

SAGUAROWAND

BULLETIN

DESERT BOTANICAL GARDEN OF ARIZONA

JANUARY, 1955



Agave cernua Berger
F. Riviere photo



REG-MANNING

EDITORIAL

Once again our Cactus Show time approaches as the show, this year, will open on Sunday, February 20th, at 12 noon and close at 5 P.M. Sunday, February 27th.

Again this year our Eighth Annual Show will be under the direction of W. H. Earle, our Superintendent, who made a great success of the last three shows.

Mr. Earle again calls for volunteers from our membership to act as guides, guards and hostesses during the show and he asks you to contact him by phone or in person and let him know

first to make reservations will be given the best spaces.

We then can have some idea of the number of tables we will need for this show and can be prepared to give ample space to all entries.

As this editorial is written the year 1954 nears its end and we look forward with great expectations to 1955. It is a suitable time to assess the accomplishments and failures of the old year and to plan for greater progress in the year ahead.

We feel that we have accomplished



A view of last years Cactus Show in Webster Auditorium

the time which will be most agreeable to you so that he can be sure in advance of enough volunteer helpers to have several on duty every hour of the eight days of the showing.

A schedule of entries for exhibits is printed in the center section of this issue of the Bulletin and can be removed for more convenient use.

Why not plan now to enter the show and decide in which section and classification your entries will be made, then notify Mr. Earle of the number of entries you plan and the approximate space that you will need for your entries.

Space will be assigned to you and the

many of the things we planned at this same period of 1953. New walks have been opened and blacktopped. Four new stone benches have been built as has our new meditation room and large new areas along the new walks have been landscaped. We have completed the Archer House by adding to its large terrace.

We have slightly increased our membership over the last year but not to the extent that it should have increased. We have done little towards the needed new parking lots and entrance building except to landscape up to the point where the building will be erected.

Increased membership and progress

on the parking lots and entrance building will therefore be our main objectives for 1955.

Our gratitude to the many members who so generously gave of their time and money during this past year. They have been wonderful and much too numerous to name in the available space.

A few names, however, stand out in our memory. There is John Eversole who has given us many needed pieces of equipment and generous cash contributions. Mr. Albert Simms of Albuquerque, whose contribution paid for our herbarium cases and the work on the new Morawetz path.

Charlie Mieg has donated cash and made three expensive trips to secure for us several hundred rare plants from Mexico and the United States all thoroughly annotated. The Hermann family who gave generously of their time to

the garden and took time, at their own expense, to make collections of the new *Pediocactus hermannii* and many other species, for us.

Herman Schroeder of Avalon, Calif., has sent us many beautiful seedlings grown by himself over many years which are now admired as outstanding in our lath house, and Paul Hutchison of the Botanical Garden of the University of California from whom we have received several hundred rare plants, many collected by himself in Peru and Chile.

The list might go on and on but these mentions will indicate the reason for the marked improvement in our plantings during the last year.

To all of you the best wishes of the Staff and your editor for the coming year, may 1955 be a happy and prosperous one for you.



Another view of last years Cactus Show

CORRECTION

Mrs. Carroll Mills of Phoenix advises us that the plant of the claret cup cactus illustrated by us in the December Bulletin on page 114 was photographed in color by Carroll Mills several months before the black and white picture we used was taken by John Hales.

In our article we stated that "the plant was found by our member, Man-

uel Diaz, near Mayer, Ariz." and this statement is true even though it had also been previously found by Mr. Mills and, doubtless by others, before that time.

We are glad to make known the fact that it was Mr. Mills who gave John Hales directions for finding it.

Seventh Annual
CACTUS SHOW

FEBRUARY 20TH TO FEBRUARY 28TH, 1955

Administration Building
Desert Botanical Garden

Entries can be placed in space assigned after 1 P.M. Saturday, February 19th or before 10 A.M. Sunday February 20th. Exhibits can be removed Sunday February 28th after 5 P.M. or on Monday, February 28th. For additional information telephone WH 5-8513.

Exhibits Open to the Public

12 Noon Sunday, February 20th, 1955
Daily to February 27th, 10 A.M. to 5 P.M.

No Admission Charge

W. H. Earle, Show Manager

Schedule of Classifications

SECTION "A" POTTED SPECIMEN PLANTS

1. One species of cactus
2. Seeding cactus
3. Grafted cactus
4. Crested cactus — own root
5. One species of a Succulent plant other than Cactus
6. Desert Trees and Shrubs. One species potted.

SECTION "B". COLLECTIONS OF POTTED PLANTS

1. Cacti, at least five species
2. Other Succulents, at least five species
3. Desert trees or shrubs, at least five species
4. Cacti, ten species or more
5. Succulents, ten species or more
6. Collections of 5 plants of one genus — Cactus
7. Collection of 5 plants of one genus — Succulents
8. Collection of over 5 plants of one genus — Cactus
9. Collection of over 5 plants of one genus—Succulents
- 10: Collection of Cactus Grafts
11. Collection of Chollas
12. Collection of Prickly Pears
13. Collection of Echinocereus
14. Collection of Barrels
15. Collection of Mammillarias
16. Collection of Coryphanthas
17. Collection of Epiphyllums
18. Collection of Cereanae
19. Collection of Echinopsis
20. Collection of Lobivias & Rebutias
21. Collection of Crests

SECTION "C". DISH GARDENS (Accessories Permitted)

1. Dish garden 9" or less — Cactus
2. Dish garden 9" or less — Succulents
3. Dish gardens 9" or less — Cactus and Succulents
4. Dish garden over 9" — Cactus
5. Dish garden over 9" — Succulents
6. Dish garden over 9" — Cactus & Succulents
7. Miniature Cacti in containers
8. Hanging Basket
9. Strawberry Jar 14" tall or less
10. Junior entries by schools. Juniors may enter in any classification and will be judged separately.

SECTION "D". ARRANGEMENTS WITH ACCESSORIES

1. Cacti for centerpiece
2. Succulents for centerpiece
3. Cacti and Succulents for centerpiece
4. Cacti with garden flowers as accessories
5. Succulents with garden flowers as accessories
6. Cacti, American Indian influence
7. Corsage of Succulents
8. Terrarium
9. Novelty container with Cacti
10. Novelty container with Succulents
1. Novelty container with Cacti and Succulents
12. Button Gardens
13. Arrangements with Dried Material
14. Miniature arrangements

SECTION "E". ROCK GARDENS. (Entries open to individuals, Garden Clubs and Organizations; space must be reserved in advance)

1. Rock garden, not over 9 square feet
2. Rock garden over 10 square feet

SECTION "F"

1. Educational exhibits
2. Book exhibits
3. Water Colors — Oils — Pen & Ink

SECTION "G"

1. Rarest Cactus
2. Rarest Succulent

Judges Scale of Points:

Maturity and condition of plant	30
Number of species in a collection	30
Staging	15
Correct labeling	25
	<hr/>
	100

NEW STAFF MEMBER

We are happy to announce the appointment of Dr. James A. McCleary as our Senior Botanist. Dr. McCleary is presently Associate Professor of Botany at Arizona State College at Tempe and he will continue in that capacity but will also be at the Garden as often as his duties at the College permit. He will be here on Saturdays and Sundays regularly.

Dr. McCleary's first interest was the club mosses but he has acquired a deep interest in the Desert vegetation since coming to Tempe and has used our Garden as a center for his study of the succulent plants. As a result of those studies an excellent course on succulent plants was given by him at the College.

In October, Dr. McCleary and four of his students made the first of four planned trips to the bottom of the Grand Canyon to study and record the flora of that area.

The trips, made possible by a grant, are designed to cover the area in each

of the four seasons and thereby to record the plants of each season. Of particular interest was an Agave, a single leaf of which had been collected some years ago but without flowers or fruit and which varied considerably from any species known to be indigenous.

The first expedition collected several variations in Agaves to be grown in cultivation for further study.

The Desert Botanical Garden has accumulated a considerable number of specimens of Agaves in the last ten years but their determination will have to await flowering and fruiting.

We have asked Dr. McCleary to take the Agaves as his particular study with the ultimate intention to monograph them.

This project will take many years and a great deal of cooperation from such of our members who live in areas where the Agave is indigenous or who travel through such areas. His appeal for assistance appears below.



Agave bracteosa Mar. flowering in "Pinya de Rosa" Garden
Gerona, Spain. Fernando Riviere photo

A New Research Program At The Desert Botanical Gardens

The Desert Botanical Garden is launching a new, long-time research into the Genus Agave. Even the common name "Century Plant" is indicative of the lengthiness of the problem. Monographs on the "Agaves" of various areas, such as that of Trelease "The Agaves of Lower California" or Mulford's "Agaves of the United States" have appeared from time to time and Berger in 1915 published a book on the entire genus. Since that time only scattered articles have been written describing new species or presenting new data on distributional aspects of the group. It is our plan to restudy the genus and to bring information concerning it up to date.

Members of the Garden staff will attempt to obtain living specimens of all species known from a number of widely separated regions, plant them in the garden, and then study them under as near normal conditions as possible. Since various species may live thirty-five years, more or less, before flowering, this project will take considerable time for completion but it is felt that

the time and effort spent will be eventually justified.

Perhaps the greatest difficulty facing anyone who attempts to do research in classification of large and complicated genera is the original step of obtaining desirable specimens or materials. It is hoped that the many friends of the garden will help at this point. You are invited to share in this work by collecting Agaves and sending them to the Gardens. Living plants with not over eight inches spread are the most desirable. If you are making a collecting trip into an area or live in a region where these plants are located, we would appreciate receiving several of them. Even the same species of Agave from different localities would be helpful especially if any variation at all is shown. Certain precautions are necessary, however. Plants without sufficient data are useless, particularly the exact location. The scientific name would save a lot of time for us, however, don't withhold the plant simply because the name is not known to you. Perhaps we can identify it. If nearby plants of the same



A prize winning arrangement in last year's Cactus Show.
The center of interest is an Agave.

species are in flower or fruit, include specimens of these since identification is based upon these portions primarily. Photographs are often useful. Other information such as time of flowering or fruiting, color of flower or fruit, direction of slope if on a hillside, soil conditions, amount of moisture available during the year, amount of shade, etc., can be extremely helpful to the horticulturist in locating a likely spot for its continued growth and seeing that climatic conditions are as nearly like the

original condition as possible.

When gathering the plants, be careful in digging that the roots are not damaged. Wrap in several thicknesses of dry newspaper and ship as quickly as possible. Unlike the cacti, the Agave cannot take prolonged drought nor can the plant endure having the roots removed.

From time to time, information acquired from this study will be published in the Bulletin.



Agave cernua Berger flowering in "Pinya de Rosa" Garden
Gerona, Spain. Fernando Riviere photo

DESERT BOTANICAL GARDEN

BOOK DEPARTMENT

P. O. Box 547 Tempe, Arizona

PACKAGED CACTUS PLANTS

Attractive packages with cut cellophane packing.

			Post- Price age*		
No. 1	5 year old Saguaro Seedling				
	2" high	.50	.10		
No. 2	Golden Barrel	.50	.10		
No. 5	5 plants	1.00	.30		
No. 10	10 plants	1.50	.40		
No. 10W	10 white spined plants, collectors items	3.00	.40		
No. 15	15 large plants	2.50	.50		
No. 16	16 still larger plants	4.50	.60		
No. 24	24 large plants, many of flowering size	7.00	1.00		

PRICKLY PEAR PRODUCTS

Prickly Pear Delight—

A Turkish delight type of confection made from prickly pear cactus fruits, provocative flavor

½ pound box	.85	.25
1 pound box	1.60	.35

Prickly Pear Jelly—

4-12 oz. glasses in shipping carton. A clear red jelly of exceptional flavor

	2.35	1.25
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Kachinas

These dolls are made of drift wood, always cottonwood root which has been water-logged and sun dried. They are carved by hand and hand colored with tempera paints and are each an accurate reproduction of Hopi Indian Gods and made by a Hopi-Abbott Sakiestewa. We have many different Kachinas in each price range.

	Postpaid
2½ inches high.....	.85
3 inches high.....	1.10
4 inches high.....	1.65
5 inches high.....	2.20
6 inches high.....	3.30

BOOK SUGGESTIONS:—

	Postpaid
Arizona Cactuses; Marshall paper binding, 2nd Edition	1.15
cloth binding, 1st Edition	1.85
A description of all the species native to Arizona. 60 ills.	
Cactaceae, Marshall & Bock	8.25
Only 2 more copies available.	
Succulent Plants, Marshall	10.00
Including 20 Viewmaster reels. Viewmaster \$2.00 extra and postage.	
Now out of print: 4 copies available.	
Cactus for the Amateur	3.65
Succulents for the Amateur	3.65
Flowers of the Southwestern Desert — Dodge	1.15
Flowers of the Southwestern Mesas — Patraw	1.15
Flowers of the Southwestern Mountains — Arnberger	1.15
Animals of the Southwestern Deserts — Olin	1.15
Flowering Cactus — Carlson, Avey & Proctor, 81 Color Plates, 34 black and white plates.	
Trees & Shrubs of the Southwestern Desert — Benson & Darrow	8.70
The Giant Cactus Forest and Its World — Howes	7.70

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DESERT BOTANICAL GARDEN OF ARIZONA

FEBRUARY, 1955



Toumeyia papyracantha in
Arizona



REG-MANNING

EDITORIAL

This is the month of the Cactus Show and this year's show will be the eighth annual one.

At this time the prospects for a good show are very high and exceptional interest has been shown by exhibitors.

The Phoenix Gazette will again co-sponsor the show so that full newspaper coverage is assured. We are very happy about our cordial relations with this excellent newspaper.

Mr. Earle, the show manager, needs additional volunteers to help out during the show either as guards, hostesses or aids at the sales tables. If you can spare us a day or so of your time please phone Mr. Earle, WH 5-8513, and arrange to be here on a given day or part of a day.

WILDFLOWERS

The rains of January may or may not produce wild flowers but they have caused a heavy increase in incoming telephone calls for information on the prospects of wild flowers.

We can only say that if the rains continue in February, as predicted, and the temperatures are moderate we should have a nice showing of wild flowers in March.

REPLANTING DESERT AREAS

We had a visit from Dr. Peter Duisberg of El Paso, Texas, who has become deeply interested in the Cactaceae of the United States and is a member of the El Paso Club who will be hosts to the Convention of the Cactus & Succulent Society of America this summer.

Dr. Duisberg has made the suggestion that collectors of desert species of cactus could make a valuable contribution to the preservation of desert flora by planting seeds of cactus species in favorable locations while collecting specimens.

To be successful only seeds of species endemic to the area should be planted and the planting should be done in areas of public land or on private land with the owners permission.

This suggestion has considerable merit and we will offer it for consideration at the next meeting of our Cactomania.

INFORMATION

Your editor has received a letter from Mr. John Palmer Rogers in which a number of valuable suggestions of extension of range for Arizona Cactuses are noted and other interesting ecological facts are given for our information on the next revision of "Arizona Cactuses."

We thought the letter so interesting and informative that we are printing it in full for the use of our members.

SCHEDULE OF EVENTS

For the information of our members we are also printing a complete schedule of all of the planned special events for the remainder of this winter season:

Thursday Afternoon Lectures At
3:30 P. M.

Subjects:

Feb. 3rd — Deserts of Texas and New Mexico.

Feb. 10th — Cactus Flowers.

Feb. 17th — Wild Flowers, Trees and Animals.

Feb. 24th — Cactus Show. No lecture.

March 3rd — Northern Arizona.

March 10th — Southern Arizona.

March 17th — Deserts of Texas and New Mexico.

March 24th — Cactus Flowers.

March 31st — Wild Flowers, Trees and Animals.

April 7th — Northern Arizona.

April 14th — Southern Arizona.

April 21st — Deserts of Texas and New Mexico.

Last of Season.

Wednesday Afternoon Classes in Appreciation of Desert Plants.

A series of 5 talks. Repeated 4 times each year.

Feb. 2 — Lesson 4: Mesophytes and Annuals.

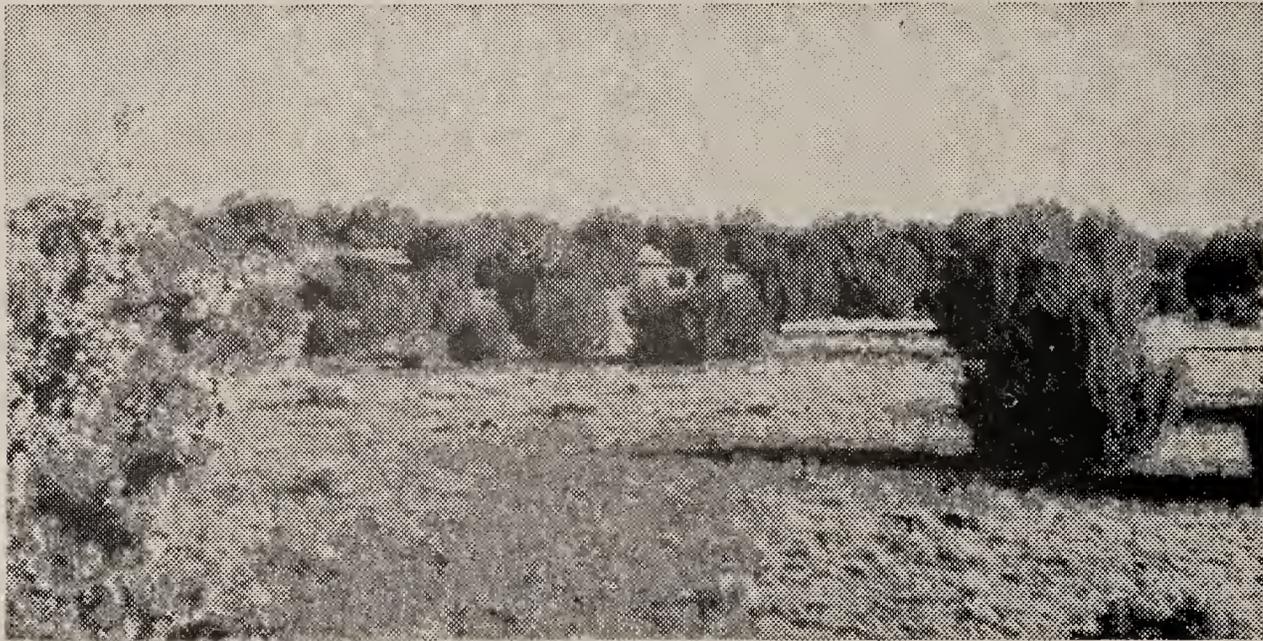
Feb. 9 — Lesson 5: Review and Awarding of Certificates.

Feb. 16 — No Lecture.
 Feb. 23 — Cactus Show — No Lecture.
 March 2 — Lesson 1: General Vegetation of Deserts.
 March 9 — Lesson 2: Succulent Plants.
 March 16 — Lesson 3: Xerophytes.
 March 23 — Lesson 4: Mesophytes and Annuals.
 March 30 — Lesson 5: Review and

Awarding of Certificates.
 This is the last Lecture of this Season — To be resumed next fall.

CACTUS SHOW

Opens Sunday, February 20th, at noon.
 Feb. 21st to Feb. 27th, 10 A. M. to 5 P. M.
 closing at 5 P. M. Sunday, Feb. 27th.
 Exhibits in Administration Building.



Habitat of *Toumeyas papyracantha* in the White Mountains of Arizona. Note the Juniper Trees and the absence of Pine Trees.

COVER ILLUSTRATION

A plant of *Toumeyas papyracantha* (Engelmann) Br. & R. located by the Hermanns last summer in a district where they were not known to occur.

We print above a picture taken by the Hermanns at the point of collection of the plant illustrated on the cover

showing a typical terrain for *Toumeyas*.

Known locally as Arizona's paper-spined cactus, *Toumeyas papyracantha* is one of the most insignificant of cactus plants but one of the most interesting and curious.

MRS. LOU ELLA ARCHER

This month we introduce to our readers the Vice President of Arizona Cactus and Native Flora Society, the sponsors of the Desert Botanical Garden of Arizona.

Mrs. Archer is one of the original Founder Members and was on the Building Committee when the Administration Building was planned.

On April 1st, 1946, Mrs. Archer was at Camelback Inn and attended an illustrated lecture by our Director in which he explained that the death of Mrs. Webster and the terms of her will necessitated a rapid build up of mem-

berships in the Garden from the less than 50 on the books to over 200 as stipulated by her will.

Mrs. Archer came to the Garden the next day and there purchased memberships for 75 friends and her generosity and the generosity of two other persons made it possible for the Garden to qualify for Mrs. Webster's endowment.

Elected to the Executive Board in 1947, Mrs. Archer was elected to the Vice Presidency by the Board and has been continuously reelected because of her helpful suggestions and generous contributions in times of need.

Mrs. Archer presented us with our first air conditioning and a wonderful pest control device which is still in use.

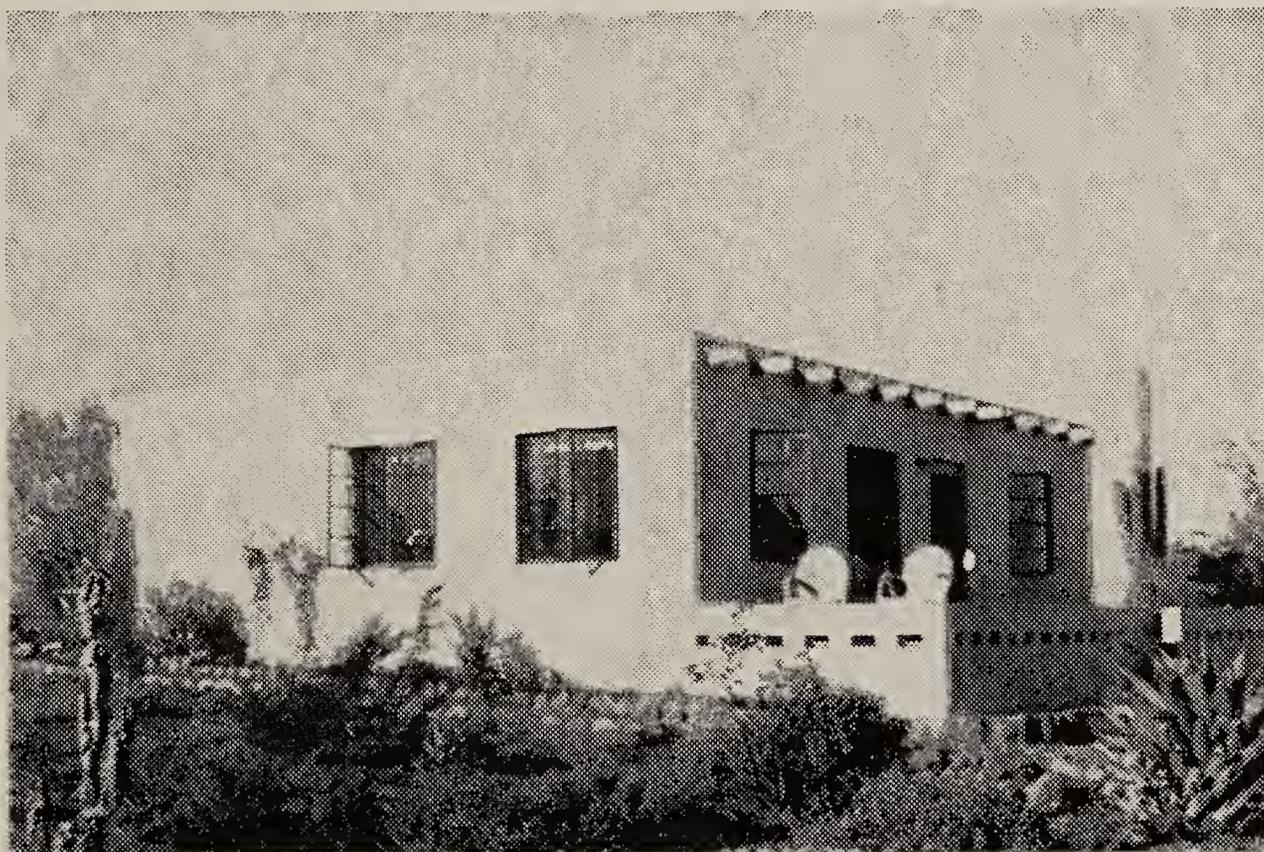
In 1951 the entire roofs of the Administration Building, there are 7 separate roofs, had to be replaced and the roof drainage leveled and no funds were available but Mrs. Archer came to our rescue and donated enough not only to care for the roof repairs but a surplus which we used as the major part of the cost of a new residence we were erecting for our Superintendent. For that reason the new residence was named The Archer House.

Mrs. Archer has permitted the use of her home for many Executive Board

Meetings and has always found time from her many activities to help us solve many of the problems that have arisen.

In addition to her interest in the Desert Botanical Garden, Mrs. Archer is an active worker and contributor to a Phoenix hospital and she is intensely interested in several Garden Clubs and exhibits in the Flower Shows where she always collects many blue ribbons.

The Executive Board and our entire membership have every reason to appreciate Mrs. Archer's many kindnesses and we are sure that she will be re-elected to the Board for many years in the future.



A view of Archer House taken in the summer of 1954 when we added the terrace in front of the residence.

LETTER FROM JOHN PALMER ROGERS

W. Taylor Marshall
Desert Botanical Garden of Arizona
P. O. Box 547
Tempe, Arizona

My dear Mr. Marshall:

For some time I have been using your booklet, "Arizona's Cactuses;" and I believe that, as a result of a large number of field trips to various parts of Arizona and neighboring states in pursuit of as much knowledge as I might obtain through study of cactus plants growing in their native haunts, I may have come into possession of a few facts which may be of interest to you and to the Society which you represent. Until his death a few years ago, I was a friend of Dr. Forrest Shreve, who very considerately guided me with great helpfulness in the study which I was undertaking. I am not a professional scientist; and it is possible that the information below is of less value and of more common knowledge than I realize; but I am passing it on to you in the hope that it may be useful.

1. It seems to me that there are at least two varieties, worthy of separate recognition, of *O. versicolor*: the one, which should probably be regarded as the typical variety, which grows throughout most of the recognized range of the species, and has long-persistent, plump, usually smooth, largely or entirely spineless fruits — and branches which in many plants are plump and largely or entirely lacking in tubercles, except during prolonged dry spells, when the joints contract, with the consequent appearance of tubercles; and the other, which grows in the region of the Tucson Mountains, and has been classified as *O. versicolor* by both Dr. Shreve and Alan Blackburn, which has spiny, highly tuberculate fruits, which quickly dry and fall to the ground, and branches which are always obviously tuberculate. This second variety bears some resemblance to *O. acanthocarpa* var. *ramosa*, and I believe it may possibly have evolved

therefrom; but the spines are far less numerous than in the *O. acanthocarpa* variety.

2. It seems to be the opinion of the recognized authorities that typical *E. triglochidiatus* is found in Arizona only around Fort Defiance. I have found plants which appear to me identical to those which Dr. Benson found in that area, growing in considerable profusion around Ganado as well. In that region, however, var. *melanacanthus* grows also, and some specimens appear to be a cross between the typical variety and var. *melanacanthus*; but there are many apparently pure specimens of the typical variety. I strongly suspect from the large number of typical plants I have seen near and south of Ganado without any extensive searching that the species probably covers a considerable portion of that part of the state.

3. I see from your booklet that you have been unable to locate *O. compressa* var. *microsperma* within Arizona. I have seen what I am sure is this variety growing southeast of Kanab, Utah. I made a field trip in that area several years ago, along the Utah-Arizona line, during the course of which I probably crossed and recrossed the border several times. While I am unable to say that I positively saw specimens on the Arizona side, I definitely observed a sufficient number of plants in the vicinity to cause me to assume that they probably spread over into our state at that point.

4. I understand that *O. flavescens* is regarded as growing in the southeastern portion of the Papago Indian Reservation. A cactus identical to, or at least closely resembling those already recognized as belonging to this species, is to be found in various locations northeast of Tucson at the foot of the Santa Catalina Mountains. The outside of the fruit is pale red, the interior yellowish green, and the flesh is exceptionally delicious, resembling a nectarine in flavor and consistency. A



Fig. 68. *Mammillaria heyderi* var. *macdougallii* (Rose) Benson.
R. C. Proctor photo.

variation appears in some specimens, in which the fruit wrinkles and dries as it matures, acquiring such an appearance as to be utterly uninspiring to the appetite, though it might be edible in case of necessity.

5. I once happened upon a strange grove of cactus plants in a small valley of the Santa Catalina foothills. These were a vertical prickly pear, with joints similar to those of *O. phaeacantha*, but short white spines on the upper portion of each joint, the plants frequently reaching eight or ten feet in height. I am still wondering whether I may have encountered the type locality of *O. toumeyi*, especially since I have seen other plants, similar though not so tall, in other areas of the same general vicinity, which I understand constituted a portion of the range of this formerly recognized species.

6. I believe that *C. muehlenpfordtii* var. *robustispina* is regarded as having a wide range in Pima and Santa Cruz Counties. However, I have encountered specimens in the vicinity of the Sierrita Mountains and at the northern tip of the Santa Rita Mountains, near the base of Mt. Fagan, and nowhere else. I am therefore wondering if juvenile specimens of *F. wislizeni* have not been mistaken for this variety, with a range larger than it actually covers having been assigned to it as a result.

7. It seems to me that the range of *E. fendleri* var. *robustus* is considerably larger than is usually supposed. My impression is that this variety is constantly enlarging its range and becoming more plentiful, while var. *rectispinus* is gradually disappearing. The latter seems exceptionally susceptible to damage from trampling by cattle, and it may be that this is the reason for its gradual disappearance.

8. As a boy I frequently hiked in the mountains, and I recall encountering *O. laevis* frequently. Now I almost never encounter pure specimens, though I often observe plants at a distance which appear to belong to this species. Upon closer inspection, however, they

almost always turn out to be something else, often var. *canada*.

9. I wonder whether or not it is generally known that in at least certain areas in the western part of its range, *E. intertextus* frequently grows entirely without the spike-like central spine, especially in the case of mature plants. I do not know whether this species is capable of crossing with *E. pectinatus* var. *rigidissimus* or not; but if so, perhaps the plants without the spike-like spine are the result of such a hybridization. In all other respects, however, such specimens as I have seen have had all the other characteristics of *E. intertextus*.

10. In your booklet, you state that *E. erectocentrus* is always a plant of the valleys. I have also seen it growing in considerable abundance in a vast area of rocky, hilly country on the east side of the Redington Pass in northeast Pima County. Northwest of the village of Redington, just above the San Pedro Valley, is a concentration so dense as to present a startling appearance, where the plants grow in a profusion greater than I have ever observed in the natural groves of any other species of small cactus, with the possible exception of *M. microcarpa*.

11. In southeastern Pinal County there grows a most peculiar opuntia, which looks to me like a natural hybrid of *O. arbuscula* and *O. spinosior*. The joints are slender, like *O. arbuscula*, but are spiny and tuberculate like *O. spinosior*. These plants are definitely not *O. kleiniae* var. *tetracantha*, nor are they typical *O. kleiniae*, though they bear some superficial resemblance to the latter.

12. I do not know what degree of importance you may attach to natural hybrids; but I have seen the following, which I do not believe are especially common: (I realize that in some cases you might not agree with my opinion as to precisely which species may have crossed to produce a given plant; but, in any event, here are my opinions for whatever they may be worth).

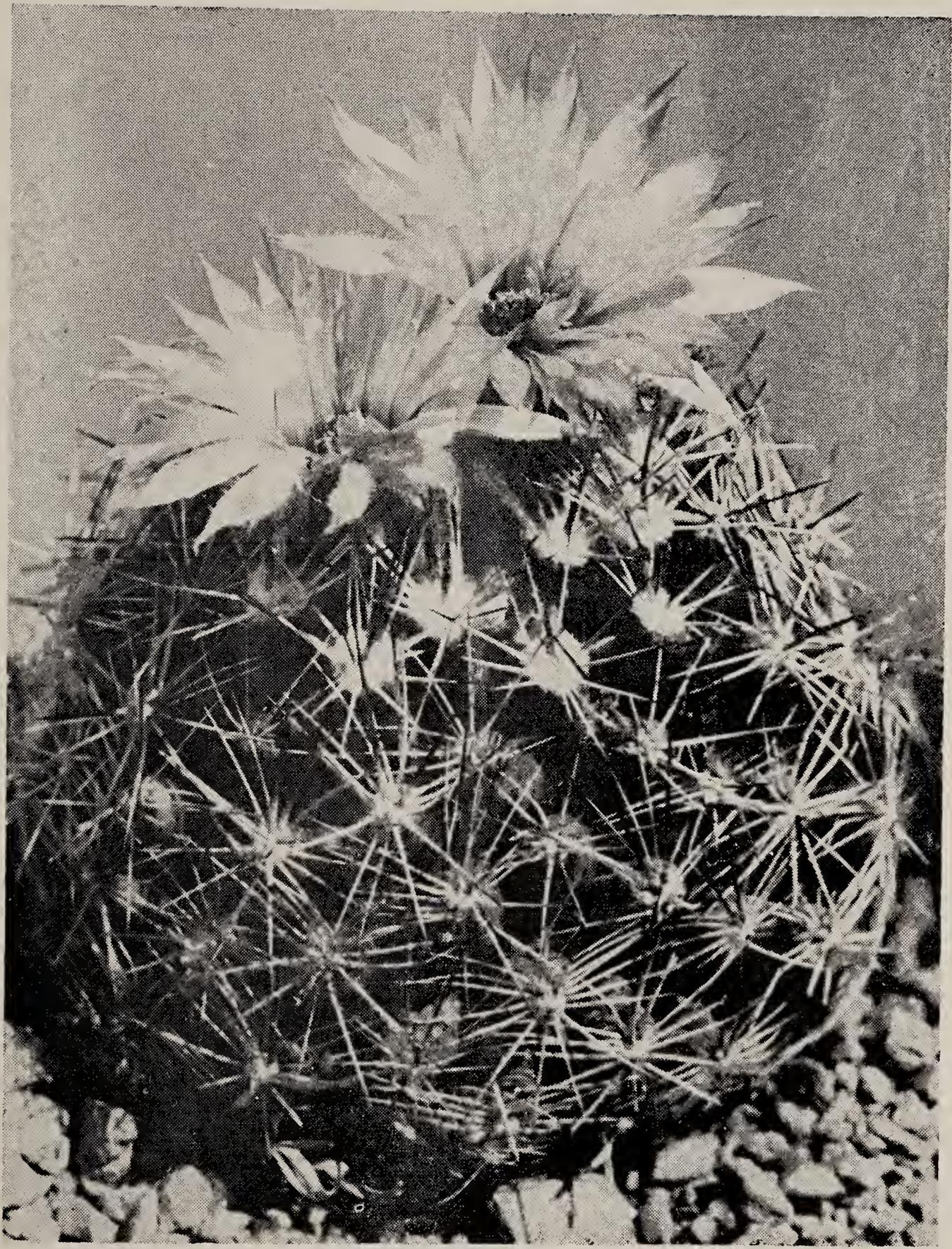


Fig. 65. *Coryphantha vivipara* var. *arizonica* (Eng.) Marshall.
R. C. Proctor photo.

A. *O. leptocaulis* and *O. arbuscula*, with general plant structure resembling the latter, but with flowers, especially as to time and frequency of blooming, resembling the former — and fruit like that of *O. leptocaulis* except that it usually does not turn red. . .

B. *O. gosseliniana* var. *santa-rita* and *O. Engelmannii* — with joints resembling the former, but spines, both in appearance and arrangement, resembling the latter. . .

C. *O. fragilis* and *O. erinacea* var. *hystricina*, with spines similar to the latter, but shape of plant like the former. . .

D. A three-way cross of *O. engelmannii*, *O. phaeacantha*, and *O. compressa* var. *macrorhiza*. . .

E. A three-way cross of *E. engelmannii* with *E. engelmannii* var. *nicholii* and *E. fendleri* var. *robustus*. . .

F. *E. erectocentrus* and *E. intertextus*. . .

G. *C. vivipara* var. *arizonica* and the small *mammillaria* (I do not know its name) which grows in such profusion in western Colorado and eastern Utah.

13. Concerning *M. oliviae* and the question of whether or not it deserves recognition as a separate species, I have watched a specimen which was apparently *M. oliviae* turn rather rapidly, for no obvious reason, into a perfectly conventional *M. microcarpa*; also I have observed a three-headed specimen growing from a single root: two heads had the characteristics of *M. oliviae*, while the third head appeared to be *M. microcarpa*. I cannot help wondering whether perhaps *M. lasiacantha*, *M. oliviae*, and *M. microcarpa* may not represent, in reality, three stages of development of what is really one species, with most plants reaching the third stage rapidly, but a few remaining in either the first or the second stage. In any event, *M. oliviae* seems to be most frequently encountered in the Rincon Valley of eastern Pima County; in some localities there it is plentiful and grows to a considerable size.

