Orchids in a Basement

Text and photographs by Charles E. Bracker, PhD

Part 1. Creating an Environment under Lights with Three Temperature Zones

[1] About half of our orchid collection shown in the prebasement days. These plants were growing in an alcove by an east-facing window, with fluorescent lights above them, in an upstairs bathroom.

[2] A view of about half of the cool room in the basement. Note the quarry tile floor partially covered with a rubber mat. This room is illuminated with low intensity fluorescent lighting.

IN THE LATE 1980S, MY LATE WIFE, Anri, built a small collection of orchids that she kept in one of our bathrooms near an east-facing window on three shelves. She cared for the orchids, and I was just a spectator and admirer of her success. When she died, I had to learn about and care for the orchids she had raised. But because of my partial disability, I found it difficult to manage the orchids the way she had. So, I decided I would attempt to build a lean-to greenhouse obtained from one of the companies that sells greenhouse kits. A good friend of mine learned of my plans, and he questioned the wisdom of building a limited greenhouse. He was absolutely correct. It would have been wrong for me to build a greenhouse, even with the help of a handyman who was skilled at doing such things.

It mostly boiled down to economics and the small size of a greenhouse I could build. My original plans for a 16 × 16-foot (4.8 × 4.8-m) greenhouse would have cost a lot of money, but there were other reasons that a greenhouse seemed inappropriate. So, I started searching my property to see if there were alternatives. One day, I was in our basement, which at the time was used for storage. It was a mess, as many basements are. But I looked at the rooms, and I thought for a few minutes that perhaps instead of a greenhouse, I could convert the basement into a larger environmentally controlled growth facility, and grow the orchids there.

At the time, I had in mind expanding the number of orchids from 30 to 40 (in the bathroom) to a few hundred. I finally decided that the basement was perfect. I could have several times as much space as my proposed 16 × 16-foot (4.8 × 4.8-m) greenhouse. The cost, in rough terms, would be about the same. The main room in the basement was about 15 × 25 feet (4.5 × 7.6 m). Another room was almost as large, 14 × 24 feet (4.2 × 7.3 m) in area. A small 8 × 16-foot (2.4 × 4.8-m) tool room could serve as a cool room. As spillover space, I could use about half the laundry/furnace room and put some orchid benches and storage in there if necessary.

PLANNING STAGE I roughed out some plans to make a self-contained, environmentally controlled, orchid-growth facility. What is more, with several rooms, I could create a few different environments in the basement instead of being limited to one, which would have been the case in the greenhouse.

Growing any number of orchids under lights in a basement facility is entirely different from cultivating them outdoors or in a greenhouse. Why? Because all the environmental factors that orchids require must be provided by the grower. Nature provides almost nothing because the basement facility is isolated from the outdoors. At the peak, I had approximately 2,000 orchid plants, but I now have about 1,500 orchids of various kinds growing in four rooms of the basement. To accomplish this, we had to start from scratch and provide everything that orchids need for survival and flowering.

Those factors included light, humidity, cooling, heating, a purified water source, a fertilizing apparatus, air circulation, and protection of the basement and the rest of the house from mold growth. This all requires installation of a number of utilities, special preparation, additional space for repotting and storage, and places to work apart from the benches that hold the orchids.

Early on, I decided on a theme for my orchid collection. By reading, I had

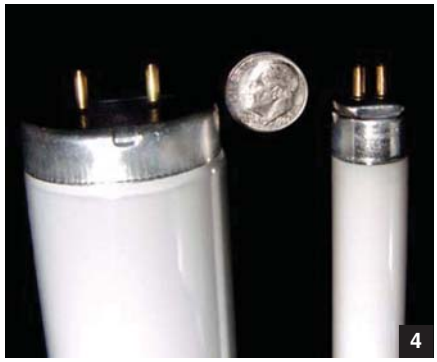
become impressed by the diversity of orchids. Almost every aspect of orchids exhibits various levels of diversity: e.g. their optimum habitat, size of plants and flowers, flower color, morphology, aroma, tolerance of changes in their environment, watering schedule — the list goes on and on. Because the theme was "diversity," I had to provide rooms that could be isolated from each other, and environments that could be varied when necessary.

