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ORCHIDS

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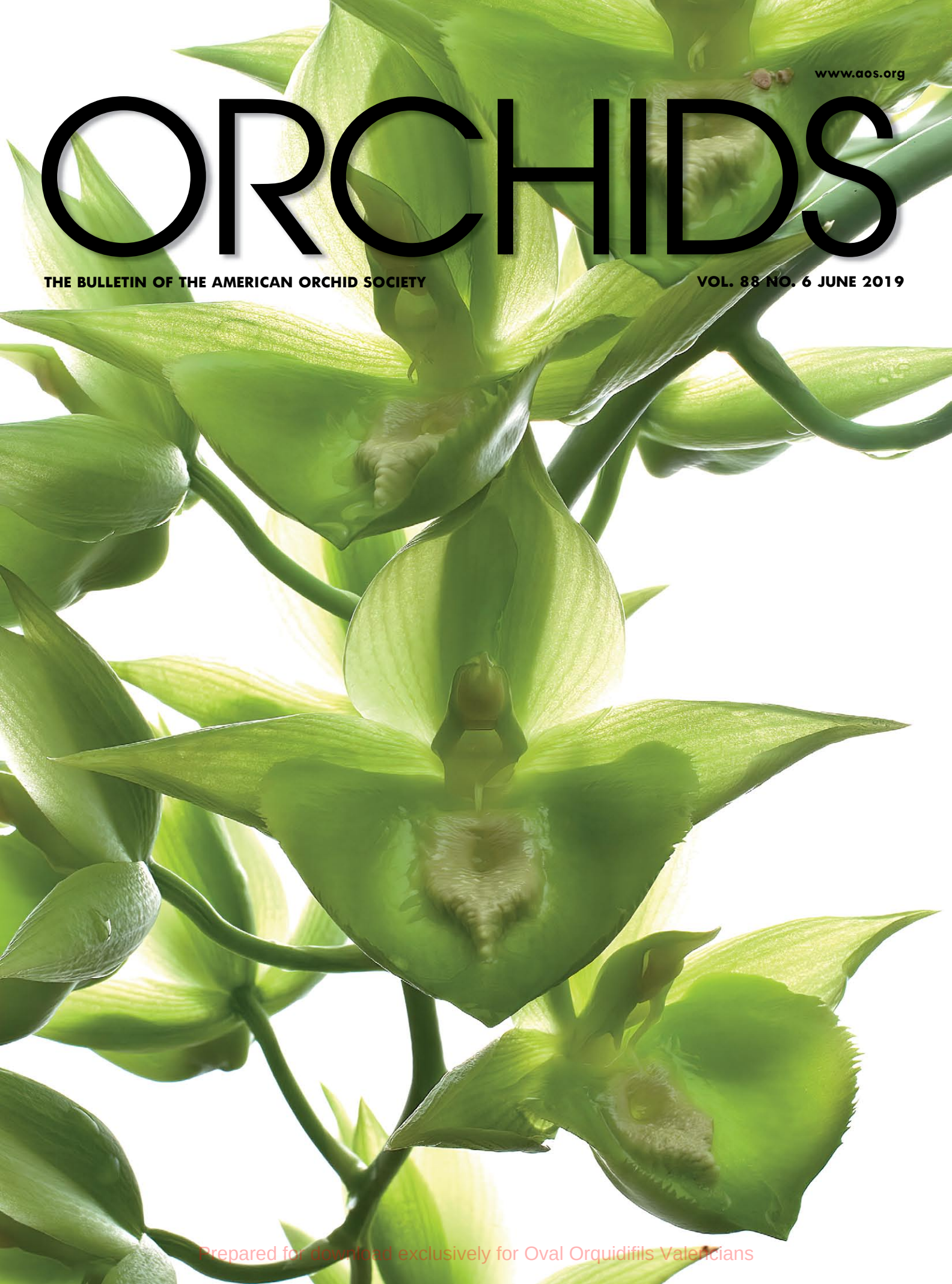

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The Bulletin of the American Orchid Society

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FRONT COVER

Fred Clarke registered Catasetum Louise Clarke (Susan Fuchs × Donna Wise) in 2009. The cross is of excellent high quality and several have received AOS awards. Flowers range from brilliant red to burgundy or dark red or burgundy spots on a green background. Solid green forms such our cover subject are rarely encountered. Photograph by Greg Allikas.

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The mission of the American Orchid Society is to promote and support the passion for orchids through education, conservation and research

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The American Orchid Society provides leadership in orchids

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Pronunciation of orchid names can be daunting for the novice and experienced grower alike. Presented below is a simplified pronunciation guide specific to the names found in this issue of *Orchids* magazine. An attempt has been made to represent each syllable using easily recognized sounds or words separated by hyphens and not standard phonetic symbols. Check out the Orchidist's Glossary on our website at https://www.aos.org/orchids/orchidists-glossary.aspx.

albiflora (al-bee-FLORE-a)
americana (a-mer-ih-KAN-a)
Amparoa (am-pah-ROE-a)
Angraecinae (an-GRAY-kee-nee)
anosmum (an-OSS-mum)
apifera (a-PIF-er-a)
aquilonis (a-kwih-LOH-niss)
Arethuseae (air-e-THEW-see-ee)
arisanensis (air-iss-an-EN-sis)
Basiphyllaea (bass-ih-FILL-ee-a)
bictoniensis (bik-tone-ee-EN-sis)
bifolia (bye-FOL-ee-a)
Bletilla (bleh-TILL-la)
Brasiliorchis (brass-ill-ee-ORE-kiss)
Brasilocycnis (brass-ill-oh-SIK-niss)
bulbosa (bulb-OH-sa)
Calanthe (kal-AN-thee)
callichroma (kal-lih-KROH-ma)
Calypso (ka-LIP-so)
Calypsoeae (ka-lip-SOH-ee-ee)
Catasetinae (kat-a-SET-ih-nee)
Catasetum (kat-a-SEE-tum)
Cattleya (KAT-lee-a)
Cattlianthe (kat-lee-AN-thee)
cervantesii (ser-van-TESS-ee-eye)
coccinea (kok-SIN-ee-a)
Coelia (SEE-lee-a)
Coeloglossum (see-loh-GLOS-sum)
Corallorhiza (kore-al-oh-RYE-za)
cordata (kore-DAY-ta)
costeriana (kos-ter-ee-AY-na)
Cranichideae (kran-ih-KID-ee-ee)
Cryptocentrum (KRIPT-oh-SEN-trum)
Cymbidieae (sim-BID-ee-ee)
Cymbiglossum (sim-bih-GLOS-sum)
Cypripedium (sip-rih-PEE-dee-um)
Cyrtidiorchis (sir-tid-ee-ORE-kiss)
Cyrtochilum (sir-toh-KYE-lum)
Cytherea (sye-the-REE-a)
Dactylorhiza (dak-till-oh-RYE-za)
Dendrobium (den-DROH-bee-um)
denticulatum (den-tik-yew-LAY-tum)
dilatata (dye-la-TAY-ta)
diluvialis (dye-lew-vee-AY-liss)
elegans (EL-eh-ganz)
elongata (ee-long-AY-ta)
endresii (en-DRESS-ee-ey)
Epidendroideae (eh-pih-den-DROY-dee-ee)
Epidendrum (eh-pih-DEN-drum)
estesii (es-TESS-ee-eye)
expansum (eks-PAN-sum)
fimbriatum (fim-bree-AY-tum)
fractiflexa (frak-tih-FLEKS-a)
fungumolens (fun-gew-MOH-lenz)
Galeopetalum (gal-ee-oh-PET-a-lum)
Galeottia (gal-ee-OTT-ee-a)
glauca (GLAW-ka)
Gongora (gone-GORE-a)
Goodyera (good-YEAR-ah)
grandiflora (grand-ih-FLORE-a)
grandis (GRAN-diss)
Habenaria (hab-ih-NARE-ee-a)
Heliophila (hel-lee-OFF-ih-la)
hennisiana (hen-nis-ee-AY-na)
Houlletia (hoo-LET-tee-ah)
japonica (ja-PON-ih-ka)
juergensii (jer-GEN-see-eye)
kleberianum (kleb-er-ee-AY-num)
kostiukiae (kos-tee-YEW-kee-eye)
Laelia (LAY-lee-a)
Laeliinae (lay-LEE-ee-nee)
lankesteri (lank-ESS-ter-eye)
Lemboglossum (lem-boh-GLOS-sum)
Lepanthes (leh-PAN-theez)
leucostachys (lew-koh-STAK-iss)
leytensis (lay-TEN-sis)
londesboroughiana (lon-des-bur-oh-ee-AY-na)
longispica (lon-jih-SPEE-ka)
lucis (LEW-sis)
luisae (LEW-ee-see)
Lycaste (lye-KAS-tee)
lycopodioides (lye-koh-poh-dee-OY-deez)
maculata (mak-yew-LAY-ta)
madrensis (mah-DREN-sis)
Maxillaria (maks-ill-AIR-ee-a)
Maxillariinae (maks-ill-air-EE-ee-nee)
menziesii (menz-EEZ-ee-eye)
Mesoglossum (mee-zoh-GLOS-sum)
Microtis (mye-KROH-tiss)
Miltoniopsis (mil-tone-ee-OP-sis)
molitor (MOH-lee-tore)
Mormolyca (more-moh-LYE-ka)
Neohoulletia (nee-oh- hoo-LET-tee-ah)
Nohawilliamsii (noh-a-will-ee-amz-EE-eye)
Norna (NORE-na)
nutans (NEW-tanz)
Oberonia (oh-ber-OH-nee-ah)
oblongifolia (ob-lon-gih-FOLL-ee-ah)
obtusata (ob-tew-SAY-ta)
occidentalis (oks-sih-DEN-ta-liss)
Odontoglossum (oh-don-toh-GLOS-sum)
Oncidiinae (on-sid-EE-ee-nee)
Oncidium (on-SID-ee-um)
Ophrys (OFF-riss)
orbiculata (ore-bik-yew-LAY-ta)
Orchidium (ore-KID-ee-um)
Ornithidium (ore-nith-ID-ee-um)
ozettensis (oh-zet-EN-sis)
pachyrachis (pak-ee-RAK-iss)
padangensis (pad-ang-EN-sis)
parviflora (par-vee-FLORE-a)
pedalis (PED-ay-liss)
Phalaenopsis (fail-en-OP-sis)
picta (PIK-ta)
pileatum (pil-ee-AY-tum)
Pimpla (PIM-pla)
Piperia (pye-PER-ee-ah)
Pittcarnia (pit-KARN-ee-a)
Pityphyllum (pit-ih-FILL-lum)
Platanthera (plat-AN-ther-a)
platypetala (plat-ee-PET-a-la)
Pleurothallidinae (plur-oh-thal-LID-ih-nee)
prainiana (pray-nee-AY-na)
pseudoreichenheimiana (soo-doh-rye-ken-hime-ee-AY-na)
Pseudotsuga (soo-do-TSOO-ga)
pygmaea (PIG-mee-a)
ramossissimum (ram-os-SISS-ih-mum)
reichenheimiana (rye-ken-hime-ee-AY-na)
repens (REE-penz)
Rhyncholaelia (rink-oh-LAY-lee-a)
Rhyncholaeliocattleya (rink-oh-lay-lee-oh-KAT-lee-a)
Rhynchostele (rink-oh-STEE-lee)
rodrigueziana (rod-ree-gez-ee-AY-na)
romanzoffiana (roh-man-zoff-ee-AY-na)
rossii (ROSS-ee-eye)
Rossioglossum (ross-ee-oh-GLOS-sum)
sambucina (sam-BOO-chee-na)
sanderiana (san-der-ee-AY-na)
sanguinea (san-GWIN-ee-a)
sanguineum (san-GWIN-ee-um)
scalariformis (ska-lair-ee-FORE-miss)
schunkiana (shun-kee-AY-na)
setigera (set-IJ-er-a)
Solenidium (soh-len-ID-ee-um)
sophronitis (sof-roh-NYE-tis)
sparsiflora (spar-sih-FLORE-a)
speciosa (spee-see-OH-sah)
Spiranthes (spy-RAN-theez)
Spiranthinae (spy-RAN-thin-nee)
splendens (SPLEN-denz)
Stanhopea (stan-HOPE-a)
Stanhopeinae (stan-HOPE-ee-nee)
striata (stree-AY-ta)
stricta (STRIK-ta)
tenebrosum (ten-eh-BROH-sum)
tenuifolia (ten-yew-ee-FOL-ee-a)
tessellata (tess-ell-AY-ta)
tigrinum (tye-GRYE-num)
titania (tye-TANE-ee-a)
tonsbergii (tonz-BERG-ee-eye)
trifida (TRY-fid-ah)
Trigonidium (trig-on-ID-ee-um)
triloris (trye-LORE-iss)
unalascensis (oon-a-lass-SEN-sis)
uroskinneri (yew-roh-SKIN-er-eye)
Vanda (VAN-da)
Vandeae (VAN-dee-ee)
variabilis (vair-ee-AY-bil-liss)
viridis (VEER-id-iss)
vreelandii (vree-LAND-ee-eye)
whittenii (wit-EN-ee-eye)
wisteriana (wis-teer-ee-AY-na)
Zygopetalinae (zye-goh-pet-A-lee-nee)
Zygopetalum (zye-goh-PET-a-lum)

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Correction to the May donations list: A donation from the South Bay Orchid Society in memory of their member David Okihara was inadvertently listed by only the individual's last name. We sincerely regret the oversight.

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Susan Wedegaertner
Graham Wood - Lehua Orchids

THE SPRING AMERICAN Orchid Society Members' Meeting was recently held in beautiful San Diego, California. On Wednesday morning the few of us who arrived early were given a tour of the San Diego Zoo's orchid greenhouses. They care for the plants, including orchids, that are then planted around their zoo and in with the animals. It was all very informative! We were able to spend a few hours actually in the zoo before we had to head back for our first of several meetings.

Wednesday afternoon the trustees met to work on long- and short-term strategies for the society. We broke into groups to brainstorm where our society needs to go in the next year to five years. We then regrouped to hear all the options each group had decided on for their topic. There were a lot of great suggestions and areas that we will be exploring. On Wednesday evening we held the Judge's Forum, run by our new national training coordinator, Jean Allen-Ikeson. The topic was "the values to pay attention to in substance and texture." It was a very well received Judge's Forum.

Thursday morning, most of the committees met in person as a supplement to their monthly electronic meetings. I try to attend all of the meetings, for a least a few minutes, in case they have questions that I can answer and also to say thank you for being such great volunteers for the AOS. Thursday afternoon was the Trustees' Meeting. Although the meeting lasted the complete three hours, I must say we accomplished a lot. Remember that meetings of the trustees are open to the general membership if you ever want to attend one and observe the business of the AOS.

Friday was the day to judge the San Diego County Orchid Society show. Ribbon judging, AOS award judging and Cymbidium Society of America judging were done simultaneously. The AOS team I was on gave three awards. The team was comprised of AOS judges from across the country, and it was so much fun. Of course, once judging was completed, some headed to the sales area, which was filled, as with most shows, with gorgeous plants for sale. Friday night was the Society's preview party, with all of the ribbons and awards displayed in the exhibits, showing off for all to see. What a sight!


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President Susan Wedegaertner congratulating:

[1] Carol Beule, newly accredited judge.
[2] Donna Ballard, new associate judge.
[3] Charles Wilson, outgoing trustee.
[4] Sarah Waddoups, outgoing trustee.
[5] Graham Ramsay and Leslie Ann Keller, winners of the 2017 Walter Off Exhibit Award for the Western North Carolina Orchid Society display.
[6] Robert Fuchs, winner of the 2017 Fuchs Family Award, Martin Motes Breeder's Award, Roy T. Fukumura Award and the Paul and Mary Storm Award.

Saturday morning was the AOS Annual Meeting of Members, where all committee chairs in attendance presented a brief recap of their committee's accomplishments since the last meeting and a preview of what lies ahead. Senior staff gave reports on the AOS business and educational efforts. I especially enjoy the spring meetings because the special annual awards are presented to the exhibitors who are lucky enough to win one (or more) of these national awards and also to the photographers who took the award-winning pictures. The meeting is rounded out with the announcement of judging promotions, the names of those who have been accepted as student judges and any other people given special awards and recognition. I get to congratulate all these award winners, promoted judges and new students. In addition to the year-end award winners, former president George Hatfield was recognized with an AOS Hybridizer's Award for his outstanding work in the genus *Cymbidium*, and it was my special honor to present a President's Award to former president Sandra Tillisch-Svoboda to recognize all the work that she has done for the AOS and her work on the World Orchid Conference Trust during her tenure as a WOC trustee and Trust President.

Three trustees left the board with the annual election and three new people joined the board. I thank David Toyoshima, Sarah Waddoups and Charles Wilson for their service, commitment to the organization and their advice while on the AOS Board of Trustees. The new trustees serving a three-year term from 2019 to 2022 are Luiz Hamilton Lima (Brazil), Joyce Medcalf (Ontario, Canada) and Jeff Saal (North Carolina); they join Jay Balchan (Texas) and Greg Filter (Michigan) who return to the board for second three-year terms.

Saturday, early evening was our auction. Who in their right mind pays $125 for a bag of macadamia nuts coated in toffee and dipped in milk chocolate? I did! And I must say, it was worth the price; they were so delicious! I am happy to report we raised $13,000 for our conservation endowment. The evening was crowned by our banquet. The food was great, but the company in the room was even better. Attendees had a wonderful time visiting, moving from table to table after dinner to visit some more.


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I am very happy the meeting in San Diego went so well and I thank our host, the San Diego County Orchid Society, for allowing us to hold our meeting in conjunction with their show. The people who attended had fun and work hard for the AOS.

So, after hearing about how much we accomplish and the fun we have at an American Orchid Society Members' Meeting, I hope you all will attend the fall meeting, October 16–20, in Homestead, Florida, in conjunction with the East Everglades Orchid Society show. Details will be forthcoming as they are worked out, but you can mark your calendars now.

Until next time, happy growing!

— Susan Wedegaertner, President (email: susan@aos.org). All photographs by Wes Newton.


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[7] Marian Sheehan, outgoing chair of the Special Funding Committee

[8] Jeff Tyler, winner of the 2017 Ann and Phil Jesup Botanical Trophy, the Butterworth Prize for most outstanding specimen and the Bill Thoms award.

[9] George Hatfield as he receives an AOS Outstanding Hybridizer's Award for his work in the genus *Cymbidium*. Cheryl Erins, Secretary is on the left.

[10] Frank Smith, winner of the 2017 Masatoshi Miyamoto Award

June: The Month of the Earth

By Thomas Mirenda

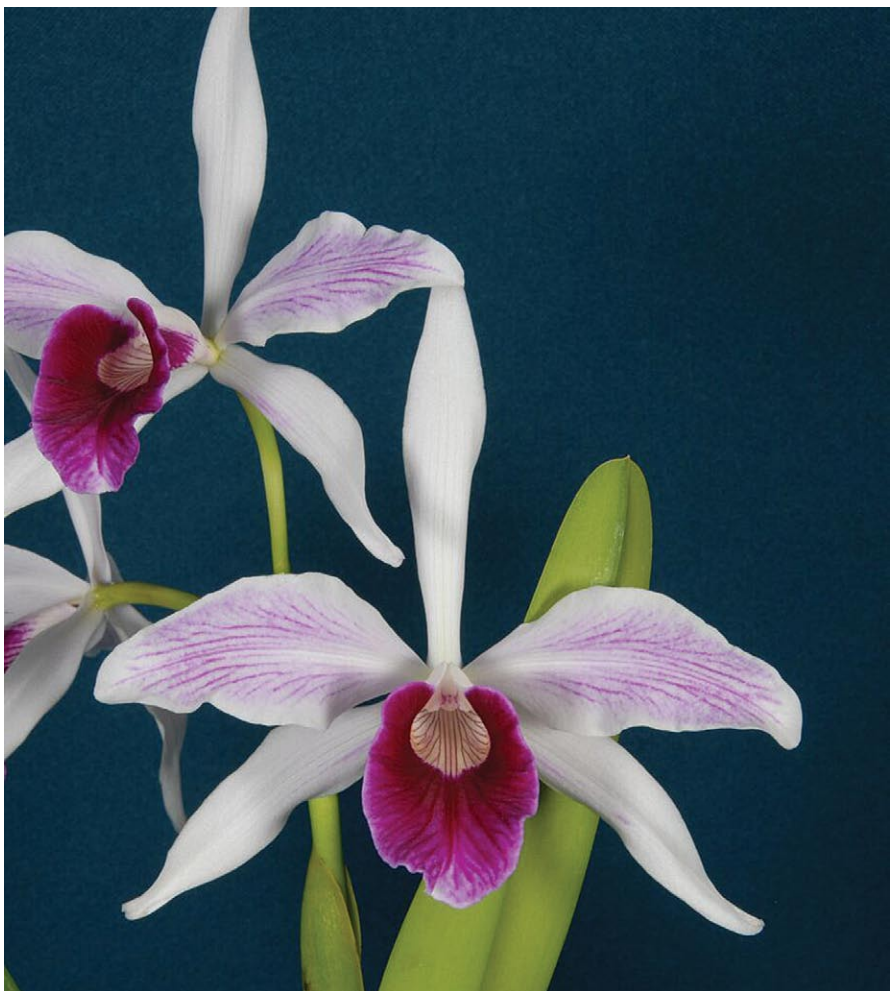
A WISTFUL TEAR or two stripes my cheek as I ponder the recent loss of two of my favorite journeying companions on our beautiful planet, Mark Whitten and Clare Parmalee. Their lives touched and influenced mine in extraordinary ways. Though their absence leaves a profound void in my life, I am still thankful to have known them, learned from them and loved them. My tears are not of sadness, but rather of the realization that the joy I associate with them is now mostly memory and will only be repeated in my mind's eye. I have always believed memory akin to immortality, and what we honor in this way will continue to exist as long as we remember.

Thomas Mirenda

Both these friends were great lovers of orchids and reveled in their beauty and diversity in quite different ways. Clare was aesthetically oriented, enjoying their sublime beauty and fragrance, while Mark sought to understand the science behind their beauty. This is the nature of the vast world of orchids. There is room in it for all of us to enjoy, investigate and ponder their mysteries. As they are laid in earth, the earth they loved so deeply, I have the certainty that their spirits are free and mingling with all the astounding denizens of our planet.

Mark's student, Dr. Kurt Neubig, wrote to me about Mark's burial; it was all natural, in the countryside, no chemicals or caskets, surrounded by loved ones. Kurt's young son, Henry, beloved by Mark, delighted in catching dragonflies and grasshoppers during the service. I cannot help thinking how happy that must have made him.

LIVING IN THE OPEN Most of your orchids enjoy being outside this month, danger from frost being long gone, and nights still reasonably cool throughout most of the continent. Find a spot outdoors with dappled light and good air movement, but with some protection from high winds and forceful deluges. Rainwater is possibly one of the best tonics for your plants, though of course, not in excess. If you are in an area prone to heavy rains and storms, a roof over your orchids would be wise. Those of you growing on windowsills and light rooms can still take advantage of these excellent conditions by keeping windows open and mimicking the natural day length of your lights with a timer. Most important though, is the nightly dip in temperature of 10–15 F (5.5–8.3 C), so crucial for excellent growth and blooming in season.



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Cattleya purpurata 'Springwater' JC/AOS

GROWING AND PROPAGATING June may be the most critical time to water and fertilize your orchids. Most cattleyas, oncidiums, cymbidiums and dendrobiums are in very active growth and loving the perfect weather. The long days influence excellent progress and the storage of nutrients in pseudobulbs. Phalaenopsis, angraecoids and other vandaceous orchids are sending out roots and making new leaves. Do not miss this chance to feed your orchids before the dog days of summer ensue in the coming months. It is also a fine time to take divisions of your larger specimens to share, up-pot to the next size container or remount before roots get too obstreperous. Mounted plants may start to detach or outgrow deteriorating mounts about now. Fresh branches, slabs (cork or tree fern) or baskets may be in order for such plants. Make sure any new mounts are tied tightly and securely as plants will not establish well if they wobble.

GIFTS FROM THE EARTH So many of our temperate terrestrial orchids are up and about this month. Gardening with orchids can be tricky. Make sure these plants are getting the light levels and moisture they need. Often planted near shrubs or under trees, these orchids can sometimes be starved of light and water as their larger plant neighbors grow into glorious specimens. Conversely, if

overgrown shrubs and trees are trimmed or removed, light levels may have changed significantly. Think of your garden as an ecosystem with all the life forms within affecting each other. Clare would have been outside daily, carefully tending and enjoying her patches of bletillas, calanthes and cypripediums, sharing divisions with her friends.

SUMMERS IN THE FIELD Here in North America, this is the field season for many botanists and an awesome time to get outside and find wild orchids. Mark would have been out searching for interesting populations around Florida as well as studying their companion plants, insects and other animals. In this spirit, we should all join him this year. What better pastime could there be for a group of likeminded friends, or what better way to introduce a child to nature? Maybe you will delight in them discovering their first wild orchid while chasing a dragonfly.

— Tom Mirenda has been working professionally with orchids for over three decades. He is an AOS accredited judge and is the chairman of the American Orchid Society's Conservation Committee. He recently coauthored The Book of Orchids: A life-size guide to 600 species from around the world (email: biophiliak@gmail.com).

Too hot in the summer greenhouse?

Stick one side of Velcro disks a foot apart onto the outside of the west side of the greenhouse to fit the shape of the foil-covered, bubble-wrap-type batts like the material used as jackets for hot water heaters. It can be purchased in rolls. The foil will reflect the hot west sun and the bubble wrap will help insulate against the heat. It may also be used to insulate the north side of the greenhouse on the inside to keep heat in and reflect the light back into the greenhouse. — *Jean Allen-Ikeson (email: jean.ikeson@gmail.com).*

Webinars-Coming Attractions!




When	**June 5, 2019** 8:30 pm EDT Wednesday	**July 11, 2019** 8:30pm EDT Thursday	**July 18, 2019** 8:30pm EDT Thursday	**August 08, 2019** 8:30pm EDT Thursday
Topic	The Care and Feeding of Stanhopea	The Story of White Cattleyas	Greenhouse Chat (Orchid Q&A)	Greenhouse Chat (Orchid Q&A)
Presenter	**Inge Poot** Toronto Judging Center	**Jean Allen-Ikeson** National Training Coordinator, Chair of the AOS Editorial Board	**Ron McHatton** Chief Education and Science Officer	**Ron McHatton** Chief Education and Science Officer

REGISTRATION REQUIRED: www.aos.org/orchids/webinars.aspx
Cannot make it on the scheduled date or time? No need to worry. Register anyhow!
We digitize the webinars and they are available to view at your leisure from the same webpage.

