preparing material are suggested. Brief summaries of observations on vascular bundles of foliage leaves (Mann, unpubl. notes) and on chromosome numbers (Cave, et al. 1956-1964; Ornduff, 1967; Tutin, 1957) are given. In the tabulation, species are grouped as proposed by Traub (1968).

MATERIALS AND METHODS

PERMANENT SLIDES.[1] The best means to demonstrate the arrangement of vascular bundles requires glass slide preparations from material fixed, embedded, and then cut on the microtome. For this purpose Mann fixed leaf pieces in Craf III (Sass, 1951). Soft material was embedded in water soluble carbowax (polyethylene glycol) (Riopel and Spurr, 1962) and hard material in tissuemat by the well-known tertiary butyl alcohol method (Johansen, 1940). For both procedures sections were stained in hematoxylin. Carbowax-embedded material to be photographed was mounted temporarily in water. This gave beautiful preparations free of distortion, plasmolysis, and cell wall shrinkage. These slides were made semi-permanent by drawing off the water, mounting the sections in glycerine jelly (Johansen) and ringing the cover glasses with an air-tight cement such as Duco.[2] Sections mounted in this manner suffer some distortion and are not suitable for photographs but can be used for microscope study and for making camera lucida drawings.

HERBARIUM SECTIONS. To survey bundle orientation in a large number of species, a simpler, more rapid technique is required. Dried leaf sections serve this purpose, and the preparations can be permanently attached to the appropriate herbarium sheets. This technique is not a replacement for glass slides but is a useful method for preliminary observation.

Very thin cross-sections of leaves are cut free hand with a sharp knife or razor blade. A rectangle about 6 cm. x 8 cm. of moisture permeable cellulose acetate film (DuPont brand, thickness 200-ca-43) (Traub, 1950, 1951) is wetted on one side with water, the sections arranged in order, and a second rectangle of cellulose acetate film placed over the sections so they are tightly held in place. The preparation is placed between pieces of blotting paper about 8 cm. x 10 cm., labelled, and pressed. A discarded book suitably weighted works well. When the sections

1 The procedure for making permanent slides has been contributed by Miss Dora G. Hunt, Department of Vegetable Crops, University of California, Davis.
2 E. I. du Pont de Nemours & Co., Wilmington, Delaware.

Table. **Allium** L. species: observations on vascular bundles in foliage leaves and chromosome numbers. Grouping according to Traub (1968).
Abbrev.—**canal.** = canaliculate; **flattd.** = flattened; **sl.** = slightly

Lineagic category	Basic chromosome number (x)	Vascular bundles number rows orientation	Foliage leaf blade shape of X-section
Subgenus I. **AMERALLIUM** (x=7 except a few x_2=8, x_3=9)			
Sect. I. **CAULORHIZIDEUM**			
A. brevistylum S. Wats.	2n=14	1	broadly canal.
A. gooddingii Ownb.	2n=14	1	broadly canal.
A. validum S. Wats.	2n=—, 28, 56	1	broadly canal.
Sect. II. **AMERALLIUM**			
Subsect. I. **MEXICANA**			
A. scaposum Benth.	2n=?	1; 2 bundles at mid-vein	half terete
Subsect. II. **CANADENSIA**			
A. macropetalum Rydb.	2n=14	1 (circle)	terete
A. canadense L.	2n=14, 28	1	shallowly canal.
A. drummondii Regel.	2n=14, 28	1	shallowly canal.
A. plummerae S. Wats.	2n=14, 28	1; 2 bundles at mid-vein	shallowly canal.
A. textile Nel. & Macbr.	2n=14, 28	1	shallowly canal.
A. geyeri S. Wats.	2n=14, 28, 42	1	shallowly canal.
Sect. III. **LOPHIOPRASON**			
Subsect. I. **CERNUA**			
A. sp. (near **obtusum**)	2n=?	1	furrowed
A. stellatum Fras. ex Ker-Gawl	2n=14	1	furrowed
A. haematochiton S. Wats.	2n=14	1	furrowed
A. californicum Rose	2n=14	1; 2 bundles at mid-vein	thick
Subsect. II. **FALCIFOLIA**			
A. douglasii Hook	2n=14	1	canal.
A. madidum S. Wats.	2n=14, 42	1	canal.
A. nevii S. Wats.	2n=14	1	canal.
A. tolmiei Bak.	2n=14	1	canal.
A. anceps Kell.	2n=14	1	flat
A. siskiyouense Ownb.	2n=14	1	flat
A. fibrillum Jones	2n=14	1	canal.
A. persimile (Ownb.) Traub	2n=—, 42	1	canal.
A. crenulatum Wieg.	2n=14	1; 2 bundles at mid-vein	canal.
A. platycaule S. Wats.	2n=14	1 irregular (or 2?)	flat
Subsect. III. **SANBORNIANA**			
A. fimbriatum S. Wats.	2n=14	2-3 (circle)	terete, solid
Subsect. IV. **ACUMINATA**			
A. amplectans Torr.	2n=14, 21	1	furrowed
A. hyalinum Curr. ex S. Wats.	2n=14	1	half terete
Subsect. V. **CAMPANULATA**			
A. campanulatum S. Wats.	2n=14, 28	1	canal.
A. bisceptrum S. Wats.	2n=14	1	canal.
Subsect. VI. **BOLANDERIANA**			
A. bolanderi S. Wats.	2n=14	1	half terete
Sect. IV. **RHOPHETOPRASON**			
A. glandulosum Link & Otto	2n=—, 28	1	thick, sl. canal.
Sect. V. **MOLIUM**			
A. neapolitanum L.	2n=14	1	flat, sl. keeled
A. subhirsutum L.	2n=14	1	flat, curved
A. roseum L.	2n=16, 32	1	flat, curved
A. zebdanense Boiss. et Noe	2n=18	1	flat, v. thick mid-vein
Sect. VI. **XANTHOPRASON**			
None studied			
Sect. VII. **CHAMAEPRASON**			
A. chamaemoly L.	2n=?	1	flat
Sect. VIII. **OPHIOSCORODON**			
Subsect. I. **URSINA**			
A. ursinum L.	2n=14	1	keeled, nearly triangular

Subsect. II. **TRIQUETRA**				
A. triquetrum L.	2n=18	1;3 bundles at keel		triangular
Subgenus II. **NECTAROSCORDUM** $x_2=8$				
Sect. IX. **NECTAROSCORDUM**				
A. bulgaricum (Janka) Prodan	2n=?	1		flat
Subgenus III. **ALLIUM** ($x_2=8$, except a few x=7?, $x_3=9$, $x_4=10$)				
Sect. X. **RHIZIRIDEUM**				
A. tuberosum Rott. ex Spreng.	2n=16, 32	2, opposed		flat, thick
Sect. XI. **MELANOCROMMYUM**				
A. aflatuense B. Fed.	2n=16	2, opposed		flat, sl. curv.
A. nigrum L.	2n=16	2, opposed		flat, sl. curv.
Sect. XII. **CODONOPRASON**				
A. oleraceum L.	2n=—, 32, 40	2, opposed		flat, sl. curv., thick 7 canal.
Sect. XIII. **PETROPRASON**				
A. polyphyllum Kar. et Kir.	2n=—, 32	2, opposed		flat
Sect. XIV. **ALLIUM**				
A. ampeloprasum L.	2n=16, 32	2, opposed		flat, keeled
A. sativum L.	2n=16, 48	2, opposed		flat, keeled
Sect. XV. **HAEMOPRASON**				
None studied				
Sect. XVI. **MICROSCORDUM**				
None studied				
Sect. XVII. **ANGUINUM**				
A. tricoccum Ait.	2n=—, 32	2, opposed		furrowed
Sect. XVIII. **CEPA**				
Subsect. I. **FISTULOSA**				
A. fistulosum L.	2n=16	1 (circle)		fistulose, circ.
Subsect. II. **SCHOENOPRASA**				
A. schoenoprasum L.	2n=16, 32	1 (circle)		fistulose, sl. angled
Subsect. III. **POPOVIANA**				
A. chinense G. Don	2n=—, 24,32	1 (circle)		fistulose, 3-5-angled
Subsect. IV. **CEPA**				
A. galanthum Kar. et Kir.	2n=16	1 irreg. (or 2?) (circle)		fistulose, flattd.
A. cepa L.	2n=16, 32	1 irreg. (or 2?) (circle)		fistulose; often flattd. on one side

are dry, the edges of the film are stapled together and the preparation attached to the herbarium sheet. Some sections can be examined satisfactorily without magnification.

