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ORCHIDS

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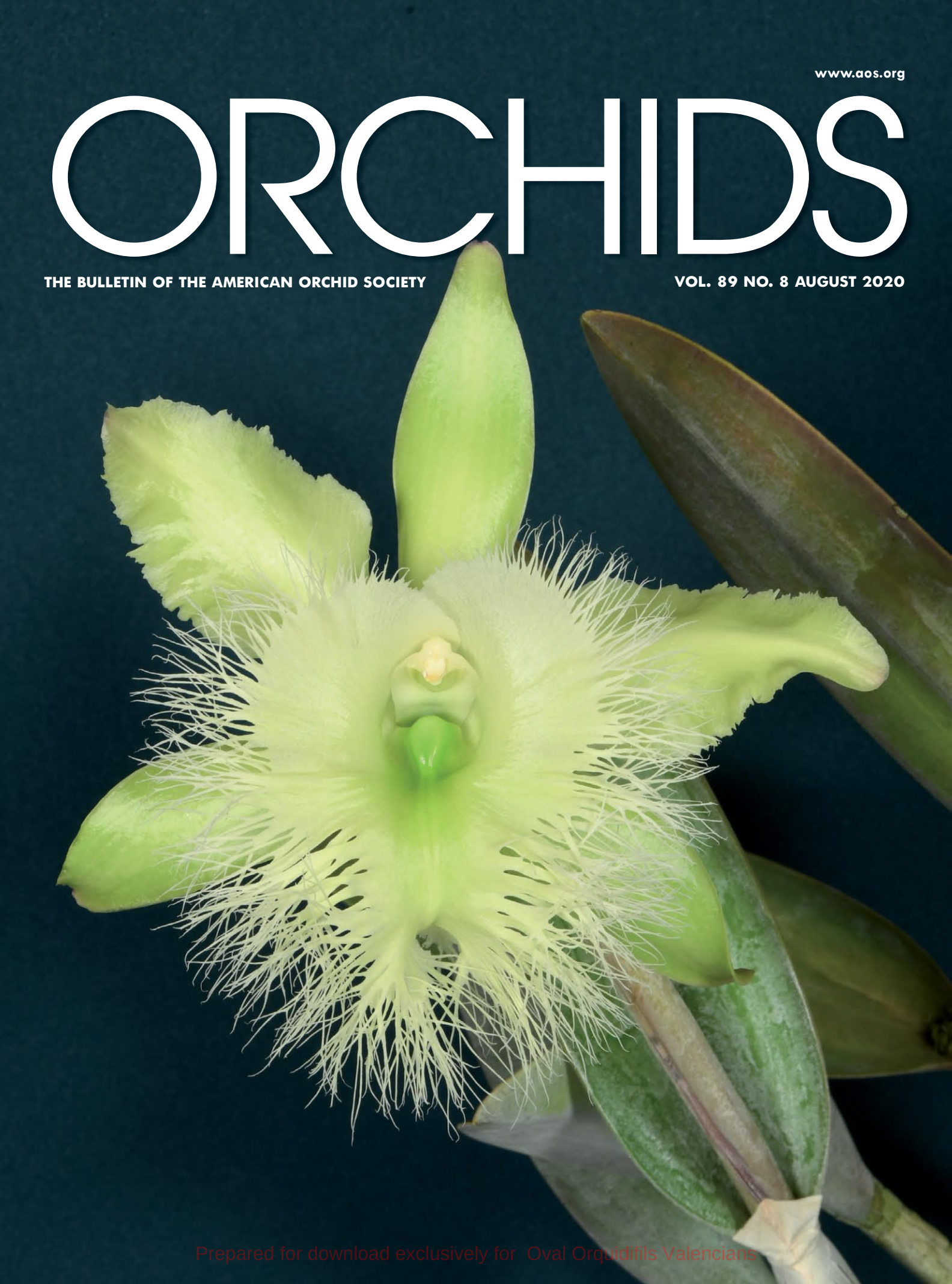

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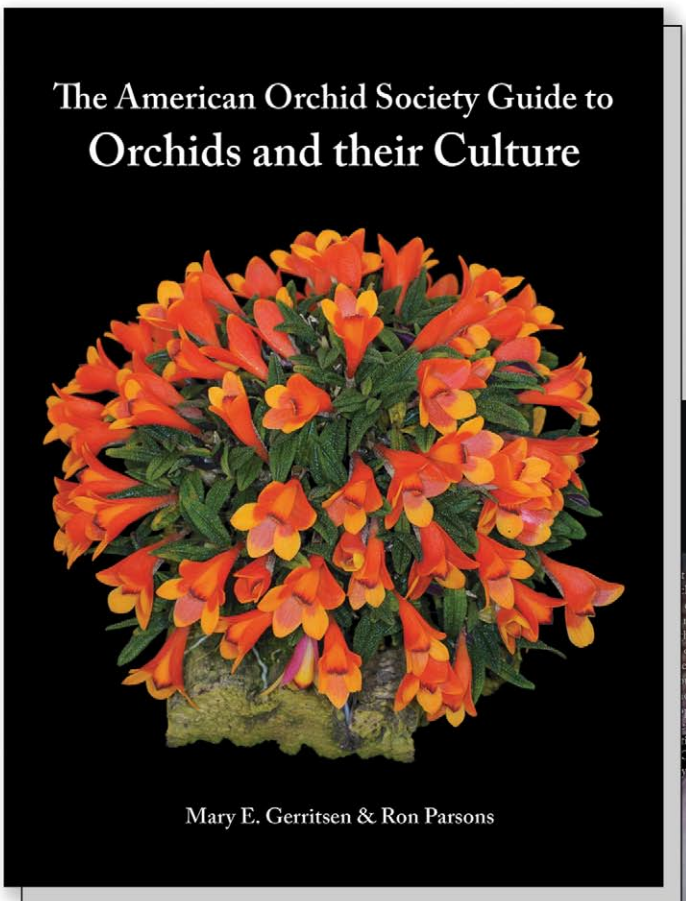

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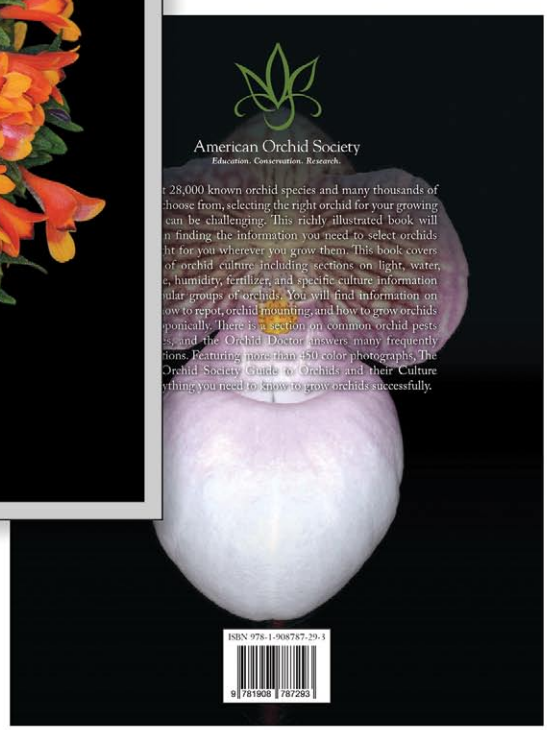

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ORCHIDS

The Bulletin of the American Orchid Society

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In This Issue

FRONT COVER

Those massive, frilly lips that we have come to love in complex *Rhyncholaeliocattleya* hybrids (often so-called "brasso-lips") owe their origin to *Rhyncholaelia digbyana*. This incredible species has proven to be a goldmine for cattleya breeders over the years. Pictured here is Rl. digbyana 'Springwater' AM/AOS, photographed by Ernest Walters, was grown by Thanh Nguyen, Springwater Orchids.

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A 501(c)(3) Nonprofit Organization Founded in 1921

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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 GUIDE

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.

acaulis (ay-KAW-liss)
Adenorachis (ay-deen-oh-RAY-kiss)
affinis (af-FYE-niss)
alaorii (al-a-ORE-ee-eye)
alyssana (a-liss-AY-na)
anitana (an-ee-TAY-na)
anthropophora (an-throh-POFF-ore-a)
aporophylla (a-pore-of-ILL-la)
Arethuseae (air-eh-THOOS-a-ee)
asperata (as-per-AY-ta)
attenuata (a-ten-yew-AY-ta)
aurea (AW-ree-ah)
austro-yunnanensis (aw-stroh-yew-nan-EN-sis)
barbeliana (bar-bell-ee-AY-na)
beverlysacklerae (bev-er-lee-SAK-ler-ee)
Bletia (BLEE-tee-a)
Bletilla (bleh-TILL-la)
blumei (BLOOM-ee)
bradei (BRADE-ee)
Brassavola (brass-AH-vol-lah)
briegeri (BREE-ger-ee)
Bulbophyllum (bulb-oh-FILL-lum)
Calopogon (kal-oh-POH-gon)
carprina (kar-PREE-na)
Catasetinae (kat-a-set-EE-nee)
Cattleya (KAT-lee-a)
Cattleyodes (kat-lee-OH-deez)
caulescens (kaw-LESS-enz)
cavaleriei (kav-a-LEER-ee-eye)
chaperi (CHAP-er-ee)
chorisiana (kor-iss-ee-AY-na)
ciliolata (sil-lee-oh-LAY-ta)
cinnabarina (sin-a-bar-EE-na)
Cirrhopetalum (seer-ho-PET-a-lum)
coccinea (kok-SIN-ee-a)
Coelogyne (see-LOJ-ih-nee)
Coelogyninae (see-loj-in-EE-nee)
Crispae (KRIS-ee)
cristata (kris-TAY-ta)
crumenatum (kru-men-AY-tum)
cucullata (kew-kew-LAY-ta)
cuspidilingue (kus-pid-ih-LING-yew-a)
Cymbidium (sim-BID-ee-um)
cymbisepala (sim-bih-SEEP-a-la)
Cypripedium (sip-rih-PEED-ee-um)
delacourii (del-a-KUR-ee-eye)
Dendrobium (den-DROH-bee-um)
digbyana (dib-bee-AY-na)
Dimorphorchis (dye-morf-ORE-kiss)
dissitiflora (diss-sit-ih-FLOOR-a)
disticha (DIS-tih-ka)
dubia (DOO-bee-a)
eberhardtii (eb-er-HARD-tee-eye)
elegans (EL-eh-ganz)
Encyclia (en-SIK-lee-a)
enoensis (en-oh-EN-sis)
Epidendrum (eh-pih-DEN-drum)
equitans (EH-kwih-tanz)
falcata (fal-KAY-ta)
ferruginea (fer-roo-JIN-ee-a)
fleuryi (FLUR-ee-eye)
flexuosa (fleks-yew-OH-sa)
fungumolens (fung-yew-MOLE-enz)
gibbosa (gib-BOH-sa)
glandulosa (gland-yew-LOH-sa)
Goodyera (good-YEAR-a)
griffithiana (grif-fith-ee-AY-na)
guttatum (gut-TAY-tum)
humilis (HEW-mill-liss)
imbricata (im-bree-KAY-ta)
insectifera (in-sek-TIF-er-a_
intermedia (in-ter-MEED-ee-a)
Isotria (ee-SOH-tree-ah)
jenkinsiana (jenk-inz-ee-AY-na)
jostii (JOST-ee-eye)
kaniensis (kan-ee-EN-sis)
khuongii (KAWN-ee-eye)
kostoglouana (kos-toh-gloo-AY-na)
Labidous (LAB-ih-dus)
Laelia (LAY-lee-a)
lampongensis (lam-pong-EN-sis)
Lampyridae (lam-PEER-eh-dee)
lanceolata (lan-see-oh-LAY-ta)
lawrenceanum (law-ren-see-AY-num)
lehmanniana (leh-man-ee-AY-na)
Lepanthopsis (leh-pan-THOP-sis)
lizziefinchiana (liz-zee-finch-ee-AY-na)
longirepens (lonj-ee-REE-penz)
lowianum (low-ee-AY-num)
lowii (LOW-ee-eye)
luteola (loo-tee-OH-la)
macrophyllum (mak-roh-FILL-lum)
Malaxis (mal-AKS-iss)
Masdevalliaceum (mas-de-vahl-ee-AY-see-um)
maxillare (maks-il-LAIR-ee)
mcgregorii (mik-greg-ORE-ee-eye)
medeoloides (mee-dee-oh-LOY-deez)
Menophyllum (men-oh-FILL-lum)
milleri (MIL-ler-eye or MIL-ler-ee)
moisesii (moyz-ESS-ee-eye)
montanum (mon-TAY-num)
mossiae (MOSS-ee-eye)
murkelensis (mer-kuhl-EN-sis)
Myrmecophila (mir-meh-KOF-il-la)
nesyana (nes-see-AY-na)
nodosa (noh-DOH-sa)
Oberonia (oh-ber-OH-nee-a)
oblongifolia (ob-long-ih-FOLE-ee-a)
Oncidium (on-SID-ee-um)
Otoglossum (oh-toh-GLOSS-sum)
oxystophyllum (oks-iss-toh-FILL-lum)
pahudii (pa-HOO-dee-eye)
palawensis (pa-la-WEN-sis)
pandangensis (pan-dang-EN-sis)
pandurata (pan-dur-AY-ta)
Paphiopedilum (paff-ee-oh-PED-ih-lum)
Parviflorae (par-vee-FLORE-ee)
perrinii (pare-RIN-ee-eye)
Phalaenopsis (fail-en-OP-sis)
phasmida (FAZ-mih-da)
Pholidota (foh-lih-DOH-ta)
Platanthera (plat-AN-ther-a)
Platystele (plat-ee-STEE-lee)
Pleione (plye-OH-nee)
Pogonia (poh-GON-ee-a)
portillae (pore-TEE-eye)
praecox (PREE-koks)
Pteroceras (tare-oh-SER-as)
punctata (punk-TAY-ta)
punctulata (punk-tew-LAY-ta)
puroana (pure-oh-AY-na)
purpurata (per-per-AY-ta)
recurva (ree-KUR-va)
Renanthera (ren-AN-ther-a)
rex (REKS)
Rhyncholaelia (rink-oh-LAY-lee-a)
Rhyncholaeliocattleya (rink-oh-lay-lee-oh-KAT-lee-a)
rufilabris (roo-fee-LAY-bris)
Sacoila (sa-KOY-la)
sancheziae (san-CHEZ-ee-eye)
sanderianum (san-der-ee-AY-num)
Sophronitis (so-fro-NYE-tis)
Stanhopeinae (stan-HOPE-ee-nee)
stricta (STRIK-ta)
subanajamensis (sub-an-a-jam-EN-sis)
tahitensis (ta-heet-EN-sis)
teaguei (TEEG-ee)
Teagueia (TEEG-ee-a)
tenebrosa (ten-eh-BROH-sa)
tentaculata (ten-tak-yew-LAY-ta)
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Vanda (VAN-da)
veitchianum (veech-ee-AY-num)
verticillata (ver-tih-sill-LAY-tah)
virens (VYE-enz)
walkeriana (walk-er-ee-AY-na)
warscewiczii (var-shuh-VITZ-ee-eye)
werneri (WER-ner-eye)
xanthina (zan-THEE-na)
zeus (ZOOS)
zimmermanniana (zim-mer-man-ee-AY-na)

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AS I AM handed the baton as the newly elected President of the American Orchid Society, I cannot help but reflect on the issues that defined 2020 thus far. Under the grip of a global pandemic, we, as a nation, joined together to fight this coronavirus and proved that by cohesive action, positive results are possible.

The American Orchid Society was not immune to this, as was no one else in the country, or in the world, for that matter, but we had to carry on. Overnight, the country abruptly stopped. No longer were in-person social gatherings permitted, there was no eating out and something as simple as a haircut became impossible.

Social distancing and face masks became commonplace. Toilet paper, paper towels, bleach, and alcohol suddenly flew off the grocery stores shelves and became limited purchases.

However, we had to persevere and through modern technology and innovations, GoTo and Zoom meetings were held, webinars were watched and life continued under a new normal. There was a learning curve, but over a relatively short amount of time, many got back into the swing of things.

Even under these circumstances, calendar agendas could not be ignored and there had to be a way to complete the tasks. A perfect example of this is that the American Orchid Society will be celebrating its centennial next year. A 100-year-old society that affects the daily lives of orchid lovers worldwide, that helps with all aspects of this breathtaking plant as an indispensable resource, should be celebrated.

But how? We already know how — by having a glorious Centennial Gala Celebration. And with it, all of the members will share in the glory of this affair. At the conclusion, all the profits from this will be delegated to our conservation endowment to boost the very important area of orchid conservation.

A Centennial Gala Celebration of this size does not happen on its own, however. It takes the efforts of many people working together, with a common goal, to make it happen.

But the American Orchid Society is not "them," it is "us." All of us make up the American Orchid Society. Together, we are the roots, the pseudobulbs, the leaves and the flowers. Because we make up the American Orchid Society conjointly, the culmination of work from many high-caliber people who are sacrificing their time, talents and treasures to ensure the success of this event will make the Centennial Gala Celebration the apex of the American Orchid Society since inception.

As members, we should all, in our own way, consider contributing to the occasion. It is just a few months away and there is a good deal of work to be done before then.

Having reflected on what has already happened, it is time to look forward. Starting with a blank slate, the next two years will be the vehicle to make the American Orchid Society an even more unified organization.

We have learned we have a greater reservoir of information technology at our disposal to spread more of the American Orchid Society's ideology: education, conservation and research. Using what we have learned from the year's events, we found compromises that have turned into opportunities. We also found that these new opportunities might have taken us out of our comfort zone, but they have also opened our eyes to seeing things differently and trying something new. As a result, we found, more often than not, we were reaping the rewards of being flexible.

It will be this continued, cooperative effort of sharing ideas and strategies that

will no doubt cement the success of the American Orchid Society for generations to come.

Thank you for showing your confidence in me and I am looking forward to working with you for these next two years.

—Bob Fuchs, American Orchid Society President (Bob@rforchids.com)

August: The Month of Fireflies

By Thomas Mirenda

FOR CHILDREN OF all ages, few experiences can rival the magic of bioluminescence. Our first exposure to this mysterious magic came in the form of nocturnal, winged beetles in the Lampyridae, a.k.a. fireflies, and their flightless cousins, known as glowworms. Mushrooms, dinoflagellates and deep-sea creatures have also evolved to emit light for various strategies that give their species some survival advantage. In fireflies, this "cold light" is generated within special abdominal organs, where the chemical luciferase is manufactured and combined with oxygen to produce this astonishing effect.

Thomas Mirenda

About 20 years ago, utilizing a genetic engineering technique called particle bombardment, Professor Chia Tet Fatt from Singapore's National Institute of Education's National Science Academic Group managed to produce a strain of genetically stable, bioluminescent orchids from some white-flowered dendrobiums, using firefly DNA. As genetically modified organisms (GMOs), these types of "frankenflowers" are not imported to the United States. Personally, I would not mind having one of these as a night light! A similar technique was used to produce truly genetically blue phalaenopsis as well. You might think that producing GMO orchids is a questionable practice, and in some cases I would agree. But how different is it really from hybridization? If you have a strong opinion either way, it would be interesting to hear it!

USING YOUR LIGHT Although fireflies use their lights to attract mates or, more alarmingly, prey, orchids use light for photosynthesis and growth. Getting your light exactly right for your orchids is ultimately a crucial area of your culture. In the Northern Hemisphere, August light often is accompanied by intense heat, which can be a deadly combination for forest-dwelling orchids. If your orchids are summering outside in this most torrid month, make sure they are shaded most of the day, and in a spot where gentle air movement is likely to occur. Even your highest-light orchids, such as vandas, dendrobiums and cattleyas, can sunburn if placed improperly. Although strong light may be necessary to get flowers, they will not bloom if they have baked to death.

HEAT OF THE MOMENT Many lowland and equatorial orchids, such as certain oncidiums, vandas, laelias, myrmecophilas and encyclias, are spurred on by the hot weather this month and often initiate spikes during a hot spell. Most of these types of orchids engage in crassulacean acid metabolism (CAM), where their stomata open for transpiration in the evenings rather than midday, when doing so would cause extreme desiccation of their tissues. Such plants are well-adapted for this and actually store water in their velamen-encased root systems and thickened pseudobulbs. Although it is tempting to try to cool plants by spraying them often at midday to attempt to bring down their temperatures, this practice has been shown to cause stomata to open during the day, which you really do not want. Overly soggy substrate can also be a breeding ground for bacterial rots. Light mistings can be helpful, accompanied by a light breeze to dry them off, but heavy waterings at midday are a mistake for most orchids. Early morning watering, mimicking morning dew, is perhaps the best strategy this time of year.

NEW GROWTH AND SPIKING Although a majority of our cultivated orchids tend to slow down metabolically and suspend growth in the hottest months, many plants of the seasonally dry forest are using energy stored in pseudobulbs from this spring or early summer as a source for flowering. Check the pseudobulbs of your catasetinae and stanhopeinae plants for spikes this time of year. Chances are if you have been feeding these spectacular and often bizarre orchids well during the growing season, suspending your fertilizer regime now will result in the formation of inflorescences. Try it and see what happens shortly thereafter.

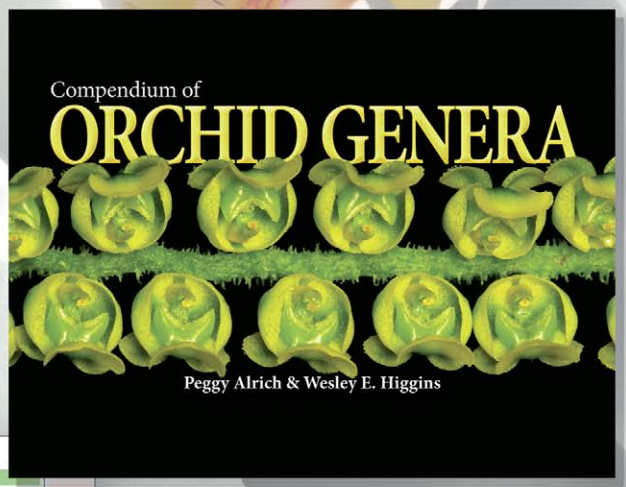
GETTING BOGGED DOWN For the enthusiasts of terrestrial orchids, one of the more rewarding things to enjoy this month are bog gardens. Many North American and certain Asian orchids such as platantheras, calopogons, pogonias and even bletillas enjoy a naturally wet spot or swale in your yard. There they can be accompanied by fascinating carnivorous plants that often grow alongside them in nature. It is likely that you have just a moderate drive to find such habitats to see them in the wild. I found them in the New Jersey Pine Barrens in my youth. Such habitats are not all that rare, especially in Florida. The Green Swamp of North Carolina and the Serpentine seeps of northern California are other incredible places to find amazing wild orchids this month. Time to get out there and enjoy nature again.