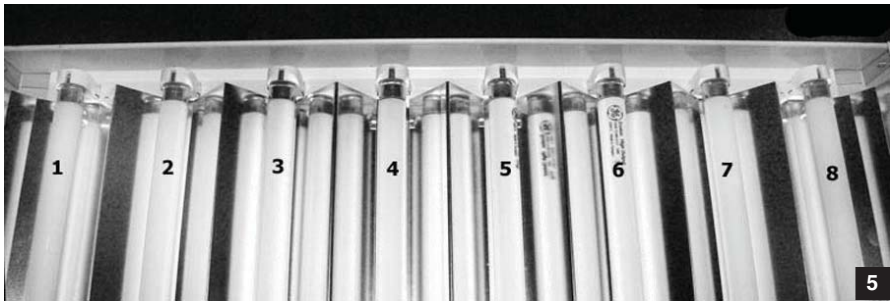
I decided to provide three different environments to accommodate orchids that came from different parts of the world and were adapted to different growth conditions. First, there was a cool room (65 F [18 C] daytime and 55 F [13 C] at night). This would house most of the pleurothallids and other orchids that thrive in high-elevation cloud forests of Central and South America, and some other parts of the globe. Two rooms had intermediate temperatures (75 F [24 C] daytime and 65 F [18 C] at night). Most of our orchids reside in those two rooms. Finally, we needed a warm room in which to grow cattleyas and their relatives that do best in a warmer environment (low 80s F [28 C] daytime with a 10 F drop at night).

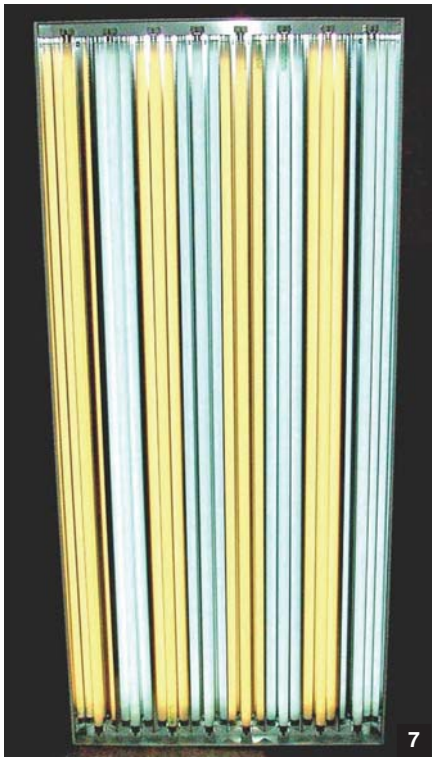
So far, these descriptions refer only to the temperature, but temperature is only one of the factors we had to consider.

When the decision was made to grow orchids in the basement, two other considerations came to mind. First, I am partly disabled, so the actual physical work to maintain the orchids had to be kept to a minimum. Second, the humid environment would be conducive to the growth of fungi (molds) all over the facility. A number of molds produce toxins that are harmful to animals and humans. In fact, some of the mycotoxins are even fatal if people are exposed to them too much or for too long. Both of these problems had to be overcome when we converted the basement, which had been used only for storage, into rooms that were suitable for orchids to grow.

PHYSICAL LABOR Minimizing physical labor was accomplished by mechanizing or automating as many utilities as possible with sensors, timers and ways to provide diurnal changes in the lighting and temperatures. Thermostats were installed in each room to control the temperatures during daytime and at night. Humidistats were







[3] The warm room during the early stages of its preparation to become a growth room for cattleyas and their relatives that require a warm environment. The benches are covered with a vinyl coated grill to help keep pots from tipping over. All five HID lights are visible near the top of the photograph.

[4] Close-up comparison of a standard Agrosun fluorescent light tube (left) and a narrower T5 tube (right). The size comparison is aided by a US dime.

