

THIS PAGE *Paphiopedilum venustum* fma. *measuresianum* 'Woodstream', HCC/AOS, like other slipper orchids, bears a lip that is modified into a pouch. Grower: Woodstream Orchids. OPPOSITE *Pleurothallis gargantua* 'Not Itty-Bitty', AM/AOS, bears a flower measuring 1 $\frac{3}{8}$ inches wide by 3 inches long (3.4 x 6.9 cm). This appropriately named giant dwarfs the blooms of its fellow *Pleurothallis* species, some of which bear flowers less than $\frac{3}{16}$ inch (.5 cm) long. Grower: Ginny Worthington.



What is an Orchid?

Characteristics Unite More Than 25,000 Species and 110,000 Hybrids Into a Family of Amazing Diversity

BY THOMAS J. SHEEHAN, PHD

THIS PAGE: JAMES OSEN; OPPOSITE: RICHARD CLARK

VARIATION IN A GENUS

I KNOW THERE ARE MANY OF YOU out there who love and enjoy growing orchids. We are all fascinated by the fantastic array of colors, sizes and shapes of the often intricate flowers, and how often we have taken pride in pointing to a flower and saying to our nonorchid-growing neighbor, "That's an orchid." In general, we take it for granted that those flowers are orchids, but how many of you have ever given thought as to what makes these beautiful flowers orchids. On the facing page there is a collage of unusual flowers, yet, despite their great variations, they all have certain elements that make all of them orchids. Consequently, we must ask, "Why are they all called orchids?"

The Orchidaceae is a vast family found in all parts of the world, except the Antarctic and major deserts. The family, depending on which taxonomist you follow, is composed of more than 800 genera, around 25,000 known species — a number that continues to rise — and more than 110,000 registered hybrids. (A number of new species have appeared in *Orchids* over the past year and there are probably many more out there waiting to be named.) In this multiplex of genera and species we find vast differences in plant size ranging from *Platystele minimiflora* ($\frac{3}{16}$ inches [3 to 5 mm]) to some *Sobralia* species 40 feet (12.2 m) tall. Plants may be leafless (*Polyradicion*, also known as *Dendrophylax* and *Polyrrhiza*) or leafy (*Dendrobium*). They can be terrestrial (growing in the ground, such as *Calopogon*), epiphytic (growing on trees, such as *Encyclia*), saprophytic (growing on decaying organic matter, such as *Hexalectris*) and some are even found growing on rocks (lithophytes, such as *Laelia crispata*).

There are two major growth habits found in the orchid family: sympodial and monopodial. In sympodial orchids (e.g., *Cattleya*) the main stem grows horizontally and produces determinate lateral branches that, when mature, usually have terminal flowers. After flowering, the plant produces a new growth from the base of the last growth continuing on in a horizontal direction. In monopodial orchids (*Vanda*) the main stem is perpendicular to the surface of the medium, is always vegetative at the apex (indeterminate growth) and has axillary



CHARLES POWDEN

flowering. This perpendicular or indeterminate growth habit can theoretically grow upward ad infinitum.

Orchid flowers exhibit a high degree of variability in size, shape and color. Flowers range in size from $\frac{3}{16}$ inches (a few millimeters) (*Lepanthes*) to almost 14 inches (35 cm) in diameter (*Brassia*). The labellum (lip) is the most prominent floral segment in many orchids (*Cochleanthes*, *Cattleya*), while in other genera (e.g., *Masdevallia*), the three sepals are the showy portion of the flower and the lip is minuscule. Unlike many other families in the plant kingdom, many orchid flowers are resupinate. When the buds begin to emerge, the lip is uppermost and during enlargement the buds will turn 180 degrees before they open, placing the lip at the bottom. This turning is easy to observe in genera wherein the flower has a spur (e.g., *Dendrobium*, *Vanda*). Flowers where the lip is uppermost are

ABOVE Diversity in flower color, shape and presentation can be seen in these two examples from the genus *Cymbidium*. The hybrid *Cymbidium* Richard Tauber 'Miki', HCC/AOS (Radiant Harry x Vogelsang), bears open flowers. Grower: Casa de las Orquideas.