14. In the Molina Basin of the Santa

Catalina Mountains I have encountered a grove of hedgehog cacti which appear different from the common *E. fendleri* var. *robustus* normally found near Tucson. I do not desire to give a definite opinion concerning these until such time as I have an opportunity to study them further; but my first impression of these was that, despite their location, they were remarkably close in their characteristics to typical *E. fendleri*.

15. Before closing I desire to relate a tale so strange that you may well find it unbelievable; however, I have definite knowledge, as distinguished from rumor or hearsay, that the story is true: A considerable time ago a section of horizontal cactus root was brought from near Flagstaff to a locality near Tucson and there planted; from the root grew several small prickly pear joints, all too small to permit definite identification as to species; in due course the root and its attached joints grew larger — until, for entirely extraneous reasons, it became necessary to transplant the entire unit a second time, on which occasion the root was accidentally broken into three parts, each with one joint attached thereto; after this transplanting the joints were permitted to grow undisturbed until ultimately three complete plants had been produced, each possessing a number of joints; none has to this date blossomed, but to all appearances each plant belongs to a different species — one is *O. compressa* var. *macrorhiza*, complete with bluish cast on the joints, white spines on their upper portion, and tendency of the joints to wither and collapse on the ground during cold weather; the second is identical with *O. engelmannii* as found in its commonest form around Tucson; while the third resembles *O. megacantha* more than anything else, although I am well aware that the latter is not regarded as an Arizona species.

I hope that you have not found this recital too boring, and that at least some bits of information which I have enumerated here may prove of use to

you and to the Society with which you
are associated.

Sincerely yours,
John Palmer Rogers.



Fig. 47. *Echinocereus fendleri* var. *rectispinus* (Peeples) Benson.
Geo. Olin photo.

DESERT BOTANICAL GARDEN

BOOK DEPARTMENT

P. O. Box 547 Tempe, Arizona

PACKAGED CACTUS PLANTS

Attractive packages with cut cellophane packing.

		Post- Price	age*
No. 1	5 year old Saguaro Seedling 2" high	.50	.10
No. 2	Golden Barrel	.50	.10
No. 3	Old Man of Andes.	.50	.10
No. 5	5 plants	1.00	.30
No. 10	10 plants	1.50	.40
No. 10W	10 white spined plants, collectors items	3.00	.40
No. 15	15 large plants	2.50	.50
No. 16	16 still larger plants	4.50	.60
No. 24	24 large plants, many of flowering size	7.00	1.00

PRICKLY PEAR PRODUCTS

Prickly Pear Delight—

A Turkish delight type of confection made from prickly pear cactus fruits, provocative flavor

½ pound box .85 .25
1 pound box 1.60 .35

Prickly Pear Jelly—

4-12 oz. glasses in shipping carton. A clear red jelly of exceptional flavor 2.35 1.25

Kachinas

These dolls are made of drift wood, always cottonwood root which has been water-logged and sun dried. They are carved by hand and hand colored with tempera paints and are each an accurate reproduction of Hopi Indian Gods and made by a Hopi-Abbott Sakiestewa. We have many different Kachinas in each price range.

	Postpaid
2½ inches high.....	.85
3 inches high.....	1.10
4 inches high.....	1.65
5 inches high.....	2.20
6 inches high.....	3.30

BOOK SUGGESTIONS:—

	Postpaid
Arizona Cactuses; Marshall paper binding, 2nd Edition 1.15 cloth binding, 1st Edition 1.85 A description of all the species native to Arizona. 60 ills.	
Cactaceae, Marshall & Bock Only 1 more copy available.	8.25
Succulent Plants, Marshall Including 20 Viewmaster reels. Viewmaster \$2.00 extra and postage. Now out of print: 2 copies available.	10.00
Cactus for the Amateur	3.65
Succulents for the Amateur	3.65
Flowers of the Southwestern Desert — Dodge	1.15
Flowers of the Southwestern Mesas — Patraw	1.15
Flowers of the Southwestern Mountains — Arnberger	1.15
Animals of the Southwestern Deserts — Olin	1.15
Flowering Cactus — Carlson, Avey & Proctor	7.70
Trees & Shrubs of the South- western Desert — Benson & Darrow	8.70
The Giant Cactus Forest and Its World — Howes	7.70

SAGUAROWLAND

BULLETIN

DESERT BOTANICAL GARDEN OF ARIZONA

MARCH, 1955



Cover picture: An arrangement of dried desert plants by Sylvia Hermann — A winner.



EDITORIAL

ELECTIONS

As provided for in the By-laws of the Arizona Cactus and Native Flora Society, I, W. Taylor Marshall, President, did appoint August Hermann, Sylvia Hermann and K. R. S. Fisher, all members in good standing, as a nominating committee for the Society this 1st day of Feb., 1955.

W. Taylor Marshall,
President.

We, the members of the nominating committee of the Arizona Cactus and Native Flora Society, do nominate Lou Ella Archer, Angela Bool and William Eliot to succeed themselves as members of the Executive Board for the next four years.

August Hermann
Sylvia Hermann
K. R. S. Fisher.

In accordance with the nominations of the proper committee we enclose with this issue of Saguaroland Bulletin Post Card Ballots for each member of the Society in good standing according to our By-laws.

Please vote by marking the ballot for 3 candidates or by writing in additional selections in the space provided.

Ballots should be returned before the April 17th 1955 Annual Meeting.

The Annual Meeting of the Arizona Cactus and Native Flora Society will be held in the Webster Auditorium of the Desert Botanical Garden at 3:30 P. M. on Sunday, April 17th, 1955.

This is in compliance with the By-

laws of the Society for a meeting on the third Sunday of April of each year.

Angela Bool,
Secretary.

At the Annual meeting additional nominations may be made from the floor for the offices to be filled.

Reports of progress and finances will also be presented at the meeting for the information of our members.

Color in Saguaroland Bulletin:—

We are negotiating for the use of 10 color cards $3\frac{1}{2} \times 2\frac{3}{4}$ of Cactus plants in flower made from R. C. Proctor's Kodachromes to be tipped in ten issues of our Bulletin. The story of the plant illustrated and a list of locations in which each plant can be seen in nature will accompany each plate.

We hope to start their use with the April issue if the cards are available by then, otherwise we will start with the May issue.

Cactus Show Report:—

In order that we may bring you the record of winners in the Cactus Show and pictures of some of the Cactus Show activities we will hold this March issue up for one week.

Last year the Show report was not given until the April issue and this was much too late and we then resolved to have the Show report in the March issue for the future.

We express our appreciation to Mr. R. S. Brecheisen of the Cactus Lumber Company and to John H. Eversole who took the pictures at the show which we reproduce in this issue.

THE 8th ANNUAL CACTUS SHOW

They came in cars, trucks, on foot, horseback, bicycle and scooter. They came by the thousands, as a matter of record, nearly 5,000 persons attended the 8th Annual Cactus Show on the opening day last Sunday, Feb. 20th, held in the Auditorium of the Desert Botanical Garden. As this is being written on the 2nd day of the Show all evidence

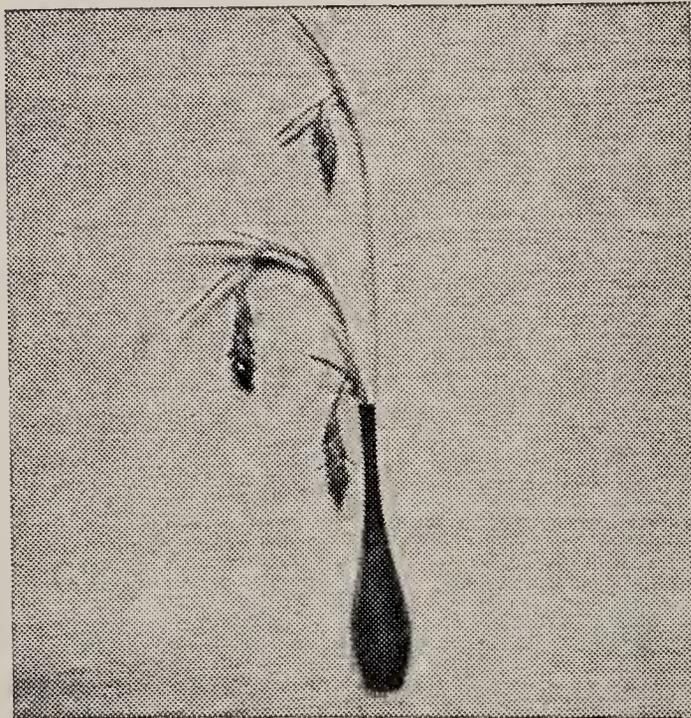
points to this being the largest attended show to date.

Twenty-eight exhibitors have entered over 120 entries to make this Show the best yet in quality.

Ken Fisher of Mesa, Arizona, won sweepstakes in total points followed by Mrs. Harold Covert, Phoenix, Mrs. R. I. Turner, Phoenix, Fred McClure, Phoe-



Gargoyles are found on the outer walls of old European Cathedrals, but in an Indian Type Building they are sometimes found seated at a desk. Your editor here disproves the statement of our staff: "He has a nice even disposition — he is mad all of the time."



The extreme simplicity and blending colors of this entry by Dick Landis made this a cup winner.

nix, and Mrs. Gladys Prophet, Scottsdale.

The co-sponsors of the Show, The Phoenix-Gazette, thru their reporters and photographers have given us excellent daily stories and pictures while the Tempe Daily News, The Arizonian, Scottsdale, and the Arizona Republic have also given us good coverage. KPHO TV station gave us an excellent announcement last week. All of this publicity is certainly reflected in the larger attendance to date.

Great credit is to be given to the 35 members of our Society and the 24 students of Dr. J. McCleary's Botany class of Arizona State College, Tempe, who volunteered from 1/2 a day to 8 days of their time to further the success of the Show. These volunteers served as guides, guards, hostesses, salespersons, helped direct traffic, issued camera

permits and helped in numerous other ways. The Garden's staff of 5 members would have been trampled underfoot except for the excellent aid of the following volunteers:— Mrs. Harold Covert, Mr. and Mrs. W. A. Thomas, Jr., Mr. and Mrs. Fred Parrott, Mr. and Mrs. A. Hermann, Mrs. Ralph Baird, Mrs. G. R. Probert, Mrs. Clarence Oskins, Mrs. Nola Belford, Mr. and Mrs. Ken Fisher, Miss E. Kemp, Mr. C. C. Pidgeon, Mr. L. F. Brady, Mrs. J. Spurr, Mr. John Hales, Mr. Wm. Rand, Mr. Fred McClure, Mr. John Weber, Miss Helen A. Dunn, Miss Marion Northway, Mrs. Agnes Faucett, Miss Frye, Mrs. Van Syckle, Mrs. Chas. Mieg, Mrs. Cochrane, Mrs. J. Birchett, Mr. and Mrs. Manuel Diaz and Mr. George Purdy who generously gave the Show 8 full days of his time.

Trophies were awarded to the following winners:—

RESULTS OF 8th ANNUAL CACTUS SHOW

Awarded Trophy Cups

Listing of Awards in the Following Classifications

Sweepstakes — Ken Fisher, Mesa, Ariz.

Rarest Cactus — Ken Fisher, Mesa, *Aricarpus Kotschubeganus cristata*.

Rarest Succulent Other Than Cactus — Wm. F. Rand
Haworthia truncata.

Cacti, at least five species — Mrs. Gladys Prophet, Scottsdale.

Individual Succulent — Euphorbia — Fred McClure.

Collection of Mammillarias — Ken Fisher, Mesa.

Arrangement with Accessories Using Cactus — Mrs. R. I. Turner.

Arrangement — Dick Landis

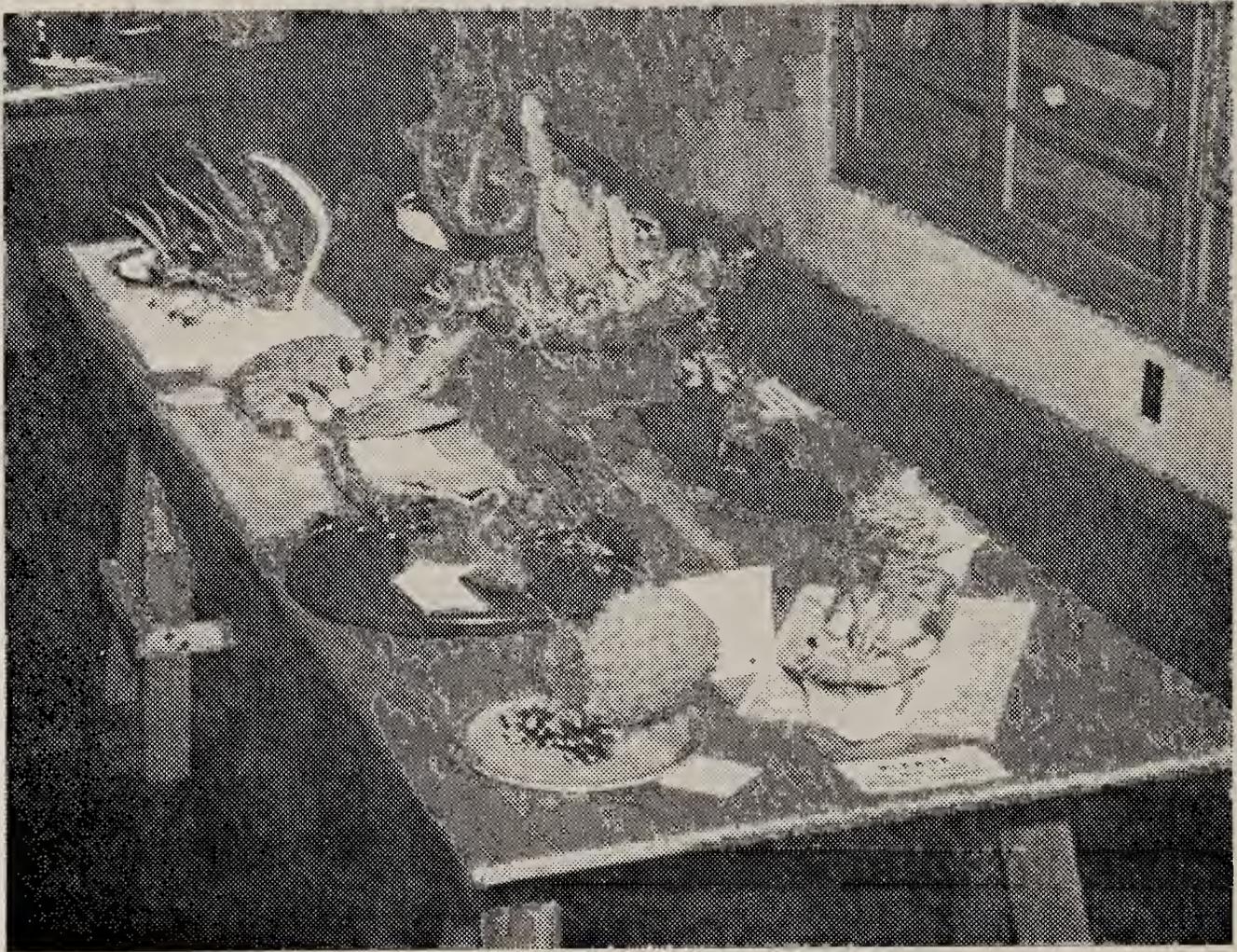
Arrangement of Cactus, American Influence —
Mrs. Harold Covert.

Listing of Ribbon Awards in the Following Classifications

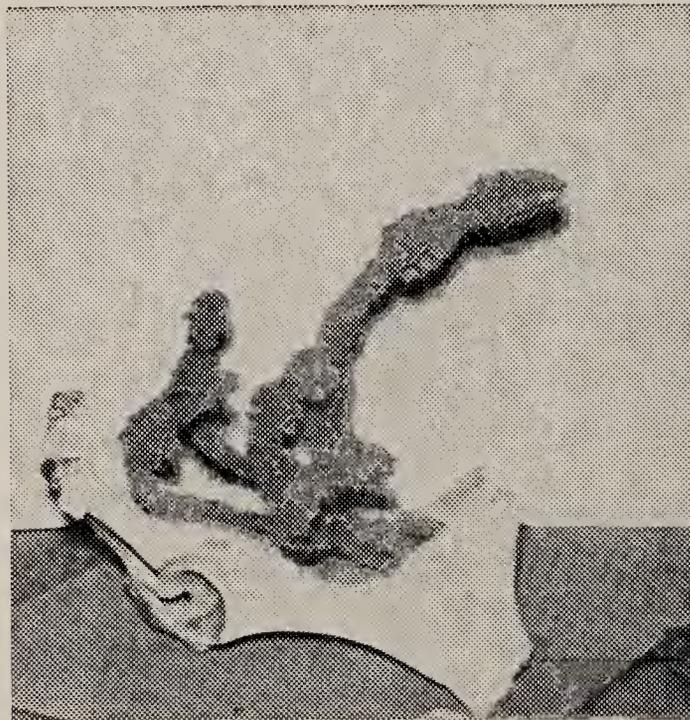
Section "A" Potted Specimen Plants

One Species of Cactus —

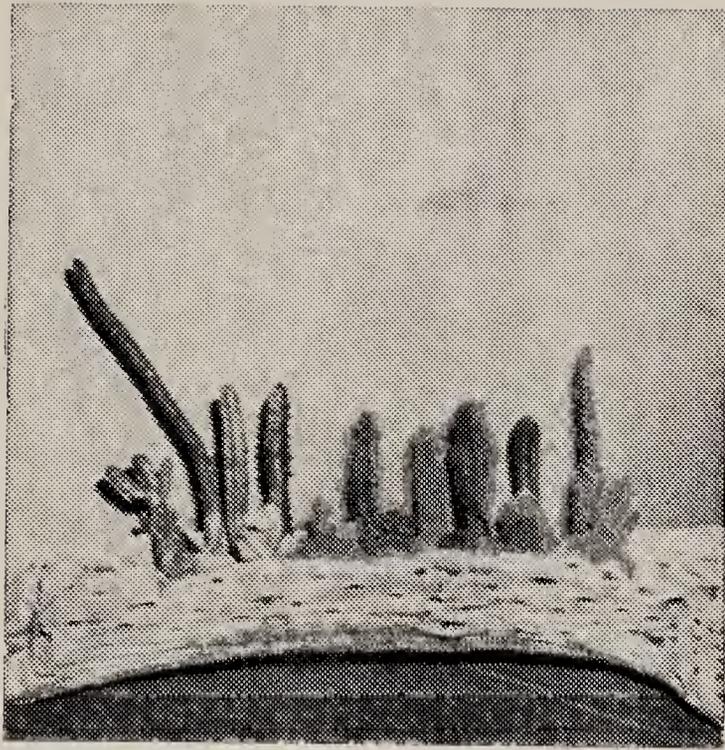
First Ken Fisher, 2nd and 3rd Mrs. Gladys Prophet.



Various arrangements before the judging. Color pictures are needed to show the true beauty of these entries.



Euphorbia pseudocactus is attached to the hip bone.



An interesting use of the skeleton
of a cholla cactus.



The Judges at work. Left to right judges: W. Taylor Marshall and
Herbert Bool. Clerks: John Hales and William Rand.

Seedling Cactus — 1st Fred McClure

Grafted Cactus — 1st & 2nd — Ken Fisher.

Crested Cactus — own root —

1st & 2nd Ken Fisher, 3rd Mrs. Gladys Prophet.

One Species of a Succulent Plant other than Cactus

1st Fred McClure, 2nd Wm. Rand, 3rd Mrs. G. R. Probert.

Desert Trees and Shrubs — 1st Manuel Diaz.

Section "B" Collections of Potted Plants

Cacti, at least five species

1st Mrs. Gladys Prophet, 2nd, Ken Fisher, 3rd, J. B. Hales.

Cacti, ten species or more

1st Ken Fisher, Special Fred McClure.

Collections of 5 plants of one genus — cactus

1st Ken Fisher, 2nd John Hales, 3rd Fred McClure.

Collections of 5 plans of one genus — Haworthias

1st Wm. Rand.

Collection of Ariocarpus — Ken Fisher 1st.

Collectio nof Echinocactus — Ken Fisher 1st.

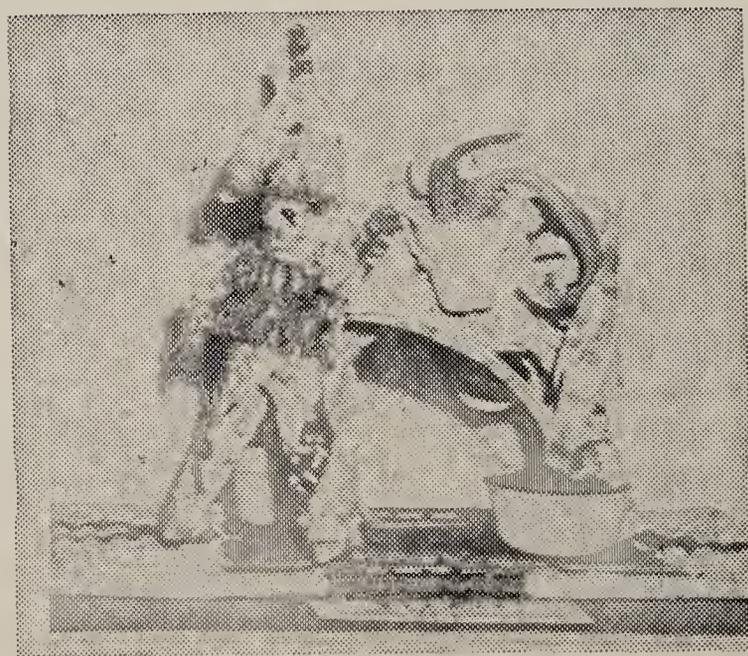
Collection of Espostoa — Ken Fisher 1st.

Collection of Barrels — Ken Fisher 1st.

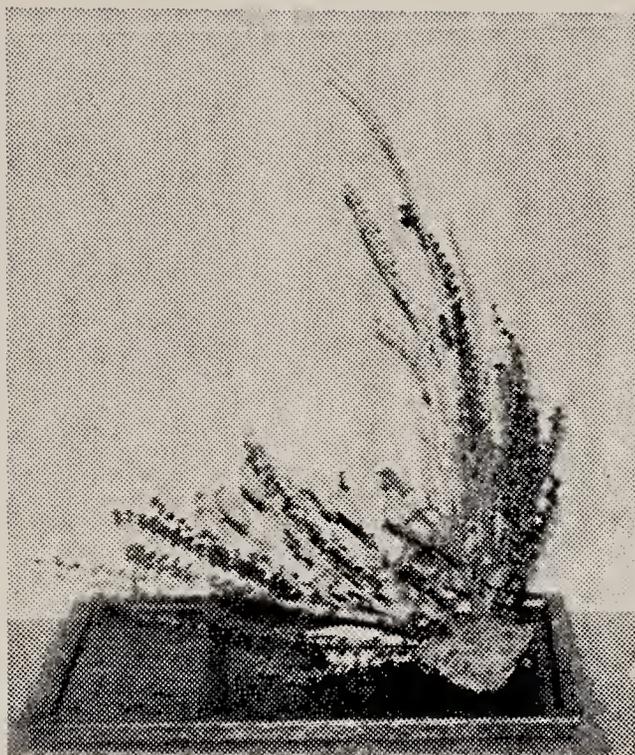
Collection of Mammillarias — Ken Fisher 1st, J. B. Hales 2nd.

Collection of Coryphanthas — Ken Fisher 1st.

Collection of Echinomastus — Ken Fisher 1st.



Mrs. Harold Covert entered this basketware horse and peon.



A winning entry by
Mrs. R. I. Turner.

Collection of Thelocactus — Ken Fisher 1st.

Collection of Crests — Ken Fisher 1st, J. B. Hales 2nd,
Fred McClure 3rd.

Section "C" Dish Gardens

Dish Garden 9" or less — cactus — Junior, 1st Alice Foster.

Dish Garden 9" or less — succulents — 1st Laura Nixon.

Dish Garden 9" or less — cactus & succulents — 2nd Sally Feese.

Dish Garden over 9" — cactus — 3rd John Hales.

Dish Garden over 9" — succulents — 1st Mrs. Gladys Prophet.

Miniature Cacti in containers — 1st Mrs. Harold Covert;
Junior 1st Lynda Lee Covert.

Hanging Basket — 1st Mrs. Harold Covert.

Junior Entries by Schools — Special Award — Yowanedo
Camp Fire Girls — Rossevelt School.

Section "D" Arrangements with Accessories

Cacti for centerpiece — 1st Mrs. R. I. Turner, 2nd Mrs. Harold
Covert, 3rd Dick Landis, Junior 1st Dolores Larson.

Succulents for centerpiece — 1st Dick Landis, 2nd Mrs. Harold
Covert, 3rd Dick Landis, Junior 1st Cissy Taylor.

Cacti & Succulents for centerpiece — 1st Mrs. R. I. Turner, 2nd
Mrs. Harold Covert. Junior 1st Cissy Taylor, 2nd Bee-
Bop Hobby Club.

Cacti with garden flowers as accessories — 1st Mrs. R. I. Turner.
Succulents with garden flowers as accessories — 1st Mrs. Sylvia Hermann, 2nd Mrs. R. I. Turner.

Cacti, American Indian Influence — 1st & 2nd Mrs. Harold Covert.

Novelty container with cacti — 1st Mrs. R. I. Turner. Junior 1st Janet Martian, 2nd Lynda Lee Covert, 3rd Eunice Porris.

Novelty container with succulents — 1st Mrs. R. I. Turner, 2nd Dick Landis, 3rd Mrs. Harold Covert.

Novelty container with cacti & succulents—1st Mrs. R. I. Turner, 2nd Sally Feese, 3rd Mrs. R. S. Probert. Junior 1st Lynda Lee Covert.

Button Gardens — 1st Mrs. Sylvia Hermann. Junior 1st Kathy Smith.

Arrangements with Dried Material — 1st Mrs. Sylvia Hermann. Special Mrs. Harold Covert, 3rd Mrs. R. I. Turner.

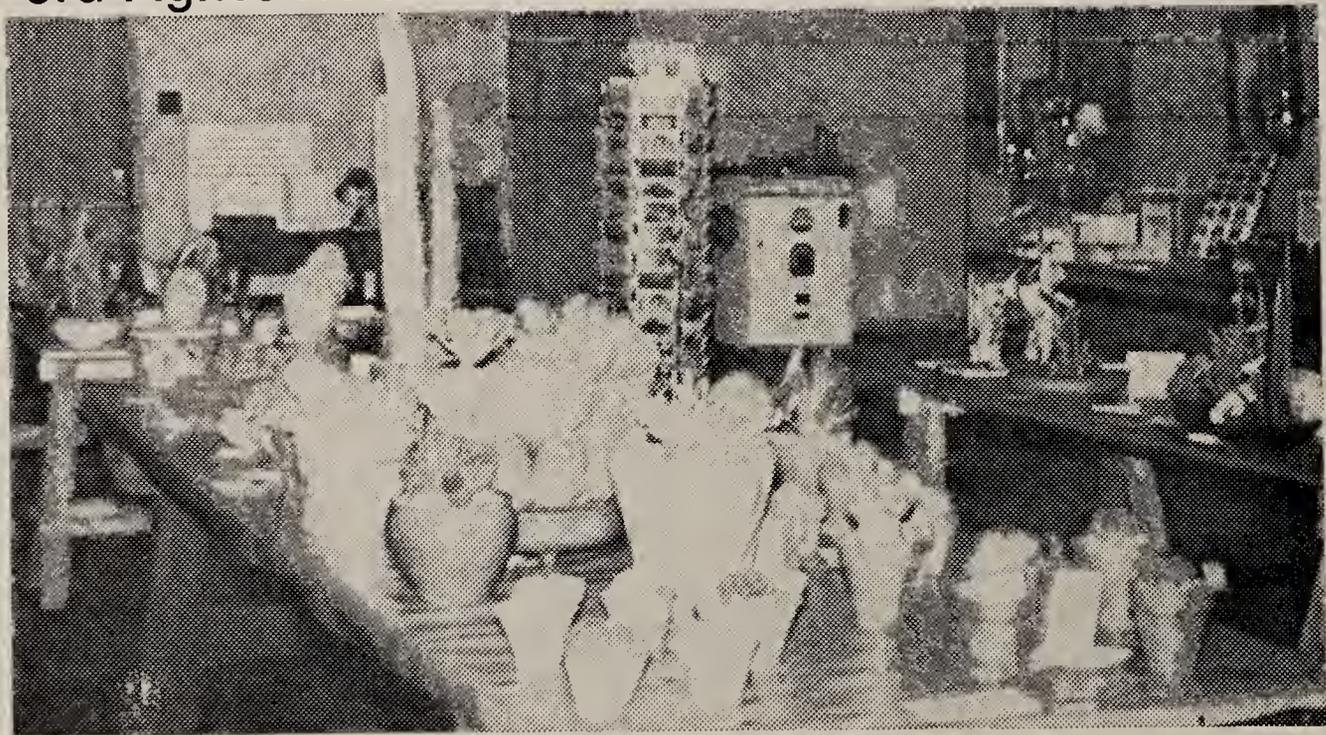
Miniature arrangements 1st and 2nd Mrs. Harold Covert. Junior 1st & 2nd Eunice Porris, 3rd Lynda Lee Covert.

Section "F" Educational Exhibits

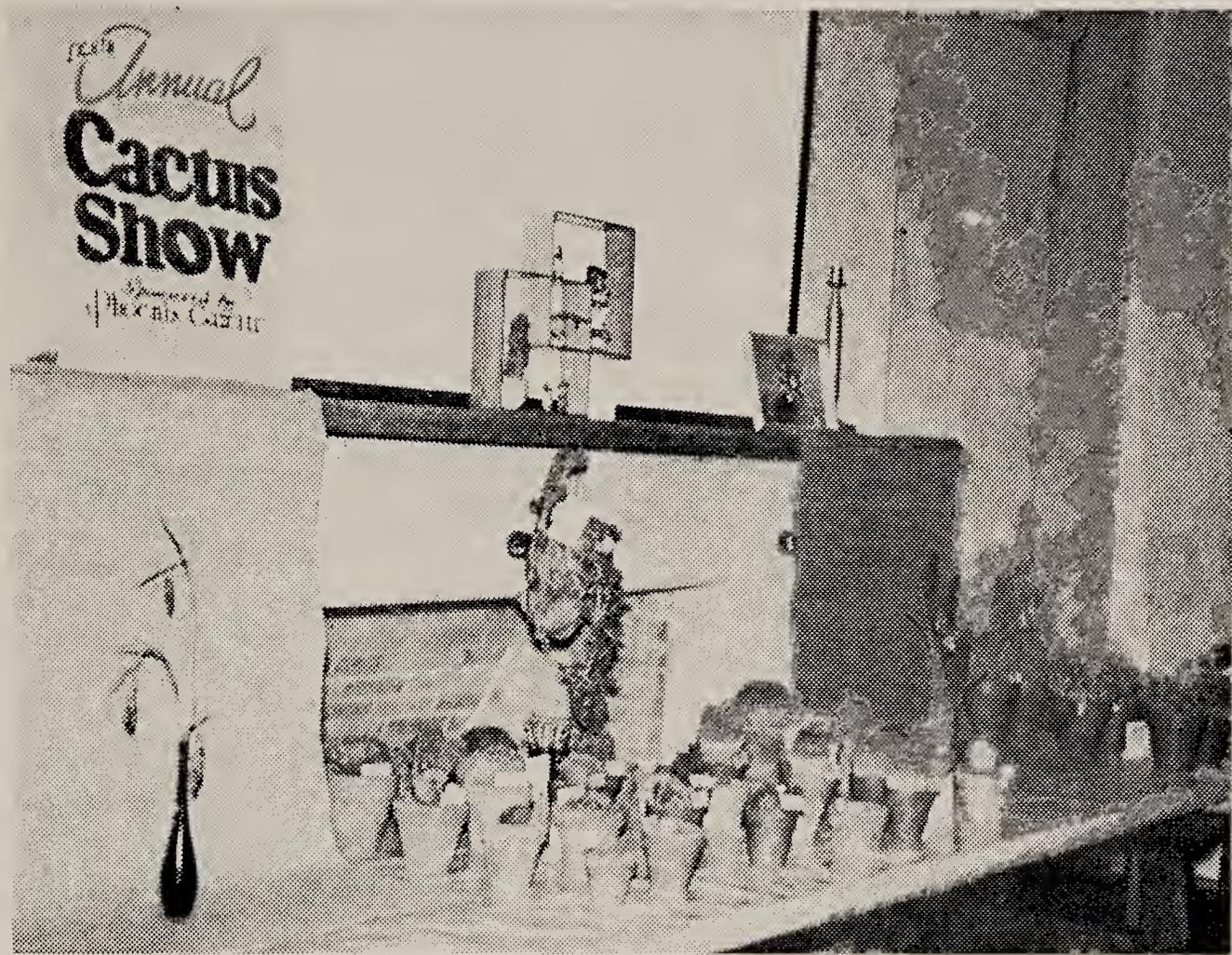
1st Mrs. Nora Belford, Special Fred McClure.

Water colors or oils — 1st Mrs. Sylvia Hermann.

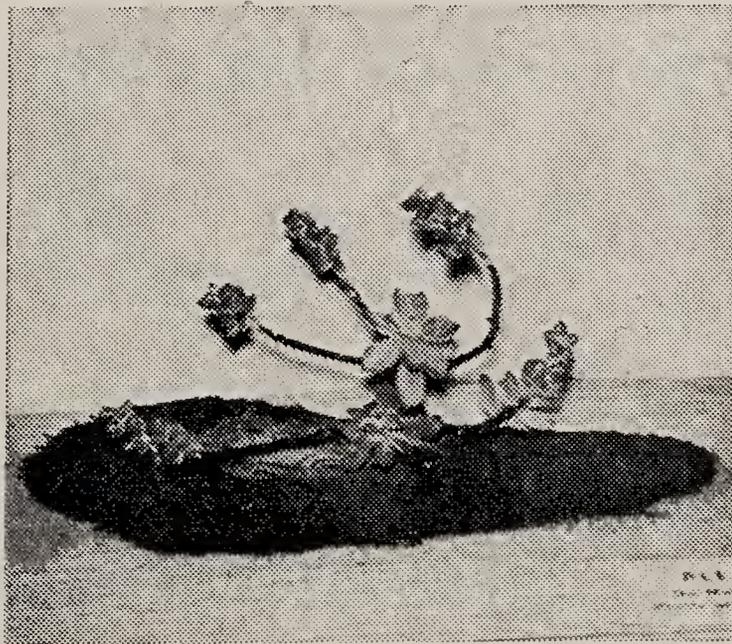
Black & White photographs — 1st & 2nd Howard Soule, 3rd Agnes Holst.



Another table of exhibits which consists mostly of entries of individual specimens. The plants entered this year were more nearly perfect and were more tastefully displayed.



West end of Auditorium showing a group of crested plants and an entry of a collection of Mammillarias and one of Ferocacti.



Another Dick Landis arrangement which was notable for its perfect color combinations.

DESERT BOTANICAL GARDEN

BOOK DEPARTMENT

P. O. Box 547 Tempe, Arizona

PACKAGED CACTUS PLANTS

Attractive packages with cut cellophane packing.

		Post- Price age*	
No. 1	5 year old Saguaro Seedling 2" high	.50	.10
No. 2	Golden Barrel	.50	.10
No. 3	Old Man of Andes.	.50	.10
No. 5	5 plants	1.00	.30
No. 10	10 plants	1.50	.40
No. 10W	10 white spined plants, collectors items	3.00	.40
No. 15	15 large plants	2.50	.50
No. 16	16 still larger plants	4.50	.60
No. 24	24 large plants, many of flowering size	7.00	1.00

BOOK SUGGESTIONS:—

	Postpaid
Arizona Cactuses; Marshall paper binding, 2nd Edition	1.10
cloth binding, 1st Edition	1.85
A description of all the species native to Arizona. 60 ills.	
Cactus for the Amateur	3.90
Succulents for the Amateur	3.90
Flowers of the Southwestern Desert — Dodge	1.15
Flowers of the Southwestern Mesas — Patraw	1.15
Flowers of the Southwestern Mountains — Arnberger	1.15
Animals of the Southwestern Deserts — Olin	1.15
Flowering Cactus — Carlson, Avey & Proctor	7.70
Trees & Shrubs of the Southwestern Desert — Benson & Darrow	8.70
The Giant Cactus Forest and Its World — Howes	7.70

PRICKLY PEAR PRODUCTS

Prickly Pear Delight—

A Turkish delight type of confection made from prickly pear cactus fruits, provocative flavor

½ pound box	.85	.25
1 pound box	1.60	.35

Prickly Pear Jelly—

4-12 oz. glasses in shipping carton. A clear red jelly of exceptional flavor

2.35 1.25

Kachinas

These dolls are made of drift wood, always cottonwood root which has been water-logged and sun dried. They are carved by hand and hand colored with tempera paints and are each an accurate reproduction of Hopi Indian Gods and made by a Hopi-Abbott Sakiestewa. We have many different Kachinas in each price range.

