BEGINNER'S SERIES

Orchid Culture — 5
— Air Pollution, Air Movement, and Humidity

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Though a less evident factor in orchid culture, the air in a growing area is nevertheless vital and highly influential. From the surrounding air, plants take in carbon dioxide, a necessary ingredient for photosynthesis. Oxygen, on the other hand, is needed for respiration. Potted orchid roots, for instance, require oxygen derived from the air pockets or well-aerated water present in a porous medium, because the uptake of water and nutrients (in addition to root maintenance and growth) is a process which demands energy. Since oxygen and carbon dioxide levels in the air we breathe are adequate for plants as well as animals, the orchid hobbyist need only consider whether the air in the growing area is free of toxic gases, circulating properly, and adequately moist.

Sepal wilt on a *Cattleya* hybrid. Photo: Charles Marden Fitch

ETHYLENE TOXICITY

No conclusive evidence yet exists to prove that the more notorious forms of air pollution can also damage orchids. However, one by-product of our modern, industrial world, ethylene, does have a well-known, detrimental effect on orchids. Even in small quantities, this gas can cause a kind of premature aging in flowers called sepal or petal wilt, which is associated primarily with cattleyas and their kind. When exposed to ethylene, sepals of newly-opened flowers typically lose their substance, becoming somewhat transparent. They soon fold and eventually turn dry and brown. At higher concentrations, petals will respond in a similar manner. Only at extremely high concentrations of long duration does ethylene cause the plants themselves to react adversely, with the yellowing of leaves being the likely result. Other orchids highly susceptible to ethylene damage include many phalaenopsis and dendrobiums. In the presence of ethylene the flower buds of these orchids cease development, turn yellow, and fall off.

All of these various orchid responses to ethylene can usually be observed to-

wards the last day of an orchid show. Ethylene produced by the smoking public, and low humidity levels, are probably in large part responsible for the short life of orchid flowers on exhibition plants. Those who have placed their prized cattleya at the peak of its flowering in the car trunk, intending to take it to an orchid society meeting for the accolades it justly deserves at the show table, know how quickly ethylene can do its damage when out comes a plant which looks instead like it is well past its flowering prime.

Ethylene is generally present as a result of the incomplete combustion of a fuel, commonly from running car engines and poorly ventilated (or faulty) heaters. Logically, then, the more completely a machine can convert fuel into heat and energy, the less likely potentially dangerous by-products, such as ethylene, will be produced. This is why a number of new and more efficient heaters on the market today are safer to use for orchids; they emit less of such toxic gases by burning fuel more thoroughly than their predecessors. Even so, all practical devices (and not-so-practical personal habits) which involve burning something, be it gas, natural gas, wood (or tobacco), should be eyed with suspicion when it comes to protecting orchids in flower. The exhaust or smoke they give off should be kept as far away from the growing area as possible. Heaters to be used directly with the orchids should be carefully investigated with the aid of those who own them or sell them, to determine if they do indeed emit ethylene, and if they do, how it might be feasible to properly vent this offending gas.

AIR MOVEMENT

Once you have fairly assured yourself and your orchids of ethylene-free air, the next consideration should be air movement. Air in constant motion is widely believed to be beneficial to orchids. For one, it is an effective means of equalizing ambient conditions. If air is circulating around your orchids, pockets of hot or cold air, low and high humidity, are less likely to develop. For another, air moving past orchid leaves has the same cooling effect a breeze can have on us. "When the air is still, a blanket of insulating air clings to the leaf and actually prevents cooling to a considerable degree. On the other hand, moving air is an excellent means of conveying heat, but it must be kept moving to do so. It picks up the heat by direct contact and carries it away ... By keeping good air movement across the leaves you can treat your plants to much more sunshine than you can without it in the summer." (Mitchell, 1963) Moving air also has a drying tendency, which can be helpful in terms of disease control, because water left on leaves or flowers for any duration creates conditions conducive to fungal or bacterial attack.

Ordinary fans will get the air moving around your orchids, particularly if your growing area is somewhat confined. Small "muffin" fans perched above light-garden trays are a familiar sight. More average-size household fans can do the trick in window areas. They should not be aimed directly on the plants unless at low speeds, though. Plants and spikes rocking in fast-moving air may be reminiscent of palm-fronds swaying in a tropical breeze, but even palms can be damaged by hurricane winds! For larger growing areas, perhaps more specialized, low-speed, high-volume fans, similar to turbulators in greenhouses, like the kind of ceiling fans now becoming popular as home fixtures, would be better able to move the large volumes of air involved. Naturally, opening several windows, if possible without too drastic a temperature change, can cause significant cross-ventilation and air movement. Open windows can also favorably influence the humidity levels in your growing area, assuming that the air is more humid outside. In greenhouses during the win-

ter, opening vents can cause a loss of some humidity which escapes with the rising, warm greenhouse air.

