

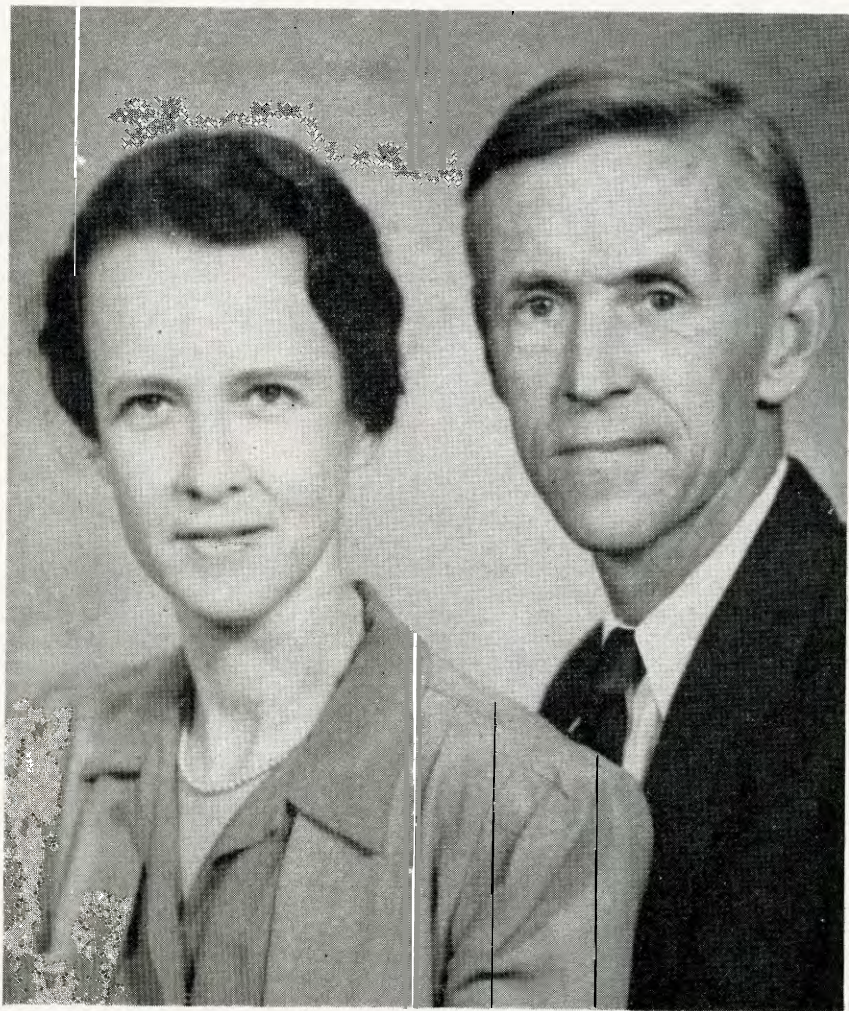
PLANT LIFE



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FIRST BROMELIACEAE EDITION

Dedicated to
MULFORD B. and RACINE FOSTER
in recognition of
their outstanding work
in collecting and popularizing bromels.



Mulford B. and Racine Foster

Plate 1

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ANDRÉ'S BROMELIAD COLLECTING IN COLOMBIA AND ECUADOR

LYMAN B. SMITH

When Edouard François André, botanist, horticulturist and editor, journeyed from the mouth of the Rio Magdalena in northern Colombia to Loja in southern Ecuador, he collected and studied a great variety of plants and animals, but there can be little doubt that his main interest lay with the bromeliads or members of the pineapple family. It must have been or he would never have continued to collect such difficult plants to prepare through all that grueling journey. Then after his return to France he spent many years studying his collections and produced as his one great monograph, the "Bromeliaceae Andreanae," an account of the 122 species and 14 varieties which he had brought back. Of these, 91 species were described as new either here or in his earlier brief enumeration, and it should be noted that the great majority of them are still considered valid. With excusable pride he noted that Humboldt and Bonpland found only 19 new species of bromeliads over a much wider area.

André's achievement in making such a notable contribution to science can best be understood in the light of his character and training as revealed in the narrative of his journey in "Le Tour du Monde" and in the introduction to the volume on his *Bromeliaceae*. Since André was not given to self-analysis, one must read between the lines to see the man. There one is struck with his enthusiasm for collecting and his firmness of purpose that sees him through the difficulties and disappointments of travel under the most primitive conditions. Yet all the time he is describing his hardships, he seldom fails to see their humorous side and point it up with a dry Gallic wit.

His training he dismisses briefly except for an affectionate tribute to his friend and teacher, Edouard Morren, the leading authority on bromeliads in his day. There is not even a hint that André was a landscape architect famed the length and breadth of Europe, and the bald statement of the scope of his commission from the French government is all we have to indicate the esteem of his fellow countrymen. The fact remains that he was superlatively well prepared to take advantage of every opportunity to advance natural science.

Thus, after an introduction much too long for André's approval, we find him and his two companions one day in late November of 1875 embarking on a new but ramshackle stern-wheeler at the Magdalena river-port of Barranquilla. He paid humorous tribute to the Yankee owners and skipper, passengers, food, service and last, and doubtless most difficult, to the mosquitoes.

The ship had to stop at intervals for fuel and André seized each such opportunity to rush ashore and collect. At Isla Brava, one of these stops along the torrid lower reaches of the Magdalena, he collected his first new species of bromeliad, *Aechmea penduliflora* with its delicate nodding inflorescence. Evidently it did not make much impression on him at the time, for Isla Brava is not mentioned in his narrative. Understandably the great heat (sand up to 127° F.), the poisonous snakes and the vara santa tree with hollow branches full of vicious ants, all had greater impact at the moment.

The other species of the lower Magdalena were typical of tropical lowlands around the Caribbean: *Guzmania monostachia*, *Catopsis sessiliflora*, *Tillandsia Valenzuelana* and *recurvata*, and *Aechmea magdalenae*. It seems strange that he should be the first to discover the latter species, for it extends from Colombia to Yucatan, grows in dense impenetrable stands of great extent and has long been used by the Indians for its fiber. Possibly its resemblance to a pineapple caused earlier botanists to overlook it, or to look the other way rather than to try to collect it.

Even on the more temperate upper Magdalena, André found the elevation still too low for optimum conditions for bromeliads. At Honda, he changed from the boat to the mule train which was to be his chief conveyance henceforth, and started southeastward up the Cordillera Oriental toward Bogotá.

André was quickly adjusted to this new mode of travel and even the toboggan tactics of the mules on wet clay slopes soon failed to distract his attention from the spectacle about him. The trail rose, the temperature dropt, and soon Spanish moss, *Tillandsia usneoides*, and stunted vegetation marked the beginning of the "tierra fria" or cool upland where gaudy *Ericaceae* predominate.

At Facatativa he reached the rim of the ancient lake-bed in which Bogotá lies. There he found his first truly Andean species of bromeliad, *Tillandsia incarnata*, which covers the ground with a gray carpet flecked with the bright red of its bracts.

After a short stop in Bogotá where he made some very helpful acquaintances, he continued across the remainder of the Andean chain to Villavicencio on the western edge of the great llanos or prairie country of the Orinoco Basin. Crossing the Andes he began to pick up new bromeliads in earnest: *Tillandsia heterandra*, *Pitcairnia guaritermae* and *brachysperma*, and *Aechmea servitensis*, as well as a number of older species. However, in the bromeliad-poor llanos, André found only *Aechmea angustifolia*, a characteristic species of the Amazon Basin.

From Villavicencio, André retraced his steps to Bogotá, then swung off his old course toward a more southerly junction with the Rio Magdalena. At first he followed along the lazy curves of the Rio Funza where



Aechmea columaris

he found two more new tillandsias, then where the Funza suddenly drops off nearly five hundred feet in the great Tequendama Falls, André encountered his *Tillandsia tequendamae* with its own cascade of bright red bracts in a pendent inflorescence.

His route turned southward now to Barroblanco and Fusagasuga, whence he made a side trip to the famous Gulf or Chasm of Icononzo. A short distance from Icononzo he found a striking bromeliad which he later described as *Aechmea columnaris* (Plate 2) on account of its slender inflorescence which reaches a height of eight feet and seems to be made of hundreds of golden beads. Its leaves are blood red for two-thirds their length, making even the sterile plants extremely ornamental.

Nearby André collected what might be called the minimum bromeliad, for it had no stem, no scape, and only a single flower in the center of a tiny rosette of leaves. It was later named *Tillandsia Andreana* by Edouard Morren. André also discovered *Bromelia nidus-puellae* which has a dense mass of flowers nested in the center of the rosette.

Back at Fusagasuga he turned westward again and descended the Cordillera Oriental to the Magdalena at Guataqui, finding little of note in bromeliads as he rapidly lost altitude.

After crossing the Magdalena in a precariously balanced dugout canoe he started up the first slopes of the Cordillera Central. Beginning with a single new pitcairnia just across the river, his list was increased by another pitcairnia, a tillandsia and three guzmanias by the time he reached the crest at Quindio Pass.

On the way up, his route passed for a time through stands of beautiful wax palms with white trunks like slender columns of ivory, and at Las Cruces he came to a hacienda whose economy was based in large part on the collection of this wax. The owner of the hacienda proved both intelligent and hospitable and André stayed for a while to take advantage of the rich collecting.

On one occasion his host organized a jaguar hunt for André's special benefit. André struggled down to the bed of a ravine through dense jungle and laid in wait for the jaguar to be driven past. Unfortunately some epiphytes—among them some new tillandsias—so distracted his attention that the beast got clean by him and he caught only a glimpse of it as it flashed into the brush.

Leaving Las Cruces, André went up over the divide and struggled into Salento after nightfall. Here his *Tillandsia rariflora* proved to be rare in more than flowers, for nobody has collected it in the seventy years that have elapsed since then. Another night on the downslope he was forced to spend in a filthy hovel at Tambores, but the next day he reached Cartago in the Cauca Valley. The west slope of the Cordillera Central had netted him a new aechmea and four new tillandsias.

From Cartago, André turned sharp left and proceeded southward up the Cauca Valley. As usual, the return to the lowlands signalled the practical disappearance of interesting bromeliads. The same distance that had yielded him so many new ones in crossing the Cordillera Central, now gave him nothing new and very little old along the winding swampy Cauca.

By the time he reached Buga about seventy miles to the south of Cartago he felt there was little more to learn from the monotonous valley. So agreeing to rejoin his companions at Cali, he took one peon and started on a side trip across the Cordillera Occidental. After ferrying the Cauca, he went down its west bank over terribly muddy and often flooded roads until he reached Vijes. There he was warned that his intended route over the mountains was both difficult and dangerous, but feeling sure that the alternate route offered but poor collecting he stuck to his decision.

He was soon rewarded with some very rich collecting as his trail entered the dense humid forest of the Alto del Potrerito. There he found a great variety of cryptogams and the new bromeliads, *Guzmania sphaeroidea* and *Tillandsia Carrierei*, as well as *Tillandsia tenuispica* that he had discovered but a short time before.

As André climbed higher he came out on the rounded crests of the Cordillera with their short grass or loma formation. Then his route went down and for a time he found forest between Alto del Bitaco and the Rio Dagua. This stretch of trail drops three thousand feet in a short distance. Looking down, André remarked on the strange white pattern on the vegetation below and his guide explained that it was the bones of travelers and their mules picked clean by the vultures. In spite of the risks of such a trail, he still managed to collect a few more new bromeliads.

At Las Juntas he started back after an unpleasant night with vampire bats. His *Tillandsia fragrans* comes from this locality and further on where he entered an arid region at Los Hornos (the ovens), he came on a great bromeliad, six to nine feet high with rigid leaves like fluted zinc and great red-violet panicles. This was the *Tillandsia secunda* of Humboldt. In the small settlement of Los Hornos the houses were surrounded by very effective hedges of *Bromelia Karatas* with its long leaves armed with great sharp hooks pointing in all directions.

André rejoined his companions at Cali, rested from an attack of fever and made preparations for the next leg of his journey. This part from Cali to Popayan was uneventful.

Next he had a choice of two southward routes from Popayan to Pasto and deliberately chose the worse because so little was known of its geology. Both his expectations and his fears were justified and the party reached Pasto much the worse for fever and little richer botanically.

At Pasto, André rested and refitted for two weeks and also took some short side trips. Best of these was the one to Laguna Cocha high in the western Andes near where the great Rio Putumayo has its source. A local mountaineer offered to guide him and they set out early one day with several other natives of Pasto. Leaving their horses at an Indian village they began the hard ascent of the Cordillera del Tabano by the "monkey trail" using their hands almost as much as their feet. On every side an infinite variety of cryptogams, orchids and bromeliads covered all parts of the trees and in spite of the difficulties of the trail

André managed to collect a goodly number. *Guzmania candelabrum* hung from high branches like the chandeliers of a cathedral.

After going through a narrow defile so overgrown as to be almost a tunnel, they emerged on the Alto de la Cruz and were rewarded with a magnificent view of Laguna Cocha. A painful descent by two "ladders" of roots brought them to the edge of the lake at the hut of Casapamba, but not without losing two of the party who spent a miserable night in the woods.

The next day André set out in the driving rain to explore the lake margin. As he waded through tall sedges something like a telegraph pole suddenly loomed up before him. It was *Puya gigas*, (Plate 3) one of the largest of bromeliads with a flowering stem thirty feet high. Although André was able to cultivate it in France, it never produced flowers there.

Before leaving Pasto, André was met by Jules Thomas, a French resident of Tuquerres who had come especially to conduct him to that city. About halfway there, near the deep gorge of the Rio Guitara they encountered a beautiful puya with a graceful open panicle and pale green flowers. Years later André described it as *Puya Thomasiana* in pleasant memory of their association.

From Tuquerres, André made a short excursion to Volcan Azufral on whose lower slopes he found puyas, tillandsias, guzmanias and other plants that grow well in European cool houses. In sharp contrast to the deep green lowland was the pale grass of the upper slopes and the riot of color in the crater lake of Laguna Verde and its surrounding amphitheater.

André had heard of the rich lowland country about Barbacoas to the northeast and decided to go collecting in that direction in spite of reports of the worst roads yet. He soon passed the western crest of the Cordillera and before him lay the great alluvial outwash from the bursting of the prehistoric lake that used to occupy the upper reaches of the Patia. At San Pablo the trail became too bad for his horse and he had to proceed on foot or riding in a chair strapped back to back on his Indian porter. About the same time he entered the rainiest country he had yet seen. Heavy storms were almost continuous and the Indians built their cabins on stilts like lake-dwellers.

If the trail to Laguna Cocha merited the title of "monkey trail" this could only be described as the "bird trail." At the Rio Cuaiquer which he had to cross on a swaying bridge of lianas, André found his *Guzmania Morreniana* with its close-packed chestnut spikes and hieroglyphic leaf-markings and *Guzmania Eduardi* with its brilliant red involucre. Both commemorate his friend Edouard Morren.

At Los Astrojos at the summit of a long climb, Indians had erected a rustic cross and adorned it with an epiphytic guzmania with appropriately blood-red leaves. This was André's *Guzmania sanguinea* which became popular in cultivation.

Near another crest, Alto de Armada, he looked up to see bright red and yellow heads of flowers hanging from delicate vine-like plants of *Guzmania caricifolia* and *graminifolia*. These two species that have yet



Puya gigas

to be rediscovered, he placed in a new genus, *Sodiroa*, on the basis of their habit.

Just short of Barbacoas, André turned back in order to save the collections he had made. In addition to the bad trail he had his worries from close landslides and a drunken porter whose delay in returning to Tuquerres nearly ruined the last lot of specimens.



Fig. 1. André and companion sleeping among bromels; Niebli region, Ecuador.

Heading south on his last lap toward Ecuador, André traveled over a high nearly bare plateau where the only trees were an occasional alder or willow. However, the low vegetation of such genera as *Bomarea*, *Fuchsia*, *Berberis* and *Vallea* was very colorful, and many high cascades

added to the grandeur of the scene. Bromeliads were few, but he did find *Tillandsia lajensis* near the sanctuary of the Virgin of Laja and *Tillandsia rectiflora* by the natural bridge of Rumichaca which he crossed into Ecuador.

In Colombia, André had frequently been below the optimum range of bromeliads, but now in Ecuador he traveled at such an altitude that he was more often well above it. On the paramo above Tulcan, he met with his first Ecuadorean bromeliads including *Tillandsia tetrantha* var. *scarlatina* with brilliant red bracts.

By the cañon of the Rio Chota he found both extremes of bromeliad range, with the new *Puya aequatorialis* on the bleak paramo and *Tillandsia recurvata* along with sugar cane plantations on the riverbanks some 4500 feet below. The puya was another indication of the height of his route since it is a genus of the open paramo formation above tree-line while the majority of bromeliads prefers dense forest.

After reaching Quito, André did a little local collecting and then had the good fortune to meet R. P. Sodiro who knew the region in great detail. On their first expedition they went south to Corazon and then struck west down the Rio Toachi. At Tambillo near Quito, André found his *Tillandsia pastensis* for a third time. It is interesting to note how often André recollected his own new species, a situation which is eloquent of the neglect of the family by earlier collectors.

On the slopes of Corazon André found his *Puya vestita* with densely woolly sepals and *Tillandsia homostachya*, another member of the subgenus *Pseudo-Catopsis* with zig-zag spikes of tiny flowers. At one point along the river they passed through a stand of horsetails, *Equisetum giganteum*, over fifteen feet high. The return was complicated by mutinous porters but André cowed them by heroic measures and brought his collections safely back to Quito.

A second trip was north and west of the region of Niebli where André found his richest collecting in Ecuador. In the haul were three new guzmanias and a new tillandsia and according to his illustration (Fig. 1) they even slept surrounded by bromeliads.

After about a month, André left Quito and collecting a little more as he moved south he finally arrived at Babahoyo on the Rio Guayas and here his account in "Le Tour du Monde" ends. However, we know from his collections that he went to Loja before starting home.

After his return to France, his bromeliads occupied much of his time for the next thirteen years, and later botanists are grateful to André not only for the magnitude of his collecting but even more for the accuracy and fullness of his reports.

THE SUBFAMILIES AND GENERA OF THE BROMELIACEAE

LYMAN B. SMITH

In constructing these keys to the subfamilies (or tribes if you prefer) and genera of the *Bromeliaceae*, special reference is made to cultivated material. An asterisk is placed after any genus now known in cultivation and two after those that are really widespread.

Cultivated material has for the student the great advantage of showing the petals and stamens which are all too often lost in herbarium specimens. Consequently for live plants we can make a natural key based on characters of primary systematic value, while we are forced to construct artificial keys in order to have efficient means of identifying most dried specimens.

Following Mez and Harms, the character of the form of the pollen-grains has been retained as a basic division in the subfamily *Bromelioideae*, but correlating characters have been added so that it will be unnecessary to resort to a microscope in many cases. The character of petal-appendages breaks down very badly in the *Bromelioideae* and has had to be abandoned in large part. On the other hand the distinction between simple and compound inflorescences has been used for its great convenience although it is of secondary importance systematically.

Seeds variously appendaged (naked in *Navia*, but the ovary superior and the fruit dehiscent); ovary wholly or in part superior (wholly inferior in *Pitcairnia anomala*); fruit a capsule (but indehiscent in a few species of *Pitcairnia*).

Seeds with entire appendages, not plumose; ovary usually wholly or in part superior; leaves often spinose-serrate; plants almost always terrestrial.Subfamily 1. *Pitcairnioideae*.