Webinar announcements are posted to Facebook, Instagram and in the AOS Corner of your affiliated society's newsletter.
Send your Greenhouse Chat questions and photos to: greenhousechat@aos.org

GREATIdeas

text and photographs by Esteban (Steve) González-Costa

Water Temperature — the Last Challenge

I have been growing orchids for a long, long time. When I worked at Pennock Gardens in San Juan, as I started to work with the orchid collection, I will never forget one of my first directives "always water thoroughly, even if it just rained." The good of this was that I was in the Caribbean tropics where you could almost do no wrong. This could be the reason that I later had to curb my enjoyment of "overwatering." When I moved to the upper Midwest, everything changed, including relearning how to pot, and technology advances in bark, fertilizers, and other accessories that we use to improve and fine tune our orchid growing techniques. Times are good.

I now grow in an over 120-sq-ft (11-sq-m), isolated basement room and have some cooler growing areas set up for my intermediate-to-cool growing orchids and smaller-sized bromeliad collection. I have used a 55-gallon (208-L) drum as our water source for our plants. Water is dispensed either manually or through a switch with a remote control via hose to my plant room at the other side of the wall from a laundry room.

I have always wondered about the water temperature though. In the tropical and subtropical parts of the world, nonsoftened water comes out of the tap fairly warm and pleasant. Here in the Twin Cities of Minnesota, the water comes out very cold, even in the summer. I always had it in the back of my mind that this was a primary cause of sudden black-rot death to many of my plants, particularly the over 65% of an 800-plant collection composed of susceptible cattleya alliance species and hybrids. It always bothered me. The first sign of this cause and effect was seen when I watered with fresh reverse osmosis (RO) water that had been sitting around in the drum and two days later I would lose a *Cattleya purpurata*, *Cattleya alaorii* or other cattleya alliance plants.

I looked and looked for some type of drum heater but most only melt ice for farm animals in water troughs. I could not find anything that had a thermostatic control and some sort of flow or mixing mechanism at any hardware store. Couple this with a long-time fear (really a phobia) that I have of glass and heating in a submerged environment. In the 1970s I worked at the largest pet store known to mankind. Through all my high school years, I worked in Hato Rey, Puerto Rico at *EXOTICO*, a few blocks from my home. This was a megastore with over 500 freshwater tanks and at least 200 marine aquariums. Indeed, I was lucky. I worked with orchids, hung out with puppies, and on free weekends when I was not scuba diving, I was hiking the island with my crazy cousins seeing orchids in unreachable canyons. Back to the pet shop. At the time, the only way to heat aquariums was with that old, thin glass bulb technology. It was terrifying! All you have to do is have one fail or break and

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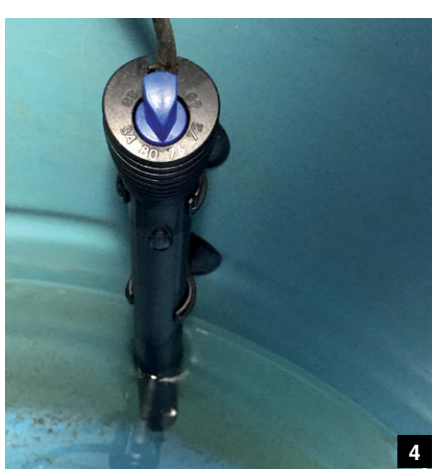
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you were either shocked or bleeding! So the pet store was the last place I went for a solution.

Thinking that I had to resolve this issue for the good of my investment in my hobby, I started looking on the internet for solutions. What I did not find was any kind of solution that heated *and* mixed the water in one gadget. But I did find something earth shattering: there are now aquarium heaters that are temperature controlled and are made of materials that are safe and have no glass components to shatter or break. This provides a durable and, more importantly in my mind, safe solution. Of course, price is not an obstacle now, but finding the best energy-efficient heater that can slowly heat up my RO water source and then turn itself off is my new challenge. In the end, my vision evolved into a two-mechanism solution using a 150-watt heater and an aquarium pump to circulate and mix the water as it warms up. How do I know what the effect was? I have measured tap water in our basement coming out at 50 F (10 C) at the tap. I estimate that it warms up 6–8 F (3.3–4.4 C) as it goes through the RO system. When I pump, there also might be some heat transfer from the sump pump at the top of my RO drum, so water temperatures in the winter might be in the low 60s F (16 C) range. This was of course still too cold for all but my cool-growing orchids.

The other issue to resolve was that of circulating and mixing the water as it warms up. To solve this, I made an aluminum bracket that I screw-fastened to the top of the drum to hold the 500 gallon-per-hour (1893 L-per hour) circulation pump that mixes the water near the base of the heater in the bottom of the drum. To monitor the temperature, I have an aquarium wire-probe thermostat that measures the temperature of the water at about 10 inches (25 cm) from the bottom of the drum. I have set my temperature at the heater to turn off when my thermometer measures 77.5 F (25 C).

My results over the last two winters have been favorable. I did lose one *Cattleya* species this winter, but none of my *Cattleya alaorii* plants that are mounted on cork have turned black and died two days later. Before, I would lose 5–15 plants a season. All my plants seem to grow better and I have minimized these losses. I should mention that my wife, an African violet grower and judge, has over 400 plants in her collection and sale inventory at any given time. She is also very happy with the results and does not complain about cold water anymore. This is something I should have done much sooner. Hindsight is 20/20, right? Now, if I told you that what finally motivated me to act was being the fourth person to take a shower before an activity, would you believe me? From the start, that was the coldest shower I had taken in my life, and it really made me think of what my plants had gone through. My cold-growing maxillarias and pleurothallids are another story; I keep their RO in our basement fridge.

[1] Small circulation pump.
[2] Modern aquarium heater — NO FRAGILE GLASS SHELL.
[3] Aluminum bracket for the pump diffuser.
[4] Heater mounted inside the author's 55-gallon (208-L) holding drum.
[5] Bottom view of the drum.
[6] Close-up of the pump diffuser.
[7] Author's reverse osmosis system.
[8] Temperature controller and probe.

— Steve Gonzalez has been growing orchids for over 35 years since landing a neighborhood garden job repotting cattleyas in Rio Piedras, Puerto Rico. He is a past president and has been a member of the Orchid Society of Minnesota since 1991, and is currently an accredited judge in the Chicago judging center. Living in the Caribbean and US Midwest and working as an international manager traveling Latin America over time has given him the opportunity to see plants in situ and meet many of the business and botanical experts in the Americas' orchid world over the last 40 years (email stevegonzalez@live.com).

Sylvia Strigari

Miltoniopsis warszewiczii

By Franco Pupulin/Watercolor by Sylvia Strigari

Tribe Cymbidieae
Subtribe Oncidiinae
Genus Miltoniopsis *Godefroy-Lebeuf*

Miltoniopsis warszewiczii (Rchb. f.) Garay & Dunst., *Venez. Orchid. Ill.* 6:278. 1976. Basionym: *Odontoglossum warszewiczii* Rchb.f., *Bot. Zeitung* (*Berlin*) 10(40):692–693. 1852. TYPE: [Panama or Costa Rica]. Cordillera de Chiriquí, 8000' auf Leguminosen. October–January, *J. Warszewicz s.n.* (holotype, W).

Synonyms: *Miltonia endresii* G.Nicholson, *Ill. Dict. Gard.* 2:368. 1886, avowed substitute based on the same type of *Odontoglossum warszewiczii* ("Señor Endres was the first to introduce the species in a living state to this country. [B.M. 6163, under name *Odontoglossum warscewiczii*]"). *Miltonia superba* Schltr., *Repert. Spec. Nov. Regni Veg.* 3(42–43):249. 1907, *nom. nov. illeg. Odontoglossum warscewiczianum* Hemsl., *Biol. Cent.-Amer., Bot.* 3(16):277. 1884, *sphalm.*

Epiphytic, caespitose, erect, gray-green *herb* to 20–30 cm tall. *Rhizome* short. *Roots* flexuous, glabrous, to 2 mm in diameter. *Pseudobulbs* ovoid-ellipsoid, 3.8–4.5 × 1.5–2.5 cm, apically monophyllous, subtended and nearly completely concealed by four to six foliaceous bracts arranged in a fan, the lower ones losing the cataphyll at flowering time and becoming dry-papyraceous. *Leaves* and foliaceous bracts articulate, petiolate; the blades carinate abaxially, oblong-elliptic, acute to acuminate, to 30 × 2–3 cm. *Inflorescence* produced laterally from the base of the pseudobulb and emerging from the axil of one of the upper sheaths, a lateral, few-flowered (3–5) raceme 25–30 cm long including the peduncle; *peduncle* terete, green, with translucent, triangular bracts ca. 3 mm long. *Floral bracts* triangular, acute, semihyaline, 4–6 mm long. Pedicellate *ovary* slender, terete, 3.5–4.5 cm long. *Flowers* delicate, flat, white to pink with a wine red to salmon spot at the base, around the yellow callus; column white to magenta with white anther. *Sepals* subsimilar, 2.5–3.5 × 1.2–1.6 cm; *dorsal sepal* elliptic-obovate, erect, concave, obtuse and apiculate; *lateral sepals* elliptic to obovate, slightly reflexed, obtuse and apiculate when spread. *Petals* similar to the sepals but more distinctly obovate, obtuse, apiculate, gently recurved at apex, 2.8–3.5 × 1.3–1.5 cm. *Lip* obovate-pandurate, deeply emarginate, 3.5–4.0 × 3.5–4.0 cm; united to the column base by a narrow keel; disc with semicircular callus at the base, provided with fleshy and slightly elevated border. *Column* stout, straight, semiterete from a narrower terete base, abruptly expanding around the stigmatic arc, 4–5 mm long. *Anther cap* deeply cucullate, subspherical-obovate, strongly keeled in the middle, bilocular. *Pollinia* two, ovate-pyriform, cleft, on a rectangular, hyaline stipe and a peltate, brown viscidium. *Fruit* an ellipsoid capsule ca. 7 cm long including the beak, plus ca. 2 cm of the pedicel.

Reichenbach described the species in 1852 on the basis of a dried plant collected 30 years before by his friend Józéf Warszewicz, who had found it in the mountains of Chiriquí. Notwithstanding the dried flowers he had at hand, the German professor did not hesitate in defining it "one of the most glorious discoveries of our traveler" (Reichenbach 1852), comparing it with *Rossioglossum* (*Odontoglossum*) *grande*. In fact, *Miltoniopsis warszewiczii* shows no particular affinity, both vegetatively and florally, with the true *Odontoglossum* (now included in the genus *Oncidium*) species of South America, and the species spent much of its taxonomic life, together with its sisters, in the genus *Miltonia*, but under a different name.

When George Nicholson, in his *The Illustrated Dictionary of Gardening* (1886) wanted to treat *Odontoglossum warszewiczii* in the chapter for *Miltonia* — as these plants were usually placed at that time — he could not transfer the epithet coined by Reichenbach to *Miltonia* as that name was already occupied in this genus, and therefore blocked, by another of Reichenbach's species, *Miltonia warscewiczii* (Reichenbach 1856), described on the basis of a specimen originally collected by Warszewicz in Peru and ranging north to Panama, today classified under the name *Oncidium fuscatum* Rchb.f (a name that Reichenbach himself created to transfer the species to *Oncidium*, where the epithet was blocked by *Oncidium warszewiczii* Rchb.f. 1852). For this reason Nicholson created a replacement name (*nomen novum*), an avowed substitute based on the same type of *Odontoglossum warszewiczii,* dedicating it to Auguste Endrés, who first had introduced in Europe living plants of this delicately beautiful species. Rudolf Schlechter using the same reasoning and, unaware of Nicholson's work, created *Miltonia superba* in 1907 to replace *Odontoglossum warszewiczii*. However, as Nicholson had already replaced this name 50 years before, the name created by Schlechter is illegitimate. Finally, in 1976, when Leslie Garay and "Stalky" Dunsterville recognized that this species of "pansy-orchid" correctly belonged to the genus created by Alexandre Godefroy-Lebeuf in 1889 for the soft-leaved "Miltonia" species (typified by *Miltoniopsis vexillaria*), they realized that the epithet *warszewiczii* — the first used for the species — was not occupied in that genus and had to be resumed in *Miltoniopsis warszewiczii*.

The name of the great Polish gardener, botanist, explorer and orchid-collector Józef Warszewicz appears in orchid literature with several spellings, including Warscewicz, Warczewicz, and Warszewicz. As it happens in most West-Slavic languages, Polish pronunciation is much more sound-rich than English and other Germanic and Italian/Latin languages. Since the twelfth century, scribes have struggled to fit the abundance of Slavic phonology (with nine vowels and 23 consonants) into the 23 letters of the Latin alphabet. The modern Polish alphabet has 32 letters, nine of which are unique. Some of the letters form digraphs (7) and even one trigraph.

In Poland, the name is invariably written in the form Warszewicz, even in the inscriptions of public monuments and on the funerary tombstone of the mythical orchid hunter (C. Ossenbach, pers. comm.). As it is written in Polish, the name Warszewicz, includes two digraphs, "sz" and "cz" (War**sz**ewi**cz**). These two digraphs are used to represent two different sounds ("š" and "č", respectively). The sound of the digraph "sz" is similar to the English "sh", while "cz" is, more or less, similar to the English "ch" in the word chandelier. As the letter "w" is pronounced in Polish like the English "v", the English pronunciation of Warszewicz's name would be, more or less, "Varshevich".

The understanding of Polish digraphs allow us to conclude that at least the transcription Warczewicz (with two "cz") is not to be used, as it employs the same

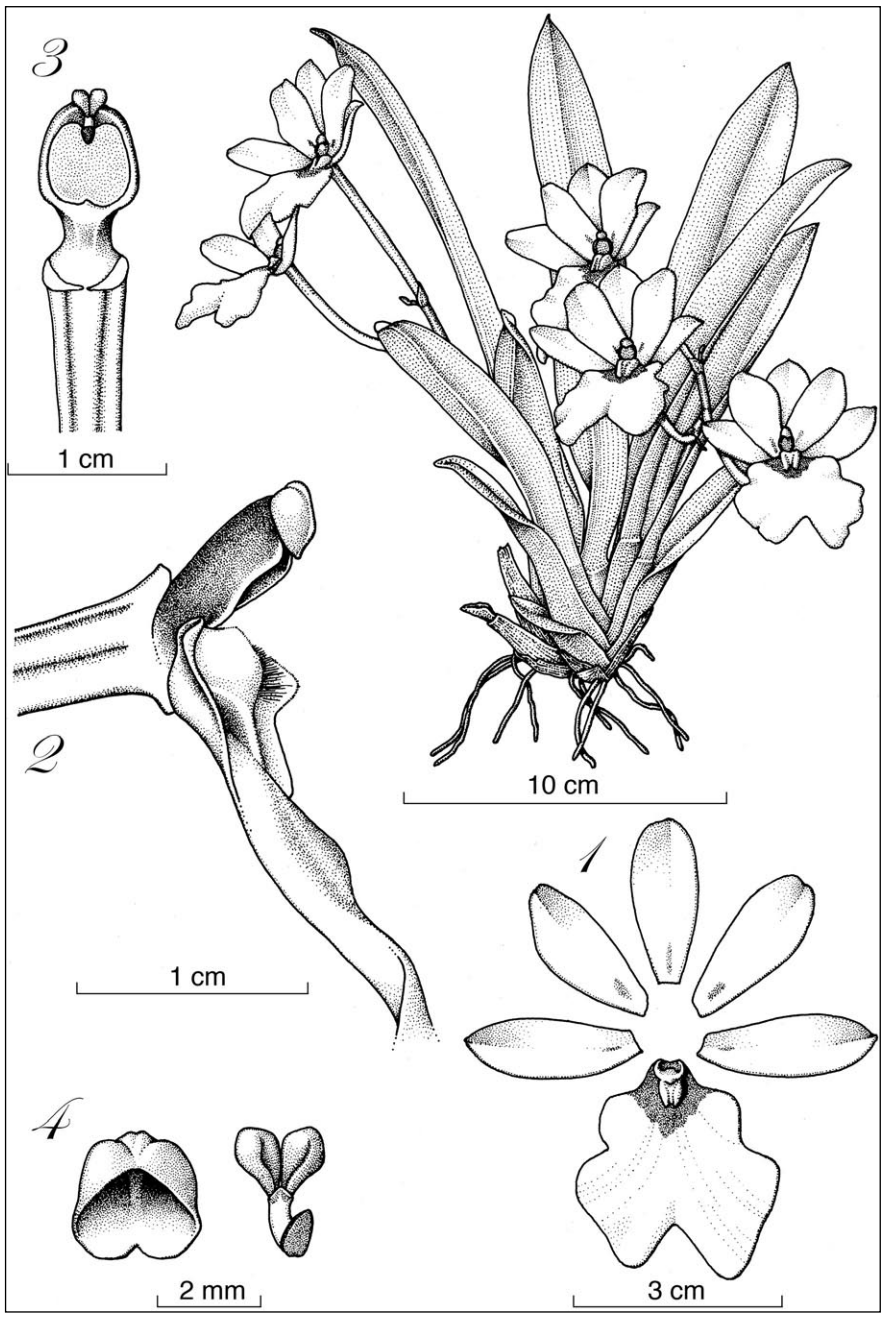
digraph (cz, "č") to represent two sounds that are distinctly different.

Quite distinct is the case of the transliteration "Warscewicz" (with "sc" and "cz"). Heinrich Gustav Reichenbach, who was very acquainted with Warszewicz, dedicated several species and one genus to his Polish friend, alternatively writing his name as Warszewicz, with "sz" (i.e., *Cycnoches warszewiczii*, *Odontoglossum warszewiczii*), and Warscewicz, with "sc" (i.e., *Warscewiczella*, *Cattleya warscewiczii*, *Miltonia warscewiczii*). Modern authors (including myself) have treated the latter transliteration as an error to be corrected, but I am now convinced that we were wrong.

Classical Latin mainly used simply "s" to transliterate both the sounds "č" ("ch") and "š" ("sh"), but it also used "ch" for "č" and "sh/sc" for "š". "Š" also corresponds to how "sc" (before e/i) sounds in ecclesiastical Latin pronunciation (in ecclesiastical Latin *discere* sounds about like "dishere"), and in the same way the sound was represented in Old English (while "ch", on the other hand, was represented by "c" alone). So, the name *Warscewiczella*, as well as the epithet *warscewiczii* (both with "sc") must be interpreted as voluntary latinizations of Warszewicz's name, and must therefore be conserved as such in botanical literature. This eventually led to the undesired consequence that two possible transliterations of Warszewicz name will coexist in botanical literature; one derived from his surname (*warszewiczii*) and the other obtained through a latinization of the surname (*warscewiczii*), and the only way to be sure which alternative has to be used is to go back to the original protologues case by case.

Exclusively known from central Costa Rica to western Panama, *Miltoniopsis warszewiczii* mostly grows in the intermediate regions covered by premontane and lower montane cloud forests (which Mora de Retana [1999] called the "rainbow zone") , from branches of the understory up to high in tree crowns. In its natural habitat, plants of this species flower profusely from October to December, at the very end of the rainy season.

In keeping with the evenly moist climate of their native environments, plants of *Miltoniopsis warszewiczii* have no rest period and should never be allowed to dry out completely or the leaves on new growths will pleat like an accordion. For this reason, plants of *Miltoniopsis* are better suited for pot-culture, with a rather fine substratum. They require enough light to maintain the leaves a light, bluish green, but do not tolerate direct sunlight.



Miltoniopsis warszewiczii. The plant.
1. Dissected perianth.
2. Column and base of the lip, lateral view.
3. Column, ventral view.
4. Anther cap and pollinium.
Drawn from *Pupulin 38* (USJ) by Franco Pupulin.

Sylvia's watercolor, reproduced here, has been painted on *vellum*, a treated animal skin (note the warm tone of parchment of the illustration background) that requires a special technique of fine brushes so as to not dissolve the previous layers of pigments, but which produces a semitranslucent and particularly vivid palette of colors.

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Selected Terms

abaxial – lower surface
acuminate – tapering to a point
acute – pointed
adaxial – upper surface
apex – tip or top
apiculate – having a sharply pointed tip
articulate – hinged
attenuate – reduced in thickness
bilocular – two-chambered
caespitose – clumped
carinate – having a keel-like ridge
cataphyll – reduced small leaf
caudicle – slender, elastic structure to which the pollen masses are attached
claw – slender connection
clinandrium – cavity on the column in which the anther is located
column foot – extension at the base of the column in some orchids
complanate – in one plane
concave – bowl-shaped
conduplicate – folded lengthwise
congested – closely spaced
connate – fused to form a single part
convex – curved like the exterior of a circle or sphere
coriaceous – leathery
cucullate – hooded
digraph – two letters that form a single sound; *ph* pronounced as 'f' for example
distichous – arranged alternately in two opposite rows
elliptic – oval
emarginate – having a notched margin or tip
epiphyte – a plant that grows on another plant for support
flexuous – flexible, full of bends and curves
foliaceous – resembling a leaf
glabrous – smooth
hyaline – glassy, translucent appearance
ligulate – strap-shaped
membranaceous – thin, pliable
mentum – chinlike spur
monophyllous – having one leaf
obovate – egg-shaped with the wide end up
obtuse – blunt or rounded
ovate – egg-shaped with the narrow end up
ovoid – egg-shaped
pandurate – fiddle-shaped
papyraceous – papery
pedicel – a stem carrying a single flower
peduncle – the lower part of the inflorescence below the first bud
peltate – shield-shaped
petiole - the stalk joining a leaf to a stem or pseudobulb
pollinarium – In orchids, a set of pollinia with their viscidia and collecting parts
pyriform – pear-shaped
raceme – flowers arranged along a central stem
recurved – bent or curved backward
semihyaline – more or less glasslike
semiterete – almost cylindrical
sphalm. – abbreviation for s*phalma typographicum*; a misprint
stipe – stalk or stem
subspherical – almost globular
subsimilar – somewhat similar;
subtend – extend under so as to support or enfold
terete – pencillike
trigraph – three letters that, together, form a single sound; for example, the German, *sch-*
viscidium – the sticky pad on the caudicle or stipe of the pollinarium that attaches the pollinarium to a pollinator

Buying Orchids for Your Collection

Text and photogarphs by Larry Sexton

I HAVE BEEN in an orchid society since 1992. One of the most frequent questions I get asked is where can I buy orchids? I would like to answer that with some of the sources I use.

Local orchid nurseries, if you are lucky to live near one, are a good source for new plants. Ask someone in your local society about the local orchid vendors. A trip to their greenhouse is always a source of excitement for me. Actually any time I am buying orchids is exciting to me. Talk to the local grower and find out where their plants come from. Also ask which plants are the most recent additions to their plant sales table. This way you will know what conditions the plants came from, and how long the plants have been growing in your local conditions. Do not hesitate to ask the local vendor about watering frequency, humidity levels and when the plant's most recent repotting was done. All this is helpful in getting your new plant off to a good growing start.

One of my local vendors imports vandas from Thailand. I like to know how long the plant has been here. Some are in bloom. I want to know if I can duplicate growing conditions, and how long the plant will take to adapt to my conditions. To facilitate this, I always put the acquisition date on my plant label. This helps me remember how long it has been in my collection and how close to adapting to my conditions the plant is. I also like to record when the plant was in bloom. This also helps me look for flowers at the proper time for that plant.

One of my first and better resources is, and has been, *Orchids* magazine. There are ads in the magazine from reputable growers throughout the nation (and even the world). It is easy to use their phone numbers or access their websites. When ordering from vendors out of your local area, there are a few important things to know. Do not be afraid to order from these vendors. They have shipped orchids all over the country for many years. They know the weather conditions in your area, and how to get the plants to you safely in all types of weather.

I personally do not like to order in the heart of winter. I live in the Chicago area and weather can be quite bad at certain times of year. You can consult with the vendor as to shipping options and costs, dates, or ways you want things shipped. Most vendors ship early in the week so plants do not sit in trucks or on docks over weekends. I recommend getting next day shipping service if possible. When I was working, I had plants shipped to my office so that they would not be left out in the elements — plants can quickly cook sitting in the sun on a porch or in a metal mailbox or freeze if too cold.

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[1] This shipment from Ecuagenera has been imported from Ecuador. Boxes should be unpacked as quickly as possible and the plants unpacked to allow them exposure to fresh air. Importing plants isn't for the timid — the rigors of international travel means the plants need extra TLC on arrival.

[2] Ask plant vendors how long particular plants have been in their care. Often, especially at shows, flowering plants have been brought in recently by the vendor specifically for show sales.

Most vendors now send a tracking number for your package so you know the date the package shipped and the approximate time it will take to reach your home or office. In cold weather, vendors can also put heat packs in with your order. They are inexpensive considering the value of the package and other shipping expenses and often well worth the investment.

It is also wise to talk to the vendor and find out how they grow the plants you order. You can use that information to change or modify your growing conditions — and, even more importantly perhaps, rethink your order if it is just impossible for you to manage the necessary conditions

Speaking of your growing conditions, I have a rule I use when ordering new plants or types of plants. I will only order three of any one type of orchid. For me to order more of that type, I need to bloom at least one. That lets me know that I have a good chance of successfully growing my new orchid in my conditions. Early in my growing career, I ordered 10 draculas without a clue as to how to grow them properly. Needless to say, it did not take long (about four months) for all of them to die — a costly lesson learned the hard way. Another rule of thumb I follow with new plants is that it can take up to two years for a new plant to acclimate to my growing conditions. This keeps me from getting discouraged when the plant does not bloom right away. Reasonable expectations help to make the hobby much more rewarding. Enjoy your new plants and happy growing!

— Larry Sexton started growing orchids in Batavia, Illinois in 1992. He became a student orchid judge in 1998. Six years later he became an accredited judge. His collection consists of about 700 plants, mostly species. He likes to combine travel with visits to orchid areas. He is the past president of the Batavia Orchid Society, and currently is the training coordinator for the Chicago Judging Center (email: orkiddoc@aol.com).

Dr. William Mark Whitten (1954–2019)

By Mario Blanco, Mark Chase, Lorena Endara, Tom Mirenda and Kurt Neubig

If timeless odes were penned, to immortalize your legacy the true essence of our friend, would still be lost entirely.
We cannot do you justice, though through our sorrow we may try.
An unsung hero leaves us, with nary a goodbye.

THE WORLD OF orchid academia was rocked on April 12, 2019 when the shocking and completely unexpected news that Mark Whitten had passed began to circulate. Many readers of *Orchids* magazine may not be familiar with Mark's contributions to orchidology, but his scholarship, mentorship and influence on modern orchid research are reflected in this magazine. Indeed, his groundbreaking research changed the way many of us understand orchid biology and evolution.