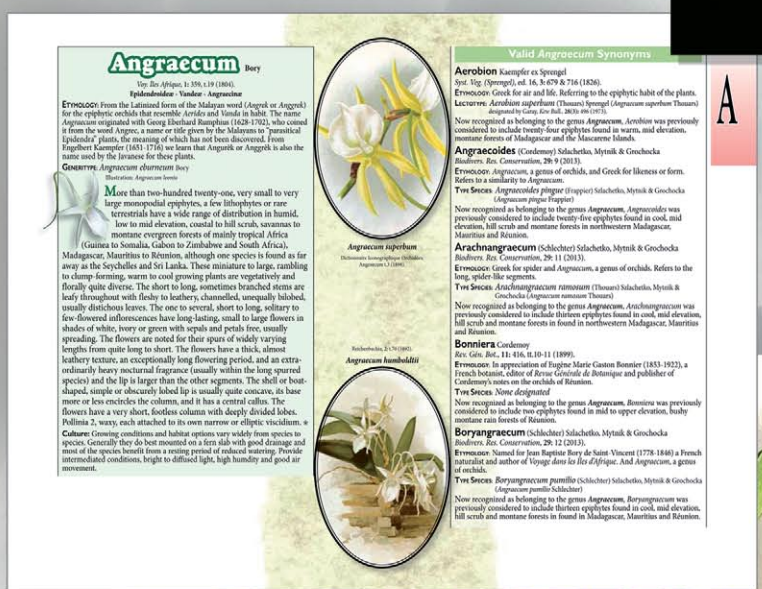
Cycnoches barthiorum 'Jungle Mist Freckles' AM/AOS; exhibitor: Jungle Mist Orchids, photographer: Glen Barfield.

— Thomas Mirenda has been working professionally with orchids for over three decades. He is an AOS accredited judge in the Hawaii Center (email: biophiliak@gmail.com).

Presenting

The Compendium of Orchid Genera by Peggy Alrich and Wesley Higgins





More than 200 orchid genera are presented with the original orchid discoverer and date as well as the etymology and an easy to read description of growth habit. The book is illustrated with antique color plates, many from an original publication, all compete with citations. This book will be a welcome and beautiful addition to any orchid grower's library, a stunning work and artistic treasure.

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COLLECTORS' ITEM

Bulbophyllum maxillare

A Beautiful *Bulbophyllum* by All the Names

Text and photographs by Charles Wilson

1

MANY OF US hobbyists have at one time or another faced a bit of embarrassment in finding out that the "new" orchid species we just acquired is a synonym of another orchid species (or sometimes two or more) that we already have in our collection. Sometimes the differences are extremely minute and difficult to see, but on occasion the differences can seem striking even though they are all synonyms. *Bulbophyllum maxillare* is just such an example.

Synonyms (also called taxonomic or heterotypic synonyms) are simply different names based on different type specimens for the same species. It sometimes takes many years for taxonomists to connect that two different names have been used to describe the same orchid species because the herbarium where the different specimens were deposited may be thousands of miles apart. That should be no surprise given that *Bulb*. *maxillare* has been known for over 160 years and is so wide ranging, found from peninsular Malaysia to Sumatra, Java, Borneo, Sulawesi, New Guinea, the Phillippines and on to the Solomon Islands and Australia.

At one time there were three additional species varyingly known by the names *Bulbophyllum blumei*, *Bulbophyllum cuspidilingue* and *Bulbophyllum masdevalliaceum.* There has been heavy debate among taxonomists over the last 40 years or so as to whether these are all the same species or representatives of a "swarm" or complex of closely related species. For now, the World Checklist of Plant Families considers them all synonyms of the oldest name, *Bulbophyllum maxillare*, because the winning taxonomists determined that the few microscopic differences did not warrant all three names. The valid name is considered to be the first name properly published (Lindley, 1843).

The older synonym names still abound in the marketplace, and there can be a bit of fun with purchases to collect both the two major color forms (and being ever watchful for both the rarer yellow and alba forms).

This species is reasonably small with a 6-inch (15 cm) combined length of pseudobulb and leaf. Under ideal conditions, it can quickly form large masses with pseudobulbs separated by creeping 1–2 inches (5–7.5 cm), frequently branching rhizomes along which three or more flowers may emerge each flowering season, providing multiple cascading shows of flowers for several years. The regular use of rhizome clips can encourage new growths to grow around and inside the pot. The single flowers, although apparently not fragrant to humans, may be as tall as 4.5 inches (11 cm) atop a 4.5-inch (11-cm) peduncle typically held attractively just above the foliage. In some forms, the ends of the lateral sepals may be fused. Flowers are recorded appearing from August through April, with reports that some flowers close each night for the first few days after opening before remaining fully open for a week or longer. This unusual trait may be an adaptation to protect it from unwanted nocturnal visitors until it is ready for pollination.

[1–2] The most commonly encountered forms of *Bulbophyllum maxillare* are the cherry red and yellow form depicted on the facing page and the rich tones of the purple and white form in the photograph above. Both forms can easily form large masses in a pot freely producing flowers over a long blooming season.

LIGHT LEVELS *Bulbophyllum maxillare* thrives in light shade to even bright, indirect light. It can even enjoy the higher light levels often appreciated by some cattleyas provided the higher light is introduced gradually and there is adequate air movement and humidity.

TEMPERATURES This species prefers warm growing temperatures with night minimums of 60 F (15.5 C) and can tolerate higher day temperatures even into the 90s F (≥32.2 C) provided there is excellent air movement and high humidity. *Bulbophyllum maxillare* will grow year-round if kept warm and watered. Growing conditions that are too cool, below 55 F (13 C), generally slow growth and can retard blooming.

POTTING AND WATERING Like most bulbophyllums, this species has threadlike or fine fibrous roots. A shallow layer of potting mix (we use seven parts small bark, one part perlite and one part small charcoal) or a quality sphagnum moss atop an ample bottom layer of expanded polystyrene "peanuts" in a shallow pot or basket will provide the needed perfect drainage. This shallow layer of medium allows for the grower to water nearly every day without much worry of rotting the roots or the potting medium. This method of shallow potting closely

3

4

resembles the way bulbophyllums grow in the wild — on top of branches and trunks that dry out quickly. The advantage of this shallow rooting in nature is in capitalizing on the high humidity of the tropics as well as the morning dew. In nature they seldom totally dry out for long periods, even in the drier seasons.

This beautiful *Bulbophyllum* by any name can be rewarding to cultivate and worthy of some bench space.

Charles Wilson

— *Charles Wilson is an accredited AOS judge out of the Pacific Northwest Judging Center, the chair of the AOS Conservation Committee and has been growing orchids for over 40 years. His special interests include* Bulbophyllum, Cattleya, Coelogyne, Dendrobium, Paphiopedilum *and about everything else, too (email: zooemeritus@gmail.com).*

[3] The orange color form with yellow margins of *Bulbophyllum maxillare* on the left has been often sold under varying names of *blumei*, *cuspidilingue* and *masdevalliaceum*.

[4] The purple color form with white margins has been more commonly sold under the name *Bulbophyllum maxillare*.

IX International Conference on Orchid Conservation "Soroa 2021"

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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	**August 13, 2020** 8:30pm EST Tuesday	**August 26, 2020** 8:30pm EST Wednesday	**September, 01, 2020** 8:30pm EST Tuesday	**September 10, 2020** 8:30 EST Thursday
Topic	Greenhouse Chat (Orchid Q&A) *Send in your Questions!*	*Maxillaria* Not just *tenuifolia* anymore	Greenhouse Chat (Orchid Q&A) *Send in your Questions!*	Encyclias and their Hybrids
Presenter	**Ron McHatton** Chief Education and Science Officer	**Eric Sauer** Awarded Maxillariaologist & Greenhouse Grower	**Ron McHatton** Chief Education and Science Officer	Mike Curtin is an AOS Student Judge and member of Oregon Orchid Societies

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Sylvia Strigari

Coelogyne lawrenceana

Text by Melania Fernández and Franco Pupulin/Watercolor by Sylvia Strigari

Tribe Arethuseae
Sutribe Coelogyninae
Genus Coelogyne *Lindley*

Coelogyne lawrenceana Rolfe, *Gard. Chron. Ser.* 3, *vol*. 37:227. 1905. Type: Annam [Vietnam]. Collector unknown (holotype, presumably at K).

Synonym: *Coelogyne fleuryi* Gagnep., *Bulletin du Muséum National d'Histoire Naturelle*, *sér.* 2, 2:424 (1930). Syntypes: Annam [Vietnam]. Ca-Na: Phanreang, *Poilane 5975* (P); Annam [Vietnam]. Grand Piton Lang-bian, prés Beneur, *A. Chevalier 30900* (P).

A sympodial, epiphytic, robust *herb* up to 60 cm tall. *Roots* glabrous, stout, thick, to 5 mm in diameter. *Pseudobulbs* ovoid-oblong, 5.0–8.0 × 1.5–2.5 cm, basally covered by brown sheaths, furrowed when old, bifoliate. *Leaves* erect to arching, coriaceous, petiolate, narrowly elliptic-lanceolate to ligulate, acuminate, 20.0–28.0 × 3.0–3.8 cm, including the ca. 1 cm long, grooved petiole, with 5–9 veins evident both adaxially and abaxially, the central vein abaxially more prominent, shiny green. *Inflorescence* terminal, born at the apex of the mature pseudobulb, peduncle arching, 17.5–40.0 cm long, 1- flowered, the rachis slender, 3.5 cm long. *Floral bracts* spathaceous, clasping the rachis, obtuse, striate, 3–4 cm long. *Ovary* terete, pedicellate, to 1.5 cm long, with six prominent angles. *Flowers* showy, spreading, waxy, sweetly fragrant, long lasting, with sepals and petals greenish yellow to lime green to bronze, lip white with the basal half stained with dark orange to brown, with the keels orange-brown and the apical lobe bright white. *Dorsal sepal* elliptic-lanceolate, acute, adaxially keeled, 4.7–5.5 × 1.9–2.5 cm, 9-veined. *Lateral sepals* lanceolate, slightly falcate, acute, adaxially keeled, basally concave, up to 4.5–5.3 × 1.5–2.2 cm, 9-veined. *Petals* narrowly oblanceolate to linear, acute, 7.5–8.2 × 0.5–1.0 cm, 5-veined. *Lip* clawed, trilobed, 5.5-7.0 × 3.2–3.7 cm, the lateral lobes narrowly elliptic-oblong, rounded at the apex, erect to flank the column, the midlobe broadly ovate, apiculate, recurved, the margins undulate-ruffled, 3.5–4.0 cm long; disc with three laciniate keels, extending from the base of lip to the basal portion of the midlobe, the central keel lower than the lateral ones, margins of the lateral keels adorned with thick teeth. *Column* semiterete, incurved, winged from the upper half to the apex, up to 5.0 cm long. *Pollinia* four, obliquely orbicular, connate by a flattened, triangular, granulose caudicle. *Fruit* a glabrous, ellipsoid capsule.

The extraordinary British botanist John Lindley (1799–1865), whose orchid collections are housed in the herbarium of the Royal Botanical Gardens, Kew, described the genus *Coelogyne* as part of his series of eight fascicles under the title *Collectanea Botanica; or, Figures and Botanical Illustrations of Rare and Curious Exotic Plants* (Lindley 1821). The series includes a wide array of descriptions and illustrations of genera and species from several different plant families. *Coelogyne* was described as a bulbous herb recognized by the trilobed labellum and an articulate, winged column with four pollinia (Lindley 1821). The name *Coelogyne* derives from the Greek *koilos*, hollow, and *gyne*, female, in reference to the concavity of the stigma (Gravendeel 2005) that can be observed in *Coelogyne lawrenceana by* turning the column upside-down and slightly pushing the anther. In the original publication, Lindley compared *Coelogyne* with *Cattleya* and *Cymbidium*, from which *Coelogyne* was different in having a winged column with a unilocular anther (Soon 1980). As Lindley originally described four species of *Coelogyne* (*Coelogyne cristata*, *Coelogyne humilis*, *Coelogyne praecox* and *Coelogyne punctulata*), two of which are today considered to belong to the genus *Pleione*, and he did not designate a *typus generis*, Charles H. Curtis (1950) chose to typify *Coelogyne* with *Coelogyne cristata.*

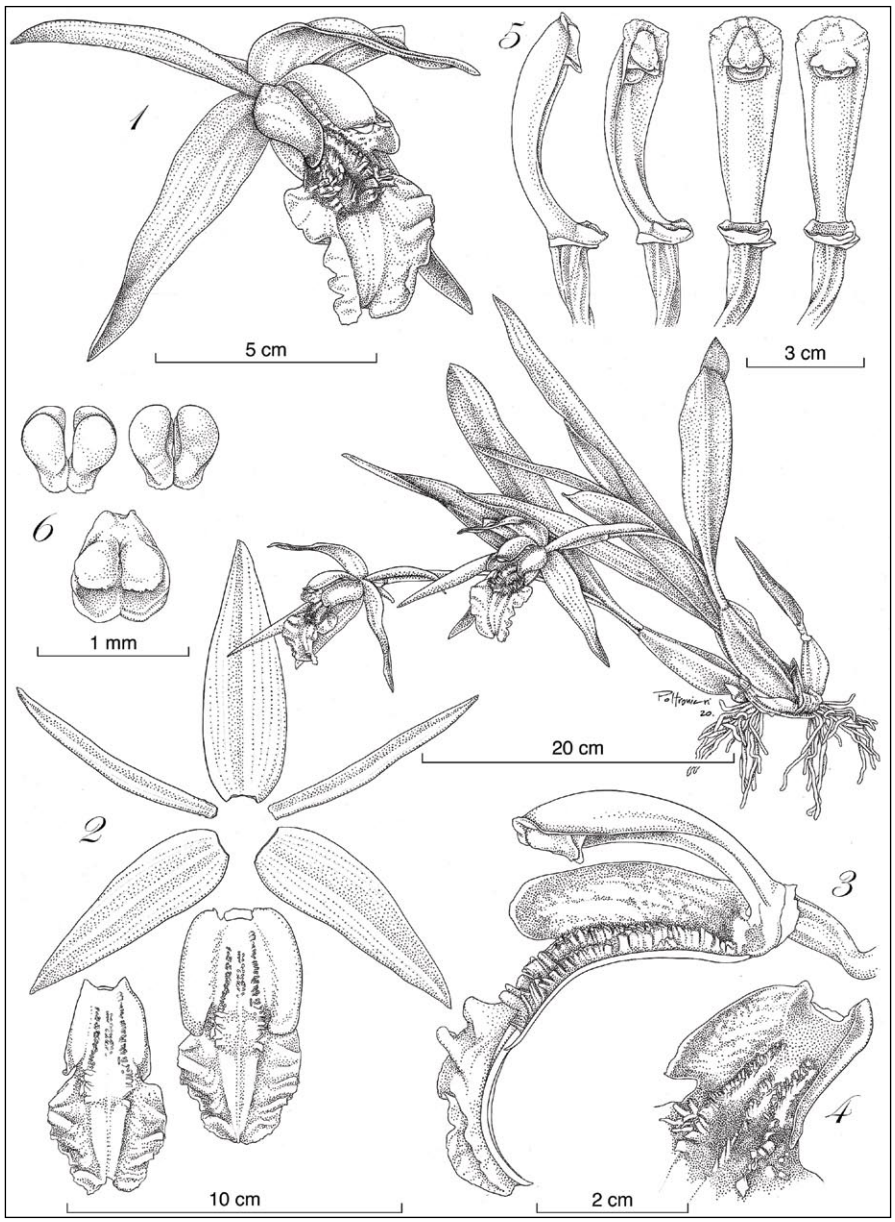
Within the subtribe Coelogyninae, *Coelogyne* is merely distinguished from sister genera by the lack of structures, such as the absence of a saccate lip base or the adnation of the lip to the column (Gravendeel 2000, 2005). Currently, the genus is considered polyphyletic (i.e., comprising the descendants of several distinct lineages) and comprises around 200 species distributed from Southeast Asia to as far as Fiji and Samoa in the Pacific, with centers of diversity in Borneo, Sumatra and the Himalayas (Gravendeel 2005, Zhou et al. 2018). The great variability in plant size and habit, which can be caespitose or strongly repent with pseudobulbs far apart from each other; monophyllous or with two apical leaves; basal or apical inflorescences produced from the mature pseudobulbs or the new growths; single-flowered or racemose and many-flowered, as well as the great variability in floral shape and colors, make *Coelogyne* a genus difficult to diagnose.

It was not until 1905 when another British botanist, Robert Allen Rolfe (1855–1921), orchid curator at the Royal Botanic Gardens, Kew, described *Coelogyne lawrenceana* from a plant brought by Sir James John Trevor Lawrence, hence the epithet, who first exhibited this species at the Royal Horticultural Society where the plant received an Award of Merit (Lindley 1905). The plant came as part of a special shipment from Annam, the French protectorate enclosing the territories of what is now known as Vietnam. The protectorate was created toward the end of the 19th century after the colonial expansion of France into southern Asia, and lasted until the establishment of the State of Vietnam in the second decade of the 20th century. From there, large consignments of tropical plants were sent to the famous warehouses of Mr. Henry Frederick Conrad Sander (1847–1920) settled at St. Albans, north of London, where Sander's commercial methods largely impacted the popularization of orchids in Europe. In the exhibition of March 28, 1905, Rolfe noticed a "*Coelogyne* of the speciosa group," in reference to *Coel. speciosa*, from which *Coel. lawrenceana* can be readily distinguished by the larger flowers, ovate apical lip lobe (vs. bifurcate) and the laciniate keels (instead of fimbriate). *Coelogyne lawrenceana* belongs to a small group of two (or three) species denominated by Clayton (2002) as *Coelogyne* section *Lawrenceanae* and characterized by smooth pseudobulbs (when young), hysteranthous inflorescences (i.e., having the leaves expand after the flowers have opened), a peduncle with few floral bracts, the largest flowers in the genus, and deeply incised, glabrous keels on the lip (Gravendeel et al. 2001,

Gravendeel 2002, 2005). Other species such as *Coelogyne eberhardtii* Gagnep. and *Coelogyne fleuryi* Gagnep. (the latter probably a synonym of *Coel. larwenceana*) have been considered as belonging to the section. In the molecular analyses aimed at reconstructing the phylogeny of the genus (Gravendeel et al. 2001), the few species close to *Coel. lawrenceana* are recovered as sister to *Coel. cristata*, the type species of the genus, and well separated from species of the section *Speciosae* with which they have been suggested to be combined (Seidenfaden 1975).

Even though the literature frequently describes the distribution of *Coelogyne lawrenceana* as "from the Himalayas and Vietnam," and even "from many places between Malaysia and Vietnam" (Vermeulen and Rosenfeld 1997:194), we were unable to find any documented record of the species outside of Vietnam, where it is possibly endemic. Here *Coel. lawrenceana* has been recorded from southern Vietnam as an epiphyte of large trees in the evergreen broad-leaved montane forests of the Chu Mom Ray protected area, at around 1,500 m elevation, and from the montane forests along the western side of Mount Lang-Bian at around 2,500 m (Averyanov and Averyanova 2002).

Coelogyne lawrenceana appears to be temperature tolerant and grows well in a range of greenhouses from warm to pretty cool. It requires partial shade and constant watering. In fact, inhabiting naturally mid- to higher-elevations in Vietnam where humidity is high, plants of *Coel. lawrenceana* in cultivation should not be allowed to dry out completely while maintained in a humid area. That said, excessive moisture should also be avoided, as roots tend to rot with excess water. To avoid this, plants are usually grown in pots or baskets that allow constant drainage, in a substrate prepared with a mix of tree fern fiber, fine bark and charcoal or perlite (Gravendeel 2005). Sphagnum moss along with charcoal is also a suitable option, as long as a fair supply of humus is provided (Holttum 1964). As the plants tend to climb out of their pots due to their long rhizomes, the species is also a good candidate to be grown on large plaques of wood. Regardless, plants are worth cultivating as *Coel. lawrenceana* produces one of the largest and showiest flowers among the coelogynes. Although these flowers are usually produced one at a time, they are long-lived and up to five or six flowers can be open at any given time (O'Byrne 2001), offering an alluring spectacle that may last for months.



Coelogyne lawrenceana. The plant.
1. Flower.
2. Dissected perianth.
3. Lateral view of column and lip, the lip in longitudinal section.
4. Base of the lip, showing calli.
5. Column, lateral, three-quarters and ventral views (on the right, emasculated).
6. Pollinarium and anther cap.

All drawn from *JBL-03748* by Sara Poltronieri.

