



St. Augustine Orchid Society

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## Apical Dominance and Growth Patterns

by Sue Bottom, sbottom15@gmail.com

Apical dominance is the tendency for a plant to grow upward in search of more light. The internal plant signaling mechanism controlling apical dominance involves plant hormones, naturally produced substances created in small amounts in one part of the plant that affect the growth of plant tissue in a different part of the plant. Auxin is formed in the growing point of the plant, sometimes called the shoot apical meristem, and moves downward in the plant suppressing lateral bud formation. This phenomenon causes the main, central stem of a plant to grow more strongly than the side stems. When you pinch the top of an annual to encourage it to have a bushier shape, you remove the source of auxin so another hormone, cytokinin that promotes branching, becomes more dominant. Apical dominance is expressed differently in monopodial and sympodial orchids.



11. Monopodial orchids grow upwards, forming new leaves at the apex of the plant and inflorescences and keikis form from bud primordia in the leaf axils. New roots also emerge from nodes around the stems.

**Monopodial Orchids.** Vandas and phalaenopsis are monopodial orchids growing continuously upward, sprouting new leaves from the apex of the plant. Phals and vandas typically have at least two bud primordia at each leaf axil that can waken from quiescence to develop into inflorescences or keikis. When the signal to initiate the inflorescence is received, one of the buds begins to grow to form an inflorescence. Another bud can be activated to form a keiki. Some monopodial orchids have a natural tendency to form offshoots so they form multiple keikis. Others tend to remain dormant until damage to the growing tip triggers the bud to form a keiki to ensure the continued survival of the plant. Some phalaenopsis also have the tendency to form keikis from nodes along the inflorescence. This tendency is seen more commonly in species than in hybrids, particularly the summer flowering varieties in the lueddemanniana group like *Phal. pulchra*.

Crown rot can be fatal to a phalaenopsis or vanda. If the rot destroys the growing tip of the plant, it can no longer grow new leaves. The death of the apical tip changes the internal hormonal balance and encourages basal keikis to sprout from one of the lower bud primordia as long as the rot has not destroyed the buds. Do not repot or disturb the roots during the several month period while you are waiting for the new plantlet to form. Simply remove the rotting tissue, disinfect with some hydrogen peroxide, water sparingly and wait. When the new plant is large enough to be self-sustaining, you can separate it from the dying mother plant.



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12. The growing tip of this phal has succumbed to crown rot, so new leaves can no longer be produced from the growing tip. After disinfecting the wound, wait for a basal keiki to form.



13. Some phalaenopsis freely form basal keikis from one of the primordial buds present between the leaf axils; others do not sprout new growths unless the growing tip is damaged.

You may have seen a phal with an apical spike, in which the flower spike emerges from the central crown of a phalaenopsis rather than from an axillary bud adjacent to the leaves. This inflorescence consumes the apical tip of the plant so it can no longer grow more leaves or flower spikes from the plant apex. You will normally have to wait for a basal keiki to form for this plant to continue growing and flowering for you.



14. Some phals freely form keikis from nodes on the inflorescence.



15. An apical spike growing from the crown rather than a bud between the leaves usually consumes the apical growing tip of the plant.



16. This one has not read the orchid books. After the apical spike formed, it is not supposed to grow a second one from the apex.

If the top of a vanda gets damaged, the internal hormonal balance is altered and the plant responds by sprouting offshoots from the lower axial buds. Sometimes vandas get so tall they are difficult to manage and become unattractive from loss of leaves at the base of the stem. Vanda growers can let their too tall plants flop over on their sides to reverse apical dominance. As David Grove wrote in his book on vandas:

*Any plant that shows signs of serious stress, whether from Fusarium wilt or any other cause, will benefit from several weeks or a few months of the upside-down treatment.*





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*Hanging the plant in this way prevents water from lingering in the leaf axils, thus discouraging the growth of fungi and bacteria. The principal benefit, however, comes from a reversal of apical dominance. Hanging the plant upside down thwarts apical dominance by reversing the direction of the internal flow of hormones that normally inhibit root and lateral shoot growth in order to provide more energy to the top of the plant. As a consequence, energy is diverted from the production of new growth at the old top of the plant to production of new roots at what now is the uppermost section...*

**Sympodial Orchids.** Sympodial orchids have a lateral growth pattern in which each new shoot arises from the apical renewal bud or eye on the basal, rhizomatous part of the plant. The new growth enlarges into a swollen stem, the pseudobulb, as it matures and then the apical growing part of the plant is consumed by the formation of either a terminal inflorescence or terminal leaf. Once the apical tip terminates its production of auxin ceases. This stimulates a renewal bud to grow and form another pseudobulb, repeating the process. The result is that the rhizome, which may appear to be continuous, is derived from multiple meristems, different from a monopodial plant whose stem derives from a single meristem. Many orchids are sympodial, including those with obvious pseudobulbs like cattleyas, cymbidiums, dendrobiums, oncidiums and bulbophyllums as well as those without obvious pseudobulbs like paphiopedilums and phragmipediums. Sympodial orchids can be further divided into two groups depending on whether the blooms originate at the growing tip of the plant or from the leaf axils.