[5] The ends of T5 fluorescent tubes mounted in their reflector. This reflector contains eight fluorescent tubes (numbered) that are turned off.

[6] Part of a group of orchid benches illuminated by T5 fluorescent tubes (left) and standard fluorescent lights (extreme right). Note the difference in distance between the lights and the canopy for each type of light. These orchids are in the laundry/furnace room, which has an intermediate temperature.

[7] An entire face view of the lit T5 bulbs mounted in their reflector. Note that the bulbs give off two colors of light. They are placed so that they alternate between bluish and red-orange parts of the visible spectrum. What appears to be three of each bulb is really only one. The appearance of three adjacent bulbs of each color is created by the beveled reflectors. The reflector housing also contains two ballasts to run the fluorescent tubes.

[8] An HID light reflector, with lights inside, mounted on the metal track attached to the ceiling of the room. The reflector moves back and forth across the room, driven by a motor in the small box by the mounting of the reflectors near the ceiling.

attached to each humidifier to maintain the proper humidity level in each room. Timers controlled the on and off switches for lighting.

LIGHTING Lighting is the most complicated part of the basement system. Overall, we have three general levels of light: High light, intermediate light and low light. This is achieved with different kinds of lighting. All plants in the cool room are under low light. The low light is achieved by the use of 4-foot- (1.2-m-) long fluorescent tube lighting with two tubes in each reflector. We use Agrosun Full Spectrum Grow Lights, fluorescent tubes made in Germany. They are more expensive than other fluorescent lights, but they emit a spectrum that is closest to that of sunlight (a 93 percent match). The light they emit provides 300–400 foot-candles at the plant canopy.

Intermediate lighting is provided by a new type of fluorescent light called T5 lights, made by Sunlight Supply Co. These lights are referred to as High Output Fluorescent Lighting and are considerably brighter than standard fluorescent tubes. They have only been available since 2006. The fixtures can be hung much higher than standard fluorescents and still illuminate the plants below them at a higher intensity than standard fluorescents. At the canopy level, plants receive illumination of about 1,000 foot-candles. Hanging them higher is a convenience, because people have more room underneath the lights to work with the plants, and the area that is illuminated is larger.

The T5 tubes are considerably narrower than conventional fluorescent lights. They come in 2 foot (.6 m) and 4 foot (1.2 m) lengths and are mounted in reflectors containing two, four or eight tubes. We use reflectors with eight 4-foot- (1.2-m-) long tubes. The reflectors are not expensive, and the installation of the reflectors and tubes is easy. Each batch of eight tubes is supported by two ballasts.

The tubes come in two illumination colors. One type gives off a cool bluish color. The other provides illumination that has a warmer appearance and gives a reddish or pink color. The two colors are installed in alternating positions in the reflector, giving the plants the blue light they need to support vegetative growth (leaves, roots, stems), and the reddish tone to support reproductive development (flowering).

Finally, there are the high-intensity lights that are referred to as HID lights (high intensity discharge). The ones we use were made by Sunlight Supply. I chose the Sun System VII lighting. System VII has large reflectors with two bulbs in each reflector. One bulb is a 400 watt MH (metal halide) bulb that is strong in the blue part of the spectrum, and thus supports vegetative growth but not reproductive development. The second bulb is a 400 watt sodium vapor light (HPS — high pressure sodium) that is distinctly warmer in tone and is strong in the red-orange part of the spectrum. Thus, each reflector contains lighting that favors vegetative (MH) and reproductive (HPS) development of orchids. Depending on how far away from the plant canopy they are hung, they can provide different intensities of light for the plants. Also, the closer they are to each other the brighter the illumination is that hits the plant canopy. In our main intermediate room, the lights are 5 feet (1.5 m) apart, and at the plant canopy level the light measures 1,200-plus foot-candles. In the warm room, the HID lights are hung 4 feet (1.2 m) apart. Because they are closer together, the light is brighter, and the room tends to get warmer, which is what we want for the warm room that is maintained at about 85 F (29 C) during the day. At canopy level, the light intensity is about 1,500 to 2,000 foot-candles.