One of us (TM) met Mark at a conference in Ecuador almost two decades ago, and we became instant friends. It was just his nature to be positive and enthusiastic. Over the years, I had the honor of traveling with him to fascinating orchid destinations such as highland Ecuador, southwestern Australia and Jamaica. Indeed, he took the picture of me with *Cyrtochilum ramosissimum* that accompanies all my articles in *Orchids*. He helped clarify many things about orchid biology that I had completely wrong (such as erroneous thinking about co-evolution). I could always depend on him to send me a paper (or an interesting story) about any orchid genus about which I was writing, so if you have read any of my columns, you have absorbed some of his knowledge and wisdom.

He was a mentor to many younger, upcoming orchid scientists, particularly PhD students at the University of Florida (UF, Gainesville), and the Florida Museum of Natural History (FMNH), many of whom have subsequently made their own substantial contributions to orchid science. All of them describe him as a mentor, a father or a brother.

Dr. Mario Blanco, professor at the University of Costa Rica and an ex-Director of Lankester Botanical Gardens in Paraiso, Costa Rica relates the following about Mark:

"Mark was one of five members of my dissertation committee at the University of Florida. In charge of the molecular systematics lab in Norris Williams´s lab in the Florida Museum of Natural History, he was extremely knowledgeable of molecular systematics, plant morphology, chemical ecology and pollination biology. Together with Norris, he kept a substantial living collection of tropical orchids in the Museum´s greenhouse, a resource that was heavily used by him and by Norris' students. Mark freely shared his knowledge and data with everyone. He provided wise guidance to the students, and encouraged us to both participate in his various projects and to initiate our own projects. He liked to take graduate

LORENA ENDARA

MARIO BLANCO

[1] Mark in the paramo of Ecuador near Papallacta at an elevation over 10,000 feet (3,000 m).

[2] Norris Williams and Mark posing with a plant press full of orchid herbarium specimens at Ecuagenera, all of which served as vouchers for DNA studies. Ivan Portilla can be seen in the background.

students out as a group and treat them to dinner every once in a while. A very kind person, he showed concern not only with the academic progress of the students, but also with their personal well-being. He always spoke in a very clear, calm way and was very patient when explaining procedures. After I graduated from UF, he kept in touch with me, with messages about interesting plants, news from UF, etc."

Among his most important academic contributions are:

- Together with Norris Williams, he published several scientific articles on the chemical composition of floral fragrances of orchids that are pollinated by male euglossine bees. This was the 1980s, when the relationship between euglossine bees and many orchids was still being deciphered by a small group of researchers. Mark was also instrumental in documenting many of the euglossine bee–orchid relationships in the field, which are generally highly specific and mediated by mixtures of chemical compounds.
- Related to the previous topic, Mark published several scientific articles on many aspects of the natural history of euglossine bees. Together with Robert Dressler, Calaway Dodson and Norris Williams, he gathered one of the most important collections of euglossine bees from throughout Latin America, deposited in the Florida Museum of Natural History. Mark continued to collaborate with other euglossine bee specialists, among them Günter Gerlach, Thomas Eltz and Santiago Ramírez.
- He co-authored scientific studies on the vegetative anatomy of Stanhopeinae, floral anatomy of *Sobralia* and *Elleanthus* and, together with William Louis Stern, developed a method for staining fragrance-producing glands in orchid flowers, making them visible to the naked eye.
- Mark discovered and/or described several species of orchids and other plants new to science. According to a search in the International Plant Names Index, he described or co-described species in the following genera: *Basiphyllaea* (1), *Gongora* (5), *Ornithidium* (1), *Solenidium* (1), *Stanhopea* (1) and *Pitcairnia* (Bromeliaceae, 1). He also co-described two new orchid genera (*Brasilocycnis* and *Nohawilliamsia*) and one subgenus (*Houlletia* subgen. *Neohoulletia*). The previous lists do not include the many generic transfers that he also authored or co-authored. However, he helped discover or document many other new orchid species and genera, but frequently gave them to other specialists or students for their description and publication.
- Four orchid species were named in Mark's honor: *Epidendrum whittenii* Hágsater and Dodson, *Lepanthes whittenii* Pupulin and Bogarín, *Maxillaria whittenii* Dodson and *Stanhopea whittenii* Soto-Arenas, Salazar and G. Gerlach; too few, in our opinion, for his large contributions to orchidology.
- Mark made the transition from floral chemistry to molecular biology by traveling first to the University of North Carolina (Chapel Hill) in 1990 to obtain training in DNA techniques in the laboratory of Mark Chase (then an assistant professor in the Biology Department) and later (1994) to the Molecular Sytematics Laboratory at the Royal Botanic Gardens, Kew (London), again in collaboration with Mark Chase, with whom he published a series of DNA phylogenetic papers on orchids. He then set up a small DNA laboratory in the Florida Museum of Natural History, in which he and a series of orchid-focused students collected DNA data on orchids.
- Through the analysis of DNA data, Mark made substantial contributions to the knowledge of evolutionary relationships and taxonomic recircumscriptions of many orchid groups, for example: Angraecinae, Arethuseae, Catasetinae, Cymbidieae, Laeliinae, Maxillariinae, Oncidiinae, Pleurothallidinae, Spiranthinae, Stanhopeinae, Vandeae, Zygopetalinae, etc. This involved a long-standing collaborations with many researchers throughout the world.

Dr. Lorena Endara, a Postdoctoral Associate in the department of biology, at UF wrote the following:

"Mark was my academic brother and I am grateful that he was also my friend. I will always remember him as a kind person who legitimately cared for people. Mark was a true mentor and facilitated science for so many. He welcomed everyone in the lab and shared his incredible knowledge and resources with so much generosity.

KEN CAMERON

[3] Mark Whitten (left) and Tom Mirenda (right).

Academically, he always challenged my ideas with some of the most exquisite arguments, he always gave me examples of cases that broke the rule to my generalizations, and he always shared some obscure papers that molded or enriched my hypotheses. Most delightfully, Mark always added a spark of humor to everything — it did not matter how terrible the situation was — he always found a way to make me laugh. He was a true and irreplaceable mentor.

Regarding his legacy to orchid biology, Mark will most likely be remembered for his contributions to orchid systematics and his pioneering work on the mechanisms of orchid speciation mediated by fragrances, ideas that changed the way in which we think about orchid biology and co-evolution. Although Mark worked primarily with bees and I worked in pollination systems that are fly-mediated, Mark was always curious and supportive of my research and our conversations were an intellectual treat that I will always treasure."

Dr. Kurt Neubig, now a professor and herbarium curator at Southern Illinois University poignantly added the following:

"Mark was a father, brother, friend and mentor to me; and he loved my son Henry so much, which made me love him more. We were planning a trip to see him next month and I was going to make him go to the Harry Potter theme park in Orlando with us. He said that Henry was the only person in the world he would do that for. I will miss him dearly."

Indeed Kurt, all of us who knew him, will miss him dearly as well.

P. Stroobant, Chromolithogr. Gand J. Linden, publ.

ODONTOGLOSSUM MADRENSE REICHB. FIL.

Rhynchostele by Peggy Alrich and Wesley Higgins

A Central American Genus

Reichenbach filius *Botanical Zeitung* (Berlin), 10:770 (1852).

ETYMOLOGY From the Greek for beak (*rhynchos*) and column (*stele*). Probably descriptive of the elongate rostellum of the original species.

TYPE *Rhynchostele pygmaea* (Lindley) Reichenbach f. (*Odontoglossum pygmaeum* Lindley).

HETEROTYPIC SYNONYMS *Amparoa* Schltr., *Mesoglossum* Halb., *Cymbiglossum* Halb., *Lemboglossum* Halb.

When Reichenbach f. described the genus *Rhynchostele* (1852) he based it on a plant collected by Karl Hartweg in "Guatemala at the foot of the active volcano Xetuch, about 8,000 feet (2,243 m) above the sea, near Quezaltenango." This plant had been described by John Lindley in 1841 as *Odontoglossum pygmaeum* in *Plantas Hartwegianas* [Bentham]. Lindley commented in *Folia orchidacea* (April 1852) "This curious little alpine plant forms tufts of pseudobulbs and membranous sheaths, from among which just peep out the tiny colourless flowers, which are not above three lines [6.3mm] in diameter, even if spread out."

The genus *Rhynchostele* has 17 sympodial epiphytes or accidental terrestrial species that are found in seasonally dry, middle- to upper-elevation, montane forests from northwestern Mexico (Sinaloa) to northern Panama; there is a small patch in northwestern Venezuela (Merida), with the center of diversity in Mexico.

These small to large plants have clustered, egg-shaped, somewhat flattened pseudobulbs, subtended by distichous, leaflike sheaths, each with a solitary, eventually deciduous, thinly textured, narrow, straplike, pale green leaf. The erect to arching, long to short, simple to branched, numerous- to few-flowered inflorescence has small, yellow, white, pink, purple or dark brown–purple, fragrant flowers heavily barred or spotted dark red or brown. The heart-shaped, white or pink, shortly clawed, trilobed lip has small, united side lobes forming a small saddle with a tiny, grooved callus in the center, and a large, thinly textured midlobe with a wavy margin. The flowers have a long, straight to curved, slender, winged, footless column. Pollinia: two, oblong to pear-shaped, waxy, caudicles irregular, viscidium oval.

CULTURE

These easy growers should be potted in a well-drained fir bark mix. Provide cool to intermediate conditions, moderate light and high humidity.

— Peggy Alrich is a freelance graphic designer (sunflowerltd@earthlink.net).

— Wesley Higgins is an AOS accredited judge (higgins@alumni.ufl.edu).

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Antique Plates— *Rhynchostele*

[1] *Rhynchostele madrensis* (as *Odontoglossum madrense*), *l'Illustration Horticole*, 30:t.480 (1883).

[2] *Rhynchostele cervantesii* (as *Odontoglossum cervantesii*), *Paxton's Flower Garden*, 1:t.15 (1851).

[3] *Rhynchostele bictoniensis* (as *Odontoglossum bictoniense*), *l'Illustration Horticole*, 15:t.1502 (1868).

[4] *Rhynchostele rossii* (as *Odontoglossum rossii*), *The Woodlands Orchids*, page 229 (1901).

[5] *Rhynchostele ureskinneri* (as *Odontoglossum uroskinneri*), *A Monograph of Odontoglossum*, t.2 (1874).

[6] *Rhynchostele londesboroughiana* (as *Odontoglossum londesboroughianum*), *Floral Magazine*, 16:t.246 (1877).

[7] *Rhynchostele cordata* (as *Odontoglossum maculatum*), *Botanical Magazine*, 81:t.4878 (1855).

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The Catasetinae — Part 1

The Cat's Meow: New Developments in Breeding and Growing Catasetums

BY FRED CLARKE

THE GENUS *CATASETUM* includes nearly 180 described species that occur across a large geographic area from Mexico through Central and South America, with the largest concentration of species in Brazil. This impressive distribution and wide range of habitats has facilitated the development of a magnificent variety of flower shapes and colors. Pronounced kat-ah-SEE-tum, the name is comprised of "*cata*" from the Greek indicating downward, and "*seta*" from the Latin meaning bristles. Thus, catasetums are "downward hair" orchids, in reference to the prominent pollen-ejecting triggers on the male flowers.

Catasetum flowers are especially intriguing and different from most orchids, which have perfect flowers, meaning they include both male and female reproductive structures in each bloom. Catasetums, however, produce male "staminate" and female "pistillate" flowers that often look quite different from one another. This difference is termed "sexual dimorphism." Male catasetum flowers are showy, highly fragrant, produced in large numbers, short lived (5–10 days), and have a pollen-ejecting trigger below the column. Female flowers are helmet-shaped, generally green, lightly fragrant, tend to be long-lasting (4–6 weeks), and the column has a narrow slot to allow pollinators access to the stigmatic surface. These radical differences in flower morphology confused early taxonomists, who originally considered the male and female forms to be different species.

Another aspect of this dimorphism is the male flowers' ability to discharge or "shoot" their pollinia in response to physical contact. One of the funniest things in the greenhouse is watching the expression of the unsuspecting orchidist who, while smelling the flower, triggers the pollinia, which shoot out from the flower and stick to their cheek or nose! These flowering habits and unusual floral traits of the Catasetinae are unique among orchids and make them especially interesting and desirable plants for orchid enthusiasts to grow and flower.


1 GREG ALLIKAS


2 FRED CLARKE


3 FRED CLARKE


4 FRED CLARKE

All catasetum flowers are fragrant, but not in a perfumelike way. Instead, fragrances are reminiscent of a mixture of scents that may include pine, eucalyptus, mint, and cinnamon. These fragrance compounds are oil-like substances that are physically present on the surface of the flower. The pollinator, usually a male euglossine bee, collects these fragrances and stores them in special pockets on their hind legs. Only the male bees

collect these oils, and it is theorized that these fragrances help the male to attract female bees. Male catasetum flowers are highly fragrant and colorful, making them relatively easy to locate. As the male bee touches down on the lip of a male flower to collect the fragrance oils, it eventually contacts the pollen-ejecting trigger that releases the pollinia. There is a sticky pad at the base of the stipe that holds the pollinia, and this pad adheres the pollen mass to the bee's head or back. Pollinia are ejected with considerable force and speed, faster than the human eye can follow. The shock of such a forceful hit firmly attaches the pollinarium and forcefully knocks the bee away from the male flower, resulting in an experience not quickly forgotten.

Female flowers do not look like male flowers, and the male bee, perhaps traumatized by his recent encounter with the forceful impact of the pollen from the male flower, is willing to enter the not-so-threatening-looking green, helmet-shaped female flower. The fragrance compounds are located inside, near the top of the helmet. The bee is driven to collect the fragrance oils and squeezes into the confined space of the helmet-shaped lip. The close confines of this space require the bee to exit backwards. Upon exiting, the pollen stuck to its back from the earlier visit to a male flower is deposited through the slot in the column onto the sticky stigmatic surface. The slot closes a few minutes after pollination, greatly reducing the chances of a second pollination. How fantastic is that?

Plants produce male or female flowers depending on environmental conditions. Female flowers are often produced when plants receive favorable growing conditions: long periods of ideal light levels with ample moisture and nutrients. These conditions result in large, robust plants with sufficient moisture and nutrient reserves to carry seed capsules through the dry winter dormant period, surviving to disperse their seed. Male flowers are generally produced when growing conditions are less optimal. When plants are young, do not get as much light or too much light, are stressed from lack of moisture or nutrients, etc., the result is a plant suitable for producing pollen but not the more challenging task of carrying a seed capsule to maturity.

Breeding in the genus *Catasetum* has been focused on working with the showy male flowers, with their huge diversity in color, shape, etc., rather than the green helmet-shaped female flowers. Due to sexual dimorphism, breeding catasetums can be challenging, because both male and female flowers are required. Pollen from male flowers can be saved for future use, but it is not unusual for some plants to go several years without producing female flowers.

In the 1970s, there were two Florida orchid nurseries that developed and distributed the first important *Catasetum* hybrids: Jones & Scully, which produced *Catasetum* Orchidglade (*pileatum* × *expansum*), and R. F. Orchids, which bred *Catasetum* Susan Fuchs (Orchidglade × *expansum*). From this beginning, catasetums enjoyed a brief period of


JUAN FERNANDEZ
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FRED CLARKE
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FRED CLARKE
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[1] Learning about catasetums in their natural habitat during a trip to Venezuela in 2005.

[2] The showy male flowers of *Catasetum pileatum* 'SVO Independence'. Notice the crossed pollen ejecting triggers below the column.

[3] The green helmets typical of female flowers. Is it any wonder the early taxonomists considered them to be separate species?

[4] For humans, pollinating catasetums can be fun! The sticky pad on the stipe is glued to these fingers, with the pollinia still attached.

[5] Euglossine bee approaches female flower.

[6] *Catasetum* Orchidglade 'Davie Ranches' AM/AOS (*pileatum* × *expansum*).

[7] *Catasetum* Susan Fuchs 'Burgundy Chips' FCC/AOS (Orchidglade × *expansum*).

attention by hobbyists during the late 1970s and through the 1980s. New developments slowed in the 1990s, before JEM Orchids in Florida began to breed Catasetinae, taking the lead in working with this group and providing much of the inspiration for breeding Catasetinae in the early 2000s. In recent years, catasetums have experienced a revival and become widely popular around the world, with Jumbo Orchids in Taiwan and my nursery, Sunset Valley Orchids in California, developing and registering many new hybrids. New and more complex hybrids began to appear, including popular greges such as *Catasetum* Penang (Susan Fuchs × *pileatum*), *Catasetum* Donna Wise (Orchidglade × *tenebrosum*), and *Catasetum* Portagee Star (*pileatum* × Black Knight). More recently, flower quality has been raised even higher in the form of more complex hybrids such as *Catasetum* Mark Dimmitt (Donna Wise × Orchidglade), *Catasetum* John C. Burchett (João Stivalli × Susan Fuchs), and *Catasetum* Louise Clarke (Donna Wise × Susan Fuchs).

During the early years of this revival, several new *Catasetum* species were introduced from Brazil. The first was *Catasetum denticulatum*, followed by *Catasetum tigrinum* and then *Catasetum kleberianum*. These new species have short pseudobulbs that mature at around 6 inches (15 cm) tall and are quite floriferous, with 25 or more flowers produced two or three times a season. The small stature of these three species has played an important role in reducing the size of catasetum hybrids and given rise to a new style of breeding, the mini-catasetum. Some notable crosses include *Catasetum* Karen Armstrong (*denticulatum* × Susan Fuchs), *Catasetum* Chuck Taylor (*denticulatum* × Portagee Star), *Catasetum* Melana Davison (*denticulatum* × Penang), *Catasetum* Double Down (Chuck Taylor × *kleberianum*), and Catasetum Dentigrianum (*denticulatum* × *tigrinum*). Mini-catasetums have all of the qualities of their larger cousins, with beautifully colored blooms, plants that flower several times a year, and ease of cultivation. Best of all, everyone has room to fit these fantastic miniatures into their collections.

The next generation of breeding involved crossing the best mini-catasetum crosses with standard-sized parents, in an effort to maintain plant size while increasing flower size. There have been three particularly successful hybrids in this effort: *Catasetum* Dark Odyssey (Karen Armstrong × John C. Burchett), *Catasetum* Extravaganza (Karen Armstrong × Louise Clarke), and *Catasetum* Dreamboat (Chuck Taylor × Penang). As hoped, these all have improved flower size and a compact plant habit.


FRED CLARKE

More recent catasetum breeding also includes some progressive developments in standard-sized hybrids. Areas of particular focus include unique-looking frilly lips, long inflorescences with large flowers, and novel flower colors. Several hybrids have been noteworthy: *Catasetum* Millie's Frilly Dragon (Frilly Doris × Voodoo Dragon), *Catasetum* Dagny (*pileatum* × Brent's Black Hawk), and *Catasetum* Sheriff Frank Drew (Susan Fuchs × Frilly Doris).

Another influential species is *Catasetum sanguineum*, which is one parent of *Catasetum* José Abalo (*sanguineum* × Orchidglade), contributing a strong upright inflorescence that carries many dark flowers with heavy lip substance. Hybrids with *Ctsm*. José Abalo produce surprisingly beautiful flowers of remarkable size and substance, including *Catasetum* Hat Trick (José Abalo × *fimbriatum*), and *Catasetum* Fong Cing (José Abalo × Orchidglade).

When breeding with untested new species, one can only hypothesize about which traits are dominant or recessive, and there is no way to know for sure until the first hybrids flower. A great example of success with a previously untested species is the grex *Catasetum* Richard Fulford (Orchidglade × *lucis*). This hybrid displays exceptionally nice flower color and shape, a strong stem, high flower count and flower longevity of 2–3 weeks, all of which are inherited from *Ctsm*.


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[8] *Catasetum* Penang 'Sweetheart' (Susan Fuchs × *pileatum*).

[9] *Catasetum* Donna Wise 'Kathleen' AM/AOS (Orchidglade × *tenebrosum*).

[10] *Catasetum* Portagee Star 'Brian Lawson's Sunrise' HCC/AOS (*pileatum* × Black Knight).

[11] *Catasetum* Louise Clarke 'Wonder Woman' (Donna Wise × Susan Fuchs).

lucis.

With nearly 180 described *Catasetum* species, we have only scratched the surface of the potential this genus offers in hybridizing. If you are a species aficionado, this genus offers remarkable variety in flower color and shape to delight the grower. Whether your interest lies in hybrids or species, catasetums should hold a well-deserved place in the hearts and growing areas of current and future generations of orchid hobbyists.

GROWING CATASETUMS

The best way to understand how to grow orchids well is to learn about the environmental conditions in their natural habitat, where orchid species have adapted to survive and thrive. Catasetums grow primarily in areas with a warm, wet summer followed by a dry winter, and these plants have evolved very specific seasonal growth habits. In the spring, just before the onset of the rainy season, they begin growing and rooting, in anticipation of a period when moisture and nutrients will be plentiful. Plants develop their pseudobulbs during the growing season to store moisture effectively while they are dormant during the dry winter season. Besides annual rainfall patterns, there are other seasonal environmental triggers for the plants: lengthening days in the spring, warm nights and long days of summer, shortening days of autumn, and short days and cool nights of winter. These seasonal changes are the signals for catasetum plants to start growing in the spring, develop in the summer, prepare for dormancy in the fall, and finally become dormant in the winter.

Dormancy is a plant's adaption to conserve moisture during the droughtlike conditions in the winter and early spring. Leaves turn brown and drop off, leaving the pseudobulbs wrapped in dried leaf tissue that forms a natural sunscreen. The pseudobulbs also harden their exterior surface, further assuring that moisture is stored during the pronounced dry winter period. This ability to conserve moisture over the dry season is critical for the plant's existence. Female flowers pollinated in the wet summer season mature their seed capsules during the winter, consuming the plant's energy reserves while waiting until spring to disperse their seeds when the rains begin again. Few orchid plants go through such a dramatic seasonal change. The key to your success in growing these plants is understanding the importance of the adaptations that catasetums have evolved in their natural environment. An understanding of these adaptations was used to produce this seasonal guide to growing these plants successfully.


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SPRING Catasetums begin their growth in the early spring with the warming and lengthening days. New growths emerge at the base of the prior year's pseudobulb prior to the rainy season, and the plant does not need watering during this initial growth phase. The new growth produces roots that develop in anticipation of the forthcoming spring rains. Once the roots have reached a length of 3–6 inches (7.5–15 cm), it is time to begin watering and fertilizing. Restricting water during the initial growth period encourages better root development. This is an important rule of thumb that should be followed for best results.


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[12] *Catasetum denticulatum.*
[13] *Catasetum tigrinum* 'Very Wide Petals'.
[14] *Catasetum* Chuck Taylor 'WOW' (*denticulatum* × Portagee Star).
[15] *Catasetum kleberianum* 'SVO'.
[16] *Catasetum* Karen Armstrong 'Sunset Valley Orchids' HCC/AOS (*denticulatum* × Susan Fuchs).

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[17] *Catasetum* Melana Davison 'Bombshell' AM/AOS (*denticulatum* × Penang).
[18] *Catasetum* Melana Davison 'Summer Snow'.
[19] *Catasetum* Melana Davison 'Hoorah'.
[20] *Catasetum* Melana Davison 'Red'.
[21] *Catasetum* Double Down 'XDPYL' (Chuck Taylor × *kleberianum*).
[22] *Catasetum* Dentigrianum 'Very Nice' (*denticulatum* × *tigrinum*).
[23] *Catasetum* Dentigrianum.
[24] *Catasetum* Dark Odyssey 'SVO Yellow Odyssey'.

SUMMER With the heat, humidity and long days of summer, the plant enters a period of very rapid leaf growth and pseudobulb development. This is the rainy season in nature, and the plants have evolved to utilize constant moisture and nutrients. In most cases, irrigation will be needed two or three times a week for best growth. A balanced fertilizer applied at a rate of ½ teaspoon to a gallon of water (0.65 ml/L) is suggested. Bright light levels at or above those suggested for cattleyas will help to produce strong growth and flowering. This is also the time when you will begin to see the first blooms of the season. During active growth in the summer, when plants are being watered and fertilized frequently, the ideal day temperatures should be 70–95 F (21–35 C) F with nights 5–15 F (2.8–8.3 C) cooler. Catasetums enjoy abundant air movement. If you are growing in a greenhouse, use air-circulating fans. Hanging the plants high in your growing area allows for maximum air movement around them, as well as increased light levels.

FALL Catasetums have fully developed their pseudobulbs by late fall, which is the peak of the blooming season. In their natural habitat, the shortening days, cooler temperatures and end of the rainy season are the signals that cause plants to begin hardening off in preparation for dormancy. Now is the time to reduce irrigation and stop fertilizing. The first signs of dormancy in your collection will be yellowing leaf tips on the lower leaves. Shortly thereafter, the whole leaf will yellow and drop. The general rule to follow is: on the first of November reduce watering frequency and stop fertilizing. Continue to reduce watering frequency until late December, then stop watering completely.

WINTER During early winter, the dry season begins, with its short days and cool temperatures. The plants respond by completing the hardening off of their pseudobulbs, dropping the last of their leaves, and entering dormancy. By late December and January, most leaves should have yellowed or fallen off, and irrigation should be stopped. Plants will generally stay in this dormant state for 1–3 months. During dormancy, minimum temperatures should be 50–65 F (10–18.3 C).

INDOOR GROWERS In the fall and winter it is important that plants receive dormancy signals. In their natural environment, this is caused by several factors: shortening days, cooler


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[25] *Catasetum* Dark Odyssey 'Dark Enough' (Karen Armstrong × John C. Burchett).
[26] *Catasetum* Extravaganza 'Super Nice' (Karen Armstrong × Louise Clarke).
[27] *Catasetum* Extravaganza 'Memorial Day'.
[28] *Catasetum* Extravaganza 'Mint Chip'.
[29] *Catasetum* Extravaganza 'SVO Spotted Beauty'.

temperatures, lack of rainfall. Plants grown outdoors or in greenhouses will enter dormancy naturally in response to these triggers. When plants are grown in the home or under lights where changes in daylength and temperature are less pronounced, the only dormancy signal might be the reduction in watering frequency. Starting on the first of November, reduce irrigation and continue to lengthen the dry interval until late December, when watering should stop, regardless of the number of green leaves. If there is a bit of pseudobulb shriveling, one or two additional waterings may be needed in January to plump them back up. It is important that plants go dormant on schedule so that they will begin their new growth in the spring, providing a long summer growing season and assuring best flowering. Catasetums in dormancy prefer humidity levels from 40–80% relative humidity. This can be challenging to achieve in the winter, especially in northern climates. An effective technique involves grouping the dormant plants on a humidity tray filled with water, which can help to create higher humidity levels around the plants.

