
BROMELIADS

A CULTURAL MANUAL



THE BROMELIAD SOCIETY, INC.

INTRODUCTION

Bromeliads have enjoyed a worldwide surge of popularity during the last few decades. Although they are often treated as ephemeral decorations to be discarded after they fade, this need not be so. Bromeliads are easy to grow; you can enjoy their graceful symmetry and flamboyant blooms year round. This booklet will introduce these fascinating plants to the novice and provide basic cultural information in nontechnical terms. It can also serve as a reference for experienced growers.



Garden of Wally Berg WB

A First Look At The Bromeliad Family

Bromeliads (broh-MEE-lee-ads) are a family of about 2500 species native to tropical North and South America. There are also several thousand hybrids and cultivars (cultivated varieties) that have been developed by plant breeders. The commonest growth form is a stemless rosette of leaves. The rosette may be exquisitely symmetrical or twisted and curled into bizarre shapes. The foliage ranges from shades of solid green to brightly spotted and banded. The inflorescences often flaunt dazzling color combinations as well as fantastic forms.

About half of the species are epiphytes, plants that grow on trees or rocks; the rest are terrestrials that grow in the ground. Bromeliads are not parasites; they do no harm to the host tree but simply use it as a perch to gain access to sunlight (forest floors are too dark for most plants). The root systems are normally small and serve mainly to anchor the plants to the tree branch or rock. Most of the functions of water and nutrient absorption have been taken over by the leaves. The leaves often form a reservoir that collects and holds water; these are called tank bromeliads. Those that don't hold water are called xerophytic or atmospheric (epiphytes only) bromeliads.

The 2500 species are grouped by certain shared characteristics into genera (JEN-er-ah, singular: genus). The genus (JEEN-us) is the first word in the scientific name of a species, e.g., *Aechmea fasciata*. The scientific name is always italicized (or underlined); the genus name is always capitalized and the species name (the second word) is not. The generic name is often used as a common name, in which case it is neither italicized nor capitalized: the scientific genus *Tillandsia* becomes the common name tillandsia.

Although the characters that formally identify a genus are frequently small details that can be seen only under magnification, most genera can be recognized by the forms of their foliage and inflorescences. Of the approximately 50 bromeliad genera, the following eight are common in cultivation. The descriptions are for the commonest cultivated species; within each genus exceptions will be found. The pronunciations offered are typical American ones; there is a great deal of variation throughout the world.

Aechmea (EEK-me-uh or ECK-mee-uh) species are all tank epiphytes. The rosettes are usually broadly bowl-shaped, and the arching leaves have spiny margins. The inflorescences are round in cross section and have large, colorful bracts. They remain in color for weeks or even months. The flowers are followed by fleshy berries that are often brightly colored.



Billbergia (bill-BUR-gee-uh) is similar to *Aechmea* but differs in producing few-leaved rosettes that usually form cylinders or narrow vases. The inflorescences are mostly pendent and last for only a couple of weeks.



C. zonatus, a terrestrial TOR

Cryptanthus (crip-TAN-thus) is a terrestrial genus; the nearly flat rosettes do not hold water. The leaves are succulent, usually with wavy margins and teeth; they are often strongly banded with white, bronze, or pink. The white

(sometimes light green or pink) flowers appear nested in the center in most cultivars.

Dyckia (DICK-ee-uh) is also a terrestrial genus; none of the species has a water reservoir. The succulent leaves are very spiny. Unbranched spikes bear bright yellow or orange flowers. The spikes emerge from between the leaves instead of from the center, and the rosette does not die after flowering as it does in most bromeliads.

Guzmania (guh-z-MAIN-ee-uh or gooz-MAHN-ee-uh) species are almost all tank epiphytes. The leaves are green or sometimes colored, shiny (not visibly scaly), and have smooth margins. The rounded inflorescences may be elongate to compact and have large, brightly colored bracts. The petals are usually yellow or white.

Neoregelia (KNEE-oh-reh-GEE-lee-uh) species are all tank epiphytes. The rosettes are usually broad though some are vase-shaped. The leaf margins are usually serrated but not spiny and may be green or conspicuously banded, striped, or spotted with various colors. The inflorescences are stemless; the inconspicuous flowers barely rise above the water in the centers of the plants. In many species the center leaves turn brilliant colors at maturity.



T. bulbosa, an atmospheric epiphyte MAD

Tillandsia (till-AND-see-uh) is a large, diverse genus of largely epiphytic species, most of which do not form tanks. The smooth-margined leaves are usually densely covered with fuzzy scales that make the foliage gray-

green to white. Rosettes vary from symmetrical to very contorted. The flowers may be nestled among the leaves or borne on long, single or branched, round or flattened inflorescences. Many have brightly colored bracts and/or flowers. In short, if the plant is a spineless, gray-leafed, tankless epiphyte, it's most likely a tillandsia.

Vriesea (VREE-see-uh or VREE-zhuh) species are nearly all tank epiphytes. The rosettes form broad vases, and the smooth-margined leaves are either shiny green or intricately to boldly patterned with scales or translucent windows. The tall, single or branched inflorescences are mostly strongly flattened (sword-shaped); they are composed of overlapping, brightly colored bracts that last for several months.



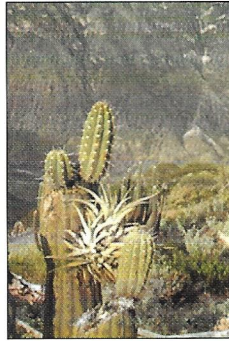
BASIC CULTURE

Bromeliads will SURVIVE in satisfactory condition for months or even years under more variable conditions than are recommended in this publication. Their adaptability and resilience are major reasons for their popularity. However, this booklet is intended for people who want their plants to THRIVE and bloom repeatedly; therefore, GOOD cultural conditions are described here.

The general guidelines in this section are just that: they are more or less applicable to the commonly available bromeliads of all genera. These plants have been tested and proved for their ease of culture and good performance under a variety of conditions. More detailed cultural instructions are given under each group, IF needed.