Seeds plumose; ovary nearly or quite superior (except in *Glomeropitcairnia*); leaves always entire; plants chiefly epiphytic.

Subfamily 2. *Tillandsioideae*.

Seeds always naked; ovary wholly or in very large part (*Acanthostachys*) inferior; fruit always baccate, fleshy to coriaceous; leaves usually spinose-serrate; plants chiefly epiphytic.

Subfamily 3. *Bromelioideae*.

Subfamily 1. Pitcairnioideae.

1. Seeds appendaged; sepals convolute with the left side of each overlapping the right of the next one.
2. Petals free; filaments not forming a tube.
3. Flowers perfect.
4. Ovary wholly superior.
5. Petals naked.

- 6. Seeds with a wing surrounding at least three sides; usually large coarse plants.
- 7. Petals broad, much more conspicuous than the sepals; seed-wing little if at all produced. *Puya*.*
- 7. Petals narrow, inconspicuous; seed-wing produced dorsally *Encholirium*.*
- 6. Seeds caudate-appendaged at each pole.
- 8. Seeds or ovules merely apiculate; placentae basal. *Cottendorfia*.
- 8. Seeds long-caudate; placentae usually extending almost the full height of the cell. *Lindmania*.*
- 5. Petals each bearing a single large scale near base.
- 9. Spreading shrubs; the scape with a definite cambium layer; inflorescence paniculate. *Deuterocohnia*.*
- 9. Low cushion-forming plants; scape lacking; inflorescence 1-flowered, at the ends of the branches. (Including *Meziotamnus*). *Abromeitiella*.
- 4. Ovary at least partly inferior.
- 10. Flowers large and conspicuous, usually zygomorphic; petals often appendaged, several times as long as the ovary; ovules numerous. *Pitcairnia*.**
- 10. Flowers minute, regular; petals from about twice as long as the ovary to much shorter; ovules few.
- 11. Filaments all free; petals elliptic, clawless. (Including *Bakeria*). Imperfectly known and possibly a synonym of some other genus.) *Bakerantha*.
- 11. Filaments of the second series connate with the petals; petals clawed or clawless. *Brocchinia*.
- 3. Flowers functionally dioecious with one sex aborted, inconspicuous, never more than 15 mm. long; ovary from wholly superior to very slightly so. *Hechtia*.*
- 2. Petals joined centrally to a tube formed by the bases of the filaments but their margins free, yellow or orange; seeds winged. (Including *Prionophyllum*). *Dyckia*.**
- 1. Seeds naked; sepals imbricate with both posterior ones overlapping the anterior *Navia*.

Subfamily 2. Tillandsioideae.

- 1. Ovary wholly or almost wholly superior; seeds plumose-appendaged only at base or apex.
- 2. Appendage of the seed basal, straight at maturity.
- 3. Petals free or slightly joined with the corolla-tube deeply included in the calyx.
- 4. Petals naked or rarely with vertical folds; inflorescence of one or more distichous-flowered spikes or rarely simple and polystichous or even 1-flowered (Including *Cipuropopsis*)
..... *Tillandsia*.**
- 4. Petals each bearing one or two scales on the inner surface.

5. Flowers distichous or if rarely polystichous then the floral bracts forming the conspicuous element of the inflorescence; branches usually elongate when present (Including *Alcantarea*). *Vriesia*.**
5. Flowers polystichous or the branches of the always compound inflorescence (as shown by the two series of bracts) reduced to single flowers; primary bracts always the conspicuous element of the inflorescence; branches usually aborted. (A weak genus that is increasingly difficult to separate from *Vriesia*). *Thecophyllum*.*
3. Petals joined or closely agglutinated and simulating true fusion, the corolla-tube about equaling the calyx; flowers always polystichous.
 6. Petals naked. (Including *Caraguata*, *Schlumbergera*, *Sodirola*, *Massangea*). *Guzmania*.**
 6. Petals bearing two scales on the inner surface. *Mezobromelia*.
2. Appendage of the seed apical, folded over at maturity; sepals strongly asymmetric in most species; flowers polystichous.
 - *Catopsis*.*
1. Ovary only half superior; seeds plumose-appendaged at both ends.
 - *Glomeropitcairnia*.*

Subfamily 3. Bromelioideae.

1. Pollen-grains smooth; scapeless plants or else (*Bromelia* subgenus *Eubromelia*) the petals centrally connate to a filament-tube.
2. Petals free, appendaged on the inside.
 3. Filaments of the second series free; petals clawless, fleshy.
 - *Fascicularia*.*
 3. Filaments of the second series connate with the petals; petals clawed, thin.
 4. Inflorescence compound; several flowers in the axil of each large bract. *Sincoraea*.
 4. Inflorescence simple; a single flower in the axil of each bract.
 - *Cryptanthopsis*.*
2. Petals connate toward base, naked.
 5. Petals joined by their margins.
 6. Inflorescence simple; sepals nearly or quite free; petals fleshy, erect. *Greigia*.
 6. Inflorescence compound with several flowers in the axil of each foliaceous bract; sepals joined for much of their length; petals thin, white, their lobes spreading. *Cryptanthus*.**
 5. Petals centrally joined to a filament-tube but their margins free.
 7. Inflorescence compound. (Including *Karatas*). *Bromelia*.**
 7. Inflorescence simple, few-flowered *Deinacanthon*.
1. Pollen-grains variously sculptured or marked (smooth, irregular and probably aborted in *Aechmea magdalenae*).
8. Pollen-grains with 2, 4 or numerous protruding pores; sepals usually asymmetric and strongly mucronate or aristate.

- 9. Stems dimorphic, the flowering stems scaly and leafless, the vegetative with rosettes of fully developed leaves.*Disteganthus*.
- 9. Stems all alike.
- 10. Inflorescence involucrate with leaves or colored bracts surrounding it, dense.
 - 11. Petals naked, usually much connate; sepals usually somewhat connate.
 - 12. Flowers sessile; petal-blades erect and cucullate in most species.*Nidularium***
 - 12. Flowers slenderly pedicellate; petal-blades spreading, acute. (Including *Aregelia*).*Neoregelia***
 - 11. Petals appendaged.
 - 13. Petals free.
 - 14. Sepals free*Canistrum***
 - 14. Sepals connate*Aechmea* subgenus *Ortgiesia*.*
 - 13. Petals connate; scape-bracts and primary bracts foliaceous.*Wittrockia*.*
- 10. Inflorescence not involucrate.
 - 15. Filaments bearing 2 large auricles which overtop the anthers*Androlepis*.*
 - 15. Filaments not appendaged.
 - 16. Inflorescence compound.
 - 17. Scape-bracts large and foliaceous.
 - 18. Leaves subentire, grass-like; epigynous tube large. *Andrea*.
 - 18. Leaves spinose-serrate; epigynous tube very short or none.
 - 19. Sepals nearly or quite symmetric. *Orthophytum*.*
 - 19. Sepals asymmetric; inflorescence densely digitate with reflexed bracts.*Aechmea magdalenae*.
 - 17. Scape-bracts distinctly different from the leaves.
 - 20. Flowers strobilate, strongly compressed.
 - 21. Epigynous tube none or minute; pollen grains with 2 or 4 pores; petals naked or appendaged. *Hohenbergia*.*
 - 21. Epigynous tube well developed; pollen-grains with numerous pores; petals appendaged. *Gravisia*.*
 - 20. Flowers not strobilate nor compressed.
 - 22. Flowers slenderly pedicellate; sepals mucronate.
 - 23. Petals naked; sepals connate; flowers minute. *Araeococcus*.
 - 23. Petals appendaged.
 - 24. Pollen-grains with 2 pores; sepals free. *Aechmea* subgenus *Podaechmea***
 - 24. Pollen-grains with numerous pores; sepals connate*Portea*.*
 - 22. Flowers sessile or if pedicellate then the sepals unarmed.

25. Ovules not more than 10 in each cell; flowers minute; sepals unarmed; petals naked.
Araeococcus.*
25. Ovules numerous in each cell.
26. Petals naked. (Including *Pironneava*).
Streptocalyx.*
26. Petals appendaged, sometimes obscurely.
27. Sepals mucronate or aristate or if entire then the ovules long-caudate. (Including *Wittmackia*).*Aechmea*.**
27. Sepals unarmed; ovules obtuse; inflorescence very little branched when compound.
Quesnelia.**
16. Inflorescence simple.
28. Ovaries always remaining distinct.
29. Ovary slightly superior, its apex rounded and protruding above the insertion of the perianth; scape slender, naked except at apex; inflorescence small, strobilate*Acanthostachys*.**
29. Ovary wholly inferior.
30. Ovules obtuse; petals naked; inflorescence lax.
Ronnbergia.
30. Ovules caudate or if obtuse then the petals appendaged; inflorescence often strobilate.
31. Sepals mucronate or aristate or if entire then the ovules long-caudate. (Including *Chevalieria*).
Aechmea.**
31. Sepals unarmed; ovules obtuse.*Quesnelia*.**
28. Ovaries fusing to form a compound fruit or syncarp.
32. Syncarp at maturity bearing a minute inconspicuous coma of reduced bracts, never producing slips at its base; petals bearing lateral folds. *Pseudananas*.*
32. Syncarp at maturity bearing a conspicuous coma of foliaceous bracts, frequently producing slips at its base; plant not producing stolons; petals bearing infundibuliform scales*Ananas*.**
8. Pollen-grains without pores, but with fine markings and a lateral fold on drying; sepals usually unarmed and nearly or quite symmetric (minutely mucronate and asymmetric in *Neoglaziovia*).
33. Petals naked.
34. Inflorescence capitate; scape none or almost none; stamens exerted. (Including *Rhodostachys*).
Ochagavia.
34. Inflorescence and scape elongate; stamens included.
Fernseea.
33. Petals appendaged; scape evident.
35. Ovules few in each cell; flowers regular*Neoglaziovia*.*
35. Ovules numerous in each cell; flowers zygomorphic.
Billbergia.**

WHERE BROMELIADS ARE FOUND

MULFORD B. FOSTER

Without a doubt the Andean area of South America mothered the family into existence. While the puyas, the earliest members of this interesting group, have devoted their efforts toward survival in their original home area, regardless as to how high they have been pushed up into the clouds (Plate 2), their great line of descendants have migrated all over South America and the southern area of North America.

Whenever we study the migration of birds, men or animals we see a similar pattern, we find men following the plants in low swampy land, in the high mountains, in low rolling hills or on the desert.

Brazil, it seems, has been the favorite place of residence for the bromeliads, as the greatest number of different genera and species are to be found there. And yet, one could travel for days within certain areas without seeing hardly one bromeliad.

The puyas have traveled from Chile to Costa Rica, yet they have not set root in Brazil.

Tillandsia usneoides and *T. recurvata*, called Spanish Moss (Fig. 2) and Ball Moss, have been the greatest migrators of all; they now live in every country and state where there are any bromeliads to be found (with the exception of Africa.)

In marked contrast to these *Tillandsia* species that use the most modern way of travel, via air, their relative *Vriesia itatiaiae* (Plate 5) has been so self-satisfied that it lives on Mt. Itatiaia, one of Brazil's highest mountains and nowhere else on the earth. There are other endemics in the family but few with a range so limited.

The genera *Navia*, *Brocchinia* and *Bakerantha* are found north of the Amazon in the Guianas, Venezuela, Brazil and Colombia. They are rare and isolated in habitat.

Cryptanthopsis, *Cottendorfia* and *Sincoria* are limited to a small area of southwestern Bahia in Brazil.

Encholirium is coastal from below the mouth of the Amazon to Espirito Santo and inland as far as Minas Geraes and Bahia.

Ochagavias are isolated on Juan Fernandez Island off the coast of Chile.

Abromeitiellia and *Fascicularia* choose high Andean ranges of Chile to be near their ancestors.

Greigia has not left the home ground of the puyas and are to be found from Costa Rica to Chile.

Lindmania, a very early relative of the puyas has kept close to them but has also gone farther north and on into Mexico as well as around the northern rim of the Amazon basin, but it has not gone down into Chile.

Ronnbergia and *Mezobromelia*, rare genera, seem to prefer the western part of Colombia.

Deuterocohnia with its few known species is found in the central and southern area of the puyas but has gone over into the Matto Grosso of Brazil. They have shared some of the territory with *Dyckia* but the dyckias have taken in parts of Argentina, Paraguay, Bolivia, Uruguay and a great area of Brazil as far north as the Bahia area.

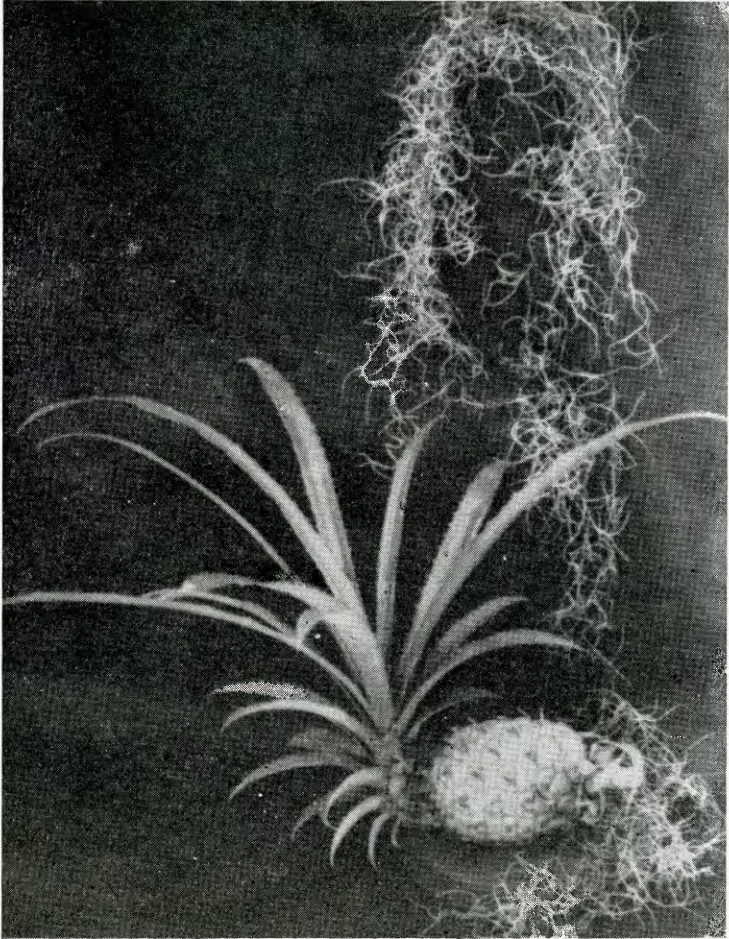


Fig. 2. Bromel cousins—Spanish Moss, *Tillandsia usneoides* travels entirely by air on its own; *Ananas bracteatus* is grounded, and travels with the assistance of man and beast by its appeal to their palates. Photo by Mulford B. Foster.

Hechtia, though closely related to the puyas, has apparently never trespassed into the *Puya* domain. They have chosen their territory to be in Central America from north of Costa Rica with a northern boundary line in lower Texas, Arizona and Baja California.

Pitcairnia, on the other hand, has spread from the central part of Mexico, including the West Indies and a greater part of South America with its southern limits in the Argentine, Bolivia, and a portion of Chile. *Strange as it may seem just one species has been reported in Africa.*

In very nearly the same area as the *Pitcairnia*s dwell, you will find the genus *Catopsis* excepting that it avoids Chile and some parts of the lower Argentine.

Vriestia, too, which has the southern part of Mexico as its northern limit, takes in all of the *Catopsis* area and a bit more of Bolivia and Peru. However, most of the species are native to Brazil.

The circle shrinks for *Guzmania*. The northern limit is southern Mexico and the tip end of Florida. The southern limit swings around the northern part of Brazil from Bahia across to the Pacific Coast. It is interesting to note that the Florida species of *Guzmania monostachia* has taken up residence in much of that area even to Bolivia.

A much smaller inner circle, taking in Costa Rica, a part of the West Indies and the northeastern section of South America would circumvent the area occupied by *Thecophyllum*.

The few species of *Glomeropitcairnia* are found in a very limited island area of the Lesser Antilles with Trinidad as its southern limit.

Tillandsia, greatest of all migrants in the family has made a territorial line swinging around all of the species so far named and those yet to be zoned in this treatment. Its very northern limit is the southeastern tip of Virginia at the 35th parallel; its southern limit in the Argentine to the 45th parallel would be comparable to being in the neighborhood of Maine and Nova Scotia in the North.

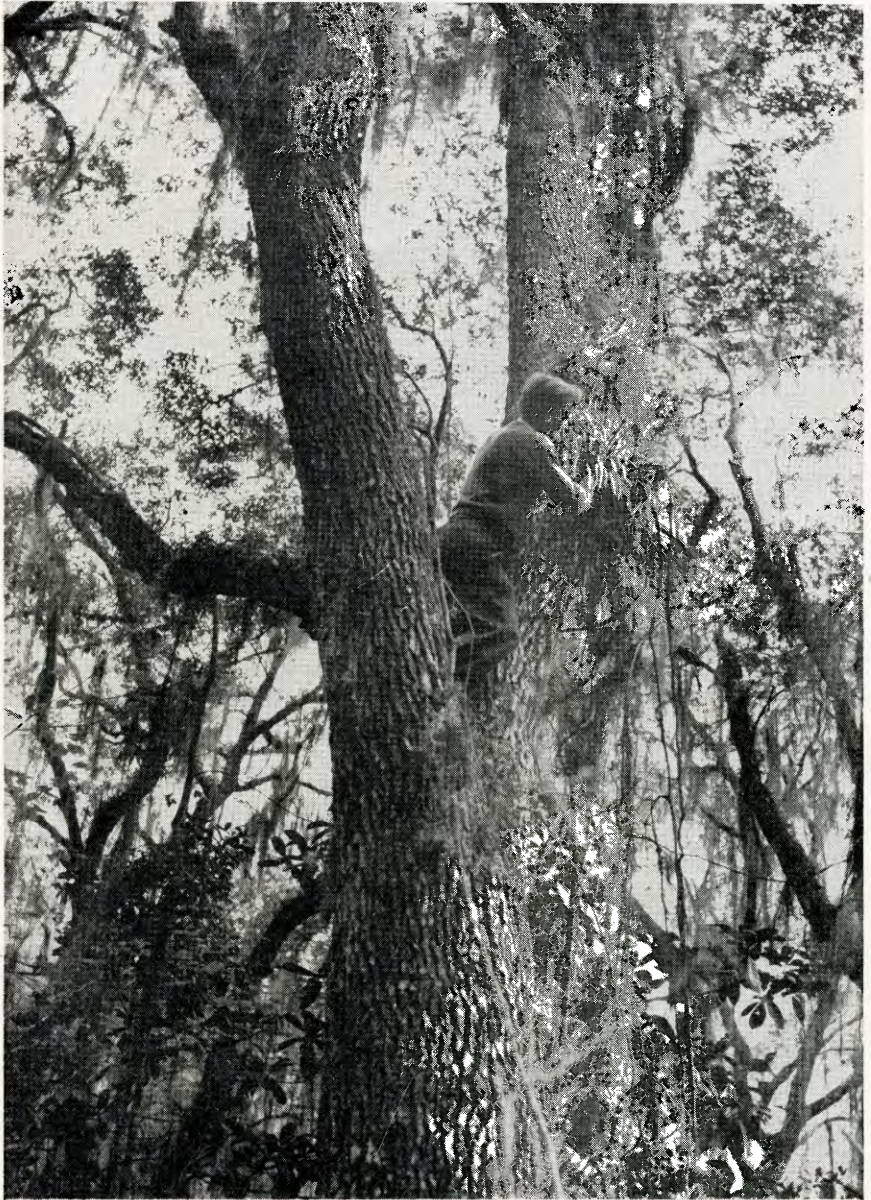
One of Brazil's finest fiber plants *Neoglaziovia*, a monotypic genus is found only in a limited area of Bahia and states bordering its northern boundary. *Acanthostachys*, another genus with but a single member is also Brazilian but has a greater range throughout the central section of Brazil. *Disteganthus* from French Guiana, *Wittrockia* from coastal mountains in Brazil, *Araeococcus* from Costa Rica and northern South America, *Pseudananas*, the false pineapple found on the high planes of Brazil, all six of these genera, have but from one to three species to their credit.

