

Growing Orchids on Guam



James McConnell
and
Frank Cruz



**Agriculture
and
Natural Resources**



**College of Agriculture & Life Sciences
University of Guam**

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September, 1996

J. McConnell and F. Cruz
Horticulturists
College of Agriculture and Life Sciences.

Additional information can be obtained by contacting the Guam Cooperative Extension,
College of Agriculture and Life Sciences, University of Guam.
Telephone 735-2080. Fax 734-6842.

Issued in furtherance of Cooperative Extension Work, Acts of May 8, and June 30, 1914, in cooperation with the United States Department of Agriculture. Jeff D. T. Barcinas, Dean/Director, College of Agriculture and Life Sciences, Guam Cooperative Extension College of Agriculture and Life Sciences, University of Guam, UOG Station, Mangilao, Guam 96923.

This project was partially funded by USDA Special Grants Program for Tropical and Subtropical Agriculture Research Project # 91-34135-6136.

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Introduction

Orchidaceae is one of the largest and most diverse families of flowering plants with over 25,000 species. Orchid hybridization began in 1852; since then, hobbyists and growers have produced over 100,000 hybrids. There is great diversity in this family. Orchids range in size from a whole plant that is a fraction of an inch to others with 10 foot stems and 15 foot inflorescences. Some orchids produce only one flower at a time and others produce hundreds of flowers.

Within this family are plants with different growing requirements. Orchids have adapted to growing in many different climates and growing conditions. There are orchids that grow in every climate except those that are continuously covered by snow or that are hot, arid deserts. There are orchids that grow on rocks or on trees (epiphytes) and others that grow in the ground (terrestrials). Terrestrials have roots similar to other plants, but the roots generally grow just below the surface and do not penetrate deeply into the ground.

Orchids are not parasites like mistletoe or dodder (McConnell and Muniappan, 1993), which penetrates the bark of trees and takes nourishment from the tree. Orchids use trees only for support. Their specially adapted roots grow over the surface of trees or rocks and take nutrients and moisture from bird droppings, decomposed vegetation and rainfall. Orchids are independent plants that need some sort of support, as well as some light, water and nutrients. Many orchid species can be grown in the environmental conditions found on Guam. However, it is best to select species that are adapted to our climate. Once the species is selected, the proper location, and management practices can be determined. This booklet covers much of the basic information needed to grow orchids on Guam.

Where Orchids Grow

It is helpful to know where orchids are found in nature. The majority of orchids are epiphytic. Other types are terrestrial, lithophytic, and climbing orchids. Figure 4 shows some examples of orchid habitats.

Epiphytic Orchids

Most tropical orchids are epiphytes, meaning that they grow on trees but are not parasites. They do not take nourishment from the tree. They have roots that are adapted to exposure to the elements. Orchid roots often grow on the exposed surfaces of pots or potting material. They need to be potted in materials other than soil. The medium should be well-drained and provide good aeration.

Terrestrial Orchids

Terrestrial orchids grow and flower on the ground. They are best grown in well-drained soil or peat-based potting mixes. There are only a few species of orchids adapted to terrestrial tropical lowlands. Most terrestrial orchids are found in temperate climates.

Lithophytic Orchids

These are orchids that grow naturally on rocks. There are not that many species although many epiphytic orchids can be grown in rocks.

Climbing Orchids

These orchids originate on the ground, but climb up into trees. They have aerial roots that cling to any support. Climbing orchids can be grown as epiphytes. These orchids are always monopodial and usually are grown in beds or on posts to which the roots attach. These orchids can grow to several meters, making them difficult to move once established.

Orchid Structures

Stems and Growths

Orchids have two basic growth habits: sympodial and monopodial. Sympodial orchids (Fig.1) have multiple growths that start from the bottom of the plant and grow to a certain length. The shoot stops growing and often flowers. At the base of the previous season's growth a new bud will form and develop during the next growing cycle. The bottoms of the growths form a creeping stem called a rhizome. Roots appear at points along the rhizome. The stems of many sympodial orchids have adapted into storage organs called pseudobulbs. These can be found in many different shapes and sizes depending on the species. Many species continue to use the pseudobulbs as storage organs even after dropping their leaves. Dendrobiums and other species will often flower on older pseudobulbs for several years. Some examples of sympodial orchids are *Cattleya*, *Dendrobium*, and *Oncidium*.

Monopodial orchids (Fig. 2) have unlimited terminal growth and continue to grow new leaves and inflorescences on the same stem. Many monopodial orchids are climbers. They will produce aerial roots which will attach to surfaces they come in contact with. Some examples of monopodial orchids are *Vanda*, *Phalaenopsis*, and *Renanthera*.

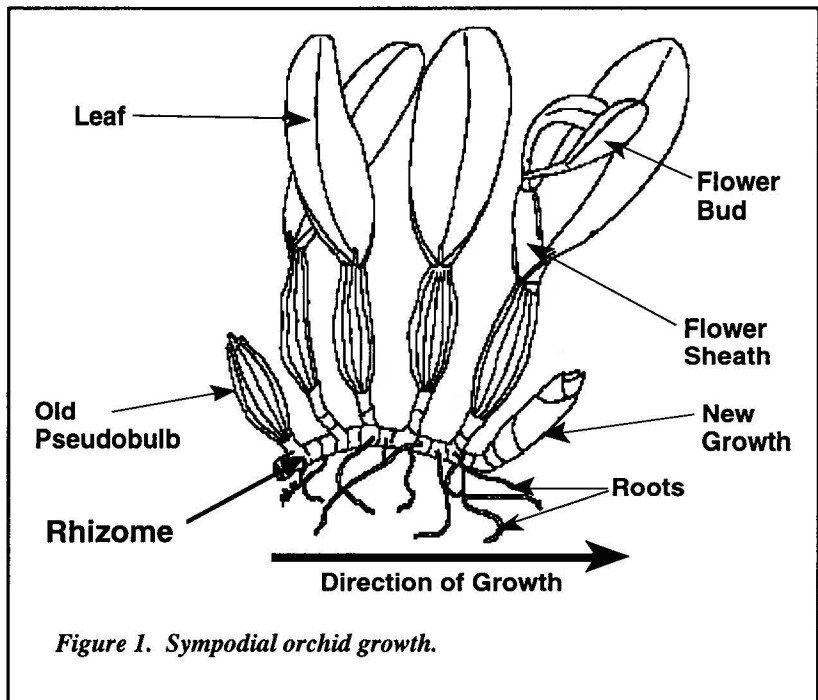


Figure 1. Sympodial orchid growth.

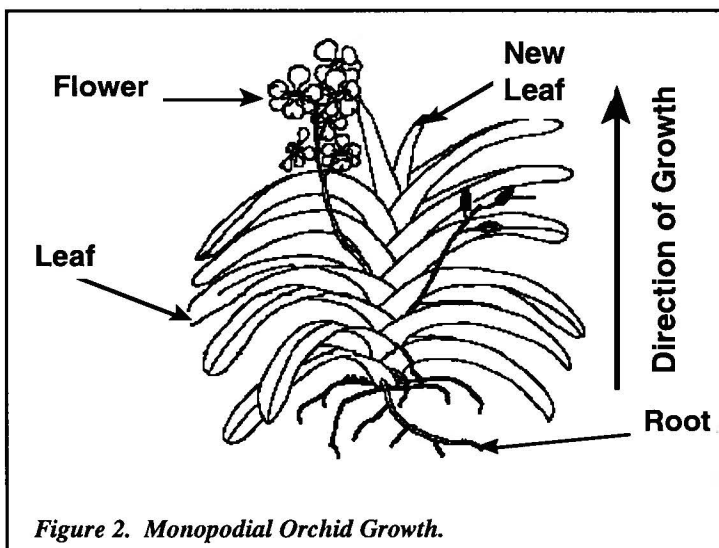


Figure 2. Monopodial Orchid Growth.

Leaves

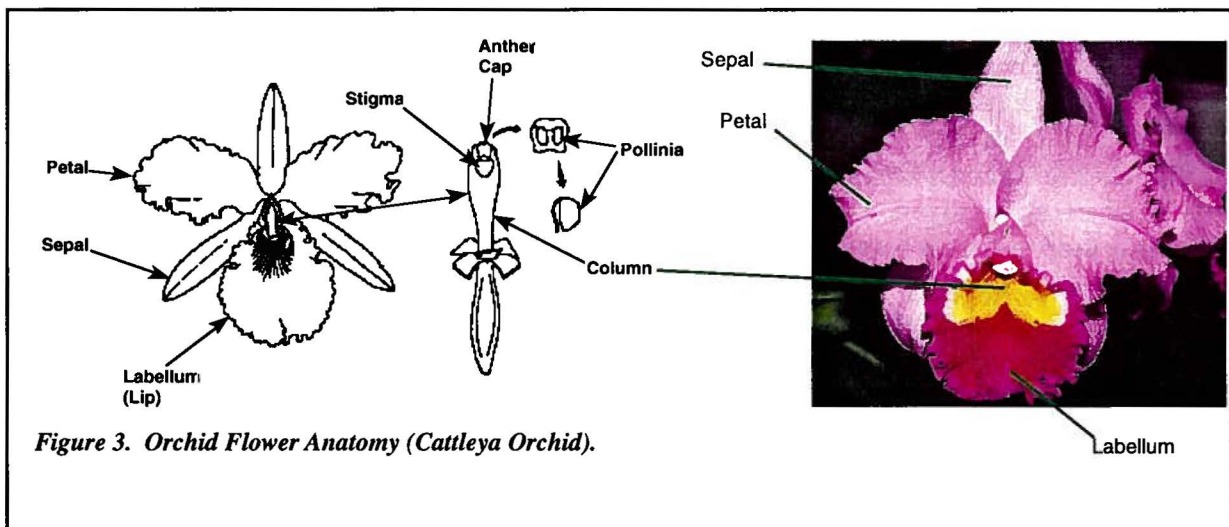
The leaves of orchids take many different shapes and sizes. Some species have leaves that mimic other plants. Orchid leaves can be tough and leathery or flexible and pleated. The shape of the leaf can vary in different species from flat (strap) to round (terete). Close observation of orchid leaves reveals that the veins run parallel along the length of the leaf. This is characteristic of monocots.