WHERE TO GROW THEM. Of course, nearly all plants do well in a greenhouse, and bromeliads are no exception. They can also be grown superbly in your home in windows or under artificial lights. In mild climates they can be grown outdoors year round.

LIGHT. Summary: Adequate light is the most critical factor for growing healthy plants of any kind. Most bromeliads will perform satisfactorily if given 2000 footcandles of light for 12 hours per day. They will show better form and color with 3000-4000 footcandles (high humidity is necessary at this higher light level).

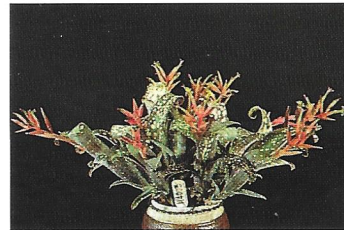


Till. cactifolia in habitat MAD

MEASURING LIGHT INTENSITY.

Unfortunately, publications routinely give worthless recommendations such as "strong light" or "full sun." Full sun in Seattle, Washington, is not the same quantity as full sun in Phoenix, Arizona. It is also impossible to estimate light intensity by eye. A serious plant grower should invest in an inexpensive light meter. It costs no more than one good plant and can save you years of trial and error learning.

You can use your camera's light meter with the following conversions to footcandles. Set the ASA to 100 and the f/stop to 16. Place a sheet of white paper horizontally on the surface where you intend to grow plants and aim the camera at it from a high angle. The intensity of full sun in clean, dry air is about 10,000 footcandles, under which conditions your camera will indicate an exposure time of 1/500 second. Each doubling of the indicated exposure time translates to one-half the light intensity: 1/250 second = 5000 footcandles, 1/125 = 2500, 1/60 = 1250, etc. Take readings in early morning, noon, and late afternoon to determine the average intensity throughout the day. If you prefer to use lux as the unit of light intensity, multiply footcandles by ten to get lux values. Lumens per square foot is equivalent to footcandles.



Billi. 'Pocito Bianco' DB

Within the acceptable range for each species, higher light intensities produce more compact growth and better foliage and inflorescence color. The general rule is to give a plant as much light as it can tolerate without bleaching or burning. Plants must be acclimated gradually (over a period of several weeks) to the highest intensities indicated. At higher light intensities plants must also be provided with higher humidity and more air circulation to prevent drying and burning.



DAYLENGTH. The duration of light is as important as the intensity. Bromeliads should receive 12 to 16 hours of light per day. Fewer than 10 or more than 16 hours per day for long periods may result in abnormal growth

or failure to flower. Brighter light and longer days will speed maturity as well as improve form and color.

ARTIFICIAL LIGHT. Bromeliads can be grown well indoors under some types of artificial light. Standard incandescent bulbs do not produce an adequate color balance for healthy plant growth. Fluorescent light provides the proper color range and uses the least electricity. Wide-spectrum or daylight tubes are the best of the standard types, and cool white tubes are satisfactory. Serious growers can invest in more expensive tubes designed specifically for plants, or in high-intensity tubes. Use fixtures that hold four or six 48-inch or longer tubes. Suspend standard output tubes not more than two feet/60 cm above the tops of the plants; about eight inches/20 cm is best for most bromeliads. Plug the lights into a timer set for a period of 12 to 16 hours a day.



TEMPERATURE. Temperature is not very important within a broad range. Most commonly available bromeliads will tolerate nights near freezing in winter and days near or above 100°F/ high 30s°C in summer. Their appearance may suffer after several weeks of such extremes, but they will recover when temperatures moderate. For best performance, the nights should be 50-65°F/10-18°C, and the days 70-90°F/21-32°C during most of

the year. A day-night differential of at least 10°F/6°C is also desirable. (Most bromeliads have a special kind of photosynthesis called CAM, which requires substantial day-night temperature variations.) Guzmanias and vrieseas tend to be less tolerant of temperature extremes, especially cold nights.



AIR CIRCULATION AND HUMIDITY. There is a relationship between air circulation, humidity, and heat. Circulation is generally unimportant, as long as the air is not stuffy. Good air movement is essential at high

temperatures or at humidities near saturation. Plants that do well in the sun outdoors may burn in an unshaded window, because the still air fails to conduct heat away. Stagnant, saturated air such as occurs in tight greenhouses or very humid climates encourages diseases. At the other extreme, homes with air conditioning or forced air heating have air that is below 20% relative humidity. In such dry air, strong circulation may cause leaf tips to dry out and die (dead leaf tips are also a symptom of alkaline or salty water).



The relative humidity should ideally be 50% to 75%. The higher the temperature and the more vigorous the air movement, the higher the humidity should be. If your home is dry, you can provide extra humidity

with trays of wet gravel placed under your plants. Very high humidity seems to reduce the density of leaf scales. Since the beautiful leaf patterns of many bromeliads are created by bands of scales, plants may be less attractive under very humid conditions. Brighter light should compensate somewhat for this condition.

WATERING. Summary: Water quality is important. Most domestic water is satisfactory for growing bromeliads but some supplies are too salty or alkaline. The use of good (acidic, low-salt) water promotes the development of show-quality plants.

You should be aware of what mineral salts are in your water supply, for your own health as well as for that of your plants. Some minerals are quite harmful to plants, others less so. The agency that supplies your water can give you an analysis. Ask for the pH, hardness, sodium, and total dissolved salts, and ask for an interpretation of the numbers (i.e., whether the values are high or low).



HARD WATER. Water that is hard (contains calcium or magnesium salts) or alkaline (pH above 7) deposits unsightly spots on foliage but does no serious harm to most species. (These are the same minerals that leave

spots on windows and dishes.) The harder the water, the worse the spotting. Bromeliads with shiny foliage may become unattractive. Species with very scaly, gray foliage, such as *Aechmea fasciata* and most tillandsias, tend not to show hard water spots.