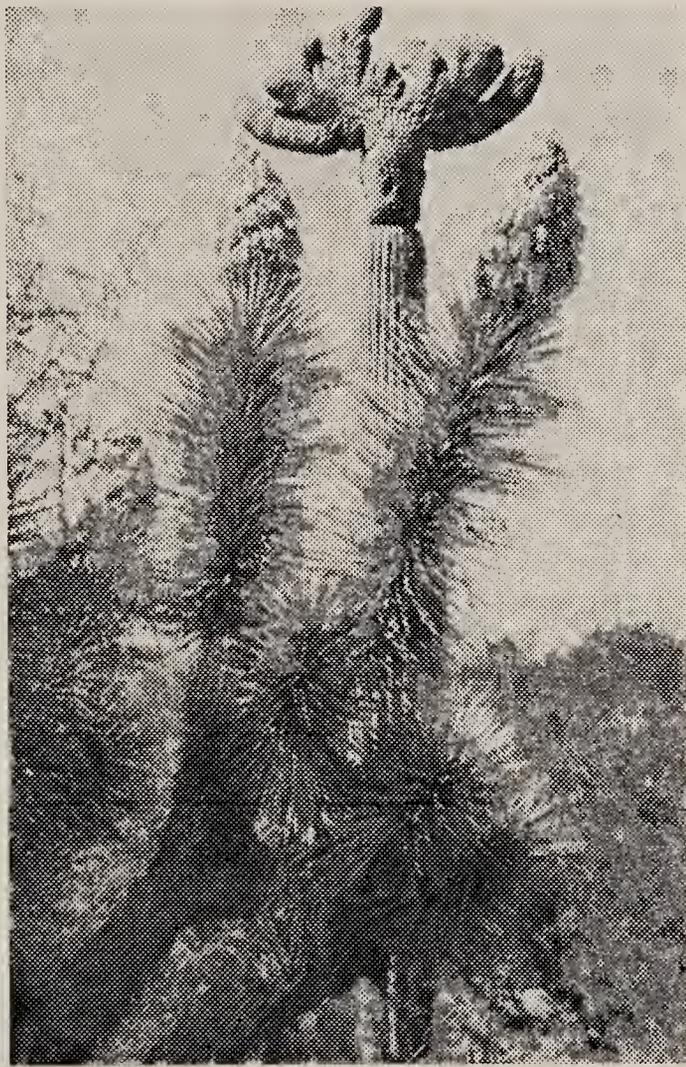
	Postpaid
2½ inches high.....	.85
3 inches high.....	1.10
4 inches high.....	1.65
5 inches high.....	2.20
6 inches high.....	3.30

SAGUAROUND

BULLETIN

DESERT BOTANICAL GARDEN OF ARIZONA

APRIL, 1955



The Joshua Tree in flower.



REG-MANNING

EDITORIAL

The Annual Meeting of the Arizona Cactus and Native Flora Society, Inc., will be held on Sunday, April 17th, the third Sunday in April at 3:30 P. M.

Members within reach should attend this meeting to hear the report of the year's activities and to participate in the election of three members of the Executive Board.

The post-card ballots have been slow in reaching us as only 67 have been received up to March 20th. Please mail in your ballot if you have not done so as yet.

We acknowledge, with gratitude, the gift of another herbarium case by Charles Mieg valued at \$200.00. It was badly needed as our present cases are well filled and we have many more sheets to file.

We have at several times mentioned the destruction of our signs by vandals but we have just had one destroyed without malice by a mother who left her infant child in her very modern car on our parking lot.

The car was equipped with an automatic transmission which failed to act and the car rolled backward into the

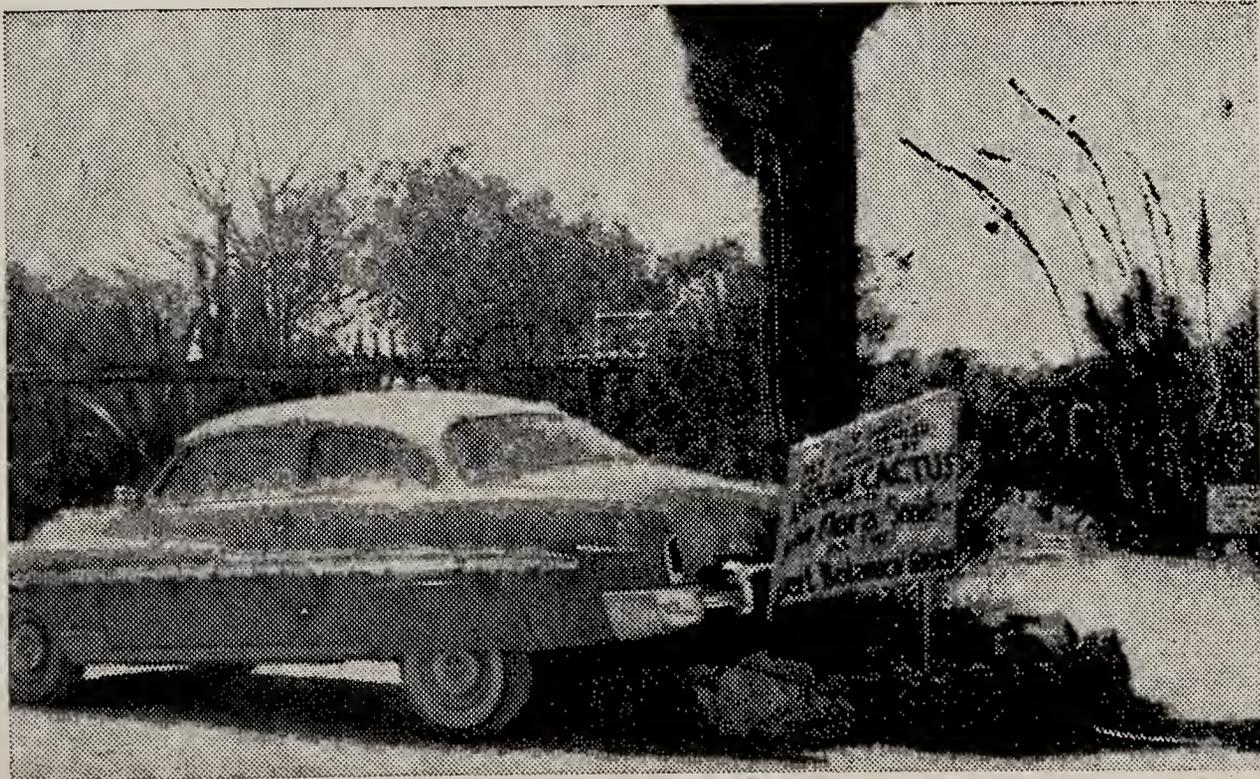
high bed around the Saguaro in the center of the inner parking lot. There was, fortunately, no harm to the child but another \$30.00 sign of ours was damaged almost beyond repair and a heavy iron post supporting it was snapped off at ground level (see picture).

SALES OF PLANTS

Many of our members have written us to enquire the prices of specimen plants. Apparently such members think that we can sell the plants from our collection but this is not true.

All our plants are here for study and each has a complete history of its collection date, collector, location and altitude of location and a description of the soil conditions and plants associated with it.

They are here to help us solve intricate taxonomic questions and if we have a number of plants of the same species they were collected at various habitats and must be grown for many years under observation for possible changes in form or spination due to movement to new environment and differing soil and moisture conditions.



Another expensive sign is destroyed. No casualties, fortunately.

You may say that each of our plants is growing under controlled conditions to add something to our knowledge of the desert plants generally.

Therefore the only plants we offer for sale are those commercially grown and packaged plants listed on our back cover.

Specimen Cactus plants and some specimen Succulents can be purchased by mail from:

Sandyland Cactus Nursery, 2735 E. Camelback, Phoenix, Ariz.

Gates Cactus, Inc., P. O. Box 247, Corona, Calif.

Johnson Cactus Nursery, Paramount, Calif.

The last two issue catalogues, Gates may be obtained without cost but John-

son, who has a much larger one with colored illustrations, makes a charge for his catalogue.

We have found all three very reliable.

Doubtless there are many other growers of Cactus seedings who are both good growers and reliable merchandisers but we list the above because of our intimate knowledge of their products and business methods.

For Epiphyllums and Haworthias we can with equal confidence recommend:

Beahm's Nursery, 2686 E. Paloma St., Pasadena, Calif.

Our sincere thanks to Herman Schroeder for a 40-inch plant of *Espostoa*, the "Old Man of the Andes."

MEET JOHN RHUART

John Rhuart has been a member of our Executive Board since his appointment in 1951 and he has proved to be a most valuable addition to our "brain trust."

He has a most pleasing personality and is quietly observant, seldom taking part in preliminary discussion, but he listens and digests the opposing arguments and then quietly comes up with a valuable suggestion.

He is a native Arizonian and the son of a pioneer family. He was educated at Phoenix Junior College and the University of Santa Clara in California. He enlisted in the U. S. Army and served from 1942 to 1946 in the Recruiting Service in Arizona.

Since 1946 he has been Real Estate

Loaning Officer of the Valley National Bank and is now an Assistant Vice President of that institution.

Besides being the youngest board member of our organization he is a member of Phoenix Country Club, Valley Field Riding and Polo Club, Arizona Pioneer's Historical Society, Phoenix Humane Society, Arizona Humane Association, Arizona Territorial Sons and Daughters, Knights of Columbus, Phoenix Fine Arts Association and the Phoenix Iris and Daylily Club of which he was president in 1954.

John is just another example of the civic-minded, men and women of high integrity who constitute the governing board of your Society of which you can be justly proud.

REPRINTED FROM NEW ZEALAND CACTUS & SUCCULENT JOURNAL

Lapsus Linguae. An unconscious but quite understandable "faux pas" by one of our lady members provided a real pear of wisdom which we feel should now be shared by others.

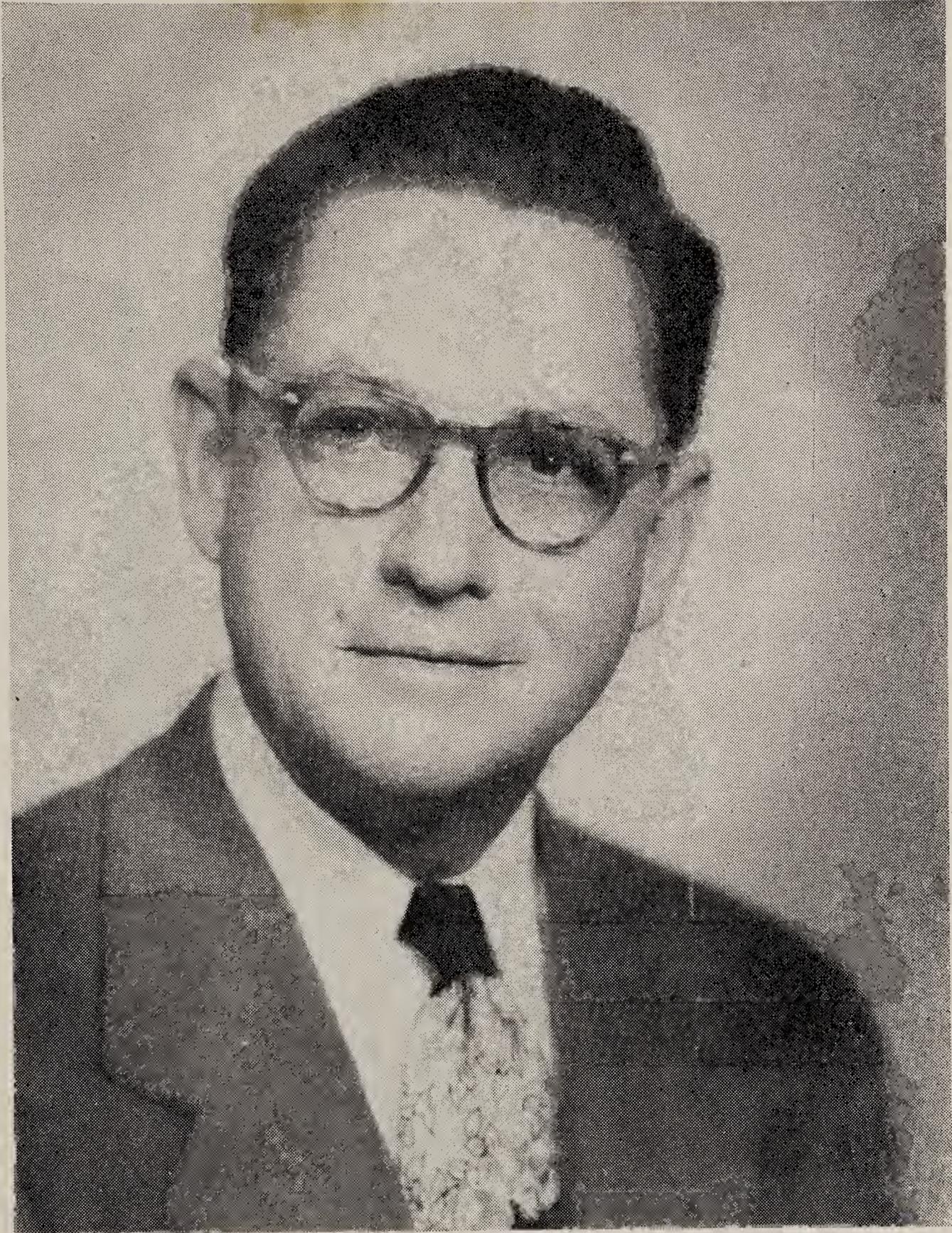
"One of the known causes of monstrose and cristate forms of plants is

bombardment by cosmetic rays!"

We have known cases of a few men going a bit "off form" too from these same rays!

This cosmic sphere can well do with more comic rays these days.

—A. Bruce.



John H. Rhuart
Photo courtesy of Valley National Bank.

YUCCA ELATA ENGELMANN SPANISH BAYONET — SOAPWEED — PALMILLA



YUCCA, NEW MEXICO'S STATE FLOWER

The Yuccas are always prominent features of the vegetation of all of the Southwestern States. Many of them are medium sized trees, as is the one illustrated, but even the shrub-like species such as *Yucca glauca* of the Great Plains become important when the inflorescence of creamy white flowers are on the plants.

Yucca elata Engelmann attains a height of six to fifteen feet and the inflorescence extends about 6 feet above the plant. While thought of by many as a species of Cactus the Yuccas are actually members of the Lily family even though far removed from the herbs developed from bulbs or corms and featured in many gardens.

In much of the Mojave Desert and in Texas and New Mexico the Yuccas are the largest trees over much of the land-

scape and New Mexico has selected the Yucca as its State Flower.

Aside from the beauty of both plant and flower the Yuccas have a prominent place in the economy of desert people as the fibres of the leaves are utilized for the manufacture of a coarse cloth and types of rope. The roots of many species are used as soap especially as surgical soap and shampoos.

Both trunk and leaves contain chemicals that are used in medicine.

The fruits of the baccate species are eaten either raw or roasted and are important in the diet of the Navajo Indians and other tribes.

In addition to their ornamental and economic value the Yuccas provide the outstanding example of mutual dependence of a plant and an animal, called symbiosis.

The Yucca depends on a species of the moth *Pronuba* for the pollination of its flowers and the moth depends on the Yucca fruits as a depository of eggs which when hatched, produce larvae which feed on some of the seeds in the Yucca fruit.

When the flowers first open the moth is attracted by the perfume of the flower and its white luminance in the desert night and the female moth visits several flowers collecting a load of pollen from each till it has a considerable supply.

Then going to still another flower the moth inserts its ovipositor through the walls of the ovary of the Yucca flower and deposits several eggs. As payment for the board and lodging that the plants supplies for her young the moth then climbs to the top of the pistil and places on it a supply of pollen sufficient to pollinate the flower and to assure seeds.

The complete story of this plant-insect association was told in Reports of the Missouri Botanical Garden by Dr. C. V. Riley in 1892 and it has been retold in *Desert Plant Life Magazine* for December 1942 and in the *Cactus and Succulent Journal* for June 1943.

Numerous other Magazines have also featured the association from time to time and the unique relationship loses nothing by its frequent repetition.

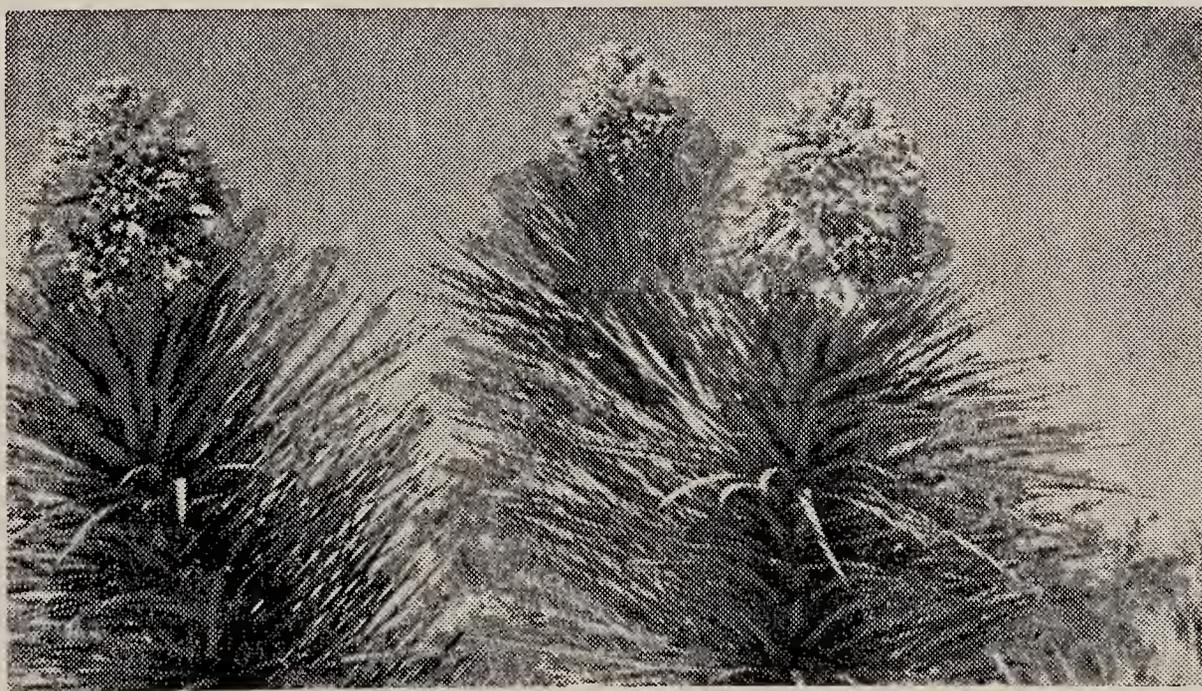
Yucca elata, pictured in our color plate, is found at altitudes from 2,000 to 6,000 feet in Arizona, New Mexico, Texas and Sonora and Chihuahua, Mexico.

Another Yucca which dominates the landscape in the area it occupies is the Joshua Tree shown in flower in our garden in the first week of March.

The Joshua Tree is perhaps the largest of the Yuccas but is limited in its range by altitude limitations as it is never found below 2,000 feet according to Benson in "Trees and Shrubs of Southwestern Deserts." We have never observed them below 2,500 feet and they usually range from 3,000 to 5,000 feet altitude.

We have been successful in establishing eight plants of over 50 plants we brought in about 15 years ago as our altitude here is about 1,200 feet. It then required 15 years for them to reestablish to the point that they produced flowers for the first time this year.

Yucca brevifolia Engelm., the Joshua Tree, is found in California, Ne-



Flowers of the Joshua Tree.

vada, Utah and in Arizona from Congress Junction northwest to Kingman and Hoover Dam.

It is thought to be the oldest living plant of the desert areas and some botanists estimate that it may live as long as 1,000 years. This is pure specu-

lation as there are no tree rings to date them and records of annual growth rates at various ages are not recorded.

A Joshua Tree appears to bear flowers each second year but even this detail has not been confirmed.



The Joshua Tree, *Yucca brevifolia* Engelm. in flower in our garden. A crested plant of the Saguaro Cactus can be seen in the center background. The shrub to the left is a *Lycium* or Wolfberry.

MAMMILLARIA MICROHELIA WERDERMANN VAR. MICROHELIOPSIS (WERDMANN) BACKBERG

This charming little pincushion was first described in 1930 from the State of Queretaro, Mexico. It is still rather rare in collections but its beauty entitles it to a more widespread interest.

It is usually simple, cylindrical to 6 inches high and up to 2 inches in diameter. The nipples are arranged in

8 and 13 spirals and are short blunt conic in shape.

The central spines on the species are sometimes absent but may be as many as 4 but are mostly 1 or 2, straight or slightly curved. On the variety *microheliopsis* there are 6 to 8 central spines and this constitutes the major

difference between the species and the variety.

Radial spines are 30 to 50 and they are bristle-like and shining yellow to red brown at the base, flattened against the body of the plant completely concealing it.

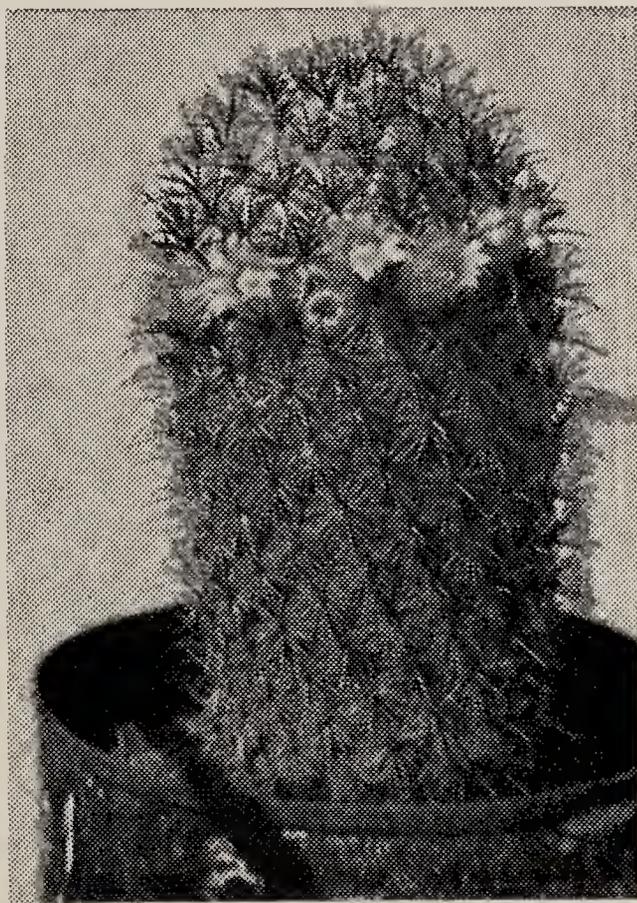
The cream to greenish flowers are borne in a circle below the summit of the plant and are followed by pale green to whitish or pink fruit.

The specimen photographed came to us from Gates Cactus, Inc., who grew them from seed and presented this and a number of other rare seedlings of

Mexican species at the time of and for display in our Cactus Show.

Both the species and its variety have been collected in the Sierra de San Martin in the State of Queretaro, Mexico as reported by Craig in "Mammillaria Handbook" and this is the only exact location that we can find recorded.

In its almost irridescent spines and graceful form as well as its free flowering it assumes a place second only to *Mammillaria bombycina* as your editor's choice for the most desirable species of *Mammillaria*.



Mammillaria microhelia Werd. var *microheliopsis* (Werd.) Bckbg.

PLANT OF THE MONTH

Coues' senna, *Cassia Covesii* Gray

Bright yellow flowers against a background of soft gray foliage indicate a colony of Coues' senna in our Garden. The flowers are continuous from April to October, in cultivation, which makes this a most valuable native ornamental which can be grown without effort in desert country. Its culture in any moderate climate should not be too difficult as it ranges into fairly cold districts within our State.

It is an interesting shrub of one to two feet high with but few branches, the branches covered with soft, white hairs. The leaves are compound with the large leaflets in two or three pairs, each leaflet up to an inch long and half as wide, green, but so covered with short, white hairs as to appear gray and to feel like velvet to the touch.

The bright yellow flowers are borne in racemes which arise in the leaf axils. Each raceme bears six flowers, each about one inch in diameter, and by the time the upper flowers are opening there are pods forming where the first flowers appeared. These straight pods split when ripe to release the numerous, pea-like seeds.

Cassia Covesii Gray is reported by Jaeger as rare in California in dry washes of the Colorado Desert but in Arizona it can be found in Coconino,

Mojave, Yavapai, Greenlee, Maricopa, Cochise, Santa Cruz and Pima Counties at elevations of 1,000 to 3,000 feet. The particular plants grown in our Garden were collected in Paradise Valley.

Kearney and Peebles report the flowering period as from May to August but, as reported above, this period is greatly extended when the plants get more water and care. They are easily grown from seed and have been successfully grown from cuttings.

Cassia is a genus of mostly tropical plants in the Legume family but two hardy species are cultivated, *Cassia marylandica* and *C. Chamaecrista* both native to the New England States and southward. *C. artemisoides*, introduced from Australia, is in common use in both California and Arizona. All of the above as hedge plants. The best known garden species is *Cassia corymbosa*, sometimes called *C. floribunda*, an Argentinian species. Arizona boasts nine species of *Cassias*, all interesting and many of them perhaps as desirable for garden use as our plant of the month.

Cassia Covesii was named by Dr. Asa Gray to honor Dr. Elliott Coues, a noted ornithologist, who was stationed at Fort Whipple in 1864 and who wrote "Birds of the Colorado Valley."

(Reprinted from *Saguaroland Bulletin*, September, 1948)

DESERT BOTANICAL GARDEN

BOOK DEPARTMENT

P. O. Box 547 Tempe, Arizona

PACKAGED CACTUS PLANTS

Attractive packages with cut cellophane packing.

		Post- Price	age*
No. 1	5 year old Saguaro Seedling 2" high	.50	.10
No. 2	Golden Barrel	.50	.10
No. 3	Old Man of Andes.	.50	.10
No. 5	5 plants	1.00	.30
No. 10	10 plants	1.50	.40
No. 10W	10 white spined plants, collectors items	3.00	.40
No. 15	15 large plants	2.50	.50
No. 16	16 still larger plants	4.50	.60
No. 24	24 large plants, many of flowering size	7.00	1.00

BOOK SUGGESTIONS:—

	Postpaid
Arizona Cactuses; Marshall paper binding, 2nd Edition	1.10
cloth binding, 1st Edition	1.85
A description of all the species native to Arizona. 60 ills.	
Cactus for the Amateur	3.90
Succulents for the Amateur	3.90
Flowers of the Southwestern Desert — Dodge	1.15
Flowers of the Southwestern Mesas — Patraw	1.15
Flowers of the Southwestern Mountains — Arnberger	1.15
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The Giant Cactus Forest and Its World — Howes	7.70

PRICKLY PEAR PRODUCTS

Prickly Pear Delight—

A Turkish delight type of confection made from prickly pear cactus fruits, provocative flavor

½ pound box	.85	.25
1 pound box	1.60	.35

Prickly Pear Jelly—

4-12 oz. glasses in shipping carton. A clear red jelly of exceptional flavor

2.35 1.25

Kachinas

These dolls are made of drift wood, always cottonwood root which has been water-logged and sun dried. They are carved by hand and hand colored with tempera paints and are each an accurate reproduction of Hopi Indian Gods and made by a Hopi-Abbott Sakiestewa. We have many different Kachinas in each price range.

	Postpaid
2½ inches high.....	.85
3 inches high	1.10
4 inches high	1.65
5 inches high	2.20
6 inches high	3.30

ANOTHER ADDITION TO THE ARIZONA FLORA

In our last issue we reported the finding of *Epithelantha micromeris* in the State for the first time. This discovery was made by Don Bryant, a geologist, who has made many field trips this summer. This same gentleman located another species new to the State in *Mammillaria Wrightii* which was found by him in Apache County about two miles west of the New Mexico line.

In August we had another expedition in northeastern Arizona to again attempt to relocate *Toumeyia Peeblesiana* and again our expedition failed in its

objective. It did, however, follow up Mr. Bryant's discovery and it collected nine specimens of *Mammillaria Wrightii*.

The plants were found under pine trees or in the open in bunch grass which they greatly resemble. One or rarely two plants would be located on each outcropping of a certain type of gravel which made small mounds amidst the red clayey soil of that district. An indication of their rarity is that four experienced collectors in our party spent an entire day in the collection of the few plants we located.

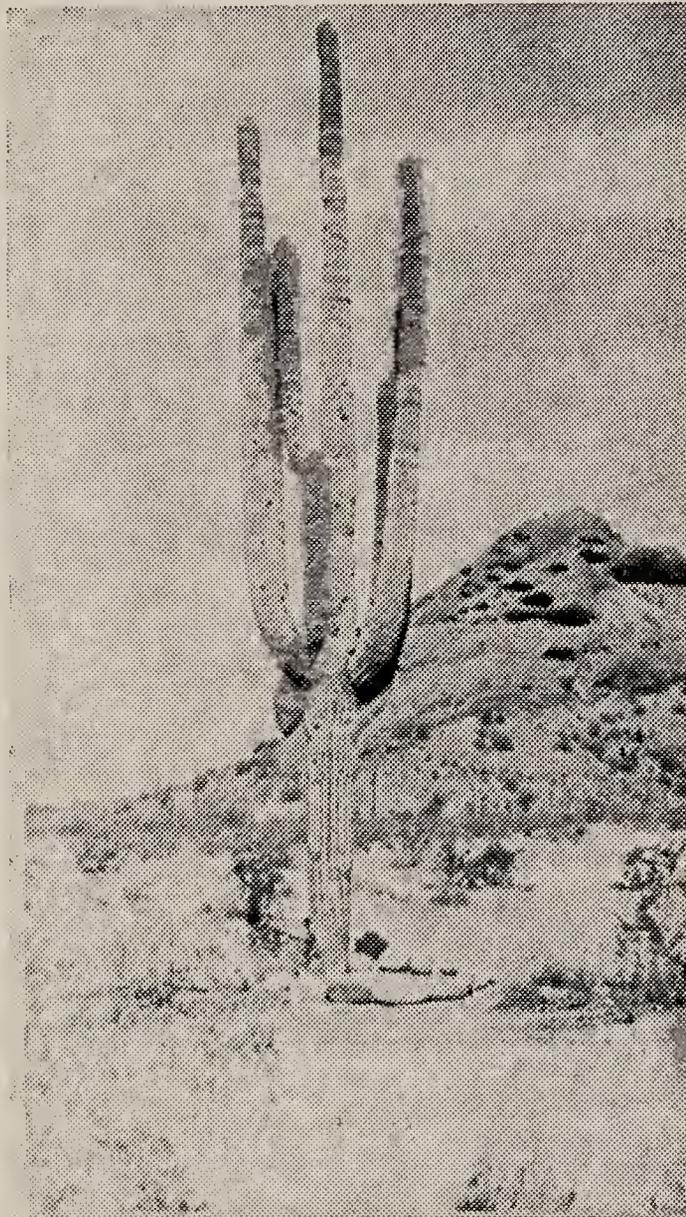
(Reprinted from Saguaroland Bulletin, September, 1948)

SAGUAROWLAND

BULLETIN

DESERT BOTANICAL GARDEN OF ARIZONA

MAY, 1955



REG-MANNING

SAGUAROLAND BULLETIN

Published and owned by the Arizona Cactus and Native Flora Society, sponsors of the Desert Botanical Garden of Arizona, P.O. Box 547, Tempe. Saguaroland Bulletin attempts to promote the Garden and to provide information on the desert plants and their culture. Subscription \$3.00 per year, the subscription including active membership in the Society and the Desert Botanical Garden. Issued 10 times a year.

W. TAYLOR MARSHALL, Editor

Volume 9

May, 1955

No. 5

Arizona Cactus and Native Flora Society

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Desert Botanical Garden of Arizona

STAFF

Director	W. Taylor Marshall
Senior Botanist ...	James A. McCleary, Ph.D.
Superintendent	W. Hubert Earle
Curator of Herbarium ...	E. R. (Jim) Blakley

Garden open every day in May except Monday, from 10 A.M. to 5 P.M.

No charge for admission.

Open only Saturday and Sunday, 1 P.M. to 6 P.M., in June.

EDITORIAL

April 30th marks the close of the 17th fiscal year for the Desert Botanical Garden and the 9th year under the direction of your editor.

In the first period of our history, from 1938 to 1941, considerable progress was made in assembling a collection of desert plants under the direction of George Lindsay and later of J. Fleming and the Administration Building was erected and dedicated in 1940 by Mrs. Webster and her associates.

Then, during the war years, the plant collection was allowed to disintegrate through neglect and lack of understanding by the long succession of caretakers who succeeded each other from 1941 to 1946 so that only the hardiest plants were alive when the gardens were reopened in December, 1946.

Since then we have extended the plantings and buildings and built an educational program which today makes the Desert Botanical Garden a very great attraction to Arizona's visitors and a distinct asset to the State.

This could not have been accomplished by the unaided efforts of your editor and it was made possible only by the unselfish devotion of those civic minded men and women who have acted as Executive Board members and the friendly advice and assistance of the many other members of our Advisory Board.

It is, therefore, with great pleasure that we can report that the general membership has recognized the value to our organization of our incumbent board members by reelecting them unanimously at our Annual Meeting held here on Sunday, April 17th.

Later that same day the Executive Board in their April meeting reelected the officers who served during last year as listed on the front cover of this issue of the Bulletin.

At the Annual Meeting a financial report for the fiscal year was read by me. They are based on complete figures for the year except for the items marked with an asterick(*) and figures so marked are up to April 16th and will be higher when the additional 14 days receipts are added.

The profits on sales of merchandise are based on an estimate of inventory and may change somewhat when the actual inventory is taken on April 30th and the additional sales for the next 14 days are added.

The report is as follows:

INCOME	
From Trust Fund	\$ 9,473.56
Contributions	474.60*
Memberships	1,526.50*
Profits on Merchandise (Gross)	4,900.00*
Other income	150.00
	<hr/>
Total	\$16,524.66
EXPENDITURES	
Salaries	\$11,624.00
Insurance	242.50
Utilities	685.52
Misc. Expense	2,981.57*
Capital Investments	802.55
	<hr/>
Total	\$16,336.14

For the coming year our cost will rise still higher due to increases in salaries for additional personnel and higher utility costs to meet our ever increasing attendance.

We will have to have about \$1,500 additional funds for the 1955-56 fiscal year and this will have to come from new memberships. We solicit your aid in interesting new people in participation in the Garden and its support.

We have been notified by the National Science Foundation that our application for assistance in our Agave research project was one of a number of pro-

posals that their advisory panel of consultants approved as acceptable on the basis of scientific merit, contingent upon the availability of sufficient funds, but that because of their budgetary limitations it has not been possible to activate it.

This will mean that we will have to conduct our research without financial aid for the present and it will be very much slower work.

We will assemble material from our own collections this summer and the collections to be made by three groups of members who plan extended trips into the Agave territory in the same period. Perhaps we will get assistance from other members who may plan trips also and who will collect for us small offsets of any species of Agaves they may find growing under natural conditions. Be sure to note carefully the exact locations of the collections, the altitude at the point of collection and a note on the type of soil in which the Agaves were growing and a list of other plants that grew in the same location.

Pictures of the plants in place, especially if they are in flower or fruit and dried flowers and fruits will aid in identification.

We plan to attend the Convention of

the Cactus and Succulent Society of America at El Paso from July 8th to 11th but will not make the field trips on July 11th and 12th but will return to the Garden to receive any of the members of the Convention who may stop off at the Garden.

I will be at the Garden up to the morning of July 7th and will return by noon of July 12th and extend a cordial invitation to all cactophiles to stop off enroute to or from the Convention.

From the 7th to the 12th some member of the staff will be on hand to welcome visitors in my absence.

An inquiry from a member as to the number of copies of the Marshall books that have been sold lead me to compile a set of figures that were surprising even to me.

I have written five books of full book size of which 18,500 copies have been sold, one 16 page booklet of which 35,000 have been sold and an edition of 12,000 is now on the press and 42,000 copies of our 12 page Saguaroland Bulletin in which all of the writing was mine making 95,500 copies of my books sold to date and 12,000 additions on the press.

All royalties from my books since 1946 have gone to the Desert Botanical Garden.

THE SAGUARO CACTUS ARIZONA'S STATE FLOWER

The Saguaro Cactus was first observed by early missionaries to Sonora, and what is now Arizona, about 1540 and was referred to by Humboldt in his work on New Spain published about that time.