There are some orchids which are from areas that have periodic dry spells. These orchids have adapted by producing

fleshy pseudobulbs to store food and water. These orchids will lose their leaves during part of the year. They are referred to as deciduous orchids. Deciduous orchids are generally sympodial. One of the best known tropical deciduous species is *Dendrobium superbum* (hono hono orchid). Flowers of deciduous orchids are usually produced on the old pseudobulbs therefore pruning or removing old growths is not recommended.

Roots

Epiphytic and climbing orchids have unique roots. Most plants have root systems that are either fibrous or have a tap root plus a branched network of fine roots. These fine roots are covered with root hairs. Epiphytic orchid root systems are different and are roughly the same diameter throughout their length. Orchid roots that are exposed to air are covered with a white coating called velamen. Velamen is absorbent and spongy. The tip of an orchid root is green and is capable of photosynthesis. Orchid roots produce a sticky substance when they come in contact with a surface which allows the root to strongly adhere and cannot be easily removed without damaging the roots. Roots act as anchors along



the surfaces of trees. Roots can grow to lengths of several meters. Orchid roots are adapted to being in the open air. If they become waterlogged in a heavy or decomposed medium, they will rot. Terrestrial orchids have roots with root hairs and can tolerate damp conditions, however, they also do better with good drainage.

Flowers

Orchid flowers have developed many interesting mechanisms to help insure that they get pollinated. Some orchid flowers resemble bees or flies. All orchid flowers have 3 sepals and 3 petals, in some species the parts fuse so the individual parts are less obvious. Figure 3 shows the parts of a cattleya flower. The third petal is often a different shape and color than the other two petals. It is often larger or more showy. This different petal is called the lip or labellum. All orchids also have a thick clubby structure called a column. The column contains the male and female reproductive parts fused into one structure. Generally the tip has the anther that holds the orchid pollen. In orchids the pollen forms masses of pollen grains called pollinia. This mass of pollen insures that a large number of seedlings are produced. Below the anther is the stigma where the pollinia are deposited during pollination. Orchids may produce over one million seeds in one fruit.

Classifying Orchids—Plant Nomenclature

Scientific Names

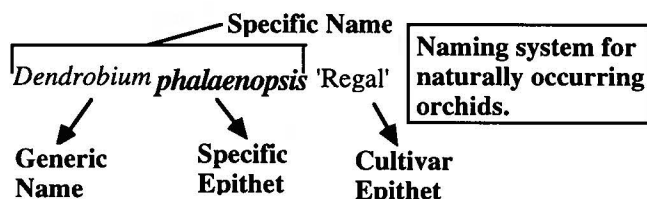
The scientific naming system is used to identify unique groups of plants. Related plants are grouped by certain similarities. Each lower level of classification has fewer members. An orchid hobbyist will only need to know a few of these levels to get started in understanding orchid nomenclature. The scientific naming of orchids uses different levels of classification. Plant nomenclature is used to give every unique plant a specific name. Table 1 shows the complete classification of a specific orchid. The nomenclature discussed here are the levels of classification most commonly used by orchid growers.

The scientific classification of an orchid:	
Class	Monocotyledon
Family	Orchidaceae
Sub-family	Orchidoideae
Tribe	Vandaeae
Sub-tribe	Sarcanthinae
Genus	<i>Phalaenopsis</i>
Section	<i>Zebrinae</i>
Sub-section	<i>Leuddemannianae</i>
Species	<i>violacea</i> (Most specific category)
The name of this orchid, as it would appear on plant label is: <i>Phalaenopsis (Zebrina) violacea.</i>	

Table 1 . Orchid nomenclature for plant classification.

The most general category is Orchidaceae. This is the Family name of orchids. The most specific category is the species. Traditionally, the definition of species is used to define the reproducing group. In general, plants and animals of different species cannot reproduce. Orchids are rather unique in that not only can species reproduce (interspecific hybrids), but there are also viable hybrids among genera (intergeneric hybrids).

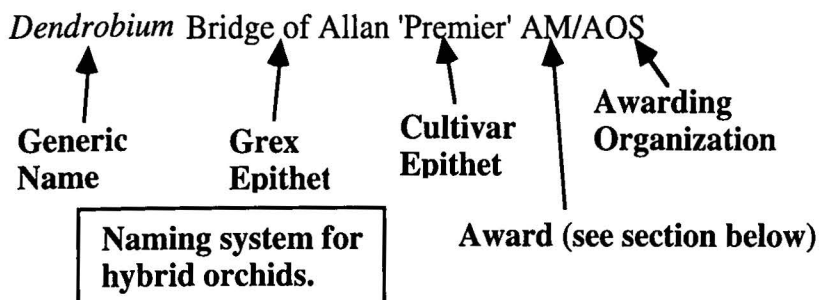
There are different naming systems for naturally occurring orchids and man-made orchid hybrids. For naturally occurring orchids, the generic name labels the genus. The plural is genera. Finally, the most specific category is the specific epithet that names the species. The genus and species names are written either underlined or in italics. Together the genus and species names are called the specific name. For example: *Cattleya skinneri* is the specific name of a cattleya species that is found naturally occurring in the wild. *Cattleya* is the genus and *skinneri* is the species. If you find a plant of *Cattleya skinneri* (or *Cattleya skinneri*) that you like because of its particular color then you can give it a special name called the cultivar epithet. Here is a labeled example:



When the orchid is a man-made hybrid, a different naming system is used. When orchids are produced from man-made cross pollinations, the offspring are given a hybrid name. The hybrid name is called the grex epithet. The seedlings from one fruit or seed pod may look different from one

another. When certain offspring of a hybrid are especially attractive they can be given a cultivar name. It is written in plain text but is capitalized. A unique individual plant is given its own special name called the cultivar epithet.

An example is:



Abbreviating genus names

The standard way of abbreviating a scientific name is to use on the first letter of the genus with the full specific epithet. For example *D. phalaenopsis* would be the abbreviation for *Dendrobium phalaenopsis*. For orchids, longer abbreviations are used: *Den. phalaenopsis*, *Phal. amabilis*. This is done because the orchid family is so large that it helps clarify which plant one is referring to. Otherwise it would be impossible to determine to which genus one is referring.

Intergeneric hybrids

When plants of two different genera are hybridized (cross-pollinated), a new genus is created and it is given a new hybrid generic name. An example is *Ascocenda* which is the bigeneric or intergeneric name for hybrids of the genera *Ascocentrum* and *Vanda*.

Up to three generic names can be combined in this way. The most common example is *Brassolaeliocattleya* (abbreviated *Blc.*). This is a complex hybrid of species from the genera *Brassovola*, *Laelia* and *Cattleya*.

Hybrids including three or more genera can have a name that ends with the suffix '-ara'. For example *Northenara* honors the author of several orchid books Rebecca Tyson Northern. *Northenara* is the generic name for hybrids of species from the genera *Cattleya*, *Epidendrum*, *Laelia* and *Schomburgkia*. It is abbreviated as *Nrna*.

Orchids with Awards

As orchids are successfully flowered, one will begin to notice that some are more interesting, beautiful and outstanding than others. Orchid societies have developed award systems for recognizing outstanding plants. The American Orchid Society has awards recognizing superior forms of species and hybrids. The flowers of individual plants can win three different awards. The highest award is given to species or hybrids receiving 90 points or more on a 100 point system. It is called the First Class Certificate and is abbreviated FCC/AOS. The AOS stands for the American Orchid Society. The Award of Merit (AM/AOS) is given to plants that score in the range of 80 to 89. They are of lesser quality than the FCC/AOS. The third class is the Highly Commended Certificate (HCC/AOS).

These awarding systems help growers choose the highest quality plants. Note that when a plant receives these awards their value increases. These awards will appear on labels following the name of the plant. For example, *Dendrobium phalaenopsis* 'Regal' AM/AOS. This plant received 83 points when it was judged.

There are awards specifically for rare and outstanding species (nonhybrids). This is the Certificate of Botanical Recognition (CBR/AOS). The Certificate of Merit (CHM/AOS) is awarded to a well grown and well-flowered species or natural hybrids. The Certificate of Cultural Merit (CCM/AOS) recognizes that a plant was grown well. The quality of an individual flower is not judged for the CCM/AOS.