OBSERVATIONS

In the grouping of *Allium* species in the accompanying table, there appears to be a significant relation between vascular bundle orientation and basic (x) chromosome number. With 2 exceptions the species under subgenus *Amerallium* have the basic x=7 chromosome number, and with few exceptions, the foliage leaves in transverse section have essentially one row of vascular bundles normally oriented, i. e., phloem on the lower, xylem on the upper side of the leaf. Species having one row plus 2 or 3 bundles at the mid-vein are probably variations of the single row form.

The subgenus *Nectaroscordum,* with the basic x=8 chromosome number, is separated from the other two subgenera by the discoidally

swollen pedicel apex, and the floral tepals 3—7-nerved. In the one species studied, the leaf vascular bundles are oriented in one row as in the subgenus *Amerallium*.

Species in subgenus *Allium* so far as reported here are uniform in having the basic $x_2=8$ chromosome number and in having leaf vascular bundles arranged in either 2 opposing rows or a circle.

Further understanding of relationships among the species of *Allium* awaits additional studies from many approaches such as the anatomical, morphological, genetical, and chemical.

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Postscript.—On further consideration, in the above article, and the one following (Traub, 1968), it appears that the Sections **Xanthoprason** and **Chamaeprason** should be reduced to subsections under Section V. Molium (see pages 144 and 161) since the differences are not sufficient for maintaining them on the sectional level:

Section V. **Molium** Endl. (1836)

Subsection I. **Neapolitana** (nomenifer: **A. neapolitanum** L.)

Subsection II. **Moliana** (nomenifer: **A. moly** L.)
Syn.-Section **Xanthoprason** F. Hermann

Subsection III. **Chamaemoliana** (nomenifer: **A. chamaemoly** L.) Syn.-Section **Chamaeprason** F. Hermann

THE SUBGENERA, SECTIONS AND SUBSECTIONS OF **ALLIUM** L.

HAMILTON P. TRAUB

I. INTRODUCTION

The genus *Allium* L. is among the more difficult groups in the *Amaryllidaceae*. It comprises a great, wide-ranging phylon in the North Temperate Zone; one very hardy species, *Allium schoenoprasum,* ranges even into the arctic. More than 600 species are recognized. The subtle differences in living plants are lost more or less in dried specimens. They are at once much *alike* to the uninitiated and yet quite distinct to the student who knows them as *living* plants.

The ideal procedure in the study of such plants is to preserve dried specimens and at the same time collect living material for more detailed study in the greenhouse or experimental garden. An adequate sample of living plants in each case should also be turned over to the caryologist for determining the chromosome complement. A dried specimen with the chromosome data added should then be deposited in the amaryllid herbarium maintained by such an organization as the American Plant Life Society where it can serve as a permanent reference source.

ALLIUMS AS A WHOLE, 1753-1875

Linnaeus (1753) recognized 31 *Allium* species. The Alliums were first placed under subgeneric groups by George Don (1827), who arranged 129 species under eleven divisions which were placed under seven sections as shown in Table 1.

Table 1. The sections of **Allium** according to G. Don (1827).

Porrum (Divs. I & II)	Molium (Divs. VIII & IX)
Schoenoprasum (Div. III)	Anguinum (Div. X)
Macrospatha (Divs. IV, V & VI)	Ornithogalodeum (Div. XI)
Rhizirideum (Div. VII)	

Since 1827, additional sections have been proposed by other workers. Regel (1875) grouped 262 *Allium* species under six sections as shown in Table 2.

Table 2. The sections of **Allium** according to Regel (1875).

Porrum	Macrospatha
Schoenoprasum	Molium
Rhizirideum	Nectaroscordum

In the contributions of G. Don and Regel it is understandable that the North American *Allium* species were inadequately represented. Only a minor part of the North American species had been discovered, and the available herbarium material of the known species was meagre. After 1875, the study of the genus *Allium* was fragmented by being included only in various regional and local floras.

OLD WORLD ALLIUMS, 1876-1967

When Edmond Bossier published his "Flora Orientalis" (Bossier, 1882), including the area from Greece and Egypt to the boundaries of

India, he recognized a total of 141 *Allium* species for this region. J. D. Hooker published his "Flora of British India" in 1892, which included the treatment of the Alliums for this restricted area.

Victor Janka (1886) provided a key to the Alliums of Europe, and F. Hermann (1939) proposed sectional and subsectional names for the genus *Allium* in Europe, some of which are synonyms for groups proposed earlier.

Vvedensky (1935) grouped 228 *Allium* species of the U. S. S. R. under nine sections as shown in Table 3.

Table 3. The sections recognized for the Alliums of U. S. S. R., according to Vvedensky (1935). See also the English translation by Airy-Shaw, 1944 (1946).

1. Anguinum G. Don (1827)
2. Ophioscorodon (Wallr.) Endl. (1836)
3. Rhizirideum G. Don (1827)
4. Phyllodolon (Salisb.) Prokh. (1931)
5. Cepa (Moench) Prokh. (1931)
6. Haplostemon (Boiss.) Halaczy (1904)
7. Porrum G. Don (1827)
8. Caloscordum (Herb.) Bak. (1874)
9. Nectaroscordum (Lindl.) Gren. et Godr. (1855)

Thus matters stood, when Stearn (1936) published a bibliographical note on Don's 1827 "Monograph of the Genus *Allium*." Interest in Alliums was further stimulated when, in 1944, Volume 11, of Herbertia (published in 1946) was devoted almost entirely to the genus. The Herbertia symposium included among other contributions, Airy-Shaw's translation from the Russian into English of Vvedensky's "Genus Allium in the U. S. S. R. (1935)", with corrigenda by W. T. Stearn. The following named papers were contributed by Stearn: "The Floristic Regions of the U. S. S. R. with reference to the Genus *Allium*," "Nomenclature and Synonymy of *Allium odorum* and *A. tuberosum*"; a translation into English of Janka's "Key to the Alliums of Europe"; and "Notes on the Genus *Allium* in the Old World." In connection with the discussion in the last named article, Stearn suggested a provisional list of 14 sections to accomodate the *Allium* species as shown in Table 4.

Table 4. Stearn's provisional list of sections for the genus **Allium** (Stearn, 1944 (1946)).

1. **Melanocrommyum** Webb et Berthl. (1848)
   (nomenifer: **A. nigrum** L.)
2. **Moly Endl.** (1836)
   (nomenifer: **A. neapolitan** L.)
3. **Briseis** (Salisb.) Stearn (1946)
   (nomenifer: **A. triquetrum** L.)
4. **Microscordum** Maxim. (1887)
   (nomenifer: **A. monanthum** Maxim.)
5. **Chamaeprason** F. Hermann (1939)
   (nomenifer: **A. chamaemoly** L.)
6. **Xanthoprason** F. Hermann (1939)
   (nomenifer: **A. moly** L.)
7. **Ophioscorodon** (Wallr.) Endl. (1836)
   (nomenifer: **A. ursinum** L.)
8. **Cepa** (Moench) Prokh. (1931)
   (nomenifer: **A. cepa** L.)
9. **Phyllodolon** (Salisb.) Prokh. (1931)
   (nomenifer: **A. fistulosum** L.)
10. **Haemoprason** F. Hermann (1939)
    (nomenifer: **A. melanantherum** Panc.)
11. **Codonoprasum** (Rchb.) Endl. (1836)
    (nomenifer: **A. oleraceum** L.)
12. **Rhizirideum** G. Don ex Koch (1837)
    (nomenifer: **A. senescens** L.)
13. **Anguinum** G. Don ex Koch (1837)
    (nomenifer: **A. victorialis** L.)
14. **Alliotypus** Dumort. (1827) [=**Allium**]
    (nomenifer: **A. sativum** L.)

In the following volume of Herbertia, Stearn (1945) published a revised and supplemented version of Hooker's "The Alliums of British India." In 1955, Stearn published a plate on *Allium bulgaricum* in Botanical Magazine. Later, Stearn (1960) published "*Allium* and *Milula* in the Central and Eastern Himalaya," in which he proposed

new *Allium* species, and reported the presence of the alliaceous smell in *Milula*; evidence of its affinity with *Allium*.