OPPOSITE The nodding flowers of *Cymbidium elegans* 'Duk Won' CCM/AOS, consist of petals and sepals that are fused together for one quarter of their length, which prevents them from opening. However, the flowers of first-generation hybrids derived from *Cym. elegans* do open. Grower: Anna S. Chai.

called nonresupinate (e.g., *Encyclia cochleata*). In some nonresupinate flowers, the lip is hinged, and, when the pollinating insect lands, the lip falls toward the column to position the insect to ensure the removal of the pollinia. A rainbow of colors can easily be



MICHAEL GALLAGHER

A CASE STUDY

SEVERAL of the characteristics of orchids are seen in this portrait of *Malaxis latifolia*, which belongs to a genus of 300 species distributed worldwide (except in Africa). Plants in the genus *Malaxis* bear minuscule, nonresupinate flowers. *Malaxis* are terrestrial orchids with a sympodial growth habit.



LABELLUM (LIP)

In orchid flowers, one petal is often highly modified into a structure called the labellum or lip.



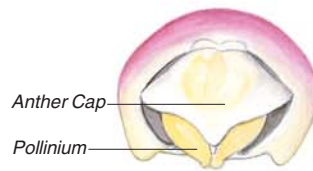
POLLINIA

In orchids, the pollen grains are agglutinated together in little packets called pollinia (singular pollinium). The number of pollinia in a flower varies among genera from two to 12; *Malaxis* has four pollinia.



ZYGOMORPHIC FLOWER

Orchids bear bilaterally symmetrical flowers that can be cut in half to produce two mirror images (see vertical rule above).



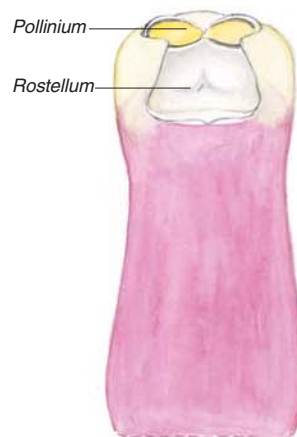
ANTHER CAP

The anther cap and a portion of the two pollinia are visible at the end of the column.



GYNANDRIUM (COLUMN)

The male and female parts of the flower are fused into the usually waxy structure in the center of the flower containing the anthers, style and stigma.



ROSTELLUM

The rostellum, an extension of the stigmatic tissue, serves a twofold purpose related to reproduction.

found in orchid flowers, as every color exists except black. One can also find bicolor and tricolor flowers. There are very fragrant orchids (e.g., *Maxillaria tenuifolia*) and others that have less pleasant odors (e.g., *Bulbophyllum phalaenopsis*, *Coelogyne trinervis*) Vines are present too. *Vanilla* is the best known. Yet, this vast array of plants, regardless of point of origin, size or number of flowers, and a multiplex of variations in vegetative growth and size can all be tied together by their floral characteristics to make up the Orchidaceae.

Therefore, let's look at the orchid flower and see which features contribute to placing it in the Orchidaceae. There are several main characteristics that a flower must have to be called an orchid. They are:

- ◆ A zygomorphic flower
- ◆ A gynandrium (column)
- ◆ A rostellum
- ◆ Pollinia
- ◆ A labellum (lip)
- ◆ An unusual seed

Because many individuals do not see orchid seed in their everyday activities we will deal mainly with the first five factors, as they are always visually present. Granted, in a 1/16-inch (2 mm) flower of *Trichosalpinx* you would need at least a 10× hand lens to identify the various floral segments, while in *Cattleya* and *Phalaenopsis* they are readily visible to the naked eye.

ZYGOMORPHIC FLOWER In the plant kingdom there are two main types

of flowers. Regular flowers (actinomorphic), which can be divided in any plane and produce two equal halves (e.g., lilies) and irregular flowers, which cannot be divided in any plane to produce two equal halves (e.g., some cannas). The orchid flower is a special type of irregular flower in that it has bilateral symmetry. It can be divided in one plane and one plane only to produce two equal halves (mirror images) — see illustration of the *Phalaenopsis* flower below. Dissecting an orchid flower vertically produces the two equal halves; cutting in any other plane will not produce two mirror images.