It should be noted that while awards recognize high quality plants, this system does not identify plants that would necessarily be the best for commercial flower production. Choosing cultivars for commercial use requires additional considerations: the number of flowers produced, the frequency of flowering and postharvest qualities of the flowers.

For additional information on orchid nomenclature refer to Cribb et al. (1985). This book contains a complete description of the rules for naming orchids including a list of all the hybrid generic names. Hybrid orchids are registered with the Royal Horticultural Society in England. Recently registered hybrids are published in various orchid journals and there are books available that list all of the orchid hybrids registered.

Basic Needs of Orchids

Orchids can be grown anywhere if their cultural requirements are met. Understanding an orchid's natural growing conditions helps to determine the environmental conditions required. Different orchid species require different conditions. Certain species are more suitable for Guam. In choosing orchids, find genera that will grow in the conditions provided. For example, certain orchids such as cymbidiums require low temperatures to induce flowering. Orchids that require cool temperatures are not suitable to growing on Guam. Other orchids are adapted to growing for certain locations in a tree or on the

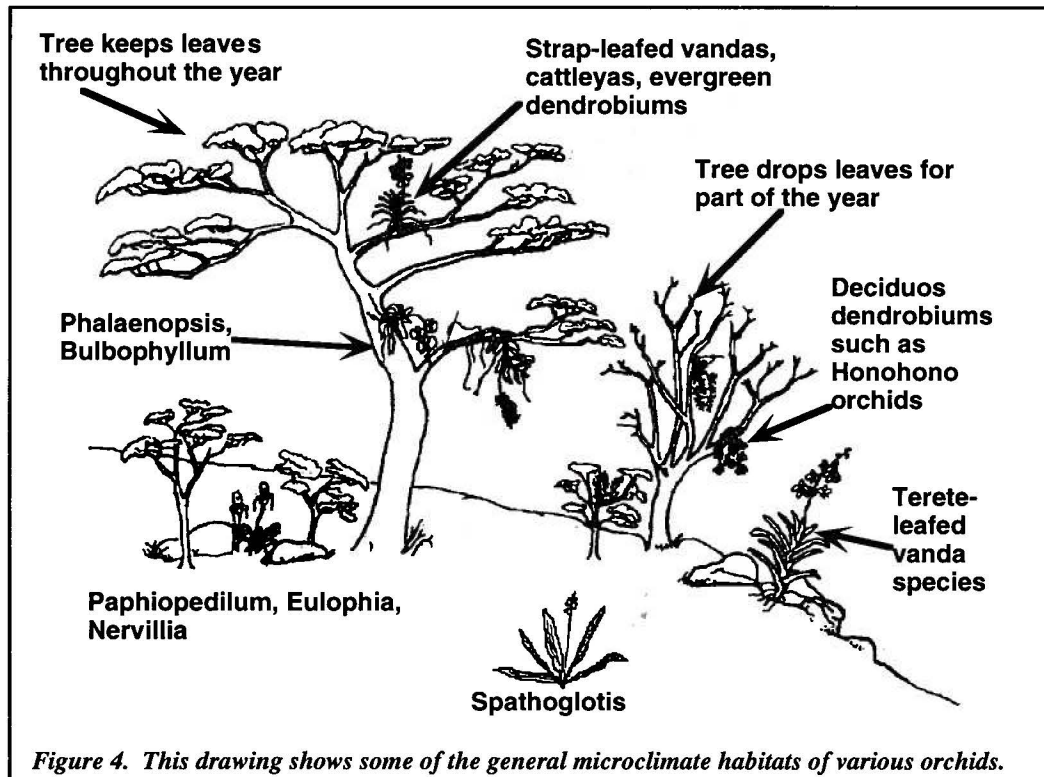


Figure 4. This drawing shows some of the general microclimate habitats of various orchids.

ground (Fig. 4). The following sections discuss some of the general growing conditions for orchids. Six factors are considered in this section: temperature, light, moisture, air movement, support (growing medium) and fertilizing.

Temperature

Many orchids require specific ranges of day and night temperatures. Orchid growing conditions are categorized into three temperature ranges: cool-, intermediate-, and warm-growing conditions. These are based on the temperatures that are found in the orchids' native habitat. Cool growing orchids, which include cymbidiums, odontoglossums, and paphiopedilums, grow best with day temperatures of 60°F-70°F and night temperatures of below 50°F. Intermediate temperatures are in the range of 65°F-75°F day and 55°F-60°F at night. Examples of intermediate orchids are some types of cattleyas, oncidiums, and dendrobiums. Warm-growing orchids prefer day temperatures of 70°F-90°F and night temperatures of 65°F-75°F. Warm-growing orchids include phalaenopsis, vandas and many dendrobiums.

The ranges are broad and there is much overlap between the categories. Temperature is the most important factor for getting orchids to flower. The orchids in the warm-growing category are most suited for Guam. Some in the intermediate category will also grow on Guam but may not flower every year.

Light

Light requirements vary with each species making it impossible to make general recommendations. A good rule to follow is to grow orchids in as much light as possible without injuring the plants. One must use caution when determining their preferred light levels. The light intensity needed will vary with different genera. Vandas and dendrobiums will grow in full sun to light shade, while cattleyas require more shade. The other extreme is the genus *Phalaenopsis* that requires far less light. *Phalaenopsis* are damaged by exposure to full sun. If one tries to grow phalaenopsis with cattleyas, the phalaenopsis will receive too much light which will bleach the green color out of the leaf. The leaf will first turn yellow, or if extreme, the leaf will burn and shrivel. Figure 5 shows dendrobium leaves with leaf burn. If the plants are grown in too little light, the leaves will be dark green and succulent. Plants grown in light that is of too low intensity will probably not flower. When increasing the light intensity, **do it gradually** to allow the plant to adjust to the brighter light. The right amount of light will result in leaves that are firm, with a light green color. These plants will tend to flower regularly. Finally, when the light requirements for a certain plant are not known, it is safest to place it at lower light levels and gradually increase the light.

When deciding on a location for plants keep in mind that the position of the sun changes through the year. A shaded area may get full sun exposure at another time during the year. An orchid that has been growing in the shade can be severely damaged if it is exposed to direct sun light resulting in sun burn .

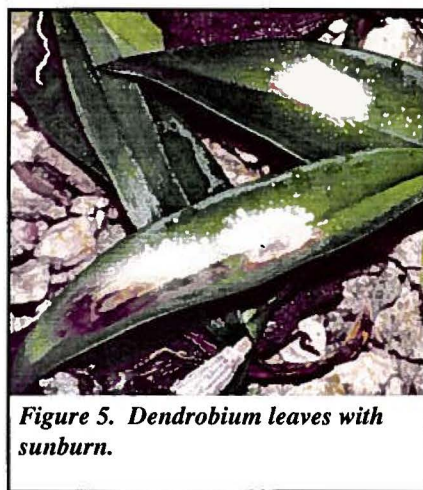


Figure 5. *Dendrobium* leaves with sunburn.

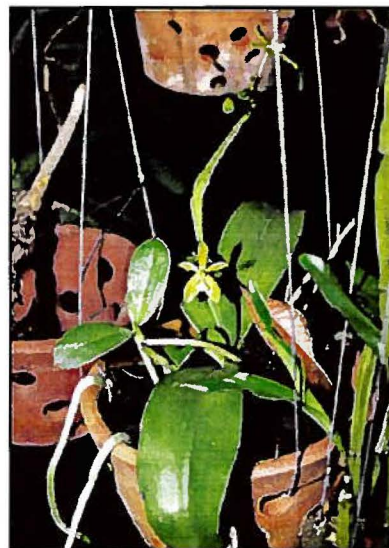


Figure 6. A *phalaenopsis* planted in a clay pot. Note the holes in the sides of the pot. These improve the aeration and drainage. The medium is charcoal.

Moisture and Air Movement

Orchids require a moist atmosphere but do not like to be kept constantly wet. Generally in their natural environment, orchids get frequent rains followed by drying breezes. They do better when allowed to dry slightly before getting watered again. Orchids prefer constant air movement. Some orchid growers consider positioning orchids for good air movement as the most important factor in successfully growing orchids. Air movement will reduce the possibility of bacterial and fungal diseases infecting the plants. It is important to grow orchids in conditions that allow them to get the best air movement possible (Fig. 6).

Support

Support is supplied by what the orchid grows on. Many orchids do not naturally grow in soil like other plants.

Orchid roots grow on the surface of the growing medium or support object. This can be a slab of wood, bark, coconut husk, a basket or other growing medium in a pot. The medium should provide a holding place for water and nutrients. The best support varies with the different genera and specific growing conditions.