Cryptanthus species are all central Brazilian and the four or five *Orthophytum* species are to be found in a somewhat similar area. *Andrea* species too are limited in their central Brazilian home.

With the exception of one *Neoregelia* (which is in Peru) all of the *Neoregelia*, *Nidularium*, and *Canistrum* are confined to Brazil.

Hohenbergia species are native to Cuba and the West Indies with ten of the species from Jamaica; they range on down through Trinidad and into Brazil. A typical species of this genus, *Hohenbergia caatingae*, is a stiff-leaved bromel that grows in great masses on the caatinga which is similar to mesquite. It will stand very severe drought (Fig. 3).

Wittmackia and *Gravisia* seem to keep to the Atlantic Coast of South America from northern Brazil up to Costa Rica and into Puerto Rico and the Lesser Antilles.



One way to obtain bromels

Ladislau Cutak wanted Florida's largest *Tillandsia* for the Missouri Botanical Garden collection—this put Mulford Foster up a tree. Photo by Ladislau Cutak.

Plate 4

Androlepis has a Central American residence for its few species, while *Streptocalyx* seems to be just as satisfied in Peru as in Brazil for its species may be found in the western and northern end of South America right on down to Rio and surrounding country.



Fig. 3. *Hohenbergia caatingae*. Photo by Mulford B. Foster.

Ananas, the pineapple, may be found wild in many parts of Brazil but in just how many of the other countries of South America it was originally native is open to much discussion. At any rate some of the species grow wild over quite an area.

The genus *Bromelia* covers a great area. Some of its species may be found in Mexico, the West Indies or right on through Central Amer-



Vriesia itatiaiae

A saxicolous type of bromeliad which enjoys the wide open spaces above the tree line in a "penthouse" on the "roof" of Brazil. Photo by Mulford B. Foster.

ica, over a great part of South America on both the Atlantic and Pacific coasts. I have found it growing wild in many American tropical countries where almost universally it has been used by the natives as a property line marker where conditions are primitive.

The beautiful *Portea* species are few in number with a range along the Atlantic coastal region in Brazil from Rio north to Bahia.

The range of the delightful *Quesnelia* species is from the Guianas to southern Brazil and they do not go inland for any great distance.

The *Chevaliera* species keep to the Brazilian coast line also.

Most of the *Billbergia* species find their home in Brazil but they are lightly sprinkled from Mexico south and well down the Atlantic coast to Argentina with a few on the Pacific to Peru.

The *Aechmea* species are greater in numbers and greater in range than almost any of the other berry-fruit bearing bromeliads; they are native from Mexico south, including the West Indies and throughout South America. Brazil, of course, has by far the greatest number of species.

They are an intriguing family, the bromeliads. They may be found perfectly at home on the side of a house or a perpendicular rock, attached to a giant cactus or a telephone wire, overhanging a waterfall or on a rainless desert.

With or without roots the species will be found, each one finding much of their food in the air carried to them by favorable air currents or rainfall dropped into their water-filled cups far up in the trees and under the trees.

The bromeliads have explored the American Tropics for centuries and have settled down in so many out-of-the-way places that inquisitive plantmen are still seeking their whereabouts in order to know more about them.

HOW TO RECOGNIZE THE BROMELIADS

MULFORD B. FOSTER

[Mr. Mulford B. Foster has favored the readers with 36 excellent line drawings of various bromel species. These drawings are reproduced in Plates 6, 7 and 8. These illustrations are to be consulted in connection with the following text, and will convey an idea of the very great variety of forms to be found in the Bromeliaceae.—Ed.]

One of the most interesting plant families in America is botanically known as BROMELIACEAE, but is commonly known as the Pineapple Family. The fifty genera recognized in this family contain some 1600 different species, and all are native to the Americas except one *Pitcairnia* which has been found in Africa. Twenty genera are represented in North America from Panama north.

The bromeliads are mostly epiphytic (living on trees) but none of them are parasitic. Some of them, especially pitcairnia and puyas are

terrestrial while most of the dyckias, hechtias and encholiriums are saxicolous (living on rocks).

Most of the bromeliads bloom from the axis or center of the plant but the dyckias, encholiriums, hechtias and deuterocohnias nearly always bloom laterally, or from the side;¹ the inflorescence may appear in simple or compound spikes, heads, or branching panicles, or singly as in Spanish Moss.

The leaves are spirally arranged in rosettes and more than half of the species hold water in small "tanks" formed by the close fitting base of these trough shaped leaves.

Species of *Tillandsia*, *Vriesia*, *Guzmania*, *Thecophyllum*, *Catopsis*, and *Glomeropitcairnia* all have smooth-edged leaves, while all other members of the family except some *Pitcairnia* have spines on the leaf margins.

The epiphytic forms use their roots more for holding fast than for any other purpose. The terrestrial forms no doubt draw mineral nutrients through their roots, but they too, like the epiphytic forms, obtain mineral nutrients from air-borne dust particles that lodge on the leaves or fall into the moisture that collects at the leaf bases and in the crown.

Bromeliads have, for the most part, an unusual ability to adapt themselves to many different conditions under which many different plants survive. They have greater adaptability for adverse or man-made conditions than most other plants could cope with.

There are few plant families that possess such a great percentage of decorative forms as do the bromeliads, regardless as to whether they are in flower or not. While the flowers vary in form and color, the inflorescence generally receives most of its radiance from the colorful bracts or fruits which often put on a "show" for six months.

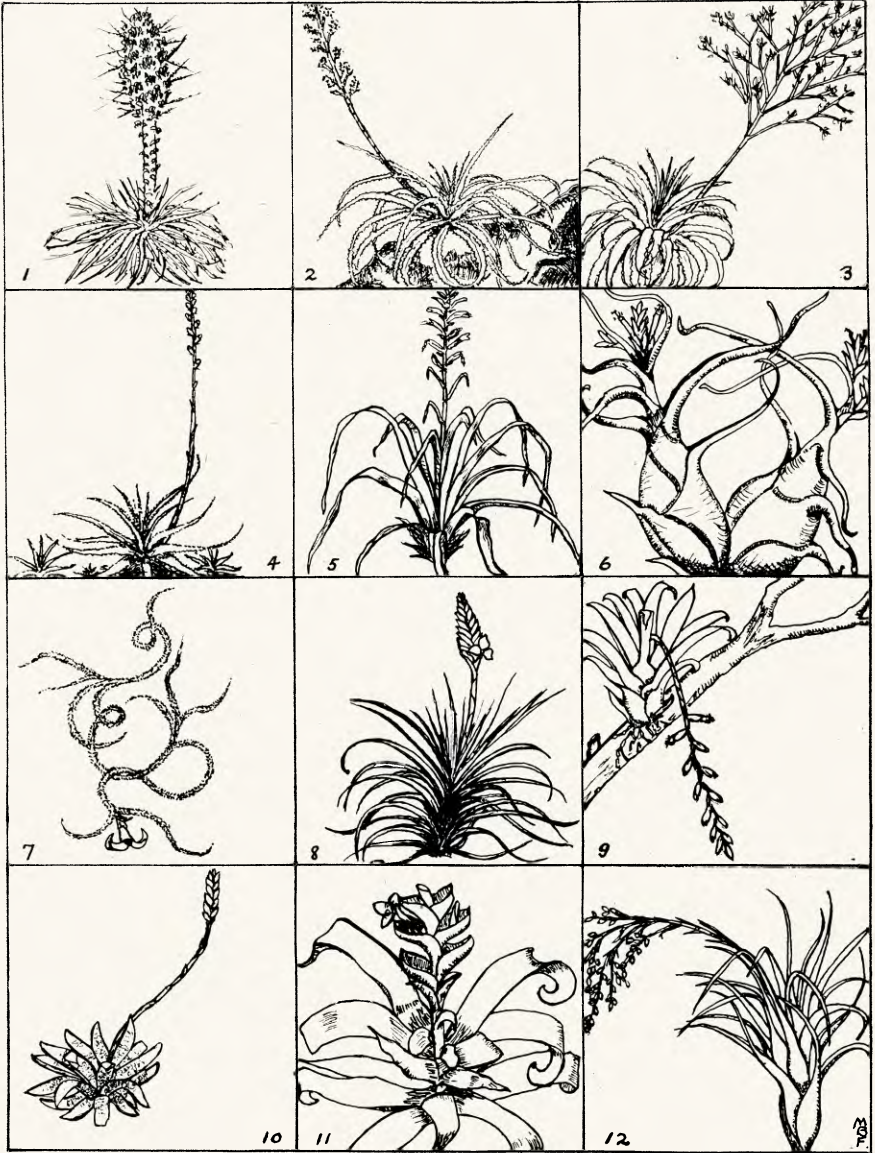
Although I have more than 400 representatives of thirty-five of the fifty known genera in this family, living in my collection, the majority of them are species of only eight genera, namely, *Vriesia*, *Tillandsia*, *Aechmea*, *Billbergia*, *Neoregelia*, *Nidularium*, *Dyckia* and *Cryptanthus*.

To know a few of the outstanding characteristics should help the average plantsman determine the more common genera of bromeliads that might be found either in the wilds or in cultivated collections.

ANANAS

The pineapple is number one in the Family of bromeliads, known the world over and grown in every tropical land, and to some extent in sub-tropical regions. The genus *Ananas* (Brazilian Indian word) to which this delicious fruit belongs has several species, all native to Brazil. The commercial pineapple belongs to the species, *Ananas comosus*; it is a terrestrial plant with leaves that are spiny in most of the forms, although there is a cultivated form, (Smooth Cayenne) which rarely has any spines on the leaf edges. The vegetative pineapple top which

¹ See Lateral Inflorescences in Bromeliaceae by M. B. Foster National Horticultural Magazine Jan. 1945.



Bromel portraits—1. *Puya coerulea*; 2. *Hechtia capituligera*; 3. *Deuterocohnia Meziana*; 4. *Dyckia leptostachys*; 5. *Pitcairnia flammea*; 6. *Tillandsia bulbosa*; 7. *Tillandsia usneoides*; 8. *Tillandsia Lindeniana*; 9. *Vriesia simplex*; 10. *Vriesia Fosteriana*; 11. *Vriesia heliconoides*; 12. *Catopsis floribunda*. Drawings by Mulford B. Foster.

develops on the top of all pineapples is a miniature plant itself. There may also be a number of these growths at the base of the fruit, they can all be planted to form new plants. The pineapple plant also forms offshoots or "suckers" at the base as do most of the bromeliads. The fruit which forms at the top of a stout stem is a composite one and actually contains many fruits welded into one. The flowers of all the different species are a purple blue in color. The commercial varieties of *Ananas comosus* are practically seedless but the wilder species which grow in great profusion in Brazil, contain seeds. *A. bracteata* with its beautiful long lasting red fruit is also edible but much more decorative as a garden subject and much more easily grown. *A. ananasoides* var. *nana* is the dwarf of the genus. The fruit, one to two inches long atop a tall stem, is easy for your eye and nose but would be a tough subject for your teeth.

PSEUDANANAS

There are two other genera that resemble very closely the foliage of the pineapple; one is *Pseudananas* or false pineapple and the other is *Bromelia*. Only one species of *Pseudananas*, *P. macrodontes*, is recognized and it looks just like a pineapple without the regulation green leaf-like top. It forms new plants on long underground stolons and not at the base as in the true pineapples.

BROMELIA

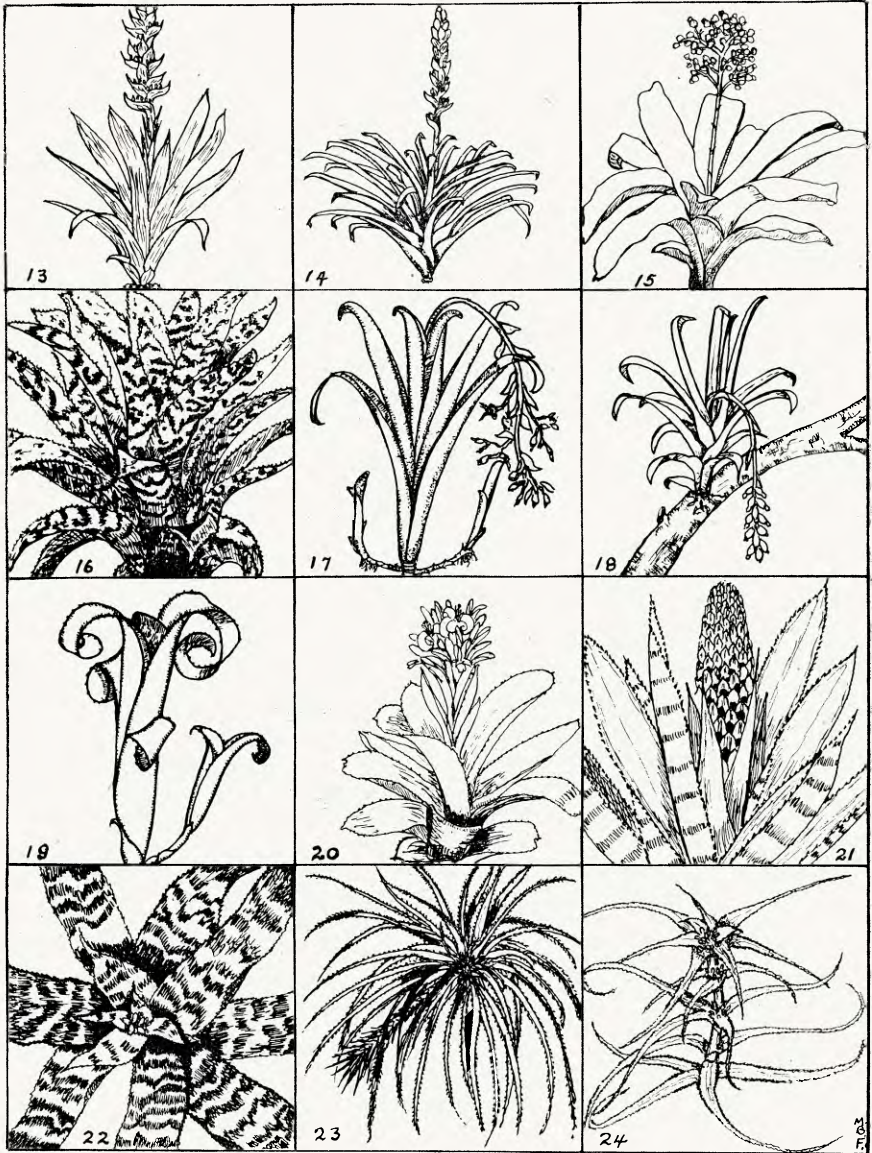
The genus *Bromelia* was named for the Swedish botanist, Bromel. The foliage of this genus is pineapple-like but the fruits are not fused, each fruit is separate on a branched head. Possibly the most dramatic members of the Family as they are coming into bloom are several of the species of these bromeliads, especially *B. serra*. This spiny-leaved *Bromelia* shoots forth a center of blazing red bracts surrounding a head of flowers that rise two feet high. The maroon and white flowers emerge from a wadding of "pure white cotton." This plant called "heart-of-flame" is quite beyond description. The variegated form of *Bromelia serra* is the most striking of all terrestrial bromeliads whether in flower or not (Fig. 4).

In several Central and South American countries bromeliads are planted in rows on property lines by the natives, making quite effective barriers.

PUYA

The genus *Puya* is no doubt the earliest member of the entire family of bromeliads. The majority of them live high in the Andes. Some of them develop a yucca-like trunk as they continue to bloom year after year from the center of the same plant; the flower stalk may be simple or branching. Their many leaves are serrated on the margins.

The plants range in size from one to thirty feet in height. André described the flower stalks of *P. gigas* as looking like telephone poles.



Bromel portraits—13. *Thecophyllum fastuosum*; 14. *Guzmania monostachia*; 15. *Aechmea miniata* var. *discolor*; 16. *Aechmea orlandiana*; 17. *Aechmea marmorata*; 18. *Aechmea Racinae*; 19. *Billbergia leptopoda*; 20. *Billbergia pyramidalis*; 21. *Quesnelia Quesneliana*; 22. *Cryptanthus zonatus*; 23. *Cryptanthopsis navioides*; 24. *Orthophytum foliosum*. Drawings by Mulford B. Foster.

McBride states that *P. Raimondii* of Peru is the largest member of the entire family of bromeliads and its inflorescence attains a height of over thirty feet. Its giant flower stalks are "used for timbers in roofs." The flower colors predominate in blue-greens, greens, yellow-greens and white. Their dry seed capsules hold winged seeds. Many of the puyas can stand quite low temperatures but do not as a general rule care for low altitudes.