OTHER SALTS. Sodium and some other minerals (especially boron, copper, and zinc) are very harmful to bromeliads. Leaf tip dieback is usually the first symptom. Evaporation of water from the central reservoirs can concentrate salts enough to kill plants. **Artificially softened water is very salty (sodium); never use it on any plants!**

If your water has a low to moderate mineral content, flushing the central reservoirs at least once a week may prevent leaf tip dieback and reduce spotting. If you still have problems, use bottled (deionized) water or rain water. Distilled water is so pure that it will pull nutrients out of plant tissues; always add a little fertilizer to it. Collect and store rain water in plastic containers, not metal.



Pressure-treated lumber, which is green from being impregnated with a copper compound, is deadly to bromeliads and many other plants. Do not place it above plants where condensation or runoff can drip copper-

laden water onto them.

ACIDITY. The acidity of your water is of moderate importance. Ideally, it should be acidic, with a pH between 4.0 and 7.0; 6.5 is best. Alkaline water (pH above 7.0) makes essential minerals less available to the plants and contributes to spotting, but many bromeliads grow satisfactorily with water up to at least pH 8.0.

Some common and many rarer species require very pure water. Those from high elevations and the miniature species tend to be most sensitive to salts.

For information about watering atmospheric epiphytes, see the chapter on *Tillandsia*. Water quality seems to cause no problems with most nontank terrestrial species; *Cryptanthus* is an exception.



POTTING AND MOUNTING.

Summary: Any potting mix is acceptable as long as it is acidic and holds moisture yet drains quickly. It should also be sufficiently firm to hold the plant steady.

The subject of potting mix probably generates more discussion among gardeners than any other topic. It is a field of great experimentation, and there are almost as many potting mixes as there are gardeners. What works for one person may not for another because of varying conditions. One rare point of agreement is that potting mix is not the same as soil. **DO NOT** put garden soil into pots; it almost never works.



The ingredients of a bromeliad potting mix are not important, only the results are: the mix must be acidic, hold moisture, and yet be sufficiently coarse-textured to drain rapidly and provide aeration. Bromeliad roots

quickly suffocate in a tight or saturated medium. Cymbidium mix (1:1:1 orchid bark:coarse perlite:humus) is good for almost all bromeliads that tolerate being potted. Other commonly used ingredients are pumice, lava rock, charcoal, coarse peat or sphagnum moss, and tree fern fiber.

Whatever mix is used, fill the whole pot with it. A layer of much coarser material such as gravel or pot shards on the bottom will impair drainage, not improve it. (Water cannot move downward past a sharp boundary layer between media of very different textures until the upper layer is saturated. Saturation is exactly what you want to avoid.)

Pot type is relevant to climate and individual cultural habits. People who grow their plants in very humid climates or tend to overwater may gain an advantage by using porous clay pots or baskets that allow the medium to breathe and dry out quickly. The opposite is true for people who neglect plants or who live in arid climates; they should use plastic or ceramic pots because they hold moisture longer. Keep in mind that a plant in a house with air conditioning and forced air heating is in an arid microclimate even if it is very humid outdoors.

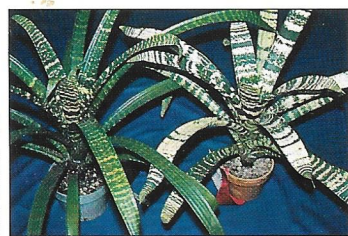
Pot size is important. Overpotted plants tend to stay too wet, encouraging rot. Most bromeliads have small root systems. They should be grown in pots much smaller than would be used for other plants of the same size. A four- or six-inch/10-15 cm pot is appropriate for a single plant of most species. If a plant in the correct pot size is unstable, put the pot into a larger, heavier one, wedging it in if necessary.



MOUNTING. Many bromeliads can be mounted on pieces of wood or any nontoxic substrate that will last for several years. Use wood that is naturally resistant to decay, such as cork bark, manzanita, cedar, or grape; **do not use treated wood.** For most species a layer of moss or other water-holding medium is not necessary. It can harm some of the more arid-adapted species. (The moss commonly seen on tillandsias in stores

is cosmetic – it conceals the glue.) Neoregelias do benefit from moss; smaller plants result without it even in humid climates. *Tillandsias* and *aechmeas* are especially recommended for mounting. It should be noted that mounted plants need higher humidity and more frequent watering than potted ones. In dry air mounted plants may fail to develop sufficient roots to attach to the substrate and may suffer from dehydration of the foliage.

There are at least three good ways to fasten plants to their supports. The most time-consuming but permanent method is to tie the plant with nylon monofilament (fishing line) or strips of nylon stocking. Tie it so firmly that the plant cannot wiggle, or new roots will be broken before they can attach to the wood. This method is difficult with single plants that lack any basal stem.



Plants can be fastened to the substrate with **nontoxic**, waterproof glues; hot glue and Liquid Nails™ are commonly used. However, these tend to let go within a couple of years, especially if the plants are soaked in water.

Adhesives containing the ingredient combination of toluene, VM, and P naphtha (Tilly Tacker™, Shoe Goo™ and Plumber's Goop® are some brand names) are completely waterproof and will not let go. Use just enough to fasten the plant; don't bury the base of the stem in glue, or the roots can't grow through it.

Plants with thick, woody stolons can be stapled or nailed onto the wood. Nails can be driven through thick stolons; staples straddle thinner ones. Use two nails to keep the plant from swivelling.

FEEDING. Summary: Feed bromeliads frequently with dilute, water-soluble fertilizer, about one-eighth to one-quarter the rate specified on the label.