Epiphytic orchid roots, in the wild, grow freely along the bark of a tree (Fig. 7). Orchid roots are adapted to growing in the open air. When you grow an orchid in a pot, the root exposure to air is restricted. A growing medium must be of a coarse nature producing large air pockets. This will help prevent rotting. Crushed rocks such as crushed limestone or the crushed basalt used in road construction are good materials. For potted plants, a coarse fir bark is usable, but it is best to improve the drainage and aeration by mixing with sponge rock (a coarse perlite). Make sure that the bottom of the pot is filled with coarse drainage material such as broken clay pots or small stones (1" pieces of rock). In beds, it is best to remove soil and fill the area with coarse rock (baseball size pieces). On top of this the orchids can be planted in coconut husk or 3/4" to 1" crushed rock.

Another option is to use no medium, supporting the orchid in an empty pot or against a piece of wood (Fig. 8). The support should be sturdy enough to hold the roots in place allowing them to grow onto the material. If tying to a tree, make sure that the roots come into contact with the bark. It is best to place a small pad of sphagnum moss or some other organic matter and wrap the roots and tree with coconut stipules (coconut cloth). This will hold sufficient moisture to allow the roots to get established onto the tree without excessive drying. It is most important to make sure that the roots are not dangling but rather are in contact with the bark of the tree. If the roots are physically separated from the bark, they will not attach to the tree.



Figure 7. Orchid species attached to mango trees.

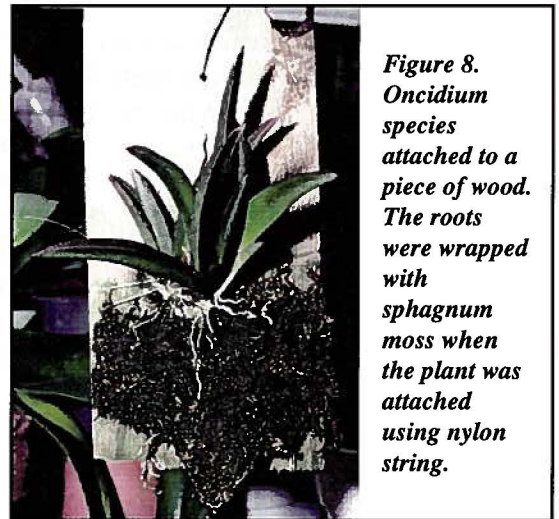


Figure 8. Oncidium species attached to a piece of wood. The roots were wrapped with sphagnum moss when the plant was attached using nylon string.

Fertilizing

Generally it is best to apply frequent applications of dilute fertilizer solutions. Water soluble fertilizers are best. Select a fertilizer that is specific for orchids. It is safest to apply fertilizer at half the recommended strength and double the frequency. For example, if 1 tablespoon (Tbs.) per month is recommended, apply 1/2 Tbs every other week. This precaution is needed because the best orchid growing media hold only small quantities of water and nutrients. Some genera are sensitive to high fertilizer rates. Seedlings need a dilute solution (use 1/4 the recommended rate). If you apply excessive fertilizer, the plants may grow faster without damage, but the growths will be succulent and more prone to disease in wet periods. Also, too much fertilizer may reduce flowering. If the fertilizer application is very high, young orchids can be killed quickly. As one learns to grow a certain genus, refinement of the fertilizer program is suggested.

Fertilizing an orchid which is in bud is not recommended. Certain genera will drop their buds if fertilizer is applied at this time. Usually it is best to fertilize only while an orchid is actively growing. This is especially true for genera that have a definite dormant period.

Some growing media require fertilizers with higher nitrogen content. Orchids growing in fir bark may require slightly higher nitrogen fertilizers. Fertilizer labels show the ratio of the main nutrients nitrogen (N), phosphorus (P), and potassium (K). The fertilizer analysis will be listed in the order N-P-K as numbers in percent. Some common orchid formulations are: 20-20-20, 30-10-10, and 10-30-20. Specific recommendations can be found in the discussions on the various genera.

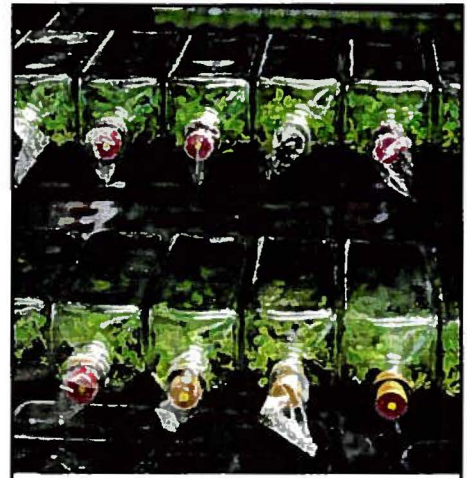


Figure 9. This is a stack of flasks each containing 50 to 100 orchid plants propagated by tissue culture.

Different Stages of Orchids to Obtain and Grow

Orchids can be obtained in many different stages of growth. These stages range from plants in flask to blooming size. It is worthwhile to try growing orchids from these various stages. There are advantages and disadvantages in growing different stages. Young plantlets are cheaper per plant, but are more susceptible to diseases. One such disease is damping off where fungi rot the stem causing the seedlings to die. Once one seedling is infected, the disease will spread to other seedlings.

Plants from Flasks

Plants in flask are generally low in price. Flasks range in price from \$10⁰⁰ to \$100⁰⁰. The plants in flasks are either grown from seeds or are mericlones. Plants from seeds will generally show variation in color and quality of flower from plant to plant. Seedling flasks are a great way to expand the variety of an orchid collection. Mericlone flasks contain plantlets that are

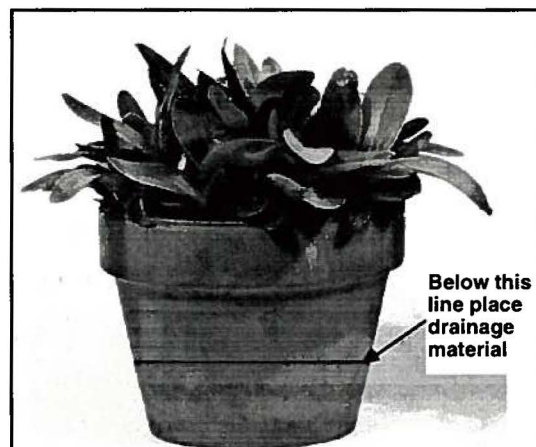


Figure 10. An orchid community pot. This is a 6 inch clay pot. The bottom third of the pot is filled with 3/4" crushed stone. The rest of the pot is filled with chopped tree fern fiber or other medium. This compot is ready for replanting..



Figure 11. *Dendrobium* seedlings in flats. As the seedlings developed they can be removed without disturbing the surrounding plants and transplanted to 2" pots. The medium of peat moss and perlite (1:1).

propagated from the tissue of a selected plant. Plantlets from a mericlone flask should have the vegetative and floral characteristics of the original plant. Seedling flasks are generally less expensive. There are usually 30 to 100 plants per flask making the individual plant cost very inexpensive (Fig. 9). Plants, in flask, are often ready for transplanting at the time of purchase. The growing medium is a jelly-like material that is mixed with different nutrients the orchids need.

An advantage to buying orchids in flask is that plants from foreign countries can be brought directly to Guam without inspection in Hawaii. Plants not in flask, including community pots, are required by plant quarantine to be inspected in Hawaii. One should still obtain an import permit at the Department of Agriculture and inquire of the current regulations.

Growing Containers

Before removing the plants from flask, have containers prepared. There are three common types of containers for growing the plantlets. In all cases the seedlings are planted close together into communities. These are called community pots (compots for short). Some people grow the seedlings in 4 to 6 inch pots (Fig. 10). Shallow types, called bulb pots, are best. Fill the bottom third of a pot with 3/4 inch rocks for drainage. Make sure not to block the drainage holes. Another type of container is a flat. On Guam, seedling flats have been used successfully. These are plastic trays with 1/2 inch holes (Fig. 11). Seedlings are placed in individual holes in the flats making transplanting very easy. Also, seedlings are easily transplanted individually into pots when they are ready. In a compot, all the seedlings are replanted at once. It is also possible to establish the out-of-flask seedlings in plastic baskets. This method is widely adopted in Thailand. For dendrobiums, cattleyas, and oncidiums a layer of tree fern fiber is placed in the bottom of the basket (Fig. 12). For vandaceous orchids no medium is used (Fig. 13). The success rate of using baskets with seedlings on Guam has been nearly 100%.

Growing media

Many different growing media have been used successfully in compots. Some commonly used materials are: tree fern fiber, sphagnum moss, fine grade (1/4 inch) fir bark, and commercial peat moss mixes.



Figure 12. A community pot of *dendrobiums* planted into a plastic basket. The medium is chopped tree fern fiber.

The peat moss mixes have been particularly good to use with the seedling flats. Generally the commercial mixes are pest free. It is also good to choose brands that include a wetting agent in the mix. This allows the peat moss to absorb water more easily.

Transplanting plantlets from flask

The next step is removing the plants from the flask. First, add about 1/2 cup of room temperature water to the flask. Swirl the flask to allow the water to loosen the plants from the medium. Pour the loosened seedlings into a shallow bowl. Repeat this process, several times, until

all the seedlings are removed. If the seedlings do not come out of the flask, try to carefully pull them out with large forceps.

