The Orchid Doctor Speaks Frankly About Sex …

Presented to the Kona Orchid Society on 10/3/08 by Charles Pikcunas of Tsunami Tropicals, Ltd.

A few years ago, I had lunch with dr. Ruth Westheimer, the noted sex therapist. While waiting to be served, I asked her what was the secret to great sex. In her jewish, elfin voice, she said "Dahling, you got to relax!"

And that's what I want you to do tonight – Relax. This is the most rewarding aspect of growing orchids that you can learn and the most fun you will ever have with a toothpick.

My story starts in the Garden of Eden. When Orchids first evolved from lower plant forms, certain changes took place. First, they moved out of the dirt and debris of the forest floor and up into the trees to secure better light. Second, they evolved fleshy roots and pseudobulbs to allow them to capture and save moisture without being rooted in the dirt. And third, they developed unique sexual organs to attract pollinators and ensure the continuation of their species.

The defining factor of what constitutes an orchid is this unique sexual structure. Ordinary plants have pistils that hold their pollen and stamen to receive it when pollinated. That pollen is usually dry and powder fine so it can be dusted from plant to plant either by visiting insects or by the wind. But in orchids, those two sexual organs have fused into a single organ called the column. This is the "nose" shaped structure in the center of each flower from which the petals, sepals and labellum radiate.

At the tip of the "nose" you will find a small, hinged cap called the anther cap. Beneath that cap are a pair of sticky, glutinous pollinia. Proceed deeper into the flower and you will find the stigmatic surface, which has replaced the stamen. When pollinated, the insect, bird or bat is attracted to the flower either by sight or smell and attempts to reach its nectary. In doing so, it rubs any pollen that may be on its head or back upon the stigmatic surface of its new host and while backing away, unhinges the anther cap allowing the new pollinia to adhere to its back or head.

This mechanism is not only simple, but prevents a plant from being "self-pollinated" since any seed from such a cross is usually

sterile. Furthermore, it is highly effective and predictable. When Charles Darwin examined an angraecum having a 12" nectary, he opined that there must be a moth in its locale with a 14" tongue. He knew it must be a moth since the flower was only fragrant at night when moths were active. Biologists uniformly rejected his theory for decades until ultimately a night flying moth with a 12" + tongue was captured in the act of pollinating the angraecum in question.

Having been successfully pollinated, things start happening fast. First, the pollinated flowers quickly wilts giving off ethelene gas. This gas wilts all of the other nearby flowers on the plant to prevent them from being further pollinated and thereby weakening the plant itself.

Then, the ovary of the pollinated flower, which is located directly behind the column, begins to swell as the pollen interacts with its yet unfertilized seeds. Over a period of up to a year, that ovary grows, sometimes up to the size of a baseball. When the seed is fully ripe, it dries and splits allowing millions of extremely tiny seeds to be scattered by the winds.

So many seeds are necessary for several reasons. First, to germinate and become a plantlet, they must find a hospitable spot. Seed that lands too deep in the forest will ultimately rot due to too much moisture and too little light. Likewise, seed that lands too high in the canopy will dessicate in the winds and the sun. Second, orchid seed needs a host fungus to germinate and thrive because it does not have any stored food of its own. The pea that you plant to eat is 99% stored food and 1% genetic material. An orchid seed is 99% genetic material and that is why it is so small. Without this fungus, it cannot begin the process of turning carbohydrates into sugars and thereby sustain its life. Finally, like all seed, orchid seed is subject to predation by insects and animals. Therefore, millions of seed are produced, but few survive to become sexually active flowering plants.

By the middle of the 19th century, botanists had figured out the mechanics of orchid pollination and had begun making crosses of their own. All this took was a laboratory probe, or for our purposes, a toothpick, a pair of scissors, and a steady hand. To artificially pollinate a flower, first cut away the petals, sepals and labellum of the plant that will carry the pod leaving only the column. Then take the pollen from the other parent by unhinging the anther cap. The pollen should adhere to the probe, or can be easily picked-up by touching the probe directly to the pollinia. With pollinia in hand, return to the pod parent and smear the pollinia upon the stigmatic surface. Say a quick prayer to St. Albans, the patron Saint of orchid

growers, and wait. Hopefully within a few weeks you should see a pod developing. And remember to always "tag" your crosses with the name of the pod and pollen parents (in that order) and the date of the cross. If successful, this information will then be transferred to all subsequent labels.