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Selected Botanical Terms

abaxial – lower or reverse surface
acuminate – tapering to a long point
acute – pointed
adaxial – upper or front surface
adnate – fused
adnation – fusion to another part
apiculate – ending abrupty in a small point
articulate – having a distinct joint
bifoliate – two-leaved
bifurcate – divided into two forks or branches
caespitose – clumped together
caudicle – slender, stalklike appendage
claw – a narrow connection between two parts
concave – curved inward like the inside of a sphere
connate – united to form a single part
coriaceous – leathery
elliptic – oval
epiphyte - growing on another plant for support and not as a parasite
falcate – sickle-shaped
fimbriate – fringed
glabrous – smooth
granulose – covered in small granules
holotype – a single specimen on which a name and description of a new species is based
hysteranthous – having leaves emerge after flowers are open
incurved – curve inward
keel – ridges or other proturbances on the lip or other floral structure
laciniate – divided into deep, narrow, irregular segments
lanceolate – narrow oval tapering to a point at each end
ligulate – tongue-shaped
linear – elongate and parallel-sided for most of its length; grass-like
monophyletic – a group sharing only a single ancestor
monophyllous – having one leaf
oblanceolate - narrow at attachment, rounded apically
obovate – egg-shaped with the wide end up
obtuse – blunt or rounded
orbicular – having a circular outline
ovate – egg-shaped, narrow end up
ovoid – egg-shaped, narrow end up
pedicel – a stem carrying a single flower
peduncle – the lower part of the inflorescence below the first bud
petiole – stalk connecting leaf to stem
phylogenetic – evolutionary history
phylogeny – evolutionary history of a group of species
polyphyletic – a group of taxa that do not share a single common ancestor
raceme – having flowers attached by short stalks at equal distances along a main stem
rachis – portion of the inflorescence carrying flowers
recurved – bent or curved backward
repent – creeping
rhizome – modified stem joining growths
saccate – shaped like a pouch or sack
scape – long internode forming the basal part (or entire) of the peduncle
semiterete – more or less pencil-shaped
spathaceous – resembling a spathe
sympodial – having a main stem that stops growing at the end of each season. A new lead branch then grows from the lead base
terete - cylindrical or pencil-shaped
unilocular – single-chambered

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Our records are only as good as the information our affiliates provide. We recommend our affiliates update their AOS record periodically — at least after every annual election — using our online form:
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Pay particular attention to:

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CONSERVATION COMMITTEE

Cypripedium guttatum

TEXT AND PHOTOGRAPHS, UNLESS OTHERWISE CREDITED, BY THOMAS MIRENDA

1

A LITTLE OVER a year ago, I made my first trip to a magical, maybe even spiritual, place called Alaska. Those living there year-round are truly another breed: adventurous, fiercely independent and individual, living off the land and sea and reveling in uncompromised and seemingly infinite freedom. The challenges involved in living there are not inconsequential, but are worth it to these hardy folk. The unimaginable winters with just a few hours of light per day (or none at all in the most northern latitudes) are described as being blacker than black. I know it would depress me over time. But of course, in the summer there is barely any darkness at all and plants grow rapidly in their abbreviated but strongly amplified growing season.

I would not dream of going there midwinter, but when my friend Colin moved there to work as a chimney sweep (a very important job in Alaska, I would think!) I could not resist the temptation to visit him last summer. After admonishing me for making Mary Poppins jokes, Colin took a few days off and showed me around the gorgeous state he had adopted as his home. It was so extraordinarily beautiful, everywhere; mountains and glaciers, whales, bald eagles and moose were among the usual unusual sights we saw almost daily. One might think that orchids would be excluded from such a harsh environment, but one would be wrong! We saw plenty.

Every morning we would get an early start and drive to some new and verdant location looking for native plants. Perhaps the greatest find occurred when he took me to the Matanuska River valley because we had heard that, if we were lucky, we might find a rare population of *Cypripedium guttatum* there, with exceptionally lovely and vibrant coloration. Luckily, we were lucky! Our informant told us that the plants were on private property near a lake. After being skunked searching for them as we walked along the lake shore, we decided to try to speak to local residents. Although we certainly did not want to bother anyone, we were hoping that they might be as enthusiastic about their botanical treasures as we were! They were! After finding the likely residence, we knocked on the door to find a lovely lady who called to her husband, "They're here to see the ladyslippers!" and graciously showed us the steep stairway down to the lake where hundreds of the miniature species were in full bloom. I was expecting to see a small colony of five or 10 plants, but Colin and I were overwhelmed by the number and beauty of these rare little orchids.

I had seen the species previously in China in Wenqing Perner's nursery near Huang Long Mountain, and there were cultivated patches in bud at the Anchorage Botanical Garden, but it was magical as well as very instructive to see them in situ in a place where they were truly natural.

Our world has some astounding flora and fauna inhabiting it. With a little effort, and care, they can be found and enjoyed. It was an unforgettable day spent with a fine friend in one of the most beautiful places on Earth.

— Thomas Mirenda has been working professionally with orchids for over three decades. He is an AOS accredited judge in the Hawaii Center (email: biophiliak@gmail.com).

[1] *Cypripedium guttatum* photographed in the wild in the Alaskan Matanuska River Valley. Inset close-up photograph courtesy of Colin F. Collins.

[2] Alaska offers some of the most pristinely beautiful vistas in the world and its fragile habitat risks destruction by myriad external forces — not the least of which is global climate change.

[3] The author's friend and guide, Colin F. Collins on the banks of the Matanuska River.

[4] Colin F. Collins photographing a tiny native Alaskan orchid, *Corallorhiza trifida*.

The 2020 Phillip E. Keenan Awards

by Charles Wilson

PHILLIP KEENAN SPENT a lifetime driving and flying thousands of miles in pursuit of orchids in their native habitats. He was passionate about sharing his adventures of finding wild orchids with the world and an ardent advocate for preserving their natural habitat. He was a founding member of the North American Native Orchid Society and was actively involved in numerous conservation societies.

He contributed multiple articles and hundreds of photographs to *Orchids*, as well as publishing two books, one on orchids and the other on his other passion — native birds of North America. To quote from the flyleaf of his book, *The Wild Orchids of America*, "In describing the world of orchids, Keenan does not confine himself to individual plants but also comments on the wildlife, geology and important natural features associated with orchid habitats." His book is a chatty account of his field trips in Canada and the United States to document many of our native species, but it also provides inspiration to explore the wealth of orchids and their habitats respectfully.

The American Orchid Society's Conservation Committee is delighted to announce that there are two recipients this year for the Phillip E. Keenan Award for distinguished efforts in the conservation of native orchid species. This award was established many years ago to recognize and reward individuals, groups and Affiliated Societies for outstanding work in the field of orchid conservation. The two recipients for 2020 are:

• **Jennifer Reinoso** of Deland, Florida (Volusia County) for her 15-year effort in the preservation of the Florida native orchid, *Sacoila lanceolata*. To familiarize yourself with her work, please see her article entitled "Confessions of a Crazy Orchid Lady: Part 1" (2015) and recorded webinar available on the AOS website (2019). Jennifer is an accredited AOS judge in the Florida-North Central center and Chair of the AOS Special Funding Committee.

• **Grande Ronde Overlook Wildflower Institute Serving Ecological Restoration (GROWISER)** in Northeast Oregon for their efforts in preserving and restoring native species to over 260 acres (105.2 ha) that they are purchasing for that express purpose. As Director, Dr. Andy Huber has set the objective of creating an area with only the plant species that were in that area 200 years ago. He refers to those as "native plants" including 11 species of native American orchids. More information can be found on their website at www.growiser.net.

How can you help? First, assist in promoting orchid conservation by contacting the Conservation Committee at conservation_committee@aos.org to let us know of any native North American orchid projects promoting orchid conservation or their habitats. Second, but equally important, please consider a contribution to the AOS's permanently-endowed conservation fund. Earnings on that endowment can only be spent to support conservation efforts.

References

Reinoso, J. 2015. Confessions of a Crazy Orchid Lady: Part 1. How I spent my summer.... *Orchids* 84(8):492–497.

— Charles Wilson is an accredited judge out of the Pacific Northwest Center and the Chair of the AOS Conservation Committee.

JENNIFER REINOSO

ANDY HUBER

[1] US 92 west toward Deland, Florida taken in 2011 before major highway reconstruction forced moving this colony of *Sacoila lanceolata*. Inset is a close-up of one of the flowering plants.

[2] A colony of *Cypripedium montanum* growing on the GROWISER property.

The SITF at Work

by Ron McHatton

Cattleya bradei 'Elizabeth Anne' CHM/AOS

SOMETIMES A LABEL is not even close to correct. This *Cattleya bradei*, grown by James G. Morris, was submitted labeled as *Cattleya* × *nesyana*, a natural hybrid of *Cattleya virens* and *Cattleya xanthina*. Both of these species belong to *Cattleya* Subgenus *Cattleya* Section *Crispae* Series *Cattleyodes* which includes such familiar former *Laelia* species as *Cattleya purpurata*, *Cattleya tenebrosa* and *Cattleya perrinii*. As such, they all share a common growth habit that clearly resembles traditional cattleyas; spindle-shaped unifoliate pseudobulbs whose leaves have more or less flat blades and all flower from a well-developed sheath. The exhibited plant clearly shares none of these characteristics let alone flowers that come close to fitting published photographs or line drawings of the natural hybrid.

In this case, the next step is easier than it could have been with a mislabeled plant. The specimen is clearly a cattleya — specifically one of the group of species formerly called rupiculous laelias. This large group of species — *Cattleya* subgenus *Cattleya* Section *Crispae* Series *Parviflorae* — includes such common species as *Cattleya briegeri*, *Cattleya cinnabarina* and *Cattleya milleri*.

The bright yellow flowers of the submitted plant limit the identity to one of about 13 species out of 43 in the section. The short, few-flowered inflorescence and the more or less flat, open lip midlobe further limits the determination to only a handful of species. In cases such as this, the taskforce very often seeks the input of experts in particular fields and in this case turned to Francisco Miranda, an expert in these Brazilian cattleyas, for his opinion. Francisco pointed us toward *Cattleya bradei*, a determination this plant clearly fits. The species belongs to the group of yellow-flowered species with short pseudobulbs and carries an inflorescence not much longer than the leaves. The bright yellow flowers are produced 2–4 per inflorescence during the summer. Growing in the cracks and crevices of lichen-covered rocks, the plants are either red or green depending on how exposed to sunlight they are.

Comparing the measurements of the flower from the award form and those given by Withner in *The Cattleyas and Their Relatives*, *Vol. II. The Laelias* (1990), indicates that the flowers are a good fit dimensionally as well. The sepals and petals are of similar dimensions and those of this flower were reported as 0.25 in × 0.67 in (0.6 cm × 1.7 cm) compared to Withner's 0.16 in × 0.63 in (0.4 cm × 1.6 cm). Unfortunately the judges did not flatten the lip of this flower when it was measured so comparison of the lip width isn't possible, however, the lip length of this flowers was recorded as 0.71 in (1.8 cm) vs Withner's 0.43 in (1.1 cm) — all indicative of a well-flowered, full-formed specimen.

— Ron McHatton, AOS Chief Education and Science Officer (email: rmchatton@aos.org).

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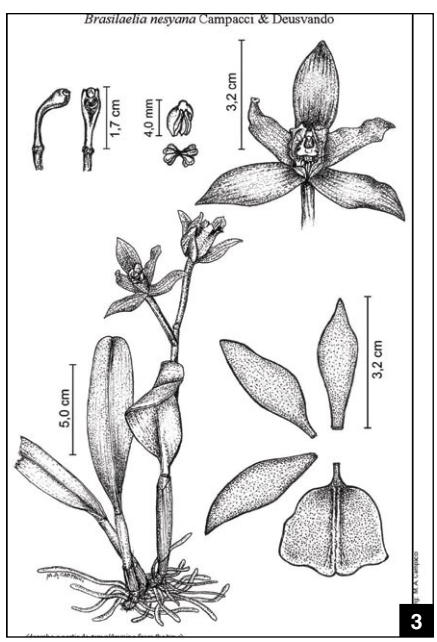
2



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[1] The award image of *Cattleya bradei* 'Elizabeth Ann' CHM/AOS taken by Ramon de los Santos at the time it was awarded as *Cattleya* × *nesyana*. Grower: James G. Morris.

[2] Photograph of *Cattleya virens*. Inset photograph, *Cattleya xanthina*, the other parent of the natural hybrid *Cattleya* × *nesyana* (Campacci & Deusvando) J.M.H. Shaw. Photographs courtesy of Lourens Grobler.

[3] Line drawing of *Cattleya* × *nesyana* from *Colet*. Orquideas *Brasil*.

Reference

Withner, C.L. 1990. Brade's Laelia. *The Cattleyas and Their Relatives Vol. II. The Laelias*. Timber Press, Portland, Oregon. p47.

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Chromolithographie.

Lith.royale de C.W. Mieling

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I. PHOLIDOTA GIBBOSA LINDL. - II. COELOGIJNE SPECIOSA LINDL.

de Vriese

by Peggy Alrich and Wesley Higgins

WILLEM HENDRIK DE Vriese, a Dutch botanist, was born Aug 11, 1806 in Oosterhout, North Brabant, Netherlands, to Gosewijn Willem Hendrik de Vriese and Angenieta Louisa Verspijck, and was baptized in the Dutch Reformed Church on August 17, 1806. He studied medicine at the University of Leiden, earning his doctorate in 1831, and then married Charlotte Theodora Antonia Bosse, on December 28, 1831. He practiced medicine in Rotterdam, where he also gave classes in botany at the medical school.

W.H. de Vriese was appointed associate professor of botany at the Athenaeum Illustre, predecessor to the University of Amsterdam, in 1834; he became a member of the Royal Dutch Academy of Sciences in 1838 and was promoted to full professor in 1841.

In 1845, he became a botany professor at the Hortus Botanicus Leiden, the oldest botanical garden in The Netherlands. In October 1857, de Vriese was commissioned to conduct botanical investigations for the Dutch East India Company, and consequently spent the following years conducting research in Java, Borneo, Sumatra and the Moluccas. He became a specialist in tropical agronomy and was interested in the cultivation of vanilla in Java. In 1861, he returned to the Netherlands in a weakened state and subsequently died in Leiden January 23, 1862.

The prints pictured here appeared in *Illustrations d'orchidees des Indes Orientales Neerlandaises* that was published in 1854. The book was published in three parts between 1854 and 1855, and has 18 colored plates with 13 pages of text. The book was published by C.W. Mieling in La Haye, Netherlands and the beautiful plates were drawn by van Aaken.

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

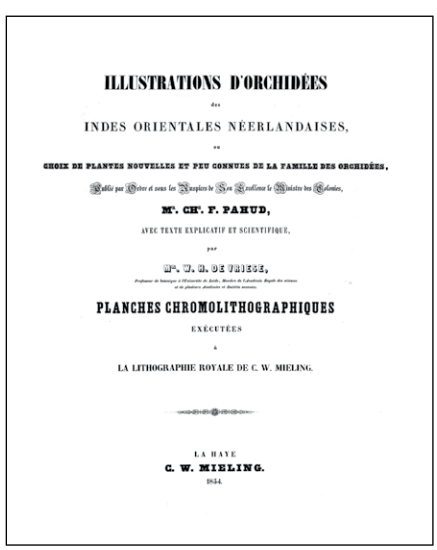
—*Wesley Higgins is an AOS accredited judge (wesley.higgins@comcast.net).*

Antique plates:

[1] *Pholidota gibbosa* and *Coelogyne speciosa* with *Dendrobium crumenatum*, *Renanthera*, *Cymbidium* and *Pteroceras* in the background.

[2] *Bulbophyllum pahudii* as *Cirrhopetalum pahudii.*

[3] *Dendrobium macrophyllum* var. *macrophyllum* as *Dendrobium veitchianum.*



ILLUSTRATIONS D'ORCHIDÉES

INDES ORIENTALES NÉERLANDAISES,

CHOIX DE PLANTES NOUVELLES ET PEU CONNUES DE LA FAMILLE DES ORCHIDÉES,

M^r. CH^r. P. PAHUD,

AVEC TEXTE EXPLICATIF ET SCIENTIFIQUE,

PLANCHES CHROMOLITHOGRAPHIQUES

EXÉCUTÉES

LA LITHOGRAPHIE ROYALE DE C. W. MIELING.

LA HAYE

C. W. MIELING.

1854.

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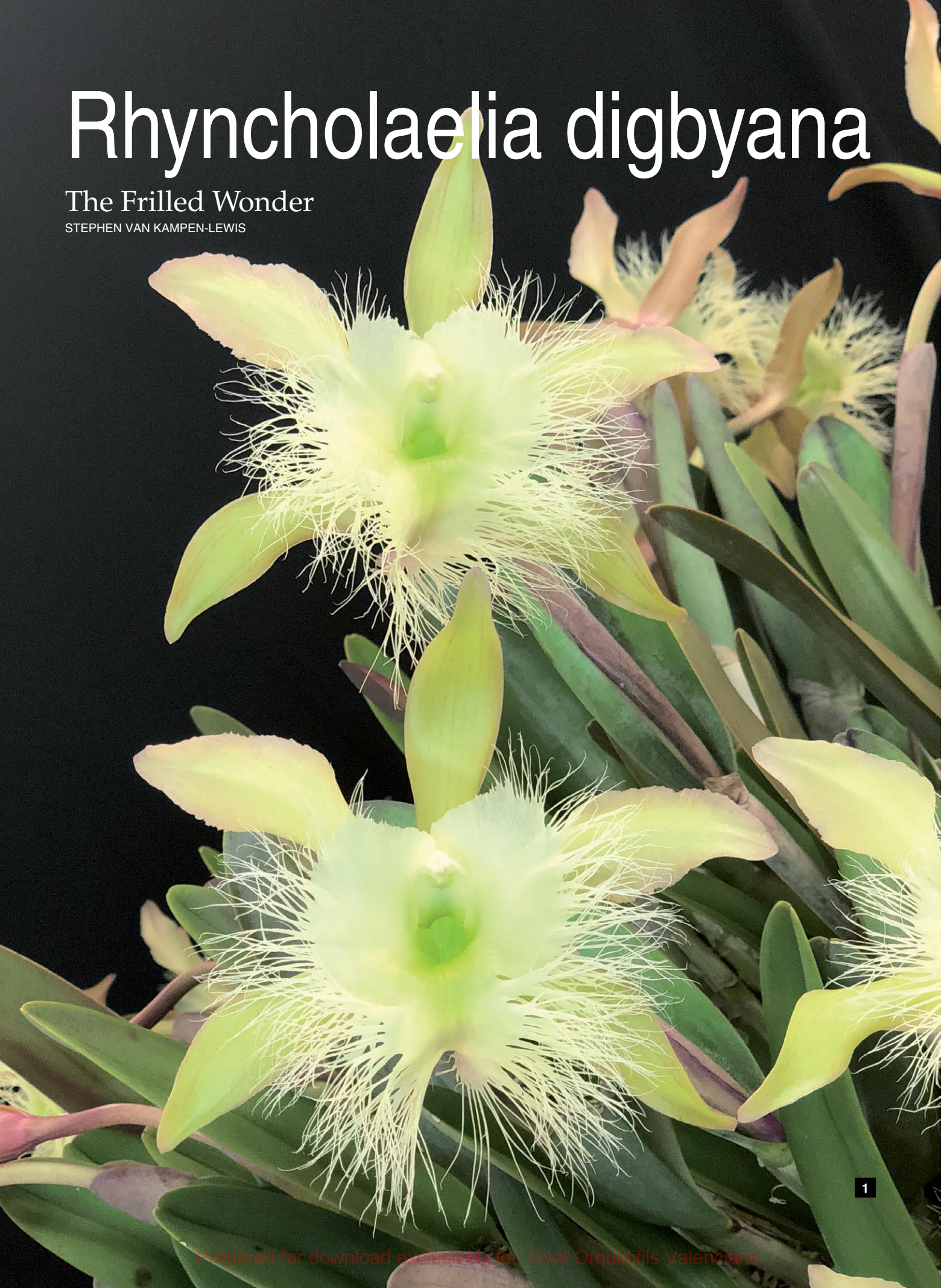
CIRRHOPETALUM PAHUDII DE VRIESE.

Rhyncholaelia digbyana

The Frilled Wonder

STEPHEN VAN KAMPEN-LEWIS



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THIS SPECIES WAS called *Brassavola digbyana* by most growers until recently. The species and many of its hybrids are quickly recognizable for the distinctive fringed lip. The term "brasso-lip," a short form for brassavola, may still be heard at American Orchid Society judging centers around the country or in articles when describing a large, intensely ruffled lip on a complex hybrid that includes this species in its background. The brasso lip is best described as open around the column (i.e., no "tube" or trumpet enclosing the column), nearly rectangular and with fimbriation (fine fringe) around the perimeter.

Rhyncholaelia digbyana was considered a *Brassavola* when first described by John Lindley in 1846 and became a *Rhyncholaelia* in 1918 according to Rudolf Schlechter. In fact, *Rhyncholaelia* actually means "beaked laelia," a reference to a structure of the developing ovary (Withner 1998). However, between 1846 and 1918, this species was a *Bletia* according to H.G. Reichenbach and a *Laelia* according to George Bentham!

Rhyncholaelia digbyana is found in scrubby, almost desert-like conditions from southern Mexico to Panama. This species is well adapted to the intensely hot, bright and often dry conditions of its natural habitat. Its leaves are leathery and succulent with a noticeable white substance on the leaves, likely produced as a natural sunscreen. Similarly, leaves and bulbs can turn red in exceptionally high-light conditions, another form of natural sunscreen designed to reduce the sunlight's impact on delicate chlorophyll. It is not uncommon to find *Rl*. *digbyana* growing alongside or even on top of cacti. That said, this species enjoys ample rainfall during the growing season, but requires its roots dry between watering. It can form large colonies in the wild.

Keep these conditions in mind when growing *Rl*. *digbyana.* This species resents having its roots wet for any length of time, so grow it in fast-draining media that will dry within 24 hours after watering. Give it plenty of water during the active growing season and reduce water dramatically in winter. One of the common problems encountered even by veteran growers is that growing a bush-sized plant is easy, but many people cannot seem to get the darned thing to bloom! Remember that *Rl*. *digbyana* is adapted to bright conditions and needs strong sun or artificial lights to grow and bloom well. Think conditions bright enough for vandas or even brighter. Fertilization is much more straight forward: simply add your preferred fertilizer (I prefer a balanced fertilizer such as 16-16-16) as you would for other Laeliinae and stop fertilizing when the plant is not growing.


WES NEWTON
2

AWARDS AND HYBRIDS The first award to this species granted by the Royal Horticultural Society was a first class certificate in 1895. The AOS has granted 40 awards to *Rl*. *digbyana.* So what exactly is it about this species that makes it so endearing to hobbyists all this time? The color probably is not this species' biggest draw. The sepals and petals are typically chartreuse and you do not get much variation in color, except for the occasional red flush on the back of the sepals. Most of the more popular Laeliinae come in a variety of colors (i.e., white-with-colored-lip, white, cerulean forms and so-called rubra forms that are heavily pigmented purple forms), but not *Rl*. *digbyana.* Moreover an inflorescence typically carries only one flower, or sometimes two (depending on the clone). However, the draw for this species comes in the form of a fantastically fimbriate lip with such fine "whiskers" and in such exuberance that it almost does not seem natural. Additionally, each flower is typically large with a mean natural spread of 5.4 inches (13.7 cm) when looking at all *digbyana* awards shown in *OrchidPro*. A marvelous fragrance of fresh lime is an added bonus exuded at dusk from this orchid flower.