POTTING MIX For seedlings and mature plants up to a 5-inch (12.7 cm) pot diameter, AAA New Zealand long-fibered sphagnum moss with the bottom ⅓ of the pot filled with Styrofoam peanuts to assure good drainage has proven to work well. A mixture of fine bark and perlite is also excellent. Catasetums are not too particular about the potting medium, as long as their seasonal irrigation needs are met.

CONTAINERS I prefer to grow in plastic pots; however, clay pots and baskets will work as well. Catasetums do not like to be overpotted, and it is important to select a pot size that will allow for two years' growth.

REPOTTING AND DIVIDING This is best done as the new growth is just starting to develop and before the new roots start to emerge. At this stage, you will best know how to orient the plant in the pot, and the new roots will grow directly into the new mix. Even though you have repotted, remember not to water until the new roots are 3–6 inches (7.5–15 cm) long. If you notice new roots are already more than a ½ inch (1.25 cm) or so long, consider slip-potting the plant up one pot size to avoid breaking the developing roots. Catasetums do well when divided into two pseudobulb pieces. Divisions are made by cutting with a sterile tool or by carefully pulling the pseudobulbs apart.


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34 FRED CLARKE


36 FRED CLARKE


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33 ARNOLD GUM


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[30] *Catasetum* Dreamboat 'Yellow Lips' (Chuck Taylor × Penang).
[31] *Catasetum* Dreamboat.
[32] *Catasetum* Millie's Frilly Dragon 'Chocolate Frills' (Frilly Doris × Voodoo Dragon).
[33] *Catasetum* Millie's Frilly Dragon 'SVO Frills' AM/AOS
[34] *Catasetum* Sheriff Frank Drew (Susan Fuchs × Frilly Doris).
[35] *Catasetum* Dagny 'Fantastica' (*pileatum* × Brent's Black Hawk).
[36] *Catasetum* José Abalo 'SVO' (*sanguineum* × Orchidglade).

Repotting can be done every second year, as plants should be potted in containers to allow for two years' growth.

INSECT PESTS The Catasetinae are generally pest-free, with the exception of spider mites, which can be attracted to the soft leaves. Spider mites are quite small; they live and feed on the chlorophyll in the cells on the undersides of the leaves. Spider mites are not actually insects, but belong to the related group Arachnida, which also contains spiders and scorpions. For effective control, be sure to use a recommended miticide from your garden center.

Although watching most orchids grow is a pastime requiring considerable patience, catasetum plant growth can be called "seasonally dynamic." When growth starts in the spring, you can almost watch the leaves lengthen, and during the most rapid growth period in early summer it is not uncommon to have leaf growth of 2–4 inches (5–10 cm) per week. Try putting a ruler in the pots next to your plant, and you will be able to measure for yourself. After many years of growing these plants, I am still surprised by how quickly they develop each summer. Suddenly, flower spikes appear, and many can flower two to four times a season. Now that is a nice trait! Shortly afterward, fall arrives, leaves begin to yellow and drop off, and suddenly plants are in winter dormancy. It is truly a dynamic cycle.

One final feature for those of us who occasionally damage a leaf or have some sort of blemish appear — on other orchids, the damage persists for years, serving as a constant reminder. This is not the case for catasetums; they are very forgiving in this regard, and any leaves that are damaged drop off and are replaced with a new set during the next growing season. This is just another of the many reasons to grow this amazing genus.

Acknowledgment

I am greatly honored and indebted to have Ron Kaufmann and Sue Bottom as my editors; their combined insights and wisdom are truly beneficial.

— Fred Clarke owns and operates Sunset Valley Orchids, located near San Diego, California, USA. His interest in breeding orchids spans over 35 years. He is recognized as the foremost breeder in the Catasetinae, but is also actively developing new cattleya, paphiopedilum, and Australian dendrobium hybrids. He travels extensively, dedicating his time to the world-wide education of hobbyists (email: fred.clarke@att.net; website: www.sunsetvalleyorchids.com).

FRED CLARKE

Do not be in any hurry to water the emerging new growth. Wait until it is 5 or so inches (12.7 cm) tall and the leaves are beginning to unfurl, like the catasetum on the far right.

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ALLEN BLACK 41

[37] *Catasetum lucis.*

[38] *Catasetum* Richard Fulford 'Sunset Valley Orchids' (Orchidglade × *lucis*).

[39] *Catasetum* Fong Cing 'Lonely Heart' (José Abalo × Orchidglade).

[40] *Catasetum* Hat Trick 'Top Hat' HCC/AOS (José Abalo × *fimbriatum*). Strain made using *Ctsm. fimbriatum* var. *morrenianum.*

[41] Catasetums growing in situ during the early spring This robust plant has held these seed capsules through the dry winter and is awaiting the spring rains.

Orchids in Watercolor

Galeopetalum Starburst 'Parkside' AM/AOS

Marcia Whitmore

Galeottia fimbriata and *Zygopetalum* Jumpin Jack are the parents of *Galeopetalum* Starburst 'Parkside' AM/AOS. The plant was registered in 2009 by Parkside Nursery. It is a lovely plant with gorgeous contrasts of mint green and purple–red. My plant has more red than purple. It grows in partial shade with high humidity and plenty of air movement. It appears to enjoy being pot bound and I only repot when the new growth threatens to grow over the edge of the pot. I water with cistern water. I have an old underground cistern adjacent to the greenhouse. The cistern provides rainwater from the roof of our old farmhouse year-round. I fertilize this plant weakly with Michigan State fertilizer formulated for rainwater three times a month and flush with clear water during the fourth watering. One of the outstanding features is fragrance. My plant reminds me of hyacinth. This painting was completed on Canson 300 lb. coldpressed paper and is 14 × 16 inches (35.6 × 40.6 cm).

Marcia Whitmore began growing orchids in a basement room under fluorescent lights in 1972 and moved into a 14-ft × 18-ft (4.3 m × 5.5 m) greenhouse in 1984. Marcia is a retired teacher and fine arts coordinator and taught in public schools for 35 years. She has earned many AOS awards and is a member of the Illowa Orchid Society, Eastern Iowa Orchid Society, American Society of Botanical Artists and the Great River Chapter of Botanical Artists (whitbrits@gmail.com, https://asba-art.rog/member-gallery/marcia -whitmore).

Maxillaria — A Complex and Variable Genus

Part 1: Larger to Medium-Flowered Species

ESTEBAN (STEVE) GONZÁLEZ-COSTA

THE NAME *MAXILLARIA* comes from the Latin word *maxilla* or jaw. This genus is so named because the lip bends up and down from a springy connection at the base and the side lobes curl up just like a jaw bone!

The type species is *Maxillaria platypetala* [Ruiz & Pav. (1798), *Syst. Veg. Fl. Peruv. Chil*. 221] from Peru. Although plants from this group have been grown and awarded for a long time (*Maxillaria sanguinea* in 1937), the genus has been described as an "unduly neglected orchid genus" (Schuiteman and Chase 2015). Some taxonomists have tried to cluster *Maxillaria* species depending on whether they have tightly clustered pseudobulbs, and others have tried to group them depending on whether they have larger internodes and rhizomes (McHatton pers. com.). It has been difficult for taxonomists to agree on having any kind of simplified grouping arrangement.

Molecular phylogenetic studies and taxonomic shifts have been changing how we look at many orchid groups, particularly larger genera, for well over 10 years. Based on such studies, in 2007, maxillarias were divided into about 17 subgroups. The excellent book, *Maxillaria: An Unfinished Monograph*, divides them into 19 sections. The result over time, after breaking the group out into many subsections, has been to return the species to one large genus of multisections, similar to what happened with splitting and regrouping of cattleyas or oncidiums.

Currently, only the genus *Maxillaria* is recognized by the Kew World Checklist of Selected Plant Families. Other genera that are considered as synonymous include *Trigonidium*, *Cyrtidiorchis*, *Cryptocentrum*, *Pityphyllum* and *Mormolyca*, which have all reverted back into the genus *Maxillaria*.

Estimates on how many species have been identified easily puts the genus at or over 500–600 species. Whether one is a judge or a hobbyist exploring plants that need identifying, there are currently many issues with these species being labeled under the "old" or "new" genus names. We also have issues with some species names because of duplicate or changed genera or species names. One example is *Maxillaria lankesteri*. It is a totally different species from *Trigonidium lankesterii*. It is amazing what difference one vowel can make at the end of the name! The nearly identical names between these two plants became even more convoluted when trigonidiums became maxillarias, and, as referencing Kew, *Trigonidium lankesterii* is now known as *Maxillaria luisae*.


JAMES HARRIS 2


NICOLAS GOMEZ 3


LYNN O'SHAUGHNESSY 4

Overall, maxillarias come in many seemingly unrelated shapes of foliage and flowers from a large expanse of locations across tropical Central and South America. In trying to lump them and separate them, it is amazing how even *Maxillaria* species that seem to be related are not, as they do not converge geographically. The perfect example of this is what Patricia Harding describes as the "grandiflora complex" of larger white flowers in *Maxillaria: The Unfinished Monograph* (Christenson 2013). She describes these large, white-flowering species as largely unrelated. In the end, she mentions that criteria pertaining to orientation and presentation of sepals and petals, flower colors, especially lip markings, and, finally, lip apex shapes are the real distinguishing features for each species.

[1] *Maxillaria molitor*. Photograph by Greg Allikas.
[2] *Maxillaria* Maui Coconut 'Westfield' AM/AOS (*sanguinea* × *tenuifolia*)
[3] *Maxillaria luisae* 'Memoria Cilia Hurtado' CCM/AOS (*Trigonidium lankesterii*)
[4] *Maxillaria lankesteri* 'Okemos' CHM/AOS

DOMESTICATING MAXILLARIAS It has been said that flowers of this botanical genus are often not showy and tend to be relatively monotonous in form (Whitten 2011). Maybe this is why interest has been lagging? Maybe we do not see many of them because they are difficult to obtain and grow. Although *Maxillaria* species have many great traits, some of these traits are not beneficial to their aesthetics. But they also have other positive attributes, including floriferousness, fragrance, and duration of blooms; some of them repeat

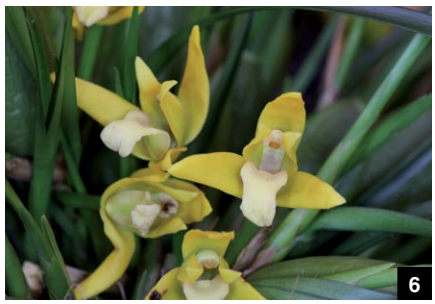
a fireworks-like flush of flowers multiple times a season. But my objective is not to convince you to grow them. What you will find is that if your maxillarias are growing and blooming well, you will want to add more plants of this diverse genus into your expanding collection. Another thing to consider is that when "acclimated" and happily growing, most maxillaria plants will turn into huge clumping specimens that will reward you with a show of abundant clusters of flowers.

GOING COCONUTS—MEDIUM-TO-LARGER FLOWERED MAXILLARIAS The most commonly seen and cultivated maxillarias follow the trend of botanical orchids where the ones most often seen are those that are larger and more colorful. Another reason we might not see maxillarias commonly cultivated is that they are not commonly reproduced.

Of the 16 species (not hybrids) of maxillarias that have been made more visible by receiving six or more AOS awards, 11 of them are to larger- and medium-sized flowers (over 1.2 inches [3 cm] natural spread). The remaining five species are the smaller-flowered *Maxillaria sophronitis*, *Maxillaria juergensii*, *Maxillaria coccinea* and the popular *Maxillaria schunkeana* and *Maxillaria variabilis*.

Looking at the midsize to larger-flowered maxillarias, clearly orchid growers have gone "coconuts" over *Maxillaria tenuifolia* more than any other species. Indeed, many cultural and flower awards have been given to this fragrant species. *Maxillaria tenuifolia* flowers typically have a natural spread of 1.6–2 inches [4–5 cm] and a fragrance of coconuts. This species occurs from Mexico throughout Central America. What is impressive about *Max. tenuifolia* flowers is that some are quite dark or heavily overlaid with dark burgundy or maroon and have broad sepal widths, as seen in *Max. tenuifolia* 'Santiago' AM/AOS. Outside of that, other flower types of *Max. tenuifolia* that stand out are the yellow forms. Two plants with those beautiful yellow flowers have been awarded: 'Yamada' AM/AOS and 'Marty Martin' AM/AOS. I have been familiar with *Max. tenuifolia* for over 30 years, but I have never seen this beautiful yellow form in person. If I came across a division or a plant with flowers like these, I would not think twice to bring it into my collection. Sometimes the only drawback to this species might be that flowers might be smaller and many times roll backwards, becoming narrow at the tips of their sepals. I have also heard and read that some flowers are not fragrant. Others, such as 'Cayey' HCC/AOS and 'Merlot' AM/AOS show beautiful dark flowers, approaching a black color with distinct spotting contrasting on a lighter cream-colored lip.


5 GREG ALLIKAS


6 LARRY HENNESSEY


7 KIM FRANKENFIELD


8 IRMA SALDAÑA


9 JAMES OSEN

[5] *Maxillaria tenuifolia*
[6] *Maxillaria tenuifolia* 'Marty Martin' AM/AOS
[7] *Maxillaria tenuifolia* 'Merlot' AM/AOS
[8] *Maxillaria sanguinea* 'Pretty Doris' AM/AOS
[9] *Maxillaria sanguinea* 'Courthouse High Constable' CCM/AOS
[10] *Maxillaria picta* 'Nancy' AM/AOS
[11] *Maxillaria triloris*
[12] *Maxillaria sanderiana* 'Rona' AM/AOS

Next in availability and popularity is the other somewhat smaller-sized relative of *tenuifolia*, *Max. sanguinea*. These two related species should be discussed together. This species occurs further down the isthmus in Costa Rica and near Panama. *Maxillaria sanguinea* is slightly smaller and usually ranges from around 1 to 1⅓ inches (2.5–3.3 cm) in natural spread. Normally, this species seems to display a much more cupped dorsal sepal that lies right on top of or above the petals. Many *Max. sanguinea* flowers display fairly flat segments with less rolling and back curling than *tenuifolia*. This species

shows how olive, tan, or brown segments can be overlaid with flushes of burgundy to rose burgundy.

A wonderful example of the color blend is seen in *Max. sanguinea* 'Pretty Doris' AM/AOS. The most striking color feature of the flower is probably the deep dark ruby in the basal portion of the lip that gives a striking contrast to the white-to-cream lip base color. Strong color that is sharply defined is definitely a trait to seek in this and other *Maxillaria* species and hybrids.

Cultural awards to either *Max. tenuifolia* or *sanguinea* show how they can be grown into specimen-sized plants that provide heart-stopping flower counts that range from 100 to 1,000 flowers, with many of these documented awards converging on a 400–600 flower and bud count!


CHARLES ROWDEN
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GREG ALLIKAS
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MAURICE MARIETTI
12

Another group of medium-flowered *Maxillaria* are those that come from the South American *Maxillaria picta* and *Maxillaria triloris* complex. Some of the plants in this group were also previously known as *Brasiliorchis*. *Maxillaria picta* flowers are slightly smaller at 1⅓–2½ inches (4–6 cm), whereas *triloris* is larger, ranging from 3–4 inches (8–10 cm). Most of these can have twisty and unevenly overlapping petals with irregular spotting and coloring. When looking at these, I wonder if they are truly the species or a hybrid, as many of these overlap in appearance and might have come from an inadvertently misidentified, imported species or are maybe of mixed parentage.

LARGE-FLOWERED MAXILLARIAS The larger-flowered maxillarias might not have as high a flower count as others, but admiring one of these would be like seeing their close relative, a large lycaste, or a large cattleya or phalaenopsis flower. This "large flower" group includes *Maxillaria sanderiana*, *Maxillaria grandis*, *Maxillaria grandiflora*, *Maxillaria striata* and the slightly smaller *Maxillaria molitor.* Collectively, these plants have larger individual flowers that range in natural spread from 4 to 6 inches (10–16 cm). Compared to the smaller-flowered species, these plants are large and throw out an appropriate, but lesser, quantity of flowers. All have wide segments that can be flatter and present themselves well when they shoot downward or away from the base of the plant and even halfway up within the leaves. Unfortunately, the flowers also open within the foliage on tighter-growing clumps, making it difficult for them to show well. Blemishes and mechanical damage are issues for these larger white or lighter-colored flowers. Like any other maxillarias, the petals could be closed or reflexing in some strange manner, but sepal and lip appearance and coloring are their main attraction.

A good example of one of the largest-flowered species is *Max. sanderiana*, whose flowers typically range from 4⅓ to 6 inches (11–15 cm). Flowers almost resemble in shape and size a moderately large lycaste, their next of kin. Some great and strong-colored *Max. sanderiana* examples are 'Rona' AM/AOS, which had smaller segments than the slightly pointier petaled 'Kenn' AM/AOS.

Overall, flower count for these is not significant on plants at four or five flowers plus some buds from a 6-inch (15-cm) potted plant. Even at the CCM and CCE level in larger specimens, flower count only ranges from 20–30 flowers. Indeed, looking at photos I took at the 22nd World Orchid Conference in Guayaquil, Ecuador, I see that the maxillarias in this group that had the most flowers in an 8-inch (20-cm) pot had at the most about two dozen flowers. Having seen baskets of these specimens hanging in frigid, drizzly fog in Colombia, I clearly recognized the challenges of growing these plants outside of their native habitats and appreciate the dedication and skill required to do so successfully.

Maxillaria grandis is similar to *Max. sanderiana*, but is typically slightly smaller, with a 4–5½ inch (10–14 cm) - wide flower. Overall, the flowers of *Max. grandis* seem even more twisty than those of *sanderiana*, but with much more speckling or spotting on their sepals and petals. Flowers, particularly the dorsal


NICOLAS GOMEZ


JUAN CARLOS


CHARLES MARDEN FITCH


NICOLAS GOMEZ


JORGE CARLOS


AOS AWARD ARCHIVES

[13] *Maxillaria grandis* 'Gloriosa' AM/AOS; inset 'Susan' FCC/AOS by Jorge Carlos.
[14] *Maxillaria grandiflora* 'Hermosa' AM/AOS
[15] *Maxillaria striata* 'King Tut' AM/AOS
[16] *Maxillaria speciosa* 'La Sorpressa' AM/AOS
[17] *Maxillaria fractiflexa* 'Dr. Ruben Alvarez' AM/AOS
[18] *Maxillaria rodrigueziana* 'Annie Girl' AM/AOS
[19] *Maxillaria nutans* 'Eichenfels' CHM/AOS
[20] *Maxillaria cal4lichroma* 'Sidney' CHM/AOS
[21] *Maxillaria endresii* 'Victor' CCM/AOS
[22] *Maxillaria tonsbergii* 'Spooky' AM/AOS
[23] *Maxillaria scalariformis* 'Yasnita' AM/AOS

sepal, tend to be much more closed or cupped.

Maxillaria grandis has a broader range in nature, extending from the same Ecuador/Peru region where *Max. sanderiana* is found up through to Colombia. *Maxillaria grandis* also flowers on a shorter inflorescence that does not seem to travel downwards through media as much as *Max. sanderiana* does. *Maxillaria grandis* 'Susan' FCC/AOS was awarded in Guatemala with five flowers that were 5 × 3⅔ inches (12.9 × 9.4 cm) and two buds, which were heavily spotted maroon.

Similar in shape, but with a white base color and strong sulfur-yellow lip that is marked reddish brown, is *Max. grandiflora*. Looking at these larger, white flowers, they show even more symmetry and are flatter (fewer twists and less asymmetry). *Maxillaria grandiflora* flowers range from 2⅓ to 4 inches (6 to 10 cm). This plant is quite a bit smaller than the other white maxillarias. They occur in a broad range from the Andean region at higher altitudes to Bolivia and Brazil.

The inflorescences of *Max. grandiflora* are longer and present the flowers within the foliage above the middle of the plant to the upper part of the leaves, although they can also be thrown out in any direction and even through the potting mix. If you look at size, symmetry, segments, and openness of the flowers, an older awarded flower, *Max. grandiflora* 'Bob Hoffman' HCC/AOS, is a stunningly broad flower described as being "bone white" showing beautiful, broad sepal widths and flatness.

From the realm of these three white-flowered species, we jump into flowers with more colorful, larger and narrower segments. Maybe because of its stripes and coloration pattern, *Max. striata* has been cultivated in collections and has the most awards in the larger group. Cultural reasons could also play into acceptance with many growers, as it comes from a more intermediate habitat and with flowers held either high or even at leaf tip level, usually providing a better presentation. Although the flowers tend to recurve severely toward their tips, they usually measure as much as 4–6 inches (10–15 cm). Two beautiful dark-striped, suffused flowers are those of clones 'King Tut' AM/AOS and 'Robin Jane' FCC/AOS.

While on the topic of yellow, another colorful species that deserves mention is *Max. molitor*. This species can have full, relatively flat flowers that are usually smaller, ranging from 2 to 3½ inches


CHARLES MARDEN FITCH
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CHARLES MARDEN FITCH
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AOS AWARD ARCHIVES
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ARTHUR PINKERS
22


LOREN BATCHMAN
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(5–9 cm). It is mostly a yellow flower, but can vary to an intense orange–yellow, sometimes with beautiful dark flaring at the tips, and it is fragrant. This is a species that I have admired since I first took photos of it during an Ecuador tour in 2001.

Moving away from the larger maxillarias with wider segments are other species that are large but more "spidery" and narrowly segmented. Of these, we find the larger but narrow segments of *Maxillaria fractiflexa* and the wide-open flower of *Maxillaria speciosa*. Interestingly enough, both of these wiry, spidery flowered species share a proportionately smaller and less prominent lip. The main features of these species are the length of their narrow sepals and the symmetry and form of their petals. A main feature of *Max*. *fractiflexa* is its stature, with a vertical natural spread of up to 9½ inches (24 cm) and width of at least 3⅛ inches (8 cm). The petals can curl or hug (if more open) in a bowing manner. Sepal widths range only from ⅛ to ⅜ inches (0.5–1 cm) and petal widths are barely 0.1–0.2 inches (2–4 mm) at their base. A great example of an open-petaled flower is the recent award to *Max. fractiflexa* 'Dr. Ruben Alvarez' AM/AOS. This flower is relatively symmetrical and has wider sepals at around ⅜ inch (1 cm). The three flowers are colored golden bronze and the petals cream white. Petals curl in a pleasant open manner for the three flowers that are well presented and held towards the top of the foliage. Whatever *Max. fractiflexa* does, it should look better if its petals curl or twist evenly in a mirror image of each other. *Maxillaria speciosa* is another wiry flower with a possible tendency in which the dorsal sometimes drops forward and downward; otherwise, it is typically an open, stellate flower.

An atypical grex with an open upward-facing dorsal sepal is 'La Sorpresa' AM/AOS, which was awarded in Colombia in 2010. This tiger-bar flower has an impressive 7⅛-inch (18.7-cm) width and an impressive upright dorsal giving the vertical 3½-inch (9-cm) vertical length. Flower color is white grading to yellow distally and shows uniform brown bars. Although flower count for both of these species ranges from 3 or 4 flowers to 10, specimens can have 20–30 flowers or 3–6 flowers per growth.

Other medium-to-large flowered maxillarias that have interesting and worthy flowers are *Maxillaria rodrigueziana*, *Maxillaria nutans*, *Maxillaria callichroma*, *Maxillaria endresii* and *Maxillaria tonsbergii*. These constitute a mix of maxillarias that mimic lycaste-type flowers, spidery flowers, or an intermediate in between these shapes.


GLEN BARFIELD

[24] Awarded as *Maxillaria reichenheimiana* 'Thanks Kai' CCM/AOS, this is closer to *Maxillaria pseudoreichenhemiana*. Although both species have white-spotted leaves, the inflorescences of *reichenheimiana* are always shorter than the leaves and the undersides of the leaves are tinged purple or maroon; often very heavily.

MASSES OF FLOWERS Three maxillarias that are in the smaller-flower size range are *Maxillaria scalariformis*, *Maxillaria reichenheimiana* and *Maxillaria pseudoreichenheimiana*. The flower size range for these species is anywhere more than an inch (3 cm) to as much as 2 inches (5 cm). *Maxillaria scalariformis* is a "Camaridium"-type upward-growing plant similar to a vanda. The flowers are abundant, simple in shape, and display a soft-pink color. A beautiful example of this species was the award to the flowers of *Max. scalariformis* 'Yasnita' AM/AOS.

Two species that have also been sought by hobbyists are *Max. reichenheimiana* and the more distinct, spotted foliage of *Max. pseudoreichenheimiana*. Flowers range from just over an inch to 2 inches (3–5 cm) in size and constitute the basic spidery or crab-claw flower shape. Some are more closed than others, affecting their size and presentation. Overall, flowers also occur close to the base of the plant in mass on a small, compact plant, which can have 50–100+ flowers.

Two other examples of these plants are the smaller-flowered *Maxillaria hennisiana* and larger *Maxillaria splendens*. A well-flowered specimen should remind you of miniature migrating crustaceans with their claws charging up in the air.

In Part 2, we explore this diverse, complex and morphing genera and look at the popular smaller-growing species and the limited hybridization for this group of orchids.

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Exploring the Native Orchids of Montana

TEXT BY ANSEL FIDDAMAN/PHOTOGRAPHS UNLESS OTHERWISE CREDITED BY TOM FIDDAMAN

I DISCOVERED THE world of orchids when I was 14 after finding a stack of the *Orchids* magazines in the free bins at my local library. Eventually, I came to an article about wild orchids in Washington, which interested me greatly. I realized that if there were orchids in Washington, there might be some in Montana where I live. I immediately began researching, snatching up every scrap of information on Montana's native orchids I could find. To my amazement, I learned that there were over 30 types of orchids in Montana. I immediately recognized a few species, as I had seen them before, but most were completely new to me. After a few months spent out in the woods near my house, I found not one, but seven species of orchids on our property!

One of my favorite things about hunting native orchids is that, no matter how much you search, there will always be something new and unexpected: After two years of searching our property, I found a population of nearly 20 plants of *Calypso bulbosa* that I had never seen before. Some were within 10 feet (3 m) of the path I had walked almost every day for the previous two weeks. A few days later, I found more plants of *Cpso. bulbosa* in another unexpected place — nearly completely exposed on a north-facing road cut for a logging project (*Cpso. bulbosa* tends to prefer shaded areas with heavy undergrowth). This perfectly sums up the spirit of orchid hunting: a celebration of the unexpected, strange and beautiful.