“Air plants” do not live on air. They require the same nutrients as all other plants: nitrogen (N), phosphorus (P), and potassium (K) in large amounts (macronutrients) and several other minerals in tiny quantities (the micronutrients). The three numbers in a fertilizer formula (e.g., 30-10-10) represent the amounts of the three macronutrients in the order N-P-K. A fertilizer that contains all three is said to be complete. Epiphytic bromeliads differ from plants that grow in soil in that they absorb minerals mostly through their leaves instead of their roots. In nature, the rosettes collect dust, fallen leaves, bird droppings, and rain, all of which contain nutrient minerals. In addition, the water in bromeliad tanks often contains cyanobacteria (blue-green algae), which convert gaseous, elemental nitrogen from the air to nitrogen compounds that plants can use. In cultivation, most of these sources of nutrition are absent, so bromeliads should be fed at regular intervals.



Use a complete, **water-soluble** fertilizer, and drench the potting medium, foliage, and central reservoirs with it. The fertilizer should be acidic; unfortunately, many brands do not clearly label this property. It is also important that most of the nitrogen is in the form of ammonium or nitrate and not urea; urea cannot be absorbed by leaves, and can sometimes damage bromeliads. (Soil bacteria are necessary to convert urea

into usable forms of nitrogen.) Fertilizers with dye may stain gray-leaved plants. Slow-release fertilizers can be added to the potting medium in addition to or instead of foliar feeding. Tank bromeliads can be fed exclusively through the roots.

Most growers recommend using one-eighth to no more than one-half the concentration in the manufacturer's directions, as full strength may damage the plants. Overfertilizing (particularly too much nitrogen) causes loss of foliage color in bromeliads and other plants. Neoregelias are very susceptible to such greening; so are some variegated cultivars of neoregelia and other genera. Too much fertilizer can also produce overgrown rosettes with poor form. If a plant gets leggy or loses foliage color, give it more light and/or less fertilizer. Excessive foliar feeding promotes growth of unsightly algae on the leaves, especially on scaly species.



PROPAGATING. In most bromeliad species, the plant slowly dies after blooming, but produces one to several offsets or "pups" as it is declining. Some kinds survive several years after blooming and form

attractive clumps of progeny, becoming more attractive with age. Propagation of these is seldom necessary except to share a plant with friends. Others look best as single plants, in which case pups should be removed from the mother plant and established on their own. Pups are able to survive independently when they are at least one-third the size of the mother plant. Often they are beginning to grow their own roots at this size.

The method of removing pups depends on the species and its growth habit. Some are easily popped off by grasping the pup at its base and **gently** twisting and pulling it away from the mother. Some are very firmly attached and need more forceful means. Don't pull or twist very hard; there is a risk of crushing or breaking the meristem (growing point) near the base and the pup may die. Pull tightly attached pups partly away from the mother plant, then cut through the attachment with a sharp knife or pruning clippers. Some really tough species may require a hacksaw or chisel. If the pup is borne on a long stolon, cut through the stolon with pruning clippers. Some bromeliads produce plantlets on the flower spike; these can be twisted off easily when they are ready to survive on their own.



Offsets of some bromeliads are enclosed in dry, hard, leaf-like scales. The new roots can emerge more easily if these scales are carefully peeled off. In cool or wet climates it is a good idea to treat the cut with

dusting sulfur or other fungicide. If the pup has few or no roots, it is tempting to pot it deep to keep it from falling over. This procedure may cause the plant to rot, especially in humid conditions. Bury the base of the pup no more than one inch/2.5 cm, and brace it with rocks or stake it if necessary until the roots can hold it in place. Keep the new plant in a shadier, more humid location for a few weeks while the cuts heal and new roots begin to grow. Keep the medium rather dry during this time. (If the medium is wet, the plant has no stimulus to grow roots, and the wound may become infected by fungus.) Do not fertilize until the plant is firmly rooted.

Under good growing conditions most bromeliad pups will mature and flower in one to two years after the mother plant flowers. Even in a small collection there will thus be plants in bloom almost every year.



RELUCTANT FLOWERS; FORCING THE ISSUE. Plants in marginal growing conditions may look good but may not flower. Some species are notorious for being shy bloomers even under optimum conditions. Increasing the light level and greatly reducing fertilizing often triggers flowering.

If a plant still won't flower, or if you want one to bloom out of season, bromeliads are easy to force. Ethylene, acetylene, and related gases induce flowering in nearly all species. A source of ethylene is ripening fruit, especially apples. Enclose a plant that is at least half its full size in a plastic bag with half an apple for a week, and then remove it. The plant will bloom in one to three months, depending on the species. Experimentation will enable you to time it to your desires. Be aware that smaller plants produce smaller spikes, and a few kinds fail to develop color when forced.

Billbergia



B. Catherine Wilson TOR

Members of the genus *Billbergia* can usually be recognized by the form of the rosette, which has only a few leaves and is most often tubular (cylindrical), or at least narrowly vase-shaped. The spine-edged leaves are often spotted or banded with complex patterns of bright colors, especially the newer hybrids. Many have spectacular inflorescences, but they are rarely grown for that reason because they stay colorful for barely two weeks. Form and foliage colors are the billbergias' claim to glory.

A few of the ca. 60 *Billbergia* species have broad funnellform rosettes and are difficult to distinguish from *Aechmea*. In addition to the spineless sepals, nearly all billbergias have pendent inflorescences, and the long, strap-shaped petals are often recurved or coiled.

Billbergias are highly recommended for beginners. They have extraordinary form, and the newer hybrids are stunningly colorful.

They are also among the easiest bromeliads to grow. Try them in hanging containers because they tend to look their best when viewed from below. Light shining through the leaves from above makes them particularly beautiful, and the pendulous flower spikes will be easy to see.



B. rosea MAD

LIGHT. Billbergias need high light to develop good color and form; in too little light the erect leaves of the tubular types become excessively long and may break. Outdoors or in a greenhouse, 50% to 65% shade cloth is recommended for sunny climates, which translates to 3500 to 5000 footcandles; they can acclimate to about 9000 footcandles (almost full sun) with high humidity. In windows indoors, give them about 3000

footcandles; more sun may burn the foliage.