NICOLAS GOMEZ RIOS
3

[1] *Rhyncholaelia digbyana* 'Quinnelly's Joy' AM/AOS photograph by Wes Newton; exhibited by Patti Quinnelly.

[2] *Rhyncholaelia digbyana* 'Quinnelly's Joy' CCE/AOS. Note the long pedicellate ovaries characteristic of this species. The very short peduncle is too short to extend to the top of the sheath.

[3] *Rhyncholaeliocattleya* Déesse 'Cocuy' AM/AOS exhibited by Jardines Romeral. The flower in profile clearly suggests a long decumbent ovary.

GENETIC ATTRIBUTES AND MODERN HYBRIDIZING *Rhyncholaelia digbyana* is also popular because it is one of the foundation species in many of the most famous Laeliinae hybrids. It is well beyond the scope of this article to discuss the thousands of hybrids utilizing this species as an ancestor. However, discussing

the attributes that make *Rl. digbyana* such a successful parent, grandparent, great grandparent and so on is certainly on the table. The first hybrid that had the distinctive *digbyana* brasso lip was *Rhyncholaeliocattleya* Digbyano-mossiae (*Rl. digbyana* × *Cattleya mossiae*) that was exhibited in 1889 at a Royal Horticultural Society meeting where it received a first-class certificate! Ernest Hetherington (1986a) put together the following list detailing notable qualities imparted to progeny, including:

Large flowers, which can exceed 8 inches (20 cm). *Rhyncholaeliocattleya* Déesse (Férrieres × *Cattleya* Lamartine) received four AOS quality awards in 1965, but unfortunately, the natural spread for these flowers is not readily available on *OrchidPro* because the awards are too old. However, *Rlc*. Déesse 'Cocuy' received an AM/AOS in 2018 with a natural horizontal spread of 6.3 inches (16 cm). This hybrid is crystalline white with a classic brasso lip highlighted by a yellow throat. It has *Rl. digbyana* as a grandparent and shows the size factor contributed by the species. However, note that cultural conditions can also influence flower size of a particular plant. The same plant can produce larger flowers under optimum conditions or, conversely, smaller flowers under less than ideal conditions. Another contributing factor to exceptional flower size is polyploidy. Doubling the chromosome count can increase flower size significantly. Many of the awarded *Rl*. Déesse clones are tetraploids (4n). So although it seems that plants with *Rl. digbyana* in the background can produce larger flowers, there can be other contributing factors at play.

Reduced flower count. Most hybrids of *Rl. digbyana* typically only have a few flowers per inflorescence. Although the clone of *Rlc*. Déesse awarded in 2018 had three flowers on one inflorescence, awarded clones of *Rlc*. Mount Hood average two flowers per inflorescence (AOS awards between 1969 and 1981). Meanwhile, *Rhyncholaeliocattleya* Amazing Thailand had three flowers on a single inflorescence when awarded, an awarded clone of its seed parent (first name listed in the grex formula) carried only two flowers. Reduced flower count is not always attributable to solely genetic influences. There is a significant cultural component that can influence flower count, with plants receiving superior care exhibiting higher flower count. Additionally, plant age can influence flower count. Large, mature plants often


4 ARTHUR E. CHADWICK


5 ARTHUR E. CHADWICK


6 GLEN BARFIELD


7 GLEN BARFIELD

have more flowers per stem than younger, smaller plants.

The fimbriate lip is dominant over many generations. Although having an over-sized, ruffled lip can be achieved without *Rl*. *digbyana* (think *Cattleya* Bow Bells, although the lip is tubular rather than open), because hybridizers select for the lip features, the oversized brasso lip can be seen through time even with few introductions of the species in a hybrid's background. For example, *Rlc*. Amazing Thailand (Haadyai Delight × *Cattleya* Brazilian Treasure) was registered in 2014 and the clone 'Shogun Hawaii' received an AM/AOS in 2019. This small, multicolored hybrid has 19 species in its background with only a small, statistically speaking, fraction of its heritage attributed to *Rl*. *digbyana*. However, the award profile indicates a 2.2-inch- (5.7-cm-) wide lip on a 4.5-inch- (11.-cm-) wide flower! *Rhyncholaeliocattleya* Haadyai Delight (seed parent) is a golden yellow flower registered in 1999 and received an AM/AOS in 2013 (*Rlc*. Haadyai Delight 'Bangprom Gold' AM/AOS), with a monstrous lip measuring 3.3-inches (8.5-cm) wide on a 5.7-inch- (14.-cm-) wide flower with *Rl*. *digbyana* as a great great grandparent and even farther back a couple of other places in its pedigree.

Hybrid vigor. Rhyncholaeliocatteya digbyana can impart impressive hybrid vigor through multiple generations that makes for strong plants. Ernest Hetherington (1986b) even suggested some level of disease resistance imparted to its progeny.

Hybrid vigor is a term typically used when referring to plants that grow faster than the foundation species or produce plants that are larger or more robust than the species in its background would suggest. Unfortunately, data related to hybrid vigor of *Rl*. *digbyana* hybrids are nonexistent. Hetherington's (1986b) observations are difficult to show empirically because award programs that published size data did not exist when the early hybrids were awarded and vigor is primarily observational. Even searching through award data to determine flower count is inadequate, because this sort of search would not adequately take other background species into account and would not separate out the effect of cultural excellence of the grower. Disease resistance is thought to be a driving factor for sexual reproduction in all organisms due to the proclivity for at least some individuals to survive the onslaught of a particular pathogen via genetic variability. This allows them to develop disease resistant mutations that are passed on to subsequent generations. Therefore, it is conceivable that hybrids in general could be more disease resistant due to the introduction of novel genes to a population. However, attributing such characteristics *solely* to *Rl*. *digbyana* is difficult and outside the scope of this article.

IRMA SALDAÑA 8

MAUREEN PULIGNANO 9

Yellow progeny. Yellow-flowered progeny appear free from bloom deformities that plagued other yellow lines lacking *Rl*. *digbyana* in the background. Considering the number of available yellow cattleyas in today's marketplace, you would never guess that breeding for yellow hybrid cattleyas went through a difficult period not so long ago. There are only a few large Laeliinae species that potentially produce yellow progeny, and even then, in some species the feat is limited to only a few clones. Therefore, the gene pool for yellow cattleya breeding was not extensive, at least early on. To make matters worse, yellow hybrids often suffered from a crippling genetic deformity caused by the thickening of petal or column tissue; first appearing in young plants along the petal midrib, becoming more pronounced on subsequent blooming as the plant ages or the formation of petal-like tissue growing out of the column. Over the years, a mass of thick tissue may form at the distal end of the petals as the plant attempts to form a stamen in this location, which can even contain pollinia-like structures (Midgett 2010). However, Midgett (2010) indicates Ernest Hetherington and Rita Crothers discovered that breeding with *Rl*. *digbyana* dramatically reduced or eliminated this crippling. More specifically, breeding with *Rl*. *digbyana* hybrids such as *Rhyncholaeliocattleya* Xanthette (Mindenette × Xanthedo) or *Rhyncholaeliocattleya* Primate (Primrose × Heatonensis) could eliminate crippling in the progeny. Somehow *Rl*. *digbyana* in the background appears to have been able to overcome or drastically reduce the potential for crippling.

[4] *Rhyncholaeliocattleya* Mount Hood 'Mary' AM/AOS grown by Chadwick & Son Orchids.

[5] *Rhyncholaeliocattleya* Déesse 'Polymie' grown by Chadwick & Son Orchids.

[6] *Rhyncholaeliocattleya* Amazing Thailand 'Shogun Hawaii' AM/AOS grown by Shogun Hawaii – Matthias Seelis.

[7] *Cattleya* Bow Bells 'White Sands' AM/AOS grown by Shogun Hawaii. Although the lip of this straight *Cattleya* hybrid is frilled, it is noticeably more tubular than hybrids of *Rl. digbyana*.

[8] *Rhyncholaeliocattleya* Haadyai Delight 'Bangprom Gold' AM/AOS; exhibitor: Noel Soler-Figueroa. Although *Rl. digbyana* appears many generations removed in the pedigree of this hybrid, note the huge, wide-open, ruffled lip.

[9] *Rhyncholaeliocattleya* Xanthette 'Panther Creek' AM/AOS; exhibitor: Barney and Aileen Garrison.

Drooping inflorescences. One of the characteristics of *Rl*. *digbyana* is the presence of a very short peduncle and what appears to be a long pedicellate ovary (the pedicel is the stem between the actual ovary and peduncle). What appears to be a very long ovary is actually a long nectary spur fused to the underside of the ovary and pedicel. Although primary hybrids lack the nectary of *Rl*. *digbyana*, the combination of short peduncle and

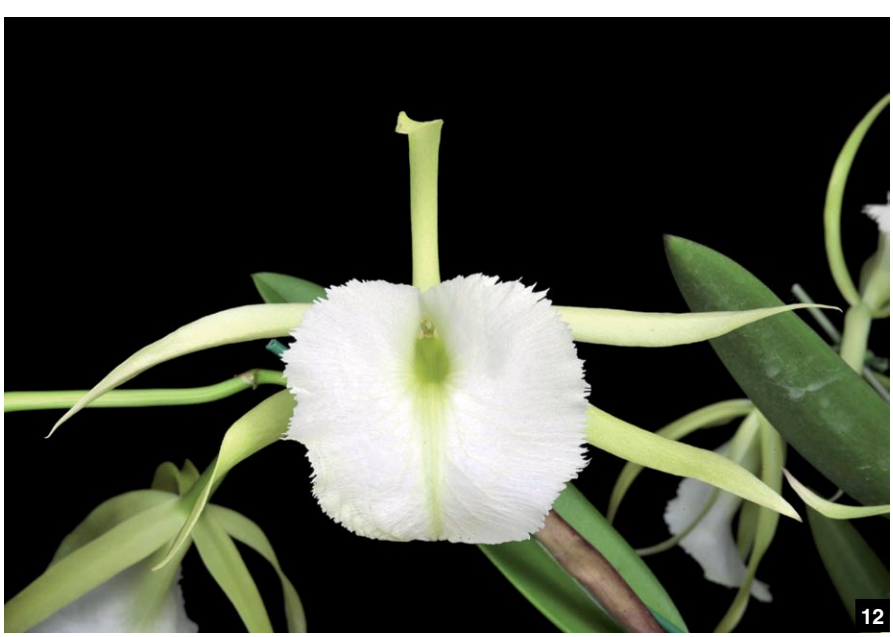
long pedicel dominates in primary hybrids and can lead to the appearance of droopy flowers. Luckily, this trait does not carry over through multiple generations, and more complex hybrids may present with well-held flowers. Sadly, inflorescence length is often not included in the AOS award descriptions of cattleyas, especially historically, so finding data that the reader of this article can investigate for themselves is not possible. Even a more qualitative investigation of primary hybrid award photographs may not necessarily reveal a shortened inflorescence with arched flowers because AOS photographers attempt (and succeed!) to show an awarded flower's best qualities and angles. Therefore, simply looking at an award photograph might not give the viewer an objective look at a flower's potentially negative qualities. Moreover, a flower noticeably exhibiting these qualities may well not receive a quality award anyway! Still, *Rhyncholaeliocattleya* Cordelia *(Rl. digbyana* × *Cattleya intermedia)* 'Lilac Lace' HCC/AOS appears to be nodding in its award photograph, as does *Rhyncholaeliocattleya* Madame Charles Maron *(Rl. digbyana* × *Cattleya warscewiczii)* 'Andy's Joy' HCC/AOS. Although not a primary hybrid, *Rhyncholaeliocattleya* Ports of Paradise (Fortune × *Rl. digbyana)* 'Emerald Isle' FCC/AOS shows nodding flowers and long pedicels leading from the flower well into the sheath (the short peduncle is buried in the sheath) in its CCM/AOS award photo (2004), thus exhibiting the same qualities Hetherington (1986a) indicated are a drawback for early crosses with the species.

Strong fragrance that mixes well with other species for a pleasing effect. I think most people reading to this point are familiar with the intoxicating scent that so many *Rl. digbyana* crosses exude. The scent seems to be some mixture of anise, sugar, sometimes chocolate, and a host of others! This is a far cry from the pleasing scent of limes that *Rl. digbyana* is known for. Orchid scents are oddly understudied and are not judged by the AOS.

SMALL HYBRIDS FOR SMALL SPACES Many orchid growers have started collecting either miniature orchids or at least smaller-statured plants. Therefore, more growers are opting to fill their grow spaces with more compact plants. Traditional breeding for big "floofy" cattleyas has changed in recent times to include small-statured species such as *Cattleya* (*Laelia) alaorii*, *Cattleya luteola*, *Cattleya* (*Sophronitis) coccinea*,

10 MILTON WITTMAN

11 MAURICE MARIETTI



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Brassavola nodosa, and rupiculous (rock-dwelling) cattleyas (laelias) such as *Cattleya milleri* and *Cattleya briegeri*. Crossing *Rl. digbyana* with small-statured allies is not a well-developed breeding direction with relatively few examples of awarded crosses when compared to standard sized hybrids. Perhaps it would be an interesting new direction.

Brassavola nodosa hybrids have certainly become more popular since Ernest Hetherington wrote about *Rl. digbyana.* The influence of this species on its progeny is evident with a quick glance; long, trumpet-shaped lip, wide, nearly flat flaring on the proximal half, stellate or star-shaped flowers, and flowers that often change color over time represent the hallmarks of a *B. nodosa* hybrid. Add in the fact that the progeny are smaller than standard cattleyas and are often considered "bullet-proof" to even the newest orchid grower, and the popularity of this species as a parent in a hybridizing program becomes evident. However, what happens when two parents with dominant lip shapes come into genetic contact? Will one with a brasso lip dominate the lip of *B. nodosa*, or will both be somehow represented in the progeny?

Rhyncovola Jimminey Cricket (*B. nodosa* × *Rl. digbyana*) has garnered seven AOS quality awards and mostly resembles its *B. nodosa* parent, but with a giant brasso lip attached to a much larger flower with a mean horizontal natural spread of 6.3 inches (15.9 cm). Flower color and plant habit strongly resemble the *B. nodosa* parent, but flower count is reduced to no more than two to three flowers per inflorescence.

Rhyncovola David Sander (*B. cucullata* × *Rl. digbyana*) is another interesting primary hybrid that yields a beautiful (and awarded) flower. The long segments of *B. cucullata* are pleasingly conserved in the progeny, but are shortened enough with additional substance to prevent the drooping inherent in the *Brassavola* parent. Moreover, the lip is drawn out into an extended triangular shape with strong fimbriation from the *Rl. digbyana* not often seen in the orchid world. Awarded flowers have a mean horizontal natural spread of 5.8 inches (14 cm) and have one or two flowers per inflorescence, a trait that may be derived from both parents.

Crossing *Rl. digbyana* with *C. luteola* yields *Rhyncholaeliocattleya* Leprechaun Legend, a relatively compact plant that is not currently awarded by the AOS. As you can imagine, the flowers are various shades of yellow to green with some clones exhibiting red in the lip directly adjacent to the column. The flower shape exhibits a prominent brasso lip. When crossed with *Cattleya* Wong Siew Kwun (Interglossa × *walkeriana*), *Rhyncholaeliocattleya* Amy Wan is the result. Similarly unawarded by the AOS, *Rlc*. Amy Wan exhibits star-shaped sepals and petals with a rectangular, open lip with obvious serration. Although the lip shape resembles the *Rl. digbyana* parent, some strong lip-shape attributes have been passed down from *C. walkeriana*. Cattleya *walkeriana* lip shape is open around the column but the midlobe is often deeply lobed.

So what happens if you "cut out the middle man" and make a primary hybrid between *Rl. digbyana* and *C. walkeriana*; two species that dominate for lip shape? This interesting cross was registered in


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[10] *Rlc.* Madame Charles Maron 'Andy's Joy' HCC/AOS; exhibitor: Cheryl Erins.

[11] *Rlc.* Ports of Paradise 'Emerald Isle' FCC-CCM/AOS; exhibitor: Jeff Kook.

[12] *Rhynchovola* Jimminey Cricket 'Marita' AM/AOS; exhibitor: Matthew Riesz. This primary hybrid of *Rl. digbyana* and *B. nodosa* looks like a giant *nodosa*.

[13] *Rhynchovola* David Sander 'Isabel's Legend' AM/AOS; exhibitor: Richard L. Rothschild. This primary hybrid of *Rl. digbyana* and *B. cucullata* is a beautiful blend of features from both parents.

[14] *Rhyncholaeliocattleya* Cynthia 'Gisela' AM/AOS (exhibitor: Joseph J. Francis) looks like a giant *Cattleya walkeriana*. The inset photograph of *C. walkeriana* 'Orchid Eros Flare' FCC/AOS (exhibitor: Ben Oliveros, Orchid Eros) was taken by Glen Barfield.

1917 as *Rhyncholaeliocattleya* Cynthia and the grex has 10 AOS flower quality awards. The easiest way to describe *Rlc*. Cynthia is that it looks like a pumped-up *C. walkeriana* with a wide range of color variation among the clones, larger segments, and a *walkeriana*-shaped lip. A mean natural horizontal spread of 4.5 inches (11.4 cm) indicates the flower size of these awarded plants has increased over all AOS awarded *C. walkeriana* clones, which have a mean horizontal natural spread of 3.9 inches (10.0 cm).

Cattleya alaorii is a tiny plant from Brazil with a cupped flower typically not even 2 inches wide (<5 cm) and has been largely ignored for hybridizing since its official discovery in 1976. However, hybridizing efforts with this little jewel have yielded some interesting results. The species has a habit of reducing overall size of anything it is crossed with, such that the resulting progeny are often described simply as smaller versions of the other parent!

For example, *Rhyncholaeliocattleya*. Omar Gonzalez (Izumi Girl × *C. alaorii*) is a typical rhyncholaeliocattleya with a brasso lip. *Rhyncholaeliocattleya* Izumi Girl is comprised of large-standard, cattleya-type parents mixed with small doses of *Rl. digbyana* (twice through *Rhyncholaeliocattleya* Nacouchee and once through *Rlc*. Déesse) with flowers that are approximately 5.6–6.3 inches (15–16 cm). *Rhyncholaeliocattleya* Omar Gonzalez 'Smartie' received an HCC/AOS in 2015 on a 4.7-inch (12-cm) flower that retained the brasso lip from *Rlc*. Izumi Girl. The *C. alaorii* parent simply reduced the flower size, although still larger than might be expected, and the positive qualities from *Rl. digbyana* in terms of the lip are obvious.

It is fascinating that *Rl. digbyana* was once considered such a mediocre parent due to its negative attributes in early crosses, but that the positive qualities of using this species became so apparent beyond the first generation. Low flower count, weak stems, and color softening gave way to larger flowers, fantastically wide lips, and one of the most recognizable fragrances in the orchid kingdom. The genetics of *Rl. digbyana* continue to amaze long-time growers with giant, floofy hybrids, as well as modern growers with limited space and a penchant for more compact plants.

Acknowledgments

I am very thankful to Jeanne Buchanan, Luiz Hamilton Lima and Jean Allen-Ikeson as my editors for this article. Your ideas and insights are very much appreciated.

GREG ALLIKAS

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— Stephen Van Kampen-Lewis is a long-time orchid grower who first started growing orchids as a preteen in British Columbia during the early 1990s. He has since moved to southern Arizona, Hawaii, and central Texas, always with orchids in tow. Van Kampen-Lewis is an associate AOS judge at the Alamo Judging Center in San Antonio. He created the AOS Instagram page, but passed the torch after the birth of his second child. He still maintains his own orchid-dominated Instagram page (@isurus79). Van Kampen-Lewis also started a YouTube channel in early 2019, where he discusses advanced growing techniques for Catasetinae and Laeliinae, his preferred groups of orchids to grow at home and outside in the unrelenting Texas heat.

[15] The miniature *Cattleya alaorii* ('Diamond Orchids' AM/AOS; exhibitor: Peter T. Lin; photographer: Arthur Pinkers) so dominates it hybrids that even when crossed to large brassos the resulting hybrids look strongly reminiscent of a giant *alaorii*. The inset pictures one such hybrid, *Rlc.* Omar Gonzalez 'Smartie' HCC/AOS (Izumi Girl × *C. alaorii*) exhibited by Tony Millet, photographed by Tom Kuligowski. Photograph of C. alaorii 'Diamond Orchid' AM/AOS courtesy of Arthur Pinkers.

[16] *Rlc.* Carlos Fighetti 'Crystelle' AM/AOS exhibited by Krull-Smith superbly illustrates the features expected in today's complex *Rl. digbyana* breedling lines: large flat flowers with exceptionally full, ruffled lips.

Orchids in Watercolor

Isotria verticillata

BY MARCIA WHITMORE

Isotria verticillata, the large whorled pogonia is found in the central and eastern United States from Texas to Maine and Ontario province in Canada. It has a purplish brown stem and five leaves that form a whorled ring around the top part of the stem. The leaves are green on the upper surface, and occasionally greyish blue or green on the bottom surface. It produces one or two flowers with purple-brown sepals, yellowish green petals, and a yellow-green to white labellum which is often striped with purple. It can be distinguished from *Isotria medeoloides* by its larger size and its purple, instead of green, sepals. It can be found in mesic to dry woodland habitats and occasionally in bogs.

This painting was made from a photograph by Jim Fowler. Fowler is a fabulous photographer whose photos are featured on the new United States Post Office sheet of native orchids. I asked Jim permission to work from his photos and used a composition based on several of his photos. The painting is executed on 300 lb. cold pressed Arches paper.

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, www.marciawhitmore.com).

In Pursuit of *Teagueia*

Fieldwork in the Most Mysterious and Dangerous Mountains of Ecuador

TEXT BY KELSEY L. HUISMAN/PHOTOGRAPHS, NOT OTHERWISE CREDITED, BY THE AUTHOR

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I STOPPED TO look at the *Teagueia* species growing along the steep trail in Cerro Mayordomo, a part of the notoriously dangerous Llanganates Mountains. I began to kneel to the level of the orchids to see which species I had come upon. "Shh . . . Listen," Eduardo Peña, my significant other and field technician, whispered. We heard a couple branches snapping in the near distance. An animal seemed to be in parallel with us, but a good distance away. "I think it's the puma," Eduardo continued to whisper as my eyes grew wide with a mixture of surprise and fear, though mostly surprise.

All that morning I had felt like we were being watched, but now it was certain. As we set off earlier that morning, we heard birds in the near distance making a lot of noise, sounding scared like they were giving warning. Then we came across a large and perfect fresh paw print in the mud of a steep ascent in the trail, and we passed disarticulated feathers just before spotting *Teagueia* along the trail.