Calypso is a monotypic genus (containing only one species) distributed throughout the Northern Hemisphere. It was established in 1807 by Richard Anthony Salisbury and has also been called *Cytherea* (Salisb. 1808), *Norna* (Wahlenb. 1826) and *Orchidium* (Sw. 1816). The genus is named after the water nymph Calypso in Homer's *Odyssey*.

Calypso bulbosa, known commonly as the fairy slipper orchid, is probably the best known of Montana's orchids and is one of its showiest. Surprisingly, although *Cpso. bulbosa* is not related to other slipper orchids such as cypripediums, it is actually a member of the subfamily *Epidendroideae*, making it more closely related to the elegant cattleyas and laelias. There are three varieties in Montana: var. *occidentalis*, var. *americana* and nothovar. *kostiukiae*. *Calypso bulbosa* var. *occidentalis* has many small spots on the lip (or pouch), var. *americana* has a tuft of bright yellow fuzz on the lip but lacks the small spots (three or four large spots may be hidden in the fuzz), and nothovar. *kostiukiae* (a natural hybrid between the two previous forms) has both spots and yellow fuzz. *Calypso bulbosa* var. *americana* is by far the most common

[1] A colony of *Calypso bulbosa* nothovar. *kostiukiae* exhibiting both spots and yellow hairs. Photograph by Ansel Fiddaman.

[2] A plant of *Calypso bulbosa* var. *americana* showing off its distinctive yellow "beard" (likely false anthers to attract bumblebees).

[3] The western variety of *Calypso bulbosa*, *Calypso bulbosa* var. *occidentalis*. Note the numerous spots and lack of yellow hairs on the lip. Photograph by Ansel Fiddaman.

variety, with *Cpso. bulbosa* nothovar. *kostiukiae* being second. *Calypso bulbosa* can be found growing in shaded, slightly damp areas blooming from May to June. It has an unusual growth cycle growing a leaf in the fall that persists through winter only to die back in the spring a few weeks after blooming.

Corallorhiza is a genus of about 11 species, established in 1755 by Abraham Gagnebin. It is characterized by leafless, mycoheterotrophic (obtaining nutrients through fungal associations) plants with coralloid rhizomes. As is fairly apparent, its name refers to the coral-like appearance of the rhizome and roots. Interestingly, the genus *Corallorhiza* is most closely related to *Cpso. bulbosa* and other genera in the tribe *Calypsoeae* (such as *Coelia*), even though they look nothing alike.

Corallorhiza maculata (or spotted coral root) is a spectacular (if not brightly colored) plant generally flowering in early June in my area of Montana. A leafless mycoheterotroph, it forgoes photosynthesis and obtains all of its nutrition from a fungus in the soil. *Corallorhiza maculata* produces large clusters of flowering stems, each with up to 50 brownish-yellow flowers with white lips spotted with maroon, which makes for a spectacular display. The main distinguishing feature of this orchid is the presence of a chinlike mentum (or extremely short spur). In Montana, there are two varieties of this species: var. *maculata* and var. *occidentalis* (var. *maculata* has a lip with straight sides whereas var. *occidentalis* has a lip that gets wider towards the tip). There is also a third variety called *Corallz. maculata* var. *ozettensis*, but its range is limited to nearby Washington. The plant is usually found in deep-to-partial shade generally in conjunction with Douglas fir (*Pseudotsuga menziesii*).

Corallorhiza striata (striped coral root) is one of the more common coral roots and definitely the easiest to identify. *Corallorhiza striata* has beige to burgundy flowers with dark stripes on the petals, sepals and lip (the lip tends to be much darker than the petals). Another interesting feature is the column, which is bright yellow (an unusual contrast to the red-brown petals and sepals). *Corallorhiza striata* is pollinated by a species of parasitic wasp, *Pimpla pedalis.* Although it does not tend to form large clumps like *Corallz. maculata*, you can usually see several plants in a relatively small area. There are two varieties of *Corallz. striata:* var. *striata*, which is much more common in the northern United States, and var. *vreelandii*, which has smaller, slightly cupped, light-colored flowers and is usually found in the southwestern United States and Quebec in Canada. It is unlikely that *Corallz. striata* var. *vreelandii* is present in Montana.


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Corallorhiza wisteriana (spring coral root) is a close look-alike of *Corallorhiza trifida* (not covered in this article) and *Corallz. maculata. Corallorhiza wisteriana* is easily identified by the lack of a mentum (short nectar spur) at the base of the flower, its dark color (although it is occasionally nearly yellow), and the oval lip (lacking side lobes). As with other coral roots, *Corallorhiza wisteriana* blooms from early June to July, and seems to prefer areas that are slightly wetter than other *Corallorhiza* species (except *Corallz. trifida*). I find this species especially pleasing because of its diminutive size and unusual metallic color.

Dactylorhiza is a genus of about 118 species and natural hybrids of which only

[4] *Corallorhiza striata* is unmistakable with its unusual coloration.

[5] A large plant of *Corallorhiza maculata* var. *occidentalis* in the woods about 100 feet (30.5 m) from my front porch.

[6] A typical *Corallorhiza wisteriana*; although it is similar to *Corallorhiza maculata*, it is usually fairly easy to identify.

[7] Easily missed because of its small size and green color, this specimen of *Dactylorhiza viridis* evaded me for nearly two years, even though it was practically in the middle of the trail.

[8] A colony of *Goodyera oblongifolia*; note the silver reticulation on the leaves. Inset: The small white flowers of *Goodyera oblongifolia*. Although the flowers are few in number and quite small, they can take well over a month to develop. Plant photograph by Ansel Fiddaman, inset photograph by Tom Fiddaman.

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two are found in North America. The genus was described in 1937 by Noël Martin Joseph de Necker. The name is derived from the Greek words for "finger" and "root" (dactylos and rhiza, respectively) referring to the finger-like roots of some species.

Dactylorhiza (syn. *Coeloglossum*) *viridis* (long-bracted orchid, frog orchid) is the only *Dactylorhiza* species in Montana and is both locally rare and easy to overlook. As its common name suggests, it has long bracts that are much longer than the flower and, as its botanical name suggests, it usually has green flowers (viridis translates to green), although the flowers are sometimes red. It tends to grow in wet coniferous forests, bogs and marshes. The flowers are similar to that of a *Platanthera*, but have an unusual forked lip, making the flower look rather like some kind of reptile or amphibian. *Dactylorhiza viridis* begins to flower in early June but can sometimes be found as late as September (depending on altitude). This is probably the rarest orchid I have encountered. I have only seen it in one small area in the woods near my house and even then I was only able to find five plants.

Goodyera is a genus of about 100 species established in 1813 by Robert Brown. The genus was named in honor of 17th-century botanist John Goodyer. Most *Goodyera* species are from tropical or subtropical regions, but there are a number of species from temperate areas. There are four species of *Goodyera* in North America: *Goodyera oblongifolia* (usually found in the western United States and much of Canada), *Goodyera pubescens* from the eastern United States and Canada, *Goodyera repens* (distributed throughout many northern states and Canada as well as a few populations reaching farther south), and *Goodyera tesselata* (found in the northeastern United States and Canada). I will only cover *G. oblongifolia*, as it is the most common species in Montana.

Goodyera oblongifolia (giant rattlesnake plantain) is likely the most common orchid in Montana (and one of the most overlooked). It has small, evergreen rosettes of dark-green leaves with beautiful silver reticulation and tiny white flowers. It is also the slowest blooming orchid I have ever seen! I have seen plants that began spiking in mid-June flowering as late as September (although the usual flowering range is from mid-July to August). It tends to grow to about 8 inches (20.3 cm) tall but can range from 4 inches (10.2 cm) to 18 inches (45.7 cm). It is pollinated by various species of bumblebee (*Bombus* sp.). According to the North American Orchid Conservation Center (NAOCC), the flowers of *G. oblongifolia* mature from the bottom up, meaning that pollen cannot be transferred to another flower on the same plant, therefore reducing instances of self-pollination and increasing genetic diversity.

Platanthera is a genus composed of about 154 species that was described in 1817 by French botanist and botanical illustrator Louis Claude Richard. The name *Platanthera* is derived from the Greek words for broad and anther (*platy-* and *-anthera*, respectively), referring to the wide gap between the pollinia bases in the type species *Platanthera bifolia*. There are eight species of *Platanthera* in Montana: *Platanthera aquilonis*, *Platanthera dilatata*, *Platanthera elegans*, *Platanthera elongata*, *Platanthera*

[9] A trio of *Spiranthes romanzoffiana* showing the dense spiral inflorescence that is typical for this species.

[10] A large patch of *Platanthera dilatata* var. *albiflora* growing on the edge of a small stream near Hyalite Reservoir.

obtusata, *Platanthera orbiculata*, *Platanthera stricta*, and *Platanthera unalascensis* (and potentially a ninth: *Platanthera sparsiflora*, which may or may not be present in Montana, as well as a few unnamed natural hybrids). Most of the plants in the genus were formerly placed in the better-known genus *Habenaria* (although some were known as *Piperia*).

Platanthera dilatata (white bog orchid) is probably the best-known and most showy of Montana's platantheras, and the easiest to identify. *Platanthera dilatata* is a tall plant, sometimes reaching an astounding 4 feet (120 cm) with up to 100 or more white long-spurred flowers. There are three varieties of *P. dilatata*: var. *dilatata*, var. *albiflora* and var. *leucostachys. Platanthera dilatata* var. *dilatata* has a spur about the length of the lip, var. *albiflora* has a spur that is shorter than the lip, and var. *leucostachys* has a spur noticeably longer than the lip. *Platanthera dilatata* is also highly fragrant, smelling something like vanilla and cloves (sometimes you smell them before you see them). As its common name suggests, this plant is most often found in bogs, marshes and along streams. I first found this orchid about 3 miles (4.8 km) in on the trail to Twin Lakes in the Crazy Mountains on a backpacking trip that turned out to be especially fruitful.

Platanthera × *estesii* (hybrid bog orchid; *dilatata* × *stricta*) is one of the few named natural hybrids. As expected, it is quite similar to both parents. Although its appearance can vary greatly, it can be distinguished from its parents by its spur (about half the length of the lip and not saccate like that of *P. stricta*), its color (a sort of greenish white) and its lip (which is tapered like that of *P. dilatata*). Altogether this orchid resembles a slightly greener version of *P. dilatata.* It can be found in bogs, marshes and along streams wherever plants of *P. dilatata* and *P. stricta* are relatively close to each other. Because of the variability of this hybrid, I do not have any photographs that I can confirm are *P.* × *estesii.*

Platanthera stricta (slender bog orchid) is a relatively common green-flowered *Platanthera,* It can be found growing in bogs and marshes as well as on stream banks, lakesides and pretty much anywhere else suitably wet. Plants are generally about 8–24 inches (20.3–61 cm) tall, but can sometimes reach up to 40 inches (1 m) and have anywhere from 2 to 6 leaves. The flowers are about 0.3–0.8 inches (8–20 mm) across. *Platanthera stricta* can be distinguished from other green platantheras by its short, saccate (wider at the tip than the base) spur that is usually about 0.1 inches (3 mm) long. It can be found flowering from May to September, with the peak blooming in July (although it is highly dependent on elevation). It was another orchid I first sighted on the trail to Twin Lakes, although I did not see this species until we had reached the lakes.

Platanthera (syn. *Piperia*) *unalascensis* (Alaskan *Piperia*) is probably one of the

most common *Platanthera* (and the most easily missed). *Platanthera unalascensis* is a small plant bearing a rosette of light-green leaves at the surface of the soil and a thin spike completely covered in tiny green flowers. The plant can vary in height from a few inches to over a foot (30 cm). Although it is not the most showy of the platantheras, it certainly has the most unique fragrance, although it is not the most pleasant and is often compared to that of ammonia or yeast. *Platanthera unalascencis* can flower from late April into mid-August (most commonly seen during July). It is often found growing in full sun in damp to dry meadows, roadsides, fields, and the edges of forests throughout Montana. I first encountered this species on the side of the road near my house. The plants I found were only about 6 inches (15.2 cm) tall and had the smallest flowers I had ever seen. Intrigued, I looked up the plant and found out that it was an orchid! Now, I see it almost everywhere.

Spiranthes is a genus of about 50 species named for the spiral arrangement of flowers on the inflorescence. The genus was established in 1817 by Louis Claude Richard who also described the genus *Platanthera*. There are two species or *Spiranthes* in Montana: *Spiranthes romanzoffiana* and *Spiranthes diluvialis*. Unfortunately, *S. diluvialis* is both very rare and hard to identify, so I have not included it in this article.

Spiranthes romanzoffiana is the most water-loving orchid I have encountered. *Spiranthes romanzoffiana* is usually found on the edges of lakes and rivers. It is also one of the smallest, sometimes only 2 inches (5.1 cm) tall! The flowers are tightly packed on the inflorescence so the spiral pattern may not be as apparent as in other species. Pollination is by bumblebees attracted by the flower's sweet scent. *Spiranthes romanzoffiana* tends to flower around August, but may flower earlier at lower altitudes. As is apparent from the flower morphology, *S. romanzoffiana* is closely related to the genus *Goodyera* (they are both in the tribe *Cranichideae*). My first encounter with this species was within about 10 feet (3 m) of my first encounter with *P. dilatata*, where I found the plants growing together in a small seep.

Acknowledgment

Many thanks to Ron Hanko for writing the article (Hanko 2011) (and blog) that first led me to look for native orchids and to the American Orchid Society for inspiring me to immerse myself in the wonderful world of orchids. Also, to my family for helping me revise, edit, and otherwise improve this article. Much of the information in this article I learned from the website of the North American Orchid Conservation Center (NAOCC). If you want to learn about North American orchids, I highly recommend their website: http://goorchids.northamericanorchidcenter.org/.

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[11] *Platanthera unalascensis* (to the right of the yellow arrowleaf balsamroot).

[12] *Platanthera stricta.*

[13] The 17-year old author, inset, is teaching himself the art of botanical illustration. This European terrestrial *Serapias* species has been very faithfully rendered including the small fungal spot on the floral bract.


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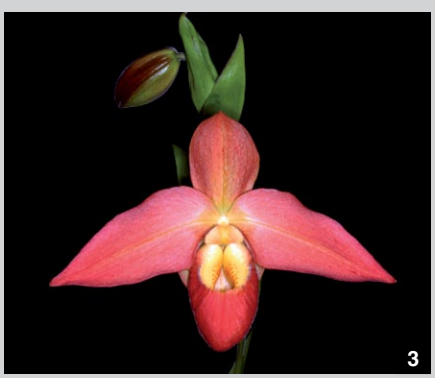
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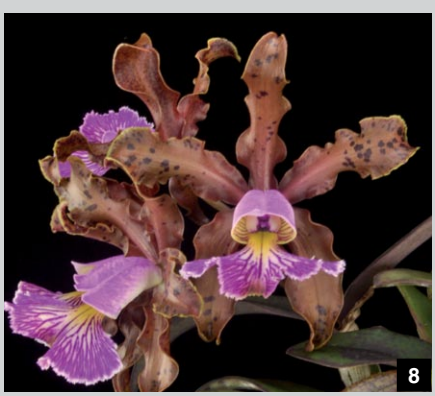
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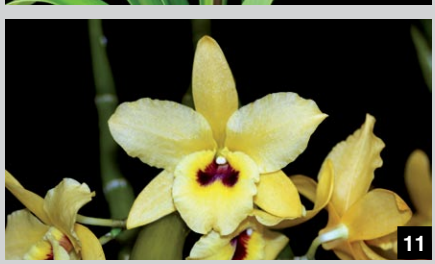
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[1] *Cattleya* Ruth Neily 'Lamai's Delight' AM/AOS (Starting Point x Memoria Robert Strait) 83 pts. Exhibitor: Natts Orchids; photographer: Paul Bujak. Great Lakes Judging Center

[2] *Lycaste* Nobuo 'Porter's Play Thing' AM/AOS (Rowland x *aromatica*) 80 pts. Exhibitor: Oakwood Orchids; photographer: Katie Payeur. Great Lakes Judging Center

[3] *Phragmipedium* Don Wimber 'Littlefrog Ron's Choice' AM/AOS (Eric Young x *besseae*) 86 pts. Exhibitor: Rob Halgren; photographer: Katie Payeur. Great Lakes Judging Center

[4] *Phragmipedium* Amitabha 'Memoria Donald C. Peace' AM/AOS (Patti MacHale x *besseae*) 80 pts. Exhibitor: Gyorgy Nagy; photographer: Lynn O'Shaughnessy. Great Lakes Judging Center

[5-6] *Renantanda* Sunrise 'Wade's Orchids' CCM-HCC/AOS (*Vanda falcata* x *Renanthera imschootiana*) 84-77 pts. Exhibitor: Wade Hollenbach; photographer: Paul Bujak. Great Lakes Judging Center

[7] *Phragmipedium* Manzur la Aldea 'Barb's Hug' HCC/AOS (*manzurii* x *besseae*) 78 pts. Exhibitor: John Curtin; photographer: Lynn O'Shaughnessy. Great Lakes Judging Center

[8] *Cattleya schilleriana* 'SFO' AM/AOS 83 pts. Exhibitor: Orchid Eros; photographer: Glen Barfield. Hawaii Judging Center

[9] *Lycaste* Dainty 'Windswept's Misty Green' AM/AOS (*brevispatha* x *campbellii*) 83 pts. Exhibitor: Windswept in Time Orchids; photographer: Katie Payeur. Great Lakes Judging Center

[10] *Paphiopedilum* Shin-Yi Williams 'Dark Star' AM/AOS (William Ambler x *rothschildianum*) 84 pts. Exhibitor: Hilo Orchid Farm; photographer: Glen Barfield. Hawaii Judging Center

[11] *Dendrobium* Yellow Magic 'Festival' AM/AOS (Happy Gold x Santana) 82 pts. Exhibitor: Andrew Okada; photographer: Michael Blietz. Hawaii Judging Center

[12] *Aerangis citrata* 'Jeff's' CCE/AOS 95 pts. Exhibitor: Tropical Orchid Farm; photographer: Michael Blietz. Hawaii Judging Center

[13] *Paphiopedilum rothschildianum* 'Tiger' AM/AOS 86 pts. Exhibitor: Hilo Orchid Farm; photographer: Glen Barfield. Hawaii Judging Center

[14] *Paphiopedilum* Chiu Hua Dancer 'Golden Seven' FCC/AOS (*gigantifolium* x *sanderianum*) 90 pts. Exhibitor: Hilo Orchid Farm; photographer: Glen Barfield. Hawaii Judging Center

[15] *Paphiopedilum* Crowning Glory 'Stairway to Heaven' AM/AOS (Johanna Burkhardt x *sanderianum*) 83 pts. Exhibitor: Hilo Orchid Farm; photographer: Glen Barfield. Hawaii Judging Center

[16] *Paphiopedilum* Shin-Yi Williams 'Dark Star' AM/AOS (William Ambler x *rothschildianum*) 84 pts. Exhibitor: Hilo Orchid Farm; photographer: Glen Barfield. Hawaii Judging Center

[17] *Guarvolclia* Valle Turabo 'Susan's Pot of Gold' AM/AOS (*Brassanthe* Sunny Delight x *Guaricyclia* Kyoguchi) 80 pts. Exhibitor: Susan Tompkins; photographer: Bryon Rinke. Great Plains Judging Center


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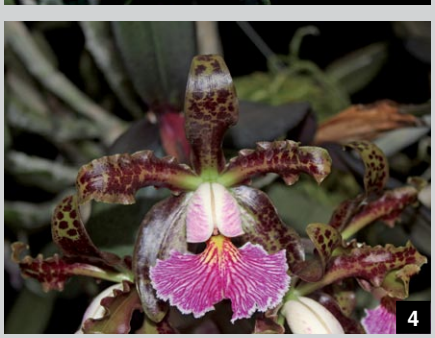
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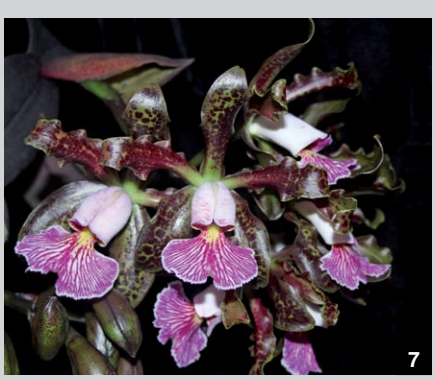
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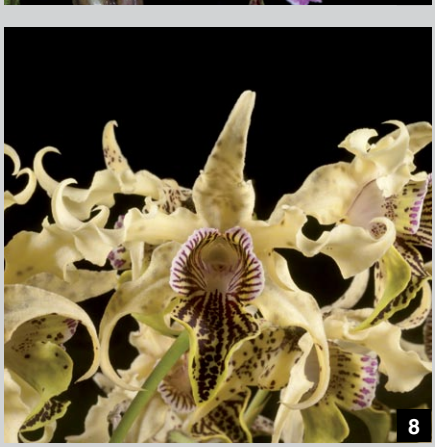
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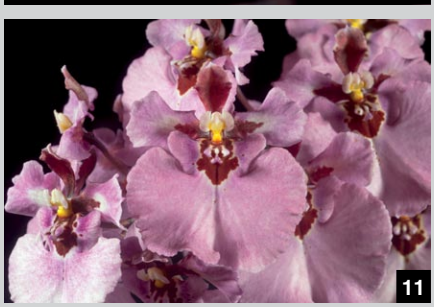
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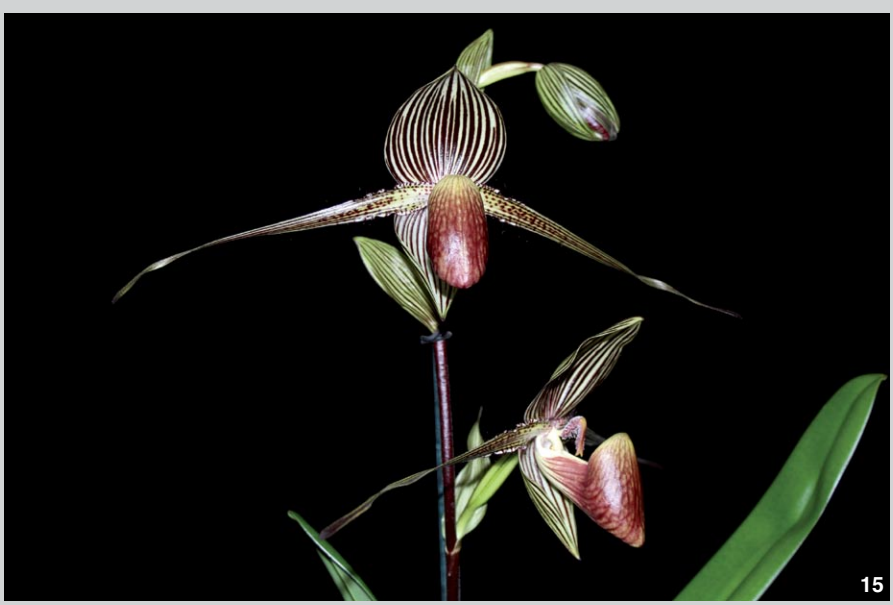

[1] *Cattleya aclandiae* (Coerulea) 'Pauwela' AM/AOS 84 pts. Exhibitor: Exotic Orchids of Maui, Inc.; photographer: Michael Blietz. Hawaii Judging Center

[2] *Cattleya aclandiae* 'Prolific' AM/AOS 85 pts. Exhibitor: Exotic Orchids of Maui, Inc.; photographer: Michael Blietz. Hawaii Judging Center

[3] *Rhyncholaeliocattleya* Jerry Rehfield 'Hawaii' AM/AOS (Hisako Akatsuka x Hawaiian Prominence) 84 pts. Exhibitor: Exotic Orchids of Maui, Inc.; photographer: Michael Blietz. Hawaii Judging Center

[4] *Cattleya schilleriana* 'Pauwela Giant' AM/AOS 87 pts. Exhibitor: Exotic Orchids of Maui, Inc.; photographer: Michael Blietz. Hawaii Judging Center

[5] *Rodrumnia* Love Bird 'Pucky' AM/AOS (Wiki Wiki x Hula Lady) 81 pts. Exhibitor: Melvin Waki; photographer: Alyn Nishioka. Hawaii Judging Center

[6] *Dendrobium* Bohemian Rhapsody 'Makawao Gem' AM/AOS (*loddigesii* x *aphyllum*) 83 pts. Exhibitor: Andrew Okada; photographer: Michael Blietz. Hawaii Judging Center

[7] *Cattleya schilleriana* 'Maui Pride' AM/AOS 88 pts. Exhibitor: Exotic Orchids of Maui; photographer: Michael Blietz. Hawaii Judging Center

[8] *Dendrobium* Bruce Gordon 'Danielle' AM/AOS (*alexandrae* x *eximium*) 83 pts. Exhibitor: Tyler Tajima; photographer: Alyn Nishioka. Hawaii Judging Center

[9] *Cattleya schilleriana* 'Maui' AM/AOS 89 pts. Exhibitor: Exotic Orchids of Maui; photographer: Michael Blietz. Hawaii Judging Center

[10] *Dendrobium* Blue Bees 'Blue Stars' AM/AOS (*lasianthera* x Blue Twinkle) 84 pts. Exhibitor: Aloha Aina Orchids; photographer: Michael Blietz. Hawaii Judging Center

[11] *Rodrumnia* Oncore 'Pam' AM/AOS (Gusto x Just Dandy) 80 pts. Exhibitor: Melvin Waki; photographer: Alyn Nishioka. Hawaii Judging Center

[12] *Paphiopedilum* Kolosand 'Pam' AM/AOS (*kolopakingii* x *sanderianum*) 84 pts. Exhibitor: Tyler Tajima; photographer: Alyn Nishioka. Hawaii Judging Center

[13] *Phalaenopsis equestris* (Coerulea) 'Toshi' AM/AOS 81 pts. Exhibitor: Tyler Tajima; photographer: Alyn Nishioka. Hawaii Judging Center

[14] *Dendrobium tangerinum* 'Sheila' CCM-AM/AOS 82-81 pts. Exhibitor: Roy Andrade; photographer: Alyn Nishioka. Hawaii Judging Center

[15] *Paphiopedilum rothschildianum* 'Alexis Plume' HCC/AOS 77 pts. Exhibitor: Ted Plume; photographer: Michael Blietz. Hawaii Judging 44Center.