TEMPERATURE. Billbergias tolerate temperature extremes; they are not damaged by several degrees of frost (ca. 25°F/-4°C) or periods at 115°F/47°C. (For specialists: the helicoid group suffers below about 40°F/5°C.) At very high temperatures and high light, foliage color and contrast fade. No permanent damage is done; color returns with more moderate temperatures.

AIR. Follow basic culture.

WATERING. Follow basic culture.

B. distachia x straussiana DB



POTTING AND

MOUNTING. Follow basic culture. Billbergias do well mounted as well as potted. Either way they form beautiful colonies in a few years.

FEEDING. Follow basic culture. Overfertilizing

ruins foliage color and plant form; the plants will produce elongated leaves that are prone to break.

PROPAGATION. Billbergia pups are usually produced on thick, very tough stolons. When the stolons are very short, considerable effort is needed to separate pups from clumps. See suggestions under *Aechmea*.

Cryptanthus



C. 'Kitt Hilbers' BW

The genus *Cryptanthus* consists of about 50 terrestrial species commonly called earth stars because of their shape. The plants have low-spreading rosettes of six to 20 leaves. The succulent, usually tooth-edged leaves may be spoon-shaped, lance-shaped, or triangular, from three to twelve inches/8-30 cm in length. Most are in the three- to six-inch/8-15 cm range. They are usually strongly banded or frosted with gray, white, or bronze, and many cultivars have a pink to red background color. The various hybrids show a rainbow of colors, and the most popular cultivars have very elaborate banding with sharp zigzag patterns. The white (sometimes light green or pink) flowers appear in the center and from between the leaves, a few at a time. The plants usually offset freely, making large clumps in time. They are so popular that there is a separate *Cryptanthus* Society affiliated with The Bromeliad Society.

LIGHT. About 2500 to 3000 footcandles of light is appropriate for most, which translates to 55% to 75% shade cloth in sunny climates. With too little light, foliage color and strong markings fail to develop. At the other extreme, too much light bleaches foliage colors. They do well on patios where the area is lit by morning or afternoon sun but not directly on the plants. The colors change with the seasons and amount of light.



C. Black Prince BW

TEMPERATURE.

Cryptanthus tolerate a temperature range from 40°F/4°C to over 100°F/38°C. Optimum growth occurs between 60-85°F/15-30°C.

AIR.

Follow basic culture.

Cryptanthus prefer at least

moderate humidity and perform well when grown on or near the ground among ferns or begonias, or close to ponds.

WATERING. Keep the medium moist at all times. *Cryptanthus* suffer if they dry out for extended periods.



C. bivittatus 'Ruby' VLS

POTTING AND

MOUNTING.

Cryptanthus are true terrestrials; they do not absorb water or nutrients through their leaves. They develop strong root systems and are not suitable for mounting. They prefer a

more water-retentive medium than most other bromeliads, but it still must drain rapidly. Do not underpot; at least a five- or six-inch/13-15 cm pot is recommended. Use a loose, porous medium rich in peat moss or other organic material.

FEEDING. They respond well to generous fertilizing. Growers recommend adding slow-release fertilizer to the potting mix and feeding with liquid fertilizer as well.

PROPAGATION. Offsets of some cultivars may be a little reluctant to establish. Propagate in spring or summer. It helps to remove the dry, rudimentary leaves at the base of the pup in order to expose the tiny root buds.

Dyckia



D. fosteriana TOR

Dyckias are characterized by clustering rosettes of tough, succulent leaves, usually with vicious spines. Some of the 100 species have green leaves, but most have dense coverings of scales that make the foliage gray-green to silvery white. In nature, plants typically grow on rocks in sunny, semiarid habitats. Small, bright orange or yellow flowers are borne on tall, unbranched spikes.

LIGHT. Most species need very high light, at least 5000 footcandles. The species with leaves that look white such as *D. fosteriana* and *D. marnier-lapostolle* can take full sun even in the desert. They can probably acclimate to hot, sunny windows.

TEMPERATURE. Ideal temperature is in the high 80s°F/low 30s°C or higher during the summer. Growth will be normal but slow at lower temperatures. Many are hardy to at least 15°F/-9°C.

AIR. Follow basic culture.

D. marnier-lapostollei MAD



WATERING. Contrary to what one might expect from their appearance, these plants love water. They will tolerate months of drought, but most species receive plentiful water during the growing season. One cultural

practice is to place the pots in shallow trays of water during the summer. Bottom watering is especially useful when a plant fills the pot so tightly that top watering is difficult.

Water quality does not seem to be important. Hard water neither spots the leaves nor harms the plants in any other way. Water that is high in salts, though, should probably be avoided on general principles.

POTTING. Dyckias, being true terrestrials, can tolerate heavier potting mixes than most other bromeliads. Use either the same mix as for other bromeliads, or a cactus/succulent mix.

FEEDING. No special requirements. They respond with more vigorous growth to fertilizer and the plant form does not suffer as long as there is adequate light.

D. platyphylla VLS

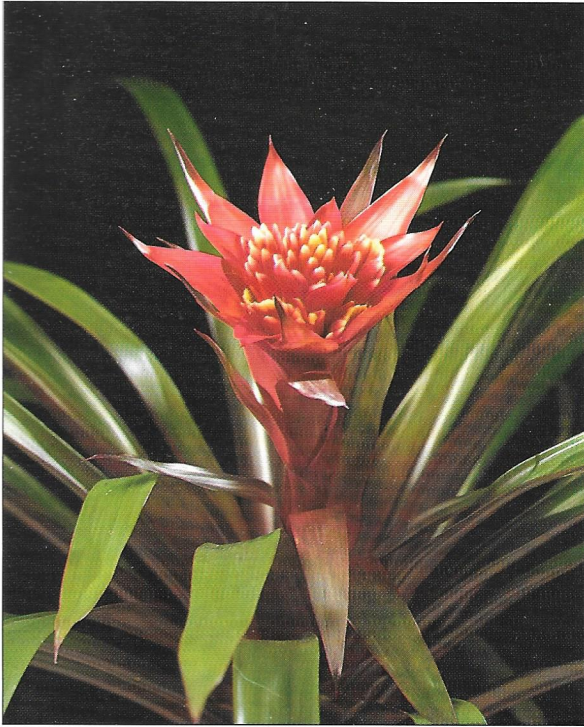


PROPAGATION.