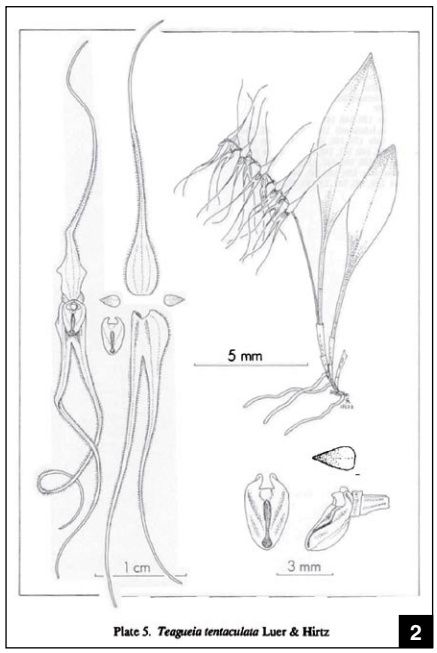
TEAGUEIA ORCHIDS I have been working in these remarkable mountains that captivated my soul years ago to study an extraordinary radiation of *Teagueia.* An "extraordinary radiation" of new *Teagueia* species means that in a short amount of time, relatively speaking, 30 or so species evolved and diversified quickly within a small area. These were only recently discovered in a small region of the Upper Río Pastaza Watershed (URPW) in Ecuador. This is a botanically remarkable region of the northern Andes: the number of vascular plant species endemic to this region surpasses those known from the Galapagos Islands (Jost 2004). This is where the Amazon Basin meets the Andes mountain range, and the warm air from the Amazon merges with the cool air of the Andes creating microclimates where species flourish (Jost 2004; Jost and Shepard 2011). These microclimates are distinguished by factors such as elevation, temperature, cloud formation, cloud cover and rainfall, which have led to the evolution of numerous endemic plant species with highly restricted distributions and with approximately half of the endemic plant species being orchids (Jost 2004; Dodson et al. 2006).

The genus *Teagueia* is within the large subtribe Pleurothallidinae (Epidendroideae) that includes more than 4,000 species. Initially, there were six known species of *Teagueia*, three from Colombia (*Teagueia lehmanniana*, *Teagueia phasmida* and *Teagueia rex*) and three from Ecuador (*Teagueia teaguei*, *Teagueia tentaculata* and *Teagueia zeus*). When they were discovered, these species seemed similar to *Lepanthopsis* and *Platystele*, but their leaf morphology excluded *Lepanthopsis* and their flowers did not fit *Platystele*: *Teagueia* flowers are larger, with two to three well-defined veins on the sepals, flashy long sepaline tails, and have a lip morphology noticeably different from *Platystele*, including a central orifice characteristic to the genus (Luer 1991). At first, the four described species were placed in a new subgenus *Teagueia* within *Platystele* (Luer 1990), because there was too little information to put them into a genus of their own (Luer 1991). In 1991, in *Icones Pleurothallidinarum VIII*, two new species were described (*Tea. lehmanniana* [originally collected in 1906 and formally described in 1991] and *Tea. tentaculata* [1991]), and, at the same time, Luer placed all six species in the new genus, *Teagueia* (Luer 1991). Relatively recently, two additional species with long sepaline tails were discovered from southern Ecuador (*Teagueia portillae* [2002]) and northern Peru (*Teagueia moisesii* [2011]; Dodson et al. 2006; Chocce et al. 2011). In addition to the characteristic sepals of these species, they grow between 5,906–8,202 feet (1,800–2,500 m) in elevation, except *Tea. teaguei*, which was collected at 9,843 and 11,155 feet (3,000 and 3,400 m). They are epiphytic, found tightly within the moss on tree trunks and are caespitose (tightly clustered) or shortly repent (creeping, but for short distances; Luer 1990, Luer 1991, León-Yánez 2012).

In about 2000, Lou Jost, cofounder and director of the EcoMinga Foundation, and colleagues discovered an extraordinary radiation of new *Teagueia* species from four neighboring mountains in the URPW. Of these 30 or so species, only 10 have been formally described (*Teagueia alyssana*, *Teagueia anitana*, *Teagueia barbeliana*, *Teagueia beverlysacklerae*, *Teagueia cymbisepala*, *Teagueia jostii*, *Teagueia kostoglouana*, *Teagueia lizziefinchiana*, *Teagueia puroana*, and *Teagueia sancheziae*). The *Teagueia* of the URPW have a different floral structure and growth habit compared to the species previously described. These species are miniature orchids and do not have long, flashy sepaline tails, though all species maintain the central orifice of the lip. They are found from 9,514–12,795 feet (2,900–3,900 m) in elevation, which is much higher in elevation than the previously known *Teagueia* species.

Although they are mainly terrestrial living embedded in moss, they can also be seen growing epiphytically. And, unlike the previous species, the URPW species produce distinctly long-repent (creeping for long distances) plants.

In addition to these differences in



[1] *Teagueia puroana*, an Ecuadorian endemic was only described in 2011. Photograph courtesy of Lou Jost.
[2] Carlyle Luer's line drawing of *Teagueia tentaculata*, a species from the Napo region of Ecuador.
[3] *Teagueia zeus*, described in 2007, is an endemic to the Pastaza region of Ecuador.

floral structure and growth habit, what makes the URPW *Teagueia* particularly special is that they form a closely related group endemic to an area less than 116 square miles (300 sq km; Jost 2004). Furthermore, species north of the Pastaza River are not found south of the river and vice versa, where other plant species in the URPW do not demonstrate these restrictions. It is also common to find three to five *Teagueia* species growing with each other, which introduces another level of competition between these closely related species (Jost 2004; Suárez et al. 2016; Jost and Shepard 2017).

Lou Jost, Lorena Endara, Kurt Neubig and the late Mark Whitten constructed a preliminary unpublished phylogeny using one nuclear gene and five plastid genes, that shows this group of species diverged around 2.5 million years ago and form a monophyletic clade with the species of the URPW more closely related to each other than the long sepaline species. It is also clear that species north of the Pastaza River group evolved separately from the species south of the river. Though this phylogeny is informative, it is not well resolved, and few of these *Teagueia* form clear groups of species. So how many species are there really? Are some species hybridizing in situ? Many ecological factors of this amazing group of orchids are still unknown. For example, one of the main questions that always comes up is, what is the pollinator or pollination syndrome of these species? We do not know. To investigate this would expose any researcher to a high risk of hypothermia at these high elevations where rain is almost always a guarantee.

The species of the URPW are likely not restricted to these four neighboring mountains, but few mountains in this region have been explored, especially at the critical elevations of 9,843–13,123 feet (3,000–4,000 m). It is likely we are only seeing and studying a small fraction of their populations. It appears they may be extreme habitat specialists and could be found in similar microclimates restricted to these high elevations from more mountains in this small region of Ecuador. It is possible there are dozens more *Teagueia* populations and new species that we just are not seeing.

Although the genus is slowly becoming better known at the species and ecological level, *Teagueia rex* is the only species in cultivation and is a rare specimen to find among orchid enthusiasts. Still, all species are considered highly endemic and rare in the central and southern Andes of Colombia and the northern Andes of Ecuador and Peru. Although all *Teagueia* species are of conservation concern, they are not included in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species and only eight have been included in the Red Book of Endemic Plants of Ecuador (León-Yánez 2012).

[4] The author and Eduardo Peña heading into the Cerro Añangu Reserve.
[5] View from the second camp of Cerro Mayordomo.
[6] The author among the swordgrass in Cerro Mayordomo.

WHAT AM I DOING HERE? I am a PhD candidate at the University of Wisconsin–Madison in Ken Cameron's lab. Some years ago, I had a lucky, by-chance meeting with Lou Jost. As an undergraduate student at Northern Michigan University, I went on a community service trip abroad to Ecuador. When our group arrived in the small city of Baños de Agua Santa, tucked away in the western Andes at the base of Volcán Tungurahua, the woman leading the trip introduced me to her longtime friend, Lou Jost, a gringo from Wisconsin who fell in love with the biodiversity of this region. Lou came down from his wild, private botanical garden that is his home to give our group a short presentation about the incredible species diversity in the mountains around Baños. The last part of his presentation was about this recently discovered evolutionary radiation of *Teagueia* orchids. Three things he said caught my attention — biodiversity hotspot, orchids and genetics.

At this moment, everything came together for me. I knew that I needed to return to study plants in the mountains here. Lou and I remained in contact, discussed project ideas, and a short time later, I received a Benjamin A. Gilman Scholarship to conduct an independent research project lasting about two and a half months during the summer of 2014, where I looked at *Lepanthes* in Cerro Añangu in the URPW. This is also where I met Eduardo and his family for the first time. Eduardo would always carry my gear up to their camp high in the mountain where they grow raspberries and have pasture for their cows to graze. The EcoMinga reserve in this part of Cerro Añangu once belonged to his father who sold it to Lou years ago. I would sleep in their small cabin, then hike up into the reserve and even farther up into the Llanganates National Park to document *Lepanthes* orchids. This mountain became my second home.

My last week in Ecuador, a group of us hiked into the Río Zúñag Reserve up to the first ridgeline of the Andes that borders the Amazon Basin. This is one of the wettest forests on the planet, where people have seldom traveled. When we stopped for lunch, a hummingbird perched on a branch about 10 feet (3 m) from us and stared, tilting its head, like it was thinking, what are you and where did you come from? On the fourth day, we began our descent back to civilization, and I realized that in a few short days I would be returning to the United States, and I did not want to leave.

I made the decision during this adventure that I wanted to return and study orchids in this region for a graduate project. As I made the transition to

graduate school, Lou was kind enough to allow me to study his precious teagueias. In 2016, I began my PhD project in the Department of Botany. For my graduate project, I will construct a new, more robust phylogeny using next-generation sequencing. Instead of a phylogeny constructed using five short gene regions, the genome of each individual will be sampled hundreds of times extracting multiple short segments of the genome. The data will also be used to assess the population genetics of the more confusing species. Finally, the fungi from the soil, and the fungi inside the leaves and roots will be analyzed. The fungi in this region are virtually unknown. Could it be possible that these closely related, coexisting species are recruiting different fungal microbiomes to reduce competition between each other?

It was immediately clear that doing a project on rare Ecuadorian orchids was going to be a huge challenge. To get things really moving for my project, I formed a collaboration with Juan Pablo Suárez at the Universidad Técnica Particular de Loja (UTPL). In collaboration with Lou and Juan Pablo, I collected samples from the URPW and brought the samples to UTPL, where I am working now. At UTPL, all flower samples are preserved in the herbarium, then DNA extractions are completed and next-generation sequencing libraries are prepared.

Help with funding from the American Orchid Society allowed me to purchase crucial lab supplies to bring with me in my luggage. Most lab supplies are difficult to impossible to obtain in Ecuador, or they are much more expensive compared to their cost in the United States. I also received a Fulbright-Hays Doctoral Dissertation Research Abroad Fellowship, which has covered the cost of living abroad for seven months and some research costs, while I complete my fieldwork and lab work. As everything started to come together, I began to prepare for my return to Ecuador starting with collecting samples in the treacherous mountains of the URPW.

HIKING IN CERRO MAYORDOMO

Cerro Mayordomo is one of the mountains of the URPW where these *Teagueia* species are found and is a part of the famously mysterious and dangerous Llanganates Mountains of Ecuador. Many people, locals and tourists, have disappeared or died in these mountains. They are a great wild place, virtually untouched by humans, and with an unruly landscape that greatly inhibits exploration. The frequent heavy rains and humidity make hypothermia a

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real danger at these high elevations. In addition, moisture condenses in seconds and clouds cover the mountains in a perpetual fog so thick that some of the mountains have never been mapped; in Google Maps the mountaintops are just a green blur. The dense vegetation creates additional dangers. A layer of fallen tree trunks, thick roots and decaying leaves creates the illusion of solid ground, one wrong step and you can break through this false ground and experience an unexpected and painful fall, potentially leading to your death. Trails made by humans are scarce, and those that exist were probably made by explorers hunting the lost Incan gold. Legend has it that the famous treasure of the Incan Emperor Atahualpa was hidden in the Llanganates where no one will ever find it. They say those who seek it out will likely die for their greed. To this day, the treasure has not been found, although people have devoted their lives — or even given their lives — in the hunt.

The mountains here are unforgiving, and, of the mountains in the Upper Río Pastaza Watershed, Cerro Mayordomo is the most difficult. The trail to the second camp is long (about 8 hours as a gringa from the Midwest), steep and winding. The trail begins on an old dirt road. Walk past the old cabin, up, switchback after switchback, up and up, through the pasture and under the powerlines. Up, up, up, through the forest that transitions in and out of small patches of sword grass (*Neurolepis* sp.; about 12 feet tall [4 m]) that cuts like a knife, following the mountain crest for hours. Out of breath, sweating, all the muscles in my body ache. Continuing up to the hardest portion of the trail means we are getting close, maybe about an hour or hour and a half left. It is a physical and mental test. As your body tires, you trip and fall more, your steps are less sure, it becomes more dangerous.

The trail is well maintained up until the first camp because it is traveled more frequently, although still not often. Large plastic sheets covered in lichens and mosses protect visitors from the elements, one plastic roof and wall protect the fire pit from rain and wind, with other plastic areas set up for tents, or to keep wood or grass dry for later use. One large plastic sheet lies beaten to the ground by a fallen tree. From here, it is still about five hours to the second camp that awaits us at a much higher elevation along the crest of the mountain in even harsher elements. As we leave the first camp and continue


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to ascend, the trail narrows and becomes steeper and more difficult until eventually we are left climbing walls of mud and roots. The closer we get to the camp, the trail becomes more and more difficult, and there are more holes and more false ground, which makes the trail tricky and dangerous. Our first trip into Mayordomo together, Eduardo and I were nearing the second camp in the dark. Eduardo was in front of me a ways. I took one wrong step and my left foot broke through a small layer of soil and leaves. In seconds, my right foot was level with my eyes, while the tip of my big toe of my left foot was barely touching the make-shift ground that was ready to break away further if I put any more weight on my tippy-toe. I yelled for Eduardo, and he came and pulled me out of the hole.

The second camp is about 9,843 feet (3,000 m) in elevation. We can see our breath in the cold air. On a clear day, you can see miles of mountains, valleys and the small pockets of civilization here and there. Though they are fewer, the same large plastic sheets are used as roofs over the fire pit area and the areas to set up tents. Bunches of large blades of grass and plastic form a buffer between the tent and the cold, wet, muddy ground. It is extremely difficult to get a fire started for cooking, warmth, or to dry our wet clothing. Large plastic bags are tied up to collect and store water, as there are no other sources of water here.

COLLECTING SAMPLES IN CERRO MAYORDOMO The day of the puma, Eduardo and I woke early. He warmed up the leftover rice and tea made of cinnamon, tomate de arbol, and panela, while I packed up the campsite. The trail from the camp to the summit is not as difficult, though it has its spots, nor is it as long as the trail from the road to the second camp. It winds through the ever-changing vegetation as the cloud forest transitions to páramo.

These miniature *Teagueia* orchids begin around 10,000 feet (3,050 m) on this trail, though there is a small patch of out-of-place *Tea*. *jostii* around 9,186 feet (2,800 m). In Cerro Mayordomo, these orchids are seen along the trail in small clusters, which is unlike along the trails in Cerro Añangu and Cerro Candelaria where, after a certain elevation of about 9,350 feet (2,850 m) or higher, *Teagueia* species line the trails abundantly. It can even be overwhelming at times. At the first small patch we came across in the trail, we collected *Tea. jostii*, *Tea. alyssana* and a medium-sized (for these species)


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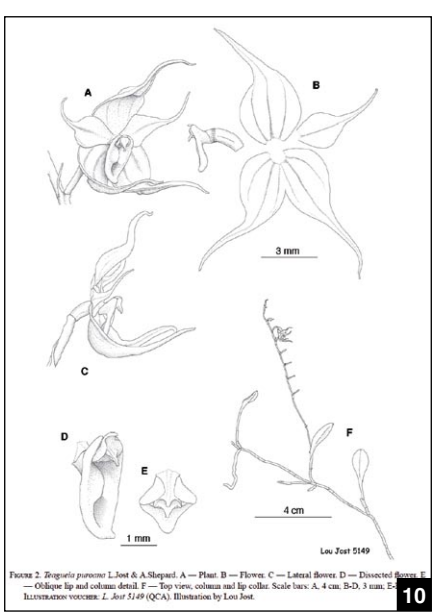

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[7] *Teagueia alyssana* growing in moss. The inset is a close-up of a flower of this species.

[8] The fuselage of a plane that unfortunately did not make it out of the reserve.

[9] *Teagueia puroana* taken in-situ. Note the scale provided by the author's thumbnail.

[10] Lou Jost's ine drawing of *Teagueia puroana*.

Close-up of the fascinating flower of *Teagueia alyssana*.
Photograph courtesy of Lou Jost

maroon flower. They were growing within inches of each other. I recorded the location and elevation using a GPS then began taking photographs for herbarium records and later identification, if needed. While I worked on photographing flowers, Eduardo placed one flower from each individual in a vial with rubbing alcohol for the herbarium voucher. He then poured a detergent buffer into two more vials and placed three to five leaves in one and three to five roots in the other. The detergent buffer preserves the DNA of the leaves and roots until I can do extractions in the lab at UTPL. Sampling *Tea. jostii* and *Tea. alyssana* went well, but there was not enough leaf and root tissue for me to collect the maroon species for my project. We collected the flower in water to bring to Lou for the microphotography he is working on with these species. With microphotography, more questions are being raised about these flowers, and their structure is increasingly more distinctive.

We continued along the trail past the wall of *Tea. alyssana* to the old, fallen, moss-covered tree trunk coated in *Teagueia* species, where there are at least five species growing within inches of each other. Here, I stopped to collect a species that I did not collect the previous trip, mainly because it looks like *Tea. sancheziae* but is significantly smaller. The previous trip, I had collected a live specimen for Lou. He was quite astonished by the flower, so it seemed important to collect samples for my own project. There was also a new flower that had opened since the last adventure to Cerro Mayordomo. I had never seen this species before. Again, medium in size for these miniature orchids, with wide, fat sepals and petals, a pale honey-yellow color with violet veins and a lip that is different from any of the other known species. Luckily, there was enough material that I was able to collect samples for my project and bring part of a live plant to Lou. I want to make it clear that my samples and the live plants are collected in a way that ensures the preservation and conservation of these *Teagueia* populations.

The next patch of *Teagueia* species is where we first heard the puma close to us. After intently listening to its movements and peering through the thick vegetation, I collected one undescribed species that was growing together with *Tea. jostii* and *Tea. sancheziae*. As we continued up the difficult and dangerous trail, we came to the site of the crashed airplane, where around 50 years ago two men were not lucky enough to make it off the mountain alive. We paused in awe. Again, in the distance, we could hear branches breaking. The puma. This time it was behind us. I began to feel nervous because we were being stalked. Was I being hunted? Of the two of us on the mountain, I am smaller, slower, and weaker than Eduardo. If one of us was going to be lunch for this cat, it was going to be me. Eduardo told me, "Don't be nervous or scared. The puma will sense if you are scared, and you will be putting yourself in danger." Luckily, since there were two of us on the mountain, it was unlikely the puma would attack either of us. In all our adventures, though we had been so close to the wild animals in the mountains, we had not yet had the fortune, or perhaps misfortune, of seeing any. It felt like we were being stalked or even hunted with a puma so near us on the trail.

AT THE END OF THE DAY After a full day of hiking up to the summit, turning around and hiking off the mountain, all the while collecting samples (a full 14 hours of hiking), Eduardo and I returned to civilization. The following day, we brought live plants and the flowers saved in water to Lou. I was excited to show him the beautiful honey-yellow flower as I knew it was special. To Lou's, Eduardo's and my amazement, the maroon and honey-yellow flowers were species new to science. In four months of doing fieldwork in the EcoMinga reserves and Llanganates National Park, we found three new species, the first being a toad we found in Cerro Candelaria that is being named in honor of nature and conservation enthusiast, TV personality and author Steve Backshall, who has helped raise money to aid in the conservation efforts of the EcoMinga Foundation. And finally, I found a new species of *Teagueia*.

This absence of research in the Andes is due to the difficulty and dangers of the mountains that has led to a lack of exploration (Pérez-Escobar et al. 2017). In fact, new species of frogs, toads, lizards, trees, orchids and other organisms are continuously being discovered as biologists are learning the ecological importance of this region and continue to explore the mountains of the URPW. With this, there is also the threat of unknown species going extinct due to the human encroachment and influence on the landscape, and the already apparent effects of global climate change. The rapid speciation of *Teagueia* species in the URPW will provide a broader understanding of rare plant conservation within the context of geographically restricted plant populations. Understanding how the effects of geographic isolation and the plant microbiome shape the structure of endemics on mountaintops will contribute to identifying their vulnerability to human intrusion and climate change (Ye et al. 2016). I sincerely hope that the research I am doing will support the EcoMinga Foundation in their important conservation efforts in this truly precious region.

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Who Were These Guys: Part 11

Hugh Low (1824–1905)

DAVID ROSENFELD, MD

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IMAGINE WHAT IT would have been like to spend most of your adult life on the island of Borneo and on the Malay Peninsula during the mid- to late-19th century. Such was the life of Hugh Low. Hugh Low spent more time away from Europe than almost all of the 14 men previously discussed in this series. Many of these orchidists either never left their native country or only traveled regionally within Europe. Of course, there were some very notable exceptions. Darwin made his round-the-world journey on the HMS Beagle from 1831–1836, but then never left England again. Benedict Roezl, Josef Warszewicz and Jean Linden all traveled to Central and South America to hunt orchids for about 10 years. Only Wilhelm Micholitz may have spent a comparable time away from his native continent as Hugh Low. However, Low's life was very different from our other orchid personalities. He was not a taxonomist, botanist, entrepreneur or a true orchid hunter in the employ of a horticultural firm. Hugh Low was a British colonial administrator first and a naturalist second.

Hugh Low was born in 1824 in Clapton, England, not far from London, into an already well-established horticultural family. His father had opened a successful nursery business in the local village several years prior to Hugh's birth. During Hugh Low's childhood he acquired a love of botany and became a keen observer of the natural world. In 1844, Low, at age 20, decided to travel to eastern Asia. It is unclear whether it was in the employ of the British East India Company or Low just desired to explore a little-known part of the world. After a short stay in Singapore, Low sailed to the island of Borneo.