It was not described scientifically until 1848 when Dr. George Engelmann published it under the name *Cereus giganteus* in a document prepared for the United States Senate as Executive Document 7 reporting Emory's Military Reconnaissance of Survey of the U. S. -

Mexican Boundary.

So outstanding is this plant that but little confusion as to its identity has arisen. Lemaire in 1862 published it as *Pilocereus engelmannii* and Rumpler accepted Lemaire's classification as to genus but retained Engelmann's specific name as *Pilocereus giganteus*.

Britton and Rose in 1908 observed the difference in fruit structure and flowering habit of our plant from that of plants in the genera *Cereus* and *Pilocereus* and erected for it the genus

Carnegiea in honor of Andrew Carnegie who financed their investigation of the Cactus family and the accepted name today is *Carnegiea gigantea* (Engelmann) Britton & Rose.

Although the taxonomy of the plant is relatively simple the morphology and physiology are not too well known. Dr. Forest Shreve who knew the plant well wrote the following account of it for the



Fig. 39. *Carnegiea gigantea* (Eng.) B. & R. An unusual group of plants photographed by R. C. Proctor.

Cactaceae of Britton and Rose:

"The geographical range of the sahuaro extends from the headwaters of the Yaqui River in southern Sonora, northward to the southern edge of the Colorado Plateau. In Sonora it is rarely found more than 150 miles inland from the coast of the Gulf of California, and in southern Arizona its range follows approximately the contour of 3,500 feet on the east and north, and the lower course of the Colorado River on the west. It is found in California only in three restricted localities on the Colorado River and reaches its northern limit on that stream at a point about 40 miles north of the mouth of the Bill Williams Fork.

The occurrence of the sahuaro is by no means continuous throughout this area, for it is never found in deep alluvial soil and is relatively rare on the nearly level plains in the drainages of the Altar, Santa Cruz, and Gila rivers. It is extremely abundant on coarse detrital soils adjacent to the larger and smaller mountains and is very common wherever there is rock in place, ascending the mountains in diminishing numbers to an elevation of about 4,500 feet. The absence of the sahuaro from alluvial soils is undoubtedly related to the adverse conditions of soil aeration in these areas, and possibly to the lack of good mechanical support.

The localities in which the sahuaro reaches its greatest size and abundance are the uppermost portions of the slopes adjacent to small mountain ranges and hills, particularly where there is a southern or southwestern exposure. In localities of this sort throughout southwestern Arizona, it reaches a height of 30 to 35 feet, which is very seldom exceeded. Individuals of this size are freely branched and often have a gross weight of as much as 6 to 8 tons. In the vicinity of Tucson branching begins on attaining a height of about 15 feet, but on the edges of the range of this cactus branching individuals are rela-

tively uncommon and the maximum size is rarely reached.

The flowers of the sahuaro are borne at the crown of the main trunk and the lateral branches, usually appearing in May, while the fruit matures some weeks in advance of the summer rainy season. The small seeds are borne in great profusion, but are eaten by birds and ants so rapidly that the crop is seriously decimated before the requisite conditions for germination occur. The seeds germinate readily at the high temperatures of the summer rainy season, but the growth of the seedlings is extremely slow, so that the end of the second year finds them only one-fourth of an inch in height, and at an age of 8 to 10 years they are still less than 4 inches high. The growth continues to be slow up to a height of 3 feet or more, so that individuals of that size are approximately 30 years of age. After reaching this size the growth rate is rapidly accelerated until it reaches a maximum of about 4 inches per year. The largest individuals are 150 to 200 years of age.

The sahuaro appears to suffer from very few diseases and natural enemies, the greatest decimation in its numbers being occasioned by mechanical agencies. When struck by lightning or wounded in any other manner during the dry season, it recovers very rapidly by the formation of a heavy callus over the wounded spot. If it is wounded in the rainy season, however, bacterial decay sets in very rapidly and a large plant may be destroyed in less than a week as a result of a small wound. The nests made in them by woodpeckers are always lined by heavy callus and appear to occasion no permanent injury.

The roots of the sahuaro are shallowly placed and widely extended, often reaching the distance of 50 to 60 feet from the base of the plant. The woody tissue may be compared to a series of bamboo fishing rods arranged parallel to each other in the form of a cylinder.



SAGUARO, STATE FLOWER OF ARIZONA

These woody rods increase in thickness with the age of the plant, so that they form a very substantial framework at the base while they taper at the summit to slender elastic rods. The fleshy tissue is found both within and outside the circle of the woody rods and the water content of these two regions appears to be the same. Determinations made near the top of the plant indicate that there is 98 per cent of water on the basis of the net weight. There are great fluctuations in the water content of the tissue from season to season and it has been shown that large quantities of water are taken up during the rainy seasons, particularly in May and June. The sahuaro, like many other cacti, is able by reason of its external form to adjust its size to these fluctuations in volume.

This plant is an extremely useful one to the aborigines of its natural range.

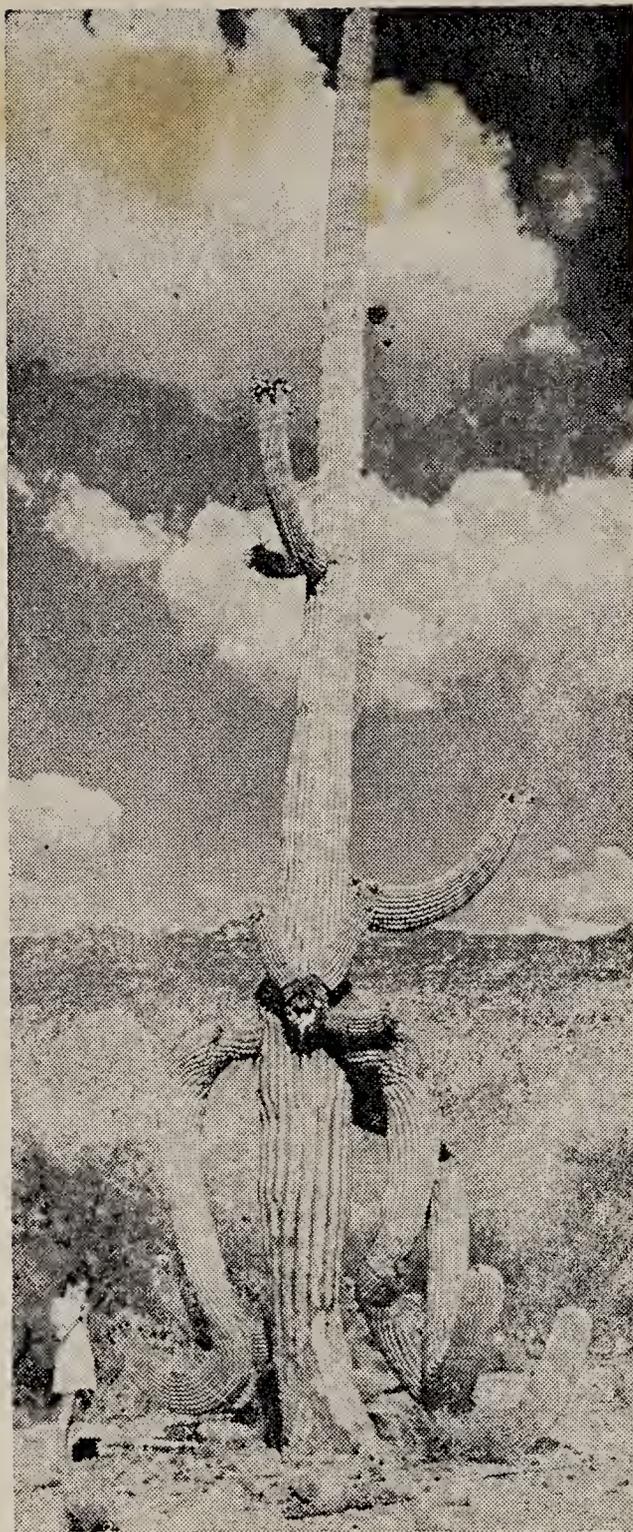
The heavy rods are used as construction material in building houses and enclosures, and the fruit and seeds are used for making both food and drink by the Papago and Pima Indians."

To Dr. Shreve's notes we add the following observations made by the Garden Staff:

Branches: We believe that a normal Saguaro in a favorable location is always a single, unbranched stem. In the sheltered canyons, especially in Organ Pipe Cactus National Monument, the great majority of the plants are simple while in areas where the heavy plants are exposed to heavy summer winds most plants branch.

We believe that branching is a balancing factor rather than the normal growth process.

Of all the cactus plants of many species we have grown only the Saguaro will not take roots when a branch is



The octopus Saguaro, an outstanding plant of Saguaro National Monument. R. C. Proctor Photo.

removed and planted. All other species we know will grow a new plant from a cutting.

Seedlings: Dr. Shreve has not mentioned that only those seeds which germinate under a bush or tree survive the first summer. In the first season the seedling is about the size of a pea and any that germinate in open ground are burned by the heat of the summer sun.

When seedlings germinate under a shrub they remain out of sight for years and become visible only when they

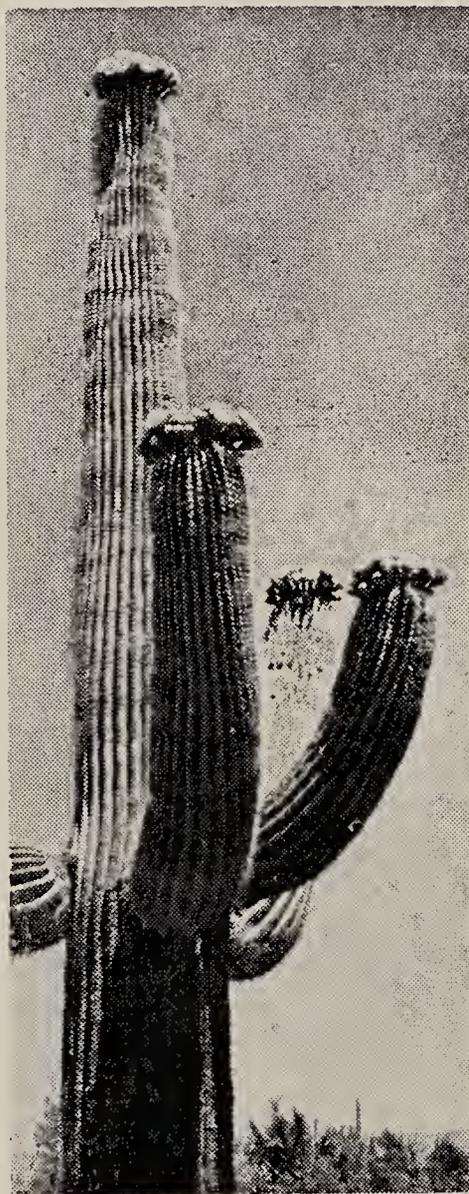
grow taller than the shrub or tree or until the protective plant dies.

Growth rate: Our observations made on a group of seedlings of various sizes from 4 to 30 inches which we moved and planted in a semicircle lead us to believe that the annual growth might be about $\frac{1}{4}$ inch a year but actual figures recorded by our Mr. Earle of plants growing naturally in our Arizona section where no watering is given and absolutely normal desert conditions prevail show the following amazing results:

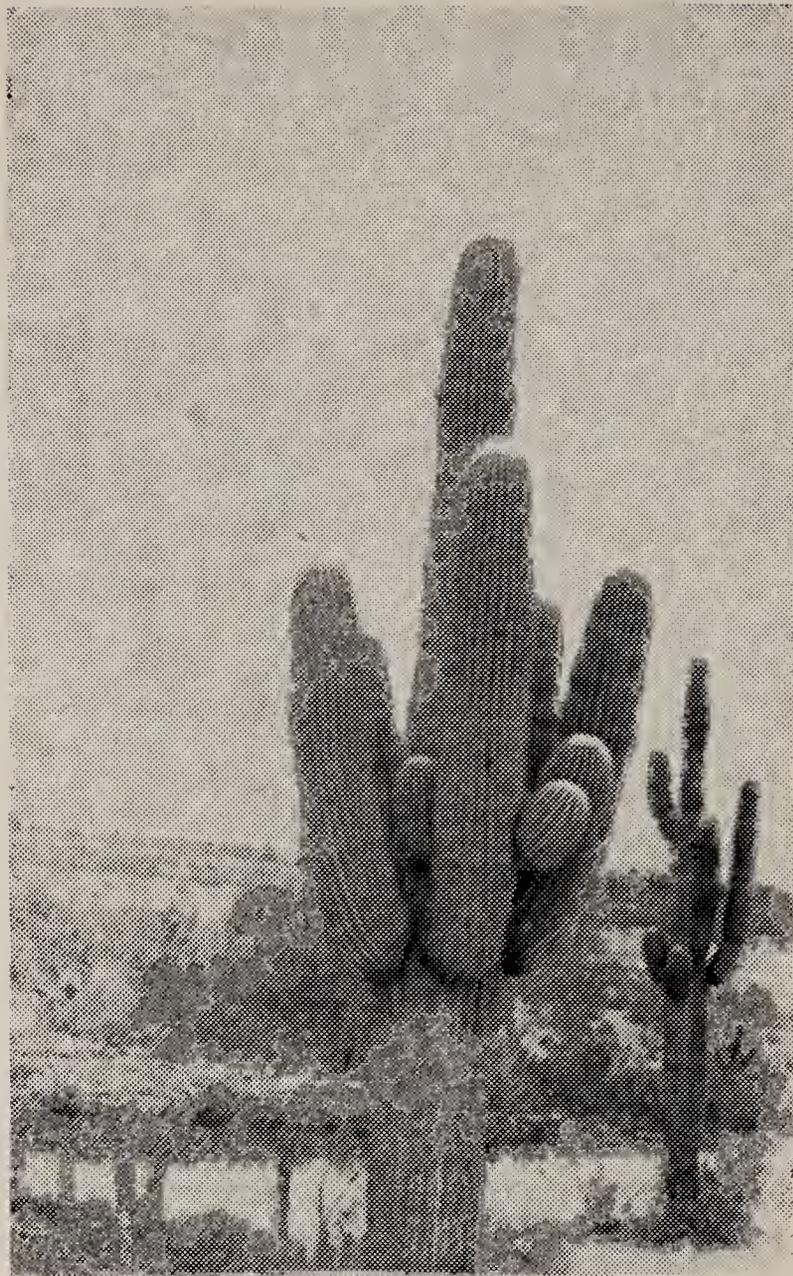
CHART OF GROWTH RATE OF 14 SAGUAROS FOR 6 YEARS

Growth Rate Per Year Shown in Inches

Height							Height
1949	1949	1950	1951	1952	1953	1954	1955
2 1/8 inches	5/8	1/2	3/4	1/2	1 1/2	1/4	6 inches
5 1/2	1 1/4	1/4	1 1/2	1/2	1/2	1/4	9 1/2
8 3/4	2 1/2	3/4	2 1/2	2	1 1/2	2	19
11 1/4	2	1/4	3 1/4	2 1/4	1 1/2	1 1/4	21 3/4
22 1/4	4	1 1/4	5 1/2	4 1/4	3	5	45
24 1/8	1 1/2	1/2	2 3/4	2 1/4	2	2 3/4	36
25 3/8	2 3/8	1	3	1/4	4 1/2	3 3/4	40 1/4
33 1/2	6	1	4 3/4	5 1/4	3 3/4	4 3/4	60
35	5 1/2	1 1/2	6	4 1/4	4 1/2	5 3/4	64 1/2
45	3 1/2	1 3/4	2	3 1/2	1 1/4	2 1/4	59 1/4
46	5 1/2	1	5 3/4	5 1/4	4	6	73 1/2
51	5 1/2	1 1/4	5	5 1/2	3 1/4	5	76 1/2
65 1/4	8	2 3/4	9 1/4	9	3 3/4	7	105
101	9	2 1/2	8 1/2	10 1/4	8	9 3/4	149
Rainfall in inches	6.74	3.62	12.37	10.65	3.56	4.31	



Saguaro in Flower. R. C. Proctor photo.



Saguaros in our parking lot
April, 1951.

Diseases: Dr. Shreve is correct in his statement of the relative freedom from disease by the Saguaro but they are occasionally destroyed by a necrosis introduced by a species of moth which causes very rapid deterioration and death in about 60 days. This is not new as Dr. Brown thought but is one of the natural controls of the Saguaro as we see it.

The principal enemy of the Saguaro is a two footed animal that first invaded this territory about 1850.

More Saguaros are destroyed by malice of men, who should know better, than by any other cause.

Flowers: The white, night flower of the Saguaro has been selected as the Arizona State Flower. It is produced

in May and early June and each flower opens after nightfall and remains open until about noon of the next day or in cloudy weather until about 3 P. M. and then closes forever. Each flower lasts less than 24 hours.

The stamens of the flowers are very numerous and as many as about 3,482 have been counted in a single flower and the ovules are nearly as numerous, nearly 1,980 having been counted in one flower. Both sexes are included in each flower.

Fruits: Saguaro fruits are ripe in June and are then olive-green with a pink blush, about 3 inches long and one inch in diameter. When fully ripened the fruits split into 2 or 3 or more segments exposing the scarlet pulp and are then



The same Saguaros, April, 1955.

mistaken for red flowers.

The fruit is high in sugar content and very palatable either fresh or preserved or fermented into a wine.

It has been an important food item of the Papago and Pima Indians, who date their year from the fruiting of the plant when a wine is prepared from the first fruits harvested and used in their new

year festivities. Others of the fruits are eaten raw as picked but the majority of the crop is stored in clay pots for winter use.

During June when we collect fruit to extract the seeds the pulp ferments within hours of the time it is collected and our patio smells like a winery by afternoon.

SPELLING OF SAGUARO

Suaharo - Suguaro - Sawarrow - Suwarro

Sahuaro - Zuwarro

THE FORM SAGUARO IS PROPER.

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2.35 1.25

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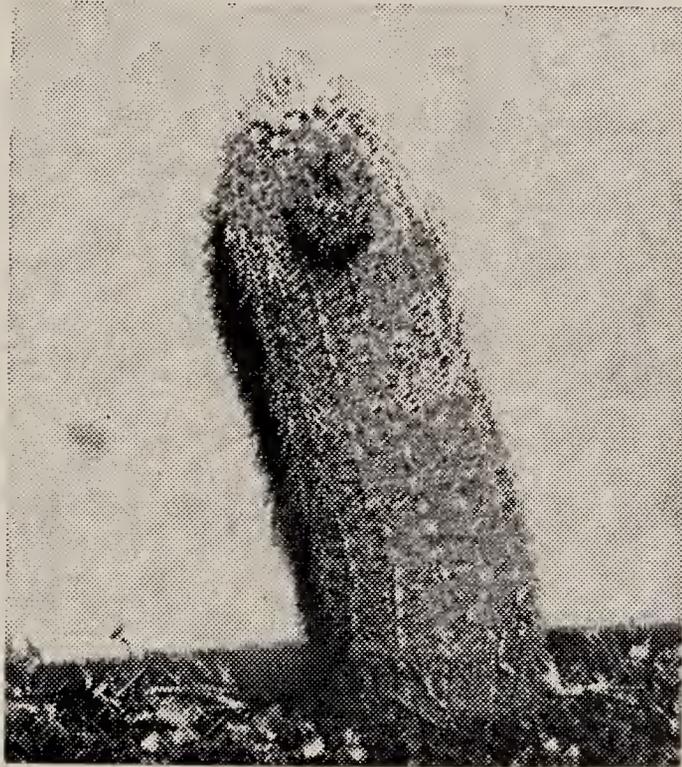
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6 inches high.....	3.30

SAGUAROWLAND

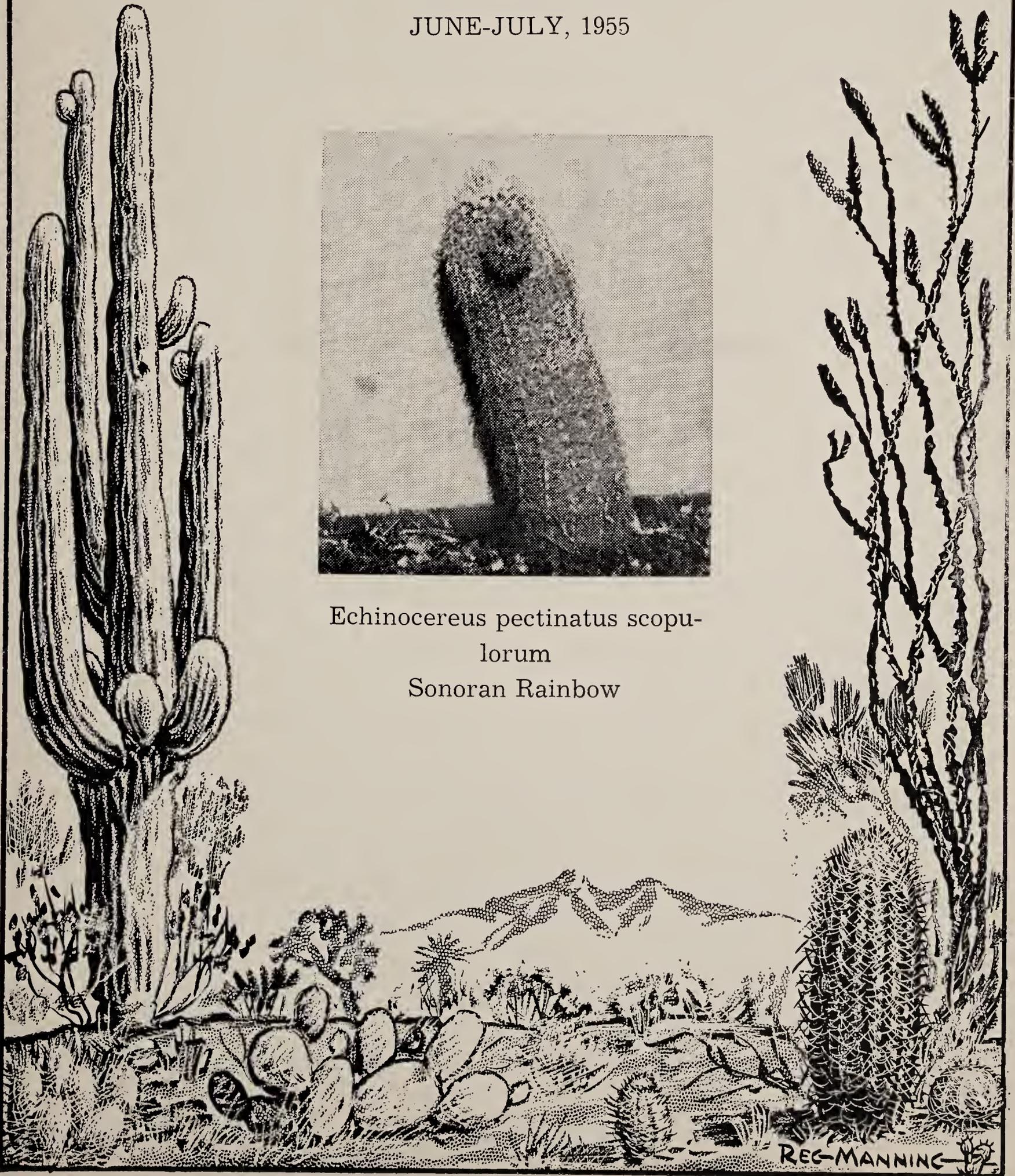
BULLETIN

DESERT BOTANICAL GARDEN OF ARIZONA

JUNE-JULY, 1955



Echinocereus pectinatus scopulorum
Sonoran Rainbow



EDITORIAL

Summer is with us again and again the Garden is closed to the general public so that we can complete our building program for the summer without interference.

While the general public is not welcomed during this period, we do welcome our members at any time, day or evening, to see the flowering plants. This privilege is another good reason why you should have memberships.

If you wish to come out in the evening to see the night flowering plants, it might be a good idea to check by phone in the afternoon to make sure that there will be flowers open that night.

The following letter which had a \$10.00 check enclosed is another example of reasons why we should have many more members of the Garden:

May 3, 1955

Mr. W. Taylor Marshall, Director,
The Desert Botanical Garden of
Arizona

P. O. Box 547
Tempe, Arizona

Dear Mr. Marshall,

While in Phoenix this winter, my wife and I had the pleasure of visiting your Garden several times, and we were greatly impressed. It is maintained in excellent condition and is a credit to the State of Arizona. I inquired as to how it is financed and as a result decided to add my bit.

It should be supported by a large membership.

We have taken a number of color snaps all around Arizona — and par-

ticularly in your place — and I have not found a spot that so typically represents that wonderful country.

I shall be glad to renew this membership annually if you will remind me.

Sincerely, signed

Additional memberships are needed to cover the ever mounting costs of caring for a constantly increasing attendance which reached about 150,000 persons for the 1954-55 season just ended. Chamber of Commerce please note.

Work on improvements is already under way and we have replaced the worn, narrow steps which were the main approach to Webster Auditorium. The old steps, like the terrace, were of flagstone and over the years had become chipped on the edges forming a hazard to our visitors. The new steps are three feet wider, are of concrete with sanded surface and have three hand rails to aid our more infirm visitors to ascend them.

We have also relaid the flagstones of the upper terrace to eliminate inequalities.

We plan to increase the size of our aluminum lath house from 4800 square feet to 6000 square feet which will mean that we can double the space devoted to display beds.

We also plan on a new, all aluminum frame, glass house for raising seedlings and a new glass room for frost tender Euphorbias.

We lack the money for some of this work but hope to be able to raise the \$1,000.00 additional funds from some of our good friends.

ACCESSIONS

Mr. John H. Eversole has presented the Garden with a Rolleicord camera equipped with portrait lenses which will enable us to get good clear plant and flower pictures for the Bulletin. He also sent us equipment to process our own film.

Mr. Herman Schroeder of Avalon,

California has sent us six large "Golden Barrel" seedlings, another "Old Man of Mexico" and a large "Old Man of the Andes," *Echinocactus grusonii*, *Cephalocereus senilis* and *Espositoa lanata* to you Cactomaniacs.

Paul Hutchison of the University of California Botanical Garden has sent

us a large number of his seedlings from his own Chilean collecting trip and from the seeds sent by Dr. Cardenas of his new species from Bolivia. All of these will be grown to maturity, as many as 100 of some species, so that observations can be made on spine variations and flower color differences within a species.

Three expeditions from the Garden are now making collections for us of cactus, Agaves and seeds of other desert plants. Heading them are Ken Fisher, a member from Mesa, Charlie Mieg, who will be gone two months, and Gus and Sylvia Herman and Gus Jr. who have gone to semi-tropical areas to collect.

The results of their expeditions will be on display when the Garden reopens next fall.

Mr. Earle and the writer will attend the Convention of the Cactus and Succulent Society of America at El

Paso July 8th to 11th and Dr. McCleary and the writer plan a trip to Utah, Colorado and New Mexico to investigate species of Agaves in August.

Our three expeditions will also collect the Agaves of the districts they will visit so we hope to make considerable progress in assembling the material needed for our Agave investigation this year.

The new herbarium case presented by Charlie Mieg has just arrived and will be used for the preservation of herbarium sheets on Agaves.

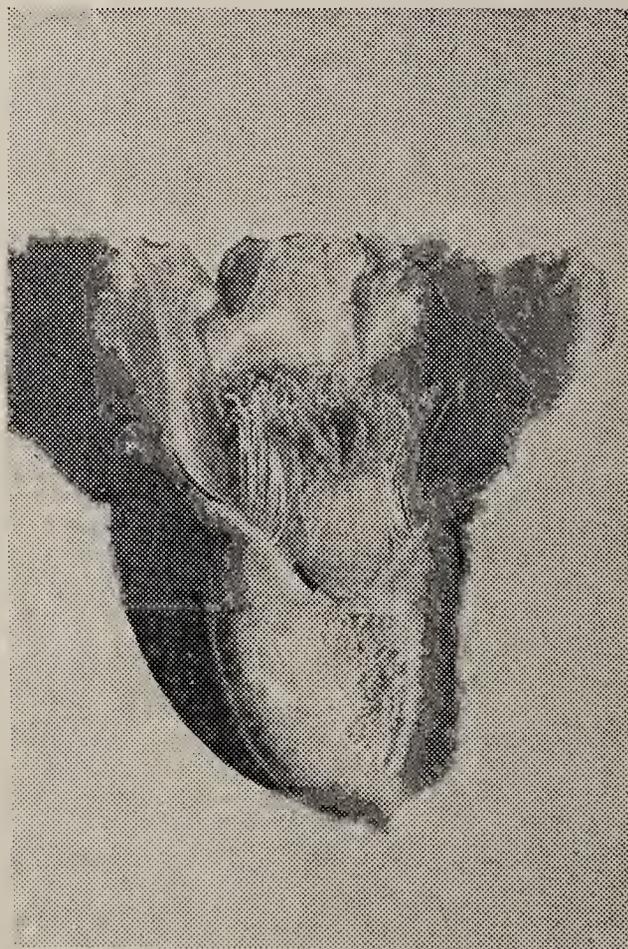
We have much to be thankful for as you see and we are deeply grateful to the above outstanding contributors and to all our members.

We sincerely hope to be successful in our efforts to secure the additional \$1,000.00 we need if the improvements outlined are to be completed this summer.

OPUNTIA UNDULATA GRIFFITHS?

In August of 1947 R. C. and Claire Meyer Proctor brought a pad of an unknown *Opuntia* to the Desert Botanical Garden. Not only was its name not known but its place of origin was also a mystery. Because of the tremendous size of the pads, it has been tentatively identified up until the present time by Mr. W. Taylor Marshall as *Opuntia undulata* Griffiths. Of course, other vegetative characteristics are also in general agreement. The pad took root, grew rapidly, and cuttings were taken from it to start several other plantings.

This year for the first time, two of the four plants produced flowers and fruits. In order to establish a definite identification, the literature was searched to see if these structures agreed with the records. Originally, the species was described by Dr. David Griffiths in Vol. 22 of the Missouri Botanical Garden Reports in an article entitled *Illustrated Studies in the Genus Opuntia IV*, pp. 32-33. Of the flower, Griffiths has nothing to say having collected the plant too



Bisected flower showing style.

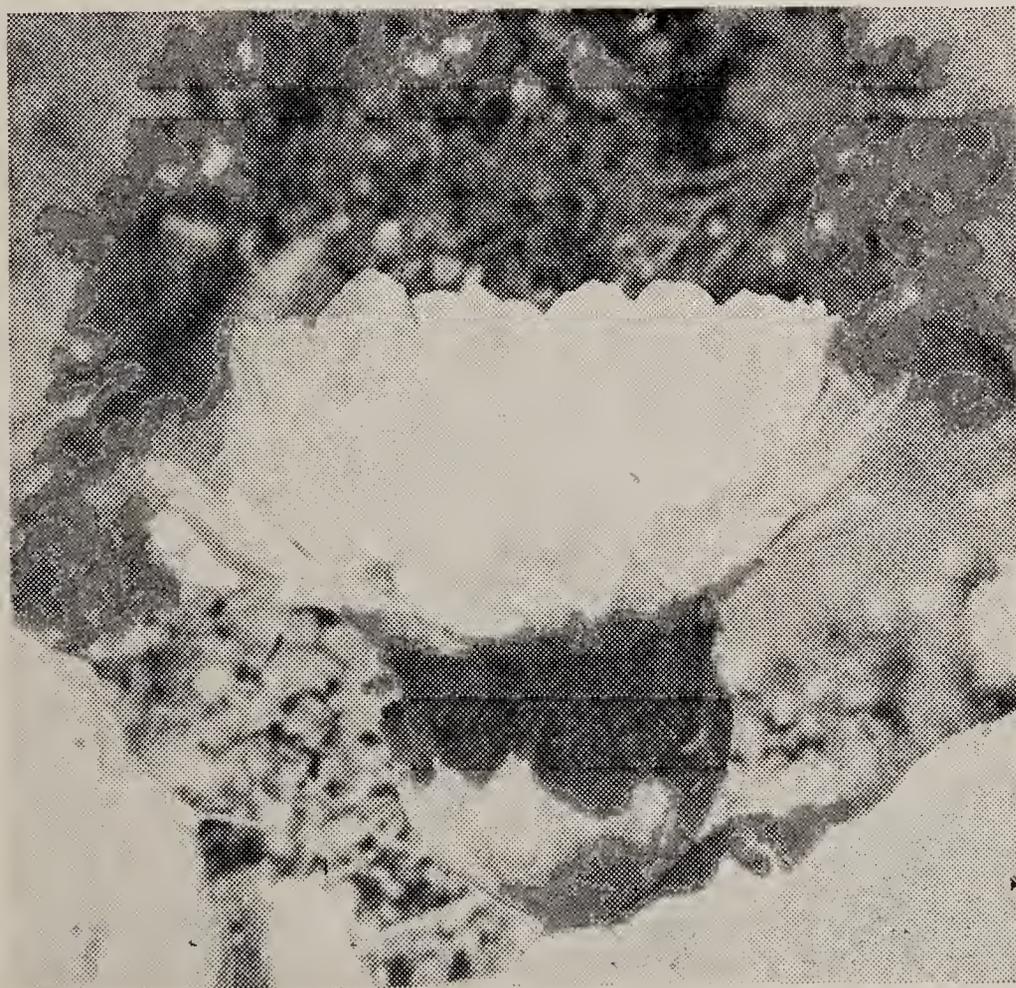


Is it
Opuntia
undulata
Griffiths?

late in the season. The fruit he describes as "fruit large, 4-5x9-10 cm., dull red to slightly tinged with orange and pulp streaked with red and orange when rind is removed." This plant was obtained at Aguas Calientes, Mexico in 1905 and, although grown by Dr. Griffiths until 1910, never flowered. Pho-

tos of the original plant show that it was grown under irrigation for commercial purposes.

A check of Britton and Rose, *The Cactaceae*, reveals nothing additional as their description was copied from Griffiths. Neither Isaac Ochoterena in *Las Cactaceas de Mexico* (1922) nor Helia



Flower
of the
above
plant.

Bravo in *Las Cactaceas de Mexico* (1937) describes the flower and fruit.

In an attempt to ascertain if any of our readers recognize or have information concerning specimens similar to the one in our garden, we shall describe the flower and immature fruit. The flowers are golden-yellow, rotate-campulate, around 12 cm. in diameter. An outstanding feature which has not been observed in any other *Opuntia* is the tremendous size of the style which is from 1 to 1.5 cm. broad and about 2 to 2.5 cm. in length and urn-shaped in outline.

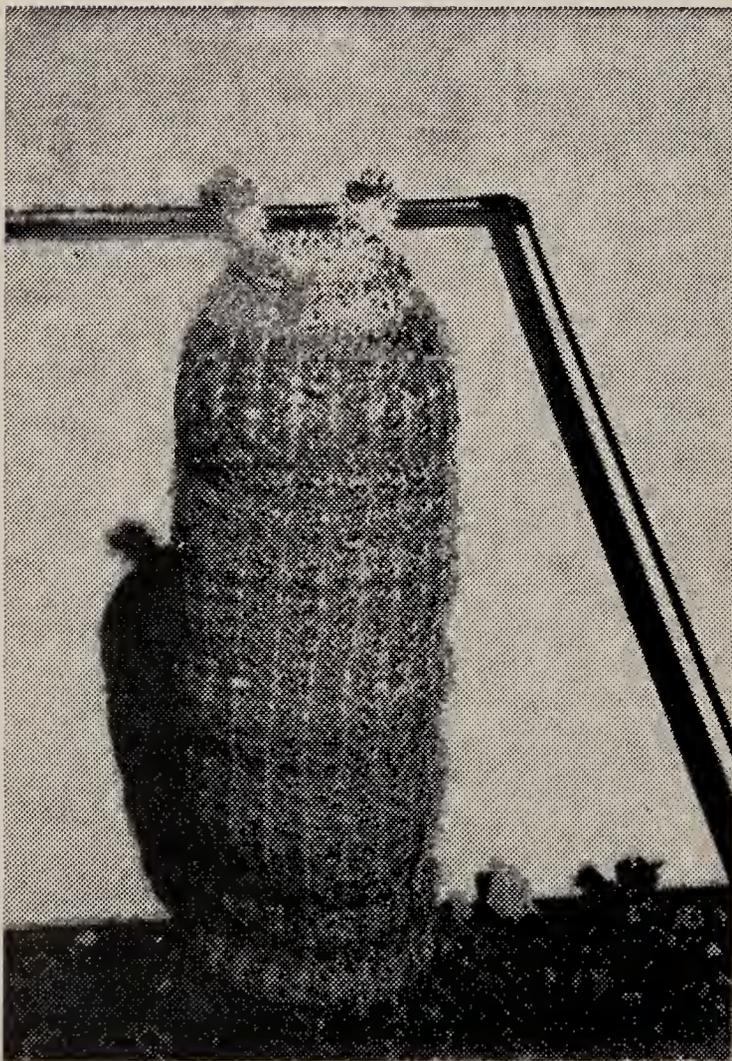
The immature fruit, which in June is approximately 5x9 cm., is bluish-green with long tubercles tipped with areoles bearing yellowish-brown glochids. Because of the length of the tubercles, the areoles are mainly produced on the upper half of the fruit. A

deep cup-like depression on the end marks where the perianth was attached.