GYNANDRIUM (COLUMN) The reproductive structures in the orchid flower are unique. In general, when you look into a flower (the Easter lily, for example), we see six yellow-tipped structures (the anthers, which are male) around the perimeter and a white erect structure in the center with a three-lobed sticky top (the stigma, which is female). Many of us as children stuck our noses into lilies and emerged with six yellow dots (the pollen) on our faces and a sticky substance on our noses (the stigmatic fluid). Orchids are unique in that during their evolution the male and female organ were fused together into the usually white waxy structure (sometimes the same color as the flower, e.g., *Phalaenopsis*) in the center of the flower containing the anther(s), style and stigma. Hence, the male and female reproductive elements of the flower are

all enclosed in the gynandrium (column).

ROSTELLUM Figuratively speaking, "little beak," the rostellum, an extension of the stigmatic tissue, serves a twofold purpose. First, it serves as a dam of tissue to separate the male portion of the flower from the female portion and thus prevents self fertilization. There are, however, a few orchids (e.g., some forms of *Cattleya aurantiaca*) wherein self pollination can occur. In these species there is a self digestion of the rostellum so self fertilization can occur. These are the exceptions rather than the rule. The rostellum is also a gland that exudes a viscid substance. When the pollinating insect visits the flower and passes under the rostellum a bead of the glue-like substance is applied to its back to ensure the insect will remove the pollinia when leaving the flower. The rostellum plays a very important role in the wild to ensure the survival of the species by affecting cross pollination rather than inbreeding.

POLLINIA (SINGULAR POLLINIUM) Another interesting feature of the orchid flower is the fact that the tetrads of pollen are not dustlike, as we see in lilies, but are agglutinated together in little packets called pollinia. The size, shape and number of pollinia varies among the various orchid genera. Individual orchid flowers will have from two (*Phalaenopsis*) to 12 pollinia (*Brassavola cucullata*). Knowing the number of pollinia will often help in identifying flowers e.g., *Cattleya* has

PARTS OF AN ORCHID FLOWER

When a *Phalaenopsis* flower is cut in half vertically, it produces two equal pieces that are mirror images of each other. The same is easily seen when you look at the flower of a *Cattleya*.

Take a close look at orchid flowers, and you will see some shared features:

- 1 Dorsal Sepal
- 2 Petal
- 3 Column
- 4 Callus
- 5 Lateral Sepal

In addition, there are some less commonly shared characteristics, such as the antennae 6 seen on this *Doritaenopsis* Plantation Acres 'Lesas Freckles', HCC/AOS (*Dtps.* King Shian's Rose x *Phal.* Rosserole). Grower: Lesa Takahashi.



ILLUSTRATION BY MARION RUFF SHEEHAN/PLANT COURTESY MICKLOW ORCHIDS

- 1 *Lepanthopsis rinkei* 'Bryon', CBR/AOS
Grower Bryon K. Rinke
Photographer Karl Siegler
- 2 *Zygoneria Adelaide Meadows* 'Lime Valentine', HCC/AOS
(*Z. Titanic* × *Dynamo*)
Grower Orchids in our Tropics
Photographer Jay Norris
- 3 *Cyrtorchilum ionodon* 'Rustic Canyon', HCC/AOS
Grower Howard Liebman, MD
Photographer Richard Clark
- 4 *Coryanthes macrantha* 'Sanctuary's Full Moon', AM/AOS
Grower Jim Longwell and Denise Ferrari
Photographer Donald F. Wilson
- 5 *Vanda Fuchs* Southern Belle 'Crownfox', AM/AOS (*Antonio Real* × *Fuchs Delight*)
Grower R.F. Orchids
Photographer Greg Allikas
- 6 *Bulbophyllum sumatranum* 'A-Doribil', AM/AOS
Grower Bill Thoms and Doris Dukes
Photographer Lewis Ellsworth
- 7 *Bulbophyllum plumatum* 'Williamsburg', HCC/AOS
Grower Christine Chowning
Photographer James E. McCulloch
- 8 *Paphiopedilum Magic Lantern* 'T.O.P. Choice', AM/AOS (*micranthum* × *delenatii*)
Grower Jack Schendowich
Photographer Greg Allikas
- 9 *Dendrobium smilliae* 'Arabella', HCC/AOS
Grower Diane and Neil Booth
Photographer Richard Clark
- 10 *Masdevallia Raymondo* Delos Andes 'Blue Sapphire', AM/AOS (*uniflora* × *macrura*)
Grower Brookside Greenhouses
Photographer John Banholzer
- 11 *Disa uniflora* 'Mendocino', HCC/AOS
Grower Sunset Orchids
Photographer Helen Michel
- 12 *Angraecum infundibulare* 'Newberry', HCC/AOS
Grower Carter and Holmes
Photographer Butch Usery
- 13 *Sarcoglottis cerina* 'Apaneca', HCC/AOS
Grower Pedro Morales
Photographer Maria Teresa Diaz Colocho
- 14 *Lycaste Absolutely Stunning* 'Sandra Dayan', FCC/AOS (*Always* × *Maliby Canyon*)
Grower Dennis Dayan
Photographer Charles Marden Fitch