But back to the 19th century: after making their cross and watching a pod develop and ripen, the early orchidists were stymied by the minute size of the orchid seed. In an attempt to mimic nature, they prepared community pots (or compots) of sifted peat or sphagnum moss and dusted them with the orchid seed pod like a salt shaker. They then covered the compots with wet burlap and sealed the entire arrangement inside a bell jar to maintain that "tropical" feeling. Their results were dismal because they had not yet discovered the mychorhizal fungus that made germination and food production possible for the seed.

What did happen is that occasionally a few seeds would manage to germinate weakly and they began to re-use the peat moss from these successful compots in their next attempts. Much like a sourdough starter batter, this spread the naturally occurring fungus from generation to generation and better germination began to be seen. It wasn't until 1922 when a young Cornell University researcher named Lewis Knudson began to experiment with germinating orchid seed on laboratory agar, much like they were currently growing fungus cultures, that the door to artificial germination of orchid seed was finally opened.

To sow an orchid flask, Knudson mixed agar (the basic ingredient in Jello), a mixture of nutrients, and vitamins and added it to sterile flasks. The orchid seed is introduced in a sterile environment to the flasks and the flasks are then stoppered with a rubber bung containing a small hole stuffed with cotton to allow pressures to equalize. These flasks are then placed in a warm environment with 300 – 500 foot candles of light. Germination takes place within a few weeks or months. By 1929, Knudson had taken his experiments to their logical conclusion by growing and flowering a laeliocattleya hybrid inside a 5 gallon laboratory flask containing only his agar solution as its nutrition.

The key to this process was the maintenance of a sterile environment and its biggest problem was the seed pod itself. Having grown in a greenhouse, the pod is naturally covered in microscopic bacteria and fungi. When it splits open, the seed inside the pod rapidly gets contaminated with these same pathogens. If that seed is then sown on a sterile medium like agar, the pathogens will grow quicker than the seeds and rapidly spoil the flask,

To combat this, botanists would disinfect the pod and its seed in a bleach solution. But any bleach solution strong enough to kill the fungi was also too strong for the developing seeds. Further, if the pod had already split, they were faced with a teaspoon full of wet dust that was virtually impossible to sow into the flasks.

It took another 30 years before the French firm of Vacherot & Lecoufle solved this and an even more tantalizing problem of orchid breeding. In the late 1950's, Vacherot began to harvest and sterilize the pods before they were fully ripened and had not yet split. This took only a toothbrush and a bit of 10% bleach solution. Then, the pods were cut in half lengthwise under sterile conditions and the still unripe seed was transferred to the agar flasks. Some seed failed to fully develop, but overall, germination was remarkable and the incidence of flasks spoiled by fungal contamination dropped radically. This process has been commonly called "greenpod" culture and is the universally preferred method in use today.

Dr. Mendel in his work on genetics postulated that if Plant A were crossed with Plant B, 25% of the resulting seedlings would look like Parent A, 25% like parent B and the remaining 50% (known as AB) would share traits common to each parent. This is the bedrock rule of all hybridizing. But what if only a few of the 2nd generation progeny were valuable enough to grow to flowering or be awarded? They could be crossed back to each other as in AB x AB or self-pollinated, but still the resulting progeny were inconsistent. But in 1964, Vacherot solved this problem by meristeming the first orchid hybrids. They found that if the meristematic point contained in a growing lead was removed and placed in an agar flask much like seed was sown, under the right conditions of temperature, light and motion, the cells contained therein would reproduce hundreds of exact duplicates of the mother plant. Further, that growing cellular mass could be further sub-divided into additional flasks allowing for potentially an infinite number of genetic twins to the mother plant. This process is now known as cloning.

No longer did hybridizers have a stranglehold upon the orchid world. Now a single awarded plant could become legions within just a few short years and each of its progeny would carry the same award as its parent since it was genetically identical. While this greatly reduced the price of fine plants for the hobby grower, it turned the award structure of the orchid world on its ear. The solution was to essentially disqualify meristemed plants from any further quality awards and only allow them to receive cultural awards such as a Certificate of Cultural Merit which recognizes the efforts of the grower rather than the breeder.