NORTH AMERICAN ALLIUMS, 1876-1967

At the turn of the century, M. E. Jones (1902) recognized that the North American Alliums should be placed in natural groups. He attempted to establish the "Reticulatum Group" centering around *Allium reticulatum* G. Don (1827) = *Allium textile* Nelson & Macbr. (1913). It was not until 1955 that Ownbey stated that the North American *Allium* species with the basic x=7 chromosome number are to be placed in nine alliances (Ownbey & Aase, 1955). In the same paper the species belonging to one of these, the Allium Canadense Alliance, were described. The other alliances were not named. The number of alliances was later reduced to eight (Ownbey, 1966), as shown in Table 5.

Table 5. Alliances of North American **Allium** species with the basic x=7 chromosome number according to Ownbey (1966).

1. Acuminatum Alliance
2. Campanulatum Alliance
3. Canadense Alliance
4. Cernuum Alliance
5. Falcifolium Alliance
6. Kunthii Alliance
7. Sanbornii Alliance
8. Validum Alliance

In order to bring the grouping of the North American Alliums, with the basic x=7 chromosome number, on a coordinate basis with the sections of Old World Alliums, Traub (1967) grouped the species under four sections, including subsections under two sections. Ownbey's Alliances were incorporated in the process by elevating them to subsectional rank as shown in Table 6.

Table 6. The sections and subsections of North American **Allium** species, with the basic x=7 chromosome number, according to Traub (1967, pp. 67: 89-95, 110). Later subsect **Bolanderiana** was added, Traub, 1968b.

Section I. **CAULORHIZIDEUM** Traub (nomenifer: **A. validum** S. Wats.)
Section II. **AMERALLIUM** Traub (nomenifer: **A. canadense** L.)
  Subsection I. **Mexicana** Traub (nomenifer: **A. mexicanum** Traub)
  Subsection II. **Canadensia** Ownbey ex Traub (nomenifer: **A. canadense** L.)
Section III. **LOPHIOPRASON** Traub (nomenifer: **A. sanbornii** Wood)
  Subsection I. **Cernua** Ownbey ex Traub (nomenifer: **A. cernuum** Roth)
  Subsection II. **Falcifolia** Ownbey ex Traub (nomenifer: **A. falcifolium** Hook. & Arnott)
  Subsection III. **Sanborniana** Ownbey ex Traub (nomenifer: **A. sanbornii** Wood)
  Subsection IV. **Acuminata** Ownbey ex Traub (nomenifer: **A. acuminatum** Hook.)
  Subsection V. **Campanulata** Ownbey ex Traub (nomenifer: **A. campanulatum** S. Wats.)
  Subsection VI. **Bolanderiana** Traub (nomenifer: **A. bolanderi** S. Wats.)
Section IV. **RHOPHETOPRASON** Traub (nomenifer: **A. glandulosum** Link & Otto)

II. THE GENUS ALLIUM AS A WHOLE, 1968

The following discussion is concerned with the background for the arrangement of the North American and Old World Alliums on a coordinate basis, including a consideration of (a) the phytogeography or distribution of the genus *Allium* and allied genera; (b) the center of origin of the genus *Allium;* (c) evolution in the genus *Allium;* and (d) the grouping of the species under subgenera, sections and subsections.

DISTRIBUTION OF ALLIUM AND ALLIED GENERA

It has been pointed out by Wulff (1943) that the present distribution of any species is a reflection of the geological revolutions and cli-

matic changes which have occurred on earth during the entire period of its existence. According to Polunin (1960) and S. A. Cain (1944), the vegetation of the aerial parts of the earth tended to be widely comparable in different regions during the earlier geological ages up to and including the Mesozoic, but this relative uniformity was not maintained through the Cenozoic. Marked local changes in conditions were taking place, particularly from the Miocene (beginning 25 million years ago) onwards, and these changes are reflected in the fossil record. These are of great significance in connection with the problem of the origin of the existing floras. However, fossils of monocots are relatively scarce as compared with those of the dicots. *Allium* fossils have not been found, and reliance has to be placed on the distribution of floras in general of which the Alliums are a part.

During the later Cenozoic Era (about 25 to 1 million years in the past) Bering Strait was bridged by a mountain range which apparently had a fairly mature topography which facilitated a general migration of plants and animals over the northeastern Siberian-Alaskan land bridge to North America. Floras were thus practically circumpolar and circumboreal in distribution and were generally spread over the Northern Hemisphere. It is reasonable to assume that along with other plants, the *Allium* species and those of allied genera also had a similar distribution. These included *Milula, Hesperocallis* and most likely other now extinct primitive genera, as well as *Allium*, and other more advanced *Allieae* still existing—*Nothoscordum, Leucocoryne, Tulbaghia, Tristagma, Agapanthus*, and the genera in the Tribe *Gilliesieae*. The circumpolar and circumboreal distribution of *Allium* is corroborated to some extent by the present extensive boreal and arctic range of *Allium schoenoprasum* from Eurasia to North America.

However, the oncoming of the colder conditions with the Pleistocene inter-glacial period, from 1 million to about 15 thousand years in the past in Eurasia and North America, apparently exterminated many of the plants in Eurasia, including practically all of the more primitive *Allium* allies due to being forced against the high east-west mountain ranges to the south. The genus *Milula* was apparently the sole survivor among *Allieae* relicts in Tibet and Nepal, and *Allium* species most likely were drastically reduced in number.

In North America, according to this hypothesis, the plants were also forced southward during the inter-glacial period, but the north-south direction of the mountain ranges facilitated fairly free migration southward of many plant species, including the *Allieae*. It is probable that during this time some of the more primitive genera, not particularly adapted to the new conditions, could have been exterminated, excepting the primitive genus *Hesperocallis* which survives as a relict in southwestern United States.

With the return of more equable conditions following the inter-glacial period about 10 thousand years in the past, immigration northward took place. Thus, *Allium* species apparently returned to the

western mountain region in North America, and spread eastward over the plains and prairies, and the relatively low Appalachian highlands to the Atlantic Coast. One allied species, *Nothoscordum bivalve,* spread northward to the midland and eastward to the Atlantic Coast. These migrations are in line with the explanation of the marked similarity between the floras of eastern Asia and eastern North America, first observed by Asa Gray. For instance, a study of the floras of the Island of Yeso, lying north of the main island of Japan, discloses that more than 26 per cent of its plants are found also in North America. It should also be noted that in addition to *Allium schoenoprasum* which ranges from Eurasia to North America, Nothoscordum species are found in Siberia and Japan and also in the eastern United States.

The other allies of the genus *Allium,* including other species of *Nothoscordum, Leucocoryne, Tulbaghia, Tristagma, Agapanthus* and the *Gilliesieae,* apparently did not migrate northward again, apparently having already moved farther south via the Mexican—Central American —Andean highlands (boreal route) as far as Chile and Argentina. The explanation for the occurrence of *Tulbaghia* and *Agapanthus* in South Africa has not been found, and their presence there may possibly be due to the transfer of seeds from South America by birds. The cormous *Brodiaeioidinae* apparently are only distantly related to the *Allieae,* and will not be considered here.

It should be noted that the genus *Allium* has only two surviving monotypic relict relatives—*Milula spicata* Prain (2n=?), in Tibet and Nepal; and *Hesperocallis undulata* A. Gray (2n=24), in southwestern United States. These relatively primitive *Allium* relatives are characterized by the marker of the alliaceous odor. Morphologically they are not closely similar to *Allium,* but *Milula,* with a scape and the flower spike subtended by a spathe, is nearer to *Allium. Hesperocallis,* with an elongated terminal raceme, may be reminiscent of the mutual ancestral plants which the *Amaryllidaceae* had in common with the *Liliaceae.* Since the relicts occur both in Asia and North America, this may be interpreted as introducing a complicating factor when the matter of the center of origin of *Allium* is considered. However, if interpreted in the light of the phytogeography of the groups concerned, as already explained, any difficulty should be minimized.

CENTER OF ORIGIN OF THE GENUS ALLIUM

Hulten (1937) has pointed out that it is "unsafe to assume that a plant (group) originates in the place where it has its most numerous relatives. In most cases such a consideration will perhaps be correct, but in others it must be misleading." In the present case, the most numerous *Allium* species are in Eurasia-North Africa with a lesser number in North America as has already been indicated. However, this apparently was not true immediately following the inter-glacial period when the floras of Eurasia had been decinated by being forced against the east-west mountain ranges to the south due to glaciation. It should also be indicated that the more numerous related genera are in South America

to South Africa, thus presenting a most unusual and complicated problem in plant distribution.