What is an Orchid?

FLORAL DIVERSITY

four while *Laelia* has eight and, although the flowers may look similar, they can easily be separated on number of pollinia. The pollinia are protected by an anther cap that can be removed only when the insect leaves the flower, thus also assuring cross pollination. Pollen may be attached to stipes or caudicles (stalks) of various and sundry sizes and shapes. They may have a disc (viscidium) at the base of the caudicle covered with a very viscid substance to assist in the removal of the pollinia by the insect. Some orchids (e.g., *Catasetum*) have a triggering mechanism that, when tripped by the insect, fires the pollinia at the insect. The pollinia combined with the stalk and disc are referred to as the pollinarium.

LABELLUM (LIP) In orchid flowers, one petal is often highly modified into a structure called the labellum. This structure is usually at the bottom of the flower (resupinate flowers, such as *Cattleya*) and serves as a landing platform for the pollinator. In those flowers wherein the lip is uppermost (nonresupinate, such as *Calopogon*) the lip may be hinged and falls down onto the column when the insect lands on it. These highly modified structures may contain spurs (some up to 12 inches long), callus tissue or other interesting artifacts. These artifacts may just attract the pollinator or, in many cases, offer a reward (e.g., nectar).

SEED Although many will not have orchid seed readily available to look at, this is another interesting aspect of the orchid family. Orchid seeds are minute and measured in microns. They are almost like dust particles. If the orchid seeds are placed on their ends it would take approximately 300 seeds to form a line 1 inch (2.5 cm) long, or laying them end to end it would take about 50 seeds to form a 1-inch (2.5-cm) line. The seeds do not contain endosperm (a starchy substance that supports germination), so have to rely on a fungus in nature to germinate. When you eat peas, corn or beans, the majority of what you eat is endosperm, which is lacking in orchids. The orchid flower, in order to compensate for this and to assure the survival of the species, produces copious amounts of seed. An average orchid seed capsule will contain somewhere between 500,000 and 1,000,000 seeds. The late Oakes Ames, PhD, at Harvard, is reported to have counted the seeds in a seed capsule on a cold wintry day, and found more

What is an Orchid?