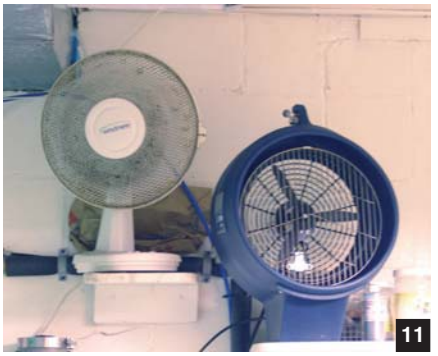
Each HID reflector, with two bulbs, is supported by a large and heavy ballast that we hang on the wall near the place where each reflector is located. Each ballast container has two separate ballasts inside, one to support each HID bulb.

The HID lights do not just hang in one place all day long. Most of the time they are moving. They are mounted on metal tracks that are attached to the sub ceiling. A motor-driven apparatus with wheels allows the HID reflectors to hang from the tracks and they move slowly back and forth across the room on the wheels.

When the lights are on, the motors turn slowly, and each lighting fixture moves slowly from one side of the room to another. When it reaches the end of the track, it pauses for about 15 to 20 seconds, and then starts moving back in the opposite direction. By having the lights pause at each end of the track, plants at each side of the room

[9] Part of a wall in the warm room. The large white rectangular structures with electrical cables at each end are the ballasts for HID lights in that room. Each ballast box contains two ballasts — one for each 400 watt bulb in a reflector. Each reflector has a separate ballast box.

[10] A close-up view of the motorized box that attaches the HID reflector to the track on the ceiling. Small wheels attached to the motorized box roll in the bottom part of the track on the ceiling and carry the reflector back and forth across the room.



[11] An air circulating fan (upper left) and a Jaybird model Aqua Fog 400 Humidifier (dark blue apparatus to the right of the fan) in the large intermediate room. These are located on head-high shelves located above the Dosmatic fertilizer mixer.

[12] A thermo-hygrometer hanging on the wall of the large intermediate room. This gauge measures temperature and humidity.

receive about the same amount of light as those in the middle of the room. By having the HID lights move, two things are achieved. First, plants beneath the lights are less likely to be burned by these very bright lights. Second, and perhaps more important, with the lights moving back and forth, a larger area is illuminated by the bulbs in each reflector.

In any one room we can have lights of different kinds. For example, in the main intermediate room, we have bright illumination (HID lights) for the plants that are in the center region of the room. But, at the periphery of the room, we have hung standard fluorescent lights that provide lower intensity light. Plants with lower light requirements are grown under low-intensity fluorescent lights there. In a sense, it is a mix and match situation.

As an aside, the electricity bill for the HID lights is high. In fact, when we first installed them, we thought we would receive a visit from authorities trying to find out why our electric bill rose so suddenly. But that never happened, and our bills were not questioned. Altogether, we have nine HID reflectors, each with two 400 watt bulbs that are on for 15 hours each day.

HUMIDIFIERS We have one humidifier in each room. The kind we use now is the AquaFog 400 (made by Jaybird). Each humidifier is connected to a tube that provides reverse-osmosis (RO) water. That way, we minimize contamination of the rooms by using pure water. Standard tap water, from the city water supply, is hard and is loaded with salts of various kinds. If we used tap water and converted it into a mist to create the humid environment, the mist would settle down on the plants and every other surface, and when it dried, it would leave a dusty layer of residual salts from the hard water that would block the stomata, among other things. The RO process reduces the soluble salts from more than 350 ppm (parts per million) down to about 2–3 ppm and eliminates the dust problem. It is as pure as is practically possible, and it helps keep the rooms clean. The RO water is the same as we use for watering plants (it comes from the same source).

Charles E. Bracker, PhD, was until recently newsletter editor for the Lafayette Orchid Society. Charles is profiled on page 571 of this issue of Orchids.