It is reasonable to assume that the distribution of *Allium* species was circumpolar and circumboreal before the inter-glacial period along with the rest of the plants of the Northern Hemisphere. Apparently the floras were drastically reduced during the inter-glacial period in Eurasia due to the east-west direction of the mountain ranges against which the plants were forced by the advancing glaciers, and were largely destroyed. Thus, the present *Allium* flora in this vast area would not be a fair index of what it was in early post-glacial times. The *Allium* species had to be replenished from a remnant after the glaciers had receded.

In North America, the *Allium* species apparently were not subject to such drastic reduction as already explained, and they would serve as a better index of what they were originally. More than 95 per cent of the species in North America have the basic x=7 chromosome number. Only two species with the x_2=8 basic number, *Allium schoenoprasum* (2n=16, 32) and *A. victorialis* (2n=16, 32), range from Eurasia to North America. The latter apparently has a common ancestry with the North American, *Allium tricoccum* Ait. (2n=—, 32). Thus, it appears that at the time of the oncoming of the inter-glacial period, most of the *Allium* species which had circumpolar and circumboreal distribution had the basic x=7 chromosome number. The secondary basic, x_2=8 had evolved from x=7, but apparently was not numerous among the *Allium* species.

In Eurasia-North Africa today the picture is reversed. *Allium* species with the basic x=7 chromosome number constitute only about 10 per cent of the more than 500 species. The rest (more than 88 per cent) practically all have the secondary basic x_2=8 number, with only a few having the tertiary basic x_3=9, and only two with the quadrinary basic x_4=10. How can this be explained?

Apparently, when the survivors from the inter-glacial onslaught began to multiply in Eurasia, the species with the x_2=8 basic number, derived from the more primitive x=7 species, moved into vast unpopulated areas, and apparently being better adapted to the new conditions, rapidly increased in proportion to the x=7 species, so that the proportions of the two have been reversed in comparison with those in North America.

On the basis of phytogeography as defined by Wulff (1943), it appears that the original basic chromosome number of *Allium* is x=7, which apparently originated from a now extinct ancestral stock with the basic x=6, which it had in common with such a related relict as *Hesperocallis undulata,* 2n=—, 24 (tetraploid).

The evidence from phytogeography appears to point to x=7 as the basic chromosome number in the genus *Allium* but this has to be considered further in connection with other available researches. A final decision can only be made after the evidence from chromosome studies,

chemistry, morphology and anatomy has also been evaluated in the following discussion.

EVOLUTION IN THE GENUS ALLIUM L.

Stearn (as quoted by Brat, 1965) has proposed the hypothesis that "the two groups, i.e., the New and Old World species, represent a case of parallel evolution from the proto-*Allium* which was of the rhizomatous kind and the purely bulbous forms, represent an adaptation to environments with a marked seasonal variation of the Mediterranean nature." This view is apparently true in so far as the ancestral stock from which the genus *Allium* originated was rhizomatous and the leaves were oblong and/or petiolate, and that species with bulbous rootstocks and sessile leaves, flat, solid terete, or fistulose, have evolved in response to particular climatic conditions. However, it is hardly possible that the New and Old World species had parallel evolution before the interglacial period when the floras of the North Temperate Zone had a circumboreal distribution. By that time, it appears that the secondary $x_2=8$ basic chromosome number had already evolved from the basic $x=7$ as evidenced by the presence in North America of (a) *Allium tricoccum* Ait. (2n=—, 32), a rhizomatous, petiolate-leaved species; (b) *Allium validum* S. Wats. (2n=—, 28, 56), an intermediate species, and (c) the more numerous truly bulbous species with flat, terete or furrowed leaves, with the basic $x=7$, basic chromosome number. Since the interglacial period, it is true that the New and Old World Alliums have had an independent development due to the barrier of geographical isolation, but not sufficient time has elapsed to produce really marked differences between the two segments. The North American $x=7$, and Old World Alliums, with *flat* leaves in the Section Molium, for instance, also with the basic $x=7$ chromosome number, usually have a single row of normally oriented vascular bundles and subepidermal laticifers in the leaf blades (Mann, unpubl. mss.; see also Traub, 1968). This surely does not point to parallel evolution of such important features. This leaf character had apparently been evolved before the land bridge between northeastern Asia and North America disappeared. Thus, any independent or parallel evolution of the New and Old World species, not influenced by reticulate hybridization, has to date from post interglacial times. Such developments as the production of flowering-sized terminal bulbs on rhizomes, the old bulb not persisting, as in *Allium glandulosum* and *A. longifolium*, from Mexico, show marked independent evolution, unless the derivation of these features from Old World ancestral stock could be proved. Similarly, the biennial habit of some domesticated forms of *Allium cepa* represent independent evolution under cultivation. Such a development has not been found in natural populations.

Within the genus *Allium*, as shown by the researches of Levan (1932, 1935), Levan and Emsweller (1939), and Mensinkai (1939), evolution is proceeding along three lines on the basis of caryological studies: (1) change in chromosome structure; (2) change in genotype, and (3) change in chromosome number.

CHANGE IN CHROMOSOME STRUCTURE

Structural chromosome changes as a mechanism for variation has relatively great significance and wide application in the evolution of organisms. Its main value lies in the production of rapid evolutionary changes. The chief drawback is that it may lead to sterility. In those cases where it has a high survival value, species evolution is rapid and marked. According to Mensinkai (1939), "Of these, inversions have played a prominent role in *Allium,* as judged from a study of the species . . . (studied). . . . Other changes, such as translocations, fragmentation, fusion, etc., have taken place in these species (which he studied cytologically), though less frequently."

CHANGE IN GENOTYPE

Mensinkai (1939) has reported on a decrease in size of the chromosome complement in *Allium decipiens* (2n=16), and *A. cyaneum* (2n=—, 32), and an increase in size of chromosomes in *A. margaritaceum* (2n=16, 32). He studied a diploid and a tetraploid race of the last named species.

Brat (1965) reported that in *Allium bidwelliae* (2n=14), and the tetraploid, *A. macranthum* (2n=—, 28), the complement shows a distinct size differentiation of the chromosomes into three groups.

CHANGE IN CHROMOSOME NUMBER

After a brief reference to recent progress in the determination of chromosome numbers in *Allium,* reports on change in chromosome number in *Allium* will be briefly considered. Such change in chromosome number is towards (a) euploidy, consisting of the duplication or loss of entire chromosome sets; and (b) aneuploidy, consisting of an increase or decrease by less than an entire chromosome set.

PROGRESS IN DETERMINING CHROMOSOME NUMBERS. Feinbrun (1965) reported that chromosome numbers had been determined for 16 *Allium* species with the x=7; 96 species with the x=8, and 4 species with the x=9, basic numbers. Since that date Aase (1965), and some previous reports, has provided determinations for almost all of the North American *Allium* species. The percentage of Eurasian species for which chromosome numbers have been determined is at least 30 per cent. The progress since 1954 is shown in Table 7, where the percentages of chromosome numbers determined in species with the basic x=7 and x=8, are indicated.

This shows that about 88 per cent of the 111 species with the basic x=7 chromosome number have been determined. It is to be noted that about 73 per cent of the species with the x=7 basic number are diploids (2x). However, for some of these tetraploid (4x) "races" and higher ploidy "races" have also been reported which do not show up in the table. About 4 and 10 per cent of those determined are tetraploids (4x), and higher ploidy, respectively.

Similarly, about a third (35 per cent) of the 521 species with the x=8 basic chromosome number have been determined. About 27 per cent of these are diploids (2x). Again, for some of these tetraploid

(4x) "races" and higher ploidy "races" also have been reported which do not show up in the Table. The percentage of tetraploids (4x) is slightly higher than for species with the x=7 basic number, but the proportion of those with higher ploidy is lower.

The reports for chromosome numbers of the species with the x=7 basic numbers is nearing completion, but much work is needed with the species having the basic x_2=8 number. As indicated in the Table, the relatively few species reported with the x=9 and x=10 basic numbers are all diploids (2x).

Table 7. Genus **Allium** L. Percentage of chromosome numbers determined for species with the basic x=7, the secondary basic x_2=8 numbers, indicating the percentages of diploids (2x), tetraploids (4x), and higher ploidy ranges. The few species with the tertiary x_3=9, and quadrinary, x_4=10 basic numbers, are all diploids.