Another method of removing the seedlings is to break the flasks. This is done by wrapping the flask in cloth or paper and tapping the neck of the flask with a hammer. Be careful not to damage the seedlings nor to shatter the entire flask. Flasks from Thailand are often whiskey bottles which can be broken by inserting a piece of re-bar into the mouth of the bottle. The inserted tip of the re-bar should touch one of the bottom corners of the flask. By tapping the opposite end of the re-bar with a hammer, the bottom of the flask will break off. Once the



Figure 13. Vanda seedlings in a plastic basket. These seedlings were transplanted from a flask. Note that there is no medium.

seedlings are removed make sure all the jellylike media is removed from the roots. Next, dip the seedlings in a fungicide solution to lessen the chance of disease. Remove them from the solution and place them on a piece of paper grouping them according to size. It is best to plant seedlings of similar size together in one pot. The seedlings are planted by making a small hole in the medium, placing the seedling in the hole and firming the medium around the roots. The planting depth is very important. The seedling should be planted so that the junction of the roots and stem is level with the top of the potting medium. If the plants have long roots, don't worry about planting the entire root in the medium. Plant enough to anchor the plants in place. New roots will grow into the medium. Plant the seedlings at a spacing of about 1/2 inch apart in the pot. In the seedling flats place one plant per hole. For pots, put the largest plants in the center and the smaller ones towards the edge. First plant along an X, and then fill in the adjoining spaces.

Once the seedlings are planted, water the plants with a fine mist. Do not saturate the medium. Generally at this stage do not let the seedlings dry but apply only sufficient water to moisten them. Spray the seedlings with a fine mist daily. Moisten the medium only enough to prevent it from drying. The medium needs some moisture to encourage root growth. Seedlings can be fertilized once per week with a 1/4 strength solution of water soluble fertilizer. As the seedlings grow, this can be increased to 1/2 strength.

Seedlings in compots should be grown in low light. Do not expose them to strong light. If the seedlings are grown under shade cloth, use densities in the range of 80 to 90% shade. Make sure that the growing area is checked during the entire day for stray beams of direct sunlight. A slight opening with direct sunlight is all that is needed to burn and kill seedlings.

While the seedlings need a moist environment, there should also be good air movement. It is best to grow the compots on wire screen benches or some other type of bench that allows good air circulation.

Orchids in compots have several pests to watch for. Damping off is a continuous problem. If the seedlings begin to turn brown and watery, treatment for damping off should be initiated. Move the infected compots away from the others and drench thoroughly with a fungicide. Two other pests are spider mites and thrips. Mites will cause purple spots to appear on the leaves. With heavier infestations, portions of the leaves will get white or brown spots. Thrips scrape the surface of the leaves causing the damaged areas to appear silvery. It is important to treat the plants for these pests as soon as they are observed.

Transplanting: Community Pots to 2 inch Pots

Compots ready to be transplanted into 2 inch pots are the next stage of plants available for sale. Seedlings at this stage are fairly durable and are easier to care for than seedlings just removed from flask. Plants in compots cost more per plant than plants in flask. The leaves of plants growing in compots have a waxy coating and are much more resistant to drying out. Seedlings about 1 1/2 inches tall are ready to be transplanted into individual 2 inch pots.

The growing medium can be the same type used for larger plants, however, the size of the medium is generally finer than for larger plants. Fir bark and crushed rock aggregate should be about 1/4 inch in size. Tree fern fiber or coconut husk should be cut to about 1 inch pieces (Fig. 14). Vanda seedlings can be removed from compots and attached to pots or baskets without medium (Fig. 15). The pots can be attached to fencing (Fig. 16) which provides good aeration and saves space.

To plant seedlings, remove them from the compot and carefully separate the individual plants. Be careful with sympodial orchids. Each plant will now consist of 2 or more growths. For plants grown in flats carefully pull the plants from their individual holes. Hold the seedling in the pot so that the top of the root crown is just below the rim of the pot. Pour the medium among the roots. Make sure the roots are spread through the medium. Once the pot is full, gently press down on the top of the medium to firm the plant in place. Do not handle roughly. Make sure to label each plant. While they are shaded, mist the seedlings as was done with the compots. Make sure that the seedlings do not dry out.

Shade the newly potted seedlings for a few weeks until they get established. Once the seedlings are growing they can be moved to an area with around 70% shade. Fertilize with quarter strength fertilizer once a week. Plants at this stage will increase in size very rapidly.

Transplanting into Larger Pots — First flowering.

Once plants are established in 2 inch pots, they will grow quickly. Some orchid species will begin to flower at this stage. The actual size or age of an orchid's first flowering varies with different genera. For example, dendrobiums usually flower at a younger age than vandas. Dendrobiums will begin to flower in 1 1/2 years while vandas may take 3 to 7 years.



Figure 14. Dendrobium seedlings in two inch clay pots. The medium is coconut husk.



Figure 15. Vanda seedlings transplanted from compot to 2'' pots. The seedlings were attached to small pieces of bamboo with florist tape and inserted into empty pots.



Figure 16. Vanda seedlings attached to fencing.

Plants at this stage can be moved from 2 inch up to 6 inch pots, coconut husk (Fig. 17), wooden baskets, or ground beds. Some suggested media are 3/4-1 inch limestone aggregate or fir bark, coconut husk.

Begin transplanting by removing the plant from the pot and examining the root system. At this stage there is no need to bare root the plant, unless the medium is decomposed. Choose a three or four inch pot for the next size. Also, choose azalea (3/4 height) pots over full height or standard pots. Azalea pots with openings in the sides allow better drainage and more aeration. For drainage, place either pieces of broken clay pots or 1 inch pieces of crushed rock in the bottom of the pot. The drainage material will improve drainage and aeration. Place the plant with the newest growth in the center of the pot and the oldest growth at the edge of the pot. Choose a coarser media than the previous potting approximately 3/4 inch to 1 inch size.

Support the newly planted orchid with a stake. There are stakes that are inserted into the medium and some that are attached to the rim of the pot. Tie the tallest growth to the stake with an insulated or coated wire.

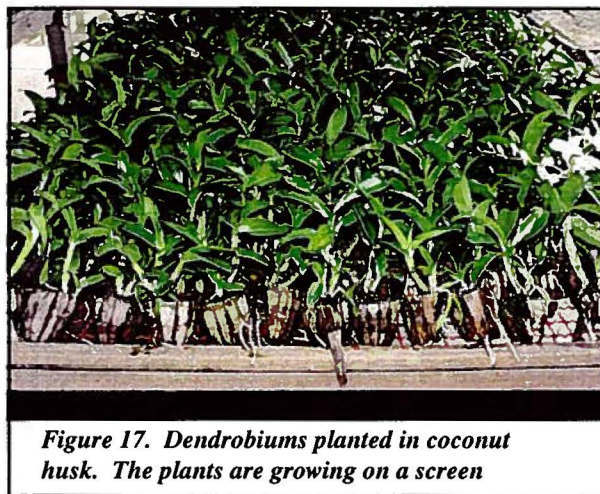


Figure 17. Dendrobiums planted in coconut husk. The plants are growing on a screen

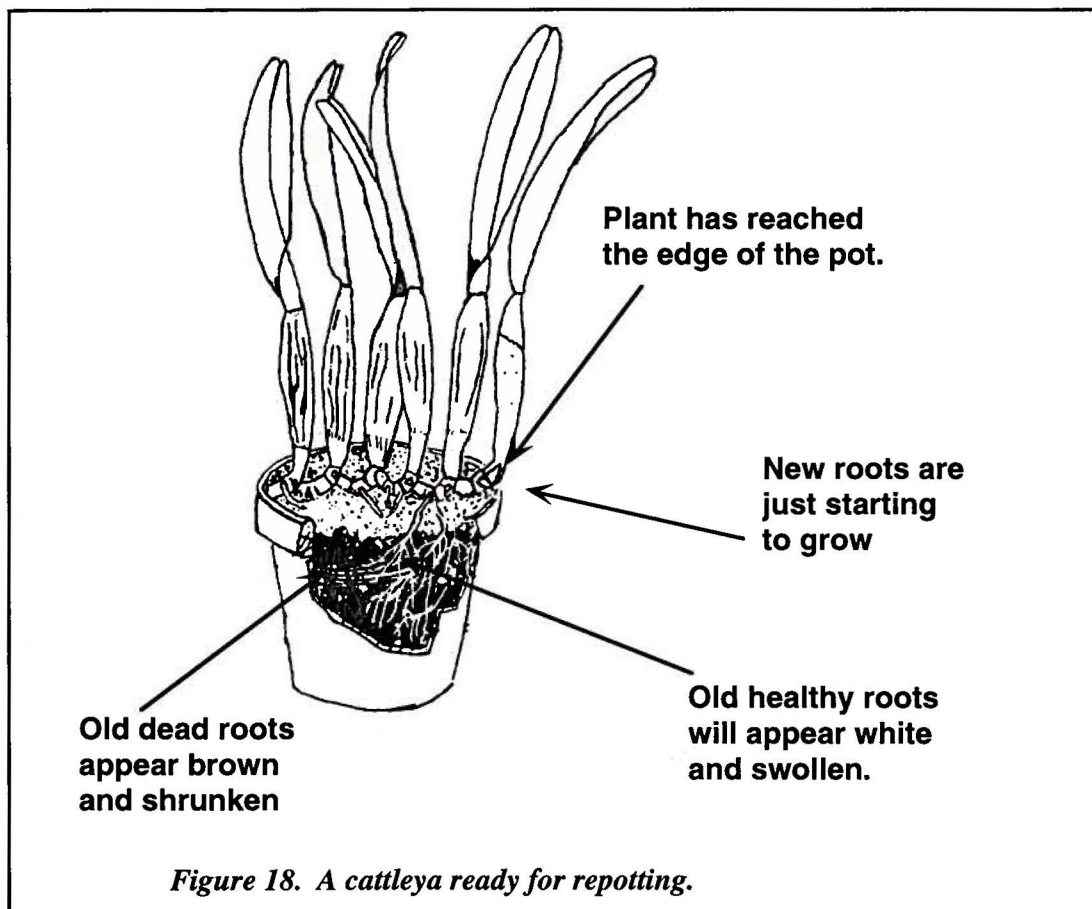


Figure 18. A cattleya ready for repotting.