Borneo is the third largest island in the world and today is shared by three countries. The southern 80% of the island is the Indonesian province of Kalimantan. The vast majority of the remaining northwest portion of the island is now part of Malaysia, except for the small, independent country of Brunei. Without getting into too much detail, this northwest region of Borneo has a very interesting history. It was called the Raj of Sarawak for about 100 years from the 1840s until the Japanese occupation during World War II. Beginning in 1841 it became an independent country controlled by the Englishman Sir James Brooke. Brooke had recently been ceded Sarawak by a local sultan for quelling a rebellion against his rule. In the 1880s, it became a British Crown colony controlled by the Brooke family. It was to this area Hugh Low ventured in the early 1840s. Soon after his arrival, Low came in contact with Sir James Brooke. Brooke was impressed with young Low and hired him as his secretary.

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Those first few years in Sarawak were an exciting time for the young Hugh Low as he traversed a territory never before explored by Europeans. During his expeditions, he encountered innumerable new species of plants unknown in Europe, some of which included orchids. Many of these plants were sent back to England to the family's horticultural business. Among the notable new orchid species were *Paphiopedilium lowii*, *Dendrobium lowii*, *Coelogne pandurata* and *Coelogne asperata*. All of these species were soon described by the famous English taxonomist John Lindley (Rosenfeld 2018).

Low returned to England in 1848 and wrote a book about his adventures entitled *Sarawak, Its Inhabitants and Productions*. The book describes the history, geography, geology, flora and fauna of Sarawak. He also discussed in detail the diverse indigenous inhabitants and their culture. He stated in the book, "My objects (plants and seeds) led me more into the country, and amongst the tribes of Aborigines than any other Englishman who has yet visited the shores of this island" (Low 1848a). Of orchids, Low wrote, "the tribe Orchidaecae is in profusion and beauty; and on the open banks of the rivers where the sun can shed its vivifying influence upon them, these delightful epiphytes decorate with their fragile and showy forms the otherwise naked and unsightly stumps of decaying forest trees" (Low 1848b).

[1] Described in 1861 by John Lindley, *Dendrobium lowii* is endemic to Borneo. This spectacular species, illustrated here by 'TG's Yellow Fever, HCC/AOS, is easily grown under intermediate conditions with bright light and ample air movement. Photographs by Judith Higham.

[2] Hugh Low circa 1848.

Low almost immediately sailed back to Borneo, or as rapidly as you could in 1848, having to sail around Africa. For the next 40 years, he was in the employ of the British colonial office. His first appointment was as Colonial Secretary to James Brooke in the new British colony of Labuan, a very small 35–square mile (90.6 sq km) island just off the coast of Sarawak. He served in various capacities on the island for almost 20 years. During these years, he acquired extensive administrative experience, fluency in the Malay language, and a reputation as an ardent naturalist.

He met and married Catherine Napier on the voyage back to Borneo. They soon had two children, but sadly she died in 1851 after only three years of marriage. Low brought his two children back to England to be raised by his grandfather and uncle in England.

Among Hugh Low's most notable achievements was being the first climber to ascend the formidable 13,435 ft (4,095 m) Mt. Kilabalu in 1851 in what is now the Sabah state of East Malaysia. The area is now a portion of the Gunung Mulu National Park and a UNESCO World Heritage Site. Although recent studies indicate that Low, on three separate ascents, only reached the granite plateau below the pointed pinnacle, it was still considered a major mountaineering accomplishment (Cowan 1968a). Low was quoted as saying the summit "is inaccessible to any but winged animals" (Hiung et al. 2004). Mount Kilabalu is a site of extraordinary diversity of flora, much of which is endemic to the area. There are reported to be over 800 species of orchids on the slopes of the mountain, including many paphiopedilums. Most notable is the so-called lost orchid *Paphiopedilum sanderianum* with its 3-foot (0.92-m) dangling petals. This species was first discovered in 1885 on Mt. Kilabulu by J. Foerstermann, one of Frederich Sander's (Rosenfeld 2017) collectors. However, it disappeared from European collections by 1900. Fortunately the species was rediscovered in the 1980s on vertical cliff faces of the mountain and now seed-propagated plants can be purchased from several orchid establishments.

After nearly 30 years in Labuan, Low was transferred and promoted as the British colonial administrator of the 8,000 square-mile (20,719 sq-km) Sultanate of Perak on the Malay Peninsula of Southeast Asia. He became the fourth "Resident of Perak" after the third was murdered. During his 11-year tenure, his most notable achievement was the initiation of the successful cultivation of South American rubber trees on the Malay Peninsula, resulting in a prosperous rubber plantation (Cowan 1968b). Low is also credited as being the first successful administrator in the region and his methods became the model for subsequent British administrators in Southeast Asia.

After 40 years of service to the British consular service, Hugh Low returned to England. He was knighted by Queen Victoria in 1883 for his contributions to the British Empire. He remarried in 1885 and lived another 20 years before dying in 1905. More than 60 orchids have been named to honor Hugh Low, including *Stanhopea lowii*, *Cymbidium lowianum*, *Phalaenopsis lowii* and *Dimorphorchis lowii*. Numerous other plants are named to commemorate him, including the giant pitcher plant *Nepenthes lowii*.

I believe the following statement in his obituary in the *Proceedings of the Linnean Society* (Unknown author, 1905) encapsulates Sir Hugh Low's personality, "In his intercourse with his fellow human beings he appears to have uniformly

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[3] *Paphiopedilum lowii* 'Extremely Lehua' AM/AOS. This species from western and central Malesia was named to honor Hugh Low in 1892. [Barfield]

[4] One of the few miniature species in the genus, *Phalaenopsis lowii* produces plants rarely more than about 7 inches (18 cm) across that are deciduous in nature. Pictured is 'Highjack' CCM/AOS (inset, 'Myra' AM/AOS), both photographed by Richard Noel.

acted in a lofty spirit of unselfishness. Although never missing an opportunity for furthering his interests in science, he sought no personal recognition. He suppressed his own ardent longing for scientific pursuits because love of his neighbor demanded of him work of a more immediately practical character."

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David Rosenfeld

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[5–6] The genus *Dimorphorchis* is unusual in the family in that these species produce strikingly different flowers on the same inflorescence that are, unlike the unisex flowers of the Catasetinae, perfect (having both male and female parts). The individual inflorescences of *Dimorphorchis lowii* are sharply arched and carry bright yellow, rather full-formed flowers (illustrated by 'Joan' AM/AOS; photographed by Ramon de los Santos) near the base of the inflorescence while more distal flowers are cream-colored overlayed with rich red-brown blotches (illustrated by 'Snookie's Surprise' AM/AOS; photographed by Maurice Marietti. The precise reason for these two dramatically different flower forms on the same inflorescence is not entirely clear but undoubtedly involved in the attraction of one or more pollinators.


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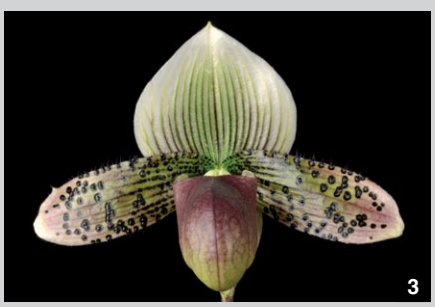
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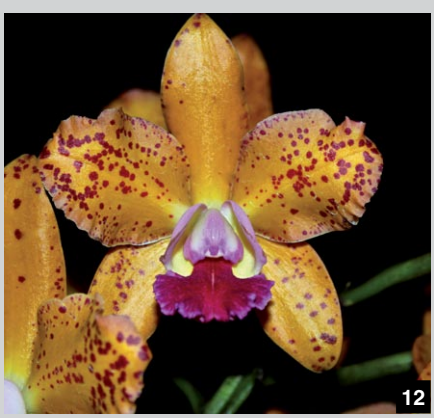

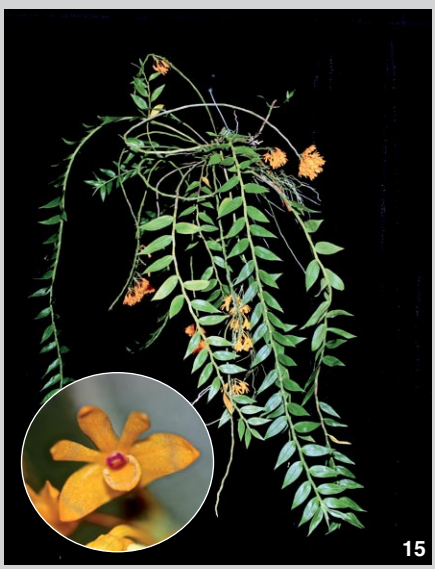

[1] *Paphiopedilum* Hawaiian Allure 'Slipper Zone Square Jaw' HCC/AOS (Hawaiian Illusion x Magic Pops) 78 pts. Exhibitor: Lehua Orchids; photographer: Glen Barfield. Hawaii Judging

[2] *Paphiopedilum* Fluttering Fred 'Slipper Zone Glowing Joyously' HCC/AOS (Montera Moth x Fred's Aura) 79 pts. Exhibitor: Lehua Orchids; photographer: Glen Barfield. Hawaii Judging

[3] *Paphiopedilum* Montera Vogue 'Slipper Zone Pink Stance' HCC/AOS (Montera Moth x Vogue Wonder) 78 pts. Exhibitor: Lehua Orchids; photographer: Glen Barfield. Hawaii Judging

[4] *Paphiopedilum* Spring Starlight 'Slipper Zone Green Ghost' HCC/AOS (*lawrenceanum* x Spring Moonbeam) 76 pts. Exhibitor: Lehua Orchids; photographer: Glen Barfield. Hawaii Judging

[5] *Paphiopedilum* Spring Starlight 'Slipper Zone Double Up' AM/AOS (*lawrenceanum* x Spring Moonbeam) 80 pts. Exhibitor: Lehua Orchids; photographer: Glen Barfield. Hawaii Judging

[6] *Paphiopedilum* Montera Vogue 'Slipper Zone Pink Aglow' HCC/AOS (Montera Moth x Vogue Wonder) 76 pts. Exhibitor: Lehua Orchids; photographer: Glen Barfield. Hawaii Judging

[7] *Paphiopedilum* Hawaiian Magic 'Slipper Zone Venus Rising' HCC/AOS (Magical Venus x Varuna) 75 pts. Exhibitor: Lehua Orchids; photographer: Glen Barfield. Hawaii Judging

[8] *Paphiopedilum* Spring Starlight 'Slipper Zone Syn Delight' HCC/AOS (*lawrenceanum* x Spring Moonbeam) 76 pts. Exhibitor: Lehua Orchids; photographer: Glen Barfield. Hawaii Judging

[9] *Paphiopedilum* Spring Starlight (*lawrenceanum* 'Syn Splendor' x Spring Moonbeam 'Lehua Dynamic Duo' HCC) AQ/AOS Exhibitor and Hybridizer: Lehua Orchids; photographer: Glen Barfield. Hawaii Judging

[10] *Paphiopedilum* Double Wood 'Slipper Zone Tall Red' AM/AOS (Delightfully Wood x Excitingly Wood) 81 pts. Exhibitor: Lehua Orchids; photographer: Glen Barfield. Hawaii Judging

[11] *Paphiopedilum* Avalon Love Stone 'Slipper Zone Yellow Dream' AM/AOS (Stone Lovely x Avalon Mist) 80 pts. Exhibitor: Lehua Orchids; photographer: Glen Barfield. Hawaii Judging

[12] *Rhyncholaeliocattleya* Maui Freckles 'Summer Spots' AM/AOS (Sun Spots x Pauwela Polka Dots) 84 pts. Exhibitor: Exotic Orchids of Maui; photographer: Michael Blietz. Hawaii Judging

[13] *Phalaenopsis* Chian Xen Pearl 'IS1540' AM/AOS (Ching Hua Spring x Nobby's Pink Lady) 83 pts. Exhibitor: Stanley Watanabe; photographer: Roy Andrade. Hawaii Judging

[14] *Paphiopedilum* Double Wood 'Slipper Zone Spots Rising' AM/AOS (Delightfully Wood x Excitingly Wood) 81 pts. Exhibitor: Lehua Orchids; photographer: Glen Barfield. Hawaii Judging

[15] *Dendrobium trichostomum* 'Natural World' CHM/AOS 82 pts. Exhibitor: Tropical Orchid Farm, Inc.; photographer: Michael Blietz. Hawaii Judging

[16] *Epidendrum horichii* 'Natural World' AM/AOS 84 pts. Exhibitor: Tropical Orchid Farm, Inc.; photographer: Michael Blietz. Hawaii Judging

[17] *Bulbophyllum dolichoglottis* 'Natural World' CBR/AOS. Exhibitor: Tropical Orchid Farm, Inc.; photographer: Michael Blietz. Hawaii Judging


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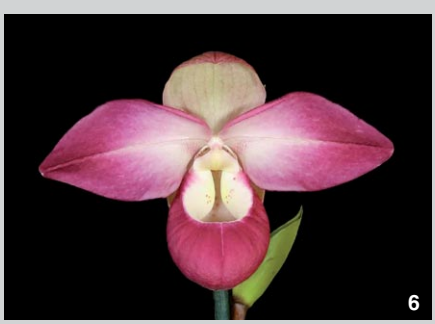
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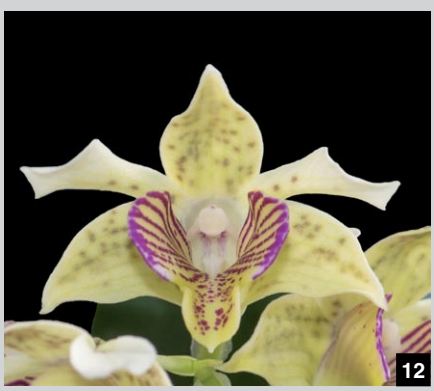
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[1] *Rodrumnia* Elation 'Mabel' AM/AOS (Tolumnia Festiva x Wiki Wiki) 83 pts. Exhibitor: Melvin Z. Waki; photographer: Roy Andrade. Hawaii Judging

[2] *Dendrobium* Violet Yamaji 'Nalo' CCE/AOS (Midnight x *spectabile*) 93 pts. Exhibitor: Walter Yamada; photographer: Roy Andrade. Hawaii Judging

[3] *Fredclarkeara* Kimberley Ariel 'Rare Earth Orchids' HCC/AOS (*Mormodia* Leopard Drops x *Catasetum expansum*) 77 pts. Exhibitor: Steve Moffitt; photographer: Malcolm McCorquodale. Houston Judging

[4] *Paphiopedilum rothschildianum* 'Toshi' AM/AOS 81 pts. Exhibitor: Mid-Pacific Orchids; photographer: Roy Andrade. Hawaii Judging

[5] *Dendrobium* Thomas Warne 'H&R' AM/AOS (Sanderae x *schuetzei*) 86 pts. Exhibitor: H & R Nurseries, Inc.; photographer: Roy Andrade. Hawaii Judging

[6] *Phragmipedium* Suzanne Decker 'Tulsa Time' AM/AOS (*kovachii* x Cape Sunset) 81 pts. Exhibitor: Kay Backues; photographer: Steve Marak. Mid-America Judging

[7] *Rhyncholaeliocattleya* Newberry Gumdrops 'LIB' HCC/AOS (*Cattleya* Final Touch x Lynette and Alan) 76 pts. Exhibitor: Larry Baker; photographer: Malcolm McCorquodale. Houston Judging

[8] *Dendrobium smilliae* 'Hiraishi' CCM/AOS 82 pts. Exhibitor: Walter Hiraishi; photographer: Roy Andrade. Hawaii Judging

[9] *Dendrobium* Ozark Atro 'Viktor' AM/AOS (Little Atro x *atroviolaceum*) 84 pts. Exhibitor: Lois Geren; photographer: Steve Marak. Mid-America Judging

[10] *Ophrys lutea* subsp. *lutea* 'Yellow Bird' AM/AOS 82 pts. Exhibitor: Doug and Beth Martin; photographer: Steve Marak. Mid-America Judging

[11] *Dendrobium spectabile* (hort. f.) *aurea* 'H & R' CCE-AM/AOS 91-85 pts. Exhibitor: H & R Nurseries, Inc.; photographer: Roy Andrade. Hawaii Judging

[12] *Dendrobium* Chocolate Chip 'Harri's Cutie-Pie' HCC/AOS (Micro Chip x *normanbyense*) 76 pts. Exhibitor: Harriet Davis; photographer: Malcolm McCorquodale. Houston Judging

[13] *Paphiopedilum* Lunar Dawn 'Windy Hill' AM/AOS (Honey Dew x Skip Bartlett) 81 pts. Exhibitor: Marilyn M. LeDoux; photographer: Melissa Garner. Mid-America Judging

[14] *Johnlagerara* Remar's Logan 'Nellie 2' HCC/AOS (*Rhyncatclia* Midnight Magenta (1972) x *Brassavola nodosa*) 79 pts. Exhibitor: Dennis Tomjack; photographer: Malcolm McCorquodale. Houston Judging

[15] *Trichocentrum splendidum* 'Desert Sands' AM/AOS 84 pts. Exhibitor: Kay Backues; photographer: Steve Marak. Mid-America Judging

[16] *Dendrobium* Memoria Carol Jean Clark 'Tanya' AM/AOS (Peter Shen x Little Atro) 82 pts. Exhibitor: Lois Geren; photographer: Steve Marak. Mid-America Judging


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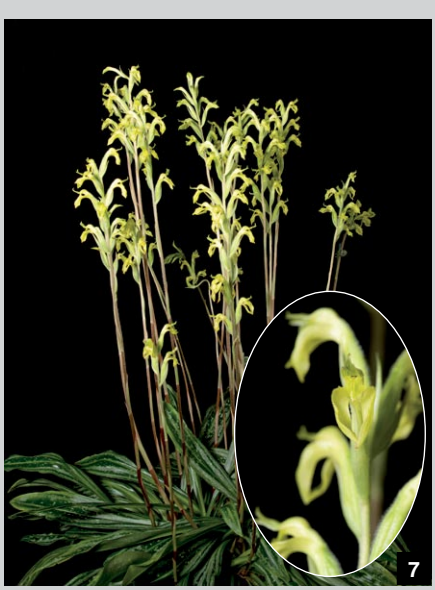
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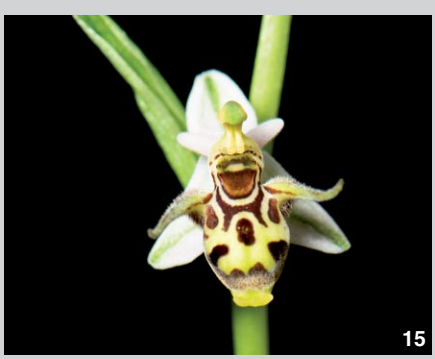

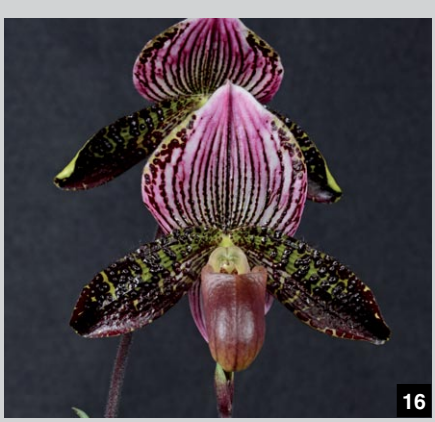

[1] *Orchis anthropophora* 'Da Man' CBR/AOS. Exhibitor: Doug and Beth Martin; photographer: Steve Marak. Mid-America Judging

[2] *Rhyncholaeliocattleya* Diana's Rubies 'Catspaw' AM/AOS (Memoria Irene Feil x Lebenkreis) 82 pts. Exhibitor: Craig and Diana Plahn; photographer: Melissa Garner. Mid-America Judging

[3] *Serapias strictiflora* 'Winter Green' CBR/AOS. Exhibitor: Doug and Beth Martin; photographer: Jim Pyrzynski. Mid-America Judging

[4] *Dendrobium rindjaniense* 'Forest's String of Pearls' CBR/AOS. Exhibitor: Randy Bayer; photographer: Melissa Garner. Mid-America Judging

[5] *Dendrobium scoriarum* 'Forest's Bloody Lip' CBR/AOS. Exhibitor: Randy Bayer; photographer: Melissa Garner. Mid-America Judging

[6] *Cattleya* Fire Magic 'Catspaw' AM/AOS (Tokyo Magic x Fire Fantasy) 83 pts. Exhibitor: Craig and Diana Plahn; photographer: Melissa Garner. Mid-America Judging

[7] *Sarcoglottis sceptrodes* 'Bryon' CCE/AOS 91 pts. Exhibitor: Bryon K. Rinke; photographer: Jim Pyrzynski. Mid-America Judging

[8] *Dendrobium* Royal Wings 'Windy Hill's White Wings' CCM-AM/AOS (Roy Tokunaga x Silver Wings) 83-85 pts. Exhibitor: Marilyn LeDoux; photographer: Melissa Garner. Mid-America Judging

[9] *Cattleya* Vermillion Fire 'Catspaw' AM/AOS (Seagulls Apricot x Jillian Lee) 81 pts. Exhibitor: Craig and Diana Plahn; photographer: Melissa Garner. Mid-America Judging

[10] *Thelymitra* × *macmillanii* 'Crimson Sunstar' CBR/AOS (*antennifera* x *rubra*). Exhibitor: Bart Jones; photographer: Melissa Garner. Mid-America Judging

[11] *Rhyncholaeliocattleya* Circle of Angels 'Catspaw' HCC/AOS (*Cattleya* Angel's Dream x Golden Circle) 77 pts. Exhibitor: Craig and Diana Plahn; photographer: Melissa Garner. Mid-America Judging

[12] *Diuris* Earwig 'Donkey Tails' CCE-AM/AOS (*corymbosa* x *sulphurea*) 91-83 pts. Exhibitor: Bart Jones; photographer: Melissa Garner. Mid-America Judging

[13] *Dendrobium lichenastrum* 'Mannell' HCC/AOS 78 pts. Exhibitor: Bryon K. Rinke; photographer: Bryon K Rinke. Mid-America Judging