Basic chromosome number; and total number of species:		2x	4x	higher ploidy	total per cent
x=7 (total number of species 111)	per cent of species determined	73.8*	4.1	10.8	88.7
x_2=8 (total number of species 521)	per cent of species determined	27.6**	6.5	1.2	35.3

* Includes some reports for tetraploid (4x) and higher ploidy races.
** Includes many reports for tetraploid (4x) and higher ploidy races.

EUPLOIDY IN ALLIUM. Mensinkai (1939) studied 17 Allium species. Six of these are polyploids and all appeared to be allopolyploids which usually are more vigorous in nature than autopolyploids. Mensinkai (1939) points out that in an autopolyploid all the chromosomes of the genome are represented several times over, and thus all of the genes of the species are duplicatd. This results in collective intensification of the characteristics. However, the spontaneous occurrence of structural variations is low, and the chances for new mutants to arise in them are few compared with the allopolyploids. Compared with diploids, autopolyploids when fertile, have greater potentialities for variation by gene mutations. Allopolyploids have the added advantage of having genetically dissimilar chromosomes and the consequent capacity for structural changes as a special mechanism of variation.

ANEUPLOIDY IN ALLIUM. As indicated incidentally earlier in this paper, one of the more significant evolutionary tendencies in Allium is toward establishing a series of supernumerary basic chromosome numbers by means of aneuploidy. This represents a step in the evolution of the genus by insuring incompatibility with neighboring species of differing basic chromosome numbers. This leads to new subgeneric groups in the course of time.

In *Allium,* four such basic numbers have evolved, x=7, x=8, x=9 and x=10. The question arises at once as to which is the primary basic number from which the others have evolved directly or indirectly. The reconstruction of the evolutionary past of the genus *Allium* as far

as possible on the basic of phytogeography in earlier discussions appears to point to x=7 as the primary basic number. This has now to be tested on the basis of caryological researches with *Allium* species beginning with Levan (1931), and supporting evidence from chemistry, phenontalogy (morphology), and anatomy.

On the basis of chromosome morphologic considerations, Levan (1935) came to the conclusion that "The karyologically . . . most primitive species of *Allium,* those with 14 chromosomes, have almost exclusively medianly (m) inserted chromosomes. The cytologically most derivative forms, those with 16 chromosomes, have proportionally more chromosomes with terminal (t) insertion." In the same paper, Levan (1935) reported on three species with x=18 chromosome number, and in an earlier paper, Levan (1932) on two 18 chromosome species with "two t or st chromosomes per genome and thus may be easily derived from the 16 chromosome species (of *Allium,* and *Nothoscordum*) by segmentation of one m chromosome per genome. Such segmentations are actually still occurring in the (related) *Nothoscordum*" (Levan & Emsweller, 1938). It is to be noted that the reasoning is based on mechanisms that are still occurring in *Allium* and the related *Nothoscordum.*

Eid (1963) studied the chromosome morphology of *Allium neapolitanum* (x=7), *A. roseum* (x=8) and *A. zebdanense* (x=9), all Mediterranean species which have been placed in Section Molium in the past. In *A. neapolitanum* the chromosomes are metacentric, but in the latter two species teleocentrics are also present. Eid concluded that in this case the basic numbers form an ascending series since the teleocentrics have been derived through misdivision of the metacentric chromosomes of the basic x=7.

Results reported by Saghir (Ph.D. thesis, 1964) indicate that "the majority of the species of the section Molium have the basic x=7 chromosome number and contain a relatively high proportion of methyl sulfide and a low proportion of allyl sulfide, but in *A. roseum* (x=8) and *A. zebdanense* (x=9) the proportion of the methyl radical in the vapor of these two species is smaller and the proportion of the allyl radical is larger than in the species with the basic x=7 number, which indicates a similarity between them and suggests the possibility of their being derived.

In the same work (Saghir, 1964), the leaf anatomy of *A. roseum* (x=8) and *A. zebdanense* (x=9) is typical of that of the species with the basic x=7 chromosome number—one row of vascular bundles and the laticifers located subepidermally. This again suggests that x=8 and x=9 are derived from x=7. In section *Melanocrommyum*, all of the species have the x=8, except one, *A. karateviense*, which has the basic x=9 chromosome number. The leaf anatomy of this species is typical of that of the x=8 species—there are two rows of vascular bundles and the laticifers are embedded in the mesophyll. This again suggests that x=9 may be derived from x=8.

On the basis of these results from chemistry and anatomy, Saghir concluded that they lend support to the work of Levan (1932, 1935),

Levan & Emsweller (1939), (also Eid, 1965) to the effect that the primitive basic chromosome number in *Allium* is x=7, and that x=8 and x=9 are derived from the first either directly or indirectly.

In contrast to the results just summarized, Mensinkai (1940) and Brat (1965) have reached opposing views.

Mensinkai (1940) states that "8 appears to be the most primitive number since 90 per cent of the species in the list (as of 1939, which he appends) have 8 or its multiple as their haploid number." As indicated earlier, in the light of phytogeography, there is no warrant in believing that this is so merely because 90 per cent of the species in the list he made have the basic x=8 chromosome number. All of Mensinkai's caryological explanations for the derivation of x=7 and x=9 from x=8 are highly speculative and are not based on observable tendencies within the genus *Allium* and the related *Nothoscordum,* and Mensinkai's explanation cannot displace Levan's and Eid's evidence from caryology, and which is based upon observable mechanisms within the genus *Allium.*

Brat (1965) suggests that in considering the basic chromosome numbers in *Allium* it is important to work within groups which inhabit particular centers of distribution. In the section *Codonoprason* most of the species have the basic x=8 chromosome number, and only two species, *A. fuscum* (x=7) and *A. pseudoflavum* (x=9), are atypical in the group. He suggests that the single x=7 and x=9 species were derived from the x=8 species which are the norm (larger in number) in the group. He has apparently overlooked the role of phytogeography as already detailed, and in so doing has assumed with Mensinkai (1940) that since most of the species in *Codonoprason* have the x=8 number, it follows that the few exceptions have been derived from x=8 simply because there are more x=8 species. He derived x=9 from x=8 again, for the same wrong reason.

The evidence from phytogeography as presented earlier in the present paper is apparently in harmony with the evidence presented by Levan (1932, 1935), Levan & Emsweller (1938), and Eid (1965) on a caryological basis, and the results reported by Saghir (1964) on the basis of chemistry, and anatomy. Thus we are justified in accepting x=7 as the primary basic number in *Allium* since the preponderance of evidence supports it.

MAKING A GROUPING CHOICE

Although *Allium* species with the basic x=7 and x_2=8 basic chromosome numbers may be growing side by side, they are each evolving in separate directions as shown for *Allium neapolitanum* (x=7), of the Section *Molium,* and *A. roseum* (x_2=8) which also has been placed in the same Section, to mention only one instance. They have different proportions of methyl and allyl volatiles (Saghir, 1965). With the passing of time, other differences have most likely appeared, and others will show up in the future due to further evolution.

Once a series of basic chromosome numbers has evolved in a genus, each member of the series tends to be effectively isolated from the others. This usually rules out reticulate hybridization between species in the separate groups under ordinary conditions. Such isolated groups may provide a natural basis for the recognition of subgenera within the genus. In such a genus as *Allium* L. with over 650 species, it is a practical necessity to subdivide it to the extent warranted by the facts in order that it may be understood.

In *Allium,* with the *primary basic* x=7 chromosome number, the *secondary,* $x_2=8$ basic number apparently has been derived at various times from the primary basic number before and after the inter-glacial period. Those derived earlier and later apparently may potentially interbreed under ordinary conditions. Thus, they each form a natural group with members that differ phenontologically in some particulars. The $x_2=8$ species have no future on a genetic basis with any species with the x=7 basic number, and the group can be considered as a natural one so long as potential reticulate hybridization is inherent within it. The same observations may be made for the derived groups with the tertiary, $x_3=9$, and *quadrinary,* $x_4=10$, basic numbers.

The genus *Allium* may be grouped into at least three natural subgenera (see Traub, 1968b) due to a significant relationship between the basic chromosome numbers and the number and orientation of vascular bundles in the leaf blade; (to which may be added the number of nerves in the floral tepals), as indicated in Table 8.

Table 8. Genus **Allium** L.: grouping into subgenera using the basic (x) chromosome numbers, the number and orientation of leaf vascular bundles, and the number of nerves in the floral tepals, as criteria.