LIPS: A WORLD OF CONTRASTS



WALTER PINOCHET



MICHAEL P. GALLAGHER



RICHARD CLARK



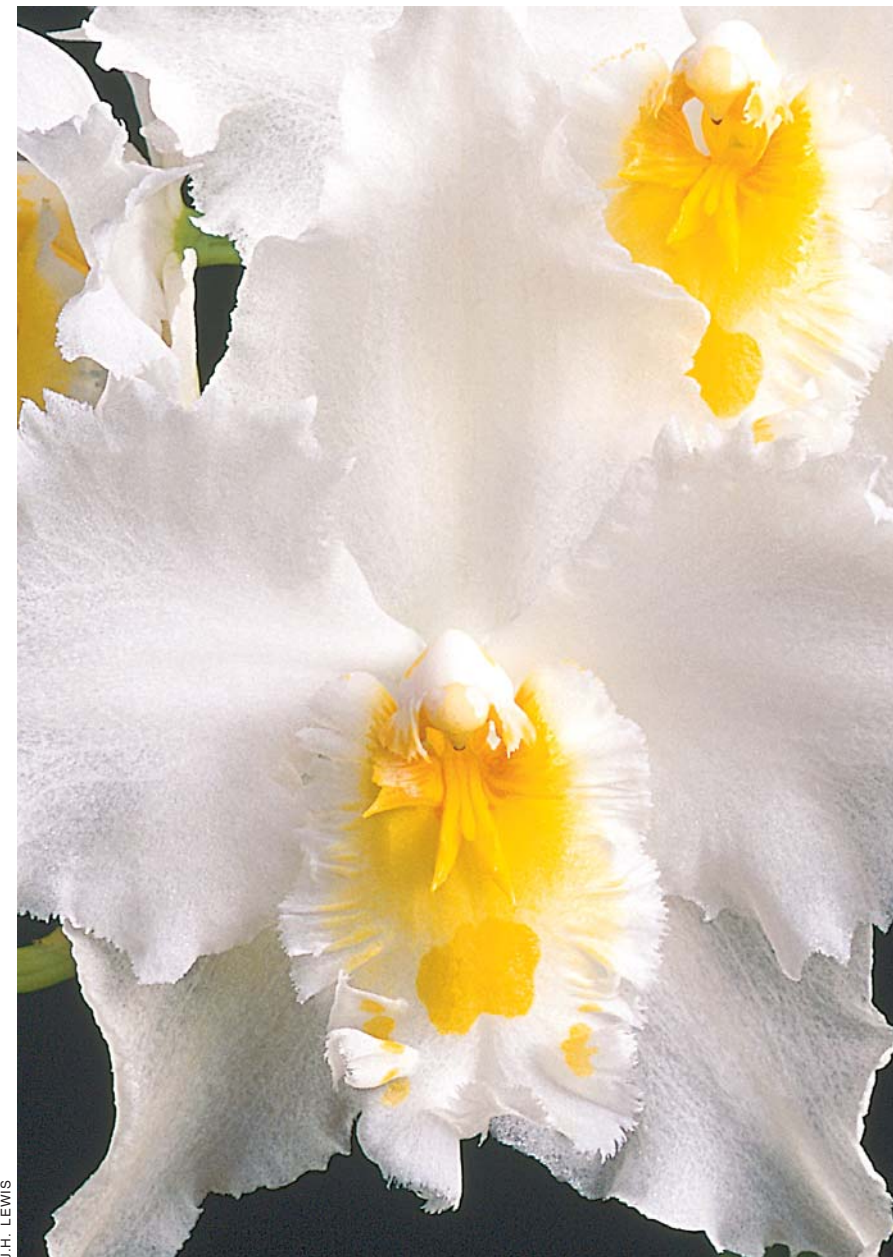
CHARLES MARDEN FITCH



J. HARRIS



LYNN O'SHAUGHNESSY



J.H. LEWIS

than 3,700,000 seeds. Fortunately, due to studies by the late Lewis Knudson, PhD, at Cornell University, Ithaca, New York, in the early 1920s, we can easily germinate orchid seeds by using a nutrient medium and aseptic conditions.

Any flower having four or more of these criteria falls into the orchid family. For example, *Hexisia bidentata* does not have a showy labellum, as all six floral segments are almost identical and, in *Vanilla*, the pollen tends to crumble rather than being in a nice packet, but both are still in the family because they have the other necessary characteristics.

It should also be noted that orchids, being monocotyledons, have their floral segments in threes. The outer whorl of perianth parts consists

of three sepals, which are usually alike in size, shape and color. The sepals protect the unopened buds as they emerge. The arrangement on the sepals can also be helpful in identification of some genera. *Cattleya* flowers have sepals arranged pinwheel fashion, each equidistantly spaced (120 degrees apart) while, in *Maxillaria*, the two lateral sepals are at right angles to the dorsal sepal. The slipper orchids (*Paphiopedilum*, *Phragmipedium*, *Cypripedium*, *Selenipedium*) have only two apparent sepals, a dorsal sepal and a synsepal, the latter arising from the fusion of the two lateral sepals. The next inner whorl consists of the two petals and, in most orchids, one highly modified petal, the labellum. The label-

lum is highly variable between and among genera, ranging from broad and flat to boot-shaped and is often the dominant segment of the flower. Here too, the labellum can be helpful in identifying some orchids. In the center, surrounded by the whorls of floral segments, lies the gynandrium. The orchid is a typical monocotyledonous flower.

Getting to know your orchid flowers can only make your vocation or avocation more interesting and desirable. What I like to do when the flowers are starting to fade is to pick one or two and dissect them. Look for the anther cap and remove the pollinia. How many are there? Is there a viscidium present? Locate the stigmatic surface on the underside of the gynandrium.