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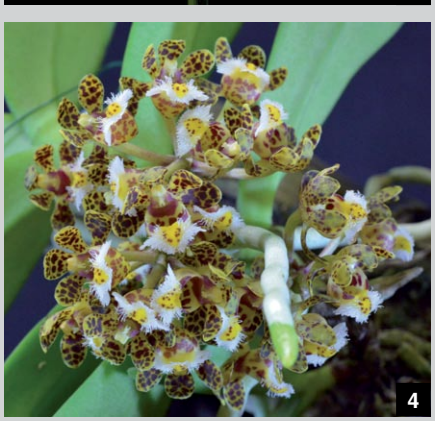
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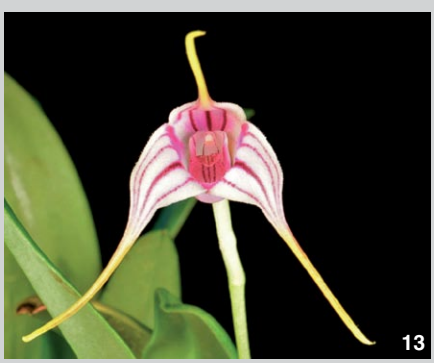

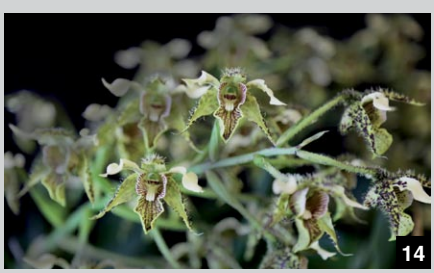

[1] *Phragmipedium* Fireworks 'Rare Earth Orchids' AM/AOS (*pearcei* x Grande) 82 pts. Exhibitor: Steve Moffitt; photographer: Malcolm McCorquodale. Houston Judging Center

[2] *Vanda* Adele Graham 'Elegance' HCC/AOS (Georgia Tasker x Robert's Delight) 76 pts. Exhibitor: Melissa Garner; photographer: Melissa Garner. Mid-America Judging Center

[3] *Paphiopedilum* Mary Ott 'Ira Kodner' AM/AOS (*glaucophyllum* x *armeniacum*) 81 pts. Exhibitor: F. Thomas Ott; photographer: Melissa Garner. Mid-America Judging Center

[4] *Gastrochilus calceolaris* 'Francie' AM/AOS 80 pts. Exhibitor: Larry Hennessey; photographer: Monica Walther. Houston Judging Center

[5] *Clowesetum* Stephen Moffitt 'Rare Earth Orchids' HCC/AOS (*Catasetum cirrhaeoides* x *Clowesia rosea*) 75 pts. Exhibitor: Steve Moffitt; photographer: Malcolm McCorquodale. Houston Judging Center

[6] *Brassocattleya* Glorious May 'Peg John' AM/AOS (*Cattleya* Gene May x Morning Glory) 85 pts. Exhibitor: Peggy White; photographer: Monica Walther. Houston Judging Center

[7] *Paphiopedilum* Big Island Flyer 'Vicki's Delight' AM/AOS (Rosy Egret x Argubull) 80 pts. Exhibitor: Terrence Thompson; photographer: Steve Marak. Mid-America Judging Center

[8] *Phragmipedium* Les Dirouilles 'Tulsa Time' AM/AOS (Sorcerer's Apprentice x Grande) 80 pts. Exhibitor: Kay Backues; photographer: Steve Marak. Mid-America Judging Center

[9] *Rhynchodenia* Magic Wand 'Nellie' AM/AOS (*Rhynchostylis coelestis* x *Seidenfadenia mitrata*) 84 pts. Exhibitor: Dennis Tomjack; photographer: Monica Walther. Houston Judging Center

[10] *Eulophia graminea* 'M&M Orchids' CBR/AOS. Exhibitor: Matt and Michelle Jaenke; photographer: Melissa Garner. Mid-America Judging Center

[11] *Masdevallia* Angel Frost 'Miss Cleo' HCC/AOS (*veitchiana* x *strobelii*) 76 pts. Exhibitor: Andrea Price; photographer: Melissa Garner. Mid-America Judging Center

[12] *Rhyncholaeliocattleya* Michael Tomihama 'Robert Richards' AM/AOS (*Cattleya* Circle of Life x Ryo Iwata) 80 pts. Exhibitor: William Caldwell; photographer: Monica Walther. Houston Judging Center

[13] *Masdevallia corderoana* 'Forest's Envy' CHM/AOS 84 pts. Exhibitor: Randy Bayer; photographer: Melissa Garner. Mid-America Judging Center

[14] *Dendrobium* Yellow Stars 'Pottsy's Fuzzy Phantom' AM/AOS (*polysema* x *finisterrae*) 84 pts. Exhibitor: Ray and Annette Potts; photographer: Matthew Nutt. Mid-America Judging Center

[15] *Phragmipedium* QF Walter Scheeren 'Darci Ezell' AM/AOS (Memoria Julius Dixler x *boisserianum*) 80 pts. Exhibitor: David Bird; photographer: Matthew Nutt. Mid-America Judging Center

[16] *Rhynchorides* Norma 'Pottsy's Candyland' HCC/AOS (*Aerides* Bangkok x *Rhynchostylis gigantea*) 79 pts. Exhibitor: Ray and Annette Potts; photographer: Steve Marak. Mid-America Judging Center


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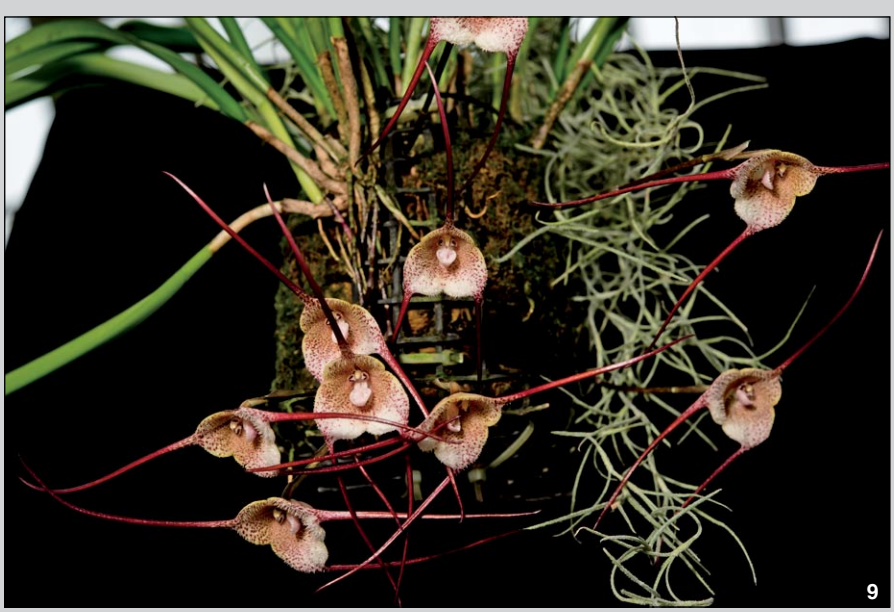
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[1] *Phragmipedium* Eumelia Arias 'Shelley Ezell' AM/AOS (*kovachii* x *schlimii*) 82 pts. Exhibitor: David Bird; photographer: Matthew Nutt. Mid-America Judging Center

[2] *Dendrobium* Nora Tokunaga 'Susan's Prairie' HCC/AOS (*atroviolaceum* x *rhodostictum*) 77 pts. Exhibitor: Susan Spencer; photographer: Matthew Nutt. Mid-America Judging Center

[3] *Cymbidium* Emerald Shamrock 'Julia' AM/AOS (Lemon Butter x Emerald Moon) 82 pts. Exhibitor: Robert Pettibone; photographer: Matthew Nutt. Mid-America Judging Center

[4] *Paphiopedilum* Master Dragon 'Dorothy Gurney' HCC/AOS (Apple-Master x Hsinying Dragon) 77 pts. Exhibitor: Joel Graham; photographer: Julie Rotramel. National Capital Judging Center

[5] *Paphiopedilum* Fanaticum 'Mark's Joy' HCC/AOS (*malipoense* x *micranthum*) 77 pts. Exhibitor: Mark Prout; photographer: Jim Pyrzynski. Mid-America Judging Center

[6] *Mediocalcar decoratum* 'Frosty' JC/AOS 0 pts. Exhibitor: Nathan Bell; photographer: Matthew Nutt. Mid-America Judging Center

[7] *Ophrys speculum* subsp. *speculum* 'Jim' AM/AOS 81 pts. Exhibitor: Jim Pyrzynski; photographer: Jim Pyrzynski. Mid-America Judging Center

[8] *Serapias bergonii* 'Wintergreen' CBR/AOS. Exhibitor: Doug and Beth Martin; photographer: Jim Pyrzynski. Mid-America Judging Center

[9] *Dracula navarroorum* 'Timbucktoo' AM/AOS 81 pts. Exhibitor: Sarah Pratt; photographer: Jim Pyrzynski. Mid-America Judging Center

[10] *Ophrys sphegodes* var. *sphegodes* 'Jim' CBR/AOS. Exhibitor: Jim Pyrzynski; photographer: Jim Pyrzynski. Mid-America Judging Center

[11] *Cyrtorchis* Hendrik van der Hoven 'Bryon' AM/AOS (*arcuata* x *chailluana*) 82 pts. Exhibitor: Bryon K. Rinke; photographer: Jim Pyrzynski. Mid-America Judging Center

[12] *Propetalum* La Jolla Delight 'Hilo Orchid Farm' AM/AOS (*Promenaea stapelioides* x *Zygopetalum* Kiwi Dusk) 80 pts. Exhibitor: Carri Raven-Riemann and the orchidPhile; photographer: Thang Dam. Toronto Judging Center

[13] *Paphiopedilum* Pedro's Moon 'Bryon' AM/AOS (*armeniacum* x Pinocchio) 80 pts. Exhibitor: Bryon K. Rinke; photographer: Jim Pyrzynski. Mid-America Judging Center

[14] *Paphiopedilum* Mystically Wood 'Haley Suzanne' AM/AOS (Fred's Ghost x Wood Wonder) 83 pts. Exhibitor: Glen Decker; photographer: Thang Dam. Toronto Judging Center

[15] *Phragmipedium* Ouaisne 'Ojo Caliente' HCC/AOS (*dalessandroi* x Eric Young) 78 pts. Exhibitor: Woodstream Orchids; photographer: Kim Frankenfield. National Capital Judging Center

[16] *Chysis* Maritza Bielecki 'Mark's Joy' CCM-AM/AOS (Langleyensis x *limminghei*) 86-88 pts. Exhibitor: Mark Prout; photographer: Matthew Nutt. Mid-America Judging Center


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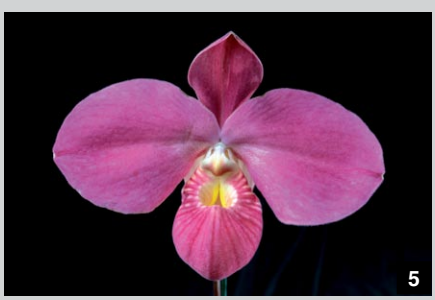
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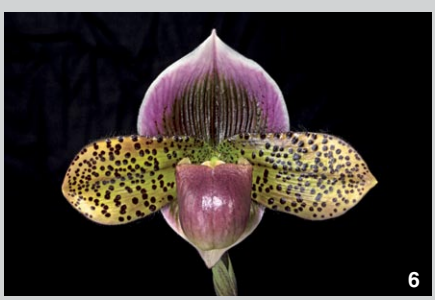
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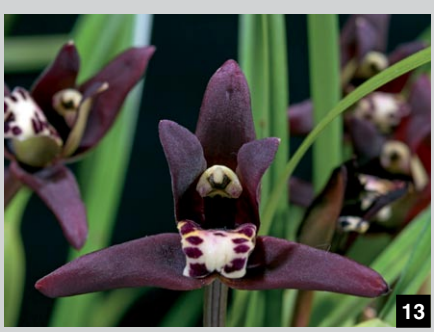

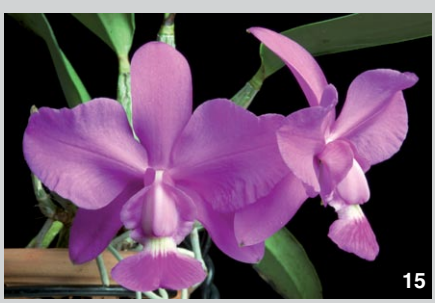

[1] *Phragmipedium kovachii* 'Jardin botanique de Montréal' AM/AOS 81 pts. Exhibitor: Jardin botanique de Montréal; photographer: Thang Dam. Toronto Judging Center

[2] *Phragmipedium* April Fool 'Woodstream' FCC/AOS (Cardinale x *besseae*) 90 pts. Exhibitor: Woodstream Orchids; photographer: James Winner. National Capital Judging Center

[3] *Phragmipedium* Waunakee Sunset 'Saylor' AM/AOS (Barbara LeAnn x *besseae*) 81 pts. Exhibitor: Jason Gebbia; photographer: Julie Rotramel. National Capital Judging Center

[4] *Paphiopedilum violascens* 'Spruce Creek' AM/AOS 81 pts. Exhibitor: Woodstream Orchids; photographer: James Winner. National Capital Judging Center

[5] *Phragmipedium* Fritz Schomburg 'Missouri River' AM/AOS (*kovachii* x *besseae*) 84 pts. Exhibitor: Woodstream Orchids; photographer: Kim Frankenfield. National Capital Judging

[6] *Paphiopedilum* Dark Destiny 'Oh My' FCC/AOS (Montagnard x Black Wizard) 92 pts. Exhibitor: Marriott Orchids/Hadley Cash; photographer: Kim Frankenfield. National Capital Judging Center

[7] *Dendrobium* Nano Chip 'Sweet Spots' AM/AOS (Micro Chip x *aberrans*) 81 pts. Exhibitor: Sarah Hurdel; photographer: James Winner. National Capital Judging Center

[8] *Phragmipedium* Eric Young 'Broadwaters' AM/AOS (*besseae* x *longifolium*) 84 pts. Exhibitor: Jason Gebbia; photographer: Julie Rotramel. National Capital Judging Center

[9] *Mormodia* Keri Ray 'Memoria Cole Litke' AM/AOS (*Clowesia* Grace Dunn x *Mormodes warszewiczii*) 83 pts. Exhibitor: Sabolcik and Sons Orchids; photographer: Charles Marden Fitch. Northeast Judging Center

[10] *Dendrobium capituliflorum* 'Floradise' CCE/AOS 93pts. Exhibitor: Floradise Orchids Stephen Shifflett; photographer: Kim Frankenfield. National Capital Judging Center

[11] *Cymbidium* Pauwelsii 'Kessander' CCM/AOS (*insigne* x *lowianum*) 88 pts. Exhibitor: Charles Crisler; photographer: Teck Hia. Northeast Judging Center

[12] *Phragmipedium* La Hougette 'Kelly Creek' AM/AOS (*dalessandroi* x Beauport) 82 pts. Exhibitor: Woodstream Orchids; photographer: James Winner. National Capital Judging Center

[13] *Maxillaria tenuifolia* 'Merlot' AM/AOS 82 pts. Exhibitor: Shawn Wood; photographer: Kim Frankenfield. National Capital Judging Center

[14] *Dendrobium lichenastrum* 'Connie Deren' CCM/AOS 86 pts. Exhibitor: Dick and Carol Doran; photographer: Charles Marden Fitch. Northeast Judging Center

[15] *Cattleya walkeriana* 'Michelle' HCC/AOS 78 pts. Exhibitor: Ken Reynolds; photographer: Charles Marden Fitch. Northeast Judging Center

[16] *Maxillaria endresii* 'Elizabeth' CCM/AOS 81 pts. Exhibitor: Belle Ribicoff; photographer: Teck Hia. Northeast Judging Center


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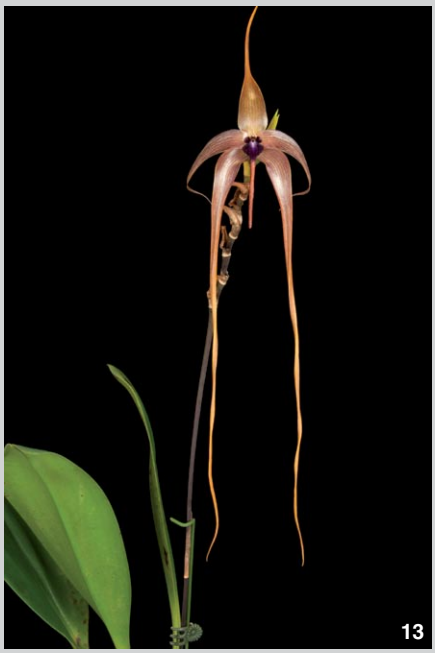
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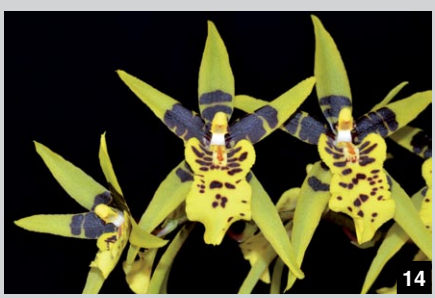
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[1] *Coelogyne taronensis* 'Susan' CHM/AOS 83 pts. Exhibitor: Chuck and Sue Andersen; photographer: Teck Hia. Northeast Judging Center

[2] *Dendrochilum uncatum* 'Susan' CCM/AOS 88 pts. Exhibitor: Chuck and Sue Andersen; photographer: Michael George. Northeast Judging Center

[3] *Cattleya intermedia* (Aquinii) 'Mason Sky' AM/AOS 80 pts. Exhibitor: Chuck and Sue Andersen; photographer: Teck Hia. Northeast Judging Center

[4] *Cymbidium* Kuranda 'Lil Stinker' HCC/AOS (*madidum* x *suave*) 78 pts. Exhibitor: Terry and Margaret Boomer; photographer: Chaunie Langland. Pacific Central Judging Center.

[5] *Masdevallia valenciae* 'Susan' CHM/AOS 84 pts. Exhibitor: Chuck and Sue Andersen; photographer: Teck Hia. Northeast Judging Center

[6] *Masdevallia karelii* 'Susan' CHM/AOS 85 pts. Exhibitor: Chuck and Sue Andersen; photographer: Teck Hia. Northeast Judging Center

[7] *Masdevallia amabilis* 'Susan' CCM-CHM/AOS 83-84 pts. Exhibitor: Chuck and Sue Andersen; photographer: Teck Hia. Northeast Judging Center

[8] *Dendrobium kingianum* 'T. R. Samara' CCM/AOS 89 pts. Exhibitor: Masaki Asuka; photographer: Ken Jacobsen. Pacific Central Judging Center

[9] *Pleurothallis niveoglobula* 'Susan' CCM/AOS 86 pts. Exhibitor: Chuck and Sue Andersen; photographer: Teck Hia. Northeast Judging Center

[10] *Paphiopedilum* Captivatingly Wood 'Haley Suzanne' AM/AOS (Luna Magic x Wood Wonder) 82 pts. Exhibitor: Glen Decker; photographer: Michael George. Northeast Judging Center

[11] *Paphiopedilum lowii* 'Viognier' JC/AOS. Exhibitor: Dave Sorokowsky; photographer: Ken Jacobsen. Pacific Central Judging Center

[12] *Paphiopedilum liemianum* 'Margaret Ann' HCC/AOS 77 pts. Exhibitor: Terry and Margaret Boomer; photographer: Chaunie Langland. Pacific Central Judging Center

[13] *Bulbophyllum echinolabium* 'Cosmos' Chasus' AM/AOS 82 pts. Exhibitor: Charles and Susan Wilson; photographer: Ross Leach. Pacific Northwest Judging Center

[14] *Brassidomesa* Golden Stars 'Big Ben' AM/AOS (*Gomesa echinata* x *Brassidium* Shooting Star) 80 pts. Exhibitor: Japheth Ko; photographer: Chaunie Langland. Pacific Central Judging Center

[15] *Oncidium* Louis Posey 'Louis' HCC/AOS (*noezlianum* x *strictum*) 79 pts. Exhibitor: Bill Zimmerman; photographer: Michael Pearson. Pacific Northwest Judging Center

[16] *Cattleya* Sarah Sears 'Owen' AM/AOS (Cornelia (1893) x Indigo Dawn) 82 pts. Exhibitor: Wes Addison; photographer: Eric Goo. Pacific South Judging Center


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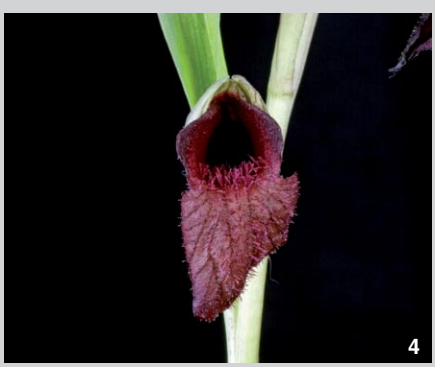
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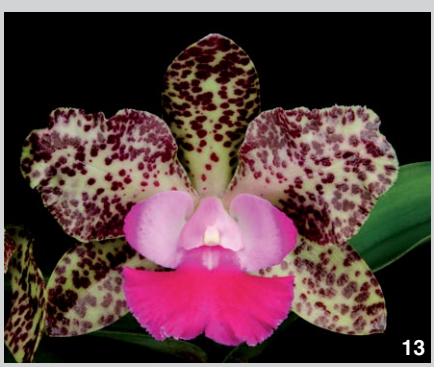

[1] *Paphiopedilum* QF Kulani 'Cocoa' AM/AOS (Memoria Miguel Medina x Paul Parks) 80 pts. Exhibitor: Edward Hanes; photographer: Mike Pearson. Pacific Northwest Judging Center

[2] *Paphiopedilum* Prince Edward of York 'Cocoa' HCC/AOS (*rothschildianum* x *sanderianum*) 78 pts. Exhibitor: Edward Hanes; photographer: Mike Pearson. Pacific Northwest Judging Center

[3] *Clowesetum* Alexandra Savva 'SVO Freckles' AM/AOS (*Clowesia* Rebecca Northen x *Catasetum denticulatum*) 82 pts. Exhibitor: Fred Clarke; photographer: Ramon de los Santos. Pacific South Judging Center

[4] *Serapias cordigera* 'Bell' Orchidea' CHM/AOS 83 pts. Exhibitor: Phyllis Prestia; photographer: Arthur Pinkers. Pacific South Judging Center

[5] *Cattlianthe* Blazing Treat 'Rainbow Valley' CCM/AOS (Rojo x Trick or Treat) 85 pts. Exhibitor: Jerry Spencer; photographer: Arnold Gum. Pacific South Judging Center

[6] *Rhyncholaeliocattleya* Very Vermillion 'Nick's Jewel' AM/AOS (Paradise Rose x Lebenkreis) 83 pts. Exhibitor: Ruben Colmenares; photographer: Arnold Gum. Pacific South Judging Center

[7] *Paphiopedilum* Golden Crest 'Seagraves' AM/AOS (*fairrieanum* x Wallcrest) 80 pts. Exhibitor: John Hagee; photographer: Arnold Gum. Pacific South Judging Center

[8] *Cymbidium* Full Moon 'Epigarden' HCC/AOS (Pure Love x Joint Venture) 75 pts. Exhibitor: Weegie Caughlan; photographer: Arthur Pinkers. Pacific South Judging Center

[9] *Phalaenopsis* San Jacinto Fancy Rose 'San Jacinto' AM/AOS (San Jacinto Rose x Chingruey's Fancy) 82 pts. Exhibitor: Glenn F. Stall; photographer: Arnold Gum. Pacific South Judging Center

[10] *Phalaenopsis* Haur Jih Fancy 'Kayla' AM/AOS (Chingruey's Blood-Red Sun x Chingruey's Fancy) 86 pts. Exhibitor: Glenn F. Stall; photographer: Arnold Gum. Pacific South Judging Center

[11] *Bulbophyllum taiwanense* 'Final Chapter' CCM/AOS 82 pts. Exhibitor: Abigail Chang; photographer: Mike Pearson. Pacific Northwest Judging Center

[12] *Cymbidium* Kulnura Snow 'White Dream' AM/AOS (Culpaulin x Pure Ice) 81 pts. Exhibitor: Weegie Caughlan; photographer: Arthur Pinkers. Pacific South Judging Center

[13] *Cattleya* Jerry Spencer 'Rainbow Valley' AM/AOS (Green Emerald x Katherine Clarkson) 80 pts. Exhibitor: Jerry Spencer; photographer: Arnold Gum. Pacific South Judging Center

[14] *Cymbidium* Mellie Cruz 'Manny' HCC/AOS (Ruby Baker x Ben Singer) 77 pts. Exhibitor: Hatfield Orchids; photographer: Ramon de los Santos. Pacific South Judging Center

[15] *Paphiopedilum* Delightfully Venus 'Tawny' HCC/AOS (Magical Venus x Venus Knight) 76 pts. Exhibitor: Dave Sorokowsky; photographer: Ramon de los Santos. Pacific South Judging Center

[16] *Cattlianthe* Straight Answer 'No Question' CCE/AOS (*Cattleya* Milton Warne x Trick or Treat) 93 pts. Exhibitor: Jerry Spencer; photographer: Arnold Gum. Pacific South Judging Center