Propagation is not technically difficult but can be a physical ordeal for the grower because of the terrible spines. Use of gloves and a chisel are recommended. Offsets of some species are difficult

to establish and may take months or longer to regain vigor. It is best not to divide plants until absolutely necessary.

Guzmania



G. 'Decora' KBN

Guzmania has more than 150 species, nearly all tank-forming. Some have colorful leaves, but most are shiny dark green. Their inflorescences are their most desirable asset; these may be compact heads or elongated spikes resembling fountains. Color may develop in large primary bracts, the central leaves, the flowers, or all of these. A flowering plant remains colorful for many months.

Most guzmanias grow in montane tropical forests in wetter, cooler, shadier habitats than most other bromeliads. They need more care but can grow well if one pays attention to their needs. Many hybrids are adapted to the home environment.

LIGHT. Guzmanias can adapt to darker conditions than other bromeliads. Many will do well at 1000 to 2000 footcandles. For this reason they do especially well in the low light of most homes.



G. conifera BSI

TEMPERATURE. Many guzmanias do not tolerate extreme summer heat, especially sultry nights, but others do. Night temperatures of 60-68°F/16-20°C are ideal for most.

AIR. Follow basic culture.

WATERING. Water quality is very important for guzmanias. They are extremely intolerant of hard, alkaline, or salty water. Flush the water in the center with bottled or rain water

frequently and the plants should do well.



G. zahmii variegated KBN

POTTING. The potting medium must be acidic. A 1:1 mix of coarse peat moss and fir bark produces good results. The addition of some dolomite lime to provide

needed calcium and magnesium is also recommended (only a little – it's alkaline).

FEEDING. Use an acidic fertilizer without boron, zinc, or copper micronutrients. Add slow release fertilizer to the potting mix. Use liquid fertilizer only if very dilute.

Neoregelia



M. Painted Lady TOR

This genus of more than 100 species is most easily recognized by the absence of a conspicuous flower spike. The flowers barely rise above the water in the central cup. The foliage compensates for the lack of showy flowers; the species and especially hybrids display an incredible diversity of leaf colors and patterns. Even those with plain green leaves usually turn brilliant pink, purple, or red at flowering time. In today's cultivars the leaves are frequently mottled, spotted, banded, or striped in glowing pastels even when young. Most varieties have broad, funnel-shaped rosettes which display the foliage colors superbly.

LIGHT. Give neoregelias very bright light. At least 3500 footcandles is recommended to produce good foliage color and compact rosettes; 5000 footcandles is better, and some develop best color in nearly full sun. Outdoors, 30% to 65% shade cloth is recommended for sunny climates. Variegated types are an exception; give them considerably more shade.

TEMPERATURE. Though many are hardy to 20°F/-7°C or less, frost protection is recommended. High temperatures do not harm the plants, but foliage color fades when nights are hot. Normal color returns when night temperatures drop to near 65°F/18°C.

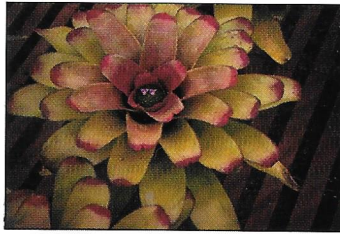
WATERING. Follow basic culture.

AIR. Follow basic culture.



N. 'Fireball' VLS

especially the stoloniferous, colony-forming ones. Those species are also good for hanging baskets, where numerous generations of plants may cascade several feet.



M. Green Apple OH

POTTING AND MOUNTING. Follow basic culture for potting. Most neoregelias are grown as single plants in order to display their symmetrical rosettes of colorful foliage. Some species do well as mounted specimens,

FEEDING. Proper application of fertilizer is crucial for producing good quality neoregelias. Heavy feeding causes colorful foliage to turn green. It also produces large, elongated rosettes that are less attractive than

compact ones. Feed your plants only for the first several months after separation from the mother plant (during the summer and fall) to produce good size, then little or none from early winter through flowering the next spring. Fertilizing very lightly year round or not at all is also satisfactory; your plants will be smaller, but will have good form and color. The important rule is not to fertilize heavily as the plants near maturity. High potassium fertilizers seem to produce better conformation.

PROPAGATION. Follow basic culture.

OTHER RECOMMENDATIONS. In order to grow show-quality neoregelias, maintain them under the same conditions throughout their pup-to-bloom cycle. Their beautiful, tight symmetry can be ruined by a substantial change in light intensity, light direction, temperature range, or feeding. If grown in a window or other location with light from the side, frequent rotation (at least a quarter turn per week) will keep the rosette upright.

Tillandsia

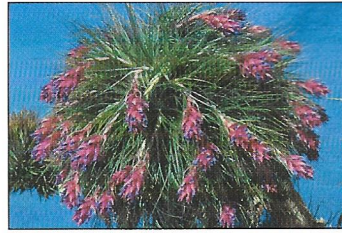


T. streptophylla TOR

Tillandsia is the largest genus in the family, with 550 known species and more being discovered frequently. They are typically gray-leaved plants native to bright, semiarid habitats; most do not hold water in their centers. The culture described here is for these atmospheric types; for the soft-leaved tank types, follow the culture for *Vriesea*.

Instead of symmetrical rosettes of leaves, some tillandsias have twisted, undulating, or curled leaves. Others have succulent leaves, or form hollow bulbous structures at the bases of the plants. Still others develop long, almost vinelike stems. Much of the appeal of this genus is due to these strange growth forms.