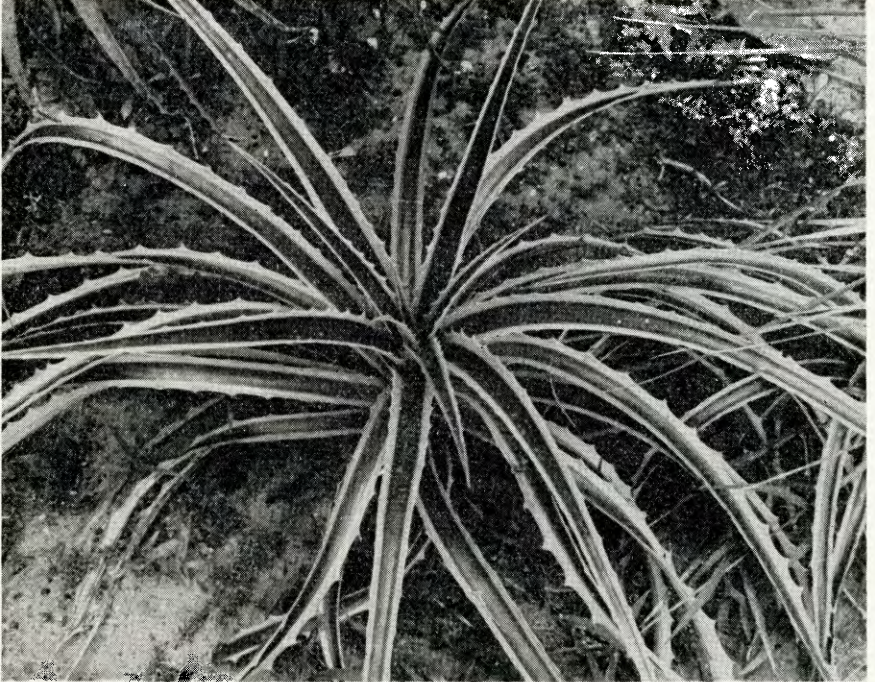
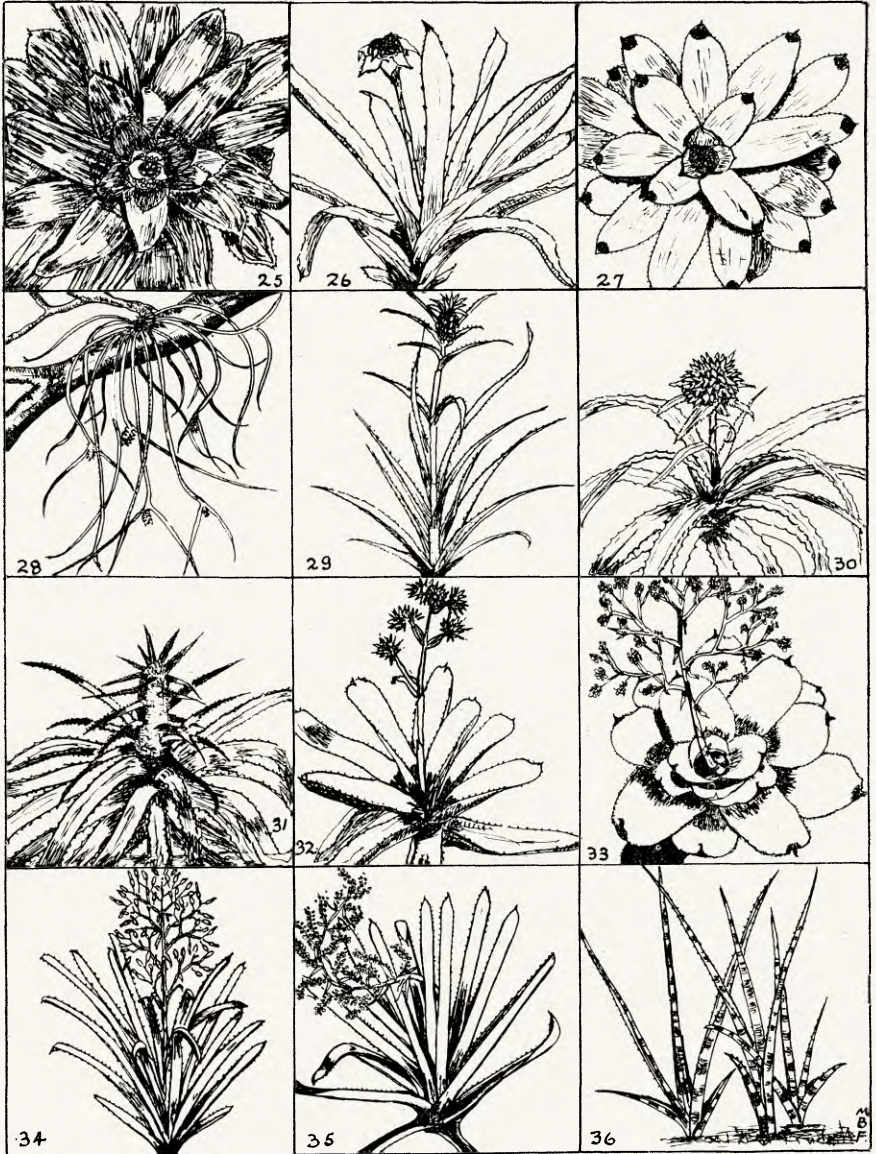


Fig. 4. A variegated form of *Bromelia serra*. The most striking of all the terrestrial bromeliads whether in flower or not. Photo by Mulford B. Foster.

DYCKIA

The genus *Dyckia* was named for Prince Salm-Dyck. Dyckias, the best known of the stiff succulent type of bromeliads have been used in sub-tropical rock gardens of Florida and California for several years. *D. sulphurea*, the best known and *D. rariflora* have been raised in quantities for dish gardens and succulent fans. All of the species of this genus are plants with many stiff spiny leaves in rosette form; they are all either terrestrial or saxicolous and their winged seeds mature in dry capsules; they all bloom laterally on rather tall spikes with yellow or orange flowers.



Bromel portraits—25. *Nidularium innocenti* (var.); 26. *Canistrum Cyathiforme*; 27. *Neoregelia spectabilis*; 28. *Acanthostachys strobilacea*; 29. *Ananas ananoides* var. *nana*; 30. *Pseudananas macrodontes*; 31. *Bromelia serra*; 32. *Gravisia aquilega*; 33. *Hohenbergia Salzmännii*; 34. *Portea petropolitana* var. *extensa*; 35. *Wittmackia lingulata*; 36. *Neoglaziovia variegata*. Drawings by Mulford B. Foster.

Some of the dyckias, no doubt, live for fifty years or more forming a caudex or trunk which lies on the rocks like a fallen yucca; the plant always blooms from the side of this prostrate spiny rosette. *D. leptostachys*, however, sends out off-shoots from under ground stolons and a great solid mat of plants may result over a period of years.

HECHTIA

The genus *Hechtia* was named in honor of M. Hecht. Hechtias, although all species are North American, are much more numerous than dyckias, but have been generally less well known. The plants themselves somewhat resemble the dyckias although they have heavier spines and have a greater variety of color and size. Their flowers, however, are smaller and seldom as showy as those of the dyckias. They, too, like the dyckias bloom laterally or from the side with the possible exception of a new species which I discovered in Mexico eleven years ago, *H. melano-carpa*. It blooms from the center on a stem almost eight feet high. Nearly all *Hechtia* flowers are small and white and while all of the flowers are perfect, each species has two phases. One phase has the stamens fully developed and the pistil undeveloped while the other has the pistil perfectly developed but the stamens are immature and do not carry pollen. The dry capsular fruits produce winged seeds as do also the *Encholirium* species which resemble in plant form, the hechtias and dyckias.

DEUTEROCOHNIA

The genus *Deuterocohnia* is another named for Cohn. The deuterocohnias also look like the dyckias, hechtias and encholiriums so far as plant form is concerned, but their longer tubular flowers easily distinguish them from these close relatives.

One very special quality that *Deuterocohnia Meziana* has is that when the tall branched flower-stalk appears it may send forth flowers for a period of six or eight years from the same inflorescence. This shrub-like inflorescence has the rare peculiarity of having a cambium layer similar to a dicotyledonous plant and new branches and flower buds appear year after year, making it quite unique in the family.

PITCAIRNIA

The genus *Pitcairnia* was named for Dr. Pitcairn. Almost any section of the American tropics where there are rocks and waterfalls you should not be surprised to find some species of *Pitcairnia*. This group makes up a large section of the Bromeliad Family. A great number of the species would remind you of tufts of grass if it were not for their vivid red tubular-like flowers, or they may be yellow or white. The grass-like leaves are generally covered with white scales on the under side. Some of them have smooth edges while others are quite well armed with spines. Many are equipped with short, stiff, horny, barbed spines rising among the leaves from the rather bulbous base of the plants.

The pitcairnias are attractive when in flower, are nearly all terrestrial in habit and I believe, will be used much more often as garden plants

when they become better known. The branched flower spikes often continue to bloom for a period of two to three months.

TILLANDSIA

The genus *Tillandsia* was named in honor of Tillands, Swedish physician. The genus having the most numerous species in Bromeliaceae is *Tillandsia* and members of this group may be found throughout the range of the entire family. Nearly one-third of the 400 species of bromeliads in North America are tillandsias. They vary in shape and size from a few inches in height, as in *T. recurvata*, to *T. grandis* which produces a flower stalk eleven feet high.

While many of them have smooth or glabrous leaves, the more common ones are lepidote or scaly (fuzzy) like the common *Tillandsia usneoides* or Spanish Moss, none of them have spines on the leaf margins. Most of the larger smooth-leaf species of tillandsias could easily solve this confusion. The flower must be dissected and the petals examined. If petals are plain and without nectar scales attached near the base, then the plant will be a *Tillandsia*. The flowers are generally found in flattened spike formations, and are either lavender, blue, white, yellow or green. The bracts range in color from white and green to pink and red. The seeds are plumose and float through the air on little parachutes in the same manner as the seeds of common milkweed with its silken threads.

VRIESIA

The genus *Vriesia* was named for Dr. de Vriese, a Dutch botanist. The vriesias too, generally have the flattened or distichous spike of flowers but at the base of the petals will be found nectar scales. In the *Vriesia carinata* type of flower, and these are the most common in horticulture, the petals are fused or fastened together at the base but in most of the larger types such as *V. Fosteriana* the petals are separate. The predominating colors of *Vriesia* flowers are yellow, white or green and the showy bracts may be yellow, red, green or purple, often strikingly decorative for six months. Leaf margins are smooth and seeds are borne on parachutes as in tillandsias.

Vriesias must have met the fancy of bromeliad enthusiasts in Europe many years ago because there appears to have been more hybridizing done with vriesias than any other section of the family. Even today *Vriesia gloriosa*, a hybrid between *carinata* and *Barilletii*, is one of the most popular vriesias in cultivation and its striking form and long life has made it one of the most sought for bromeliads by both the collector and one who just wishes a beautiful plant for the house.

In Fig. 5, an unnamed species of *Vriesia* is illustrated. This is one of several collected by the writer.

GUZMANIA

The genus *Guzmania* was named after A. Guzman, Spanish naturalist. Guzmanias are closely related to the tillandsias and vriesias but differ in always having spikes of flowers which are polystichous or radi-

ating from all directions. The petals appear to be connected or tubular but it is really only a fairly good "glue job" and there are no nectar scales attached. Flowers predominate in yellow and white; the bracts are often brilliantly colored from yellow to orange and maroon, lasting for several months. The seeds of all three of these genera as well as *Catopsis*, *Thecophyllum* and *Glomeropitcairnia* are plumose and are carried through the air. They all have smooth edged leaves. Practically

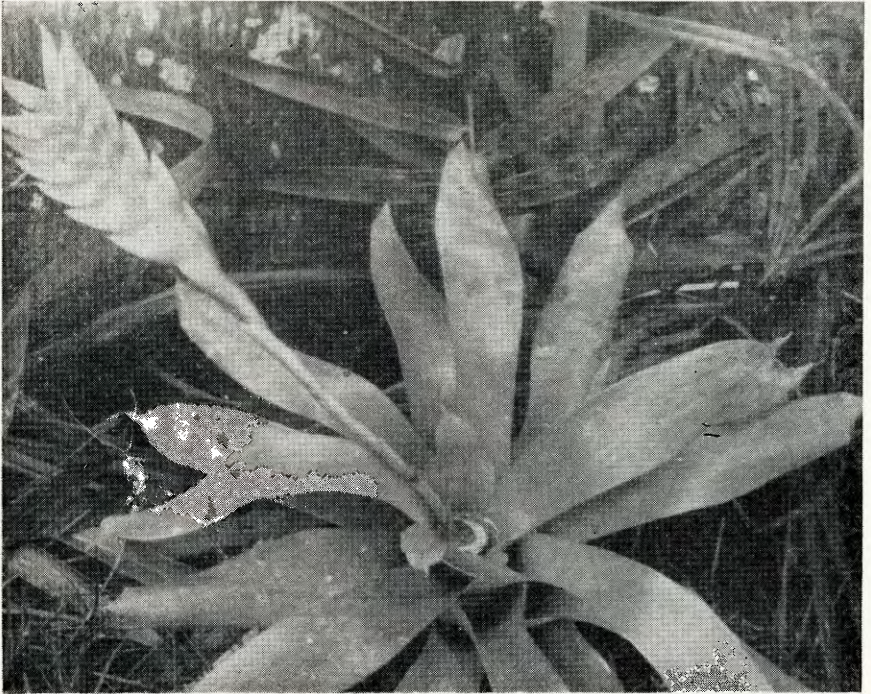


Fig. 5. Unnamed *Vriesia*. One of several different beautiful *Vriesias* that will have to wait several years for a name; Dr. Smith thinks that it is a natural hybrid. Photo by Mulford B. Foster.

all of these closely related genera are epiphytic although some members of each genus live attached to rocks or the ground.

BILLBERGIA

The genus *Billbergia* was named in honor of Billberg, Swedish botanist. It seems that some of the first introductions in the country came here as billbergias. They were easily grown and for some unknown reason the name became fixed (in the popular mind) to most of these tubular formed plants.

Billbergias, the most commonly known bromeliads in horticulture are easily distinguished from most of the other members of the family. The leaves are generally fewer in number (from 5 to 8 leaves) than in

most other bromeliads and are with but few exceptions in tubular form; they are generally banded with grey cross bars of lepidote scales. While *B. pyramidalis* and *B. horrida* have an erect inflorescence with a rather compact head of flowers, nearly all of the species have a pendant flower scape which is generally highly decorated with large brilliant bracts. The flowers are tubular with ends of petals curled back. The predominating colors of petals are purple, blue, yellow and green to white. The flowers are beautiful and defy description; the floral display, however, lasts only about two weeks. The bracts, from green to white and pink to red and maroon make up a greater part of the attractiveness of the inflorescence.

The fruits are ridged, berry-like and sweet to the taste. The fruits ripen more quickly than those of most bromeliads and in most cases are not especially decorative as in aechmeas, vriesias and many other genera.

Billbergias have been the fastest growing and easiest to propagate, so can be handled by the layman because of their unusual survival qualities. Such species as *Billbergia nutans* and *B. pyramidalis* are hardy and will stand considerable cold; they have enjoyed the neglect of many a Florida and California garden. While these two species are generally known as epiphytes I have found them both growing in their native habitat on rocks, or old stumps, and practically always if not on the ground, within a few feet above it. Thus they demand little attention when in cultivation. They propagate readily from seeds and the seedlings mature and flower in three years, with the exception, of course, of *B. zebrina*, *B. Meyer*i and *B. Portea*na.

AECHMEA

The genus *Aechmea* was named from "aechme," referring to points on the flower envelope. Of all the different genera in the bromeliad family, the aechmeas have the most varied plant forms and inflorescences. Most of the species are longer in color performance of flower and fruit and many of them put on a "show" for nearly a year. They range in size from one having a leaf spread of but a few inches to others which measure nine feet from tip to tip as in *Aechmea conifera*. This latter species has a flower head that rivals a giant pineapple. Some species may weigh but a few ounces while others will tip the scales at over a hundred pounds. Their flowering stems are generally branched and the flowers take the complete range of the spectrum for color. The bracts generally conspicuous, range in color from green to yellow and red.

The aechmeas, most of them at least, would be worthwhile decorative subjects even if they never produced their interesting spikes of flower and fruit. Their spiny edged leaves vary in form and color beyond description. The mottled leaves of *Aechmea Orlandiana* often show a color range from carbon black to pure white with splashes of red, green and purple. The flower head of orange bracts holds a cluster of yellow-white flowers and the fruit ripens to purple. *Aechmea phanerophlebia* (Plate 9) finds its habitat on ground, rocks or high on a tree limb. Its stiff leaves are edged with stout spines and it can take great punishment. It also thrives in full sun.

The aechmeas have served as a source of fiber, such as "pita" (*A. magdalena*) for centuries, as well as many forms of decorative plants in horticulture. They have a great range and are found growing natively from Mexico to Argentina, mostly epiphytic, but some are quite at home growing on the ground. Their leaves are spiny edged, generally stiff and smooth though often covered with peltate scales.

It is confusing for almost anyone to distinguish the difference between the following genera: *Nidularium*, *Neoregelia*, and *Canistrum*. About ten years ago Dr. Lyman B. Smith re-shuffled many of them. Some were listed under *Aregelia* and *Karatas* but these last two generic names have been thrown into synonymy, the botanical waste basket which is almost brim full with discarded names.

NEOREGELIA

The genus *Neoregelia* was named for Regel, Russian botanist. The neoregelias have their flowers in a compound head nestled in the center of a low spreading rosette of leaves, often banded, spotted or marbled, sometimes with red tips. The flowers generally blue or white barely emerge above the center water-filled "nest". Some species have large brilliant bracts that surround the flower head. The leaves, armed with spines, are generally stiff and covered with minute peltate scales.

The most commonly known *Neoregelia* is *N. spectabilis*, formerly called *Aregelia spectabilis*. The most popular name and one that will stick longer than any change in nomenclature is "Painted Fingernail Plant" because of its brilliantly painted leaf tips.

Neoregelia marmorata hybrid, a cross between *marmorata* and *spectabilis* is another one that has been known to horticulture for many years although the type species of *marmorata* seems to have disappeared. I brought this species back with me, however, from southern Brazil in 1939.

NIDULARIUM

The genus *Nidularium* was named from "nidus", referring to the nest form of leaves. The nidulariums have their flowers nestled in a similar position but the head is made up of several sections. Each section consists of a showy colorful bract holding possibly a dozen flowers ranging from red, white and blue. In most of the species the flowers do not open even though in full bloom. Their leaves are often colorful and may be striped or spotted. Most of them have smooth leaves and rather large spines though not stiff. A few species hold their flower heads six to twelve inches above the leaves.

CANISTRUM

The genus *Canistrum* was named from "kanos", a basket, referring to inflorescence in a basket of leaves. The canistrums, generally, much larger plants than the other two genera, have their compact flower heads on long stems that rise above the center although few species hold the



Aechmea phanerophlebia; Photo by Mulford B. Foster.

flowers deep in the nest. The flower heads are surrounded by a rim of colorful bracts that rise one to two inches above the flowers, which are mostly white. The leaves, covered with fine scales, are rather leathery in texture.

The fruits of all three of these genera are born and matured under water; they are smooth, globular or ovate shaped, holding many small seeds in a gelatin-like substance. A number of species of all three of these genera with similarly constructed plants have been known to horticulture for over fifty years and some of them were to be found in every bromeliad collection. In their native habitat most of them grow near the ground-level on trees, or rocks and the majority of them are native to Brazil.

CRYPTANTHUS

For quite a number of years the interesting genus *Cryptanthus*, has held the fancy of plant lovers and of late years some of the common species have been used in dish gardens. These weird, crinkly leaved rosettes with their colorful markings are quite distinct in form from all the other bromeliads. *Crypt* meaning hidden and *anthos* a flower, easily describes the nature of the genus. They all have white flowers which are found in the center of the plant barely emerging from the leaves. Nearly all of the species grow in low spreading rosettes, although *C. maritimus*, a new species, I found just a short distance from the ocean in Brazil, is a twelve-inch tall, narrow-leaved, grass-like plant. Most of the cryptanthi are rock and shade loving plants but *C. bahianus* is a terrestrial plant growing in the cactus desert regions and has thick, stiff succulent leaves.

The cryptanthi have two kinds of flowers, the center cluster is composed of male or staminate flowers and under the bracts surrounding the center cluster appear the perfect flowers with both pistil and stamens. The three sided fruits are rather large and fleshy, but have very few seeds and are quite hidden between the bases of the central leaves.

QUESNELIA

The genus *Quesnelia* was named for M. Quesnelonce, French Consul at Cayenne. The quesnelias which are found principally in Brazil are an interesting group. I have taken every known species in its native habitat and added one new one to the group. *Q. liboniana* which was called *Billbergia liboniana* until more recent years, does resemble a *Billbergia* in its tubular form with its drooping inflorescence. The coastal types, however, like *Q. arvensis*, *Q. quesneliana* and *Q. testudo* have much more distinctive character in their flower heads which emerge from a densely leaved plant. These three have similar inflorescences. One could easily imagine that their glorious pink flower heads made up of crinkly bracts which look like crepe paper from under which peep dark blue flowers, were some fantastic creation, but they live and thrive quite normally (with the aid of the pollinator, the humming-bird) on the seacoast. *Q. quesneliana* seems just about as happy on fiddler crab tide-water as the heavy white sand just a few feet from the ocean high tide limit.