Subgenus	basic chromosome numbers (x) of species	foliage leaf blade; vasc. bundles; number of rows; orientation	floral tepals; number of nerves
I. **AMERALLIUM**	x=7, except a few $x_2=8$ and $x_3=9$	in one row with few exceptions	1-nerved
II. **NECTAROSCORDUM** ..	$x_2=8$	in one row	3—7-nerved
III. **ALLIUM**	x=8, except a few (x=7?) $x_3=9$ and $x_4=10$	(a) in flat or furrowed leaves, 2 opposed rows; (b) in fistulose * leaves, 1 circular row; or 1 irregular circular row (or 2?)	1-nerved

* No species with terete (solid) leaves have been studied so far.

An explanation apparently is in order with reference to the few exceptions noted in two of the subgenera. The evolutionary path is *asymmetrical* and never repeats itself; and it is natural that exceptions should be noted. In subgenus I. *Amerallium,* for instance, the few $x_2=8$ and $x_3=9$ species can be retained for practical reasons with the usual x=7 species. They are still similar to the latter in various phenontological characters since not sufficient time has elapsed for marked changes. The same can be said for similar exceptions in subgenus

III. *Allium*. Those who are not satisfied with the present grouping may wish to place the species into four subgenera according to the basic chromosome numbers, x=7, x_2=8, x_3=9 and x_4=10. Such a grouping may have some practical advantages for it would stimulate work on the determination of chromosome numbers in order to know where each species belongs. However, for the present, it appears best to proceed as outlined (see Table 8). The number of exceptions encountered is relatively small, and they can be dealt with as deviations that show evolutionary trends within the subgenera, apart from those exhibited by the usual potentially and actually interbreeding members of the population.

KEY TO THE SUBGENERA, SECTIONS AND SUBSECTIONS OF **ALLIUM** L.

In the following tentative key, the subgenera under *Allium* L. are arranged in conformity with the grouping choice indicated in the previous discussion. The subgenera are based primiarily on the basic (x) chromosome numbers, recognizing a few exceptions in each case. Within the subgenera, the grouping is on the phenontological [1] basis.

The subgenera are according to Traub (1968b) as explained earlier in this paper. Sections I—IV, including the North American *Allium* species with the basic x=7 chromosome number, are according to Traub (1967, and 1968a); the subsections are based mainly on the Alliances of Ownbey (1966).

Sections V—XVIII, including Old World species, with a few North American representatives are (a) based in the first instance on those of Stearn (1946); (b) with some changes and/or additions according to L. K. Mann in 1957, and as modified by him, assisted by Miss Dora G. Hunt, up to 1963; and (c) with further changes, additions and the inclusion of the reported chromosome numbers of the nomenifer species up to 1965; and the rearrangement of the whole on a tentative evolutionary sequence according to Traub.

1a. **Species with the basic x=7 chromosome number, with a few having the x_2=8 and x_3=9 basic numbers; about 75% North American, the rest Old World species.**

SUBGENUS I. **AMERALLIUM** TRAUB, **SUBG. NOV.**

Subgenus **Amerallium** Traub, **subgenus nov.,** (Amaryllidac.)

Species numero basali chromosomorum x=7 possidentes; species pauces numero basali x_2=8 et x_3=9 possidentes; numero basali chromosomorum cum dispositione in linea singula fasciculorum vasculorum folii conjuncto. Typus: **Allium canadense** L. 2n=14, 28

2a. North American species with the basic x=7 chromosome number:

3a. Plants reproducing by means of seeds, or bulblets in the umbel, or by bulb offsets; rarely by seeds alone; when new bulbs are borne terminally on rhizomes, the old bulbs persist, excepting in **A. bolanderi** and **A. unifolium** under Sect. III, subsect. VI; (see also Sect. IV, below).

4a. Bulbs appearing in tufts, produced on stout Iris-like rhizomes, except sometimes smaller in young plants; bulb coats membranous striate with elongate cells in regular vertical rows, and persistent parallel fibers; leaves several, flat, blunt, shorter than the scape; ovaries crestless, except in **A. crotophyllum**; flowers pink:

Section I. **CAULORHIZIDEUM** Traub, in Plant Life 23: 69. 1967;

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1 The term, **phenontological,** is used in preference to the usual term, **morphological,** because not only form but also all other heritable characters are included (see Traub, 1964), such as anatomy, chemical composition, method of vegetative propagation (physiology), color, odor, taste, etc.

syn.-Allium Validum Alliance, Ownbey (1966). Nomenifer: **Allium validum** S. Wats. **2n=—, 28, 56**

4b. Rhizomes often absent, or if present, then elongated, or reduced in size:

5a. Ovary crested or not crested; bulb coats membranous, or with a persistent reticulum of fibers:

Section II. **AMERALLIUM** (Plant Life 23: 89-95. 1967; nomenifer: **Allium canadense** L. **2n=14, 28).**

6a. Bulb coats thin, papery ,with indistinct vertical fibers; ovary crestless or crested:

Subsection I. **MEXICANA** Traub, Plant Life 23: 89-95. 1967, **anglise (Mexicanae)**; ibid. 24: 135. 1968. Nomenifer: **Allium mexicanum** Traub, **2n=?.**

6b. Bulb coats with a persistent reticulum of fibers; ovary crestless or crested:

Subsection II. **CANADENSIA** Ownbey ex Traub, in Plant Life 23: 89, 95. 1967, **(Canadenase)**; syn.-Allium Canadense Alliance, Ownbey (1966), **anglise.** Nomenifer: **Allium canadense** L. **2n=14, 28.**

5b. Ovary crests present (except in **A. lacunosum** and **A. hyalinum**), bulb coats membranous; secondary development of the inner epidermal cells of the inner bulb coats; or not characterized by such development:

Section III. **LOPHIOPRASON** Traub, in Plant Life 23: 69. 1967 Nomenifer: **Allium sanbornii** Wood; **2n=14.**

7a. Plants reproducing by seeds or offsets, or by bulbs on terminal rhizomes, the old bulbs persisting:

8a. Species not marked by the secondary development of the inner epidermal cells of the inner bulb coats:

9a. Leaves 2 or more, rarely 1, per scape:

10a. Leaves 2 (or 1) per scape, often flat or falcate; crests usually poorly developed; scape usually flattened, often strongly so; with "tumble weed" type of seed dispersal; mostly xerophytic:

Subsection I. **FALCIFOLIA** Ownbey ex Traub, in Plant Life 23: 69. 1967; syn.-Allium Falcifolium Alliance, Ownbey (1966), **anglise.** Nomenifer: **Allium falcifolium** Hook. & Arnott; **2n=14.**

10b. Leaves more than 2 (several) per scape; ovary crested; bulbs mostly elongate; scape decurved near apex:

Subsection II. **CERNUA** Ownbey ex Traub, in Plant Life 23: 69. 1967; syn.-Allium Cernuum Alliance, Ownbey (1966), **anglise.** Nomenifer: **Allium cernuum** Roth & Roem. **2n=14.**

9b. Leaf solitary per scape, except leaves 2 per scape in **A. bieglovii;** ovary prominently crested with members often lacerate; xerophytic:

Subsection III. **SANBORNIANA** Ownbey ex Traub, in Plant Life 23: 69. 1967; syn.-Allium Sanbornii Alliance, Ownbey (1966), **anglise.** Nomenifer: **Allium sanbornii** Wood; **2n=14.**

8b. Species usually marked by the secondary development of the inner epidermal cells of the inner bulb coats:

11a. Leaves 2—4, rarely 1, per scape, ovary usually inconspicuously crested (except crests replaced by an obtuse, thickened ridge in **A. lacunosum,** or crests absent in **A. hyalinum**); the inner epidermis of the inner bulb coats usually becoming thickened, forming a moisture-retaining membrane with cellular markings characteristic of the

species; xerophytic:

Subsection IV. **ACUMINATA** Ownbey ex Traub, in Plant Life 23: 69. 1967; syn.-Allium Acuminatum Alliance, Ownbey (1966), **anglise.** Nomenifer: **Allium acuminatum** Hook. **2n=14.**

11b. Leaves 2 per scape; ovary conspicuously crested; bulbs small, spherical; with usually sinuous walls (cleft or recessed) on the inner epidermal cells of the inner bulb coats; mesophytic:

Subsection V. **CAMPANULATA** Ownbey ex Traub, in Plant Life 23: 69. 1967; syn.-Allium Campanulatum Alliance, Ownbey (1966), **anglise.** Nomenifer: **Allium campanulatum** S. Wats. **2n=14.**

7b. Bulbs arising, or sometimes arising, terminally on a stout lateral rhizome, the old bulbs not persisting in the process (see also Sect. **Rhophetoprason,** below):

Subsection VI. **BOLANDERIANA** Traub, **subsect. nov.**

Subsection **Bolanderiana** Traub, **subsect. nov.,** Sect. **Lophioprason,** genus **Allium** L.