Plants of this stage can be grown in brighter light than younger seedlings. Introduce them to the brighter conditions gradually. If the leaves yellow, return the orchid to shady conditions and then increase the light gradually.

Blooming Size Plants

Once the plants are blooming, potting only needs to be done when the medium is decomposed or the new growths are growing out of the pot (Fig. 18). The best time to repot is just as the new roots are beginning to grow. This allows the new roots to get established in fresh medium. New roots will emerge from the base of the most recent growth. Care must be taken not to break the new root tips and new growths (Fig 19). They are very tender and are easily broken. If the new roots grow to a length of more than 1/2 inch transplanting without damaging the roots will be very difficult. If a root tip is broken, the root will cease to grow from the tip. In older roots, branch roots will emerge, but if the root is new it will not grow again during the current growing season.

The next best time to pot is once the new shoot growth is at least 5 or 6 inches long. If it is shorter than this, there is a very good chance of breaking the new shoot. At this stage there will still be active root growth. Repotting at this time causes the plant to stop growing for a few weeks while it recovers and therefore is not the best time.

Useful tools for repotting mature plants are a pair of shears and a potting stick. The potting stick can be made by cutting the top from an old broom stick. The bottom end should be cut at a 25° angle to form a dull chisel edge. The potting stick is useful for firming the medium into the pot.



Figure 19. Dendrobium showing new growth.

Genera of Orchids to Grow on Guam

Dendrobium Alliance/Dendrobiineae Sub-tribe

Dendrobium is a large genus. There are over 1000 species, which are found in the Eastern Hemisphere. They are found from Japan to New Zealand and through Southeast Asia to India. This genus is broken into 40 sections. A section is a classification which groups similar species of dendrobiums together. Some of the more commonly grown sections are listed in Table 2. Dendrobiums are epiphytic. They live on rocks and trees. They also have a sympodial growth habit. Some are evergreen, with leaves that live and function for several years. Other species are deciduous and drop their leaves after growths mature.

Dendrobium species range from mature plants in 2" pots to plants that are 15 feet tall. The flowers range from very showy to insignificant. Many different flower colors can be found in this genus. The flowers may appear on racemes or in clusters from the tip of the pseudobulb. The flowers in other species emerge individually from the pseudobulb.



Figure 20. A dendrobium hybrid.

The sections *Phalaenantha* and *Spatulata* have been important in the development of hybrids for cut flowers. Many hybrids involving these two sections have good qualities such as flowering during much of the year and producing many flowers (Fig. 20). The cut flowers also have a long vase life.

Dendrobiums are a good choice for growing on Guam. They adapt readily to growing in pots or tied to a tree. When establishing on a tree, attach the plant with some coconut husk or sphagnum moss to hold moisture until the orchid establishes. If it is decided to grow these orchids in pots, choose pots with good drainage holes. Various potting media can be used such as course bark, coconut husk, tree fern fiber (hapu'u) or crushed limestone. Most important is to choose the proper size pot. They usually do better in a small pot relative to the size of the plant.

To grow the dendrobiums in beds, make a boarder using hollow blocks. The bed depth should be between 6 to 12 inches. Fill the bed halfway with large pieces of limestone. Fill the rest of the bed with crushed limestone aggregate. Scoop out holes big enough to fit the root ball and place the plants in the holes. Place gravel firmly around the plant to hold it in place. It may be necessary to support the plants temporarily. This type of bed will allow good drainage and air circulation for the roots.

Dendrobiums vary in their light requirements depending on which section they belong. Many species prefer bright diffuse light. Some dendrobium species can grow in full sun. Plants need to adjust gradually to higher levels of light. Expose the plants gradually to higher levels of light before placing them in full sunlight. During the hottest months of the year, it is good to cool the plants with a light watering during the hottest part of the day or grow them in light shade. Plants in flower may drop buds if they are kept in a hot, full sun location during flowering.

Cattleya Alliance/Laeliinae Sub-tribe

This is a large group of orchids that include the genera *Cattleya*, *Brassovola*, *Sophronitis*, *Encyclia* and *Epidendrum*. Hybrids among all of these genera can be found. Each combination of genera produces different flower shapes, sizes, fragrances and colors. Often the flowers are large and are commonly used for corsages and wedding bouquets. Cattleyas and the various hybrids are the most well known orchids in the world.

Many of these genera flower seasonally. By choosing certain genera and cultivars it is possible to have flowers throughout the year. In the following sections some species are mentioned which are not well suited for Guam's conditions but are mentioned because of their importance in *Cattleya* breeding.

Epidendrum

This genus is large. It is somewhat of a misfit genus for species that taxonomists could not place in another genus. There are more than 1,000 species in *Epidendrum*. Most have cane-like stems. Epidendrums are often good for landscape use.

Encyclia

This genus contains species that were originally in the genus *Epidendrum*. Encyclias are originally from the tropical and sub-tropical regions from Florida to South America. Many are showy with fragrant flowers. Encyclias often do well in hanging baskets or mounted on some material. They do better in bright light but not direct sunlight.

Section	Example species
Eugenanthe	<i>D. nobile</i>
Phalaenantha	<i>D. phalaenopsis</i>
Spatulata	<i>D. gouldii</i>
Callista	<i>D. aggregatum</i>
Nigrohirsute	<i>D. formosum</i>
Latourea	<i>D. spectabile</i>

Table 2. Some sections in the genus Dendrobium and examples of species found in each section.

Laelia

Laelia flowers are very similar to *Cattleya* in appearance. Laelias contribute some of the bright colors to hybrids. There are species that are scarlet, red-orange, coppery-bronze, and deep scarlet. Laelias are found in Mexico, Central America, and southern Brazil. They are often found at high elevations. This means that some of the species (and related hybrids) may require cooler conditions than are found on Guam. They do require a thorough drying when they are not flowering or actively growing.

Sophranitis

The species in this genus are miniature plants with brilliant red to yellow flowers. All are from Brazil and like intermediate to cool temperatures with a damp atmosphere. While they are not generally suitable for conditions on Guam, they are mentioned due to their use in breeding cattleyas. These species have been used to produce many of the red and yellow cattleya hybrids.

Brassovola

Many of the species in this genus have very narrow, terete leaves. Species of this genus can be found throughout Central and South America. The flowers have very slender sepals and petals with a lip that opens from a narrow tube. The colors range from greenish white to pure white. Some species have purple spotting. Many of the species have fragrant flowers. *Brassovola nodosa* has the common name of "lady of the night" due to its fragrance from evening to the middle of the night. It flowers throughout the year and can be established in trees or baskets on Guam. Reduce watering when new growths mature to encourage flowering.

Ryncholaelia

This genus consists of two species that were previously included in the genus *Brassovola*. The two species have been used frequently in breeding. *Ryncholaelia digbyana* has greenish white flowers with a huge lip that can be four inches across and has a very fringed edge. The flowers also have a strong citrus fragrance. The species is from Honduras and prefers a warm location with bright light.

Broughtonia

This genus has been used to produce cattleya hybrids with small red flowers. Broughtonias are from Jamaica. These plants produce flowers very easily and have produced some very attractive hybrids that do well on Guam.

Shomburgkia

This genus has about twelve species and is known to harbor ants. The pseudobulbs of some of the species are hollow and have a small hole at the base for ants to enter. The flowers of this genus are very ruffled. Some of the species produce large sprays of flowers reaching lengths of fifteen feet. The colors are often brown to creamy white with purple lips.

Oncidium Alliance/Oncidiinae Sub-tribe

While there are nearly sixty genera in this sub-tribe, only a few are suitable for the growing conditions on Guam. The most important genus, *Oncidium*, is very popular. Many of the species are miniature plants which have interesting flowers. The lips dominate the flower and resemble a lady's skirt (Fig. 21). The other parts resemble a head and arms resulting in the popular name of "Dancing Lady Orchids."

Oncidiums are found naturally in the Western Hemisphere ranging from Florida through Mexico and Central America and South America. Some of these species are from areas that are hot and humid lowlands and are well suited to Guam. The genus contains over 500 species that have been grouped

into taxonomic sections of related species. The most common flower colors are yellow and brown. Some species have white, pink or lavender flowers. The small equitant oncidiums (Some taxonomists name these *Tolumnia*) have fan like leaves and flowers in a wide variety of colors. The flower size is small but many species have numerous flowers on the inflorescence.