INDIAS published in 1535. This is said to be the first illustration of a pineapple but Rumph remains the first botanist to describe it.

It has been stated that as early as 1549 the pineapple was in horticulture in India. Undoubtedly, the rapidly growing pineapple thrived in all tropical countries where it was taken from the old sailing vessels. In those days of year-long voyages, possibly no other tropical fruit could have been so easily transported; the span of life in a pineapple fruit, plus the months that the leafy top could survive long after the fruit was gone, would give it an advantage over about any fruit or plant.

J. G. Baker records that Lord Portland introduced the pineapple into England in 1690, but there is no record of fruit production until 1712 in the garden of Sir Mathew Decker in Richmond.

It is possible that Linnaeus, the Swedish botanist and father of modern botanical nomenclature, was the first one to have any wide recognition of his bromeliad botanical publications as written in the SPECIES PLANTARUM in the year 1753 twelve years after the work of Rumph. The two genera (fourteen species) which Linnaeus recognized, *Bromelia* and *Tillandsia*, were both given by him to honor Swedish botanists, but these genera have now been divided into several other genera, including *Ananas* which he had called *Bromelia*.

Significantly, Linnaeus' publication of his description of bromeliads was preceded some twenty years by the Mark Catesby colored plate of *Viscum cariophylloides augustifolium*¹ in his magnificent work THE NATURAL HISTORY OF THE CAROLINAS, FLORIDA AND THE BAHAMAS (1730). Catesby's illustration is reproduced in Plate 10. This great book with charming hand colored plates of birds, frogs, snakes and plants of the southeastern United States probably contains the first account of an epiphytic bromeliad, and that from Florida, which is now called *Tillandsia fasciculata*. In his quaint description of this "Viscum" Catesby mentions the similarity in plant form of this *Tillandsia* to that of the *Ananas*, pineapple, a very astute observation; quoting him, "from the root grow many concave Leaves, folded in a manner like those of the *Ananas*."

The name *Ananas*, thus was known and used years before Linnaeus disregarded it, and because, man is first more interested in what feeds his stomach rather than his soul, it was many years before the decorative "stove" or house plants caught the fancy of the horticulturist.

We can only partially trace the fluctuating attention which bromeliads have received in horticultural circles during the past hundred years. The rise and decline of this interest makes a zigzag graph.

Since the first botanists and collectors who became horticulturally interested in this family were Europeans, principally German, French, Swedish, Belgian, and English, bromeliads as living plants were introduced into their countries first. For the most part they became new and amazing additions to the principal botanical gardens such as Liège.

¹ The word *Viscum* prefixed Catesby's description of all plants which adhered to trees including orchids, bromeliads, ferns, mistletoe, etc.



Tillandsia fasciculata

Reproduction of the first drawing of a Florida bromeliad by Mark Catesby, and published in 1730 as *Viscum caryophylloides angustifolium* in "The Natural History of Carolina, Florida and the Bahamas." It is now known as **Tillandsia fasciculata**.

Kew, Paris, St. Petersburg and Berlin and only gradually entered private collections.

And although concentrated effort at collecting them started early in the 19th century (Spix and Martius 1817-1820 expedition) they really did not have notable popularity until some fifty years later when André and Morren went wild over them. True, Glaziou, distinguished botanist and landscape artist, in the thirteen years he spent in Brazil from 1858, had a special penchant for BROMELIACEAE and has the distinction of having found some sixty-five new species of his favorite family, but bromeliads were not in the ascendancy until the 1870's. During the early years of the 19th century, although bromeliads were around, there was a woeful lack of widespread interest in them.

If the number of entries in current magazines of that day are any barometer as to their popularity, we find the temperature very low. GARDNERS' CHRONICLE of England which started in 1841 contained a few brief notices of bromeliads in the first twenty-five to thirty years; we are thinking mainly of the decorative, epiphytic, easily cultivated bromeliads. *Ananas* or pineapple was frequently given attention, throughout many early years, proving that a satisfied palate has priority over decorative beauty. Then a rise in the decorative bromeliad barometer took place as indicated by the notices in the GARDNERS' CHRONICLE of the years, roughly between 1870 and 1900. Much enthusiasm gained momentum in England during these years, indicated also in THE GARDEN and PAXTON'S BOTANICAL MAGAZINE, culminated, perhaps by Baker's HANDBOOK OF THE BROMELIACEAE published in 1889. To this day this small volume remains the only text of its kind in English.

Even in the later part of the 19th century when there was a decided rise in attention to bromeliads, especially on the Continent, these laments are recorded in THE GARDEN of December 17, 1892, when speaking of *Tillandsia Lindenii*, "It is difficult to understand the unpopularity of bromeliaceous plants in this country [England] when one sees this *Tillandsia* . . ." etc.

On February 18, 1888 this appeared as an editorial:

"It has long been a source of regret to me that the taste for these plants has so much declined of late years amongst lovers of plants in England. And this is all the more impressed upon my mind whenever I visit any Continental garden, especially those in Belgium where large collections of these plants are to be found and where they are much prized. I am glad to record, however, that here in this country I find places where their cultivation is being taken up. W.H.G."

Evidently editor W. H. G. was quite taken with the unique beauty of bromeliads and couldn't tolerate the indifference of the majority of plant fanciers. Yet, *Tillandsia Lindenii* in the year 1870 had been given a first class certificate by the Royal Horticultural Society.

From THE GARDEN again, for March 24, 1888, when speaking of *Vriesia brachystachys* one of the editors said, "Pretty though many of its class are by no means popular, and it is quite the exception to find them represented in gardens. In the case of some, the leaves alone en-

title them to a high place among ornamental foliage plants. Though so neglected in this country, many of the bromeliads are very popular on the Continent."

Here and there bromeliad seed or plant importation notices in the various horticultural journals give the historical touch that make plant lovers across the years reach out and shake hands.

A Mr. Rogers says, "I received this plant from Mr. Parkinson of Mexico in 1838 . . . *Tillandsia rubida* imported from Brazil by Messrs. Loddiges . . . introduced to the Gardens of Plants at Paris by M. Eugene Melinon who got it in Cayenne, [French Guiana] . . . indebted to C. B. Warner, native of Rio, for *Vriesia psittacina* . . . imported from Rio in 1841 by Lt. C. Smith, presented to Sir Charles Lemon, the *Pitcairnia micrantha*."

In Edinborough someone acquired seeds from Trinidad of *Billbergia nudicaulis* (now in the genus *Aechmea*) but promptly mistreated it by suspending it on wires where, in spite of its mistreatment it did thrive for sometime. This is one of the few aechmeas that could have stood an unsuitable substitute for a tree trunk.

THE BOTANICAL CABINET and the BOTANICAL REGISTER (Lindley, editor), the GARDEN AND FOREST and the JOURNAL OF HORTICULTURE and the BOTANICAL MAGAZINE (Sir W. Hooker, editor) all gave the bromeliads space now and then, but the bromeliad "temperature" in England was not high.

The warmest enthusiasm which predominated in the later 19th century was in France and Belgium where bromeliads were championed long and loudly by André and Morren. For twenty years each of these men concentrated every effort and enthusiasm toward the bromeliads. Morren published descriptions constantly in LA BELGIQUE HORTICOLE and he contributed 250 of his own water-color drawings in this family mainly between 1865 and 1885. These magnificent plates now repose at Kew Gardens in London. In the preface to Baker's HANDBOOK he says that at that time "Prof. Edouard Morren of Liège was universally and deservedly regarded for the twenty years previous to his death, in 1885, as the highest authority on the plants of this order."

Edouard André, like Glazicu was a landscape architect, and he became so infatuated with the family that he made the difficult and tedious exploration to Colombia (then known as New Granada), South America, where he collected mainly bromeliads. When we consider the long ocean journey, the poor equipment and the hazards of much wilder country than now exists, we bow with respect to what André accomplished in gathering his more than eighty new species of bromeliads. And his monumental work in his BROMELIACEAE ANDREANAE along with the description of the trip in his LE TOUR DE MONDE (described by L. B. Smith in this issue) cannot be underestimated in the advancing enlightenment of bromeliads.

During the late years of the 19th century other notable collectors such as Kalbrayer, Zahn, Wallis, Bruchmueller, Roezl, Werkelé, Blanchet, Ule, Wawra, St. Hilaire, Broadway and Weberbauer, all contributed their share to this amazing Pineapple Family; the collectors were auto-

matically mentioned in the current horticultural publications and thereby linked with the editors who championed bromeliads such as Gressen (LE JARDIN) Duval and André of France, Linden and Morren of Belgium, Sir W. Hooker of England, Regel of St. Petersburg and Wittmack of Germany.

The nurserymen such as Bull and Veitch in England, Jacob-Makoy in Belgium, Binot, Chantrier and Duval in France, Booth and Verschaffelt in Germany, play an equally important role in putting bromeliads "on the map." Libon and Saunders are not to be forgotten among those who by their tender care brought many a sad looking collected plant into recovery and fruition, or nursed frail seeds through babyhood to maturity.

Many collectors sent home live bromeliads, always some few of which survived. Epiphytic bromeliads did not hold up too well on the long journeys out of the jungle tightly packed, either too wet or too dry during the long journey by mule and then by boat. Terrestrial, hardier, dry land types came through with greater percentage.

In the United States practically all of the bromeliad importations came in before August 20, 1912 when the Plant Quarantine law was passed. From that time on it has been very difficult to import bromeliads alive as the U. S. Department of Agriculture has not yet perfected a method of fumigation which does not affect bromeliads seriously. Terrestrial forms seem to stand the fumigation with very little fatality and the xerophytic epiphytes such as tillandsias and aechmeas come next in endurance of fumigation. But the vriesias and guzmanias, most of those with tender leaves, seem to be unable to "take it."

Orchids have been imported in such quantities that the government has made the effort to protect them from death in fumigation, but the little known bromeliad has received very little attention, hence the great loss at Quarantine.

However, by personally packing and accompanying our many plants from our two expeditions in Brazil we were able to successfully bring through many plants, although the loss by fumigation was most pathetic. These importations have constituted practically the only new introductions of bromeliads into American horticulture since the 1912 Quarantine.

With the advent of the 20th century and rumblings of war on the horizon in Europe, during the first twenty years of the century it is difficult to trace the progress of bromeliads and their boosters. Indications in the REVUE HORTICOLE show that interest in France early in the century took on a low "temperature," possibly due to the passing of André. In England, the Kew Gardens 1915 HANDLIST had approximately 260 species and hybrids in thirty-one genera, a very notable collection. We have been anxious to obtain data on the extent of the collections in Berlin, Liège, St. Petersburg and Paris during these years, but have not been able to track down just what they had. Attention to bromeliads in the early 20th century in Europe was mostly scientific as indicated by the outstanding treatment of bromeliads as a whole by Harms and by the stupendous work of Mez's monograph.

Recently we have acquired a price list which was issued by Albert Schenkel in Hamburg, Germany with the dates 1936, '39, '40. Some seventy-three species in fifteen genera are listed, indicating that there was still horticultural interest in bromeliads up to the time of the World War II. We are looking forward to the time when we can go to Europe for a thorough investigation into the horticultural history of the bromeliads.

What about bromeliads in horticulture in America during the 19th century? They were very scarce in the "new" country; people were busy pushing out frontiers, the climate was cold, Florida and California were too young to have any hothouse plants so "refined" as the curious bromeliads of horticulture, although Florida has over a dozen species of the family growing natively.

Undoubtedly, here and there, in some of the finer private collections where lovely conservatories were fashionable, bromeliads from European importation found a resting spot. Mr. Burke of Latham Park, Pennsylvania, and the city of Philadelphia in Fairmount Park, we know had them thirty-six years ago. The Buffalo Botanical Garden made exchanges with Henry Nerhling, and undoubtedly in these early days the New York, Missouri and Brooklyn Botanical Gardens all had the beginnings of their bromeliad collections.

Very much to our surprise in an old catalogue of Pitcher and Manda, of Short Hills, New Jersey, having a probable date of about 1893 we find over a page of their catalogue devoted to seventy-six species in some sixteen genera of our favorite family. Of course, many of these names have now gone into synonymy, yet the number of different bromeliads is quite imposing for this period of time.

Julius Roehrs was one of the early bromel boosters and grew quite a stock of them but what his early collection was we do not know. The Julius Roehrs Company's 1940 and 1943 price list has nine genera with roughly 33 species and varieties.

In California, plantsmen found bromeliads curious and worth a try. In the early days of the 20th century W. I. Beecroft of Escondido, did considerable importing of bromeliads and received, as he says, plants such as *Billbergia Lietzii* and *Vriesia splendens* from L. R. Russell of Richmond, England. Some plants came from Haage & Schmidt in Erfurt, Germany as well as some from Jules Chancier of Paris, among which were *Billbergia zebrina*, *B. Moreliana*, (now *B. vittata*) *B. Saundersii*, *B. Leitzii* and *Aechmea fasciata*. Theodore Mead of Oviedo, Florida sent Beecroft his own hybrid of *Billbergia nutans* crossed with *Cryptanthus Beuckerii* and Beecroft introduced it into California.

Charles Cass of San Diego was also one of the early champions of bromeliads, having at one time, fifteen species in *Billbergia* and eight in *Aechmea*, fifteen in *Tillandsia* and a scattered few in eight other genera.

David Barry, outstanding bromeliad enthusiast of Los Angeles, started early in the 1930's in the assembling of bromeliads until it has grown to be the largest private collection in California having twenty-four genera with some 200 species.

In the 1930's the late Richard Atkinson of Leucadia, bought a good many bromeliads from Cass and M. B. Foster and made many exchanges over the country; he started a rather large project, but a few years later in about 1943 sold most of his collection to Evans and Reeves of Los Angeles who list some twenty-one species in *Tillandsia*, fifteen in *Aechmea*, two in *Quesnelia* and twenty-two in *Billbergia* (some of which are synonymous) in their collection (1942), but list for sale in 1943 a much smaller collection.

The catalogue of the Knickerbacker Nursery in San Diego (Neff Bakkers) has had listings of a few bromeliads since 1935.

Mr. Edwin O. Orpet at Santa Barbara has long held a fondness for the bromeliads and has had a number of species and seedlings. Long remembered will be the dazzling *Puya alpestris* which flowered in his garden in 1932.

Mr. J. N. Giridlian of Oakhurst Gardens at Arcadia, lists a number of bromeliads in his recent catalogues principally four genera comprising twenty-one species.

Mr. Cecil Houdyshel, of La Verne, Calif., lists billbergias.

In Florida in the early 20th century bromeliads had but few boosters, but the names of C. T. Simpson, Reasoner's Royal Palm Nurseries, Oneco, Henry Nerhling, Mr. Codwise and Theodore L. Mead will always be remembered as having had considerable interest in bromeliads.

In these earliest days Henry Nerhling was the real champion and enthusiast. His correspondence with numerous collectors and nurserymen of Europe and with Theodore L. Mead of Oviedo, was endless zealous praise for the ravishing bromeliads. His notes as published in the *American Eagle* in the early 1920's, and more recently in 1940's, reprinted and published in book form, are perhaps the most eloquent and most ardent words written in English in praise of bromeliads. It more nearly parallels the praise of the Europeans.

Mr. Nerhling's interests were more intense and varied than possibly any other one plantsman in Florida. He was over zealous in his indomitable search for plants that might adorn our Florida gardens. Of all the different plant families represented in his collection he did the most work with *Caladium*, and while Mr. Nerhling was hybridizing and working arduously with *Caladium*, Mr. Mead was taking on bromeliads and *Amaryllis* which had been the favorites of Mr. Nerhling. Each, became better known through their work in these shifted hobbies.

By this time Mead had almost given up the work he started with orchids, and although he always kept a few in his collection the bromeliads almost pushed orchids off the benches in his greenhouse and from the branches of the trees in his garden.

From 1905 up until 1923 all of Mead's plant records dealt almost exclusively with orchids. Then he apparently made his first trade of a bromeliad with Mr. Nerhling. From then on he started his first hybridization of bromeliads, and from 1926 on, almost all of his hybridizing was done in this family up until April 1936 shortly before his death. During that ten years he hybridized everything within the family re-

gardless of the nearness of the genera. During that time he had living plants of sixteen genera.

So far as we can determine there was absolutely no system nor method in mind for he would just as soon cross such distantly related bromeliads as the pineapple with Spanish Moss, or *Dyckia* with a *Billbergia*, as he would have any two species within the same genus. Cross pollinating flowers was an obsession with him.

He did finally get two bi-generic crosses, *Billbergia nutans* X *Cryptanthus Beuckerii* and *B. nutans* X *C. bahianus*. Apparently the only cross outside of the billbergias that materialized was *Neoregelia spectabilis* (then called *Aregelia*) crossed with *Neoregelia marmorata* (then called *Nidularium*).

Mr. Mead did originate some amusing names of his hybrids on *Billbergia nutans*: *nusau* (*nutans* with *saundersii*), *nuspec* (*nutans* with *speciosa*), *nuze* (*nutans* with *zebrina*) *nuleo* (*nutans* with *leopoldi*) *nuvit* (*nutans* with *vittata*).

So far as we can learn there was not one resultant hybrid that he attempted with the aechmeas, tillandsias, vriesias etc. In the billbergias he made about all the combinations that could be made by using principally *Billbergia nutans* and *B. pyramidalis* as the maternal parents. However, practically everyone of these *Billbergia* hybrids had been previously made in Europe and most of them are listed in the Kew Botanical Garden Handlist of 1915.

Long to be remembered is the day Mr. Mead saw *Bromelia serra* blooming in our garden at Orlando; he was immensely thrilled, like a child, and made a return trip to procure the fully opened flower for the pollen.

Both the Nehrling and Mead collections finally disappeared but now a very interesting growth of neoregelias is planted under the old oaks of Mr. Nehrling's former home at Gotha. Julian Nally, the present owner, is a bromeliad enthusiast and has quite a number of species in his collection. It seems right that they should be growing on that estate.

The Foster interest in bromeliads began in 1928 when by exchange a plant of *Aechmea miniata discolor* was acquired. In 1931 and 1932 first exchanges of plants were made with Mr. Mead. Seeing his collection spurred on the interest considerably and whenever possible members were added to the collection. Then the Mexican trips of 1935, 1936 and 1937 brought the bromeliad temperature up considerably. In 1938 our trip to Cuba and a personal contact with Dr. Lyman B. Smith of the Gray Herbarium increased our interest in bromels beyond that of just plant lovers.

In 1939 and 1940 on our Brazilian trips of six months each the bromeliads won first place in our hearts and our garden. From these two trips we brought back hundreds of collected plants. So far Dr. Smith has published some sixty-five of them as new species and varieties and there are quite a number yet to be published.

Our living collection now has over 400 species and hybrids representing thirty-five of the fifty known genera (Plate 11); the Foster price



Plate 11

Bromeliads in the Foster greenhouse at Orlando, Florida

list of 1942 offered fifty-seven in twelve genera while the 1945 price list offered seventy-five species in seventeen genera.

Before this writing is published we will have flown to South America, this time to Colombia, collecting in the footsteps of André, seeking bromeliads in the Andes.

Other recent American collectors such as Stanley, Steyermark, Schultes, Killip, Lundell, Woodson, Hitchcock, Pennell and others of the United States, while Castellanos, Hoehne, Cuatrecasas, Looser, Osten, Cardenas, Vargas of South America have added innumerable new species of bromeliads and have added much knowledge concerning the family.