HUMIDITY

Circulating air must have some humidity, or a sunny and warm growing area may more closely duplicate desert conditions than those of a classic tropical forest! Moisture in the air, along with air movement and temperature, has a substantial influence on the transpiration rate of a plant. Low levels of humidity, especially in combination with high temperatures, can cause orchids to lose water through their leaves at a faster rate than they are able to take up water through their roots, leading to varying degrees of desiccation and wilting. Levels of humidity which are too high for the health of orchids are not likely to be faced by growers without greenhouses, but an atmosphere near saturation (100% relative humidity), and stagnant, can lead to water forming on the leaves and flowers, as well as to the very slow drying of potting media. These are conditions, again, which make a plant and its flowers vulnerable to disease attack.

Insufficient air movement and high humidity can foster Botrytis flower blight. Photo: Greg Allikas

Recommendations in the literature center around the figure of 60% relative humidity for good orchid culture. Humidity levels are greatly determined by air temperature. The warmer the air becomes, the more moisture which must be added to maintain adequate relative humidity. For this reason, providing acceptable humidity is not so much a problem during night hours when cooler temperatures usually prevail and plant transpiration is at a minimum. Acceptable humidity proves quite a challenge, however, during warm (or heated) daylight periods, particularly indoors where few sources of significant humidity exist.

Water molecules have to break apart from each other in order to become airborne and provide humidity. Fortunately there are more ways to do this than boiling a pan of water. Water molecules exposed to air have a tendency to gradually "separate from the pack" and join the atmosphere, a process called evaporation. The more water molecules exposed directly to the air, and the warmer the prevailing temperatures (making for more active molecules), the greater the rate and number of water molecules liberated into the surrounding air to create humidity.

Porous gravel generates reasonable amounts of humidity in this way by imbibing water, thereby exposing it to more air. Orchids themselves, especially in large numbers and in freshly watered media, do at least partially contribute to the overall humidity in a similar way. Some humidifiers generate humidity by "atomizing" water into smaller amounts, creating a fine mist far more subject to air and far more likely to become a part of it. Other types of humidifiers expose small droplets of water to large volumes of air by blowing air through a fibrous pad moistened in traveling through a tray of water, conveyor-belt fashion.

Shriveling of a normally smooth and succulent leaf of a Cattleya hybrid resulted when a Cattleya hybrid was subjected to low humidity and high light. Photo: Greg Allikas

Evaporative coolers make use of the fact that water needs and absorbs significant amounts of heat and energy to go from the liquid to the gaseous state, consequently cooling the air or surface involved. Growers can make use of this cooling ability of evaporating water by "syringing", or misting, their orchids. In the process of evaporating, water will momentarily cool the leaves and raise the humidity. But unless done under conditions which will lead to rapid evaporation (high light, warm temperatures, some air movement), and done frequently, the rather fleeting beneficial effects are perhaps not worth the greater risk of spreading disease, and the nuisance of mineral residues accumulating on the leaves. Outdoor growers may possibly find misting worthwhile in terms of retarding heat build-up and its resulting sunburn during hot, still, sunny weather. But growers indoors, especially under lights where leaf scorch is not an issue, could better employ their time and efforts by taking advantage of other more effectual devices for generating additional humidity.

Maintaining humidity indoors can be greatly simplified by using a good humidifier operated on a humidistat. Nevertheless, all growers should be aware of things which tend to deplete the air of humidity. Heated or air-conditioned air is low in humidity and can quickly dry the air of a growing area. Humidifiers work overtime during cold weather when the heat is on frequently. The cold surface of window glass in the winter time will draw water out of the air by the reverse of evaporation, condensation. Double-glazing (with polyethylene, for example) will reduce this occurrence by moderating the surface temperature. And, as mentioned previously, humidity levels lower spontaneously as temperatures rise, unless additional moisture is added to the air. Conversely, relative humidity rises as the temperature drops, as it typically does during the nighttime hours. So most efforts towards increasing humidity need be taken during warmer and bright daylight hours, especially indoors when the heat or air-conditioning is on.

Hobbyists should strive for the gentle movement of clean, moist air around their orchids. Such a practice helps eliminate, or at least moderate, any extremes which

Low humidity conditions are especially trying for mounted orchids, such as the Cattleya hybrid pictured here. Photo: Greg Allikas

may develop in the growing conditions. Particularly in the case of high light and accompanying warm temperatures, humid, moving air can lower leaf temperatures and reduce transpiration and water stress. Light, temperature, air movement and humidity ultimately determine the water and nutrient needs of orchids, and therefore watering and fertilizing practices. The next article for this series will discuss these frequently troublesome responsibilities in orchid growing. — *84 Sherman Street, Cambridge, Massachusetts 02140.*

REFERENCES

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