OPPOSITE ABOVE LEFT The large lip is uppermost on the nonresupinate flower of *Telipogon ariasii* 'Eumelia', AM/AOS, grown by Manuel Arias Silva.

OPPOSITE ABOVE RIGHT *Laeliocattleya* Nora's Melody 'Twinkle Star', HCC/AOS (*Lc.* Love Knot x *C.* Little Dipper), bears an isthmus-type lip, which is sometimes called a "waisted" lip. Grower: Japheth Ko.

OPPOSITE BELOW LEFT *Paphiopedilum micranthum* fma. *album* 'Picardie', FCC/AOS, bears a lip modified into a pouch. Grower: Clark Day Jr.

OPPOSITE BELOW RIGHT A lip with a waterfall pattern is seen on *Miltonia Venus* 'Tumblebrook', HCC/AOS (*phalaenopsis* x *vexillaria*). Grower: Richard Kaufman, MD.

TOP LEFT A fine fringe edges the lip of *Epidendrum Annelie Wans* 'Westfield', AM/AOS (*ilense* x *stamfordianum*). Grower: James and Janette Harris.

ABOVE LEFT In *Dracula chestertonii* 'Free Spirit', CHM/AOS, the lip has evolved to mimic a fungus in an attempt to lure a pollinator. Grower: Lynn O'Shaughnessy.

ABOVE *Odontioda Victoria Village* 'Secret', AM/AOS (*Odm.* Augres x *Oda.* Samares), bears a spotted lip. Grower: Russ Vernon.

PLANT-GROWTH FORMS



CHARLES MARDEN FITCH



LEFT: JAMES E. MCCULLOCH; RIGHT: TECK H. HIA



TECK H. HIA



Check also for spurs on the labellum. There is an orchid flower (*Comparettia*) with three spurs but, when you look at the flower, you see only one. Where are the other two? Dissecting will tell. Try making a vertical section to see the inner workings of the reproductive structures in the column.

Orchid flowers are fascinating and really need to be looked at in detail. Then and only then will you know why it is called an orchid.

Thomas J. Sheehan, PhD, is a recipient of the American Orchid Society's Gold Medal of Achievement. 3823 Southwest 3rd Avenue, Gainesville, Florida 32607 (e-mail TSheehan@mail.ifas.ufl.edu).

SYMPODIAL GROWTH

In sympodial orchids (e.g., *Cattleya*) the main stem grows horizontally and produces determinate lateral branches that, when mature, usually have terminal flowers. After flowering, the plant produces a new growth from the base of the last growth continuing on in a horizontal direction.

TOP LEFT Fragrant flowers are borne on *Brassavola flagellaris* 'Prof. Dorothy Schweitzer', CCM/AOS. Grower: Dr. L. Schweitzer.

ABOVE LEFT *Epicattleya* First Love 'Aunt Inez', CCM/AOS (*Epi. tampense* x *C. aurantiaca*). Grower: Karen Niemann. ABOVE *Erythrodes calophylla* 'Eichenfels',

CBR/AOS. Grower: Ann and Phil Jesup. ABOVE RIGHT *Lycaste* Pixie 'Trident's Golden Beauty', CCE/AOS (*campbellii* x *cochleata*). Grower: Wilford Neptune, MD.

MONOPODIAL GROWTH

In monopodial orchids (e.g., *Vanda*) the main stem is perpendicular to the surface of the medium, is always vegetative at the apex (indeterminate growth) and has axillary flowering. This perpendicular or indeterminate growth habit can theoretically grow upward ad infinitum.

OPPOSITE *Vanda stangeana* 'Herbert', CCM/AOS. Grower: Patricia Zurschmeide.



JAMES E. MCCULLOCH

LINKS

<http://www.iucn.org/themes/ssc/pubs/orchids.htm>

Orchids: Status Survey and Conservation Action Plan – Executive Summary, edited by Eric Hágsater and Vinciane Dumont and compiled by Alec Pridgeon, is an overview of how species diversity within the orchid kingdom is threatened by encroaching development and the associated destruction of habitats.

<http://www.angelfire.com/or3/orchidsnz/scribblings/hybridisation.htm>

Diversity, pollination and hybridizing within the orchid kingdom are explored in the Web article, "Orchid Miscellany: Hybridisation."