In 1942 we started writing about bromeliads and now cannot seem to find any stopping point. T. H. Everett of the N. Y. Botanical Garden writing his Plant Portraits in the GARDENER'S CHRONICLE of America described several of the bromeliads in the last two years; Lad Cutak in September 1945 MISSOURI BOTANICAL GARDEN BULLETIN, handled the subject very well in a comprehensive survey of the family; Montague Free took it up in the April 1946 HOME GARDEN.

No horticultural survey is complete without a glimpse of the botanists who through their untiring efforts plow through a maze of dried specimens and countless records in order to trace and place plants in their taxonomic relationship and order. At best it is a thankless job.

The botanical work of Mez, Harms (German) and Baker (English) has been mentioned before, the work of Beer (German), Lindman, Wittrock and Regnel (Swedish) can be added. And not to be overlooked is the botanical paper on the genera *Ananas* and *Pseudananas* by Felisberto C. Camargo, a Brazilian botanist.

But the recent contributions to BROMELIACEAE are largely from the American botanist, Dr. Lyman B. Smith whose work has brought about many important revisions in this family and who is now recognized as the world's outstanding authority in this group.

After years of bromeliad interest abroad, botanically and horticulturally, it is fitting that the concentration of both botanical and horticultural interest now becomes centered in the Western Hemisphere, native land of the bromeliads.

BROMELIADS IN SOUTHERN CALIFORNIA

DAVID BARRY, JR.

Mark Twain has been quoted as saying that although the banana will live in California, it does not like to. With the exception of the xerophytic types, he could have said the same about bromeliads. Consider that no bromeliad is native to California and that none could be persuaded to live without the aid of man, with the possible exception of some of the terrestrial species. Most of Southern California is of semi-desert characteristics as far as climate is concerned, with low humidity and a moderate rainfall restricted to part of the year. Without the grower providing humidity by artificial means epiphytic bromeliads can not survive. Even Spanish moss, the ubiquitous bromeliad of so many Southern States, will soon dry to wisps, even when placed in apparently amenable situations near the coast.

As such a wealth of plant material of engaging interest can be made to thrive in the open and without elaborate preparation, lath or glass houses are not resorted to by the average plant enthusiast. In view of the artificially created conditions being required, the culture of epiphytic bromeliads has been rare until very recent years.

An exception must be made to this generalization in the case of *Billbergia nutans*. For years this plant has been stocked by most nurseries. It is fairly common in California gardens, being given the careless attention accorded the geranium. Sometimes it is called the "Friendship Plant," supposedly to be given only by one friend to another, a pretty fantasy for one of the less spectacular members of the great bromeliad family, promising well for its popularity when bromeliads are better known.

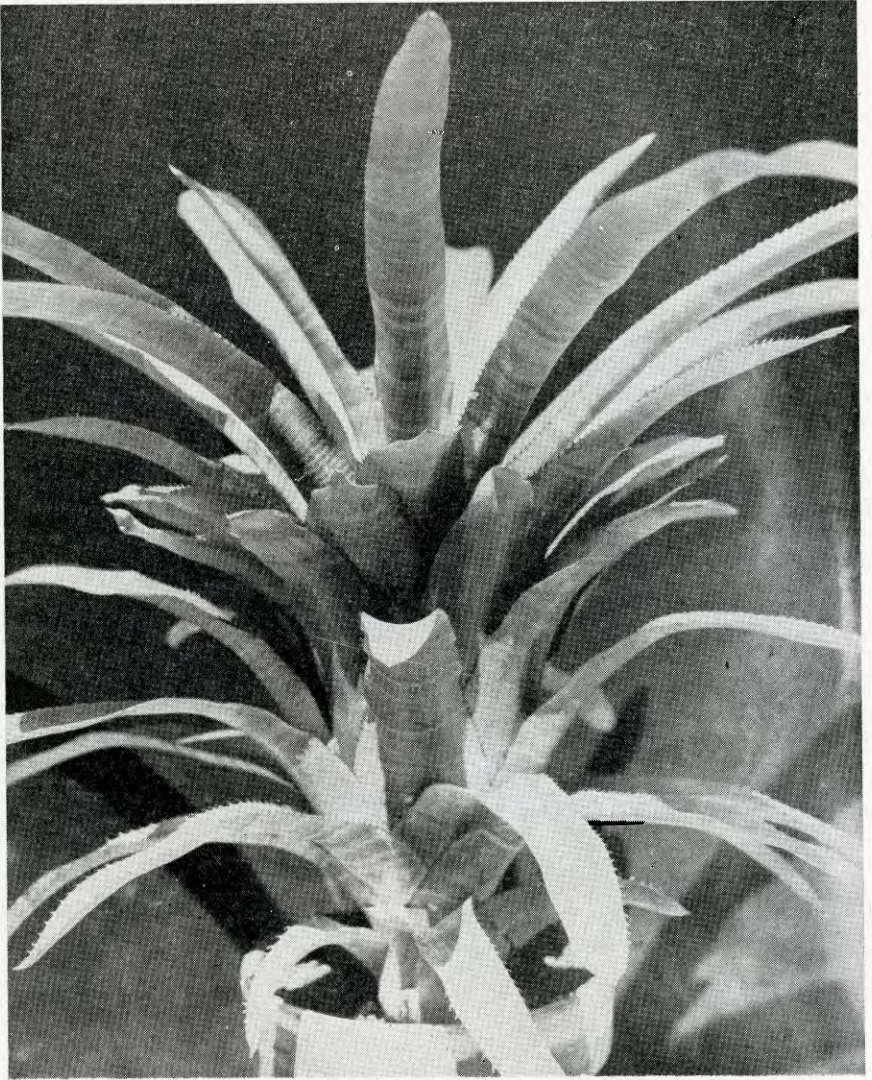
Within recent years the principal bromeliad grower and collector, in Southern California, was the late Richard G. Atkinson. At Leucadia, a small-community on the coast about one hundred miles south of Los Angeles, Atkinson brought together about two hundred species and numerous varieties and hybrids. Most of the plants were grown under glass in an unheated house. Humidity was supplied by frequent sprinkling of the benches and walks. Many species were grown in great quantity from seed. His cultural methods induced rapid growth, such as thirty months from seed to flower in some of the *Billbergia* hybrids. Sufficient plants were propagated for broad commercial distribution. The collection was acquired and offered at retail by one of the larger Los Angeles nurseries, Evans and Reeves. This distribution has been the most important single factor in the recent popularization of this plant family in California, bringing to growers acquaintance with *Nidularium fulgens* (Fig. 6) *Aechmea Weilbachii*, *caudata*, *miniata*, *fasciata*, *fulgens*, *pectinata* (Fig. 6) and *bracteata*; *Billbergia pyramidalis*, *amoena*, *Euphemiae*, *Quesnelia arvensis* (Plate 12), many *Billbergia* hybrids, *Neoregelia* species and hybrids, and many others. A *Nidularium* hybrid is shown in Plate 13.

Atkinson's passing was a loss to California horticulture. He was a great enthusiast, a perfectionist, and a capable grower. With unusual patience he took many remarkably fine kodachrome pictures of these plants at the height of inflorescence. The collection of these pictures, mounted as slides, was posthumously presented to Dr. Lyman B. Smith of the Gray Herbarium.



Fig. 6. *Aechmea pectinata*, height 23 inches, width 40 inches, and *Nidularium fulgens*, height 8 inches, width 15 inches (inset at left). Photo by Ladislaus Cutak of plants in the collection of Mrs. Emmeline Carpentier, Santa Barbara, Calif.

Among those who acquired a collection of the Atkinson epiphytic bromeliads from Evans and Reeves was Mrs. Emmeline Carpentier of Hope Ranch Park, adjoining the City of Santa Barbara on the north. On a rolling mesa, not far from the Pacific, and under glass Mrs. Carpentier has grown quantities of these plants to an astonishing perfection. In fact, the condition of these plants is so superb that Mrs.



Quesnalia arvensis

This specimen has 57 leaves; height 20 inches; width 30 inches. Photo by Ladislaus Cutak of plant in the collection of Mrs. Emmeline Carpentier, Santa Barbara, California.

Carpentier should be given the title of "Peer of American Bromeliad Growers," and the interesting question presents itself if these plants are not superior in size and inflorescence to the plants in their respective native habitats, where presumably optimum conditions obtain.

Epiphytic bromeliads in California are grown under glass, or, in Southern California under lath-house conditions near the coast. Proximity to the Pacific brings relatively a freedom from killing frosts. With the large body of air over the ocean not going to extremes of temperature, the adjacent air above the coastal plain shares in the moderating effect of the ocean. As to frosts, the heavy freeze of 1937 has not since been repeated. The ability of epiphytic bromeliads to withstand heavy frosts has not been thoroughly tested. Perhaps the wider growing of the plants which has taken place since 1937 will afford the opportunity.

The generally recommended method of planting bromeliads is to use fibrous peat, either osmunda, or, if orchids are grown also, to use the broken down osmunda discarded when they are reotted in fresh osmunda.

In California, the usual method is to plant bromeliads in a compost mixture. The generalization can be made, at least of Southern California soils, that they are neutral or alkaline. Bromeliads like a soil on the acid side. The water from most of the municipal water systems is like the soil, either neutral or alkaline. Thus, watering plants in osmunda will not bring a desirable acid condition to the material, even though the osmunda may initially test as being neutral or slightly acid. A properly prepared potting mixture will furnish not only a desirable degree of acidity, but food value as well.

The Metropolitan Water District of Southern California distributes free a leaflet entitled "SUGGESTIONS FOR GROWING ACID-LOVING PLANTS WITH COLORADO RIVER AQUEDUCT WATER." Although written primarily for growers of begonias, camellias, gardenias and azaleas, many of the problems and recommended solutions should be valuable to growers of bromeliads. In the main, reliability is placed on using peat moss or leaf mold to produce acidity from pH 5 to 6 for a considerable time with alkaline water. Most bromeliad growers follow in general the same plan. For example, the potting mixture used by Richard G. Atkinson, measured carefully, is 4 parts of light loam soil, 3 parts of well-decomposed leaf mold, 2 parts manure, and 1 part each of sharp sand and of peat.

The mixture used by Mrs. Emmeline Carpentier contains no loam soil. The leaf mold is decomposed to a soil condition. Well decomposed manure is added, with sharp sand, rice charcoal and Humenal. The last item is a kind of peat prepared in Germany and impregnated with chemicals of high food value, probably with a chemical such as sulphate of ammonia. Her bromeliads are watered with rain water collected in a cistern from the roof of the greenhouse. Sprinkling the house to maintain humidity is done two or three times daily in average weather with water from the local mains. No artificial heat is used in the glass house. An unusual amount of ventilation is provided. There are no

vents at the ridge. Small side vents near the ground are nearly always open. At each end of the house near the top is an exhaust fan, about thirty inches in diameter, which operates whenever the temperature in the house rises above 78 degrees F. One obvious advantage of watering and syringing the plants with rain water is the freedom from the grey spots usually evident on the dark leaves of bromeliads when regularly available water is used. The minerals dissolved in the water in minute quantities show grey where the drops have dried.

Where rapid propagation is desired, potting the plants lower in the soil than they would be found growing naturally will stimulate eyes to produce off-shoots which otherwise may remain dormant, or never develop. Reference is made to the illustration of *Aechmea Weilbachii* with six off-shoots before the parent plant has flowered (Fig. 7). As a rule, off-shoots are produced after inflorescence.



Fig. 7. *Aechmea Weilbachii* planted deeply to stimulate production of off-shoots. Note the six off-shoots. Photo by Ladislaus Cutak of plant in the collection of Mrs. Emmeline Carpentier, Santa Barbara, Calif.

Tillandsias should be more widely grown in California. Their ornamental value is not well recognized. Many species do not hold water in their leaf rosettes, such as *Tillandsia bulbosa*, *Andreuxii*, *dianthoidea*, and *felifera*. Such kinds of tillandsias should be able to



Nidularium hybrid

The author, David Barry, Jr. is shown with this specimen for purpose of giving comparison as to size. Photo by Ladislaus Cutak of plant in the collection of Mrs. Emmeline Carpentier, Santa Barbara, Calif

endure more frost than the softer-leaved species which collect and hold water. Much interest is added to plant groups by their bizarre forms and habit of profusely "blushing" during flowering. So many orchid growers persist in cultivating orchids only. If a few tillandsias should be placed in hanging baskets, or rafts, their houses would take on an added interest and the lack of variety would be agreeably relieved.

Dr. T. H. Goodspeed of the Department of Botany, University of California, distributed seeds of terrestrial bromeliads collected in his Botanical Garden Expeditions to the Andes taken in the late 1930's. The cultivation of the plants grown from these seeds centers in the Henry E. Huntington Botanical Garden at San Marino. There the plants are perfectly at home, making suitable additions to the extensive cactus collection. Huge groups of puyas and pitcairnias are on display. These plants belong in large gardens. A single plant with its off-shoots and sharp spines soon becomes an object too formidable for the yard. In spite of their more tropical origins than that of many of the puyas, bromelias thrive in the open in the Southern California coastal belt. When bromelias are better known many gardeners will condone their spiny nature in order to be able to enjoy their spectacular inflorescences.

The tremendously increased interest throughout the United States in the cultivation of orchids, which has taken place within the last three or four years should be reflected in a greater interest in their companion epiphytes, the bromeliads. Living naturally together in the Americas, they should be grown together in greenhouses. Most orchid collections are unattractive as to form yet attractive as to flower; bromeliads are attractive as to form and often of great floral beauty. The two plant families can be used as a supplement to one another to bring about a definite horticultural advantage.

BROMELIADS AT THE MISSOURI BOTANICAL GARDEN

LADISLAUS CUTAK
Missouri Botanical Garden

The Missouri Botanical Garden always did possess a rather fine collection of BROMELIACEAE. When checking back on the old accession lists one will immediately see that bromels occupied a prominent position on the Garden's exotic menu. A good many of the specimens were raised from seed but living plants were also acquired from various American and European institutions, commercial concerns and private fanciers. In the early days a representative collection was maintained on exhibition but it is only in the last four years that a greatly enlarged program for acquiring and studying these plants has been established.

Bromels have enjoyed a certain amount of popularity from the very beginning but very little literature has materialized from the fad. In fact, about the only material available are the so-called monographs written in more or less technical language and accessible to a chosen few. Lack of popular literature on the subject has relegated bromels into near-oblivion as far as the general garden-minded public is concerned. This condition need not be because bromeliads are a group of plants with fascinating possibilities and deserve a place in horticulture along with cacti, succulents, orchids and other exotic flora. The Missouri Botanical Garden is destined to play an important role in developing an intense interest in these plants.

Pitcairnia latifolia seems to be the oldest recorded bromel in the Garden's collection. No one now living knows when the original stock was acquired but in 1895 it was already listed on the books with this notation, 'propagation from an old plant in the Garden, source unknown.' It may be of interest to mention that in the early days propagations from plants were made annually or as the case would warrant and each new propagation received a new accession number. This practice now has been discontinued and all propagations retain the original accession number given it when the plant was first registered. The odd *Acanthostachys strobilacea* was raised from seed 48 years ago and several others date back to the close of the last century. Bromeliaceous plants, as a rule, do not attain great age; individual rosettes usually die off after flowering but new shoots are developed from the old rootstock to insure perpetuation of the species.

Although most of the bromels at the Garden are grown in pots, a great number of them are placed in beds of the Palm House and Cactus House or are grown on the trunks of trees where they seem to thrive under simulating conditions of their natural habitats. It is surprising what remarkable growths some of the species make when grown in the ground. *Aechmea bracteata*, for instance, produces a vase of tightly clasping leaves, 2 or 3 feet high, when grown in a pot but when set out

in the ground assumes another character. The tightly clasping leaves elongate and spread out in loose rosette fashion, the strapshaped leaves often attaining a length of 7 or 8 feet. *Aechmea distichantha* also produces an elongated oval receptacle in a pot but when planted out becomes a mass of spreading leaves. Some of the neoregelias and nidulariums, although of epiphytic tendency, do equally as well as terrestrials. The ornamental-leaved forms like *Neoregelia marmorata*, if grown in shade, will completely lose its vivid blotches and become entirely green.

Last winter the Cactus House was renovated, or at least a start towards that end was begun. South African euphorbias, which played a prominent role in that room for many years, were removed and in their place the beds were prepared to welcome bromeliads of the desert type (Plate 14). The kind that grow in desert regions mostly belong to such genera as *Dyckia*, *Encholirium*, *Bromelia*, *Ananas*, *Pseudananas*, *Hechtia*, *Puya* and *Pitcairnia*, although all species necessarily are not xerophilous in the strict sense of the word. Desert bromels seem to be the least represented in collections, not because they are not attractive but because up to the present they were not available to collectors. The best known of the desert bromels are the dyckias, yet surprisingly only 3 or 4 species are commonly cultivated and only two or three are frequently found in catalogs, these being *Dyckia sulphurea*, *D. rariflora*, *D. altissima* or *D. remotiflora*, although more than 70 are known to exist in nature. Most of them, or more than half the number, are native to Brazil while the remaining are scattered through Paraguay, Argentina, Bolivia and Uruguay. Members of this group look like small century plants and require about the same care. *Dyckia sulphurea* and *D. rariflora* make excellent pot plants and usually fill a container with their rigid rosettes in quick time. Because of their suckering habit, dyckias become fast propagators or will make solid masses in beds if allowed to continue for years in the greenhouse and in the open in warmer climes. A good many of the species remain small but soon become quite large. *Dyckia rariflora* is one of the small kinds with dark green, rigid leaves and with a short flower-stock bearing orange colored blossoms. The plant was first discovered in 1830 and became an instant favorite. In our collection we have the following species:

<i>Dyckia altissima</i>	<i>Dyckia leptostachya</i>	<i>Dyckia rariflora</i>
<i>Dyckia brevifolia</i>	<i>Dyckia maritima</i>	<i>Dyckia remotiflora</i>
<i>Dyckia encholirioides</i>	<i>Dyckia microcalyx</i>	<i>Dyckia remotiflora</i>
<i>Dyckia floribunda</i>	<i>Dyckia Niederleinii</i>	var. <i>montevidentensis</i>
		<i>Dyckia sulphurea</i>

The next best xerophytic group is *Puya* and there are about 90 species in existence. They prefer steep stony slopes of the Andes Mountains; the greatest number of species occurring in Peru and Bolivia. Many of these become exceedingly large for pot culture but are frequently grown in California gardens where they thrive exceedingly well. The best collection of puyas will be found at the Huntington Botanical Garden in San Marino where they often cover large areas and become a wonderful sight during the flowering season. Because a good many



Xerophytic bromels growing in the Cactus House at the Missouri Botanical Garden; *Bromelia serra* in bloom. Photo by Ladislaus Cutak.

grow at high altitudes they will stand considerable cold weather and even frost, but there are doubts whether any would withstand the winters in the Midwest. One of the superb species is *Puya alpestris*, a Chilean endemic, with a short trunk that bears an immense rigid tuft of spreading and recurved leaves. Its flower-stalk is more than 3 ft. high and bears a pyramidal panicle of blue flowers. Apparently there are two forms of *P. alpestris*, one being a dwarf variety. Seedling plants are excellent when planted in novelty containers. Another well known member is *P. chilensis*. It also develops a good-sized trunk and when in flower becomes a most striking attraction. The thick flower-stalk, more than 4 ft. high, shoots up from the center of the leaf rosette and bears a spike of large deep greenish or sulphur yellow flowers. One of the most massive of all bromels is *Puya Raimondii*, native to the Peruvian Cordilleras, whose trunks are often used for roof timbers by the highland Indians. There is still another huge monarch, *P. gigas* of Colombia, which sends up flowering spikes 20 to 30 feet into the air from rosettes of hard and thick, prickly-toothed leaves. A smaller stemless species is *P. spathacea* from Argentina. It is the first *Puya* to bloom in our collection and an interesting one with large dull and blue flowers. *P. dasylirioides* is the only North American representative of the genus and is found in Costa Rica. The garden does not possess an outstanding collection of puyas as yet but one must take into consideration that no attempt had been made to secure species of this genus until a few years ago. Even at that I doubt whether more than a dozen species are in cultivation. Then, too, puyas require lots of room for development and for this reason are not generally grown in greenhouse collections of botanical institutions.