The majority of oncidiums grow in conditions similar to cattleyas. Most important for this genus is to have good air movement. Light should be bright but diffuse. If the leaves of the miniature equitants or the larger mule ear groups get a uniform purple spotting, they are getting sufficient light. The plants are getting sufficient light if the leaves are light green with red or yellow tips. The light is too low if the color is dark glossy green. Water frequently enough to prevent the most recent pseudobulbs from shriveling. Some species require a resting period where they should not be watered. Oncidiums do require excellent drainage and good aeration. This genus has good candidates for establishing in trees, on sections of limbs, or on slabs of cork. Fertilizing should be done during periods of active growth, they should not be fertilized from the time an inflorescence appears until flowering is completed. The flower buds are extremely sensitive to fertilizer burn.

Vanda Alliance or the Sarcanthinae Sub-tribe

There are more than eighty genera in this sub-tribe. The important genera for Guam are *Vanda*, *Phalaenopsis*, *Renanthera*, *Arachnis*, *Rynchosstylis* and *Trichoglottis*. The growth habit is monopodial. Because of their relatively thin stem, they do not withstand drying as well as orchids with pseudobulbs. Their natural range is from the Philippines through the Asian tropics to Australia and Africa. They occur in regions that are warm and humid. Some are found in areas with heavy rains throughout the year but others are from areas with moderate rains throughout the year.

Phalaenopsis

The "moth orchid" gets its name from their flowers resembling a moth. *Phalaenopsis* comes from Greek, *phaluna* meaning moth and *-opsis* meaning resembling. There are about fifty species in this genus. Flowers may last two to five months. They prefer lower light and do best with night temperatures of 65°F but many do fine on Guam's environment. The stem is very compact and is not readily visible. The leaves are attractive, long, broad, curving, and may be green or mottled, and are often purple underneath. The leaves range in length from four to fifteen inches. One to three leaves are added in a year. Mature plants have five to six leaves. The roots are wide but flattened and are very sensitive to disturbance. The flower spikes appear from the stem between the lower leaves.

Phalaenopsis require small containers for their size and should not be repotted frequently. But do not let them stay in media that is decomposed. It is time to repot when the medium has decomposed, drainage is reduced or the plant has grown so long that a part of the stem is visible with no leaves. Repotting should be done when new roots are developing, after

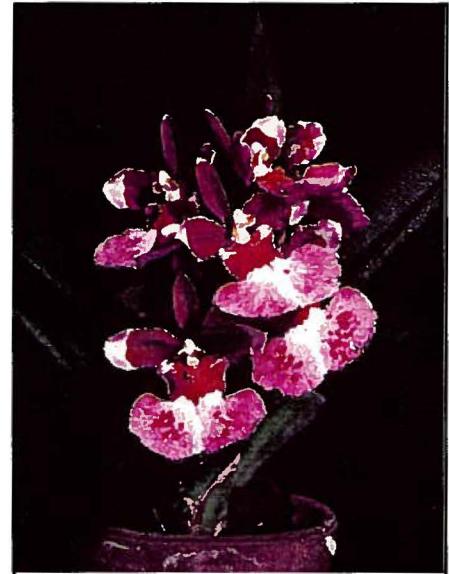


Figure 21. An oncidium hybrid.



Figure 22. A phalaenopsis hybrid.

flowering. Be careful when potting as the new roots are delicate and will stop growing if damaged. A medium to coarse fir bark makes a good medium. They also do well on hanging pieces of coconut husk.

To repot moisten the plant and then remove from the old pot. Remove the old medium and trim off the bottom of the stem that has no roots. The older roots can be trimmed to fit in the pot but the newer roots should be left undisturbed and can be left hanging out of the pot. *Phalaenopsis* do not need to have the media firmly packed as with cattleyas and dendrobiums. Center the plant because there are generally no side growths. If using a piece of coconut husk, fasten with a string or wire. Keep the wire on until the roots attach to the husk. Hang planted *Phalaenopsis* positioning them so that the leaves are tilted downward allowing water to drain from the leaf crown. This genus makes handsome hanging specimens on coconut husk. After replanting, water sparingly until new roots appear. If the leaves become limp, move to heavier shade until established.

These plants should be watered frequently so that the medium never totally dries. Make sure though that the medium does not remain sopping wet. During the dry season frequent watering is necessary. Of course the water schedule should be adjusted depending on the medium. Fresh coconut husk will require more frequent watering than older husk.

Vanda

This genus consists of about 50 species. Many are sun-loving plants. It is a very popular genus for hobbyists to grow. The flowers come in a wide variety of colors. The name is the Sanskrit word, *vanda*, which was applied in ancient India to the vanda of Bengal and related orchids (Northen, 1990). The majority of vandas have narrow, flat leaves and are grouped together as the strap-leaf vandas. There are a few species that have cylindrical leaves and are grouped together as terete-leaf vandas. Hybrids between these two groups produce leaves that come in between and are called semi-terete.

Vanda roots are produced from the stem and are thick and fleshy. *Vanda* roots often grow out into the air and eventually grow into the ground or the pot of a neighboring plant. Flower sprays appear on the newly matured growth from the leaf axils.

Vanda flowers generally have sepals and petals of similar size. They have a round, flat outer edge that narrows at the base. The lip is smaller than found in *Dendrobium* or *Cattleya*.

Vandas do best in media and containers with good drainage. Vandas can be either grown in individual containers or in beds. Fir bark chips are a common medium. It is easy to work with and is much less prone to becoming weedy. If wood chips are used, it has to be a durable wood. Tangan tangan decomposes too quickly. Coconut husk is also a very good medium but does become weedy and decomposes rapidly (Fig. 24). Decomposition can be retarded by placing the husk vertically in the pots. Some

vandas also grow well in crushed limestone. Cuttings of *Vanda* Miss Joaquim were planted in several different media available on Guam (McConnell, 1990). The growth and flowering of the vandas in the different media were compared. It was found that crushed limestone was a good medium and should be considered, especially for large bed plantings.

Vandas are relatively easy to pot compared to dendrobiums and cattleyas. Young plants require that they be moved into larger pots as they grow. Mature flowering plants only require repotting when the medium is old and contains a large amount of decomposed material. On Guam, the potted vandas

Figure 23.
Vanda Miss Joaquim, a common hybrid in Guam. It is grown in full sun in ground beds and tied to logs.



increase rapidly in height, with little or no side growth. When vandas grow too tall to easily manage, cut the top off and replant. Make sure that both the top and bottom pieces have a good number of roots and at least some leaves on the bottom piece. The top cutting should be at least 12 inches long. Remove the oldest part of the base of the plant that has no live roots. The best time to replant is when newer roots are actively growing and older roots are branching. Wet the roots to make them more flexible and resistant to breaking. If the roots break, cut them off at the break. Try to insert the root stubs (remaining attached to the plant) into the medium, if possible. If the roots are too high to insert in medium, leave them. Center the plant in the new container. Insert the growth about two inches into the medium. The old stem should be replanted, it is possible that a dormant bud on the old growth will begin to grow. After the new growth has roots, it is best to remove it from the old stem and plant it. More than one shoot may form producing several plants on one stem.

It is possible to air layer vandas to stimulate roots further up the stem. Cut a notch on the stem just under a leaf and place a ball of sphagnum moss around the cut and stem. Wrap with polyethylene film and tie securely. Once roots form and attach to the sphagnum moss, the upper section can be removed and replanted.

Vandas require abundant water during their growing season. When not actively growing, keep the vandas from drying. After repotting, water sparingly until new roots begin to grow. The roots disturbed during replanting will rot if kept too wet, but will begin to branch if kept dry.

The terete-leafed vandas can be grown outdoors in full sun. Shading during part of the day will reduce or at least delay flowering of *Vanda* Miss Joaquim. Strap-leafed vandas require some shading but still prefer high light for best flowering.

Vandaceous orchids are heavy feeders and can be fertilized weekly with a 20-20-20 solution while the plant is actively growing. Once a month a fertilizer such as 10-30-20 can be used to supply additional phosphorus that will help maintain flowering.

Euanthe

This genus has a single species. The species was known for many years as *Vanda sanderiana*. It is now called *Euanthe sanderiana*. It is one of the most attractive orchids. It has been used in producing many hybrids. It has broad flat flowers with rounded petals and sepals. The flowers of *E. sanderiana* are a fusion of colors, white to rose, appearing in the dorsal sepals and petals. The lateral sepals are yellow green with a reddish-brown tinge and a network of brown markings. The lip is crimson.

In addition, there is great color variation among plants with some having a purple tinge to red tinge. There is also a yellow-green form. It is a strap-leaf species from the Philippines.



Figure 24. Vandaceous orchids planted in coconut

Renanthera

This genus has a growth habit similar to *Vanda* with brightly colored flowers that are small but are produced in great numbers. They are striking in color with red to orange and yellow flowers. This genus is often hybridized with *Vanda* to introduce its brilliant red color and the prolific free flowering behavior. Some of the species in this genus grow very tall reaching heights of ten feet.