[14] *Phragmipedium* Rosy Charm 'Jeanie's Delight' HCC/AOS (Memoria Dick Clements x *schlimii*) 78 pts. Exhibitor: Jean Rogers; photographer: Jim Pyrzynski. Mid-America Judging

[15] *Ophrys scolopax* ssp. *cornuta* 'Lil' Cutie' CBR/AOS. Exhibitor: Doug and Beth Martin; photographer: Jim Pyrzynski. Mid-America Judging

[16] *Paphiopedilum* Hsinying Leopard 'Not Mine But Hers' AM/AOS (Macabre x Ruby Leopard) 80 pts. Exhibitor: Andy Braun; photographer: Bayard Saraduke. Mid-Atlantic Judging


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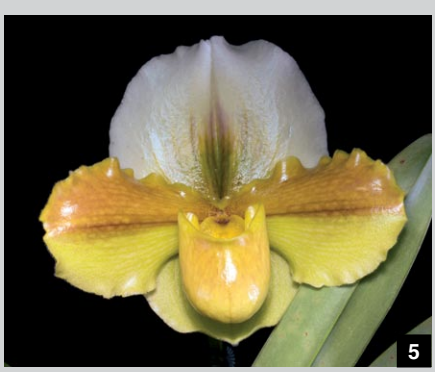
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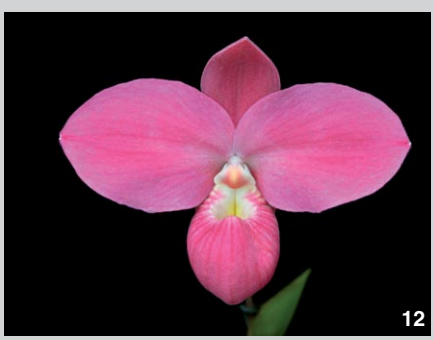
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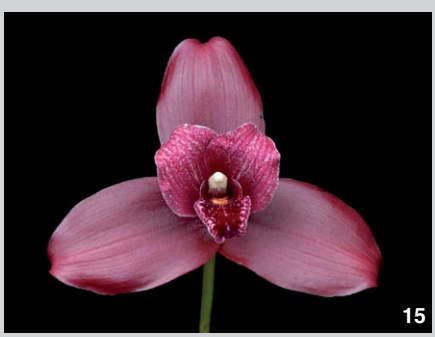
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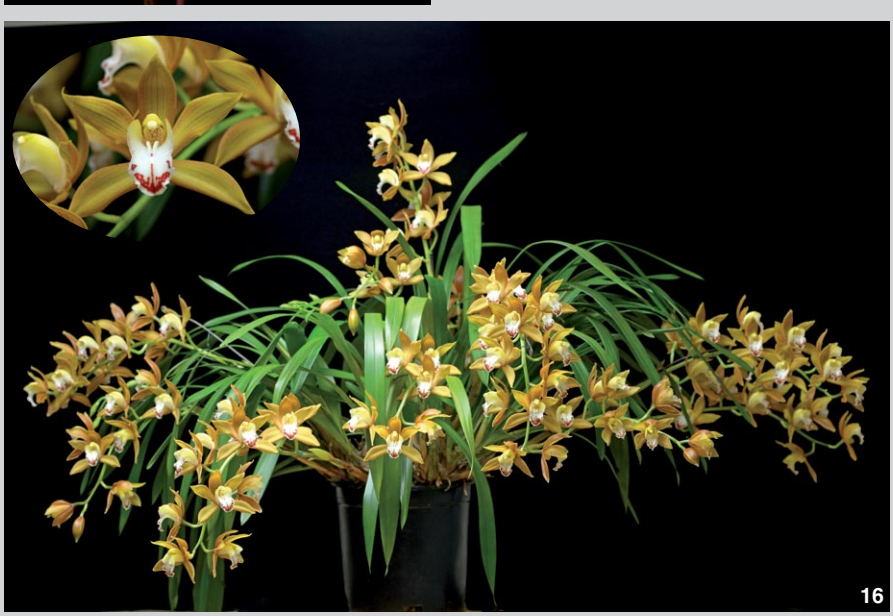
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[1] *Lysudamuloa* Red Jewel 'Champion Sunset' CCM/AOS (*Lycamerlycaste* Geyser Gold x *Angulocaste* Red Jade) 84 pts. Exhibitor: Mike Dunigan; photographer: David Oldham. Mid-Atlantic Judging

[2] *Dendrobium* Karloo's Blushes 'Longwood Gardens' CCE/AOS (Karloo x Rutherford Blushing Bride) 96 pts. Exhibitor: Waldor Orchids, Inc.; photographer: David Oldham. Mid-Atlantic Judging

[3] *Cattleya jongheana* 'Chickie' AM/AOS 84 pts. Exhibitor: Bayard Saraduke; photographer: Bayard Saraduke. Mid-Atlantic Judging

[4] *Cattleya* Pat Thrall 'Going to the Masters' AM/AOS (Bonanza Queen x Circle of Life) 82 pts. Exhibitor: David and Joan Rosenfeld; photographer: Bayard Saraduke. Mid-Atlantic Judging

[5] *Paphiopedilum* Alchemist's Gold 'Magnum' AM/AOS (Alex Szabo x Alchemy) 85 pts. Exhibitor: Marriott Orchids/Hadley Cash; photographer: Kim Frankenfield. National Capital Judging

[6] *Paphiopedilum* Macabre Illusion 'Penns Creek' HCC/AOS (Hawaiian Illusion x Macabre Contrasts) 77 pts. Exhibitor: Woodstream Orchids; photographer: Bryan Ramsay. National Capital Judging

[7] *Epicyclia* Serena O'Neill 'First Day of Spring' HCC/AOS (Mabel Kanda x *Encyclia cordigera*) 79 pts. Exhibitor: Sergey Skoropad; photographer: Bayard Saraduke. Mid-Atlantic Judging

[8] *Phalaenopsis amabilis* 'Rogan's White Gold' HCC/AOS 77 pts. Exhibitor: John Rogan; photographer: Bayard Saraduke. Mid-Atlantic Judging

[9] *Cymbidium sanderae* 'Emma Menninger 2N' HCC/AOS 78 pts. Exhibitor: Gordon M. Slaymaker; photographer: Bryan Ramsay. National Capital Judging

[10] *Paphiopedilum micranthum* (Eburneum) 'Spring Coulee Creek' AM/AOS 81 pts. Exhibitor: Woodstream Orchids; photographer: Bryan Ramsay. National Capital Judging

[11] *Dendrobium* Aussie's Mystic 'Memoria Monroe Kokin' CCM/AOS (Nellie Slade x *atroviolaceum*) 83 pts. Exhibitor: David and Joan Rosenfeld; photographer: Bayard Saraduke. Mid-Atlantic Judging

[12] *Phragmipedium* Haley Decker 'Little Alaska' AM/AOS (*kovachii* x Saint Ouen) 84 pts. Exhibitor: Woodstream Orchids; photographer: Bryan Ramsay. National Capital Judging

[13] *Phragmipedium* Eric Young 'Black Canyon' AM/AOS (*besseae* x *longifolium*) 86 pts. Exhibitor: Woodstream Orchids; photographer: Bryan Ramsay. National Capital Judging

[14] *Paphiopedilum appletonianum* 'Cherry Run' AM/AOS 84 pts. Exhibitor: Woodstream Orchids; photographer: Bryan Ramsay. National Capital Judging

[15] *Lycaste* Gamora Desire 'Merlot' AM/AOS (Flush with Desire x Gamora Ablaze) 84 pts. Exhibitor: David and Joan Rosenfeld; photographer: Bryan Ramsay. National Capital Judging

[16] *Cymbidium* Orange Nymph 'Cora' CCM-HCC/AOS (Orange Brandy x Wood Nymph) 85-78 pts. Exhibitor: John Sonnier: British Embassy Washington; photographer: Bryan Ramsay. National Capital Judging


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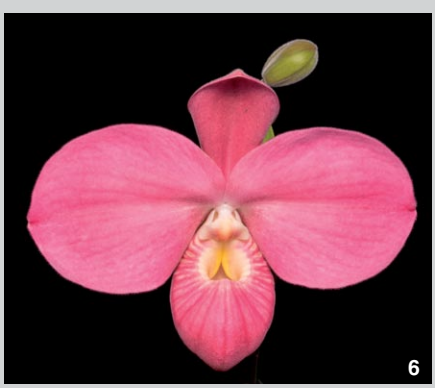
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[1] *Paphiopedilum sukhakulii* 'Peace of Mind' AM/AOS 81 pts. Exhibitor: Sergey Skoropad; photographer: Bryan Ramsay. National Capital Judging

[2] *Masdevallia* Snowbird 'Harford's Egret' CCM/AOS (*tovarensis* x *mejiana*) 88 pts. Exhibitor: The Little Greenhouse Tom McBride; photographer: Julie Rotramel. National Capital Judging

[3] *Phragmipedium* Rouge Bouillon 'Fire' AM/AOS (*dalessandroi* x Memoria Dick Clements) 82 pts. Exhibitor: Bill Keating; photographer: Julie Rotramel. National Capital Judging

[4] *Paphiopedilum* Hilo Black Eagle 'Roberts' AM/AOS (Johanna Burkhardt x *rothschildianum*) 80 pts. Exhibitor: Robert's Flower Supply; photographer: Kim Frankenfield. National Capital Judging

[5] *Cymbidium* Neon Lights 'Mini' HCC/AOS (Leprechaun x *insigne*) 79 pts. Exhibitor: John Dunkelberger; photographer: William Ammerman. National Capital Judging

[6] *Phragmipedium* Haley Decker 'Spring Coulee Creek' AM/AOS (*kovachii* x Saint Ouen) 89 pts. Exhibitor: Woodstream Orchids; photographer: Kim Frankenfield. National Capital Judging

[7] *Dendrobium* Kayla's Vista 'Madeline' AM/AOS (Golden Vista x Dunokayla) 81 pts. Exhibitor: Dick and Carol Doran; photographer: Maurice Garvey. Northeast Judging

[8] *Oberonia rufilabris* 'Jaleh' CCM/AOS 88 pts. Exhibitor: Hossein Noorbakhsh; photographer: Kim Frankenfield. National Capital Judging

[9] *Phragmipedium x richteri* 'Maggie' AM/AOS 80 pts. Exhibitor: Hossein Noorbakhsh; photographer: Kim Frankenfield. National Capital Judging

[10] *Tolumnia* Volcano Wave 'Virginia Wood' AM/AOS (Wave Dancer x Genting Volcano) 81 pts. Exhibitor: Shawn Wood; photographer: William Ammerman. National Capital Judging

[11] *Rodrumnia* The Hollow's Legacy 'Sulfur Sun' AM/AOS (*Tolumnia* Pine Hollow x Whiskey Hollow) 81 pts. Exhibitor: Jeanne Kaeding; photographer: William Ammerman. National Capital Judging

[12] *Paphiopedilum* Po Tree 'Nauti Artie' AM/AOS (Yellow Tree x *malipoense*) 82 pts. Exhibitor: Deborah and William Bodei; photographer: Maurice Garvey. Northeast Judging

[13] *Bulbophyllum dhaninivatii* 'Sue's Royal Tassels' CHM/AOS 81 pts. Exhibitor: Chuck and Sue Andersen; photographer: Robert Hesse. Northeast Judging

[14] *Oncidium* Illustre 'Volcano Queen' AM/AOS (*leucochilum* x *maculatum*) 80 pts. Exhibitor: Kit Hume; photographer: William Ammerman. National Capital Judging

[15] *Dendrobium* Kayla's Blush 'Memoria Roy Fox' AM/AOS (Blushing Vista x Dunokayla) 84 pts. Exhibitor: Dick and Carol Doran; photographer: Maurice Garvey. Northeast Judging

[16] *Dendrobium* Micro Chip 'Susquehanna Surprise' CCM/AOS (*normanbyense* x *aberrans*) 89 pts. Exhibitor: E. Jay Holcomb; photographer: William Ammerman. National Capital Judging


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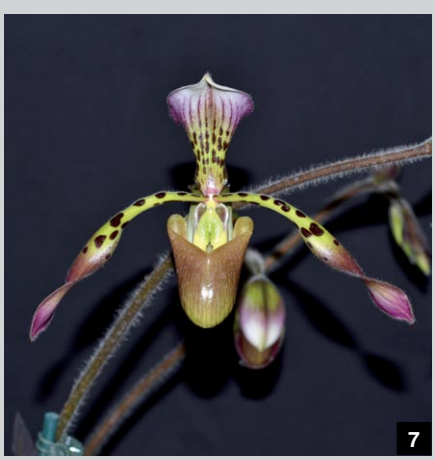
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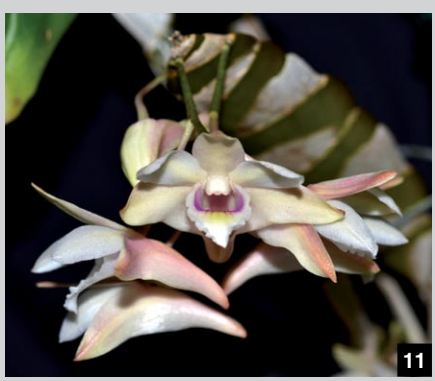
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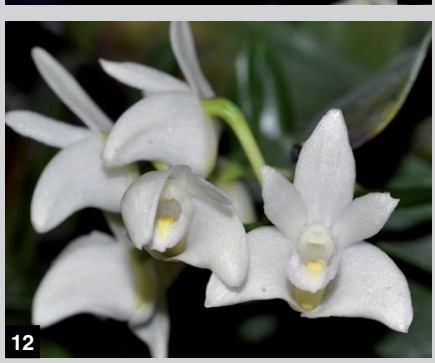
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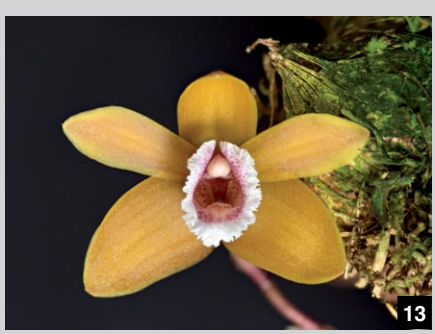
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[1] *Dendrobium violaceum* subsp. *violaceum* 'Hanging Gardens' CHM/AOS 84 pts. Exhibitor: Chuck and Sue Andersen; photographer: Robert Hesse. Northeast Judging

[2] *Paphiopedilum* Millennium 'XICO's' AM/AOS (Newtown x Spotted World) 81 pts. Exhibitor: Francisco Baptista; photographer: Japheth Ko. Pacific Central Judging

[3] *Cymbidium goeringii* 'Tristan' AM/AOS 83 pts. Exhibitor: Amy and Ken Jacobsen; photographer: Ken Jacobsen. Pacific Central Judging

[4] *Cattleya warscewiczii* (Alba) 'Adela' AM/AOS 86 pts. Exhibitor: Leon Tone; photographer: Bryan Ramsay. Pacific Northwest Judging

[5] *Phragmipedium* Inca Rose 'Velvet Kiss' AM/AOS (*besseae* x Pink Panther) 85 pts. Exhibitor: Lydia Pan; photographer: Gert Perry. Northeast Judging

[6] *Propetalum* La Jolla Delight 'JP's Kobold' HCC/AOS (*Promenaea stapelioides* x Zygopetalum Kiwi Dusk) 78 pts. Exhibitor: Ellen Kennedy; photographer: Robert Hesse. Northeast Judging

[7] *Paphiopedilum haynaldianum* 'Tavel' AM/AOS 81 pts. Exhibitor: Dave Sorokowsky; photographer: Ken Jacobsen. Pacific Central Judging

[8] *Sarcochilus* Kulnura Lemon 'Memoria Ellen Margron' HCC/AOS (Parma x Roberta) 76 pts. Exhibitor: Cynthia Battershall; photographer: Ken Jacobsen. Pacific Central Judging

[9] *Clowesia* Rebecca Northen 'Jeff's Baby' CCE/AOS (Grace Dunn x *rosea*) 90 pts. Exhibitor: Jeff Tyler; photographer: Japheth Ko. Pacific Central Judging

[10] *Chysis limminghei* 'Bonheur' AM/AOS 80 pts. Exhibitor: Lynne Murrell; photographer: Ken Jacobsen. Pacific Central Judging

[11] *Dendrobium platygastrium* 'Bailey's Best' HCC/AOS 78 pts. Exhibitor: Susan Anderson; photographer: Ken Jacobsen. Pacific Central Judging

[12] *Dendrobium x speciokingianum* 'Beryl Clarke' HCC/AOS (*kingianum* x *speciosum*) 79 pts. Exhibitor: Amy and Ken Jacobsen; photographer: Ken Jacobsen. Pacific Central Judging

[13] *Teuscheria wageneri* 'Claudia' CHM/AOS 86 pts. Exhibitor: Manuel Alejandro Berrio Restrepo; photographer: Bryan Ramsey. Pacific Northwest Judging

[14] *Dendrobium acutilingue* 'In Situ' CCM/AOS 83 pts. Exhibitor: Jeff Tyler; photographer: Japheth Ko. Pacific Central Judging

[15] *Paphiopedilum* Lady Rothschild 'Chasus' CCM/AOS (*rothschildianum* x Lady Isobel) 83 pts. Exhibitor: Charles and Susan Wilson; photographer: Ross Leach. Pacific Northwest Judging

[16] *Cymbidium x nishiuchianum* 'Double Prosperity' CCM-AM/AOS (*goeringii* x *kanran*) 85-81 pts. Exhibitor: Amy and Ken Jacobsen; photographer: Ken Jacobsen. Pacific Central Judging


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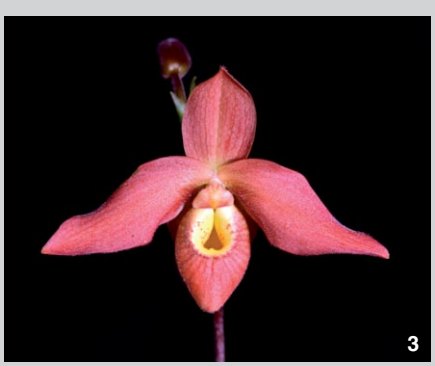
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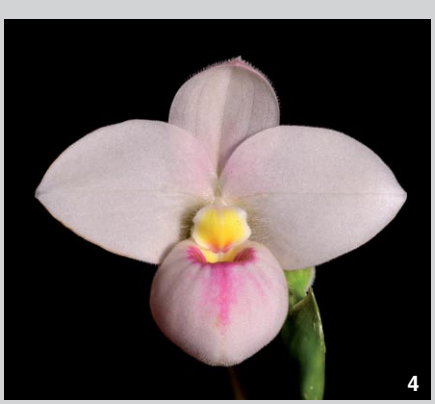
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[1] *Oncidium* Cristatellum 'Manual' AM/AOS (*cristatum* x *polyxanthum*) 82 pts. Exhibitor: Pilar Almanza; photographer: Bryan Ramsey. Pacific Northwest Judging

[2] *Phragmipedium* Manzur la Aldea 'Lucia' AM/AOS (*schlimii* var. *manzurii* x *besseae*) 80 pts. Exhibitor: Luz Maria Botero; photographer: Bryan Ramsay. Pacific Northwest Judging

[3] *Phragmipedium* La Rosiere 'Manzur la Aldea' HCC/AOS (Olaf Gruss x *besseae*) 78 pts. Exhibitor: David Manzur; photographer: Bryan Ramsay. Pacific Northwest Judging

[4] *Phragmipedium* La Aldea Sensacion 'Manzur la Aldea' HCC/AOS (Manzur la Aldea x *schlimii*) 78 pts. Exhibitor: David Manzur; photographer: Bryan Ramsay. Pacific Northwest Judging

[5] *Ornithocephalus tsubotae* 'Monica' CBR/AOS. Exhibitor: Jose Alejandro Romero; photographer: Bryan Ramsay. Pacific Northwest Judging

[6] *Stanhopea ospinae* 'La Pradera' AM/AOS 83 pts. Exhibitor: Juan Manuel Palacio; photographer: Bryan Ramsay. Pacific Northwest Judging

[7] *Stelis ciliaris* 'Romelia Maria Jose' CCM/AOS 83 pts. Exhibitor: Jose Fernando Londono; photographer: Bryan Ramsay. Pacific Northwest Judging

[8] *Paphiopedilum* Jeweled Venus 'Nora's Treasure' HCC/AOS (Jewel Green x Parisienne Venus) 79 pts. Exhibitor: Jolah Orchids; photographer: Mike Pearson. Pacific Northwest Judging

[9] *Paphiopedilum* Petula's Glamor 'Slipper Zone Magically Maroon' AM/AOS (Love Song x Petula's Magic) 82 pts. Exhibitor: Lehua Orchids; photographer: Eric Goo. Pacific South Judging

[10] *Bulbophyllum* Rachelle LCDO 'Orquivalle' AM/AOS (*frostii* x *fletcherianum*) 80 pts. Exhibitor: Orquideas Del Valle; photographer: Bryan Ramsey. Pacific Northwest Judging

[11] *Masdevallia peristeria* 'Jorge' CCM/AOS 87 pts. Exhibitor: Lucia de Gutierrez; photographer: Bryan Ramsay. Pacific Northwest Judging

[12] *Maxillaria acuminata* 'Copo de Nieve' CCE/AOS 90 pts. Exhibitor: Valeria de Estrada; photographer: Bryan Ramsay. Pacific Northwest Judging

[13] *Coelogyne lawrenceana* 'Manzur la Aldea' AM/AOS 82 pts. Exhibitor: David Manzur; photographer: Bryan Ramsay. Pacific Northwest Judging

[14] *Paphiopedilum* Macabre Love 'Slipper Zone Contrastingly Black' HCC/AOS (Love Song x Macabre Contrasts) 79 pts. Exhibitor: Lehua Orchids; photographer: Eric Goo. Pacific South Judging

[15] *Cuitlauzina pendula* 'La Mexicana' CCM/AOS 86 pts. Exhibitor: Vivero Medio Dapa; photographer: Bryan Ramsay. Pacific Northwest Judging

[16] *Epidendrum brachyrhodochilum* 'Entre Flores' CHM/AOS 86 pts. Exhibitor: Daniel Piedrahita-Thiriez; photographer: Bryan Ramsey. Pacific Northwest Judging