The genus *Pitcairnia* is not necessarily xerophytic but is treated that way at the Garden and its members seem not to mind the desert conditions given them. Nearly 200 species are recorded but only 50 or so make their home in Central America, the rest being South American or West Indian. As a rule, all are terrestrial but occasionally a few will be found epiphytic growing in crotches of trees. The most distinct and decorative is *P. corallina* of Colombia, which resembles the amaryllidaceous weevil plant (*Curculigo recurvata*) more than any other member of the BROMELIACEAE. Like the *Curculigo*, each leaf has a stiff erect petiole about a foot long and the blade is plicate; however the dense drooping racemes of large spreading coral red flowers immediately make it recognizable as belonging to the Pineapple Family. The plant makes thick colonies and can be used to good advantage as a hedge or border plant. The flower-spike is peculiar in that it does not grow erect like the rest of the pitcairniae but has a tendency to creep on the ground. Another fine plant is *P. xanthocalyx*, native to Santo Domingo. This one has long, narrow, grass-like leaves that droop in pleasing fashion and reveal silvery undersides. The flower-stalk attains a length of 2 or 3 feet and bears yellowish blooms in profusion. It, too, can be used effectively as a border plant. *P. latifolia* is likewise of grass-like habit, similar to the preceding, but has more colorful blossoms in that they are dark red and keep on flowering for several weeks. One of the dwarfs

is *P. Andreana*, native to Colombia.. Although it is insignificant in comparison with all others it does produce some lovely flowers of exquisite shade, being scarlet to bright yellow. Our collection consists of the following :

- | | | |
|------------------------------|------------------------------|--------------------------------------|
| <i>Pitcairnia Andreana</i> | <i>Pitcairnia latifolia</i> | <i>Pitcairnia undulata</i> |
| <i>Pitcairnia corallina</i> | <i>Pitcairnia maidifolia</i> | <i>Pitcairnia xanthocalyx</i> |
| <i>Pitcairnia ferruginea</i> | <i>Pitcairnia punicea</i> | <i>Pitcairnia Maroni</i>
(hybrid) |

In my estimation the genus *Bromelia* contains some of the most spectacular members in the BROMELIACEAE. They are all terrestrial and prefer dry locations. Some 30 species are known to exist in northern South America, the West Indies and Central America. One of the oldest is *Bromelia Pinguin*, already described in 1753 by Linnaeus. Most of the bromelias are rather conspicuous on account of their size. At the same time they are one of the most wicked groups in the entire family. The leaves are beset with marginal prickles that really are vicious and can lacerate flesh terribly if care in handling is not taken. In tropic regions some of the species are often planted for hedges to repel animals from the premises. When the plants are about to bloom the center leaves color up magnificently, either pink or brilliant red. Then a compact white woolly head makes its appearance and for two or three weeks rose or lavender flowers protrude from the woolly mass.

Neoglaziovia is an interesting unpretentious bromel found in Brazil from which fiber is extracted for cloth and rope. There are only two species described but apparently are rare in collections, if cultivated at all. Our specimen of *Neoglaziovia variegata* came from Mulford Foster, who collected it in Bahia on one of his excursions. The stiff tufted plants are terrestrial and in appearance somewhat resemble sansevierias. Leaves of *N. variegata* are narrow and long, usually glabrous and when young conspicuously marked with lighter transverse bands. Its flowers are like those of *Billbergia*, of a violet color and quite showy. The other species, *N. concolor*, is shorter in stature and is not striped like the former but rather more uniformly white-lepidote.

Deuterocohnia species are shrubby perennials of xerophytic nature from South America. Only 6 or 7 species are recorded and none are in the trade as far as I can ascertain. They look more like *Dyckia* and can hardly be distinguished from that group when flowers are not present. We are fortunate to possess *D. Meziana*, a new species discovered by Mr. Foster in Brazil. This rock-loving bromeliad sends up a branched woody inflorescence 4 to 7 ft. in height and blooms over a period of six or seven years.

Ananas, the true pineapple, grows best in a porous, well drained soil and is capable of withstanding protracted drought. Thus it is adaptable to culture in the Cactus House, where several plants are now established. Many varieties of the edible pineapple have been developed since white man first laid his eyes upon this luscious fruit and since pineapples are readily available one can get a good start by cutting off

the crowns, letting them callous for a few days, and then planting in sandy soil. The pineapple may have originated in Brazil although no one is sure of that. Its origin is lost in antiquity and was already a cultivated plant in the American tropics at the time the first white man came to this continent.

Hechtia species can best be described as coarse herbs with rosettes of prickly leaves, very thick and rigid in texture. It would be difficult to distinguish them from dyckias in the absence of flowers. Almost exclusively hechtias are Mexican, except for one species that grows in Texas and two or three others that are found in Guatemala. Over 30 species have been recorded but it is quite possible that many more exist and will come into prominence before long. Here again is practically an unknown group in cultivation which should be brought to the attention of unique plant fanciers. Hechtias grow well in pots and will make good house plants. Most of them possess a silvery cast due to the abundance of small scurfy scales which cover the undersides of leaves in all species. The earliest *Hechtia* on record is *H. stenopetala* described in 1835 from the vicinity of Mexico City and five years later the second species (*H. glomerata*) was recorded. At least 11 new species have been described by Dr. Lyman B. Smith, present monographer of the BROMELIACEAE, since 1937. The best known *Hechtia* and easiest one to get is *H. texensis*, which is widely distributed over southern and western parts of Texas. It makes dense rosettes, composed of many linear-triangular, spine margined, silvery green leaves and sends up an erect flowering stalk about 3 feet high with white flowers.

Encholirium is still another xerophytic genus that looks very much like the better known *Dyckia*, especially in vegetative characters. As is the case with most xerophytic bromeliads, encholiriums are not known to be in cultivation, except in a very few gardens. The group numbers only a few species and is entirely Brazilian. Foster discovered two new ones, *E. Hoehneanum* and *E. horridum*, growing on bare rocky slopes, the former in Bahia and the latter in the state of Espirito Santo. We are fortunate to possess *E. Hoehneanum* but it will be a long time before it may come into blossom.

Tillandsias are one of the most fascinating groups in the Pineapple Family. They are the most widely distributed of all the bromel groups. In their northern limits they reach the Dismal Swamp in Virginia and in the southern extremity extend way below Buenos Aires in Argentina. Many of the *Tillandsia* species, and there are approximately 400 or more described, are epiphytic in moist surroundings but others prefer dry locations, growing among boulders, on rocks and even on the prickly stems of torch cacti in desert regions. *Tillandsia recurvata* is the most common bromel which can be found on arborescent Cerei. Contrary to general belief it does not derive any nourishment whatsoever from the cactus but merely attaches itself to it for support. This little bromeliad, in fact, is not particular about its host; you will often find it suspended on telegraph and telephone wires. A very close relative and perhaps the most abundant epiphyte along the coastal regions of the Atlantic is *T. usneoides*, known as the Spanish Moss, which decorates the Live

Oaks, Cypressess, Cabbage Palms and other trees with streamers of silver-green. It has no roots whatsoever and its threadlike stems and leaves merely hang in long festoons from the tree branches. The leaves and stems are covered with tiny silver gray scales which hold moisture for the plant's sustenance. It is the most unusual bromel because it does not



Fig. 8. Scarlet Torch Plant, *Billbergia thyrsoides* in bloom. Photo by Ladislaus Cutak.

resemble any other member in the family. The great majority of tillandsias produce stiff leaves in a compact rosette, either large or small, and bear flower-stalks of either violet, rose, blue, yellow, green or white tubular flowers. Most of the time the inflorescence is composed of elongated distichous spikes or sometimes reduced to a cluster of single

flowers almost hidden by the leaves. There is a small tufted epiphytic species, only 3 or 4 inches high, which should be included in every collection. It is *T. ionantha* of Mexico. There are 40 to 70 narrowly lanceolate-triangular leaves in a dense rosette, white lepidote throughout, but with more coarser spreading scales in the lower half, appearing to the naked eye as if coated with grains of sugar. When the rosette is about to flower the center leaves turn a brilliant red pink and then dark violet flowers emerge half concealed by the leaves. It can be successfully grown in a soil mixture composed of sand, loam and leafmold but care should be exercised to be sparing with the loam. The most outstanding of all tillandsias is *T. Lindeniana*, native to Ecuador and Peru. It is definitely epiphytic and stemless. Each rosette bears a dense cluster of stiffish, gracefully recurving, narrow leaves. The 7-inch long, stout scape arises from the center of the leaf cluster and supports an oblong-lanceolate spike composed of densely imbricate red-pink bracts from which issue beautiful, spreading amethyst violet flowers. A very striking relative is *T. Lindenii* but it has a shorter and more fan-shaped inflorescence than *T. Lindeniana*. The flower bracts are brighter, being a lovely purple pink. Tillandsias are very abundant in Florida, the commonest, outside of the Spanish Moss, being *T. fasciculata* which often is sold in department stores under the enticing name of Florida Orchid. In this country it often is the first species that comes into the possession of a bromel enthusiast.

At the GARDEN an effort is being made to grow bromels on trees in the Palm House (Plate 15). At first potted plants were attached to the trunks by means of palm fiber but in time the fiber rotted and the bromels fell from their perches. Now when plants are intended for trees most of the osmunda or peatmoss is removed from the roots and the plants stapled to the palms for security. Only a thin slab of moss is placed between the roots and trunk for the sole purpose of encouraging the root cluster to get established on the trunk. After the plant is firmly established it cannot be dislodged so easily and will continue to set forth new offshoots for many years. Only the more plentiful species in our collection are being tried out on trunks, as the vast majority are still being, and will be grown in pots. *Aechmea pectinata* does exceedingly well on *Washingtonia* palms. It produces broad leaves and grows in a birdnest fashion, thus cluttering a palm trunk most attractively with bright green foliage. *Aechmea Racinae* is one of the most attractive epiphytes of this group. Foster discovered it in Brazil and it was named for his wife. It is quite different from all other aechmeas in that it possesses a most startling pendent inflorescence with individual flowers of bright red, pale yellow-chrome and black. Another attractive *Aechmea* is *Ae. fulgens* var. *discolor* from French Guiana. Its broad strap-shaped leaves, blackish purple on the undersides, form a vase-like rosette a foot or more high. A pyramidal flower spike of rich scarlet red grows from the center of the living vase and supports small, oval shaped, thick flowers of rich red and deep blue. The berries last for a long time and hold their color for several months. *Ae. miniata* var. *discolor* is likewise noteworthy, but can best be described as being paler than the above. The



Aechmea pectinata

—growing on Washingtonia Palm at the Missouri Botanical Garden; the vine is *Philodendron cordatum*. Photo by Ladislaus Cutak.

tongue-shaped leaves are three inches wide, dark green above and violet carmine underneath, more or less glaucous on both surfaces. The inflorescence is a moderately dense panicle supporting sessile flowers of flesh color, deep red and lilac. Both *Ae. fulgens* var. *discolor* and *Ae. miniata* var. *discolor* are obtainable in the trade.

I think it might be appropriate to list here some of the outstanding members of the BROMELIACEAE now cultivated in the Garden. We are always willing to exchange or receive new material to augment our growing collection and further studies on this fascinating group of the plant kingdom.

- | | |
|---|--|
| <i>Acanthostachys strobilacea</i> | <i>Bromelia antiacantha</i> |
| <i>Aechmea aureo-rosea</i> | <i>Balansae</i> |
| <i>bracteata</i> | <i>serra</i> (plate 14) |
| <i>bromeliifolia</i> | <i>Canistrum roseum</i> |
| <i>distichantha</i> | <i>eburneum</i> |
| <i>fasciata</i> | <i>Catopsis Morreniana</i> |
| <i>Fosteriana</i> | <i>Cryptanthus acaulis</i> |
| <i>fulgens</i> | <i>acaulis</i> var. <i>discolor</i> |
| <i>fulgens</i> var. <i>discolor</i> | <i>acaulis</i> var. <i>diversifolius</i> |
| <i>Lindeni</i> | <i>acaulis</i> var. <i>bromelioides</i> |
| <i>Mertensii</i> | <i>babiensis</i> |
| <i>mexicana</i> | <i>Beuckeri</i> |
| <i>miniata</i> var. <i>discolor</i> | <i>bivittatus</i> |
| <i>nudicaulis</i> var. <i>cuspidata</i> | <i>zonatus</i> |
| <i>Orlandiana</i> | <i>Deuterocohnia Meziana</i> |
| <i>Ortgiesii</i> | <i>Dyckia altissima</i> |
| <i>pectinata</i> (Plate 15) | <i>brevifolia</i> |
| <i>Pineliana</i> | <i>enbolirioides</i> |
| <i>pubescens</i> | <i>floribunda</i> |
| <i>Racinae</i> | <i>leptostachya</i> |
| <i>recurvata</i> | <i>maritima</i> |
| <i>victoriana</i> | <i>microcalyx</i> |
| <i>Weilbachii</i> | <i>Niederleinii</i> |
| <i>Ananas bracteatus</i> | <i>rariflora</i> |
| <i>bracteatus</i> var. <i>alba</i> | <i>remotiflora</i> |
| <i>comosus</i> | <i>remotiflora</i> var. <i>montevidensis</i> |
| <i>Androlepis Skinneri</i> | <i>sulphurea</i> |
| <i>Araeococcus micranthus</i> | <i>Encholirium Hoehneanum</i> |
| <i>Billbergia amoena</i> | <i>Gravisia exsudans</i> |
| <i>Euphemiae</i> | <i>Greigia sphacelata</i> |
| <i>Euphemiae</i> var. <i>nudiflora</i> | <i>Guzmania monostachya</i> |
| <i>horrida</i> var. <i>tigrina</i> | <i>musaica</i> |
| <i>iridifolia</i> | <i>Zahnii</i> |
| <i>macrocalyx</i> | <i>Hechtia glomerata</i> |
| <i>macrolepis</i> | <i>texensis</i> |
| <i>Meyeri</i> | <i>Hohenbergia cattingae</i> |
| <i>mutans</i> | <i>penduliflora</i> |
| <i>pallidiflora</i> | <i>stellata</i> |
| <i>Porteana</i> | <i>Lindmania penduliflora</i> |
| <i>pyramidalis</i> | <i>Neoglaziovia variegata</i> |
| <i>Saundersii</i> | |
| <i>thyrsoides</i> (Fig. 8) | |
| <i>Tweedianae</i> | |
| <i>vittata</i> | |
| <i>zebrina</i> | |

- Neoregelia ampullacea*
Carolinae
concentrica
cyanea
laevis
marmorata
Pineliana
sarmentosa var. *chlorosticta*
spectabilis
tristis
- Nidularium amazonicum*
fulgens
Innocentii
Innocentii var. *striatum*
Innocentii var. *lineatum*
procerum
- Orthophytum foliosum*
- Pitcairnia Andreana*
corallina
ferruginea
imbricata
latifolia
maidifolia
X Maroni
punicea
undulata
xanthocalyx
- Portea petropolitana* var. *extensa*
- Pseudananas macrodontes*
- Puya alpestris*
assurgens
chilensis
spathacea
- Quesnelia arvensis*
humilis
Liboniana
- Streptocalyx floribundus*
- Tillandsia albida*
anceps
Baileyi
Balbisiana
bulbosa
Butzii
decomposita
fasciculata
grandis
ionantha
juncea
Leiboldiana
Lindeni
Lindeniana
recurvata
Schiedeana
streptophylla
tenuifolia
tricolor
usneoides
utriculata
- Vriesia bituminosa*
Fosteriana
guttata
hieroglyphica
X Mariae
regina
scalaris
Schwackeana
splendens
- Wittmackia lingulata*

COLOR IN BROMELIADS

RACINE FOSTER

For those who like colorful flowers with accents in flaming reds, its shades and tints, and their contrasting colors, complete satisfaction will be found in the bromeliad family. In fact the bromeliads radiate about all the colors of the spectrum. Their brilliant color combinations are made up on the basis of the three primary colors, blue, red and yellow. But the one outstanding color in the bromeliad inflorescences is red and the great gamut of shades and tints thereof.

When one reviews all the blue-reds, the yellow-reds, the cherises, the pinks, brilliant and pale which are found in flower stem, bracts, sepals and petals of this one family of bromeliads, one is astonished with the great range of their colorful beauty. And their complimentary colors making brilliant contrasts are often quite breath-taking.

If one is planning a collection of bromeliads it might be interesting to consider your favorite combination of colors and aim toward either a group of bromeliads with all those colors you like best or with the idea in mind of a combination of great contrast in the colors.

There is one foregone conclusion, in making up a collection of bromeliads, you most surely must like red and its various shades, which, of course, go into pink, because the majority of the bromeliads have red or its tints in some place or other.

I. Under the red-blue combination we list:

Aechmea Weibachi has a red stem, red stem bracts, lower half of sepals is red while the upper half is lavender, and the petals are lavender.

Aechmea Victoriana has shaded red tones on sepals, purple petals with white "piping" on edge.

Billbergia vittata has purplish-red stem, red bracts, red sepals, purple petals.

Quesnelia humilis has red bracts on light stem, red sepals, red flower bract, cerise red petals.

Tillandsia ionantha has royal purple flowers with yellow stamens, a "jewel" in a cluster of brilliant red leaves.

Quesnelia liboniana has salmon red sepals, purplish-blue petals, with a whitish base.

Quesnelia testudo has watermelon pink bracts which make up the closely formed head; sky blue petals show between bracts.

Nidulariums, all have red centers with blue or purple flowers.

Billbergia Euphemia has pink bracts with a powdery effect, sepals are pale to white with lavender petals.

Tillandsia Lindenii has periwinkle blue flowers with rose-pink and green bracts.

There are many more in the blue and red combination, but these are a good starter in thinking about the bromeliad color combinations.

II. In the orange-red-yellow combinations we find a nice selection:

Aechmea Lindenii has orange to red tinge on sepals with yellow petals, a stunning color combination of two very close colors.

Aechmea Racinae has red-orange sepals, brilliant yellow petals with black base.

Vriesia carinata hybrid (Marie) has red and yellow on sepals, with yellow petals, inflorescence lasts six months.

Gravisia aquilegia has orange sepals with orange petals.

Aechmea Orlandiana has orange stem, orange bracts, white sepals, whitish-light yellow petals.

III. The red and yellow combinations offer some striking plants:

Aechmea ramosa has red stem, red bracts, yellow sepals, yellow petals.

Aechmea pineliana has large, light red bracts on stem, light green sepals, yellow petals, and these turn black with age.

Aechmea Fosteriana has maroon bracts, green sepals, yellow flowers.

Billbergia Lietzii has pink bracts, white to yellow petals.

Billbergia iridifolia concolor has pink bracts, yellow sepals and petals.