As indicated above, there is almost complete agreement between this plant and the published description of *Opuntia undulata* Griffiths. One exception must be noted, however, and that is in the color of the young growth. Griffiths notes that new growth is a glossy light-yellowish green, while the color of the young growth of our specimen is maroon similar to that of *Opuntia gosseliana* var. *santa rita*. What the effects of continued irrigation upon the color of the young growth of *Opuntia* is not known. Since our plants receive a more or less normal supply of water, this may account for the difference.

James A. McCleary,
Senior Botanist and Assoc.
Prof. of Botany at A.S.C at Tempe

ECHINOCEREUS PECTINATUS (SCHEIDWEILER) ENGELMANN VARIETY RIGIDISSIMUS ENGELMANN ARIZONA RAINBOW CACTUS



The Arizona rainbow cactus acquired its common name because of the variation in spine color from year to year, some years red, others straw colored or white but leaving bands of varying colors around the mature plant.

It is notable also for the size and brilliance of its magenta flowers which are to be seen on the plants in April and May.

It is a variety of a species, *Echinocereus pectinatus*, which is widespread from northeastern Mexico to Sonora and the islands in the Gulf of California and some of the variations can be found in Texas, Oklahoma, New Mexico and Arizona in the United States.

Any species of plants occupying such a wide range of climates and altitudes would, of necessity, have many forms and our species is no exception. The variations consist of varying sizes from the relatively small *E. pectinatus reichenbachii* of the northern range to the

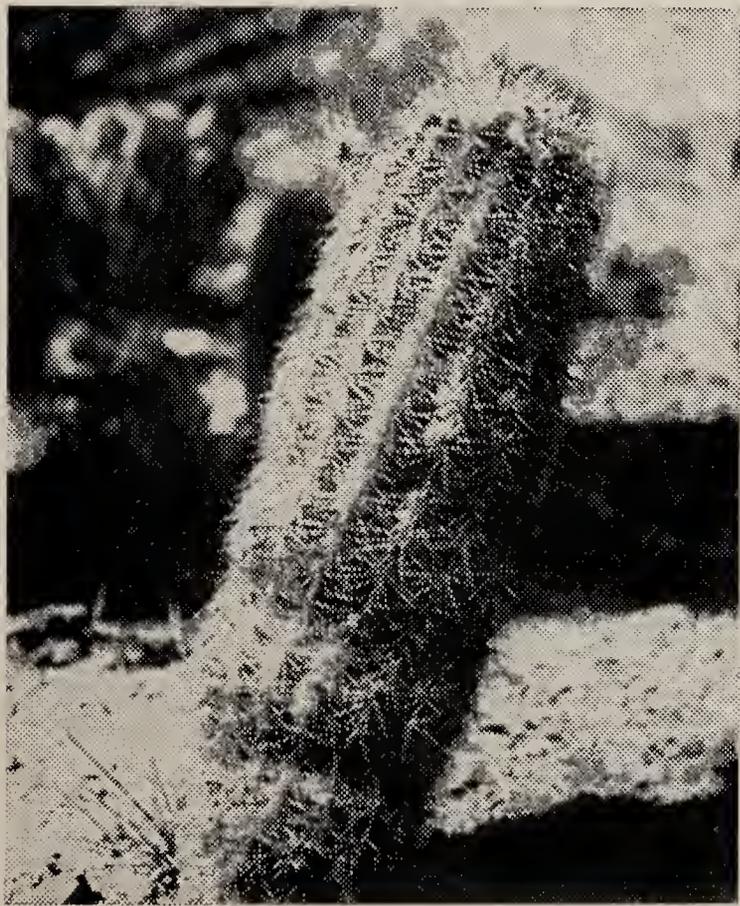


RAINBOW HEDGEHOG OF ARIZONA

Echinocereus pectinatus rigidissimus — Arizona Rainbow Cactus

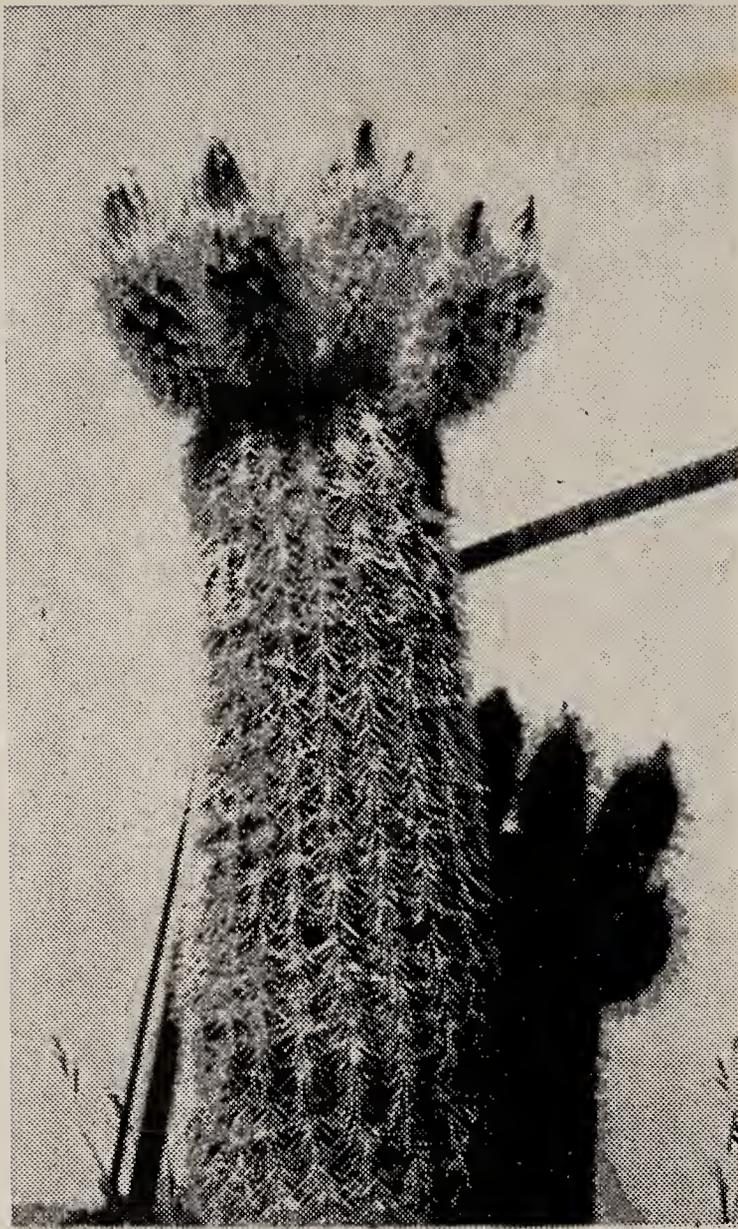
(Above and on page 66)

Echinocereus pectinatus pectinatus
A plant of the true species collected
in Cochise County, Arizona



tall growing, up to 12 inches, *E. pectinatus rigidissimus* which is almost always simple, that is, consisting of one branch only while *E. pectinatus neomexicanus* and *E. pectinatus reichenbachii* both form clumps of stems.

The flower color range within the species is even more remarkable. Our rainbow cactus, the cob cactus or lace cactus, *E. pectinatus reichenbachii*, and other variations have flowers ranging from magenta to rose color. *E. pectinatus neomexicanus* (synonym *Echinocereus dasyacanthus*, has a yellow or yellowish flower while *E. pectinatus grandis* has a small flower of a dirty-



Echinocereus pectinatus grandis

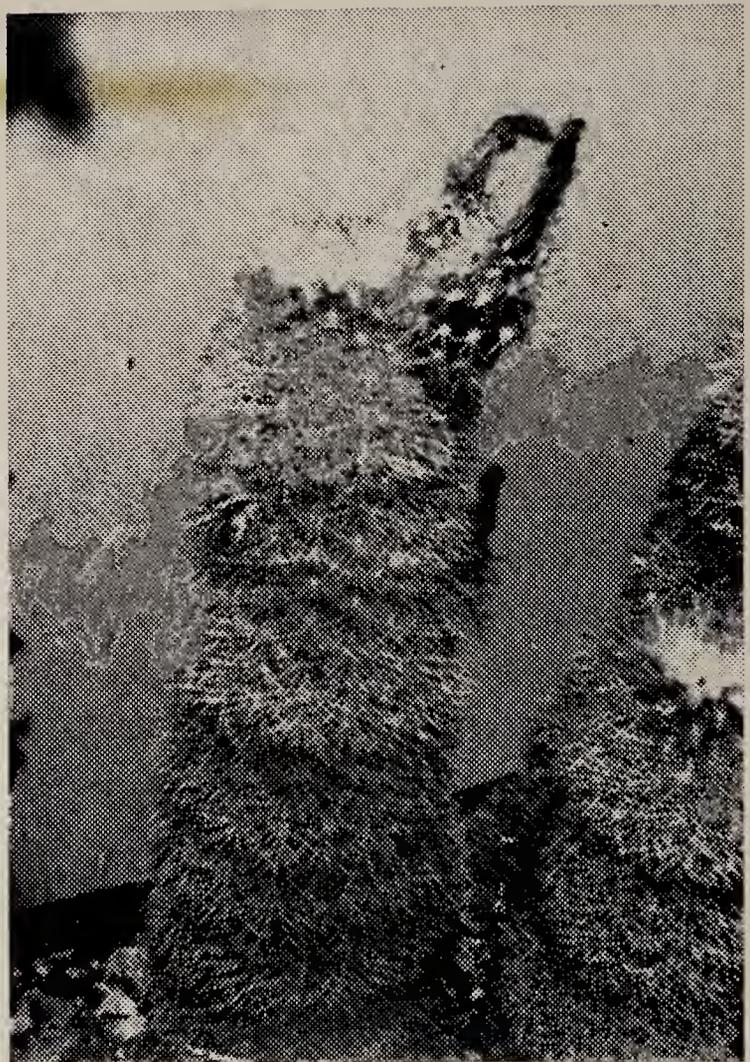
white color.

The fruits of all the variations are similar. The fruit is, at first, very spiny but the spines tend to fall off as the fruit ripens into a globose, red berry of excellent flavor.

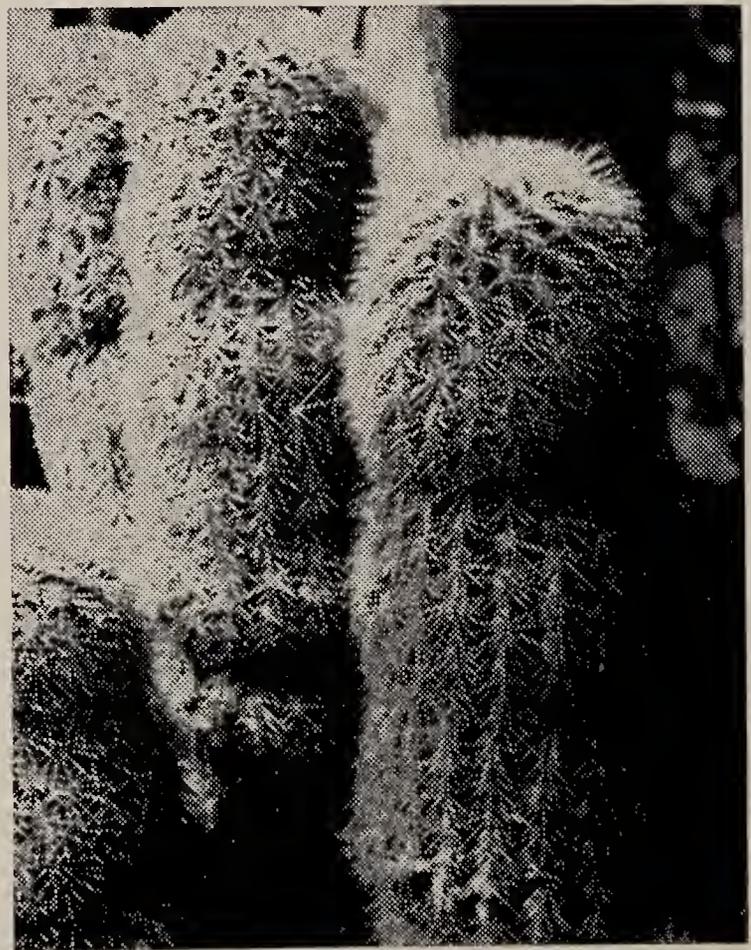
All most all of the variations present difficulties for growers outside the desert areas and it is true that only young plants are capable of meeting new conditions of humidity and temperature.

Nursery grown seedlings are best and the growth rate of such seedlings is very satisfactory.

Echinocereus pectinatus rigidissimus, *E. pectinatus neo-mexicanus* and *E. pectinatus pectinatus* are especially difficult in cultivation and only very young plants can be successfully reestablished even in the desert areas of Arizona.



Echinocereus pectinatus neo-mexicanus
Texas Rainbow. Flowers yellow



Echinocereus pectinatus grandis
White Flowered Rainbow

A GALL MIDGE INFESTING *OPUNTIA PHAEACANTHA*

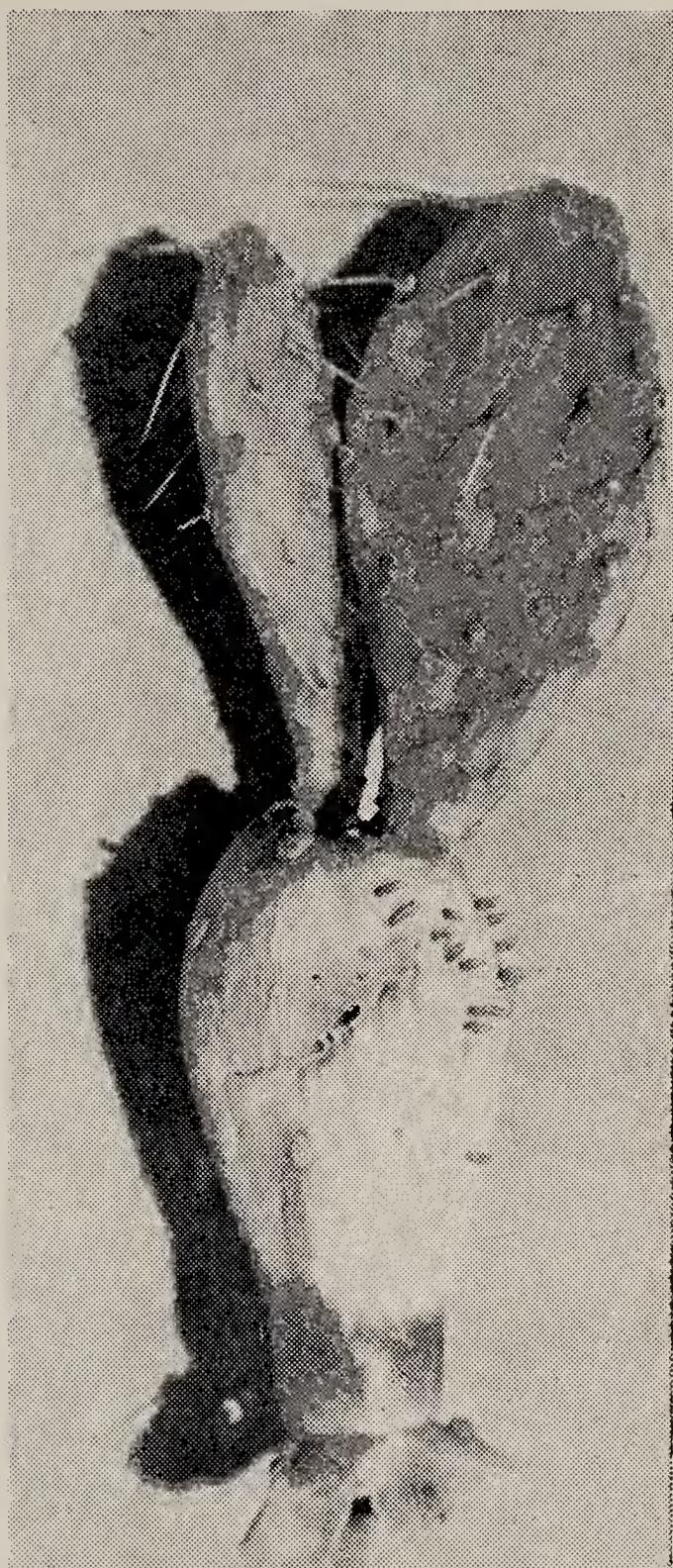
Over the weekend of May 1, 1955, the author, accompanied by Dr. Walter Tulecke of the Arizona State College at Tempe botany staff, two students, Murray Walker and Roy Johnson, undertook a botanical collecting trip along a portion of Clear Creek in the Grand Canyon of Arizona in conjunction with the National Park Service and the Grand Canyon Natural History Association.

One of the interesting collections made was that of several insect infested ovaries of *Opuntia phaeacantha*. At first, the swollen fruit was thought to be a gall because of the new pads growing from the apical end of the structure, but dissection soon showed the presence of numerous undeveloped seeds.

The fruits were brought back to the college and placed in an insect cage to await their emergence. Before caging, the fruit was kept for several days in the writers office. While sitting at his desk one afternoon, he looked down and saw an enormous "mosquito" on his ankle. The insect was promptly dispatched. Closer observation showed that this "mosquito" was actually one of the seed or gall midges. This midge has been tentatively identified by Dr. Gordon Bender, entomologist at Arizona State College, as a species of the genus *Miastor*.

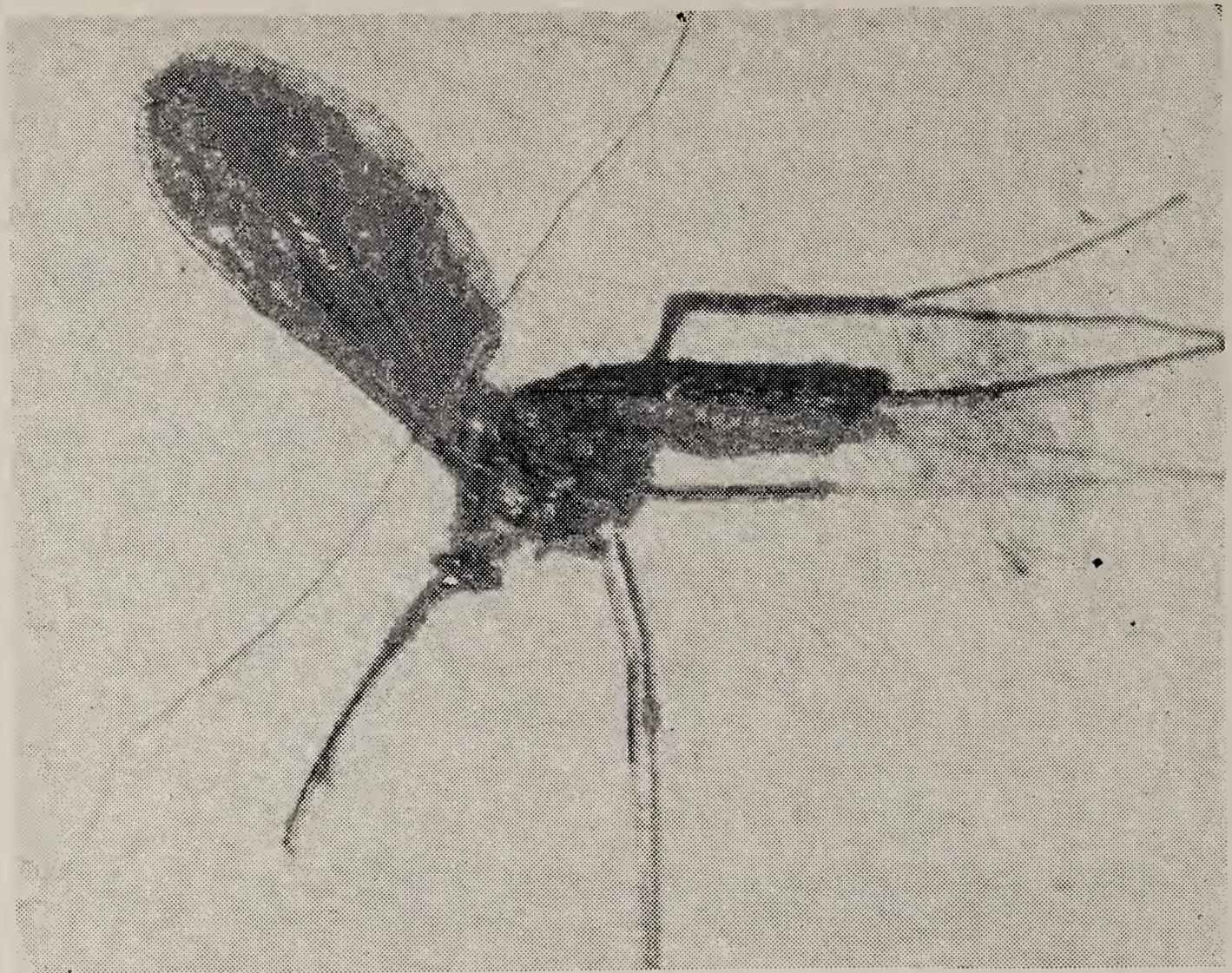
Many insects which attack and destroy the cactus are known. G. A. Frick, in the February 1953 issue of the *Cactus and Succulent Journal* states that there are 250 destructive insect species known to Texas entomologists which destroy cacti in that state. However, to the best of our knowledge, none of the *Miastor* species have been reported on cactus.

In 1920, the Commonwealth Prickly Pear Board of Australia was organized to survey means of putting to use or eradicating the several prickly pears which had affected more than 60,000,000 acres of land in Queensland and New

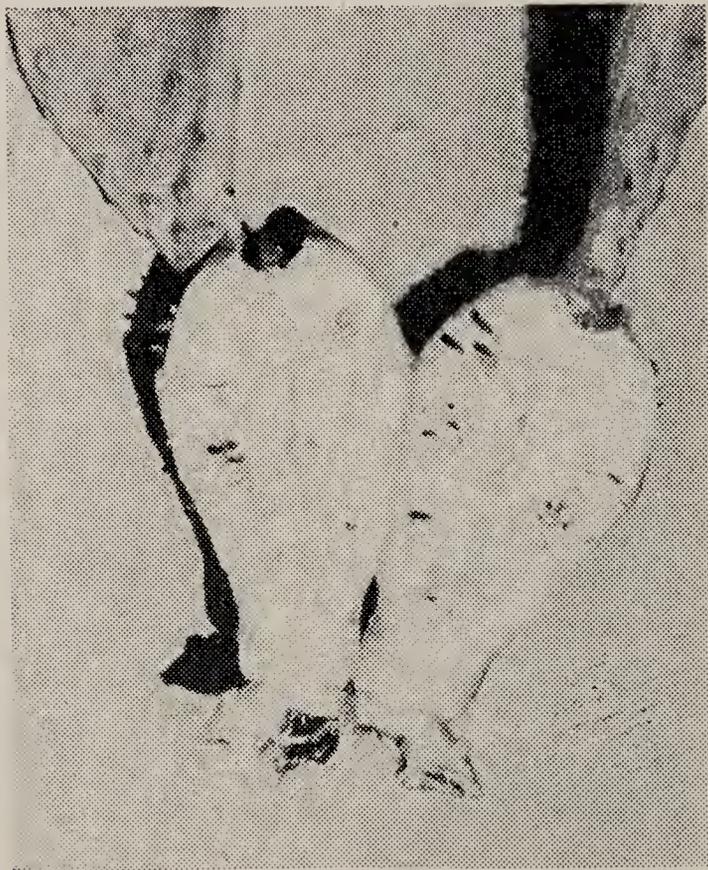


Proliferating fruit on plant attacked by gall midge.

South Wales. The use of chemicals, fungi, and insects were studied by authority of this board with the insect being soon considered as the only feasible possibility. Entomologists were sent to various countries and at least twelve centers were established in the United States where life histories and feeding habits were studied and at length at least 50 different species of insects were sent to Australia and in all, 12



Gall midge of the genus *Miastor*.



Fruit bisected to show infestation by gall midge.



Front view of gall midge.

species became established.

During the course of the above investigations, the cecidomyid midge or *Asphondylia opuntiae* was tested and found to be able to cause destruction of the prickly pear but failed to pass the so-called starvation test in so far as if it was deprived of the prickly pear, it would deposit eggs in and thus destroy the young fruit of fig, peach and apple. Although we know little or nothing concerning the feeding habits of the *Miastor*, since its life history appears similar to that of *Asphondylia*, the life history of the latter will be given in order to show the destructive possibilities which may occur.

Asphondylia opuntiae has a wide distribution throughout the southwest,

sometimes being very plentiful in local areas with resulting destruction of as high as 80% of the fruits and seeds. E. P. Felt, in a Key to Gall Midges (Bulletin No. 257, New York State Museum, 1925) reports *A. opuntiae* as so abundant as to ruin practically every cactus fruit in large sections of California. Eggs are deposited in young buds in early spring. The flower develops as usual, pollination and fertilization occur and the fruit grows normally for a time but soon becomes swollen or attenuated. The seeds remain soft and never mature. Fruits do not absciss but remain on the plant during the summer and winter during which time the larvae slowly develop until pupation occurs in February and March. The adults leave the

fruit in March and April after which the fruit withers and drops. A few species of *Opuntia* are known to proliferate and produce new pads or flowers.

Since no recent reports of these infestations have been publicized, it is not known to what extent these pests may be spread. Careful observations should be made so that control mea-

asures can be applied if necessary.

Specimens of this insect will be retained at the Desert Botanical Garden, Arizona State College at Tempe and at the Grand Canyon National Park.

James A. McCleary,
Senior Botanist and Assoc.
Prof. of Botany, A.S.C at Tempe

OPUNTIA GOSSELINIANA VAR. SANTA-RITA A CRESTED FLOWER



One of the showiest of our plants is a crested form of *Opuntia gosseliniana* variety *santa-rita*, the purple prickly pear.

In cold or dry weather this species takes on a purple coloration that is greatly admired, even in the plants which are not crested.

When, in addition to the coloration, we have a crested plant with each plate shaped pad fanned out and ruffled on top, it becomes even more noticeable.

Not satisfied with these attractions this one particular plant produced a number of crested flowers for us in May, one of which we illustrate.

Most growers are under the impression that flowering is a most unusual occurrence in crested plants but we have found that in a favorable climate

and with satisfactory growing conditions crested plants flower as freely as non-crested ones.

This is indeed fortunate as the identification of crests without flowers is very difficult because the crested growth differs widely, in most instances, not only in shape but even in spination.

For example, we had a beautiful crest supposed to be *Machaerocereus gummosus* presented to us as a grafted plant by Frank Mark. We do not care for grafted plants for display in our garden so we took the crest off the stock and established it on its own roots. When it flowered we were able to identify it as *Notocactus mamulosus* from its flowers although the spination more closely resembled *Machaerocereus*.

SAGUAROWLAND

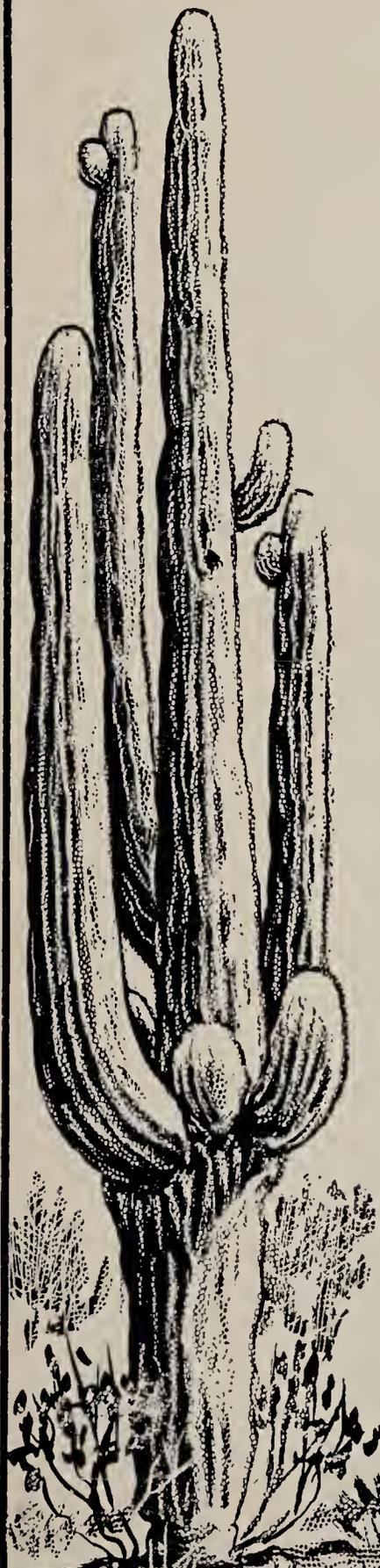
BULLETIN

DESERT BOTANICAL GARDEN OF ARIZONA

AUGUST-SEPTEMBER, 1955



Desert Lovers



REG-MANNING

SAGUAROLAND BULLETIN

Published and owned by the Arizona Cactus and Native Flora Society, sponsors of the Desert Botanical Garden of Arizona, P. O. Box 547, Tempe. Saguaronland Bulletin attempts to promote the Garden and to provide information on the desert plants and their culture. Subscription \$3.00 per year, the subscription including active membership in the Society and the Desert Botanical Garden. Issued 10 times a year.

W. TAYLOR MARSHALL, Editor

Volume 9

August-September, 1955

No. ⁷~~17~~

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Desert Botanical Garden of Arizona

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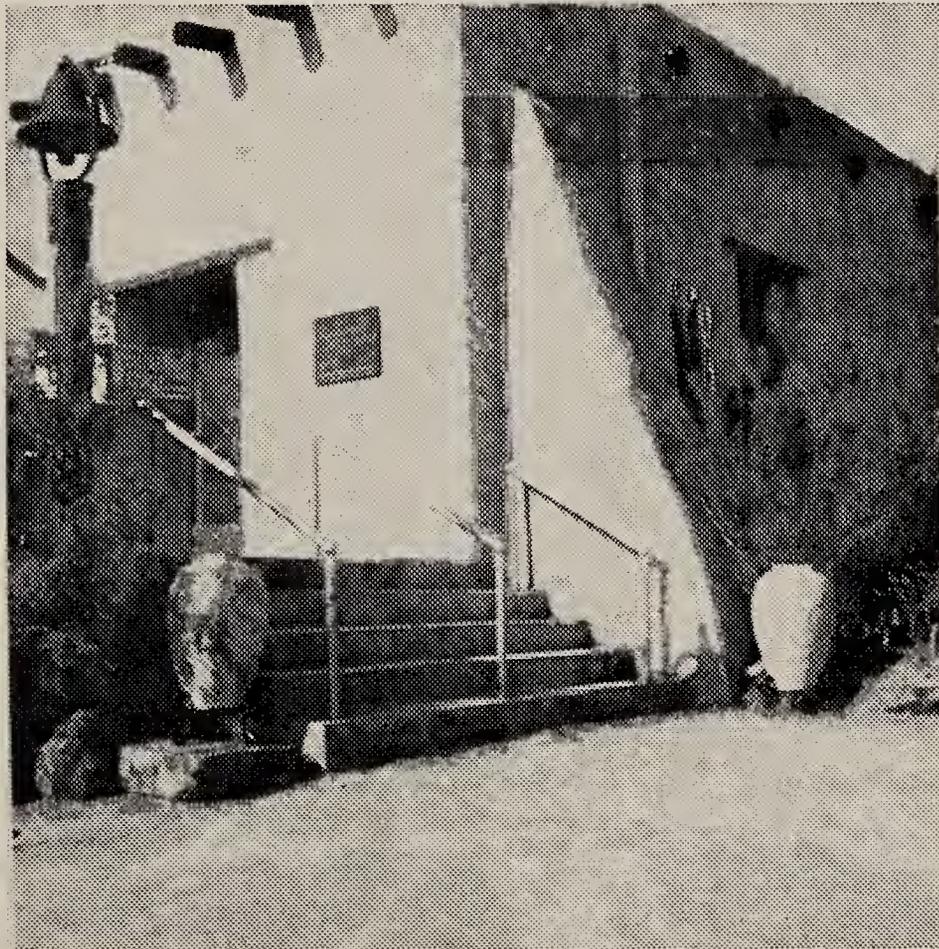
EDITORIAL

The months of June and July have been ones of exceptional activity by the staff of the Desert Botanical Garden. Physical changes have been made, collecting trips taken, new plants added to our collection and plans for the coming year have been discussed over and over again. Just as last year, the Garden will open to visitors on Saturdays and Sundays during September and remain open everyday except Mondays thereafter.

Your director and Mr. Hubert Earle, along with Paul Hutchison of the University of California at Berkeley, attended the joint meeting of the Cactus and Succulent Society and the I. O. S. at El Paso in July. The convention was well and enthusiastically attended. Among the highlights of the convention were the excellent scientific talks given by Dr. Castetter of the University of New Mexico on the cacti of that state, Dr. Lyman Benson on the geography of the cactus and by Dr. Margery Anthony on the ecology of the Big Bend cacti;

the meeting of the I. O. S. and last, but not least, the renewal of friendships with many cactus lovers from all over the country.

Visitors to the Garden during this time have been numerous. Before the El Paso meetings saw Dr. Monte Cazier, director of the new biological station in the Chiricahua Mts., Mrs. Josephine Miller, secretary to Floyd Merrill of the Greeley Daily Tribune, Dr. Burkholder, Professor of Botany at the University of Georgia, Dr. Martha J. Spence, a member of the Sarasota Succulent Society, Sarasota, Florida, and Robert Leigh, a professional photographer from California stopped for visits. Mr. Marchanton from Vancouver, British Columbia dropped by on his way to El Paso as did Mrs. Helen M. Phillips who brought a number of books as a gift to the Garden. After the El Paso convention, Howard Gates, Mert and Mort Spielman, Dr. and Mrs. Blue, Mr. and Mrs. Homer Rush, the Don Skinners



The new steps and hand-rails at the entrance to the administration building.

and the Harry Johnsons stopped at the Garden for lengths of time varying from several hours to several days. We enjoyed their visits and were happy to see each of them.

Jack Schreuder, a member of long standing, and a man who has contributed hundreds of rare plants to the Garden will spend a few days with us in August.

Our library has been increased by a gift from Mrs. Helen M. Phillips who brought numerous back volumes of Desert Plant Life and the Cactus and Succulent Journal as well as Van Laren's Succulents, Van Laren's Cacti and Thornber and Bonker's The Fantastic Clan. Paul Hutchison generously had volumes 14 to 24 of the Desert Plant Life bound as a gift to us.

Accessions

A large number of plants have swelled our collections. Paul Hutchison added 120 records to our accessions book, many of which had from one plant to an entire flat of seedlings. Charlie Mieg and Gus Hermann took their families on collecting trips to Mexico. The Hermanns brought back approximately 75 species for us and the Miegs brought 105. Some of Mr. Miegs habitat pictures from the trip are in this issue and the complete story will be in the October number.

The Aluminex Corporation of California, from whom we purchased our lath house, sent us 30 laths free in order

to replace some of the ones damaged by a wind storm.

John Hales, one of our local members, presented us with 2 exhibits showing a number each of *Coloradoa mesae-verde* and *Utahia sileri* in large display boxes in a replica of their habitats and in their own native soil.

Work Progress

Construction work has been progressing at a fairly rapid pace despite the break in of vacation periods for the staff. The front patio of the administration building has been relaid and new cement steps and guide rails placed at the north entrance (see illustration). At this time, one 20 by 20 extension to the lath house has been completed and another section 20 by 40 will soon be done. When finished this will add 1200 sq. feet of floor space for display and plant propagation purposes. The purchasing of a glass house, originally scheduled for this summer, is still being withheld pending further developments.

As our Garden grows in size and number of plantings our costs go up, much faster than our income. We took a chance that some friend or friends of the Garden would assist us with the paying for the lath and glass houses. So far, the money has not been forthcoming. If it does not come in, we will not be able to buy the glass house and payment for the lath house will seriously cut into our reserves and hamper our plans for the future.

THE GENUS MELOCACTUS IN MEXICO

W. Taylor Marshall

Four species of Melocacti have been described from Mexico since 1837 but very little was known about the actual plants until very recent years.

The first description was by Pfeiffer in Enum. Cact. 46, 1837 of *Melocactus curvispinus* which was said to come from Mexico without precise locality. It is described as globose, 10 cm. high, 7.5 cm. in diameter, depressed; ribs 10 to 12; areoles large, round, white-vel-

vety; radial spines 7, curved, brownish or white, 12 to 16 mm. long; central spines 2, erect, 2.5 cm. long, blackish.