The inflorescences range from barely visible with the flowers nestled among the leaves, to long, multibranching spikes. The foliage of the spikeless species often turns red at flowering time. The spikes are frequently very colorful and may be either round or flattened. The showiest parts are usually the pink, red, or lavender bracts enclosing the flowers. A number of species have large flowers that may be of almost any color, and those of several species are fragrant. Flowering of some species lasts only a couple of weeks; others remain colorful for several months to a full year.



T. stricta MAD

LIGHT. The light requirements of tillandsias can usually be deduced from the foliage. The harder or thicker the leaves and the more gray their color, the more light they need. The thick-leaved, gray- to white-leaved

species can tolerate full sun in humid climates, but 4000 to 7000 footcandles is recommended for best appearance. The green and gray-green, softer-leaved species need less sunny conditions, 2000 to 4000 footcandles. Experiment by moving the plants each season until you determine what they prefer in your area.

TEMPERATURE. The commonly available tillandsias are tolerant of a wide range of temperatures, from above 100°F/38°C to freezing. Most must be protected from frost though some are hardy to 20°F/-7°C.

AIR. Atmospheric tillandsias are less tolerant of dry air than are tank bromeliads. Without the water storage reservoir to draw from, the plants tend to dehydrate in the dry air of most homes. They can still be grown well indoors if proper watering is practiced. Outside, a minimum humidity of 50% is recommended though you can compensate for drier conditions with more frequent watering.



T. ionantha MAD

WATERING. Water by drenching to the point of runoff whenever the whole plant is dry. The frequency may range from daily to less than twice a month, depending on temperature, air circulation, humidity, and

the size of the plant. When checking for dryness, look at the leaf bases and the interiors of clumps. Plants are prone to suffocate and rot if any part is kept wet for long periods. Misting is not recommended; it does not supply sufficient water for indoor plants, even if done daily.

In the dry air typical of most homes tillandsias tend to become dehydrated. Common symptoms of excessive water stress are wrinkled, flaccid, or rolled leaves. Drenching will seldom reverse such dehydration; the plants should be soaked by immersing them in water overnight (not more than 12 hours). Soaking about every two weeks will maintain healthy indoor tillandsias.

Water quality is not important for most tillandsias. The scaly leaves of most species tend not to show salt spots from hard water, nor does acidity seem to affect them. The miniature species are notable exceptions; those smaller than *T. ionantha* (about one inch/ 2.5 cm) tend to become calcified by hard water and gradually deteriorate and die.

POTTING AND MOUNTING. Most tillandsias grow well when mounted on wood or other decorative background as described in the basic culture section. Many will also grow well hanging on strings with no substrate, where they may form perfect spheres. It is less aesthetic but equally acceptable to the plants to place them on an open mesh tray that permits air circulation from below.

Species with symmetrical rosettes generally can be grown in pots, where they tend to grow much larger than if mounted. Those with irregular rosettes of twisted leaves and those with white (very scaly) leaves tend to occur in more arid habitats and generally do poorly in pots. Their roots are adapted to exposure on tree branches or rock surfaces; they require plentiful fresh air.

FEEDING. *Tillandsias* will survive with no fertilizing but will grow very slowly and flower less often. For larger, more vigorous plants, feed at least once a month. Adding a small amount (one-quarter teaspoon per gallon) of fertilizer to the water used for soaking takes care of two chores at once.

PROPAGATION. Most tillandsias produce basal offsets after flowering as the mother plant is dying, but there are a number of variations. Some branch near the top of the stem, or produce offsets on the inflorescence. Others begin to offset and form clumps before flowering. The mother plant may live for years after flowering.

Many species of *Tillandsia* improve with age. They can grow to become large clumps, forming spheres of distinctive foliage and spectacular showers of flower spikes. Such plants need to be propagated only in order to share with others, or when the clump eventually decays at the center and falls apart.

Vriesea



V. Tiffany KBN

The genus *Vriesea* is known primarily for spectacular inflorescences among its 250 species. Although it is very closely related to *Tillandsia*, the plants are usually very different. Most vrieseas are tank bromeliads with soft, shiny (nearly scaleless), yellow-green to dark green leaves. Many have foliage that is red or strikingly marked with intricate patterns of bands or translucent windows. The mostly sword-shaped (strongly flattened) flowering spikes vary from single to many-branched. The bracts are usually colored brilliant red or yellow and last several months. Bicolored and multicolored spikes are common. Many hybrids have been produced; these cultivars are vastly superior in color and ease of culture to most of the wild species.

Just as some tillandsias are green, tank-forming plants, some vrieseas are gray-leaved, atmospheric epiphytes. Give these gray species tillandsia culture. The instructions in this section are for the soft-leaved, tank vrieseas.

LIGHT. Vrieseas adapt to a wide range of light conditions from fairly deep shade (guzmania conditions) to nearly full sunlight (neoregelia conditions), a range of 1500 to 8000 footcandles. At higher intensities plants require high humidity to prevent burning. The best growth is obtained between 2000 and 5000 footcandles. In sunny climates 60% to 70% shade cloth is recommended.



Hohenbergia has about 30 species. The leaves of some are beautifully marked; most have plain inflorescences. Give them aechmea culture except that they need more protection from cold and prefer lower light, 2000 to 4000 footcandles.



Nidularium is a small genus; the appearance of the plants is intermediate between guzmanias and neoregelias. The headlike inflorescences of most rise only slightly above the foliage. Give them the same culture as guzmanias; they can tolerate even less light and lower temperatures.