21. Sympodial orchids grow laterally from a rhizome with new growths emerging from a renewal bud on the rhizome to form a pseudobulb that ultimately terminates in an inflorescence.

*Single Terminal Bud Primordia.* In most cattleyas, the apical tip of the pseudobulb is consumed when it changes from the vegetative to the reproductive state and forms an inflorescence. Most pseudobulbs have several triangular patches of meristematic tissue at their bases that is capable of rapid division and differentiation. These eyes can produce a new pseudobulb when triggered into vegetative growth. There are usually two primary eyes at the base of the pseudobulb and there may be smaller secondary eyes on the next node up on the pseudobulb. Some species like *C. elongata* have dormant vegetative eyes on the internodes higher up the pseudobulb that may grow if the primary eyes are damaged.

The older parts of cattleyas can get a new lease on life as long as there are viable eyes. The back bulbs can be set in a tray or empty pot, misted daily and potted up once the renewal eye starts to swell and roots begin to form. Better yet, if you know you are going to divide a plant, you can cut the rhizome several months prior to repotting to encourage the dormant eyes to sprout prior to disturbing



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the root system. When the time comes to repot, the new plant growth has already begun and it will reestablish more quickly.



22. This cattleya has been hanging upside down under the bulbos. The buds are swelling and new roots are forming, time to repot.



23. Lc. Maui Plum 'Volcano Queen' AM/AOS putting on a show. Cattleya growths terminate when the primordia buds form inflorescences.



24. Keith found keikis growing from the nodes of a leafless, dehydrated back bulb of *C. bicolor* that was partially severed from the mother plant.

Photo courtesy of Keith Davis.



25. Courtney found nodes sprouting new growths on this *C. Terry Bottom*, you just never know what Terry will do! Was it the Purely Organic fertilizer?

Photo courtesy of Courtney Hackney.





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31. Seminobile dendrobium forms many new leads during the growing season.



32. Seminobile dendrobium blooms from the leaf axils on the previous year's mature growths.

*Multiple Bud Primordia at Leaf Axils.* Some sympodial orchids such as dendrobiums and cymbidiums have several bud primordia located at the leaf axils from which the flowers and keikis form. Dendrobium growths emerge from the rhizome and lengthen, forming from one to many leaves along the nodes until the growth terminates in a leaf at the apex, consuming the apical growing tip. The axial buds can either continue vegetative growth to form keikis or be triggered into the reproductive growth phase and form flowers.

Some dendrobiums freely keiki from the canes while they are attached to the plant and can simply be twisted off and potting up once the roots are a couple inches long. This growth pattern means many dendrobiums can easily be propagated by laying the cane horizontally along a bed of moist sphagnum moss or other suitable potting medium and waiting for the axillary buds to sprout.



33. Dendrobiums tend to a dense growth habit with canes nestled closely together, so they can grow many years in a seemingly too small pot.



34. Notice the terminal leaf at the apex of this Den. spectabile plant, along with the prior bloom stems that emerged from bud primordia around lower leaves.



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35. Dendrobiums tend to freely form keikis from nodes by the leaf axils.



36. Phalaenopsis and spatula dendrobiums so have a terminal leaf and the first flower stem forms at the closest axillary bud.



37. Pteronotus dendrobiums like this Den. Hibiki 'Tiny Bubbles' blooms at nodes along prior year's leafless stems.

Cymbidiums have multiple dormant bud primordia at the basal portion of the pseudobulb that can be activated to form inflorescences. Two or three inflorescences can be expected from a single pseudobulb, and once that pseudobulb has flowered, new vegetative growths are needed before the plant can rebloom.

Paphiopedilums have a sympodial growth habit like cattleyas, but have no pseudobulb or enlarged stem. While growing vegetatively, the stem is short with an apical meristem that is often below the media and continuously generates leaves. Once it receives the signal to begin reproductive growth, the differentiation of tissue into a flower bud terminates the growth of the vegetative shoot.

There is a whole new generation of plant growth regulators, generally natural or synthetic plant hormones, used by commercial nurseries to control plant growth habits. We orchid growers are most familiar with the auxin bearing hormone products available in various strengths and formulations that can be used to encourage root growth. Many orchid growers use seaweed on their orchids on a routine basis, in part because it contains hormonal plant growth regulators like auxin and cytokinin. Using natural substances like seaweed or synthetic rooting hormones for a month or two on newly repotted plants or plants with compromised root systems is a common practice for jump starting root growth to return plants to health. As with any hormonal supplement, it should be used with discretion to avoid unintended consequences.

Apical dominance is not a strategy for world domination. It is an adaptation to encourage upward growth encouraging the plant to capture as much light as possible. In the event of damage, plants have a Plan B in which different plant hormones trigger a growth response designed to ensure their continued existence. With healthy growing orchids, you should not need to supplement nature by supplying hormones from external sources. After you have stressed your plants in the repotting process or if your root system is ailing, a jolt of hormones, particularly the rooting hormones, can help stabilize them.



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