Trichoglottis

There are about 35 species in the genus which are originally from the Philippines and Malaysia. The plants have heavy stems with short oval leaves. The plants grow to five feet and have long-lasting flowers.

Arachnis

This genus is used frequently in hybridization with vandas. Its name means “spider-like”. This genus thrives in locations with lots of light. Plants can grow to ten feet tall. *A. flos-aeris*, a native to the Philippines, has yellow flowers with purple-brown bars.

Landscaping with Orchids

Many orchids can be grown on rocks and logs for placing in the landscape. The following are some guidelines in setting up plantings.

Orchids can be attached to either cut wooden logs, coconut logs or living trees and shrubs. For logs it is best to cut notches forming pockets for the orchids. It is also possible to attach smaller orchids to pieces of coconut husk for establishment. Once the orchids are established they will attach to the trees and logs.

To grow orchids in beds it is best to place them in terraces on a sloped area. If the area is flat, insure the area has good drainage. To improve the drainage excavate the area and fill it with crushed limestone aggregate or other crushed rock. An alternative to digging is to construct a low wall of cement blocks or rocks to contain the medium.



Figure 25. Orchids planted in a tree. This is an attractive use of orchids and bromeliads in the landscape.

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An Orchid Grower's Glossary

The following is a list of terms that an orchid grower may encounter in reading or discussing orchid growing.

- Abscission** The falling off of flowers or leaves.
- Aerial Root** A type of root produced above or away from the growing medium.
- Agar** A substance derived from seaweed and used to form a gel in otherwise liquid mixtures.
- Anther** The part of a flower that produces pollen found in the tip of the column.
- Backbulb** Refers to sympodial orchids where a pseudobulb has matured and lost its leaves.
- Bifoliate** Having two leaves usually at the top of one pseudobulb.
- Bigeneric** Hybrids from parents of two genera.
- Bud Drop** The wilting or death of a flower before opening.
- Callus** A fleshy growth on the flower lip.
- Chromosome** The body in the cell nucleus containing genes in a linear order.
- Clone** A single plant raised from seed plus all of its subsequent progeny derived from vegetative propagation.
- Column** An organ in an orchid flower formed by the union of stamens and pistils with their supporting tissue.
- Column foot** This is an extension of the base of the column to which the lip is attached.
- Compot** An abbreviation for community pot which is a pot containing a number of seedlings grown together.
- Cross** A hybrid (noun). To hybridize (verb) meaning to fertilize a flower with pollen taken from a flower of a different species or hybrid.
- Cultivar** An individual plant and those plants derived from it by vegetative propagation. Not to be confused with a variety.
- Cultivar Epithet** A name given to an awarded plant and others propagated vegetatively from that plant.
- Cuticle** The outer protective layer of cells on a leaf or stem. This layer is often waxy.
- Diploid** Possessing two sets of chromosomes. This is the normal case.
- Dorsal** The back or outer surface of an organ. Also used to indicate the upper sepal of the flower.
- Endemic** Native to a region and not found elsewhere.
- Epiphyte** A plant that grows on another using it as a support only and is not a parasite.
- Exotic** Not native. Coming from another location.
- Family** A major subdivision in the Plant Kingdom commonly including many related genera.
- Fertilization** The fusion of two sex cells (gametes) to form a new individual. In plants this may follow pollination. Fertilization results in the formation of a fruit and seeds.
- Fir Bark** A potting medium consisting of closely chopped or ground bark of white fir, red fir, or Douglas fir.

Fruit The seed bearing part of the plant.

Gamete A sex cell contained in either the pollen or the ovule.

Genotype The hereditary characteristics transmitted from a parent to its progeny.

Genus (pl Genera) A taxonomic category above species but below family, tribe and sub-tribe. The generic name forms the first word in the botanical name of the plant.

Habit The characteristic form or mode of growth of a plant.

Habitat The kind of environment in which a plant grows.

Hardening Off Making the plant more hardy, usually by increasing its tolerance of sunlight through gradually increased exposure.

Hybrid Plant or animal derived artificially, having more than one species in the parent lineage. Most hybrids are the result of human intervention, although there are a few naturally occurring.

Inferior ovary An ovary positioned below the flower parts.

Inflorescence The flower or flower cluster of a plant borne on a scape.

Internode The spaces between nodes on a stem or between pseudobulbs on a rhizome.

Keiki An offshoot arising from the stem of the plant. (Hawaiian word for baby.)

Labellum The name for the lip of an orchid flower.

Lithophytic Growing on rocks.

Monopodial A form of growth in which there is a single stem that continues to grow at the tip.

Node A joint on a stem or pseudobulb from which a leaf or bract arises singly or multiple.

Ovule An embryonic seed encased in the ovary and bearing a gamete that is fertilized by the pollen gamete.

Petal One of the three inner segments of the orchid flower which is not modified as the lip.

Pistil The seed-bearing organ of a flower including, when complete, the ovary, style and stigma.

Phenotype The observable characteristics of a plant due to varying environmental conditions even though the genotype may be identical to others of the species.

Photosynthesis Process of utilizing light to convert carbon dioxide and water to sugars and oxygen.

Pollinium (pl. Pollinia) The mass of pollen grains found in the anther of orchids.

Polyploid A term applied to a plant that possesses one or more extra sets of chromosomes beyond the normal diploid number.

Raceme An unbranched inflorescence of stalked flowers.

Respiration The process by which cells use food to produce energy. Water and carbon dioxide are produced as by-products.

Resupinate The turning of the flower, in bud, so that the lip is 'down'. Many orchids do not resupinate leaving the lip pointing upwards on the open flower.

Rhizome A root-bearing horizontal stem prominent in sympodial growth and composed of the bases of successive shoots.

Sepal One of the three outer segments of the orchid flower.

Stigma The part of the pistil that receives pollen. The part of the column in the orchid, which is receptive to the pollinia and frequently provides food for pollen tube growth.

Sympodial A form of growth in which each new shoot is a complete plant that originates from the previous growth.

Terete Circular in cross section. Often used to describe 'round' leaves.

Terrestrial Growing on the ground and supported by the soil.

Tree fern fiber Potting material made from cutting or shredding the trunk of tropical tree ferns, chiefly of the family Cyatheaceae. Also known by the Hawaiian term hapu'u.

Transpiration The evaporation of water through the stomata.

Variety A plant population having minor differences from the type species. To be used only in respect of species never for hybrids. For hybrids use cultivar.

Velamen A layer of water and air absorbing tissue over the inner part of the root and serves to collect water readily and pass it to the inner root.

ORCHID CULTURE CHART

DENDROBIUM

- Light:** Dendrobiums require high light. Plant in locations that either get full morning sun or light shade from hot mid-day sun.
- Water:** Water when the medium in the bottom of the pot becomes dry. Water less and protect from rain if plant is dormant.
- Potting Media:**
- For pots:** Crushed limestone (1/2" -1"), fir bark mixed with sponge rock, or coconut husk.
 - For beds:** Coarse crushed limestone.
 - On logs:** Palm log sections with holes cut into them. Attach the plants into holes firmly.
 - On trees:** Attach firmly to the tree in a location with good light. Put some media on the roots and wrap with coconut cloth until firmly established. Attach to tree with wire or string to firmly attach the roots to the bark. The roots must be firmly attached to the bark to become established.
- Fertilizer:** At least twice a month, weekly applications at half strength preferred during active growing periods. Use a water soluble fertilizer at half strength applied twice as frequently.
- Repotting:** Repot when media decomposes or plant grows out of the pot. Propagate by division.
- Special Note:** Certain species of *Dendrobium* have a dormancy period and require cool temperatures. These species, such as nobile dendrobiums, are not suited to Guam.

VANDA

- Light:** Full morning sun with partial shade from mid-day sun to full sun. Terete-leaf vandas require higher light.
- Water:** Every day except when raining.
- Potting media:**
- For pots:** Coarse crushed limestone (3/4"-1"), coarse fir bark mixed with sponge rock, or coconut husk. Vandas also do well in baskets. Plants in baskets may not need media.
 - For beds:** Use coarse crushed rock. Posts of logs (coconut, palms, hard-wood branches) can be inserted into media for supporting plants. Attach firmly to posts with wire or string. Make sure to secure the stem so that newly emerging roots are not damaged on windy days. Remember to remove the wire to prevent damage to tree after the roots are established.
- On trees:** Not recommended. Vandas generally do not flower until the growths pass the support.
- Fertilizer:** At least once a week with water soluble fertilizer.
- Repotting:** When medium deteriorates. Propagate by cutting.

CATTLEYA

- Light:** 30 to 55 percent shade.
- Water:** Water thoroughly and allow to dry until media is dry in the bottom of the pot. Check through a drainage hole.
- Potting media:**
- For pots:** Coarse crushed limestone (3/4"-1"), coarse fir bark mixed with sponge rock.
 - On trees:** Attach firmly with wire or string. Remember to remove the wire to prevent damage to the tree after the roots are established. Water more frequently than plants in pots.
- Fertilizer:** Twice a month at half the rate used for vandas and dendrobiums.
- Repotting:** When medium deteriorates. Propagate by division.

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