A repetition of this description was given on page 135 of *Monographia Generis Melocacti*, 1838, F. A. Guil. Miquel.

Melocactus delessertianus Lemaire, Hort. Univ. 1:125, 1839 is described as slightly depressed, about 10 cm. high; ribs 12 to 15; radial spines 8 or 9; central spines 2; flowers and fruit unknown.



Melocactus curvispinus Pfeiffer, a plant collected at Salina Cruz, Oaxaca.

This plant was also listed as from Mexico but without specific location.

The third description of a *Melocactus* from Mexico was in a circular issued by Professor Murillo of Jalapa, Vera Cruz, Mexico about 1897. Murillo offered plants for sale and stated "This *Melocactus* is found in the fissures of lofty, perpendicular mountain passes, but in very limited numbers, and in a region not exceeding a square mile in extent."

Britton and Rose, *Cactaceae* 111:228, 1922 list Murillo's plant under the genus *Cactus* as *Cactus salvador* (Murillo), with the following description: Simple, globose, 30 to 40 cm. in diameter; ribs 13; radial spines 8, somewhat recurved, central spines 1 to 3, longer and stouter than the radials, those near the center of the plant nearly erect, those on the side somewhat curved downward; cephalium 8 cm. in diameter, flowers rose-pink, seeds black.

As the type location they state that none was cited and they give the distribution as "High mountains above

Jalapa, Vera Cruz," although I cannot find that Murillo divulged the location of his mountain pass.

The April, 1898 number of the *Cactus Journal*, London, carried a half page advertisement by Murillo offering orchids and five species of cacti, including *Melocactus salvador* and this advertisement was repeated in the May, June and July issues. In the August, 1899 issue the editor reported the flowering of several of his plants of *M. salvador*.

The original circular of Murillo was accompanied by an illustration of four potted plants and this we have not seen but Britton and Rose, *Cactaceae* 111:229 have reproduced a photograph of five plants, two with cephalia, which they obtained from the library of Kew Garden who received it from Murillo. This picture shows plants which are identical with plants collected in the state of Oaxaca in Mexico.

Dr. Isaac Ochoterena in *Las Cactaceas de Mexico*, 1922 makes no mention of any species of *Melocactus* in Mexico yet

he was a colleague of Prof. Luis Murillo and credits him with assistance in the preparation of the book.

The description of the Mexican cacti in "Trees and Shrubs of Mexico," Paul C. Standley 1924, part 4, was prepared by Drs. Britton and Rose and listed only *Cactus salvador* as native to that country.

Dr. Helia Bravo in *Las Cactaceas de Mexico*, 1937, follows Britton and Rose and recognizes only *Cactus salvador*. She did note also the publication of *Melocactus curvispinus* by Pfeiffer and also mentions that plants of the genus had been received by Britton and Rose from two locations in the state of Oaxaca.

These plants were described as *Cactus* sp. by Britton and Rose, *Cactaceae* 111: 236-237, 1922 and illustrated by a photograph of a juvenile plant as figure 249 on page 236. Their description was: Plant small, globose, 10 cm. in diameter; ribs 11 to 13, rounded, low; spines usually 10 to 12, subulate, more or less recurved; central spine 1 or sometimes 2; crown 10 to 12 cm. in diameter; flow-

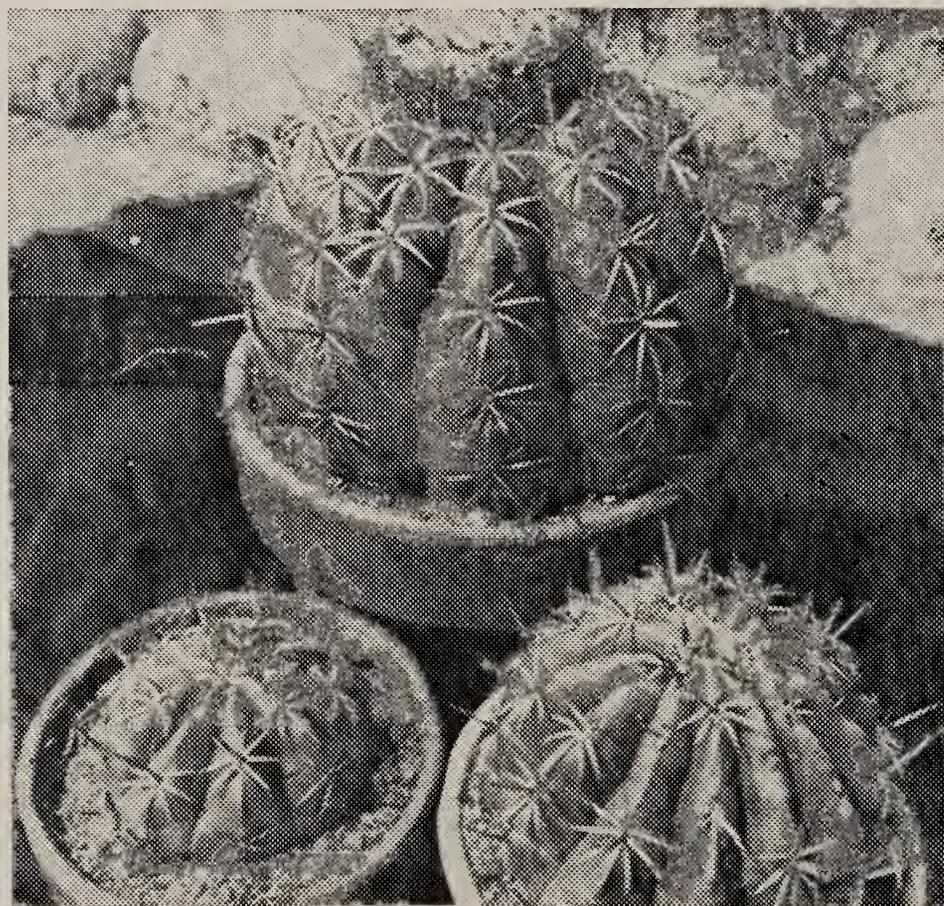
ers small; fruit small.

They comment: "A living plant was sent to Dr. Rose by Professor C. Conzatti in October 1913 (no. 151a) from Salina Cruz, Oaxaca and it has been reported by Dr. C. A. Purpus from San Geronimo.

They suggest also that *M. curvispinus* Pfeiffer and *M. delessertianus* Lemaire may apply to this species.

In *Cactaceae* IV: 289, appendix, Britton and Rose formally describe the plants under the name *Cactus oaxacensis* sp. nov. as follows: globular to ovoid, 12 to 15 cm. thick, with a small, low crown only 3 to 4 cm. broad; ribs 11 to 15, prominent, usually rounded; radial spines 8 to 12, subulate, more or less recurved, at first reddish-brown but grayish in age, 2 cm. long or less; central spines 1 or sometimes 2, erect or porrect; flowers slender, about 2 cm. long, dark rose; filaments and style light yellow; fruit thick-clavate, 2 to 4.5 cm. long, scarlet, shiny; seeds small, black.

(Turn to page 80)



Melocactus curvispinus Pfeiffer. Three plants collected by Mieg on the Tehuantepec-Oaxaca road. Note rib and radial spine variation.



BARREL CACTI ON THE DESERT

Wislizenius barrel cactus.

WISLIZENIUS BARREL CACTUS

Wislizenius' barrel is named for one of the early botanists who explored areas of northern Mexico and made plant collections . . . Found only in the areas of Arizona to Texas, usually below 4000 ft. altitude, it is the largest barrel of Arizona sometimes reaching 8 feet in height with one report of 11 feet and up to 24 inches in diameter. The flowers of this barrel are extremely variable, appearing in late July, August or September and being from red to yellow in color. In common with other barrels, this one has fruits bearing naked scales.

Because many specimens of Wislizenius' barrel slant in a southwesterly direction, it is sometimes called the "Compass Cactus." However, this is

not a dependable characteristic and individual plants in a group may lean in various directions.

The areoles contain about 4 central spines, one of which is strongly hooked. The radial spines are threadlike, white and arranged in a pectinate manner.

Like other species of barrels, Wislizenius' barrel is sometimes used to make "cactus candy." In line with our ideas on conservation, we would like to urge all our readers not to purchase any confection made from the body of the plant as certain of the barrels are being entirely wiped out in some localities. Instead, buy candy made from the fruits of any of the various cactus plants. This does no harm to the plant and saves it for future generations to enjoy.

They report that it has been found by C. R. Orcutt at Salina Cruz and that Dr. B. P. Reko had sent them photographs (one of which they reproduce as fig. 262) and flowers obtained by him in 1923, while Dr. J. A. Purpus recollected it in 1923 (type) and has sent living plants.

In the past four years we have had ample opportunity to study the *Melocactus* from Mexico including collections by the Moortens of Palm Springs, Calif., the collections of Howard Gates and Gil Tegelburg from near San Geronimo, a plant from the Botanical Garden of the University of California collected at Salina Cruz and three plants, as illustrated, collected by Charles Mieg on the Tehuantepec-Oaxaca road.

All of these collections were from the state of Oaxaca but Dr. E. Yale Dawson in Allen Hancock Foundation Publications, Occasional Papers No. 1, page 22, 1948 in addition to collections of *Cactus oaxacensis* Britton and Rose at Salina Cruz (D 3031) notes: "A more extensive distribution is indicated, however, by the authors observations

of plants probably of this species, growing in similar situations on steep granite hills overlooking the sea at Barra de Navidad, Jalisco."

A description made from the just mentioned plants would read thusly: Plants globose to sub-cylindrical; ribs 10, 11, 12, and 13; radial spines 7, 8, and 9 with the majority being 8; central spines 1 to 3, usually 2, erect at the apex of young plants, porrect and somewhat curved on the sides of the plants, mahogany red to black at first, weathering to a uniform grayish; cephalia low, about 15 cm. in diameter; flowers light fuschia; fruits 5 cm. or more in length, clavate, scarlet.

From the description just given it can be noted that *M. curvispinus*, *M. delessertianus* and *M. salvador* will all fit into the same category.

Our conclusion is that there is only one species of *Melocactus* to be found in Mexico. We propose the use of the first validly published name, *Melocactus curvispinus* Pfeiffer to cover that species with the relegation of the other names to synonymy.

LECHUGUILLA or LECHEGUILLA — A NOMENCLATORIAL PROBLEM

In 1859, J. Torrey, writing a description of the plants collected by members of the United States and Mexican Boundary Survey party, described a species of *Agave* to which he gave the specific epithet of "lecheguilla." In a discussion of the species, he states that the common name for the plant is "lechuguilla."

Since that time, many prominent botanists dealing with the species have evidently been at a loss as to the correct spelling to use. Mulford, in her *A Study of the Agaves of the United States*, published in 1896, uses the "lechuguilla" version stating that "by error, the specific name was originally printed 'Lecheguilla'." In 1915, Berger in *Die Agaven* and Wooten and Standley in *Flora of Mexico* followed Mulford in her spell-

ing. However, by 1920, Standley had changed his opinion for in *The Trees and Shrubs of Mexico* he reverts to "lecheguilla." L. H. Bailey used "lecheguilla" in the *Cyclopedia of Horticulture* published in 1943 and Benson and Darrow in the 1944 and 1954 printings of *The Trees and Shrubs of the Southwestern Deserts* retained the original spelling with the notation, "the specific name is taken with slight modification from lechuguilla, the Mexican common name which is the diminutive of lechuga, lettuce."

That lechuguilla is the diminutive of lechuga or lettuce is a fact that is borne out by the *Diccionario Ingles y Espanol*, Holt 1953, page 353. The relationship between the "leche" and the "lechu" is obvious. Wild lettuce, a member of the



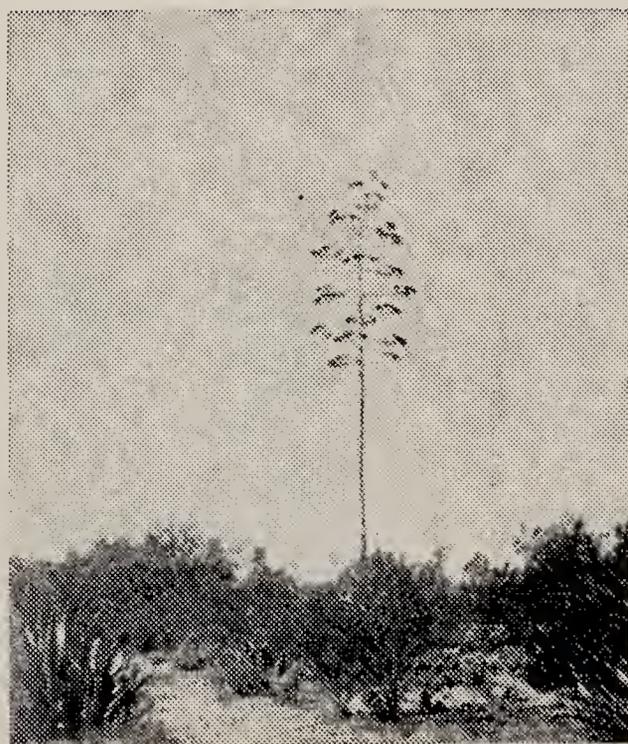
Agave lechuguilla Torrey, a group of plants in the Desert Botanical Garden.

composite or sunflower family, contains a milky juice in its structures. The Spanish word for milk is "leche". However, there is no Spanish word "lecheguilla". It will probably never be clear as to Torrey's intent, whether the use of the letter "e" was a deliberate spelling as suggested by Benson and Darrow or whether, according to Mulford, a typographical error.

Until recently, the International Rules of Botanical Nomenclature did not allow a change in spelling in a circumstance of this nature. However, the latest edition of the rules, published after the 1950 meetings at Stockholm now allows a change to be made if the spelling is a result of a typographic or orthographic error (see section 14, article 82, Orthography of names and epithets). Obviously the use of the "e" rather than the "u" was a typographical error or if it were not, the changing of lechuga to the diminutive form with the spelling of "lecheguilla" was an orthographic mistake and should be treated as such.

Thus the use of the specific epithet "lechuguilla" seems to be the correct spelling and the plant in question should be cited as *Agave lechuguilla* Torrey.

James A. McCleary,
Senior Botanist and Assoc.
Prof. of Botany A.S.C at Tempe



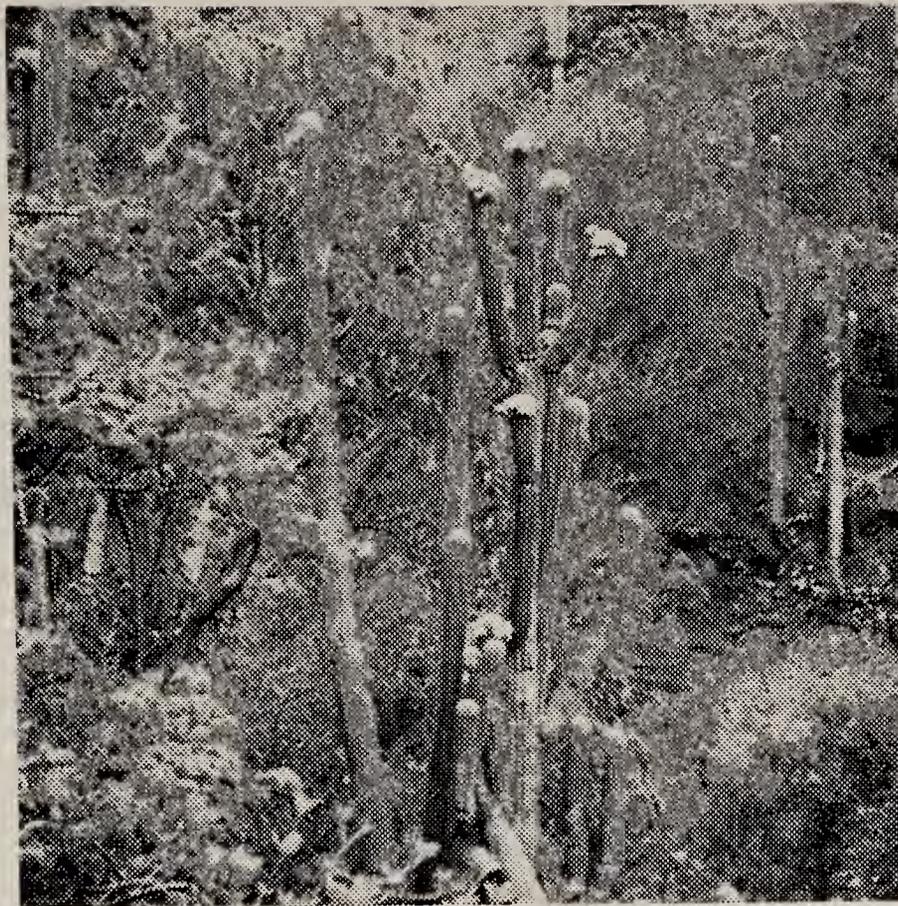
Flowering of *Agave americana*



Mammillaria guerreronis in its natural setting. Mieg photo.



A tree like Agave or century plant in flower in Oaxaca, Mexico.
Mieg photo.



Mieg photo.

Cereus tetetzo Weber (*Neobuxbaumia tetetzo* Backeberg) in Oaxaca.

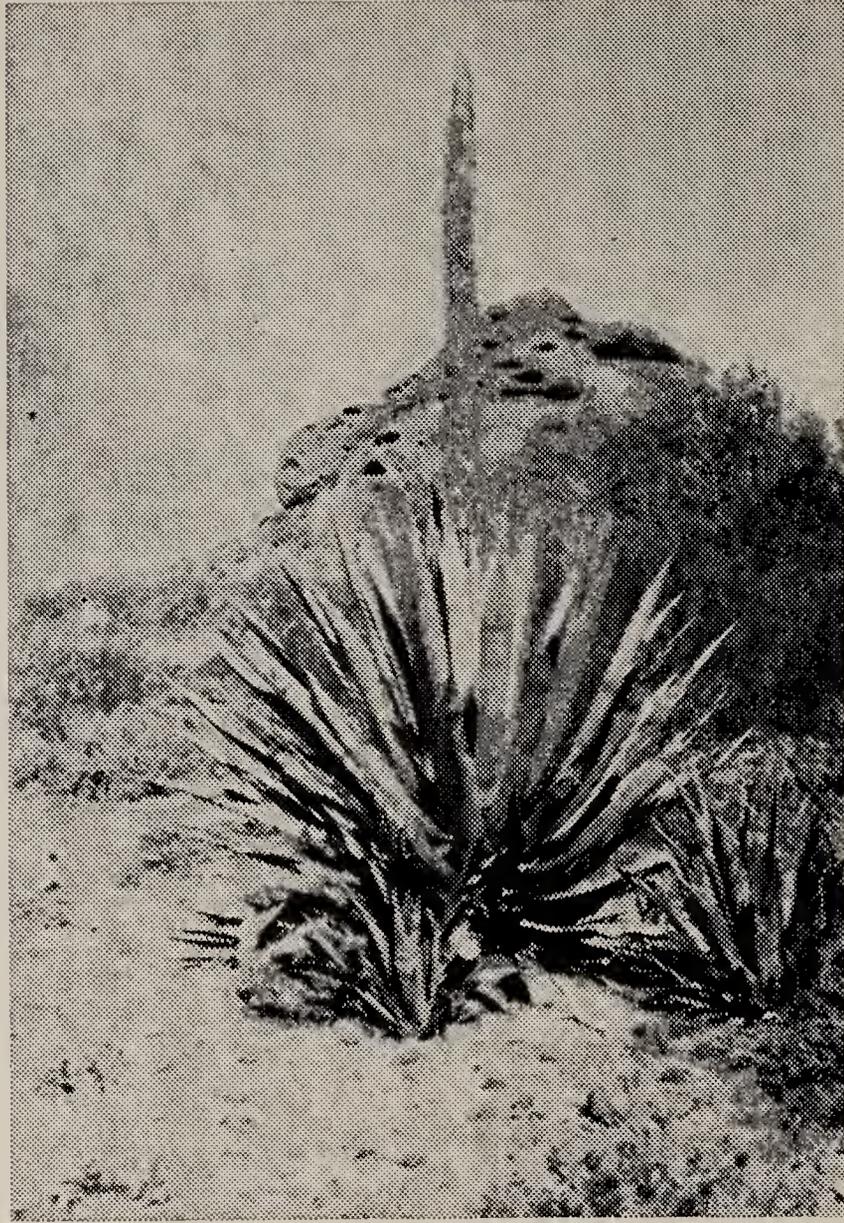
BOOK REVIEWS

Two publications of interest to those who like to travel in the southwest or collect cactus.

The American Southwest, A Golden Regional Guide, written by Natt N. Dodge, Regional Naturalist, National Park Service, and Herbert S. Zim, Prof. of Education, University of Illinois, with illustrations by Arch and Miriam Hurford. This small booklet, published by Simon and Schuster is a first in a series of guides to the regions of the United States. It gives information concerning climate, major attractions, places to see and things to do, mammals, plants, insects, the ancient and modern Indians and other things too numerous to mention. The cost of this is only

\$1.95 plus \$.10 postage when ordered from the Desert Botanical Garden.

Cactaceae y Suculentas Mexicanas is a new journal just started by the Mexican Cactus Society. Although a foreign language journal it brings first hand information concerning Mexican cacti and other succulents and their habitats. A \$2.00 membership brings a years subscription or four numbers. The first number was worth the price of the subscription in order to obtain two of Dr. Helia Bravos works which were reprinted from another journal which is difficult for most cactologists to obtain. Write directly to the treasurer, Dudley B. Gold, Aniceto Ortega No. 1055, Mexico 12, D. F.



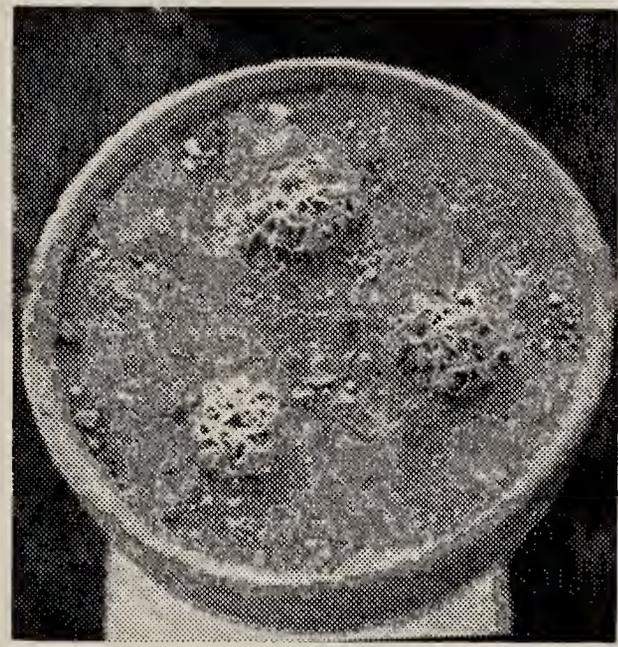
Flower stalk of *Agave americana* growing at the rate of 16 inches a day.

SAGUAROWAND

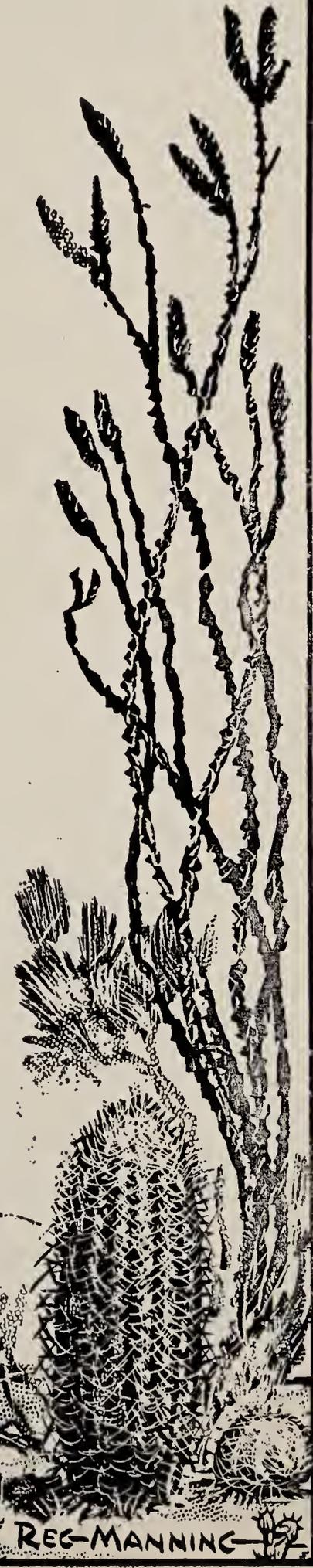
BULLETIN

DESERT BOTANICAL GARDEN OF ARIZONA

OCTOBER, 1955



Toumeyia peeblesiana
(Croizat) Marshall



REG-MANNING

SAGUAROLAND BULLETIN

Published and owned by the Arizona Cactus and Native Flora Society, sponsors of the Desert Botanical Garden of Arizona, P. O. Box 547, Tempe. Saguarioland Bulletin attempts to promote the Garden and to provide information on the desert plants and their culture. Subscription \$3.00 per year, the subscription including active membership in the Society and the Desert Botanical Garden. Issued 10 times a year.

W. TAYLOR MARSHALL, Editor

Volume 9

October, 1955

No. 8

Arizona Cactus and Native Flora Society

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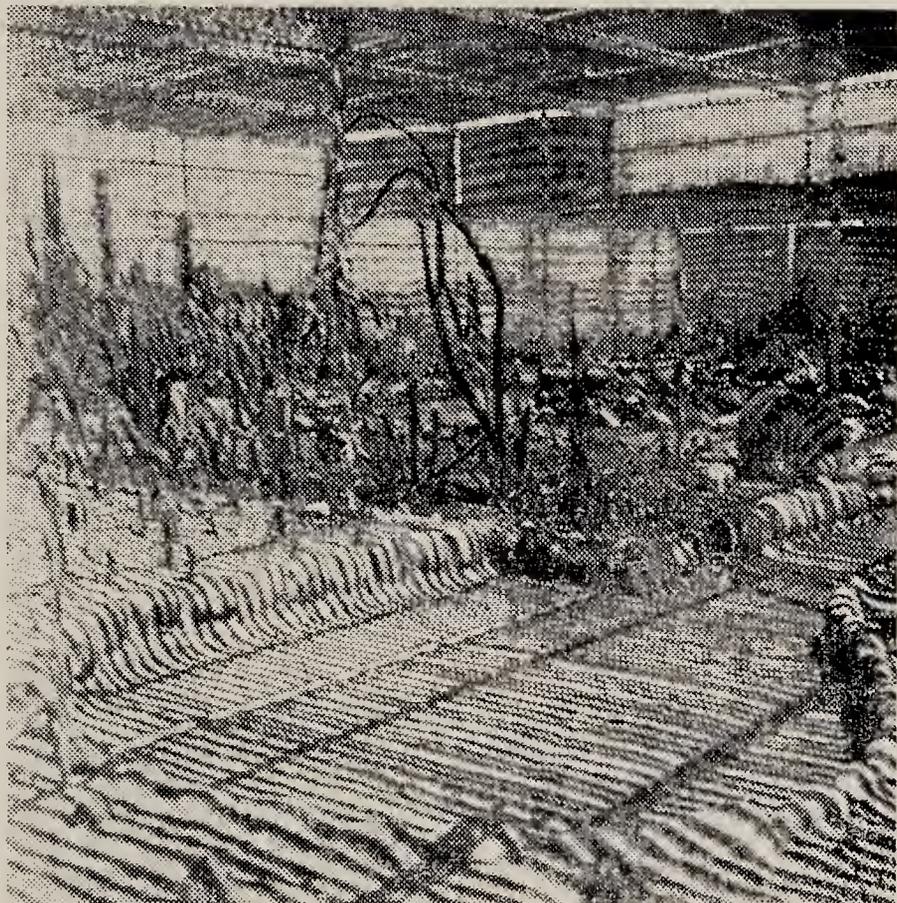
EDITORIAL

Fall in the desert country is a truly delightful season. The summer rains and heat have produced a remarkable growth on our desert plants and they are all at their very best. Flowers are frequently seen this fall due to our greater summer rainfall and everything in the garden is lush and green.

Temperatures during October and November are ideal for outdoor trips

hibits and facilities each year to accommodate the larger attendance.

All of this increases our cost of operations but, as we make no charge for admissions, our income does not increase in proportion and we have found it harder each year to meet the increased costs. This summer we doubled the planting area under lath and built a new all-aluminum glass house for the



Inteiror of the enlarged lath-house

through the plantings and we anticipate a greater number of visitors than in previous years.

Commencing October 1st the garden will be open daily from 10 A.M. to 5 P.M. except that on Mondays we remain closed all day. The usual Wednesday and Thursday lectures will be resumed late in October.

Each year we have had an increase in the number of visitors to our garden, last year about one hundred fifty thousand, and we have enlarged our area of intensive cultivation, number of ex-

propagation of new plants. To do this we have had to draw heavily on funds for the operation of the garden and unless some gifts of money come in soon we will have to cut down on our staff or reduce salaries that are already lower than in any similar work.

That our efforts are appreciated by our visitors we know from their very complimentary remarks to us but we were vastly pleased by a gratuitous compliment in the form of an editorial in *The Phoenix Gazette* on September 9th from which we quote:—

UNUSUAL ATTRACTION

The Desert Botanical Garden, one of the Valley's favorite attractions for both residents and visitors, opens for the season tomorrow. More than 1,000 new plants will be on display for the event.

A number of improvements have been made during the summer at the interesting outdoor objective located in Papago Park east of Phoenix. About 1,200 square feet of additional planting is possible this year through enlargement of the lath house, and facilities for growing unique plants have been increased in other areas of the grounds.

Those who would know the bizarre desert plants at first hand could find no more convenient method than that offered by the unusual institution which charges no admission. Many miles of travel and more time than most of us can spare would be required to view the many species of cacti and other desert growth displayed in the garden along a pleasant nature walk requiring little more than an hour to cover.

But very few people settle for an hour at the garden. Its varied attractions, including many desert birds who favor its inviting surroundings, are so absorbing that many visitors return again and again. Photographers find it made to order for striking pictures.

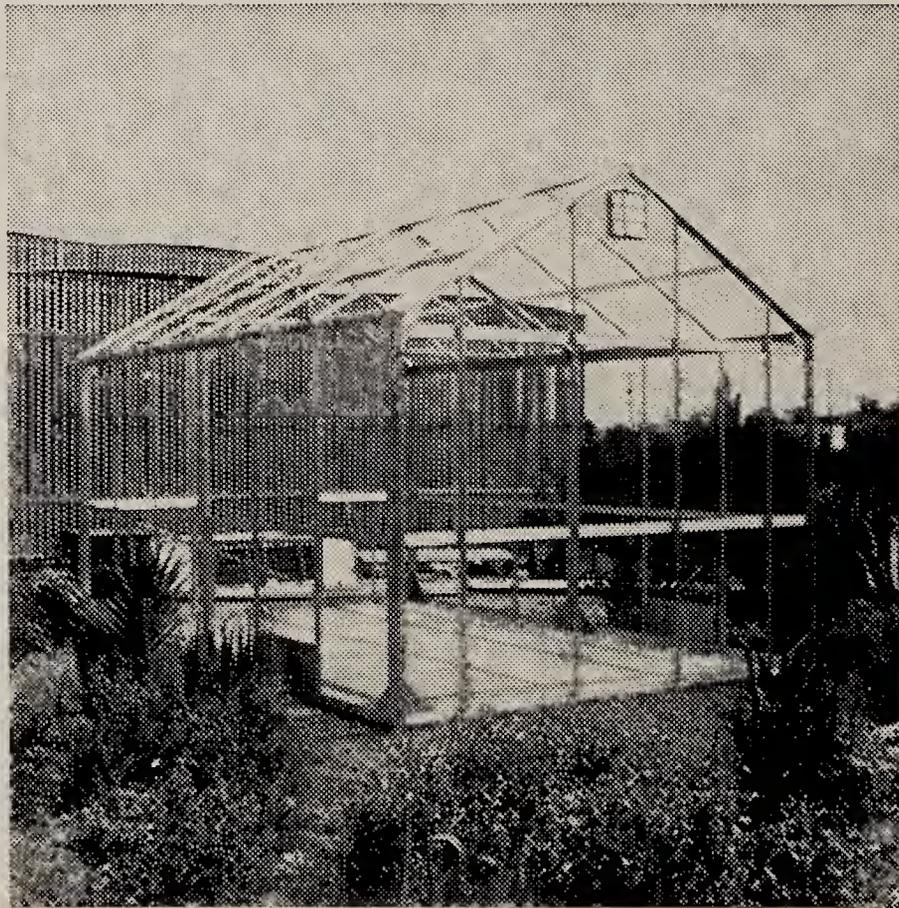
The Valley is fortunate to have the garden as a constant reminder of the amazing and delightful things that grow in our desert country.

ACCESSIONS

We have received 60 plants needed for research from Mr. and Mrs. Gus Hermann who made a special trip to northern Arizona to collect them for us at their own expense.

Dr. James McCleary, while on vacation with his family made extensive collections of needed material from Utah.

Mr. Harry Johnson donated a fine collection of specimen plants from South America which filled a large trailer. Our Hubert Earle made a trip to Paramount to get these plants which are



Our new glass-house before glass was installed

now in a new section of our lath house.

Included were large colonies of nearly mature *Huageocerei* and *Espostoas*.

Mr. John Eversole presented us with more supplementary lenses for the

Rolleicord Camera he had given us earlier.

A welcome contribution to the lath house fund was received from Hon. Orme Lewis from Washington.



Enlarged lath-house from North
See glass-house to Right

OUR COLLECTORS VISIT MEXICO

Last month we promised to have the story of the trip of the Miegs and the Hermanns to Mexico in this issue. To get a complete story each family was asked to write an account of the trip. Charlie Miegs' story took 6000 words, the Hermanns summary took 200. One issue of our Bulletin consists of about 4000 words and the accompanying pictures, so it would take an issue and half of the next to run the story as written.

We have therefore condensed the epic into this shorter story by considering the most interesting incidents.

The party consisting of Charlie Mieg, his wife Lillian and their two boys, Gus and Sylvia Hermann and their son left here early in the morning of June 4th and drove straight through to Mazatlan, Sinaloa.

The rainy season had not commenced and even here in the tropics all the vegetation was dry and mostly leafless.

From Mazatlan the two cars attempted a trip over a dirt road which crossed the mountain range to Durango but

after 30 miles of dusty travel over steep and narrow roadway they returned to Mazatlan. Then to San Blas and Guadalajara, collecting en route.

In Guadalajara the party split up, the ladies and the children remaining in town for sightseeing while Charlie and Gus attempted to reach Manzanillo in Gus' truck looking for the *Melo-cactus* reported from there.

While on this trip the boys apparently lived on peanut butter, crackers and black coffee and the local mosquitoes lived on white meat provided by our adventurers.

Finding the road practically impassable, they back tracked to Morelia where the ladies and children rejoined them and they all proceeded to Mexico City.

From Mexico City the two men and a guide took back roads to Puebla and to Mount Orizaba which they climbed to 9000 feet and camped out in what they thought to be a straw pile but which morning revealed as the cleanings from a stable. On this three day

trip the diet was exclusively peanut butter, crackers and coffee because they were just too lazy to heat up the canned chicken a la king or any of the American canned foods they had in the car.

It was very cold at 9000 feet and that night Charlie's air mattress sprung a tiny leak necessitating inflation about each 15 minutes. This appeared much more comical to Gus and the guide than to Charlie.

Another night on this side trip the camp was made after dark near several ant hills whose local population found in our adventurers a welcome change from their accustomed diet, whatever that was.

At Fortin de las Flores the men again rejoined the women and children at noon at Hotel Galindo where hot showers and a good meal put all things right again.

The Hermanns now had used all of the time available for this vacation and planned to start back the next day.

The next morning Charlie and the

Hermanns went out 60 miles on the road to Tehuacan where Charlie left them to return to Fortin de las Flores and the Hermanns continued a leisurely trip home arriving three weeks after leaving here with about 75 species of Cactus for the garden.

The Miags remained in Mexico for five weeks longer and made many valuable collections about which we will write in the November Bulletin.