Tunicae bulborum reticulatae, reticulis obscuris angustis horizontalibus vel transverse serratis; bulbis semper vel interdum rhizomas laterales terminantibus, bulbis vetustis non persistentibus. Typus: **Allium bolanderi** S. Wats. **2n=14.**

3b. Plants reproducing by seeds, and by producing flowering-sized bulbs terminally on rhizomes, the old bulbs not persisting; bulb coats membranous, sparsely vertically veined with fibers; leaves 4—5 or more, prominently sheathing below:

Section IV. **RHOPHETOPRASON** Traub, in Plant Life 23: 110. 1967, **anglise;** ibid. 24: 141. 1968. Nomenifer: **Allium glandulosum** Link & Otto; **2n=—, 28.**

2b. Old World species with usually the $x=7$ basic chromosome number, including a few species with the $x_2=8$ and $x_3=9$ basic chromosome numbers:

12a. Scape not triquetrous:

13a. Floral umbel not nesting in the center of the leaves:

Section V. **MOLIUM** Endl. (1836). Nomenifer: **Allium neapolitanum** L. 2n=14, 28.

Section VI. **XANTHOPRASON** F. Hermann (1939). Nomenifer: **Allium moly** L. 2n=14.

13b. Floral umbel nesting in the center of the leaves, which lie on the ground; minute species; leaves 4 narrow, umbel 4-flowered; flowers white:

Section VII. **CHAMAEPRASON** F. Hermann (1939). Nomenifer: **Allium chamaemoly** L. **2n=?**

12b. Scape triquetrous:

Section VIII. **OPHIOSCORDON** (Wallr.) Endl. (1836). Nomenifer: **Allium ursinum** L. **2n=14.**

14a. Leaves oblong, acuminate at both ends:

Subsection I. **URSINA** (nomenifer: **Allium ursinum** L. **2n=14.**)

14b. Leaves petiolate, blade sharply keeled; stamen-filaments very narrow, inserted in two series; seeds arillated.

Subsection II. **TRIQUITRA** (nomenifer: **Allium triquetrum** L. **2n=18;** note also **Allium pendulinum** Ten. **2n=14, 18; A. paradoxum** (M.B.) G. Don; **2n=16)**

1b. Species with the basic $x_2=8$ chromosome number, with a few exceptions having $x_3=9$, and $x_4=10$ basic numbers ;all Old World species, except one North American species, and a few North American subgroups of Old World species:

15a. Tepals 3—7-nerved; seeds 8—11 per locule; pedicels markedly discoidally swollen at the apex:
SUBGENUS II. **NECTAROSCORDUM** (Lindl.) Traub. **comb. nov.**, Syn.-genus **Nectaroscordum** Lindl., Bot. Reg. 9: pl. 1912. 1836. Nomenifer: **Allium siculum** Ucria, 2n = 16.
Section IX. **NECTAROSCORDUM**

15b. Tepals 1-nerved; pedicels, if at all, only slightly swollen at the apex:
SUBGENUS III. **ALLIUM** (nomenifer: **Allium sativum** L., 2n = 16, 48)

16a. Leaves not fistulose:

17a. Leaves oval to petiolate:
Section X. **ANGUINUM** G. Don ex Koch (1837); Nomenifer: **Allium victorialis** L. **2n=16, 32**

17b. Leaves not oval to petiolate:

18a. Umbel more than 2-flowered:
Section XI. **RHIZIRIDEUM** G. Don ex Koch (1837); nomenifer: **Allium senescens** L. **2n=—, 32, 48.**
Subsection I. **TUBEROSA** (nomenifer: **Allium tuberosum** Rott. ex Spreng. **2n=16, 32.)**
Subsection II. **INDERIENSIA** (nomenifer: **A. inderiense** Fisch. ex Bunge, **2n=?)**
Subsection III. **SENESCENSIA** (nomenifer: **A. senescens** L. **2n=—, 32, 48.)**
Subsection IV. **SIKKIMENSIA** (nomenifer: **A. sikkimense** Bak. **2n=—, 32.)**
Section XII. **MELANOCROMMYUM** Webb & Berth. (1843); nomenifer: **A. nigrum** L. **2n=16.**
Section XIII. **CODONOPRASON** (Rchb.) Endl. (1836); nomenifer: **A. oleraceum** L. **2n=—, 32, 40.**
Section XIV. **PETROPRASON** F. Hermann (1939), nomenifer: **A. obliquum** L. **2n=16.**
Section XV. **ALLIUM** (nomenifer: **A. sativum** L. 2n = 16.)
Section XVI. **HAEMOPRASON** F. Hermann (1939); nomenifer: **A. melanantherum** Panc. **2n=?)**

18b. Umbel 1-, rarely 2-flowered; plant small, delicate, slight alliaceous odor; leaves 1—2, nesting on the ground; style 3-lobed nearly to the middle:
Section XVII. **MICROSCORDUM** Maxim. (1887); nomenifer: **A. monanthum** maxim. **2n=16, 32.**

16b. Leaves fistulose:
Section XVIII. **CEPA** (Moench) Prokh. (1931); nomenifer: **A. cepa** L. **2n=16, 32.**
Subsection I. **CEPA**; nomenifer: **A. cepa** L. **2n=16, 32.**
Subsection II. **FISTULOSA**; Nomenifer:**A. fistulosum** L. **2n=16.**
Subsection III. **SCHOENOPRASA** (nomenifer: **A. schoenoprasum** L. **2n=16, 32.)**
Subsection IV. **POPOVIANA** (nomenifer: **A. popovii** Vved. **2n=16.)**

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THE INHERITANCE OF MELON FLOWER COLOR IN **HEMEROCALLIS WASHINGTONIA**

Hamilton P. Traub, G. W. Bohn and Thomas W. Whitaker

There is a paucity of information concerning the inheritance of flower color in *Hemerocallis*. The following note records some observations of flower color in the allotetraploid *H. washingtonia* (Traub, 1951, 1959, 1960) which we hope will be helpful to breeders investigating these problems. The gene or genes responsible for melon flower color (color similar to the flesh of a cantaloupe) are widely distributed in hybrid diploid *Hemerocallis* species (2n=22). For example, it occurs in the clones 'Frances Fay', 'Satin Glass', and others. It also occurs in the allotetraploid *H. washingtonia* (2n=44) derived from similar diploids. Melon flower color in its yellow or pastel form appears in progenies of both diploids and the tetraploid, but no studies have been made of its inheritance.

During 1964 a tetraploid "melon" seedling was pollinated by a tetraploid "mulberry purple" seedling. The seeds were planted in December 1964, and the seedlings transplanted to the field in February, 1965. A few of the seedlings flowered in August, 1965, and the remainder in the spring and summer of 1966. The results are shown in Table 1.

Table 1. Progeny from the cross melon x mulberry purple in **Hemerocallis washingtonia.**

Flower Color		Observed	Expected	Chi-square
Melon				
yellowish melon		6		
pastel melon		3		
	Total	9	7.25	0.4224
Purple				
deep purple		6		
red purple		101		
	Total	107	108.75	0.0281
Totals		116	116.00	0.4505

If the two shades of melon flower color and the two shades of purple are combined, the calculations show a non-significant chi-square, assuming two factor segregation in the tetraploid *H. washingtonia*. It is also

assumed that only the full recessive exhibits the melon phenotype. This interpretation is merely tentative. Selfing and backcrossing of selected melon and purple phenotypes would be required to establish the hypothesis. Unfortunately most siblings are self-sterile and cross sterile. With non-siblings, however, fertile matings occur so that the project could be carried forward by propagating these combinations. It is hoped these few observations will stimulate others engaged in breeding *Hemerocallis* particularly *H. washingtonia,* to report their results.

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PLANT LIFE LIBRARY

INTRODUCTION TO PLANT BREEDING, by Fred N. Briggs and P. F. Knowles. Reinhold Publishing Corporation, New York. 1967. 426 pp. $12.50. It seems trite to state that the test and later success of any textbook can be measured by its capability to fill the niche for which it was designed. This textbook by the late Dean F. N. Briggs and Prof. P. F. Knowles, both of the Davis Campus of the University of California, has been specifically tailored to satisfy the needs of advanced undergraduates for a course in plant breeding. In the opinion of the reviewer, *Introduction to Plant Breeding,* is admirably designed to meet this challenge.