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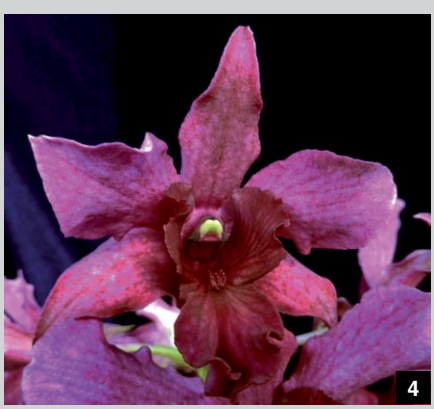
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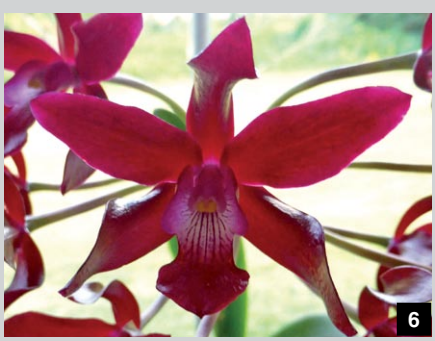
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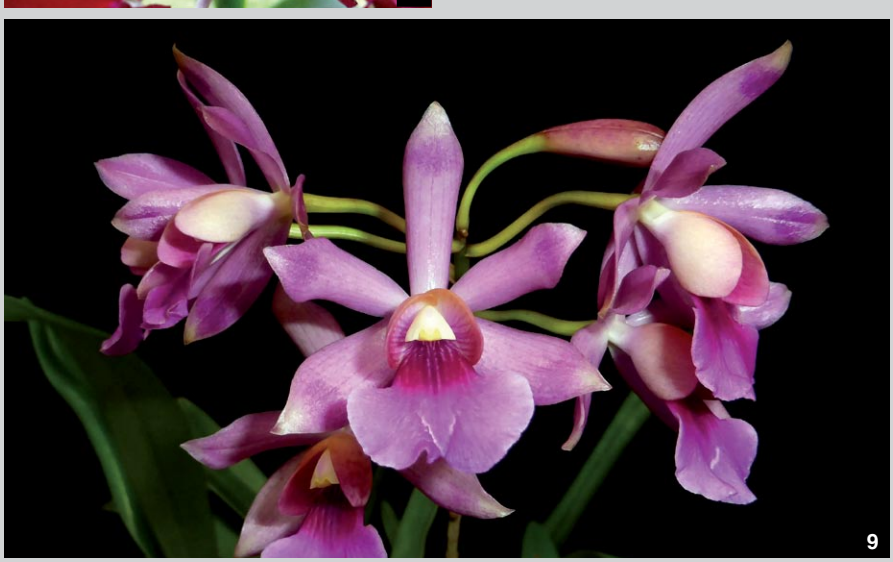
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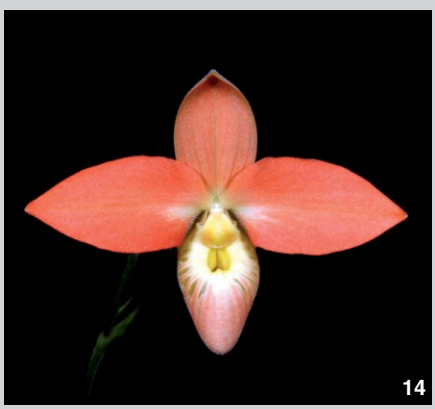
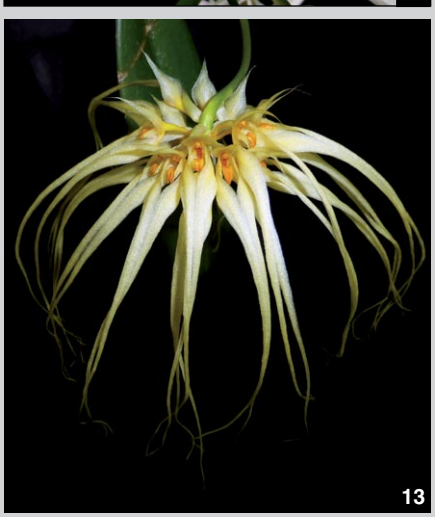




[1] *Cymbidium* Lauritz Melchior 'Ori Gem' AM/AOS (Memoria Amelia Earhart x Gala Odyssey) 82 pts. Exhibitor: Duy Nguyen; photographer: Arthur Pinkers. Pacific South Judging Center

[2] *Scuticaria salesiana* 'Edwin Alberto' CHM/AOS 82 pts. Exhibitor: Edwin A. Perez; photographer: Debra Tryon. Puerto Rico Judging Center

[3] *Dendrobium* Tiny Twister 'Karlo Javy' HCC/AOS (*carronii* x *mirbelianum*) 79 pts. Exhibitor: Carlos Javier Maldonado; photographer: Irma Saldaña. Puerto Rico Judging Center

[4] *Dendrobium* Violet Yamaji 'Puanani' AM/AOS (Midnight x *spectabile*) 80 pts. Exhibitor: Edwin A. Perez; photographer: Irma Saldaña. Puerto Rico Judging Center

[5] *Dendrobium spectabile* 'Carmen María Raquel' AM/AOS 82 pts. Exhibitor: William Pabón Vázquez; photographer: Irma Saldaña. Puerto Rico Judging Center

[6] *Laelianthe* Dulatiaca 'Lava Flow' AM/AOS (*Laelia undulata* x *Guarianthe aurantiaca*) 84 pts. Exhibitor: Noel Soler-Figueroa; photographer: Irma Saldaña. Puerto Rico Judging Center

[7] *Phalaenopsis* Tassanee Jongdamkerng 'Tiny Rubies' CCM/AOS (*equestris* x *appendiculata*) 83 pts. Exhibitor: Louis Felipe Santiago; photographer: Irma Saldaña. Puerto Rico Judging Center

[8] *Dendrobium* Jairak Fire Horn 'Adunda' AM/AOS (Jairak Little Gem x *tangerinum*) 82 pts. Exhibitor: René E. Garcia; photographer: Irma Saldaña. Puerto Rico Judging Center

[9] *Marimerara* Carlos E. Esperon 'J.A.R.R.' AM/AOS (*Psychilis macconnelliae* x *Cattlianthe* Chocolate Drop) 81 pts. Exhibitor: José Román; photographer: Irma Saldaña. Puerto Rico Judging Center

[10] *Rhyncattleanthe* My Orange 'NN' HCC/AOS (Haw Yuan Orange x Alpha Plus Nuggett) 78 pts. Exhibitor: Francisco Rodríguez Vargas; photographer: Irma Saldaña. Puerto Rico Judging Center

[11] *Cattleya mossiae* var. *coerulea* 'Bermaly' AM/AOS 83 pts. Exhibitor: José R. López; photographer: Irma Saldaña. Puerto Rico Judging Center

[12] *Dendrobium* Silver King 'Damaris' AM/AOS (Peter Shen x Silver Wings) 82 pts. Exhibitor: Noel Soler-Figueroa; photographer: Irma Saldaña. Puerto Rico Judging Center

[13] *Bulbophyllum* Meen March Madness 'Sister Jean' AM/AOS (*medusae* x Perseus) 81 pts. Exhibitor: José A. Izquierdo and Irma Saldaña; photographer: Irma Saldaña. Puerto Rico Judging Center

[14] *Phragmipedium* Waunakee Sunset 'ThienNgo Le' HCC/AOS (Barbara LeAnn x *besseae*) 78 pts. Exhibitor: ThienNgo N. Le; photographer: Larry Livingston. Rocky Mountain Judging Center

[15] *Rhyncholaeliocattleya* Anne Hughes 'Mysterious Valley Dawn' AM/AOS (George King x *Cattleya* Spencer Brooks) 82 pts. Exhibitor: Ian Rich; photographer: Larry Livingston. Rocky Mountain Judging Center

[16] *Dendrobium* Sherry Abe 'Rafi López' AM/AOS (Peter Shen x *spectabile*) 82 pts. Exhibitor: José R. López; photographer: Irma Saldaña. Puerto Rico Judging

Studies in *Oberonia* 6

Ultraviolet Reflectance Photography of Flowers Hints at Potenial Pollinators

BY DANIEL L. GEIGER

ABSTRACT Ultraviolet reflectance photography of *Oberonia* species only shows limited patterning on flowers and rachis. It suggests that pollinators have relatively poor vision, which makes Diptera a likely group. Spatial scales of the patterns suggest that visual cues only play a role at distances of 2–50 cm. Attraction to flowers over larger distances could be mediated by scent. Other modes of pollinations are discussed. Patterning in electron microscopy images is discussed.

KEYWORDS *Oberonia*, pollination, geitonogamy.

MANY ORCHIDS ARE pollinated by insects, the visual range of which extends into the ultraviolet (UV: 300–400 nm). Many flowers are known to provide visual cues to a pollinator, generally referred to as nectar guides, which are only revealed to UV-sensitive systems, and are not perceptible directly by humans.

Specialized imaging systems are necessary to investigate the presence of such UV patterns on flowers. Applying those to minute flowers is particularly challenging, and is the subject of this contribution. Imaging of small flowers can be daunting and requires some specialized techniques such as z-stacking. Those basics using light visible to humans, from blue (400 nm) to red (700 nm) have been covered elsewhere recently (Geiger, 2013).

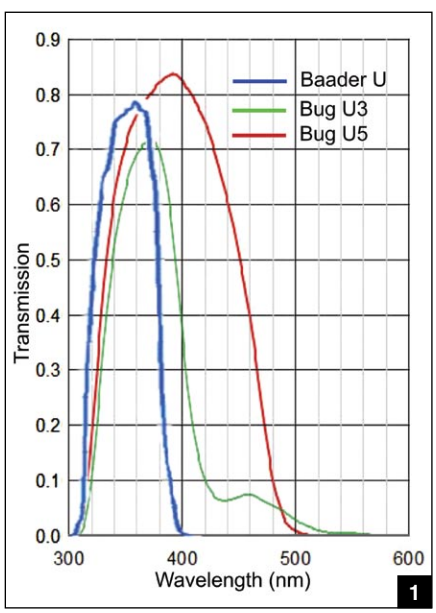
In UV photography, two types of imaging have to be distinguished:

- UV reflectance uses the UV light to image the object; the wavelength of the reflected light is the same as that of the illumination source. This type of imaging emulates insect vision.
- UV fluorescence uses UV light (300–400 nm) that is transformed by the object into light of longer wavelengths in the visual range of 400–700 nm. That shift towards a longer wavelength is referred to as fluorescence.

MATERIALS AND METHODS

Equipment. Some equipment was already at hand, some was custom modified, some was purchased from eBay, and some new equipment was acquired. Some explanations for the rationale for choosing one vs. the other and any issues are briefly discussed here. For additional information see Savazzi (2011), Prutchi (2017) or Davies (2018). The most current overall setup is shown here.

1. Camera. A Canon 5D mark II full frame digital single-lens reflex camera was modified to a full-spectrum camera (320–1,150 nm) by LifePixel (Mukilteo, Washington). The spectral range is in line with commonly cited figures for CCD and CMOS sensors (300–1,100 nm: Darmont 2009). I had the body at hand as a spare. The older sensor may have more dead pixels than a newer body, which makes image processing a bit longer (see below)
2. Lenses. Regular photographic lenses and their coatings absorb UV light. A Nikon EL 80-mm f/5.6 lens silver with M39 thread was chosen because of its good UV transmission characteristics and very reasonable price (Schmitt 2011a,b). This lens permitted magnifications of up to about 4:1, which is about at the diffraction limit for an f/5.6 lens (effective f-stop f/28). A Coastal Optics UV-Vis 105 mm f/4.5 (Jenoptic: Jupiter, Florida) was later added as a dedicated UV lens.
3. Filters. A 2-inch Baader U-Venus filter (UV pass, visible opaque), which only transmits UV light and blocks all visible light (320–400 nm transmission window, peak ~340–370 nm) was used for a pure UV image. eBay seller uvioptics provided the Bug U3 and Bug U5 filters, which covers both UV and part of the visible spectrum up to green; those are used to emulate insect vision. The transmission spectra of those filters is reproduced here.
4. Adapters. Various adapters to connect lens mounts of M39, M42, Canon EOS and Nikon F were employed as needed. Additional filter adapters were used to mount the filters. For the Nikon EL 80 with Baader U, a M34.5 mm ×0.5 male to M48 mm ×0.75 female adapter is required. Notice that the thread pitch on the filter are not standard photographic 0.5. Therefore, standard step-up/down rings cannot be used with the Baader U. Rafcamera on eBay provides various specialty filter



[1] Transmission spectra of the filters used for UV reflectance imaging. Combined and modified from Baader and iruvoptics data sheets.

adapters.

5. Bellows and extension tubes. A cheap Russian M42 bellows, a Nikon PB6 and some Kenko for Canon extension tubes were used to reach magnifications of up to about 3:1.
6. Light sources. WARNING: UV light sources are health hazards. The UV flashes, and particularly the UV studio flashes, can cause eye damage and skin burns. Wear long sleeve clothes and UV-absorbing safety glasses, or even a plastic face shield. A cheap 365-nm flashlight (like the ones used at airports to check travel documents) was first obtained for proof of concept. Many older electronic flashes emit significant amounts of UV, which is absorbed by a plastic cover over the reflector. I removed that cover on a Metz 45 CT1 to convert it into an UV flash. Fitting it with a ZWB1 (=UG11-type) filter (UV pass, visible opaque) only reduced UV output, but did not affect the quality of the UV image if a UV filter is used on the lens. To prevent camera damage caused by possibly high PC-sync voltages, the UV flash was triggered with an optical slave (FlashZebra.com) using a Canon MT 26EX RT flash firing a single head at lowest 1/512 power connected directly to the camera. The relatively low power of the Metz flash required ISO settings of 400–1,600 at f/5.6, which results in significant sensor noise. Additionally, the Metz flash has a slow recycling time of about 10 seconds, which unnecessarily prolongs the image acquisition using z-stacking. A Paul C Buff Whitelightning 1600 (660 Ws) with uncoated (UV emitting) tube proved to be sufficiently powerful to shoot at ISO 100, without overheating after 100 consecutive flashes at intervals of 1–2 seconds. Attempts to reduce light spill with a snoot reduced light output too much. A long throw reflector turned out to be best suited, but exposes the operator to more harmful UV radiation. A functional brightening card-board in the form of either aluminum foil or an steel bowl worked well. Stacks were acquired automatically and unattended, reducing UV exposure of the operator.
7. Stacking. The z-stack images were acquired with a Cognisys Stackshot with X3 controller. The X3 controller can store multiple recipes (step size, settling times, motor precision) for various magnifications and f-stops, and hence is helpful even if only a single axis is used. The start and stop positions were determined with camera live view and the 365-nm flashlight.

[2] Photographic set-up for UV reflectance z-stacking of orchid flowers. Insert top left: z-stacking artifact from defective pixels. For details see main text.

Image acquisition. Flowers were imaged on inflorescences cut from the plant. Bright light flashes and the associated heat pulses can be damaging to plants in general, and UV light can be damaging to the DNA. To minimize damage to the source plant, the freshly cut inflorescence was photographed in isolation. Two inevitable problems arise from this necessity. For one, the flowers cannot be photographed again a few days later. Second, the heat blasts from the flash stress the inflorescence and flower. The flowers may start to wilt; the inflorescence may bend during the z-stack acquisition; this renders many image stacks useless. Securing the inflorescence at both ends with clamps, and further stabilizing the inflorescence with props lightly touching the flowers out of the image area help increase the number of successful captures. It may be necessary to increase the sensitivity of the camera's sensor from base ISO 100 to ISO 200 (or even ISO 400) to reduce the heat bursts.

Visible light images were usually taken with fiber-optics light sources under a stereo microscope while the inflorescence was still on the plant (see Geiger 2013 for details), and only the UV images were taken from the isolated inflorescence.

Image processing. The source images had bad pixels in fixed positions, which leads to color streaks and swirls in the final z-stacked image (Geiger 2013; Fig. 2: insert). To remove those color artifacts, the acquired RAW/CR2 images were processed with DxO Optics Pro's prime noise reduction and exported as 16 bit/channel RGB .tif files. This procedure is extremely computationally intensive and is best carried out on desktop graphics workstations. It takes a six-core 2013 MacPro 10–20 minutes to process one stack of 70–150 images with all 12 threads at 100% CPU load and significant heat coming off the computer. I also attempted to create a Gaussian blur mask in AffinityPhoto to eliminate the fixed position color artifacts with a batch-processing macro. Despite lengthy experimentation and refinements, the results were unsatisfactory.

The .tif files were loaded into ZereneStacker and stacks were processed with the Pmax algorithm. To emphasize the color differences and to obtain a neutral overall color, the curves of the a and b channels in Lab color space of the stacked image were steepened (usually by increasing slope fro44444m one to two) in AffinityPhoto. Residual color balance adjustments to achieve a neutral black background were also carried out by Lab curve adjustments.

The resulting images are best described as false color renditions. The specific colors produced are of no consequence. The presence/absence

of patterns is the relevant piece of information. The false color nature stems from the native UV sensitivity of the color pixels, and humans' inability to see UV light. The accurate interpretation of the observed patterns would require knowledge of several unknowns: spectral sensitivity of the sensor, transmission spectrum of lens and spectral response of the pollinator's visual system. Those would then need to be combined with the spectra of the light source and the absorption curves of the filters.

RESULTS

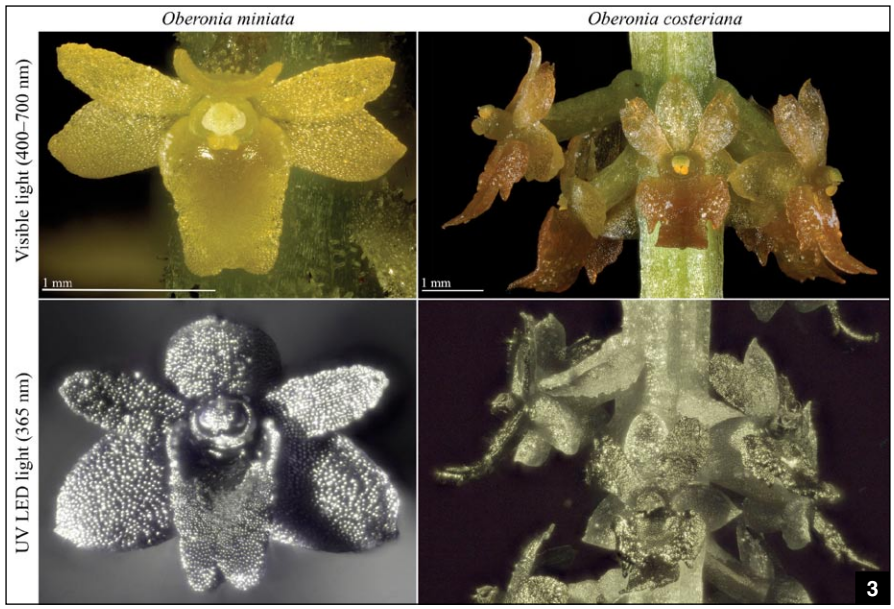
Light sources. The 365-nm flashlight produced monochromatic (black and white) images without any patterns in the species examined (Fig. 3). This is not surprising, given the monochromatic nature of the light source, which is about 15 nm above the peak sensitivity of bee vision (350 nm: Menzel and Blakers 1975, Hempel de Ibarra et al. 2014).

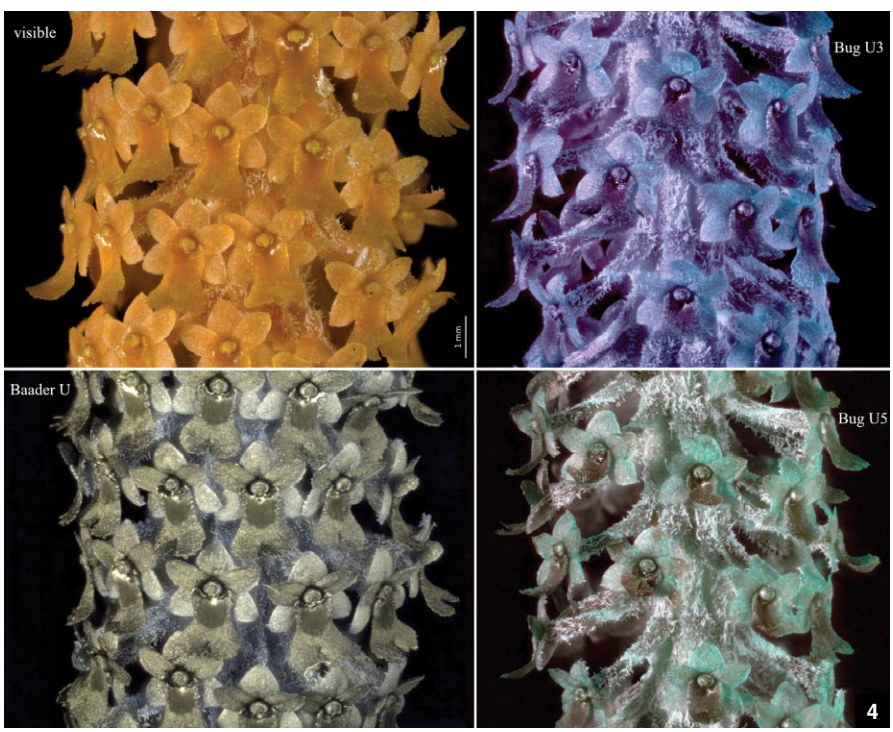
The two flashes produced equivalent results, suggesting that the flash tubes are acting like a black-body radiator even in the UV spectral range. The flashed images resulted in false-color images, which were only affected by the filtration used.

Filters. There were discrete differences in the images produced by the four filtrations applied (visible light, Baader U, Bug U3, Bug U5). The most striking patterns seen as of yet are in *O. padangensis* (Fig. 4). In visible light, the entire inflorescence and all floral parts are uniformly orange (Fig. 4: visible light). In pure UV/Baader U, there is a strong differentiation between the rachis and the flowers; the flowers themselves appear uniform (Fig. 4: Baader U). The Bug U3/5 filters, covering UV with some contribution in the visible range, render the lip darker than the rest of the floral elements (Fig. 4: Bug U3, Bug U5).

From those results, one can infer that the UV pattern of flowers vs. rachis observed with Baader U and full-spectrum flash are produced to either side of 365 nm, because no patterns were observed with the 365-nm flashlight alone. It is more likely that the pattern is produced by shorter wavelengths, because the differentiation of lip vs. sepals–petals is most likely produced by wavelengths longer than 365 nm (380–400 nm).

The differentiation of the lip was only revealed with the Bug U3/5 filters. It indicates that the pattern is caused in the near-UV range (380–400 nm) for the following reasons. The Baader U filter has relatively poor transmission in the longer UV range (0–20%) and the patterning is not picked up by Baader U filtered images.





If the pattern was caused by wavelengths in the visible range (400–700 nm) we would see those differences also in the visible light images, which is not the case. It also appears that the pattern is slightly more pronounced with the Bug U5 filter, which has higher transmission in the 380–400-nm range compared to the Bug U3 filter (see Fig. 1). However, the higher contrast of lip to petals and sepals in the greenish Bug U5 images may also be due to image processing or particulars of the sensitivities of the camera sensor.

One may wonder whether the orange colors in visible light of lip and petals/sepals are metameric; i.e., they appear differently under different photographic

[3] Comparison of visible light (400–700 nm) to narrow band UV (365 nm) images of *Oberonia miniata* and *Oberonia costeriana*. Notice the lack of any patterns and the monochromatic nature of the UV images.

[4] Comparison of *Oberonia padangensis* in visible light, pure UV (Baader U filter), and two simulated insect visions (Bug U3, Bug U5 filters).

light conditions. This is not the case, because the uniform orange color is seen both with photographic flashes (black-body radiator) as well as with LED fiber optics light sources (irregular emission spectrum). Those two light sources would render metameric color in different shades.

DISCUSSION

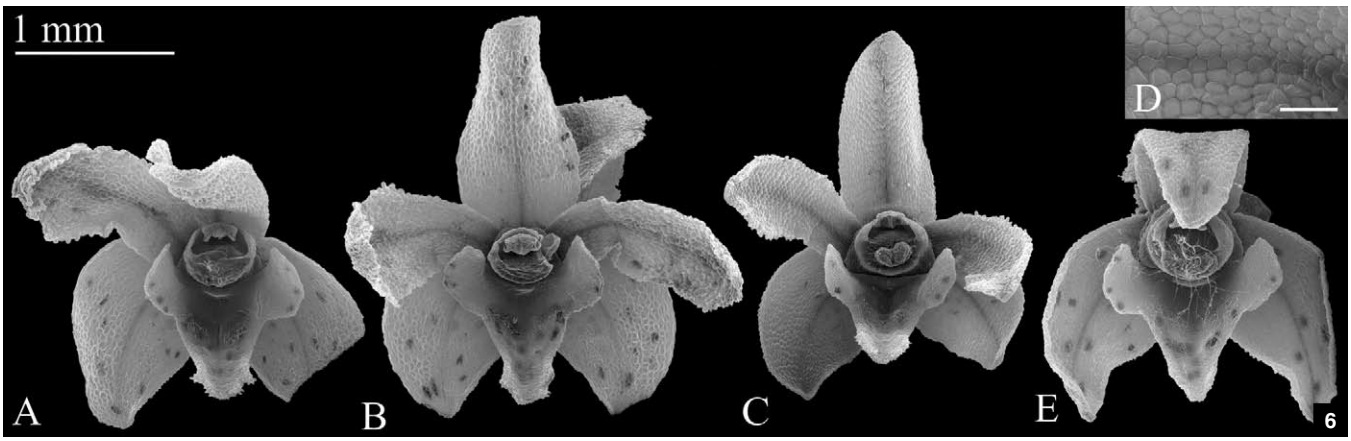
UV pattern in other orchids. There are relatively few UV reflectance images of orchids. The most extensive study by Indsto and Weston (2000) on 34 species of *Dendrobium* in near-UV (370–400 nm) noted a darker lip in several species. They interpreted it as a variation of the bullseye pattern well-known in Asteraceae. Distinctly alternate patterns can be seen in 12 of the 34 species, with several others show accentuated patterns of what can be seen in the visual range. The dark lips in near UV support the conclusion above that the darker lips in *Oberonia* with the simulated insect vision filters is caused by the near-UV range of the spectrum. Chalwatzis (2013) showed *Ophrys apifera* in which the pink sepals are rendered as dark as the lip with the Baader U filter. Kropf and Renner (2005) illustrate *Dactylorhiza sambucina* in which the dotted lip is rendered dark and the dark lip is bordered by a bright margin in pure UV with a Schott UG11 filter. Schmitt (2017) illustrated a *Phalenopsis* specimen using a variety of UV and insect vision filters, none of which revealed different patterns. A Cambria hybrid (complex oncidid intergeneric hybrid) was shown with various filters by Schmitt (2013). The pure UV image (Baader U) eliminated the bright border around the petals and sepals, while they showed again in various simulated insect visions (Schmitt proprietary XBV3, XBV5).

Flower coloration in *Oberonia*. The darker lip compared to the rest of the sepals and petals in *Oberonia padangensis* was only revealed by simulated insect vision. Differently colored lips in the visible spectrum are known in a few species. *Oberonia arisanensis*, some specimens of *Oberonia costeriana*, *Oberonia japonica* and many specimens of *Oberonia titania* have a dark red lip and light orange petals and sepals. *Oberonia heliophila* has a green lip and cream petals and sepals. *Oberonia prainiana* has an orange lip and yellow petals and sepals. Whether those differences remain apparent in simulated insect vision remains to be demonstrated.