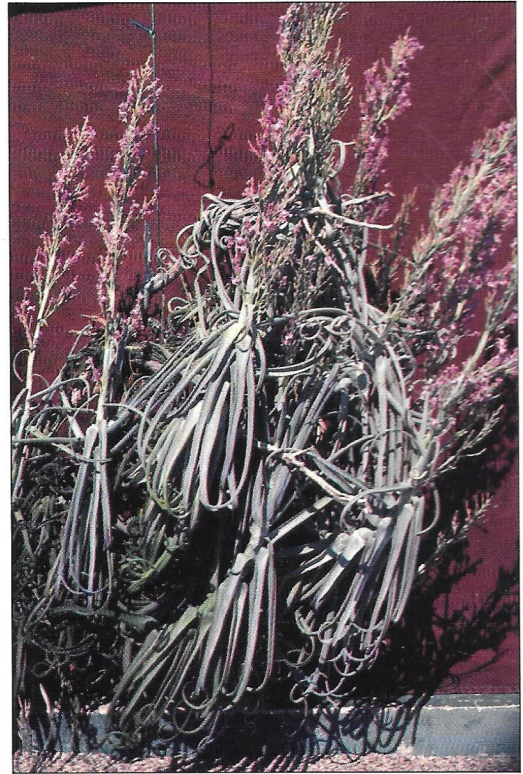
Orthophytum resembles a cross between *Dyckia* and *Cryptanthus*. They have rosettes of a few, spiny leaves. Some of the 20 species have beautiful leaf banding. When they flower, the stem of most species elongates,

stretching the leaves up with it. The flowers are insignificant. Culture as for cryptanthus, but they are hardier, many to the low 20s°F/ca. -6°C when protected by a light covering such as shade cloth.

Puya is a genus of terrestrial species mainly from high elevations. Many of the species are large, to six feet or more across. They can be grown in the ground in cool climates. Most are intolerant of hot weather. The flowers of some species are metallic blue or green. There are a few heat tolerant dwarf species; give these kinds dyckia culture.

Streptocalyx is another small genus somewhat resembling aechmea. Give them the same culture, except that most species will deteriorate rapidly if the temperature falls below 40°F/5°C.

WHAT ELSE IS THERE?



Tillandsia duratii var. *saxatilis* MAD

This booklet is only an introduction to a big subject. If you get hooked on bromeliads, there is much more to learn and many more kinds to collect. The 2500 species encompass a universe of forms, from tiny plants that look like moss to 20 foot giants that take half a century to flower. Their habitats range from steamy sea-level rain forests to chilly cloud forest to the edges of deserts. Some are as challenging to grow as they are fascinating, such as the weird species from the lost world of Venezuela.

The simplified culture given here, while adequate to get you started, omits far more than it includes. There are innumerable tricks of the trade that adventurous growers have discovered will improve the quality of plants, such as specially designed lights, epsom salts, and wick watering. Most collectors are eager to share their successes while they continue to experiment. The final word on how to grow the best bromeliads is not yet written.

The 1991 compendium of hybrids and cultivars lists more than 4500 kinds. Serious bromeliad hybridizing has been going on for only about 40 years, compared to over 100 years for orchids. The rate of improvement, manifested by the number of superior new varieties released each year, is impressive. The future undoubtedly holds many delights.

FURTHER READING

Beadle, Don, comp. 1991. A preliminary listing of all known cultivar and grex names for the Bromeliaceae. Sponsored by The Bromeliad Society, Inc. 248 pp. Order from Sally Thompson, BSI Publication Sales, 29275 N.E. Putnam Rd., Newberg, OR 97132. \$20.00 U.S. 3rd class and Canada & Mexico surface mail; all other countries \$24.00 surface mail.

Benzing, David H. 1980. The Biology of Bromeliads. 305pp., illus. Eureka, CA: Mad River Press. ISBN 0-916422-21-6. A comprehensive treatise on how bromeliads live, grow, and reproduce, with a chapter on cultivation. Very technical, but understandable by the intelligent nonscientist.

Duval, Leon. The Bromeliads. English ed. by Michael Rothenberg & Robert W. Read. 154 pp., illus. Pacifica, CA: Big Bridge Press, 1990. U.S. distributor: Big Bridge Press, 2000 Highway One, Pacifica, CA 94044; overseas distributor: Universal Book Services, Dr. W. Backhuys, Warmonderweg 80, 2341 KZ Oegsgeest, Netherlands.

Isley, Paul T. III. 1991. Genus Tillandsia; the world's most unusual air plants. Rev. ed. 22 pp., color illus. Gardena, CA: the author. Order from Rainforest Flora, Inc., 1927 W. Rosecrans Ave., Gardena, CA 90249.

_____. 1987. Tillandsia; The World's Most Unusual Air Plants. 256 pp., illus. Gardena, CA: Botanical Press. ISBN 0-9617675-0-2. The most complete work to date on this genus. Large format with lots of big, excellent color photos and descriptions of about 60 common species. Also includes detailed sections on anatomy, biology, early explorers, and culture. A fine combination of reference and coffee table book.

Kiff, Lloyd F. 1991. A distributional check-list of the genus Tillandsia. 93 pp. Encino, CA: Botanical Diversions. Order from Botanical Diversions, 5404 Encino Ave., Encino, CA 91316. A fine reference for those who want to know which tillandsias grow where.

Luther, Harry, and Edna Sieff. 1994. An alphabetical list of bromeliad nominals. 62 pp. Published by The Bromeliad Society, Inc. Order from BSI Publications Sales, as above. \$10.00. A comprehensive list of valid scientific names and correct spellings.

Padilla, Victoria, comp. A Bromeliad Glossary. 72 pp., illus. The Bromeliad Society, Inc. Order from BSI Publications Sales as above. \$3.60.

_____. 1986. Bromeliads: a descriptive listing of the various genera and the species most often found in cultivation. New York: Crown Publishers. Order from Shelldance Nursery, 2000 Cabrillo Highway, Pacifica, CA 94044.

Rauh, Werner. 1979. Bromeliads For Home, Garden, and Greenhouse. English ed. by Peter Temple, 1985. ISBN 0-916-422-445. 431 pp. Poole, Dorset: Blandford Press. 1990 ed. in German only: 458 pp., illus. Stuttgart: E. Ulmer. ISBN 3-8001-6371-3. An excellent reference, with descriptions of several hundred of the most commonly cultivated species. Lots of color photos.