So, you've sown your seed, its germinated into plantlets and they have grown to the point of filling the sterile flask. What next? If the plantlets remain too small to handle in the greenhouse, they are deflasked in a sterile environment, sorted by size, and "replated" or placed into a number of additional flasks for further growth. Once again, sterility is important since mold or fungus in the replated flasks will kill the seedlings as quickly as it would have killed the seeds themselves.

To remove plantlets from a flask, mix up a solution of sterile, distilled water and Physan, a medical grade fungicide. Then flood the flask with the solution and allow it to sit for a few minutes. Gently agitate the flask and pour its contents into a sterilized pan and rinse with plain distilled water. If the plants are too large for the flask opening, they may be removed with sterilized forceps or you may even have to break the flask. To do so, wrap the flask in newspaper or a heavy towel and rap its lower rim around its edges with a small hammer until it breaks free. Then be sure to rinse the contents thoroughly with the water/physan mix to insure that all of the glass shards have been removed from the plantlets.

If they were deemed large enough to handle outside of a flask, plantlets were traditionally planted into community pots filled with a peat moss/perlite mixture. Sheldon Takasaki uses Pro-Mix directly from the bag. Other growers use straight perlite if the roots are developed enough. The important thing is to provide continuous, even moisture in a relatively sterile medium to prevent damping-off. These compots are then placed in a shady location with around 500 – 800 foot candles of light and moderately high humidity. Once the plants are fully established and hardened, they are washed free of the potting mix and re-planted into either oasis cubes or seedling pots. The problem has always been picking that right moment when the plant is big enough to repot, but hasn't yet grown into its neighbors in the compot. An error here results in a tangled mess and a high percentage of losses as you try to untangle the community root ball.

Many growers now are replating their seedlings twice and allowing them to grow to a substantial size while still in flasks. To facilitate this, they are using wide mouth flasks with screw lids. 30 – 35 plantlets are placed in each of these second replates and allowed to grow on. When large enough, they remove them from the flask and start them immediately in oasis cubes. These cubes can be supplemented with a perlite covering, or allowed to remain as is. The large, strong, replated seedlings will rapidly grow roots into the oasis cubes, but will remain separated by the cell structure of

their tray. When they are ready to be potted, they need only be lifted from their tray like so many ice cubes and gently potted up.

Potting seedling at this stage is very easy. Start by soaking their tray in a mixture of water with Super-Thrive added to it. This will loosen the plants from the plastic trays and prevent transplant shock. Then, take a pot of an appropriate size (usually 2" pots), and hold the seedling in the center of the pot with its crown slightly below the pot's rim. Add seedling mix (being 1 part fine tree fern or peat moss, 1 part perlite, and 4 parts seedling bark). Tamp the pot firmly on the bench to insure that no air pockets remain and add any additional mix as required.

Once potted, they should be kept in a shady location (under 800 foot candles) and out of drying winds. Check on them frequently and keep them evenly moist. Water them with a dramm seedling water breaker or better yet, a 1 gallon/minute Fogg-It Mister. Using these will prevent you from washing the plantlet out of the seedling mix which has the bad tendency to float if allowed to fully dry out.

I don't recommend that you go out and start hybridizing, since unless you have awarded parent plants, your hundreds of seedlings will probably be of questionable quality. Nor do I recommend that you buy nursery Flasks with over 100 tiny seedlings of the same cross. What would you really do with all of them? But I do recommend that you try a replated flask now and then. A replate with 30 – 35 seedlings will cost about $50 - $100 and result in 20 – 25 viable seedlings. These could easily be split up or traded among friends and thereby increase all of your collections.

Likewise, buying compots sounds like an inexpensive way to go, but often causes more headaches than they are worth. Instead, buy seedlings in 1" oasis cube trays. Most growers have a 10 plant minimum per cross, but these are usually strong, large plants. In some cases, I've even seen plants flower while still in their oasis cube trays. Again, this is a fun and inexpensive way to increase your collection and have plants to trade with friends. Further, if you are buying from an established breeder, you can be assured of the quality of the plants' parents since no grower wants to waste time, money and effort on poor quality stock.