UV patterning and fitness. For *Ob. padangensis*, discrete patterns observed were in UV. In *Ob. padangensis* the flowers are crowded on the inflorescence; hence, the differentiation of the flower vs. the rachis observed in the UV range may be of limited visibility to insects. The arrangement of flowers is quite variable *Oberonia* species. It can range from the flowers covering the rachis entirely, as in *Oberonia lycopodioides*, to flowers sunken into the rachis, as in *Ob. pachyrachis*, to flowers in discrete and well-separated whorls as in *Ob. arisanensis* or *Oberonia leytensis*. In certain species, the arrangement is variable, such as in *Oberonia setigera*, with flowers either in whorls or in spirals (occasionally changing on the same inflorescence), or in *Ob. leytensis* the flowers can be in very tightly packed whorls with flowers of adjacent whorls almost touching to spacing between whorls almost as wide as the flowers. From an evolutionary perspective, variability is the raw material for evolution to act on. Reproductive structures are a key factor in evolutionary success, as they are the determinant for reproductive output of the plant. Everything else being equal (length of inflorescence, number of flowers per whorl, number of seeds per capsule, survival probability of each seed), tightly spaced inflorescences have a greater potential reproductive output than inflorescences with more widely spaced flowers. On the other hand, if visual cues can increase cross-fertilization rate, then a more highly visible pattern may be overall more advantageous. Flower in well-separated whorls may display a distinct striping pattern along the inflorescence, with the flowers in a contrasting coloration than the rachis. Accordingly, spacing of flowers may be an evolutionary trade-off in maximizing fitness (lifetime reproductive success).

Pollination syndromes in *Oberonia*. It has been suggested that *Oberonia* flowers are pollinated by water droplets carrying the pollinaria from higher flowers to lower ones (geitonogamy), or even by selfing on the same flower (M. Clements pers. comm). That could explain the not-infrequent high seed capsule counts on inflorescences, where almost every flower develops a seed capsule. Geitonogamy amounts to a sizable fraction of pollination in orchids (22.2–51%: Harder 2000). This potential mechanism can only be part of the pollination story in *Oberonia*. Rain in general causes accidental pollen loss (Harder 2000). From an evolutionary perspective, selfing leads to inbreeding depression and is an evolutionary dead end. Additionally, flowers of plants with pure physical–environmental pollination syndromes, such as wind pollination (anemogamy) in grasses (Cyperaceae, Poaceae), or water pollination (hydrogamy) in sea grasses (Cymodoceaceae, Posidoniaceae, Zosteracaea), the flowers are reduced and usually without pigmentation, and the pollen grains are dispersed as single tetrads or small clusters (Harder 2000, Pacini and Francini 2000). *Oberonia* species, in contrast, have colored flowers with distinct macrostructures (bract, petals, sepals, lip) and microstructures (cell surface sculptures in discrete areas of the lip), and the pollen are clustered into two pollinaria, which is strongly indicative of zoogamy. Self-fertilization by water droplets may potentially be a means of last resort if animal-mediated cross-pollination fails. Delayed selfing (Harder 2000) and cleistogamy as a fail-safe mechanisms are known from other plants, particularly violets (Violaceae: Meeuse and Morris 1984). It has to be noted that seed-capsule formation on *Oberonia* plants in cultivation is a rare phenomenon, despite daily watering of mounted plants. This questions water droplet–mediated fertilization, and would suggest that high seed capsule count is the result of high pollinator visitation.

Spatial patterning and visual acuity. A factor that may be overlooked is the limited resolving power of an insect eye (1–5°: Hempel de Ibara et al. 2015) compared to humans (~0.02–0.03°). The difference in resolving power is on the order of 100×, but because images are composed of both x and y axes, the actual information acquired is 10,000× less. Most flower patterns can only be recognized by an insect at close distances (millimeter to centimeter range). A 2-mm flower, typical for *Oberonia*, can only be recognized at 2.2–10.1 cm. When presented with a choice, the behavioral resolution is even worse at 13–15°. The banding pattern of flower whorls vs. rachis can extend potential recognition distances to up to about 50 cm. On the other hand, the dark lip of *Ob. padangensis* may only be discriminated at distances of 1–5 cm, and hence may only be suitable as guides for final approach of a potential flying pollinator. Long-distance attraction may either involve other mechanisms such as scent (see below), or may depend upon chance encounters. Visual cues may help in clumps of plants with multiple inflorescence, or discrete clumps in close proximity to one another. On the other hand, plants in close proximity are more



[5] *Oberonia longispica* scanning electron microscopy images of flowers showing electron dense potential nectar guides. A, B: L19252. C, D: E0022.7152. E: CANB 9010014. Scale bar entire flo ers = 1 mm. Scale bar D = 100 µm.

likely to be clones of the source plants, leading to a form of inbreeding through geitonogamy.

Pollinator groups and floral characteristics. The pollinators in tropical and subtropical areas can be classified in a simplistic fashion following Kato et al. (2008):

— Megafauna, such a mammals including bats and birds.

— Hymenoptera, such as bees, wasps, and ants.

—Lepidoptera (butterflies and moths).

— Other insects, including Diptera (flies, gnats), Coleoptera (beetles) and Thysanoptera (thrips).

Megafauna pollinators make up <10% of pollinators and decrease in importance with altitude. Hymenoptera make up 40–60% of all pollinators, and Lepidoptera contribute between 0–20%. The other insects complement at 25–55% and tend to be more important at higher elevations. Although Hymenoptera (for orchids particularly euglossine bees) and Lepidoptera (for orchids particularly moths in angraecoids) are the most frequently studied, the "other" category may be much more important as in the case of Diptera for red-flowered *Bulbophyllum* and in fungus-smelling *Dracula* (Endara et al., 2010; Humeau et al. 2011, Ong and Tan, 2011).

The majority of literature on pollination biology is centered around bees and butterflies. Smaller insects of the lesser orders are often overlooked (e.g., Eliyahu et al. 2015). Ant pollination is rare, but known in orchids (Peakall et al. 1990, Claessens and Seifert 2017), particularly in species with small flowers, such as *Microtis parviflora* R. Br. (Peakall and Beattie 1989, 1991). One reason for the rarity of seed capsule formation in *Oberonia* species in cultivation could be the strong horticultural bias against ants because of their known activity as pest vectors. *Oberonia* species can be affected by brown scale as well as aphids (D. Geiger pers. obs.), and have been reported as slug magnets (T. Mirenda pers. comm). Accordingly, it is conceivable that low seed production in cultivated *Oberonia* plants is due to ant suppression in greenhouses.

Gnats, and particularly fungus gnats, can be included in the list of potential pollinators based on a species epithet, namely that of *Oberonia fungumolens*, which means fungus smelling. That name is a synonym of *Ob*. *padangensis* (see Geiger in press). Fungus-smelling orchids are best known in *Dracula*, where fly pollination has been demonstrated (Dentinger and Roy 2010). Accordingly, an *Oberonia* described as fungus-smelling may well be pollinated by fungus gnats. I have not noticed a fungus smell, or any human detectable fragrance, either in my cultivated specimens of *Ob*. *padangensis*, or in any of the other approximately 30 species I have grown.

Nectar guides in electron microscopy. A further intriguing observation was made on the flowers of *Oberonia longispica* examined by scanning electron microscopy (Fig. 5). All petals and sepals had dark radial markings under the electron beam, indicating electron-dense compounds in those areas. They were not aligned with cell boundaries, suggesting that the pattern formed by electron-dense compounds is formed in portions of the cell walls (Fig. 5D). Rotation of the flowers had no effect on the presence and position of the dark lines, indicating that it is not an artifact of specific relative orientation of electron beam, specimen and detector. Additionally, it was observed in specimens from four independent collections, indicating it is not an environmentally induced trait, but a species-specific character. Unfortunately, no photographs of the flowers exist, and it is unknown whether those streaks are visible in daylight, or whether they could be considered more traditional nectar guides.

CONCLUSION

The pollination mechanism(s) of *Oberonia* species still remains unknown. Given the size of the flowers that have striking range of morphologies and colors, small insects are the most likely pollinators. The dark lip in near-UV in *Ob*. *padangensis* suggests flying rather than crawling insects. The fungus smell in one species may suggest fungus gnats as a pollinator. High seed formation may be attributed to either abiotic, water mediated, or animal conferred selfing or geitonogamy. It seems likely that the 150–300 species may be pollinated by more than one class of pollinators, and multiple pollinators in the same *Oberonia* species are conceivable.

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— Daniel Geiger is Curator of Malacology at the Santa Barbara Museum of Natural History, 2559 Puesta del Sol, Santa Barbara, California 9310. He is also a Visiting Research Scholar, Huntington Botanical Gardens–Botany, 1151 Oxford Street, San Marino, California 91108 (email geiger@vetigastropoda.com, dgeiger@sbnature2.org).

JUNE

1–2—Central Florida Orchid Society Show "Orchid Hunt," National Guard Armory, 2809 S Ferncreek Ave., Orlando, FL; Contact: Teri Scott, 407–463–0274; teriscottfla57@aol.com

1–2—Foothills Orchid Society "Orchids for Everyone," Triwood Community Center, 2244 Chicoutimi Drive NW, Calgary, Alberta, Canada; Contact: Marguerite Salsberry, 403–973–2687; msalsberry@telus.net

1– 2—New Orleans Orchid Society's Show & Sale, Lakeside Mall, 3301 Veterans Memorial Blvd., Suite 209, Metairie, LA; Contact: Randy Johnson, 225–205–8181; randy.johnsonian2000@gmail.com

28–30—Hilo Orchid Society Show "Orchid Odyssey," Edith Kanaka'ole Stadium, 350 Kalanikoa St., Hilo, HI; Contact: Karl Mendonca, 970–989–8064; karlsandi@comcast.net

JULY

12–14—Baton Rouge Orchid Society's Show & Sale, Burden Museum and Gardens, 4560 Essen Lane, Baton Rouge, LA; Contact: Wesley Mathews, 225–321–1912; wdmatthew@hotmail.com

19–20—International Phalaenopsis Alliance "The 25th Phalaenopsis Symposium," Highland Manor, 604 E Main Street, Apopka, FL: Contact: Mary Beth Clarke, 610–574–2777; orchidgma5837@gmail.com

20–21—*San Francisco Orchid Society Show and Sale "Orchids in the Park," San Francisco County Fair Building "Hall of Flowers," 1199 9th Avenue, San Francisco, CA; Contacts: Faye Rabino, faye@orchidsanfrancisco.org; Angelique Fry, newsletteredtor@orchidsanfrancisco.org

AUGUST

2–3—Houston Orchid Society Workshop and Sale, First Christian Church, 1601 Sunset Blvd., Houston, TX; Contact: Derek Lowenstein, 631–459–7327; dereklowenstein@gmail.com

6–11—Sociedad Colombiana de Orquideologia "Exposición Orquideas, Flores & Artesanias," Jardín Botánico – Carrera 52 #73–298, Medellin – Antioquia, Colombia; Contact: Javier Rios, (57) 313 660 0946; secretariaexposicion@sco.org.co

7–11—Virtual Orchid Society "2nd Expo Orchids Shopper," Plaza Centro Mall, Ave. Rafael Cordero #200, Cagus, PR; Contact: Reinaldo Rodriguez, 787–565–5287; vladimir4875@hotmail.com

30–September 1—Asociacion Jueces de Orquideas de Costa Rica "Exposición Nacional de Orquideas AJOCORI 2019," Ave 16, calles 0 y 1, 6° piso parqueo, Hospital Clinica Biblica, San José, Costa Rica; Contact: Ana Cristina Rodriquez León, (506)8393–3736/(506)8980–3449; orquideaslinda@hotmail.com

SEPTEMBER

14–15—Galveston Bay Orchid Society/ SWROGA Show "Symphony of Orchids," Hilton Houston NASA Clear Lake, 3000 East NASA Parkway, Houston, TX; Contact: Joyce McMillan, 832–279–0211; joycemcmillan@att.net

14–15—Wisconsin Orchid Society Show "Fall In Love With Orchids," Mitchell Park Horticultural Conservatory, 524 S. Layton Blvd., Milwaukee, WI; Contacts: Richard Odders, 262–632–3008; odders2445@gmail.com/Bil Nelson, 414–467–6642; qorchids@att.net

20–22—Alabama Orchid Society 35th Show & Sale, Birmingham Botanical Gardens, 2612 Lane Park Road, Birmingham, AL; Cotact: Dr. Beverly A. Von Der Pool, 205–821–0689; bvonderpool@yahoo.com

21–22—Ridge Orchid Society Show "Orchids Gone Wild," W. H. Stuart Center – UF IFAS Extension Polk County, 1702 US Highway 17–98 South, Bartow, FL; Contact: Glen Gary, 863–602–0778; glengary54@yahoo.com

28–29—Kentucky Orchid Society Show, St. Mathews Episcopal Church, 330 N Hubbards Lane, Louisville, KY; Contacts: Richard Humke, 502–299–1231; richardhumke@gmail.com/Catherine Luckett, 502–893–9282; catluckett@gmail.com

28–29—Smoky Mountain Orchid Society Show, Stanley's Greenhouse, 3029 Davenport Road, Knoxville, TN; Contacts: Mary Ann Lang, 865–675–3695; maryannlang@charter.net/Casey Littell, 865–297–8202; 1littellgirl@gmail.com

Events preceded by an asterisk (*) in this listing will not be judged by the AOS.

Handy Crates for Transporting Orchids

CLEVERMADE/INSTACRATE collapsible milk crates are my new favorite tool! I found them at Costco a couple of weeks ago. I bought two of the large ones then went back for two small ones. They come in two sizes and two styles plus different colors. The large crate is 20 x 10 inches (50.8 x 25.4 cm) and the smaller crate is 10 x 10 inches (25.4 x 25.4 cm). Costco sells the large one as solid only ($6.00) and the small one as slotted only ($9.00). However, I looked online and noticed you can get either as solid or slotted.

I use them to transport orchids. The slotted crates allow me to hang my small mounted orchids on the sides keeping them safe during travel. The larger, solid crate allows me to transport orchids and orchid supplies without anything falling out. Both allow me to water my orchids while they are packed because of the drainage holes and they are very easy to clean. They are light weight and durable plus, since they collapse flat, they store easily. — *Cindy Jepsen (cindyjepsen@cox.net)*

ORCHID MARKETPLACE

ORCHIDS CLASSIFIEDS

SALES

BROWARD ORCHID SUPPLY — we carry fertilizers, fungicides, pesticides, pots, baskets, growing media, tree fern, cork, wire goods, labels, pruners and more. For our complete product line, visit our website at www.browardorchidsupply.com. Call 954-925-2021 for our catalog or questions. AOS members receive a 10% discount. We cater to the hobbyist.

NEW VISION ORCHIDS — Specializing in phalaenopsis: standards, novelties. Odontoglossums, intergenerics, lycastes and vandaceous. Russ Vernon — hybridizer. Divisions of select, awarded plants available. Flasks and plants. Tel.: 765-749-5809. E-mail: newvisionorchids@aol.com, www.newvisionorchids.com.

SELLING MY PRIVATE collection after 28 years; 2,500 sq ft of overgrown cattleyas and 500 sq ft of overgrown dendrobiums are available in Titusville, Fl. Contact: Kenny Yii @ 321-720-7337.

Classified ads are $55 for five lines (45 characters/spaces per line) and $15 for each additional line. $25 for first three words in red. $25 to include logo. The first three words can be in all caps, if requested.

SALES

MAIN STREET ORCHIDS After more than 20 years in business, we are finally offering online sales. Lots of species. Phrags, Phals, Catts, Dens, Tolumnias, other. New additions monthly. Very reasonable prices. Join our email list to see new additions and specials. Visit msorchids.net.

INGRAM'S BETTER ORCHID BOOKS offers new, old, rare, classic, out-of-print orchid books and some orchid magazines. Looking for a specific item? Send order or want list via email to jeingr45@gmail.com or mail to J E Ingram, P.O. Box 12272, Gainesville, FL 32604.

ORCHIDARIUM II An exciting redesign of the original Orchidarium (Wardian Case) for growing miniatures and seedlings. Space is 20"x10"x18". Fogger holds 80%+ humidity, fan has adjustable settings. LED lighting offers a range of brightness and keeps the temperature cool. Visit www.orchidarium.us or rick@orchidarium.us

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SELLING WELL-ESTABLISHED online orchid business due to retirement of owner. Turnkey business with plants, supplies, website, customer base – everything but the greenhouse. Great potential for growth. Email olympicorchids@gmail.com or phone 206-229-7919.

PERFECT FOR ORCHIDS! Two large greenhouses (~ 3,000 sf) with water, power, fans. Central Florida hilltop home on almost 14 acres. Open floor plan, large rooms, high ceilings, over 2,500 sf of living space. Huge screened porch allows perfect views of fields, gardens and Lake Weir. Attention to detail amazing, relaxing country lifestyle but near The Villages. Possibilities are endless, or just enjoy the peace and quiet. Easy access to Orlando, the beach and Lake Weir water sports! Patricia Kilgore, Realtor Roberts Real Estate, Ocala, FL 352/843-4147 TrishKilgore@aol.com

AD INDEX

For Advertising Information, Contact: Onkar Sandal, osandal@allenpress.com

Submission of articles for *ORCHIDS* magazine

The AOS welcomes the submission of manuscripts for publication in *Orchids* magazine from members and non-members alike. Articles should be about orchids or related topics and cultural articles are always especially welcome. These can run the gamut from major feature-length articles on such topics as growing under lights, windowsills and thorough discussions of a species, genus or habitat to shorter, focused articles on a single species or hybrid to run under the Collector's Item banner. The AOS follows the World Checklist of Selected Plant Families with respect to species nomenclature and the Royal Horticultural Society Orchid Hybrid Register for questions of hybrid nomenclature. The AOS style guide and usage guides can be downloaded from http://www.aos.org/about-us/article-submissions/style-guide-for-aos-publications.aspx

Articles as well as inquiries regarding suitability of proposed articles should be sent to jean.ikeson@gmail.com or the editor at rmchatton@aos.org.

Caution: Virus Testing Causes Depression

By Thomas Dunlap

GEORGE HATFIELD, PREVIOUS President of the American Orchid Society, came to talk at the Alamo Orchid Society in San Antonio this past spring. His topic of viruses sounded dry, but I decided to attend anyway. As he presented the topic, I remembered more and more from the plant pathology course I had taken at the University of Minnesota more than a decade ago. "Do any of my 700 orchids have a virus?" I wondered. George was adamant that older plants with improper repotting techniques or plants purchased from big box stores likely had them. Guilty on both counts. Over the next couple of weeks, I obsessed over whether or not my collection was infected. If infected, how would I deal with the truth? My obsessive–compulsive disorder kicked in and I decided I would not be able to rest until I ordered a pack of Cymbidium Mosaic Virus/Odontoglossum Ring Spot Virus (CMV/ORSV) tests and checked some of my orchids.

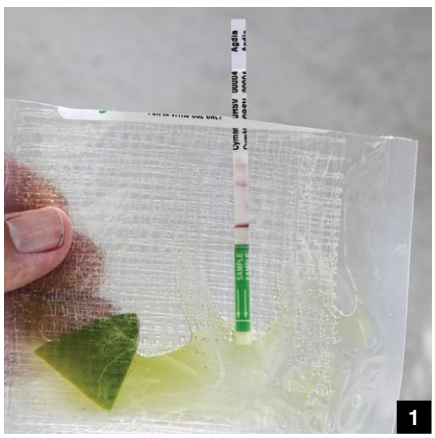
My test kits arrived about three days after I ordered them online. The kit from Agdia contained 25 sealed pouches of buffer solution and 25 test strips. The instructions were very easy to follow. I cut a ¾-inch (1.9 cm) piece of leaf from the plant, opened a pouch and put the leaf sample in the pouch, pressed the leaf to release leaf fluid into the solution and placed a test strip into the bag solution for several minutes. If the plant had a virus, one or both virus test lines would show up on the test strip. If the plant tested negative, only a control line would be visible. Both a negative or positive test would show the control line to verify the test was valid.

I decided to start by testing my cattleyas. I had 96 at the time. My first plant tested was *Cattleya* Marcia Foster 'Bob Sanker' AM/AOS. It was positive! George was right! I threw the plant outside the door of the greenhouse and continued testing. "Oh well," I thought, "not too big a loss since I had had it for only a year." The next several tests provided mixed results. Some of my older cattleyas were virus-free and some tested positive, but then it got personal. One of my oldest, largest favorites had a virus — *Rhyncholaeliocattleya* Renae Eugene (*Cattleya* Drumbeat 'Heritage' HCC/AOS × *Rhyncholaelia glauca*). Out it went. My *Cattlianthe* Chocolate Drop 'Kodama' AM/AOS was lost, as well as my *Rhyncattleanthe* Burana Beauty 'Burana' HCC/AOS. My stomach was starting to hurt.

By the time I had tested my first 25 cattleyas, I had thrown away six of them. Ouch. But it was too late. I desperately needed to verify that all my remaining cattleyas were free of viruses. Back online, I purchased 50 more test kits. After testing my complete collection of cattleyas, a total of 25 plants ended up in the trash.

Depression was beginning to set in on top of my obsessive–compulsive disorder.

How could I stop now? As soon as new kits arrived on my doorstep, I found myself seated at my workbench in the



TERRY BOTTOM

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[1] Test strip inserted in the sample bag.

[2] Left to right, the strips indicate CyMV, ORSV, a double infection with both CyMV and ORSV and a clean test with only the control line showing.

[3] Virus-infected plants exhibit a spectrum of symptoms ranging from non-detectable to obvious. These can be black streaks and spots in the foliage or pseudobulbs that almost look like fungal infections to damaged flowers. This cattleya exhibits blossom necrotic streak.

[4] Author next to a prized specimen of *Dendrobium anosmum* that turned out to be virus-infected.

[5] Rhyncattleanthe Burana Beauty 'Burana' HCC/AOS was another of the author's plants that exhibited no warning signs but proved to be virus-infected.

greenhouse, nitrile gloves on my hands, staring at each test strip as the fluid rose to see if a line was going to form. I would cheer as each virus-indication line was passed until it reached the control stripe. My happiness was becoming dependent on the feedback from each virus test. George had not mentioned that virus-testing was addictive.

Feeling that an expert opinion would be helpful, I contacted Fred Clarke of Sunset Valley Orchids and asked what his repotting protocol was to prevent spreading viruses (See Box). I made notes for future reference.

Meanwhile, my own greenhouse ordeal was not over yet. I next tested my angraecoids. Only one had a virus. Hooray! I lost eight of my phalaenopsis (which did not break my heart because I never did like them all that much, anyway). My maxillarias, pleurothalids and stanhopeas were all virus-free. Another big score for me! Ten oncidiums bit the dust. To my surprise, I lost 13 vandas; for some reason, I had assumed that vandas were not susceptible to these viruses. Finally, 18 dendrobiums went to the big trash bin in the sky.

Amidst the carnage were some of my most prized plants. My specimen *Dendrobium anosmum*, many of my largest cattleyas, and my American Orchid Society–awarded *Dendrobium* Baby Blue 'Carmela' HCC/AOS were all lost. It still hurts.

Midway through my greenhouse cleansing, my friend Susan started testing her collection and immediately became as obsessed as I had been. She would call after an afternoon of testing to commiserate over the plants she had tossed. Several times, we got together over a beer or wine to drown our sorrows over the latest results.

After the worst of the pain subsided, I realized that many of the plants that were infected were also some of my most floriferous. The ability to flower was definitely not impacted for many of my diseased orchids, although a couple did exhibit flower color break, which is typical of many virused orchids.

Many growers, I have noted, do not care if their orchids are virused as long as they bloom. So, why all of this testing, and tossing, if my own diseased plants still bloomed? Was it just my obsessive–compulsive tendencies?

During a recent drive to San Antonio for an Alamo Orchid Society meeting, I was discussing virused plant observations with Susan. It struck me that my cattleyas that had tested positive were plants with which I had periodic problems with scale or mealy bugs. I would treat them for the pests, and they would be free of them for several months, but then they would show up again on those same plants. Knowing that scale and mealy bugs cannot transfer viruses from plant to plant, I now wonder if a virused plant appears to be more appealing to the pests. Likewise, I observed that my diseased vandas tended to have little to no root tip growth. No other signs of virus were visible.

Thanks to George Hatfield, I made a commitment to eradicate CMV/ORSV in my greenhouse. In the process, I observed first-hand that diseased plants appear more likely to attract additional pests or diseases. Virused plants may also grow more slowly or have smaller flowers. Last but not least, virused plants are just another source to inadvertently infect my otherwise healthy plants and weaken them.

Out of a little over 700 orchids when I started testing, 600 tested negative for either CMV or ORSV. That is the bad news. The good news is that I now have a healthy new starting point for adding new orchids to my collection. Along with following the repotting procedures I gleaned from Fred Clarke, I now virus-test every new orchid before it enters my greenhouse.

However, I will be very cautious about attending a presentation from George Hatfield again.

— Thomas Dunlap Thomas is the president-elect of the Alamo Orchid Society in San Antonio, Texas. His first orchids were raised in his basement under lights in Minnesota 14 years ago; he now has 650 orchids in his greenhouse in Canyon Lake, Texas (email: tdunlapsr@yahoo.com).

JANICE DUNLAP 4

JANICE DUNLAP 5

Fred Clarke's Repotting Instructions

WHEN REPOTTING, ALL cutting instruments are sterilized between plants. Use new gloves on every plant, change gloves between every plant. I work on a newspaper underlayment, so after each plant is completed, I wad up the newspaper with the old bark in it and throw it out; this reveals a new clean paper surface for the next plant. When trimming off all the flowers, the cutting instrument must be sterilized between plants.

One thing to keep in mind: virus is spread from the sap of an infected plant to the sap of a healthy plant. So you want to eliminate this when working with your collection. I think most virus transmission occurs during repotting or cutting off old flowers. All the glove changing, sterilizing, and working on a clean surface of newspaper takes a little getting used to. Once you develop it as your routine, you find that it is no bother to implement.

The International Phalaenopsis Alliance presents

IPA Symposium
July 19 & 20, 2019
Highland Manor – 604 E. Main Street
Apopka, FL 32703

Olaf Gruss from Germany presents, "What is New in the *Phalaenopsis* World," and will address the controversy that surrounds *Phalaenopsis speciosa* vs. *Phalaenopsis tetraspis*.

Mike Mims from North Carolina presents, "Fragrances in *Phalaenopsis*."

Peter Lin from Texas presents, "Novelty *Phalaenopsis*."

Dr. Yin-Tung Wang, retired professor at Texas A&M University, well-known in the *Phalaenopsis* world for his research on *Phalaenopsis* culture, comes to us from California to lecture on "How to Grow a Perfect *Phalaenopsis*."

Our speakers will be joined by distinguished guests, Mr. C.C. Chen from Taiwan and Alan Koch from California for panel discussions focused on species, breeding and culture.

Vendors for this event include Mainshow Orchids from Taiwan, Gold Country Orchids from California, Big Leaf Orchids from Texas, Mike Mims Orchids from North Carolina and local Florida grower Krull-Smith.

The new book on *Phalaenopsis* species by Olaf Gruss will be available during the Symposium only.

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