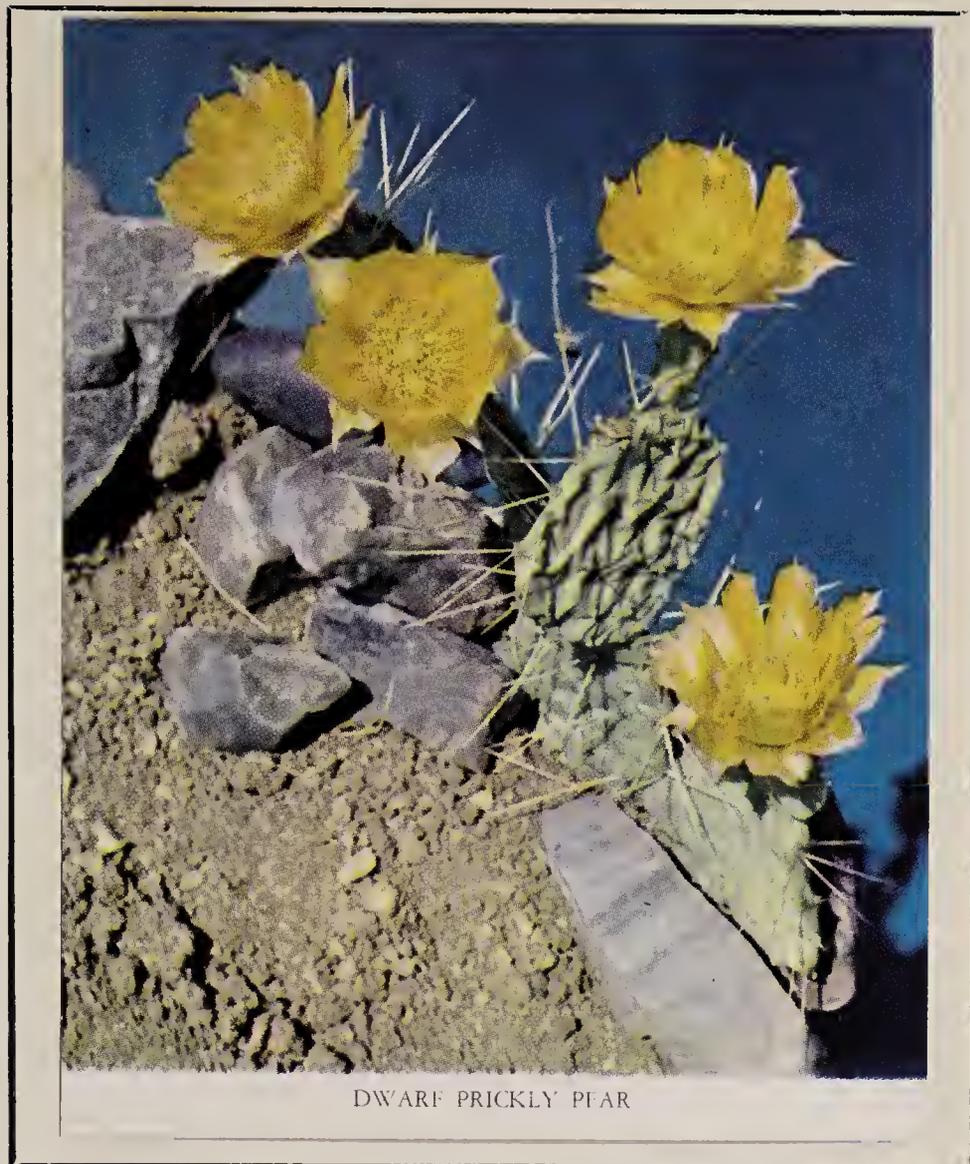
All of the party had dysentary at some time during the trip and at Moralia Charlie, in an attempt to relieve a headache, took what he thought in the dark to be Asperin tablets but which were actually caustic soda and all the rest of the night was spent giving him emetics and antidotes for the poison.

Still later Charlie found that one of the numerous mosquitos which had bitten him had given him malaria which necessitated hospitalization and numerous shots of some new wonder drug which was effective in curing it.

Continued in November



Lath-house from South



The dwarf prickly pear
Opuntia Compressa

THE DWARF PRICKLY PEAR

The dwarf prickly pear which is the subject of our color plate this month has several distinctions as it was the earliest known of the prickly pears and was called by Linnaeus *Cactus opuntia* in 1753.

It is not only the type of the genus *Opuntia* but it has also the widest distributions of all the prickly pears including the United States except a few west coast states and Vermont and a wide range across Canada and possibly into northern Mexico.

It is to be expected that any plant with such a wide range should assume many geographical forms and this is certainly true of our plant which has been described under twenty or more names as it was found in new locations

by various botanists.

Opuntia compressa (Salisbury) Macbride is the scientific name and it may be described as a low growing species with seldom more than 3 joints height but with a wide spread over the ground. The individual joints are plate-shaped from 2 to 4½ inches in diameter and during the spring and summer the joints are erect, deep green, "so round, so firm, so fully packed."

As winter approaches the plant dehydrates and the joints lay flat on the ground resembling tired flapjacks left from yesterday's breakfast of an amateur camp cook.

This complete dry out and its flattened position on the ground enables our plant to survive in very cold dis-

tricts.

Both our color picture and the black and white illustration represent variety *macrorrhiza* which has large tuberous roots and is usually found in the higher grasslands and forests from 4500 to 6000 feet elevation.

Opuntia Compressa is represented in the Desert Botanical Garden by collec-

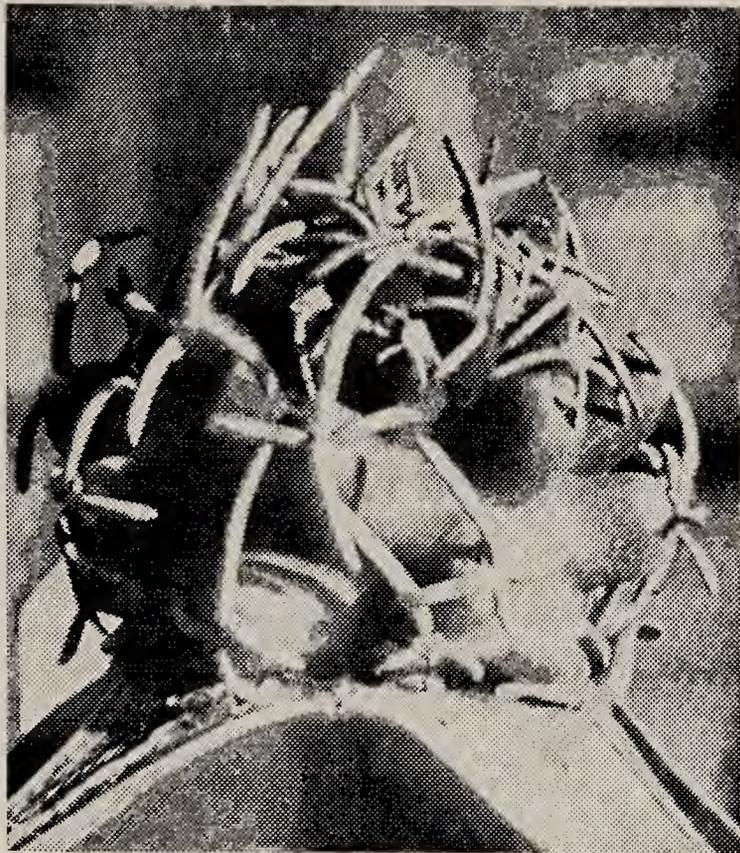
tions from New York State, New Jersey, South Carolina, Florida, Texas, New Mexico, Indiana, Illinois, Michigan, Arizona, Montana and several points in Canada.

The flower on all varieties is large and attractive in varying shades of yellow.



Opuntia Compressa (Salis.) Macbr. Var. *Macrorrhiza* (Engel.) Benson
Photo by R. C. Proctor in *Arizona's Cactuses*

TOUMEYA PEBBLESIANA (CROIZAT) MARSHALL



Navajoa peeblesiana Croizat

This illustration accompanied the first publication of the species

Reproduced thru courtesy of *Cactus and Succulent Journal*

In the *Cactus and Succulent Journal* XV:88, 1943, Leon Croizat published as a new genus and species under the name of *Navajoa peeblesiana*, a plant collected some years before by a Mr. Whittaker of the Arizona Highway Department.

The plants collected by Mr. Whittaker and associates, including our member Monte Lebert, were found on some hills north of the plant inspection station at Holbrook, Ariz., and only two of them survived the first year in captivity, and these two only because they were grafted.

Croizat evidently published on the basis of one of the grafted plants (See illustration which accompanied the description) as his description tallies with that of a similar grafted plant in our collection propagated from offsets from one of the two original plants by

J. Whitman Evans of Phoenix. Croizat's description does not agree in several important details with the collected plants we now have.

Between the time of the first collections by Whittaker and his associates (about 1936) and its rediscovery by Mr. and Mrs. Dennis Cowper of Belan, New Mexico, numerous collectors and botanists have endeavored to recollect it but without success.

The Desert Botanical Gardens expeditions have spent a total of 21 man days scouring the hills on which the first plants were found but without success. Now that we have the plants the reason for our failure is self evident as the plants are deeply seated in the ground with only a flat surface about the size of a nickel showing and this surface is usually covered with drift sand. We had been looking for a

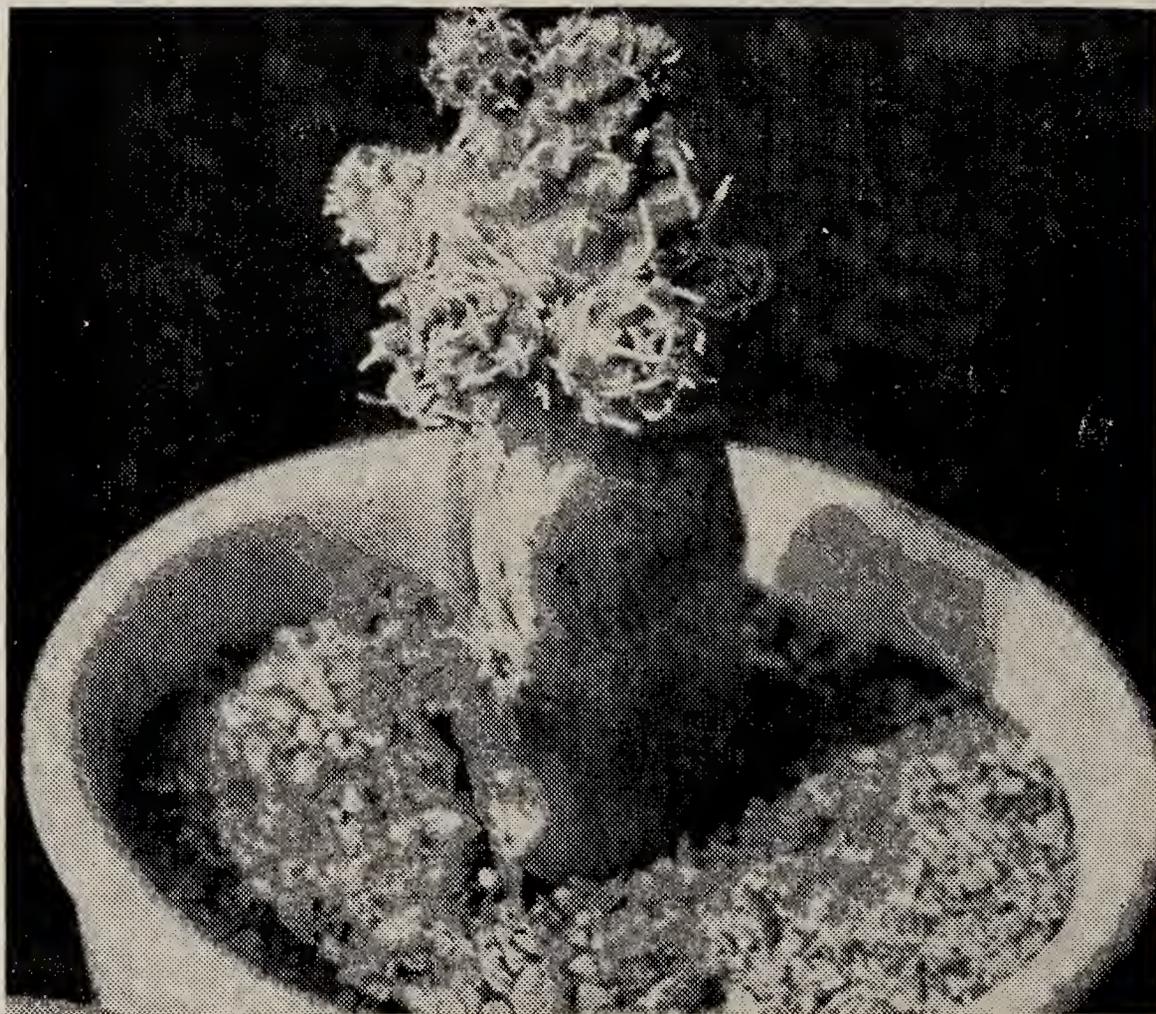
globose plant similar to the plant illustrated by Croizat.

One plant was collected in 1949 by Hester at a point north of Joseph City and about 40 miles west of the type location we are informed.

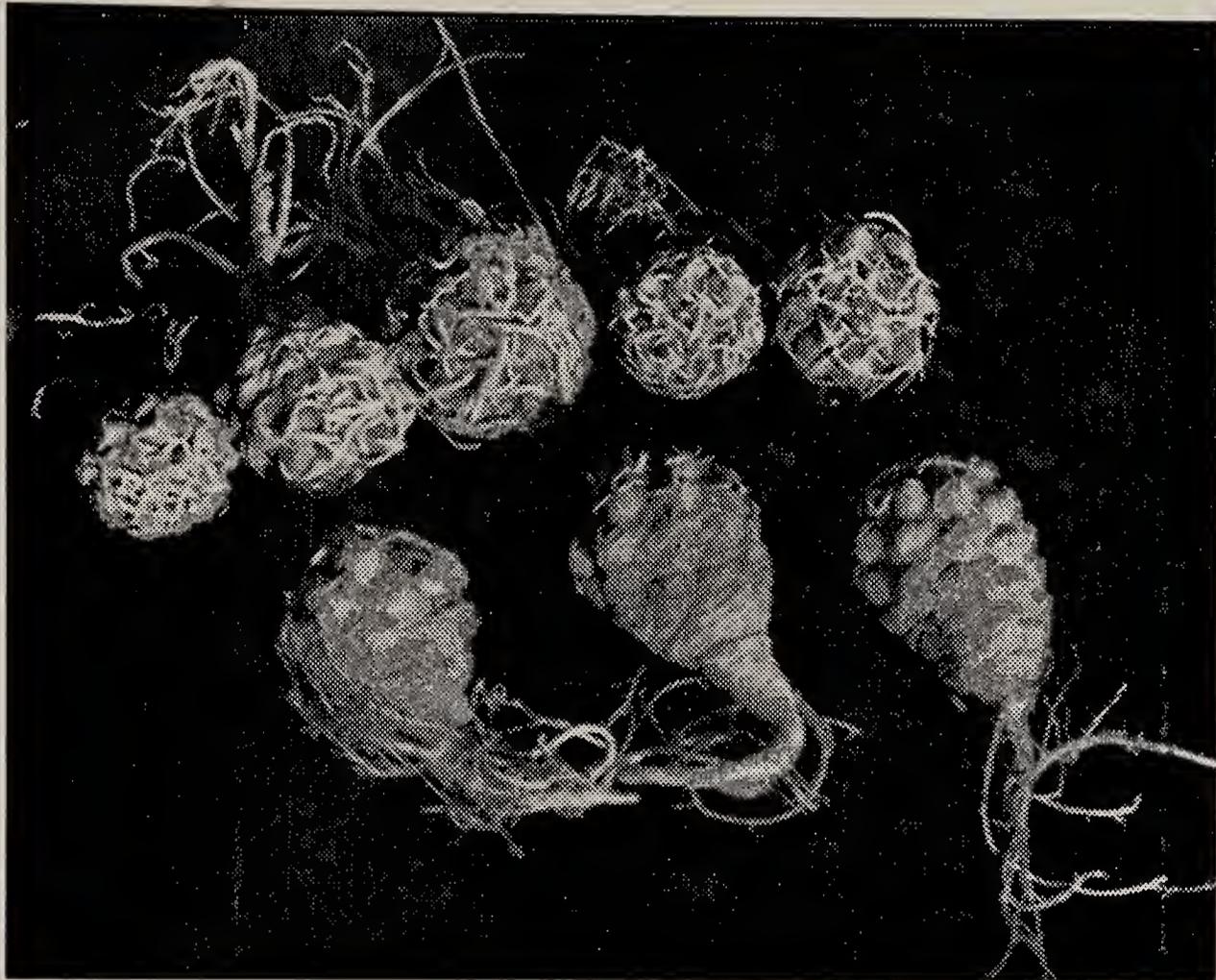
In the original publication by Croizat the description of both the genus *Nava-joa* and of the species *N. Peelesiana* were in Latin but his notes in English follow:

Seeing for the first time a live plant of the Holbrook cactus, I immediately thought of *Toumeyia*, for the cylindrical, slender body with prominent podaria of this plant is reminiscent, indeed, of the lone species under that genus. The spines, too, are not incompatible in their habit and nature with those of *T. papyracantha*. They are not as flexible as in that species, but they are neither pungent nor very hard. Usually four

of these spines, neatly arranged crosswise, stand at the tip of every podarium, this being quite ungrooved. Occasionally, a cluster of three to five smaller and somewhat irregular spines appears behind the main rosette of four spines. The pubescence is woolly and rather abundant on the aerole at the root of the spines. In the live plant in my hand the pubescence of the spines, which is said to cause the plant itself to be reminiscent of a *Typha* spike in bloom, is not in evidence. The spines seem to consist of weak woody tissue, arranged in longitudinal bands and made of longitudinal cells of uniform pale ochre color. It seems probable—though the matter must be studied further—that the “hairs” on the spines are result of the scaling off of the longitudinal cells in the outer layers of the tissue of the spine, and that such “hairs”



A grafted plant of *Toumeyia peelesiana* in the collection of the Garden and received from J. Whitman Evans



The eight plants collected for us by Mr. and Mrs. Denis Cowper
Toumeya peeblesiana (Croizat) Marshall

fail to appear when no scaling of the spine takes place.

I have not seen flowers or fruits, but a close-up that shows the details of the flower and the descriptions indicate that it does not possess the barely scaly manifest hypanthium of *Toumeya*. I regret that I cannot see more of the hypanthium from the material at hand, but should my plant ever flower I will contribute additional notes on this very important character. In the light of the material and data now available it does not prove possible to treat this plant otherwise than as a monotypic genus like *Toumeya* and *Utahia*, with the assurance at least that the entity now being published as a genus will not be lost, if even reduced of rank, in a further progress of our studies.

As the description reveals, this is a small plant, barely 3 cm. tall, as seen. The podaria (nipples) are prominent,

spreading to erect, about 3mm. long. The flowers are 16-17 mm. long, with outer lobes pale brown, inner ones lined in center by a pinkish stripe. The affinities of this monotype are definitely toward *Toumeya*, with which further comparisons will have to be made as soon as live material is available for a full discussion of the characters of the flower and fruit.

In "Cactus," Paris, France I:4:5, 1946, Revision de la Systematique et Quelques Nouvelles Combinaisons Dans le Famille des Cactacees — W. Taylor Marshall— I proposed amendments to the genus *Toumeya* Britton and Rose so that *Navajoa* could be included in that genus. An English translation of this article appeared in *Cactus and Succulent Journal* XIX:5:76, May 1947.

A description made from eight plants sent to us by Denis Cowper follows:

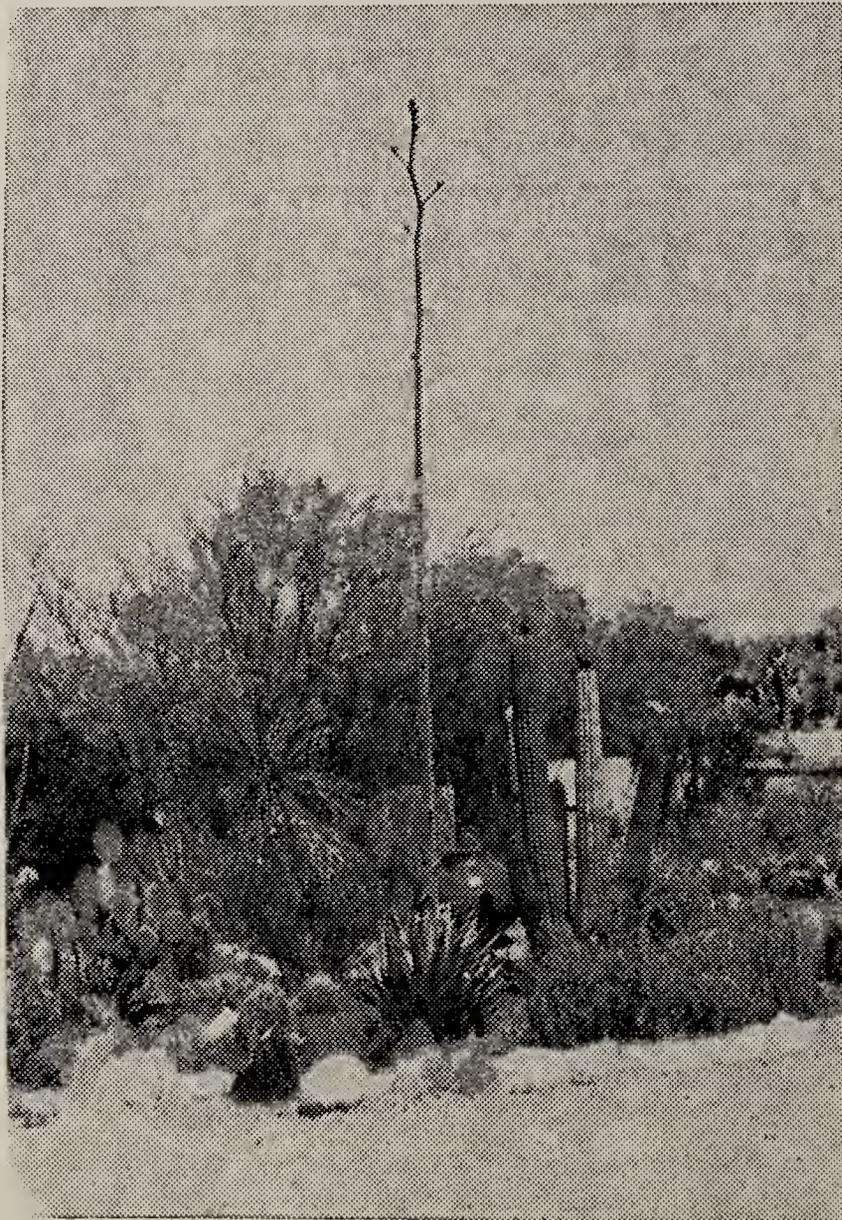
Primary root napiform, secondary

roots somewhat thickened; plant body globose to cylindrical, 3-4 c.m. long, 2.5-3 c.m. in diameter, 4/5 or more of the body underground, only the flattened top with erect tubercles at the level of the soil or slightly above the soil when turgid, usually covered with drift soil; tubercles glaucous-green, at first globose, obtuse, 4 m.m. high, later flattened laterally; areoles on apex of tubercles, small, circular and without content other than spines; spines all radial, 3 to 5 mostly 4 to an areole, subulate or sometimes flattened, the lower

3 about 3 m.m. long, sharply bent downward and appressed against the tubercle, the upper one 5 to 14 m.m. long, ascending and connivent over the top of the plant, all spines horn colored at first, later grayish, in youth coated with velvet, the texture soft and flexible, not pungent, the spines persistent on old tubercles even when below the surface of the ground but on old tubercles not velvety but then appearing annulate and woody.

Flowers known only from the photographs quoted by Croizat.

An account of the rediscovery of *Toumeyia peeblesiana* by Denis Cowper was received too late for this issue but because it is most interesting it will be in the November issue.

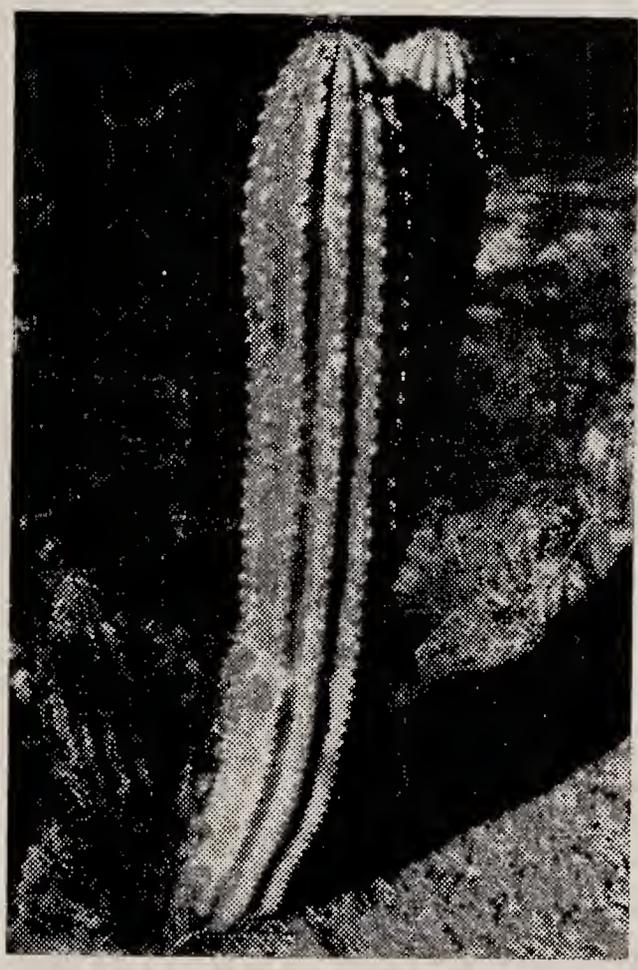


SAGUAROWLAND

BULLETIN

DESERT BOTANICAL GARDEN OF ARIZONA

NOVEMBER, 1955



Echinopsis imperialis
Hort.



REG-MANNING

SAGUAROLAND BULLETIN

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W. TAYLOR MARSHALL, Editor

Volume 9

November, 1955

No. 9

Arizona Cactus and Native Flora Society

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Desert Botanical Garden of Arizona

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Superintendent	W. Hubert Earle
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EDITORIAL

The 1955-56 season gives every indication of being larger in point of attendance than any previous year judging by October attendance.

Thursday afternoon lectures illustrated by kodachrome slides will be resumed on November 3rd at 3:30 P.M. unless the weather is too warm to close the auditorium for the talk. Subjects scheduled are:

Nov. 3 — Collecting cactus in Mexico.

Nov. 10 — Trees and shrubs of our desert.

Nov. 17 — Animals and Birds of our desert.

Nov. 24 — Thanksgiving Day — no lecture.

Dec. 1 — Cactus Flowers.

The classes in desert plant lore and use will begin on Nov. 16th and continue for 5 successive Wednesdays at 3:30 P.M. How plants survive on deserts, how to identify desert plants and the method for growing native desert plants in Arizona gardens are the subjects of these talks and a certificate of completion of the course will be awarded to all who attend all of the lectures.

There is no charge for either the classes or the Thursday lectures.

The Cactomaniacs will meet in the auditorium on Tuesday, Nov. 1st and on Tuesday, Dec. 6th at 8 P.M. Kodachrome slides will be shown, plants discussed and refreshments served each evening.

Any member of the Desert Botanical Garden may become a Cactomaniac without cost by attending the meetings. Any interested person may become a Cactomaniac by taking out a membership in the Desert Botanical Garden.

A meeting of the Executive Board of the Arizona Cactus and Native Flora Society and of the Advisory Board of the Desert Botanical Garden will be held on Monday evening, October 31st at 7 P.M. in the Auditorium.

At this meeting plans for future development of the Garden will be discussed. A method of increasing the endowment of the Garden and details of a new plan of insurance on our buildings and equipment will be presented to the Boards. We hope for a full attendance by the 23 members of these Boards.

OUR COLLECTORS VISIT MEXICO

(Part 2)

Charlie Mieg tells me that I made an error when I stated in the first installment of this epic that Gus and he did not reach Manzanillo. They did get there but were unable to make the additional 25 miles north along the coast to Bahia de Navidad where Dr. Dawson reported finding a *Melocactus*.

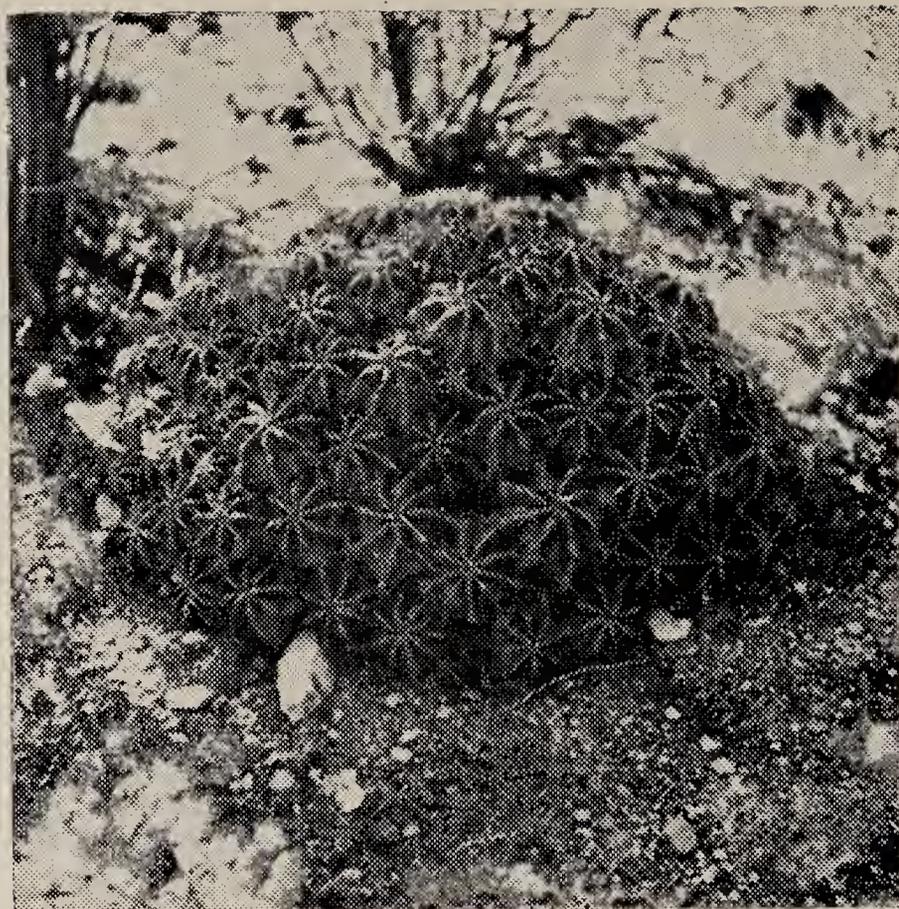
In the five weeks following the departure of the Hermanns for home the Miegs settled down to enjoy their vacation and they remained at Fortin de los Flores for 6 days then moved on to Tehuacan, Puebla and Oaxaca.

At Oaxaca they visited the ruins of Monte Alban and Charlie made several side trips collecting plants but as the

rainy season was by now at its wettest he was unable to cover many of the back roads.

After two weeks at Oaxaca they started south to the Guatemalan border reaching Tehuantepec and Salina Cruz the first day but because of heavy rain were unable to get off the main road for *Melocactus curvispinus* which is reported from Salina Cruz.

Tehuantepec afforded expensive but not too good accommodations. Hot water was absent but flies and mosquitoes abounded in the hotel. Charlie was interested in a statement in a travel folder to the effect that the world's most beautiful women were there but



Ferocactus robustus

This Barrel forms large clumps in Southern Mexico where the Meigs observed it.

he states that he saw only a few brown skinned Valkyries averaging 250 pounds on the hoof. The women of Tehuantepec are in the majority of the population by 2 to 1 and they are supposed to be the bosses of the households but Charlie asks very reasonably where the women are not the bosses.

From Tehuantepec they continued south in heavy rain thru Tuxla and over rugged mountain country to Las Casas where comfortable accommodations were found.

The altitude at Las Casas is 8500 feet and the night was very cold and continuous rains made travel south undesirable so the next day they returned to Oaxaca.

Descending from the higher mountains they had a tire blowout in a canyon just west of Tuxla and here the air was hot and humid and the tire change became a real task.

Tehuantepec was the stopping point for the night and then on to Oaxaca in a rain storm. About 20 miles out of Tehuantepec, Charlie stopped to investigate a *Cephalocereus* and some plants that he thought to be *Ferocactus macrodiscus* but on close inspection proved to be six plants of *Melocactus curvispinus* (see September Bulletin) two of them with cephaliums.

Thus by accident Charlie found the plant for which he had made several long, hard side trips. Charlie reacted normally for him, he went into a war dance with sound effects scaring his wife who was sure he had been struck by a rattlesnake.

Our travellers were now on their return trip and they came back through Matamoros, Cuernavaca, Taxco, Acapulco, where extensive damage had been caused by the excessive rains. Here Charlie had a bout with malaria which

required hospitalization.

After recovering, thanks to a new miracle drug, they returned to Mexico City, Pachuca, Ixmiquilpan, Queretaro and Guanajuato collecting enroute.

To San Luis Potosi, then Aguascalientes and Guadalajara, Mazatlan and an entry into the United States of America at Nogales.

Charlie took colored movies of the trip and showed two reels of excellent pictures at the October meeting of the Cactomaniacs. The Hermanns took 35mm Kodachrome slides of both the plants and scenery and these will be shown at the November meeting and are well worth seeing.

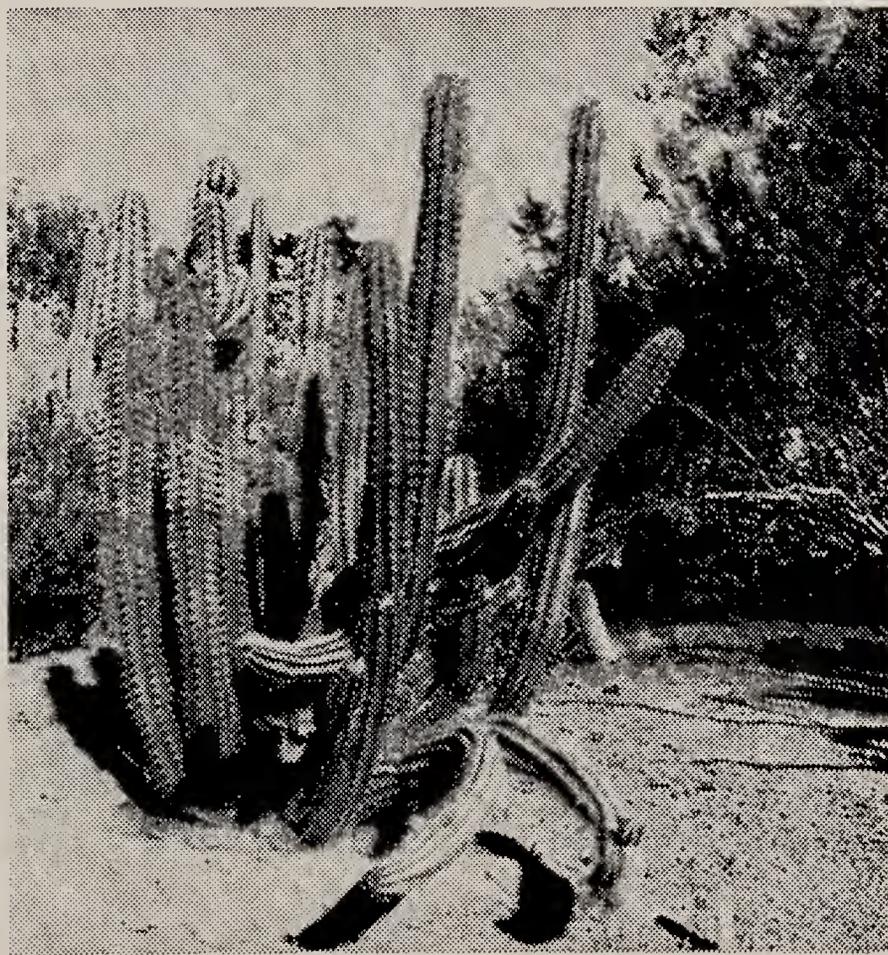
About 200 species of plants were collected on the trip for the Garden of which a number still have not been identified and we will have to await flowering and fruiting.

Several are very probably new spe-

cies as is true of a peculiar *Mammillaria* with hooked spines and with the growing center (meristem) on the side of each stem rather than at the apex. The flower on this one is very large for the genus and greenish-yellow in color.

Certain plants collected are very valuable to us as not previously in our Garden. Of these the newly erected genus *Neobauxbaumia tetetso* is very welcome. A *mammillaria* published by Dawson as *M. nejapensis* was recollected at the type locality and seems to us to be *M. compressa* in one of its many geological forms. We will have more comments on this in a future issue of the Bulletin.

This trip was well worth while for the new information gathered even on well known species and the Garden is very grateful to both the Miags and the Hermanns for their contributions of plants and pictures.



Lemaireocereus pruinosus

A plant in Desert Botanical Garden from Southern Mexico and observed there by the Miags.