A glance at the title and sub-titles of the 30 chapters of the book suggests furthermore, that the prospective student before attempting to use this book should be well grounded in the biological sciences, particularly genetics, botany, and perhaps some phase of crop production. If we assume a student has these requirements, Chapter 4 (Mode of Reproduction in Relation to Plant Breeding Methods) could be eliminated, since much of this material is covered in elementary courses in Botany and perhaps elsewhere. The same might also be said of Chapters 5 and 30, which are concerned with statistics, but here Prof. Knowles makes a compelling case for including some statistics in an undergraduate text on plant breeding.

A pleasant and instructive innovation are the quotations that follow each chapter heading. These quotations from such varied authorities as Darwin, Walt Whitman, E. R. Sears, and Paul Mangelsdorf set the theme for the ensuing chapter. The Résumé of each chapter, followed by an abundant list of pertinent references are helpful pedagogical aids. It is disappointing to note that the authors have not included a set of questions for discussion or problems for solution at the end of each chapter. Discussion and problems are proven techniques for assisting the motivated student to acquire an understanding of a subject. Surely, they would have improved a textbook of Plant Breeding.

Coverage of the principles and methods of plant breeding is current and comprehensive. There is an Appendix of three statistical tables, and a sixteen page Index.—*Thomas W. Whitaker.*

ORIGINS OF MENDELISM, by Robert C. Olby. Schocken Books, New York. 1966. 204 pp. $6.95. This scholarly, well-written book by Dr. Robert C. Olby, Librarian, Botany School, Oxford University, Oxford, England, dissipates under a load of evidence the widespread myth that Gregor Mendel, the gentle Austrian monk and founder of genetics, worked in a vacuum, and owed nothing to his

predecessors or contemporaries. Olby's researches clearly show that the success of Mendel's work was not an isolated phenomena, but the culmination of a series of studies commencing with the classical hybridization experiments of Koelreuter about a century before Mendel's paper was published. This is not to denigrate Mendel or his achievements. Mendel, although a shy and humble man, probably had one of the most brilliant and creative minds in the entire history of Biology, and he used it well.

Olby's carefully documented research reveals that Mendel's approach to biology was primarily that of a physicist. This is not surprising since much of his training at the University of Vienna was in experimental physics, the use of physical apparatus, and the mathematical analysis of physical problems. Furthermore, for a number of years he was an instructor in physics and natural philosophy at the technical high school in Brno. Olby suggests that Mendel looked upon his famous hybridization experiments with peas much as he would a classroom demonstration in physics. As Olby shows, this explains in part Sir Ronald A. Fisher's criticism of Mendel's results.

This book is important because it analyzes in detail what might be called the life and times of Mendel; the reasons why his work was ignored for a period of over 30 years, and finally the setting in which the work was rediscovered. Although Olby does not mention it, his meticulous research strongly suggests that there were really only two rediscoverers of Mendel's work, de Vries and Correns. It is clear that de Vries and Correns independently performed experiments that supported Mendel's results when they came upon his paper, "Experiments on Plant Hybrids," published in 1866. Furthermore, de Vries and Correns developed an interpretation to explain their data. On the other hand, there is no evidence that Tschermak (the third codiscoverer) had a real understanding of the Mendelian rules of heredity.

Professor C. D. Darlington has written a provocative Foreword. It is characteristic undiluted Darlingtoniana, fresh, suggestive, perhaps not always correct in detail, but invariably stimulating. Even Prof. Darlington's sharpest critics have never accused him of being dull. There is an Index, and an Appendix to each Chapter collected in the rear of the book. To avoid extensive documentation in the text, pertinent quotations from such well known biologists as Koelreuter, Buffon, Amici, Galton, Fisher and others, are assembled in the Appendices.

The Origins of Mendelism makes pleasant reading, and if one is curious about the development of great ideas in science and their subsequent reception, this book supplies a detailed documentary of the entire process. With this book along with the excellent, "Origin of Genetics—A Mendel Source Book," by Stern and Sherwood, we have a complete record, or as complete as it is ever likely to be, of all aspects of the Mendelian story.—*Thomas W. Whitaker*

GENETIK UND ZYTOLOGIE VON ANTIRRHINUM L. SECT. ANTIRRHINUM, by Hans Stubbe. Veb Gustav Fischer Verlag, Jena. 1966. 421 pp. 82 dr. For those fortunate individuals fluent in German, and interested in genetics and cytology, reading this book of 421 pages by Prof. Hans Stubbe could be a rewarding experience. Packed with information, not only about the genetics and cytology of *Antirrhinum*, but also the systematics, distribution, morphology, and ecology of the genus, it is a fitting monument to Prof. Stubbe's consistent record of high level research. Truly a *magnum opus*, Prof. Stubbe has dedicated the book to his teachers, Erwin Bauer and Fritz von Wettstein, those giants of German biology of the early part of this century. Bauer commenced investigations with *Antirrhinum* about 1906; the latest paper cited by Stubbe was published in 1963; thus the book covers nearly 60 years of experimental work with snapdragons. Lest anyone think Stubbe was not an active participant in these investigations, an inspection of the list of literature cited shows that he is the author of more than 30 papers specifically concerned with *Antirrhinum* genetics. The book is indeed a classic example of the thoroughness and best in German scholarship.—*Thomas W. Whitaker*

INVESTIGATIONS INTO GENERATION 1651-1828, by Elizabeth B. Gasking. The Johns Hopkins Press, Baltimore. 1967. 192 pp. $6.00. This scholarly, meticulous history of sexual generation from 1651 when William Harvey published his *De Generatione* up to 1828 when von Baer discovered the mammalian egg is authored by an Australian, Dr. Elizabeth Gasking of the Department of History and Philosophy of Science, University of Melbourne, Melbourne. Dr. Gasking has done her homework well. The book is copiously documented; there is a Bibliography of 101 references, and adequate Index, and a Time Chart of the history of generation from 1651 to 1915.

The word "Generation" in the title may puzzle the layman, and even the modern biologist. Dr. Gasking explains that "Generation" in its restricted sense was the term applied to the coming into existence of new individual organisms both animal and plant, regardless of the method involved. Gradually the meaning of the term was broadened to include the problems of organic growth and differentiation. After being used from antiquity until the beginning of the nineteenth century the word "Generation", through some accident of history, fell into disfavor and gradually into disuse, although there continued to be no lack of interest in the problems it formerly designated. In fact, these problems have achieved some semblance of unity in modern genetics.

Dr. Gasking is concerned primarily with the theoretical opinions advanced by influential biologists, and the investigations which moulded their opinions, and determined their outlook. The distinguished array of early experimental biologists whose work is extensively analyzed, includes in addition to William Harvey; Maupertuis, Wolff, Haller, Bonnet, Spallanzani, von Baer and several others. Present day biologists curious about what their precursors were doing and thinking during the late seventeenth and eighteenth centuries can turn to Gasking's book for an authoritative answer.

Despite the fact that the period covered was one of the most exciting in the entire history of biology, I found the book difficult to read, and occasionally downright dull. Dr. Gasking's writing is on the whole pedestrian and lacks the sparkle and zest needed to hold her readers, even though her scholarship may be impeccable. —*Thomas W. Whitaker*

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.

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[AMERICAN AMARYLLIS SOCIETY, continued from page 2.]

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1. AMARYLLIDACEAE: TRIBE AMARYLLEAE, by Traub & Moldenke (including the genera Amaryllis, Lycoris, Worsleya, Lepidopharynx, Placea, Griffinia, and Ungernia; Manila covers; 194 pages, incl. 18 illustrations. $5.00 postpaid.

This is required reading for every amaryllid enthusiast.

2. DESCRIPTIVE CATALOG OF HEMEROCALLIS CLONES, 1893—1948, by Norton, Stuntz, and Ballard. A total of 2695 Hemerocallis clones are included and also an interesting foreword, and explanatory section about naming daylilies. Manila covers; 100 pages (1—X; 1—90), includes a portrait of George Yeld. $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, 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.

PERIODICALS

(**A**) **HERBERTIA** [**First series,** 1934 to 1948, incl.], devoted exclusively to the amaryllids (Amaryllidaceae), and the workers concerned in their advancement. A complete set of these volumes is indispensable to all who are interested in the amaryllids. Libraries should note that this may be the last opportunity for complete sets.

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