Vriesia carinata hybrid (Marie) has red and yellow sepals with yellow petals, (inflorescence lasts six months).

Aechmea bromeliaefolia has soft red to pink scattered bracts on stem, pale green sepals, yellow flowers which turn black.

IV. The red and green combinations is a smaller group but is quite lovely:

Billbergia amoena has red bracts, green sepals with blue tip and green petals with blue tip.

Billbergia distachia has pink stem bracts, green sepals with blue tip, and green petals.

Aechmea Fosteriana, as above, maroon bracts, green sepals, yellow flowers.

V. Some of the tillandsias have lovely pink and white combinations of color:

Tillandsia polina has salmon-pink sepals and white petals, and is highly recommended for this combination.

BROMELIAD TIME OF FLOWERING CALENDAR

RACINE FOSTER

For a year around continuance of bloom in your bromeliad collection, this calendar guide may help you choose your next species. It is based on observations made under greenhouse conditions in Florida.

January—

Billbergia Lietzii
Billbergia iridifolia concolor
Billbergia vittata
Aechmea bromeliaefolia
Quesnelia testudo
Aechmea Victoriana

February and March—

Aechmea pineliana
Aechmea Fosteriana
Aechmea Racinae (some bloom in
 December)

Billbergia amoena
Billbergia distachia
Billbergia Euphemia
Quesnelia humilis
Quesnelia liboniana
Tillandsia Butzi
Tillandsia pruinosa
Tillandsia ionantha (April also)
Vriesia penulata

March and April—

Tillandsia fascicularia
Vriesia guttata
Vriesia simplex

May and June—

Aechmea miniata discolor (in a
 warm season their period is
 advanced)
Aechmea marmorata
Aechmea nudicaulis
Billbergia zebrina
Billbergia amoena

Billbergia Saundersii
Cryptanthopsis navioides
Gravisia aquilegia
Guzmania Zahni
Neoregelia bahianus
Neoregelia tristis
Vriesia ensiformis
Vriesia splendens

July—

Aechmea fulgens discolor
Neoregelia spectabilis
Neoregelia marmorata

August—

Aechmea fasciata

September—

Aechmea purpurea-rosea
Aechmea remotiflora
Billbergia iridifolia
Billbergia pyramidalis
Billbergia amoena

October—

Billbergia vittata
Vriesia carinata

November—

Aechmea bracteata
Tillandsia Lindenii

December—

Aechmea Racinae
Tillandsia Lindeniana
Aechmea Wielbackii
Aechmea Orlandiana
Aechmea Victoriana

SPANISH MOSS AS AN ECONOMIC PLANT

WYNDHAM HAYWARD

Tillandsia usneoides Linn., the artistic, if melancholy gray Spanish Moss of the Lower South, has perhaps contributed more to the lives of the peoples of its native area than any other one plant in its omnipresent quality as a characteristic member of the endemic flora. It has earned itself a place in art, song and fable, agriculture and industry.

Spanish Moss is a distinctive plant, lending its typical drooping streamers to the Southern landscape with an effectiveness comparable only to that of the live oak, the pine tree and palmetto. It is a silvery gray plant, soft and flexible, found as far north as Eastern Virginia and extending around the Atlantic and Gulf coasts to lower Texas, and down into the American tropics.

It hangs from trees on slender stems, not at all a parasite, but drawing its sustenance from the moisture, carbon dioxide and dust of the atmosphere, usually hooked over a twig, jutting limb or crotch. It grows fast, so that a live oak tree in Florida may be "demossed," as the operation of removing the "moss" is called, and still need a new "demossing" in half a dozen years. It is of course impossible to remove every wisp of the Spanish Moss from the bark of a large tree, and the remnants soon grow and increase, and new plants also arise from seeds blown from nearby trees. The "moss" may grow so heavily in a tree as to endanger its life (the tree). In shady, damp locations this is more likely than in open, sunny, exposed places where the wind has free play with the bearded "moss" and frequently blows big hanks to the ground, where it will die in a few months. It is strictly an aerial thing and cannot be grown in soil.

While not providing a palatable and nutritious human food like the Pineapple, its rival as a useful member of the bromeliads, the Spanish Moss is useful indeed to the country people of the South. The fibre is also used in upholstery for stuffing, in fact has been an important item for the upholstery of a certain well-known inexpensive make of car. Gathering of the "moss" for sale of the fibre is a popular livelihood in times of depression. During the early 1930's there was an active business in this in Florida. Now that times are prosperous and easy money available, little "moss" is collected. It is a tedious and laborious work, and the return is slight. The "moss" is collected from trees where it may be found the thickest, by the ton in live oak hammocks or high land woods, subjected to a "retting" process which sloughs off the scaly, felt-like exterior of the "moss," and leaves the black wiry inside fibre which is tough and springy when properly prepared. Soaking in water or various solutions accomplishes this retting process. Afterward the fibre is washed, rinsed, dried and shipped.

Spanish Moss in poor crop years and in generally hard times is widely used by countryside dairy operators, and home owners of a backyard cow, for cattle feed. The cows, if hungry enough, will eat it, although its feed value is presumably low, and its main value something like beet pulp, as a form of roughage. It is not recommended for this pur-

pose, but is resorted to, by farmers and others when unable to provide proper dairy and stock feeds. It has not been observed to benefit the cattle, but doubtless helps to fill up an otherwise aching void. In times of prosperity, cattlemen have little recourse to this expedient.

The "moss" is also a popular packing medium, although its use in interstate transit is forbidden unless inspected because of pests it is believed to harbor, as various scales, and it is an excellent thing to wrap around the roots of rose bushes and tomato plants and such things when sold at retail. The roots of citrus trees and other nursery stock are often wrapped in the "moss" for shipping within the State of Florida. It is used to make growing screens hung on wires in the yard; a "moss" house is a cheap and satisfactory substitute for a commercial lath house, if carefully constructed. Hanks of the "moss" are draped over chicken wire or barbed wire on poles. in many Southern nurseries, for half-shade.

The Spanish Moss is doubtless so called because it came to the attention of American plantmen from the Deep South when that was part of the Spanish Colonial Empire, possibly during the 18th century. As a Linnean plant, it has a long and respectable botanical history. No one has determined the first mention of the plant in European literatures, but doubtless the early voyagers with Columbus came into contact with it somewhat in the Caribbean area, or Ponce de Leon found it on the East Coast of Florida in the early 16th century. Fernando De Soto had to wade through miles of it. There is a somewhat facetious myth of its origin that De Soto, wearing a full gray beard, pursued an Indian maid through the forest, and up into a live oak tree where he caught his whiskers among the branches, so that he was able to extricate himself only with difficulty, and in the meantime the Indian maid escaped. The tree retained several wisps of De Soto's gray beard after he released himself, and these, as the story goes, grew on to become our well-beloved Spanish Moss.

The plant is sometimes grown in Northern conservatories but relatively high humidity is required to maintain it.

BIOGRAPHICAL SKETCHES

I. MULFORD B. FOSTER AND RACINE FOSTER

[The reader is referred to Plate 1 for portraits of the Fosters.]

MULFORD B. FOSTER

After graduating from High School at Elmer, New Jersey, where he was born in 1888, Mulford B. Foster went to Philadelphia and completed a course in business college. This his father had urged since he knew that his son's love of nature did not make him too practical in the line of business. He was employed for four years in Philadelphia banks, but every spare moment on week-ends he was off in the woods collecting plants, reptiles and other animals. His interest in reptiles developed to the point where he had the largest private collection of living specimens in the country at that time.

At the age of 22 years he went back to Elmer, New Jersey as an associate editor on his father's newspaper, not because there was any particular desire to become a newspaperman, but because he wanted to be associated with his father. But the call of nature was too strong. After about two years as a newspaperman, he moved to the mountains of Pennsylvania. He spent his summer months as a leader with several boys' camps, and in winter he lectured on natural history subjects, particularly on reptiles, to schools, colleges, Y. M. C. A.'s and boy-scout groups.

A few years later he became the representative of the Davey Tree Expert Company in the States of Virginia and Maryland, and Washington, D. C., which position he held for five years. His naturalist inclinations soon led him to photography, and finally to painting at the age of 36 years. His painting, without any formal training, developed in transitory stages from realistic, to abstract, to philosophical, and finally again to realistic plant portraits and botanical subjects. The very beautiful cover design of this *FIRST BROMELIACEAE EDITION* of *PLANT LIFE*, and the 36 charming bromel portraits shown in Plates 6, 7 and 8, are convincing evidence of Mr. Foster's abundant talents.

A trip to Florida in 1923 decided for him that this was the land for a plant enthusiast and his instinctive urge for building gardens soon launched him as a landscape architect in Florida where he has been building gardens for more than two decades. His home and extensive plant collections are located in the utterly beautiful City of Orlando, in the central Florida lake region.

Not at all satisfied to grow and plant the tropical and sub-tropical plants that others had collected and introduced into horticulture, Mr. Foster was bent on getting his own plants. He, and Mrs. Foster, therefore went on collecting trips to Mexico, Cuba, Brazil and currently in Colombia. From these trips he has reintroduced many old plants and discovered many new ones, principally over 80 new bromeliads. In recent years he has written on the subject of bromeliads which has become his

principal interest. The number of living bromeliads in his orchidario in Orlando, Florida exceeds that of any other collection.

RACINE FOSTER

Racine Foster was born in the State of Wisconsin in 1910, where she attended grade and high schools, and college. This included three years at Lawrence Conservatory of Music, and two years at the University of Wisconsin. She held several different positions, including church organist and private tutor. In 1935 she married Mulford B. Foster, and has been studying tropical plants with her husband ever since.

—H. P. T.

2. LYMAN B. SMITH

An autobiographical sketch

Bromeliaceously speaking, life began for me in the fall of 1926 when I met the family at the start of my graduate work at Harvard. Until that time I had been strictly a local flora botanist but since then bromels have been my dominant interest and line of research.

After two years of graduate study I had the very good fortune to receive a Sheldon Travelling Fellowship to go to eastern Brazil. There I was able to observe the elusive bromel in its native state, which is to say an elevated position difficult if not impossible to attain. Also I was able to ponder the great difference between the live bromel and its desiccated reliect in the herbarium—a difference which I still find amazing and at times embarrassing.

One more year of graduate study and I finished my thesis, a monograph of one subgenus of *Tillandsia* and an account of the bromels of British Guiana. This combination of monographic and floristic work set the pattern for my later research.

On the monographic side I have been publishing serially an artificial synopsis of the subfamily *Tillandsioideae* in an attempt to overcome the difficulties of identifying the usual incomplete herbarium material by guessing at the characters of absent petals and stamens. Also from time to time I have made keyed summaries of such genera as *Lindmania*, *Brocchinia*, *Hechtia*, *Navia*, *Guzmania*, *Greigia* and *Ananas* and have covered all the species of *Catopsis*, *Glomeropitcairnia*, *Ochagavia* and *Androlepsis* in the course of floristic work.

Floristically I have covered the bromels for North America as a whole and for Yucatan, Costa Rica, Panama, and Trinidad and Tobago individually. In South America I have published accounts for British Guiana, Peru, Uruguay and in large part for Chile. To compensate for my lack of field experience I have frequently worked with the botanists most familiar with the territory involved. In some cases we published jointly and in others my papers were the richer for much information I could never have obtained alone.

As a member of the staff of the Gray Herbarium since 1931, I have had the advantage of a great library and collection as a constant support

to my research. This situation and the steady influx of bromels for determination has led me to strengthen the side where my greatest advantage already lay and to spend most of the time I could find for travel, in visiting other herbaria to study and photograph their types of bromels. Up to 1935 I had gone to Europe three different times and had done considerable work at the British Museum, Kew, Brussels, Liège and Paris.

Most of my spare time in late years has gone into the preparation of a treatment of the *Bromeliaceae* for Dr. F. C. Hoehne's "Flora Brasili-ca." At present I have completed descriptions of nearly five hundred species, or about a third of the whole family, and the majority of the accompanying keys. The work has been greatly encouraged and en-



Fig. 9. Lyman B. Smith

hanced by the monumental collections of Mulford and Racine Foster—collections which are doubly valuable because both dried and living.

3. DAVID BARRY, JR.

An autobiographical sketch

[The reader is referred to Plate 13 for portrait of David Barry, Jr.]

The writer was born in the State of Texas, but has been a Californian for most of his life (since 1902). Some intense interest beyond his real estate development work was an essential of his search for happiness. First came aviculture. For the last dozen years his avocation has been the introduction and culture of tropical plants, especially palms, but including also cyads, aroids, bromeliads, and lately, orchids. Before the war, the conduct of "an international palm seed exchange service," which

sent, received, and redistributed palm seeds between governmental departments of agriculture and botanic gardens throughout the world, was carried on. This service afforded much material for experimenting in the introduction of new palms for California. Little work had been done in this field for the twenty to thirty previous years. Some successful new introductions were made, but the efforts resulted mostly in failures as one might expect. The work however gave much specialized experience. In 1941, some plant exploration work was carried on in western Cuba, and in Florida. The Florida visit was highlighted by a trip into the Everglades with his good friend and fellow bromeliad enthusiast, sharp-eyed Mulford B. Foster.



Fig. 10. Ladislaus Cutak

4. LADISLAUS CUTAK

Ladislaus Cutak has been associated with the Missouri Botanical Garden in St. Louis for the past 20 years. In 1933 he was placed in charge of the main Conservatories, housing the exotic flora, at the early age of 25 years. He specializes in desert plants, particularly cacti and the other succulents, but he is equally at home with cycads, palms, bromeliads and various jungle vegetation. He is recognized as one of the outstanding authorities on cacti. He has done much toward the popularizing of cacti and the other succulents. Since 1932 he has contributed more than 125

articles to various outstanding horticultural magazines, and he frequently collaborates with other authors on scientific books.

Cutak devotes a goodly portion of his time to lectures, for he is frequently called upon to speak before garden clubs, civic, religious and social societies throughout the country. All of his talks are illustrated with colored slides made from his own photographs. In recognition of his many lectures and writings on succulent plants he has been appointed to life fellowship in the CACTUS AND SUCCULENT SOCIETY OF AMERICA.

He also has done extensive exploring for plants in the deserts of the Southwest and Mexico, covering some 30,000 miles in his wanderings, searching for seeds, herbarium and living material to enhance the collections at the Missouri Botanical Garden.

—H. P. T.

FOSTER & FOSTER'S "BRAZIL, ORCHID OF THE TROPICS"

BETTY CARRUTHERS DILL

[The following review of the book, BRAZIL, ORCHID OF THE TROPICS, by Mulford and Racine Foster, Harper & Bros., N. Y., 1945. \$3.00, appeared in part in the Daily Times-Herald, Dallas, Texas, and is here reproduced by special permission.—*Ed.*]

If you are a garden enthusiast, a lover of flowers, or just an arm-chair adventurer, you'll enjoy every minute on excursions with the Fosters through jungles, up mountains, along the sea, searching for the "air garden" paradises of Brazil, native land of orchids and bromeliads. If you happen to be fortunate enough to rank as a professional naturalist, botanist, or orchidist, this fascinating book is a must for you.

With the two naturalists, Mulford B. and Racine Foster, you first board a small cargo ship, the TROUBADOUR, and sixteen days later you anchor with them at midnight in magical Guanabara Bay, the port of Río, under a full moon. "It was as if all the stars of the heaven and the pearls of the sea were strung on an invisible thread and draped around the Bay of Río."

You are led through "air gardens" where orchids grow as thick and luxurious as daisies on a plain at home, overwhelming in their vivid colorings and honey sweetness of perfume—where bromeliads hang in giant trees in the jungle, weighing from fifty to a hundred pounds; where the natives wonder why the "professores" wish to take alive "*gravata*" or "*parasita*"; where the hummingbird, (Beija-flor) flower-kisser, a native of Brazil also, is found sipping the nectar from the most brilliant flower bracts and flowers.

Every State or town or city in Brazil used by the Fosters as headquarters for their various excursions, is graphically described for the reader, with especial emphasis on customs, topography and the people themselves. These include Río, of course, with its superb Museo Nacional and Jardim Botánico. Then São Paulo, Bahía, Ilhéos, Agua Preta, loca-

tion of the Cacao Experiment Station; Jacobina, Mt. Itatiaya, where they stayed the night at a genuine "Swiss Chalet" mountain retreat; the small State of Espírito Santo (State of the Holy Ghost) where they found rich specimens of bromeliads growing on the "Finger of God" (Dedo de Deus); Vitoria of the same State; Paraná, Bello Horizonte, Santa Barbara and the Monastery of Caraca, where the lovely camellia "tree" almost a hundred years old, shook pure white blossoms over them like a benediction; and finally out to Matto Grosso and Corumbá and Uruçúm.

"BRAZIL, ORCHID OF THE TROPICS," is profusely illustrated with black and white photographs, kodachromes and sketches by Mulford B. Foster. A map at the beginning, which will intrigue you with the Equator held in place by two grinning monkeys, allows you to follow the Fosters by narrow gauge, "teapot" engines, dugout canoe and burros. True botanists, they discovered more than forty plants never before known to botanical science. Their first new species discovered was a huge *Vriesia*—named *Vriesia Petropolitana*, for the nearby beautiful city of Petropolis, set near lush mountainside jungle. Next was the elephantine plant, a new species, taken high in the giant trees by "monkey" boys, and which was later named, by Dr. Lyman B. Smith, *Aechmea conifera*. Other trips in this vicinity yielded four more new species, as well as other bromeliads which have not been identified as yet.

Going up to Jacobina on the funny little train Mulford suddenly spied a *Neoglaziovia variegata*, but the train wouldn't stop. For days they searched for another specimen of this interesting and useful bromeliad, whose fiber the Indians have named *caroa*, and which is used for the manufacture of cloth and rope. Then one day, Racine almost stepped on one! And so they tramped from village to village, mountains and jungle, through cold wet places, and hot dry desert, with their sacks of spiny plants, the herbarium press, and other paraphernalia, ever searching. One afternoon in a pouring down rain they found that lovely purple orchid, *Miltonia spectabilis*. Later, over dry granite perpendicular rocks along the sea they scrambled and worked for hours to obtain a specimen of that "spiny devil" a bromeliad which Dr. Smith named appropriately, *Encholirium horridum*. Two of their interesting finds, neither bromeliads or orchids, were the giant bogonia trees, and the *Amaryllis* growing to gigantic proportions in trees!

Not the least interesting items in the book are the personal accounts of the many friends who helped them, beginning with Dr. Lyman B. Smith, bromeliad specialist of the Gray Herbarium at Harvard, with whom the specimens were divided, half of them going to the National Museum at Río. In Brazil there were *Doutora* Bertha Lutz of Río, and director of the Museum, Dona Heloise Alberto Torres, Dr. F. C. Hoehne, one of the most outstanding botanists of Brazil, Dr. Sothenes Miranda of the Cacao Experiment Station, Captain Griete, Roberto Donati, Dr. Rubem Landeiro, plant pathologist, Maria Stella Noveas, orchidist, writer and painter, Augusto Ruschi and his brother Dr. Henriquo of Santa Tereza, and many other fine naturalists and botanists of Brazil, who proved themselves fine friends to the two plant explorers.

“Many people wonder why we will endure so much discomfort and so many hardships on our collecting trip, such as snakes, jungle animals, hot days and freezing cold wet nights, and the question is sometimes difficult to answer. But we know that the greatest compensation is the discovery and realization of our searchings later carrying a message to thousands—like the *Aechmea Orlandiana*—which carries a message directly from ‘The Finger of God!’ ”

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