Cactusland



NIGHT-BLOOMING HEDGEHOG

A hybrid *Echinopsis* or Easter Lily Cactus.

THE EASTER LILY CACTUS

Illustrated today are the flowers of one of the hybrid *Echinopsis* or Easter Lily Cactuses.

All species come from South America and they are mostly globe-shaped plants which cluster into large mounds and bear large numbers of lily-like flowers several times each summer.

The flowers of the true species are from 4 to 9 inches long and white to pink-magenta in color and most of them open at night but remain open from one to three days.

In the hybrids we find yellow and lemon-yellow flowers and white flowers shading to magenta. Numerous other color combinations are being developed and should be available soon.

Echinopsis plants want richer soil and

much more water than do strictly desert species, and in Arizona at least, they require some shading from our summer sun.

Gardeners frequently remove all the offsets from their *Echinopsis* plants on the theory that simple plants flower more freely but this is not true as large clusters of heads not infrequently bear 30 or 40 flowers at once and do this several times each season.

We illustrate a typical cluster of globe-shaped heads as grown in our Garden and on the front cover we illustrate *Echinopsis imperialis* Hort, a hybrid by Hummel which makes columnar branches to two feet or more in height and produces very large white flowers in profusion. The plant



An Echinopsis cluster in our garden.

illustrated bore more than 40 flowers each time in three successive flowerings last spring and summer. This flower is white with a green throat.

The generic name Echinopsis means resembling a hedgehog which is appropriate.

It is an old genus which was first proposed by Zuccarini in 1837 and in continuous use since that time. As understood by Schumann the genus Echinopsis contains species with long, funnel shaped flowers both day and

night flowering and the narrow tubes bear scales which subtend hair-like spines.

Under Schumann's classification the later genera Lobivia, Mediolobivia, Acantholobivia and Pseudolobivia are included in the genus Echinopsis. We agree with the classification of Schumann.

The genus Rebutia was recognized by Schumann as a valid separation from Echinopsis and we will discuss this genus in an early issue of our Bulletin.

Charley Mieg says that at a recent dinner party he attended the guests were so dumb that one lady thought Gila Bend was a reducing exercise.

REDISCOVERY OF TOUMEYA

By DENIS COWPER

The first rediscovery which we made of *Toumeyia* (*Navajoa*) *peeblesiana*, resulted, not from any planned expedition, but from frustration and bad weather. I had intended to spend the Memorial Day weekend of last year tracking down some rumors which I had heard of a small barrel cactus with yellow flowers growing in the neighborhood of B'staya on the Navajo reservation between Crownpoint and Farmington with the hope either that it prove to be a new species, or to extend the known range of *Coloradoa Mesae verde*. Leaving Saturday noon, we travelled west from Belen to Thoreau on U. S. 66, and thence north over a series of diminishing trails to White Rock where we camped under some sandstone cliffs. Everything was fine until about 5 a.m. Sunday morning when the wind started to blow. From then on it was sheer misery. The trail from White Rock to Farmington by way of B'staya is very faint and hard to follow even under the best conditions; in a sandstorm it is non-existent. All day long we wallowed from one dune to the next, frequently having to dig the pickup out when it went over the axles, and finally, towards evening, we came out at Farmington without having had an opportunity to look for anything. The wind was still blowing with a promise of continuing indefinitely, so I abandoned any idea of collecting around B'staya that weekend, and, in the hope of getting well away from the wind, we set out for Holbrook with some vague thoughts of looking for *Navajoa* the next day. Arriving at about midnight we camped on some sandhills east of town and prayed for a calm day.

Monday dawned hot and still, and by 7 a.m. I was crawling up a hogback on the south side of Marcou Mesa about two miles west of Holbrook. Applying tactics which had proved successful in

turning up *Toumeyia papyracantha* in widely scattered locations in New Mexico, I was travelling on hands and knees, peeping under every blade of grass. After some hours of crawling I found a minute plant, about the size of a kitchen match head, which I thought might be a *Navajoa*. I was soon disillusioned when I came on a colony of dwarf *Sclerocactus whipplei* with seedlings amongst them just like the one that I had found. By noon I had reached the base of a hill facing on Leroux Wash, and, since it was very hot, I left everything but essentials and continued crawling less encumbered. Four or five hours later, somewhat disheartened, I returned to my pile of belongings and was about to leave, when I noticed a small round plant growing beside a bunch of grass just a few feet away. At first glance it looked like a sickly *C. whipplei*, but, on closer inspection, it proved to be a *Navajoa*, somewhat misshapen from an old injury. Unable to believe my eyes I peered at it for several minutes before its reality dawned on me. With a wild cry of "Eureka!!" I snatched it up and proceeded to comb the hillside, nose to the ground, in search of its fellows—to no avail. Darkness forced me to abandon the hunt as I had no flashlight with which to continue.

About two weeks later I returned to the location with my wife, Jane, to resume the search. We started at the cairn which I had built where I found the first plant, but, before we had been there very long, the wind came up, and blowing sand, especially at ground level, made further search impossible.

We did not again have an opportunity to visit Holbrook until Memorial Day of this year. We made rendezvous with Mr. and Mrs. Edsel Grey of Santa Fe, also ardent collectors, and early Monday morning we set off up the east

bank of Leroux Wash hoping to find a crossing upstream which would take us onto Marcou Mesa from the north. We were unable to reach our objective and spent the greater part of the day climbing sandy hills without reward. By mid-afternoon we returned to Holbrook and again started looking in the neighborhood of the original cairn. After about an hour I found a dead *Navajoa* lying on the ground about a mile south of the spot where I had found the first one, and, upon a minute inspection of the ground, I found a live plant growing within a few inches of it, which I had till then overlooked as it was covered with a film of sand. I built a cairn and went to fetch the others. Unfortunately the Greys were unable to stay longer, but my wife and I returned to the spot, and by dark we had found three seedlings growing under *Artemesia* bushes within a few feet of the cairn.

A few weeks later we exhibited one of our plants at the Convention of the Cactus and Succulent Society at El Paso, and Mr. Marshall offered to help finance the trip if we would go back and gather some plants for the Desert Garden. Naturally we accepted.

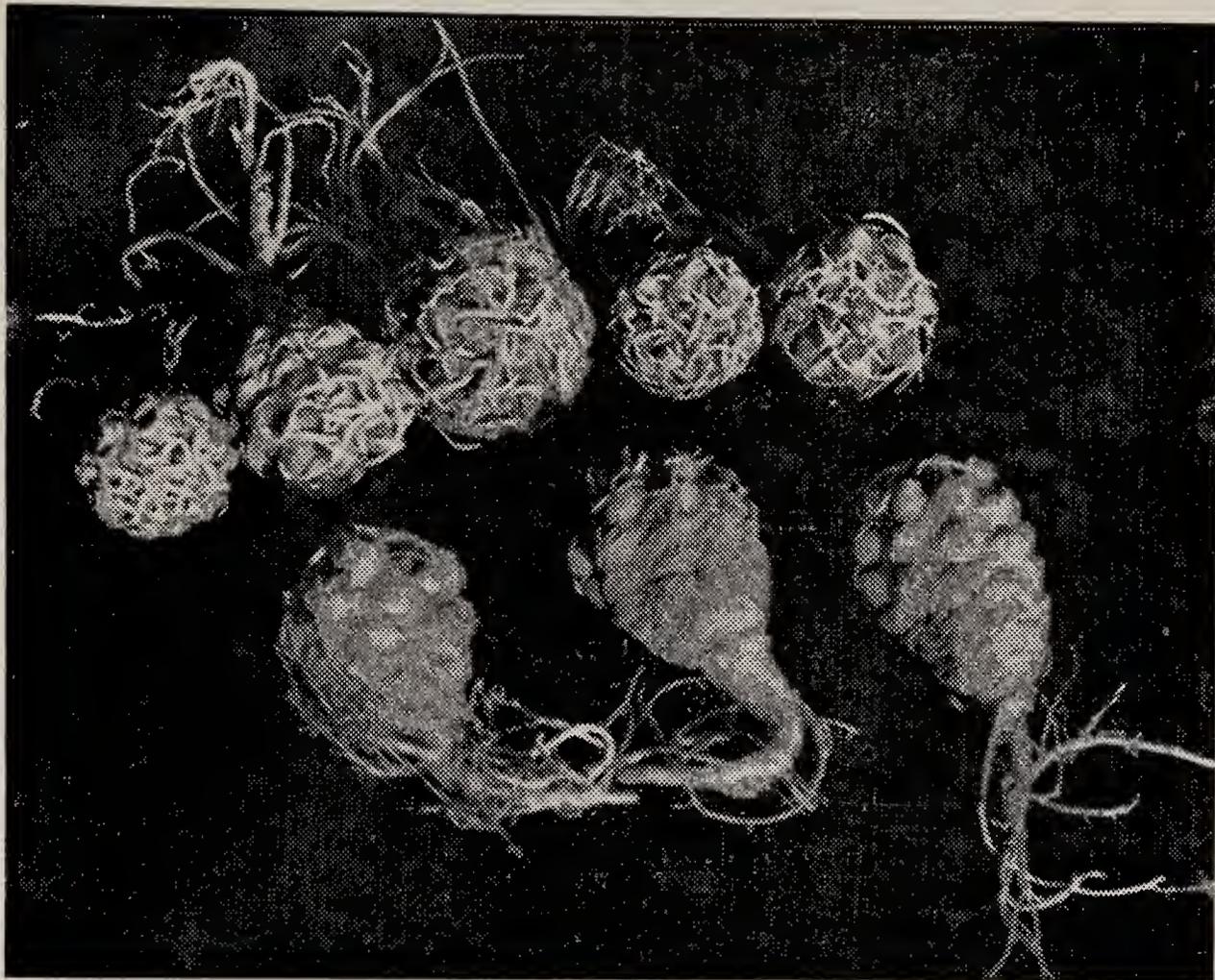
On Saturday, August 13, we set out from Belen a little after noon. Since we knew that we could not reach Holbrook in time to do much searching that evening, we detoured south from Gallup into Zuni country to investigate a reported location for *Mammillaria wrightii*, and were rewarded by finding that plant growing in great plenty amongst the pinons. They were larger than in other New Mexico locations and with comparatively scant spination.

We spent Saturday night in Holbrook and started out at dawn with an earnest intention to find *Navajoa* in quantity. First we devoted some six or seven hours to scouring the hills immediately east of Holbrook and south of U. S. 66, and those immediately south of the

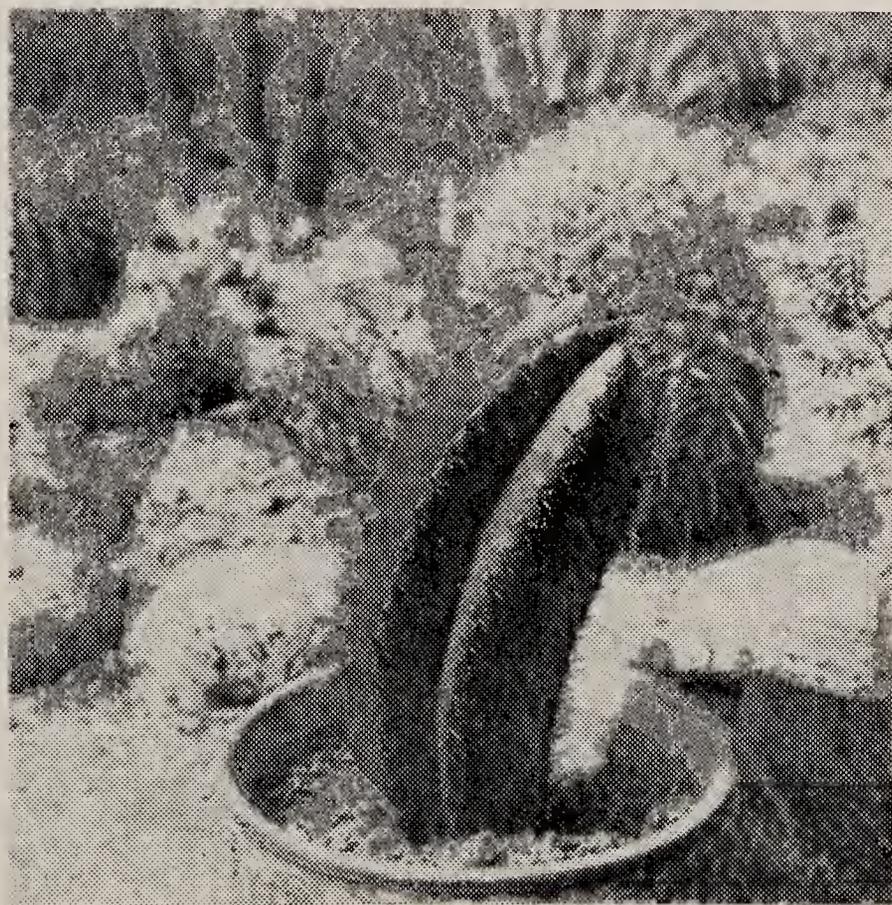
Little Colorado, both without success. Then we tried getting onto Marcou Mesa on the road a few hundred yards west of the inspection station. Unfortunately it had been raining and the pickup went axle deep in mud. With the aid of a shovel, a bumper jack, much effort and corrosive language, we emerged some two hours later with a coating of camouflage which rendered us indistinguishable from the mud hole.

Undaunted, we tried again a few miles further west, and this time we managed to get through to the mesa. Before leaving the truck we fortified ourselves from a jug of wine which we had provided against such emergencies, and then again sallied forth. There was little or no wind and it was blisteringly hot, but, by refreshing ourselves periodically from the jug, we managed to survive the two mile climb over the crest. We knew from our previous experience the type of terrain in which to look for *Navajoa*, and, on the fifty-third likely looking slope, about five miles south and east of the crest we found them in relative plenty. There were numerous colonies containing several individuals each, all swollen up from the recent rain and washed clean of dust so that they were visible even from a standing position. Some were growing in the open amongst the gravel and others under the *Artemesia* bushes. Those in the shade were rather columnar, while those in the open were appanate and superficially resembled seedlings of *E. horizonthalonius*.

After spending the balance of the afternoon examining the different colonies, we discarded the empty jug and returned home well satisfied that we had located *Toumeyia* (*Navajoa*) *peeblesiana* with sufficient certainty that we would have no difficulty in returning to collect further plants at a later date if it should prove necessary.



The eight plants collected for us by Mr. and Mrs. Denis Cowper
Toumeya peeblesiana (Croizat) Marshall



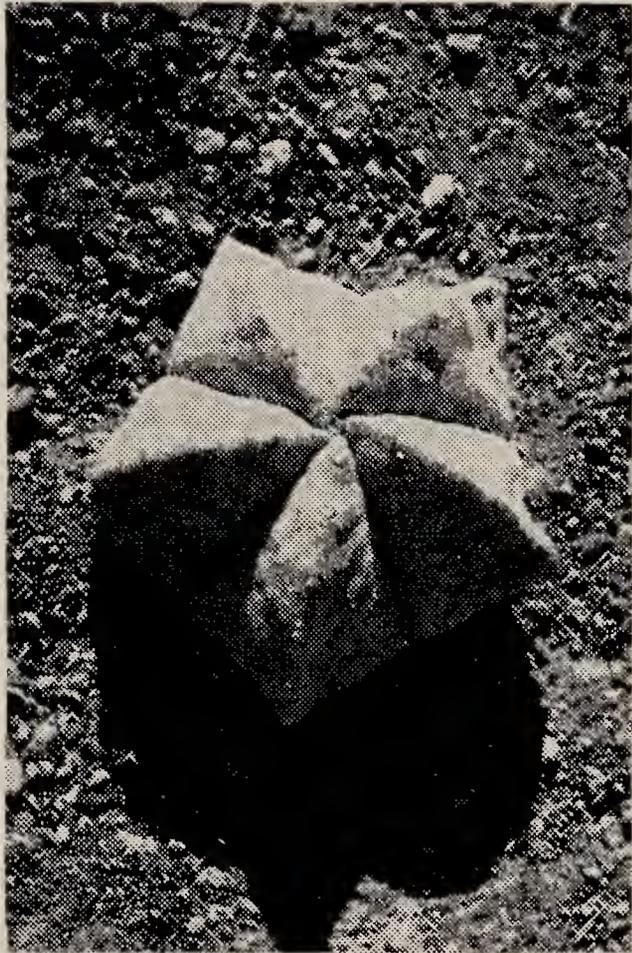
Myrtillocactus schenckii collected by Meig

SAGUAROWLAND

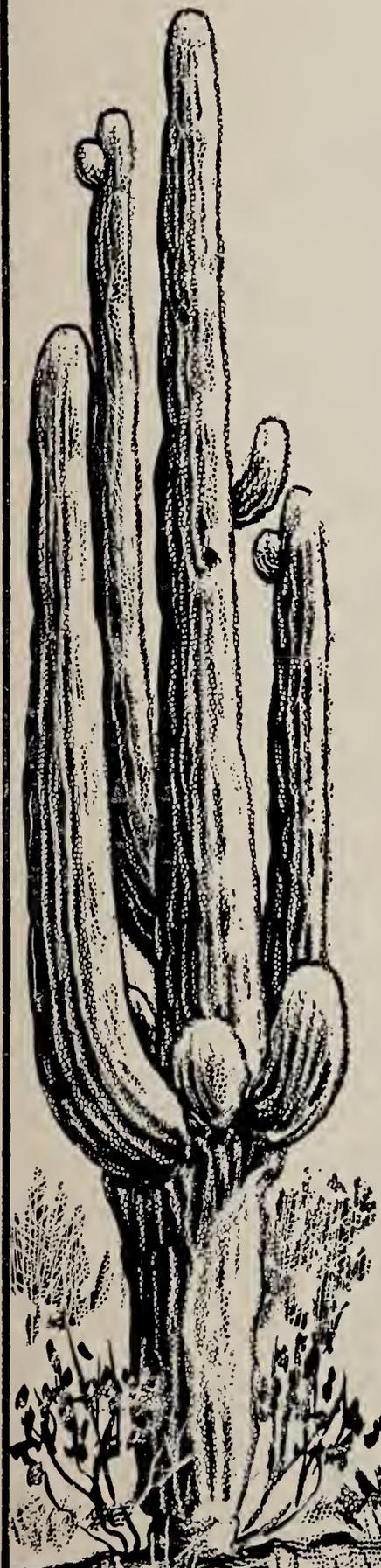
BULLETIN

DESERT BOTANICAL GARDEN OF ARIZONA

DECEMBER, 1955



Star Cactus



REG-MANNING

EDITORIAL

The star cactus on our cover for this issue is a reminder of the near approach of the Christmas Season and it carries to you the very best wishes of all of the Garden staff for a very happy Christmas and a happy and prosperous New Year.

As this is written we of the Garden are preparing for Thanksgiving Day and we do not need to look far for many causes of thanks. Our garden has grown during the past year in equipment, in area of plantings and number of plants and we continue to have ever increasing numbers of visitors. Our membership is at the highest point in our history, 372, but still much below the membership such a garden justifies.

At a meeting of the Executive Board on October 31st, we decided to purchase insurance coverage to 90% of the value of our buildings and equipment for the first time in our history. We have carried only about 25% coverage up to now.

The cost of the insurance has been a severe strain on the Treasury and we will have to curtail in many ways to meet it but the assurance that we are protected comes as a great relief from worry to your Director and all the staff.

Mr. Earle has just moved to our Garden a fine collection of plants donated to us by Mrs. J. C. Whitaker from the garden of her late husband in Glendale. 43 large plants of *Peniocereus greggii* and 5 nice plants of *Lophocereus schottii* were just part of this gift for which we offer Mrs. Whitaker our sincere thanks.

At the Executive Board meeting two plans for fund raising were approved. The most important in our view was a plan to try to interest public spirited citizens to make the Garden a beneficiary in their wills according to their ability. Our attorneys will prepare the necessary codicils to any will without charge and each board member will try to interest prospective donors.

The desirability of increased support from business houses in Arizona was also stressed.

We feel that the Desert Botanical Garden offers to the out of state visitor an opportunity to get the answer to questions on our desert vegetation and provides many days of entertainment.

Since many of our business institutions depend on out of state visitors for their success it is but natural that they should support any efforts to make our visitors happier.

One board member, Mrs. Gilliland, secured a \$25 annual membership from a leading business house the very next day after the Board meeting.

LECTURES

Our Wednesday afternoon series of studies in "Appreciation of Desert Plants" will continue each Wednesday at 3:30 P. M. to December 14th and a new series of 5 talks will start in January.

Our Thursday afternoon illustrated lectures in December will have as their focus the following subjects:

- Dec. 1—Cactus Flowers.
- Dec. 8—Northern Arizona.
- Dec. 15—Southern Arizona.
- Dec. 22—A Trip to Mexico.
- Dec. 29—Desert Animals and Birds.
- Jan. 5—Desert Trees, Shrubs and Wild Flowers.

All of our lectures start at 3:30 promptly.

PLANT PROTECTION LAW

Recently we had a letter from a gentleman in Albuquerque, N. M., advising us of the collection of over 200 specimens of *Toumeyia peeblesiana* by members of the Albuquerque Cactus Club. He thought we would be interested to know that so many of a very rare species had been collected.

We were interested.

We wrote him a letter explaining the very great possibility of the complete

elimination of the species by such over-collection and quoted to him our Arizona law for the protection of desert plants and suggested that the Albuquerque group consider seriously the subject of plant conservation and to make conservation their aim rather than excessive plant collection. (One member was reported as having over 400 specimens of *Toumeyia papyracantha*, a rare New Mexican species.)

In reply the gentleman thanked me for my suggestion and stated that he did not know of Arizona's law and he thought that the other members of the Albuquerque group were equally unaware of it.

Possibly others who read our Bulletin may not be aware of Arizona's desert plant protection law so we give herewith a brief summary of it:

Plants protected: — All members of the following families: Ferns, lily family (including *Yuccas*), iris family, amaryllis family (including century plants), orchid family, orpine family (including *Sedum*, *Dudley* and *Grapto-*

petalum), saxifrage family and cactus family.

All species of columbine, lobelia, shooting star, primroses, ocotillo and fan palm.

The following individual species: — desert holly, scarlet gilia, western redbud, smoke tree, crucifixion thorn (*Holacantha emoryi*) and flannel bush.

Prohibited plants can only be removed from public lands under permit from the State Department of Agriculture and for scientific or educational purposes only.

These plants can be removed from private lands providing that you obtain written permission from the owner and file a certified copy of the permission with the County Recorder in the county in which the land is located, and a copy to the State Department of Agriculture who will then issue a permit to transport one shipment for a \$5.00 fee.

Violations subject to fine of not over \$300.00 and each violation is a separate offense.

Any peace officer is empowered to enforce this act.



Star Cactus or Bishop's Cap.

Astrophytum myriostigma Lemaire

Bishop's Cap Cactus

The Bishop's Cap cactus is native to the States of San Luis Potosi, Tamaulipas, Coahuila and Hidalgo in Mexico and it has long been a favorite of collectors, not only for its unique shape and rock-like structure but also for the large yellow flowers freely produced from early spring throughout the summer and early fall.

Entirely spineless, the plant can be easily handled and it grows equally well in indoor culture or in outside beds where temperatures do not go too far below 32°.

A number of varieties have been listed

based on the number of ribs or the height of the plant, but most of such separation is doubtful indeed as is true of variety quadrocostatus (4 ribs) which may have 4 ribs in youth but later add several more ribs. One plant with five ribs in our garden was injured in the growing center and sent up four branches which were 4 - 5 - 6 and 8 ribbed respectively.

In Cactaceae I attempted to make a key for the identification of the varieties of this species based on a previous key by A. Moeller of Mexico as follows:

ASTROPHYTUM MYRIOSTIGMA

Flower with a red center	variety coahuilensis
Flower all yellow	
Tall columnar plants	var. columnaris
Globose to short cylindrical plants	
Plants always 4 ribbed	var. quadrocostatus
Plants mostly 5 ribbed	
Plants spotted with white	true species
Plants not white spotted	
Plants not depressed in center	var. tamaulipensis
Plants depressed in center	
Flowers small	var. potosina
Flowers large	var. nuda

Numerous hybrids of this and other of the additional three species of this genus (*A. asterias*, *A. ornatum* and *A. capricorne*) are on the market and some of them are very attractive plants.

In one of our illustrations of the Bishop's Cap you will note a specimen of the Gila Monster (*Helioderma suspectum*), one of our most colorful and least understood desert animals.

The Gila Monster is normally sluggish and shy. He will make every effort to avoid contact with people. It will attempt to hide by seeking the cover of bushes or cactuses but if cornered or annoyed it may advance with open jaws spluttering and hissing. It has a poison

sac but no fangs. Instead it has grooved teeth and it is necessary for the animal to chew the poison into its victim. Therefore it is only painful if one can promptly release oneself but the poison may be introduced if the animal hangs on.

However, only the largest of Gila Monsters produce enough poison to be fatal to an adult, but a physician should be called immediately if one is bitten.

The poison is much like that of a rattlesnake and the same treatment is indicated as for rattlesnake poisoning.

The Gila Monster is protected by law in Arizona and killing one may be punished by a heavy fine. They may not be kept in captivity legally.



Astrophytum myriostigma from Mexico.
Note Gila Monster on ground.



Three of the Kachina Dolls described
on page 120.



LACE CACTUS, TEXAS RAINBOW

Lace or Cob Cactus. *Echinocereus pectinatus* variety *reichenbachii* from Texas.

THE RAINBOW CACTUSES

Our color plate this month is of the Lace Rainbow Cactus, also called the Corn Cob Cactus.

It is a member of a large genus in the Cactus family which consists of plants of medium size but bearing relatively large and colorful flowers.

Collectively they are called "hedgehog cactuses" and belong to the genus *Echinocereus* which is native to the United States and Mexico.

The plant illustrated is *Echinocereus pectinatus* variety *reichenbachii* and it is found in Oklahoma, Texas and in northern Mexico in the states of Coahuila and Chihuahua.

Breaking down the scientific name we find that *Echinocereus* is made from two Greek words meaning hedgehog

and wax candle — and this implies that this plant, whose stems cluster like candles in a candelabrum, are covered with spines like a hedgehog.

The specific name *pectinatus* refers to the comb-like arrangement of the spines which simulate two combs laid back to back. The variety *reichenbachii* indicates that this particular variety has been named in honor of Reichenbach.

As is true of any cactus species with a large range there are many forms taken by our plant in various locations. Spine color varies greatly, ranging from all white to all cream or brown or reddish, and in many locations the plant is simple, that is it consists of one stem only. In other locations it clusters from

the base forming a group of 3 to 10 stems.

The flowers of the hedgehog cactuses are all large, in relation to the plant size, and in shades of white, yellow, magenta and red.

The fruits are shaped like a fig and about the same size. They are red when ripe and in most species the spines which cover the fruits when green drop

off as the fruit ripens or can be easily brushed off. The fruits are edible and have a flavor resembling strawberry and the plants are frequently called "strawberry cactus."

In much of its range, Reichenbach's variety occupies territory with low winter temperatures and plants from such an area can be grown outdoors in many of our colder states.

Appreciation of Desert Plants*

W. TAYLOR MARSHALL

FOREWORD

When the present director of the Desert Botanical Garden arrived in 1946 to assume his duties it was his first concern that the Garden should offer to the general public information on desert plants so that those who wished might find an appreciation of the unusual vegetation of the arid districts.

To accomplish this the Garden published our Self Guided Nature Walk pamphlet and gave Sunday afternoon lectures on various plant families.

However, many of our visitors expressed a deep interest in finding out just why and how the plants now occupying arid regions were able to survive the long rainless periods and also how the plants could be utilized in Arizona gardens.

To answer this request the Garden started a Wednesday afternoon class which continued for five successive weeks. We now have three series of classes each season, one in mid-November, one in January and the third in March.

Thirty-nine persons joined the November class in 1955, which is the largest group we have had so far.

After five years the pattern of the instruction has been standardized and we now feel that the outline of the work

should be printed in pamphlet form after it has first been printed serially in Saguaroland Bulletin.

This little booklet will cover the important points of our lectures and can be used in conjunction with the more detailed instruction given to the members of the class.

At the same time the booklet will serve to refresh the memory of our students in the years to come.

The material here presented has been derived from works by various authors as listed in the bibliography and from the experience of our own staff at the Garden.

All cultural directions are the result of our own research.

Chapter 1

A desert, for the purpose of this study, may be defined as an area of little rainfall and a high percentage of sunshine hours and high temperatures.

In such an area only the most heroic plants can survive and prosper. All of the plants now found on our deserts are relics of a heavy plant population that occupied the area when rainfall was greater.

The survivors are those species that gradually built up resistance to drought conditions as the area became increasingly dry.

*The first of a series of articles on desert plants.



Creosote Bush (*Larrea Tridentata*) desert.

The various and ingenious methods by which the plants survive is the basis of this study designed to increase our appreciation of this remarkable vegetation.

The writer feels that the study of any form of plant life will strengthen the faith of any student in the certainty of divine guidance of all things. A study of desert plants in particular indicates an intelligence greater than mere chance.

Four major desert areas are noted in the United States of which two extend south into Mexico. Each can be determined by certain species of plants peculiar to it.

The largest desert in area is the Great Basin or Great American Desert which centers around the Salt Lake in Utah and includes portions of Utah, Colorado and northern Nevada and portions of northern Arizona. The prevailing plant of this desert is sagebrush (*Artemisia tridentata*).

The Mojave desert occupies that portion of southern California roughly north

of the San Bernardino-Riverside County line and including Inyo County and the western portions of Los Angeles and Kern Counties, southern Nevada and the western part of Mojave County in Arizona, along the Colorado River.

The Indigo Bush and Parry's Saltbush are outstanding endemic plants.

The Sonoran desert includes Baja California and Sonora in Mexico and the Salton Sea basin and Colorado River basin of California (called the Colorado desert) and southern Arizona (called the Arizona desert).

The California fan palm (*Washingtonia filifera*), Bear grass (*Nolina* sps) and the desert apricot (*Prunus fremontii*) are endemic to the Colorado desert while the palmilla (*Yucca elata*), white thorn (*Acacia constricta*), desert honeysuckle (*Anisacanthus thurberi*) and desert elderberry (*Sambucus cerulea*) identify the Arizona desert.

The Chihuahuan desert extends from the States of Chihuahua and Coahuila in Mexico into western Texas, New Mexico and the extreme southeastern part of

Cochise County, Arizona, and the vegetation generally resembles that of the Sonoran desert in that the Creosote bush (*Larrea tridentata*), the Mesquites and Palo Verdes are prominent.

For convenience the desert plants can be separated into four general divisions:

1. Succulent Plants.
2. Xerophytes.
3. Mesophytes.
4. Annuals.

These in turn contain subdivisions as we will see as each category is described in detail.

Succulent plants are capable of storing food and water either in their stems or in their leaves during the short periods of rainfall for use during the long dry spells.

This storage results in a swollen appearance in the stem or leaf which makes the identification of succulent plants very easy.

In the deserts of the United States stem succulence is a character prin-

cipally of the Cactus family (Cactaceae) but it is observed also in some species of Spurges (Euphorbiaceae), notably the "Candelillo" of the Big Bend district of Texas.

On the African and Asiatic deserts stem succulence is noted in Spurges (Euphorbiaceae), Orpines (Crassulaceae), some Milkweeds (Asclepiadaceae) and in a number of other plant families.

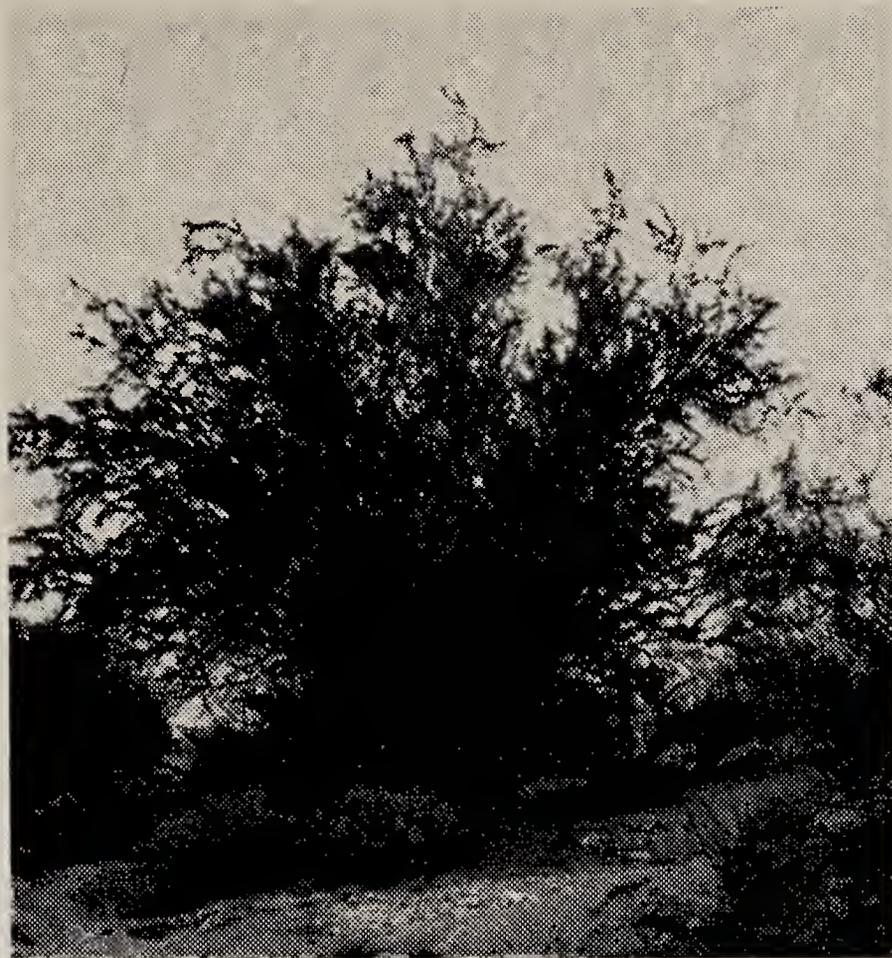
Leaf succulence is noted in new world species of Agave or century plants (Amaryllidaceae), Yucca (Liliaceae) and Orpine (Crassulaceae) while in the old world leaf succulence is noted in the Lily family (Liliaceae), Orpines (Crassulaceae), Fig Marigolds (Mesembrianthemaceae), Spurges (Euphorbiaceae) and other plant families.

The Xerophytes are plants which survive drought conditions in one or more of several ways:

1. By leaf reduction because water is lost thru leaves.
2. By shedding leaves in dry weath-



A succulent plant, *Echinocactus platyacanthus*.



Ironwood Tree (*Olneya tesota*) a xerophyte.

er and "hibernating" during dry periods.

3. By sending deep tap roots down to the underground water table.
4. By building a coating of wax or lacquer on their leaves to prevent water loss.
5. By a combination of the above methods or some of them.

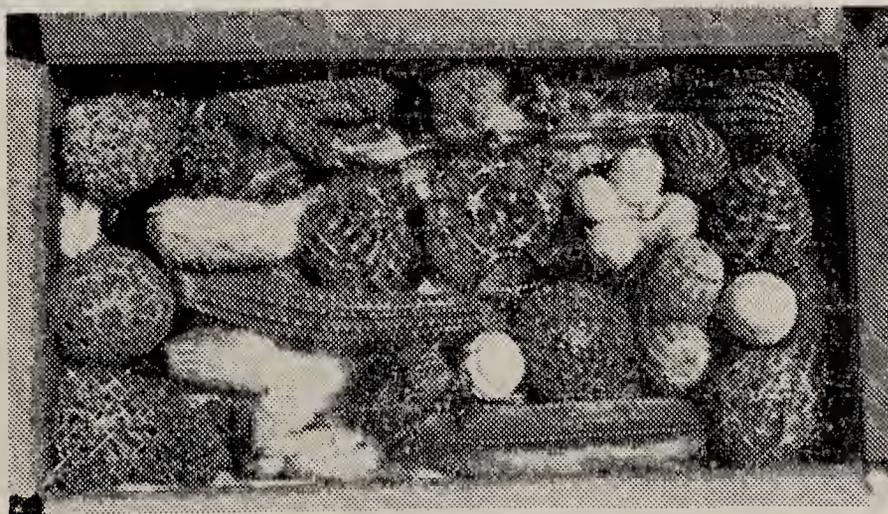
All of the trees, shrubs and subshrubs of desert areas belong in this classification.

The mesophytes are normal plants in all ways who choose only stream beds

in which there is an available flow of water either on the surface or below the surface as their dwelling place. An example is the cottonwood tree (*Pepulus fremontii*).

The desert annuals usually show some modification from their mountain relatives either in leaf reduction, waxy coating or hairs on leaves or in greatly accelerated life processes.

Each of these divisions will be considered in greater detail in our following text.



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