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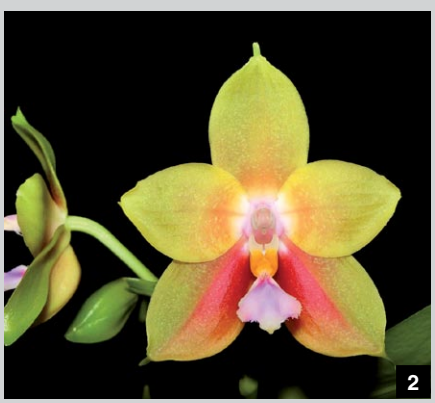
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[1] *Phragmipedium* Ruby Slippers 'Owen' HCC/AOS (*caudatum* x *besseae*) 77 pts. Exhibitor: Wes Addison; photographer: Eric Goo. Pacific South Judging

[2] *Phalaenopsis* Phoenix Passion 'Desert Sun' HCC/AOS (Hannover Passion x Penang Girl) 79 pts. Exhibitor: Eric Goo and Phoenix Orchids; photographer: Eric Goo. Pacific South Judging

[3] *Paphiopedilum* Snow Cloud 'Sunset Valley Orchids' HCC/AOS (*emersonii* x Fanaticum) 77 pts. Exhibitor: Fred Clarke; photographer: Arnold Gum. Pacific South Judging

[4] *Paphiopedilum* Lola Bird 'SVO Raspberry Jam' AM/AOS (*emersonii* x *micranthum*) 81 pts. Exhibitor: Fred Clarke; photographer: Arnold Gum. Pacific South Judging

[5] *Dendrobium tetragonum* 'Mabela' CCM/AOS 86 pts. Exhibitor: Andy's Orchids, Inc.; photographer: Arnold Gum. Pacific South Judging

[6] *Cymbidium* Jon Vickers 'Sycamore Creek' HCC/AOS (Bayaka Pendant x Mighty Tracey) 78 pts. Exhibitor: Bill Robson; photographer: Ramon De Los Santos. Pacific South Judging

[7] *Cymbidium goeringii* 'Rui Mei' HCC/AOS 75 pts. Exhibitor: Baozhong Zhu; photographer: Arthur Pinkers. Pacific South Judging

[8] *Cymbidium goeringii* 'Gui Yuan Mei' AM/AOS 80 pts. Exhibitor: Baozhong Zhu; photographer: Arthur Pinkers. Pacific South Judging

[9] *Phragmipedium* Frank Smith 'Gayle' AM/AOS (Grande x *kovachii*) 85 pts. Exhibitor: Gayle Brodie; photographer: Arthur Pinkers. Pacific South Judging

[10] *Cymbidium faberi* 'Tiger' JC/AOS. Exhibitor: Baozhong Zhu; photographer: Arthur Pinkers. Pacific South Judging

[11] *Cymbidium goeringii* 'Hannah' AM/AOS 85 pts. Exhibitor: The Orchid Place; photographer: Arnold Gum. Pacific South Judging

[12] *Paphiopedilum villosum* 'Mardi Gras' CCM/AOS 81 pts. Exhibitor: Deborah Halliday; photographer: Arnold Gum. Pacific South Judging

[13] *Ophrys sphegodes* var. *mammosa* 'Dispenzari' HCC/AOS 77 pts. Exhibitor: David Brown; photographer: Arnold Gum. Pacific South Judging

[14] *Rhyncholaeliocattleya* Remar's Harmony 'Arnie' HCC/AOS (Oro Verde Sutil x Marlene Lundquist) 75 pts. Exhibitor: Arnold Gum; photographer: Arnold Gum. Pacific South Judging

[15] *Dendrobium* Golden Arch 'Rick's Gold' AM/AOS (*speciosum* x Lynette Banks) 81 pts. Exhibitor: Rick Wells; photographer: Arnold Gum. Pacific South Judging

[16] *Dendrobium* Little Saigon 'Rainbow Valley' CCM/AOS (June Mac x *speciosum*) 84 pts. Exhibitor: Jerry and Anita Spencer; photographer: Arnold Gum. Pacific South Judging

Studies on *Oberonia* 7

Ten New Synonyms of *Oberonia equitans* (G. Forst.) Mutel Indicated by Morphology and Molecular Phylogeny

By Daniel L. Geiger, Benjamin J. Crain, Melissa K. McCormick and Dennis F. Whigham

ABSTRACT A combined morphological-molecular investigation identifies ten new synonyms of *Oberonia equitans* (G.Fost.)Mutel: *Oberonia affinis* Ames & C.Schweinf. *in* O.Ames, *Oberonia aurea* Schltr., *Oberonia ciliolata* Hook.f., *Oberonia enoensis* J.J.Sm., *Oberonia equitans* var. *chaperi* Finet, *Oberonia lampongensis* J.J.Sm., *Oberonia mcgregorii* Ames, *Oberonia murkelensis* J.J.Sm., *Oberonia oxystophyllum* J.J.Sm., and *Oberonia palawensis* Schltr. We designate here as neotype for *Oberonia palawensis Crain 198* US 3737901. The synonymies are supported by floral characters and habit of each named taxon, ecology and phenological data, and lack of differentiation in a molecular phylogeny. The species is shown to be widely distributed from Malaysia through French Polynesia based on examination of some 300 herbarium specimens. If the magnitude of over-naming in *Oberonia* is indicative of other intrageneric groups that are cryptic and/or difficult to identify in the field or from pressed herbarium specimens, diversity could be over-estimated by a third in such groups.

INTRODUCTION *Oberonia* is a genus of tropical and subtropical orchids ranging from Central Africa eastwards to French Polynesia. On the order of 470 names have been introduced for 200–300 species. The number of currently recognized species is by far too high, with large numbers of synonymies to be addressed (Bunpha et al. 2019; Geiger 2016, 2019a, in press a, unpubl. data).

Difficulties in sorting out identities of names arise from species that lack types and that were never illustrated. Furthermore, verbal descriptions are frequently difficult to match to biological species, particularly from geographic regions that have limited material in herbaria, such as the Republic of Palau in the Caroline Islands of Micronesia.

Fieldwork in Palau provided the impetus for the current study (Crain 2018). While various sources suggest that Palau is home to at least three species of *Oberonia* (Costion 2009, Costion and Lorence 2012, Hillman-Kitalong and Uesugi 2017), herbarium specimens for most of the species are sparse, and some of the type specimens are missing and/or questioned (Fosberg and Oliver 1991, Natural History Museum (NHM) 2014).

Oberonia palawensis Schtr. is a case in point. Ledermann's type specimen for the species (*Ledermann 14475*) is missing and only a few other specimens of the species are known to exist (Fosberg and Oliver 1991). Several specimens are housed in US: *Hosokawa 9100*; *Canfield 367, 666*; *Timberlake 3168*; *Fosberg 25740*; *Bowden-Kerby LR5796*; *Evans 619*. Two recent collecting trips to Palau yielded two additional *Oberonia* specimens that were preliminarily identified as *O. palawensis*. Each of these specimens was examined in detail to confirm its identity.

While we worked out the identity of the Palau specimens, it became clear that a much more far-reaching taxonomic issue needed to be tackled. We used a combined morphological–molecular approach to demonstrate that multiple described species all refer to one and the same biological species. We identified 10 new synonyms of *Oberonia equitans* (G.Forst.) Mutel in addition to the three already accepted ones.

MATERIALS AND METHODS *Light Microscopy.* Flowers on a herbarium sheet were imaged by applying z-stacking on a Zeiss Discovery V20 stereomicroscope with motorized focus and a 1.5x planapochromatic objective lens. Files of the stack were processed in ZereneStacker using the Pmax algorithm and then further adjusted in AffinityPhoto. For details see Geiger (2013, 2017).

Electron Microscopy. For scanning electron microscopy (SEM), preserved flowers were brought to 100 percent ethanol through three changes of 100 percent ethanol. The flowers were then critical-point dried in a Tousimis Autosamdri 815A (Tousimis, Rockville, Maryland) using default settings, mounted on double-sided carbon tabs (PELCO Image Tabs, Ted Pella, Redding, California) on aluminum stubs and coated with gold in a Cressington 108Auto with rotary planetary stage (Watford, United Kingdom). The flowers were imaged on a Zeiss EVO 40XVP or Zeiss EVO 10 LS SEM in variable pressure (30 Pa) at 20 kV and 50–500 pA depending on magnification and working distance.

Gatherings found in multiple institutions are cited with the most complete data. Standard repository abbreviations are used: DLG/HOAG indicates Daniel Geiger living collection/Geiger herbarium and spirit collection, Santa Barbara, California. For elevation and phenology information, data plots with local regression least square fitting were generated with DataGraph 4.3 (Visual Data Tools).

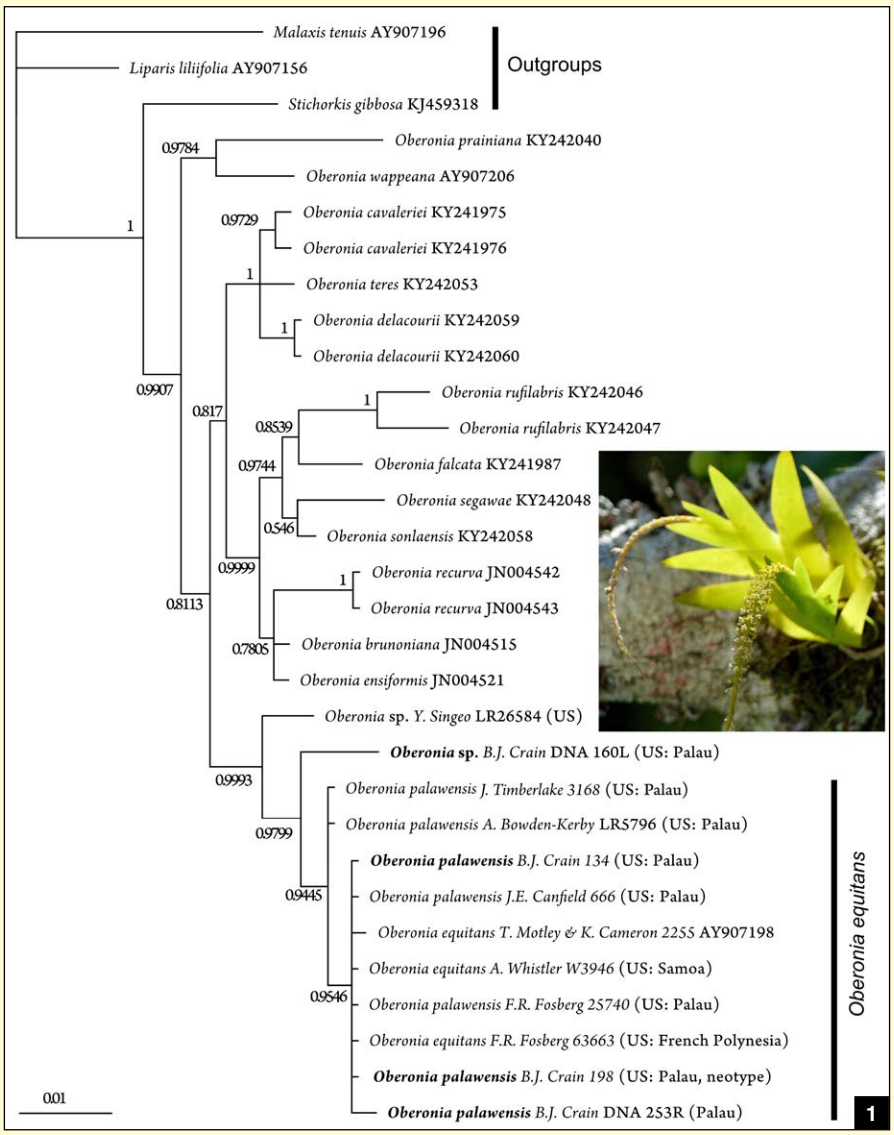
Molecular Analysis. Vegetative tissue samples were collected from four naturally growing individuals of *Oberonia* in the Republic of Palau to facilitate molecular identification. Each leaf and root tissue sample was stored in a sealed 2-ml microcentrifuge tube filled with CTAB buffer solution to preserve DNA, and then frozen at −20 C until processing in the laboratory. For DNA extraction, each tissue sample was removed from the tube with buffer and clipped into small fragments into a well of a 96-sample deep-well plate. For herbarium plant samples, a small (~1 cm^2) sample of leaf was similarly clipped into small fragments into a plate well. We extracted DNA from approximately 25 mg of plant tissue using a BioSprint 96 automated DNA extraction workstation with a BioSprint96 Plant DNA kit (Qiagen, Inc., Valencia, California) following the supplied protocol. After DNA extraction, we amplified the *matK* region of the chloroplast using matk1F/matK1R (Parveen et al. 2017) in a Bio-Rad C1000 Touch Thermal Cycler (Bio-Rad Laboratories, Inc., Hercules, California). We also amplified the internal transcribed spacer of the nuclear ribosomal repeat (ITS) and chloroplast *trnH/psbA*. These two additional loci amplified poorly from the herbarium specimens and gave similar phylogenetic patterns, so only the *matK* is presented here. We prefer an analysis based on a complete data matrix of fewer

markers to one with more markers but significant missing data.

Polymerase chain reaction (PCR) success was evaluated by electrophoresis on a 1 percent agarose gel, stained using Gel Red, and visualized on a transilluminator. All successful PCR products, defined as those producing a single band, were sequenced using Sanger Sequencing. PCR product was cleaned using ExoSap-IT (Applied Biosystems, Inc., Foster City, California) and subjected to sequencing reactions using BigDye v.3.1 (Applied Biosystems, Inc.) in quarter-strength half reactions, using 1 µl Big Dye 3.1, 2 µl Big Dye buffer, 1 µl 3.2 µmol primer, 5 µl H_2O and 5 µl (50–80 ng DNA) of PCR product, and otherwise followed manufacturer protocols. Sequencing reaction products were cleaned using Sephadex G-50 Fine (GE Healthcare Systems) and dried and analyzed on an ABI 3100 Sanger Sequencer. Sequences were manually checked for quality and trimmed. Forward and reverse sequences were combined into a single contig and discrepancies resolved manually in Sequencher v.5.4.6 (Gene Codes Corp.).

Phylogenetic analysis. We downloaded all *Oberonia matK* sequences from GenBank and aligned our sequences and the downloaded sequences using MUSCLE, implemented in Geneious Prime 2020.0.4 (BioMatters Ltd.) and checked manually. We retained a subset of the downloaded sequences to represent each clade and to demonstrate the amount of variation within a species. We used this approach to allow us to focus on phylogenetic identity of our focal samples, rather than on possible synonymies and identification issues in the genus as a whole. *Malaxis tenuis* (AY907196), *Liparis liliifolia* (AY907156), and *Stichorkis gibbosa* (KJ459318) were used as outgroup taxa. We then estimated phylogenetic trees using MrBayes, implemented in Geneious Prime 2020.0.4 (BioMatters Ltd., Auckland, New Zealand) and using a burn-in of 110,000, sample frequency of 200, total chain length of 1,100,000, four heated chains, a heated chain temperature of 0.2, GTR substitution model and gamma rate variation.

MOLECULAR RESULTS The molecular results support the morphologically derived synonymies (Fig. 1). The Palau specimens are interspersed with those from Samoa and French Polynesia, mostly in a major polytomy with rather short terminal branches. Two samples are separated in a distinct clade. However, the cumulative branch lengths of less than 0.5 percent within *O. equitans* are as long as or shorter than the terminal branch length in *Oberonia cavaleriei* Finet and *Oberonia rufilabris* Lindl. Those two species are easily identified and distinct. Accordingly, the cumulative branch lengths within *O. equitans* are compatible with a single species. Furthermore, the largest genetic differences are encountered within the rather small islands of the Palauan Archipelago, while the much more distant samples from Samoa and French Polynesia show no phylogenetic patterning at all, as they are found in a large polytomy. The voucher for *O. equitans* from Cameron (2005) *T. Motley & K. Cameron 2255* was most likely from New Caledonia (K. Cameron, pers. comm.) but the specimen cannot be found at the New York Botanical Garden herbarium (A. Weiss, pers. comm.) and is presumed lost. This sample was also positioned within the same polytomy as the Palauan samples and the more distant samples.



[1] *Oberonia* spp. *matK* phylogenetic tree inferred using MrBayes. The tree shows the relationships between field-collected samples in bold, herbarium specimens, and selected GenBank sequences for references. Values at each node are posterior probabilities. Insert: In situ photograph of *Oberonia equitans* in Palau courtesy of B.J. Crain.

We consider this detail of the topology a random result of limited sampling.

Sample *Oberonia* sp. *B.J.Crain 160L* was conservatively not included under *O. equitans*. The specimen was not in flower, for which reason the identity could not be positively confirmed. Given the extensive vegetative phenotypic plasticity of *Oberonia* spp., the overall rather poor understanding of distributional limits of species in the genus, and the fact that three species of *Oberonia* have been reported from Palau (none of which have molecular data for comparison),

we take the conservative approach of referring to it as *Oberonia* sp. The internal and cumulative branch lengths are compatible with either a single sample of a distinct species, or a further sample of *O. equitans*.

The tree is well supported at the relevant nodes with posterior probabilities >0.94. Some internal nodes are less well supported, with posterior probabilities as low as 0.55, which should be considered unresolved. Those low support values are most likely due to incomplete taxon sampling of a genus with approximately 200 species.

The marker *matK* may be considered of insufficient discriminating power by some who prefer a set consisting of *rbcL + matK + ITS*. The clean results with samples from the same species forming well-supported clades in every single case (*O. cavaleriei*, *Oberonia delacourii* Gagnep., *O. rufilabris*, *Oberonia recurva* Lindl.) indicate that for the purpose of this investigation *matK* provides the necessary information. Additionally, taking into account within- and between-species branch length and the associated morphological data further supports our conclusion.

Li et al. (2016) found a similar short branch length polytomy for 15 samples of *Oberonia jenkinsiana* Griff. ex Lindl. and its not yet formally recognized synonym *Oberonia austro-yunnanensis* S.C.Chen & Z.H.Tsi in their Bayesian phylogeny based on *matK + ITS*, while other species such as the 13 samples of *Oberonia caulescens* showed more structuring. Terminal and internal branch lengths varied in a similar way as in our analysis, and support values were similarly strong. Relative branch lengths were similar in species common to both studies. The terminal and internal branch lengths of *O. rufilabris* were longer than those of *O. cavaleriei*, which were longer than those of *O. delacourii*, suggesting that *matK* is an adequate estimator for the assessment of species boundaries.

As an aside, the spelling of *O. austro-yunnanensis* should retain the hyphen in accordance with ICN Art. 60.11 Ex. 41 (contra World Checklist of Selected Plant Families 2020).

SYSTEMATICS

***Oberonia equitans* (G. Forst.) Mutel, 1837**

Basionym. *Epidendrum equitans* Forster, 1786: 60. Type. *G. Forster 170* lectotype BM (not seen; designated by Kores 1989: 57). *G. Forster 192* isotype/isolectotype BM000084364, P [not seen in 2019, not in P database]. Possible isotype BM 000082099 *Forster s.n.*, sine loc. Isolectotype Moscow State University Herbarium, fide US herbarium sheet photo. Tahiti.

Oberonia glandulosa: Lindley, 1859: 6. [nomen illeg.]. Type. *Kartalsky (Prescott) s.n.* (K), *Matthews 158* (syntype E00373990, K s.n.), Otaheite [=Tahiti]. No lectotype has been designated (Kores 1991).

Oberonia aurea Schlechter *in* K. Schumann & Lauterbach, 1905: 109. Type. *Schlechter 14673* (syntype: B lost). Mountain forest near Punam, Neu Mecklenburg, 600 m. Syn. nov.

Oberonia ciliolata Hooker, 1890: 181. *Ridley s.n.*; *Ridley [375]* (syntype K 000943006: basis of Hooker (1895: pl. 2318), SING 0047511); not BM000088559: is lectotype of *O. dissitiflora*, see remarks. Krangi, Singapore. Syn. nov.

Oberonia oxystophyllum J. J. Smith, 1905: 237–238. Type. *Herb. Lugd. Bat. 904, 84–127,* now *[Korthals s.n.]*, syntype L 0091768, [*Hallier s.n.*] K 000942986), Gede, near Tjibodas; Patoeba, Java, [Indonesia] [6.788S 106.982E]. Reference by Smith to —128—130? cannot be considered type material, because it was not unambiguously assigned to the taxon. Syn. nov.

Oberonia flexuosa Schlechter, 1906: 62. Type. *Schlechter 15496* (syntype B: lost). On trees along streams in the mountains near Ou Hinna, New Caldeonia.

Oberonia mcgregorii Ames, 1907: 321–322. Type. *R. C. McGregor 291* (syntype AMES 9919/Harvard Barcode 00101991), Balete, Baco River, Mindoro, Phillippines. Syn. nov.

Oberonia equitans var. *chaperi* Finet, 1908: 337, pl. 10, figs 29–30. Type. (iconotype), ubi?

Oberonia lampongensis Smith, 1917: 22. Type. *H. A. Gusdorf living Culture In Hort Bogor. sub numero 62 pro parte* (syntype). Lampong near Menggala, Sumatra. Syn. nov. of *O. equitans*.

Oberonia affinis Ames & C. Schweinfurt *in* Ames, 1920: 79–81, pl. 89, figs. II, 2. Type. *Clemens J. 102* syntypes AMES 16978, 16979; Harvard Bar Code 00101935, 00101936, BM000088335, E00394089, F 493793, K 000942995, MO 68377, MO 6837753, P02291942, SING 0043926, US 1170971, Lobang, Cave, 5,000 feet (= 1,666 m). *Clemens 275*, syntype, Marei Parei Spur. *Clemens 380*, syntype, Kiau. Syn. nov.

Oberonia palawensis Schlechter, 1921: 462–463. Type. *C. Ledermann 14475* (syntype B: lost: Fosberg and Oliver 1991), Palau, near Ngatkip on Babelthaob, Palau, 50 m (7.382N 134.513E). Neotype *Crain 198* US 3737901 here designated. Ngardok Nature Reserve, Melekeok, Babeldaob, Palau. Syn. nov.

Oberonia enoensis Smith, 1928a: 454–455. Type. *Toxopeus 94* syntype L0061740, Boeroe: Wai Eno, 600 m (protologue). Buru, Maluku, Moluccas, Indonesia (type label). Syn. nov.

Oberonia murkelensis Smith, 1928b: 125. Type. *Kornassi ex Ruten 1457*, syntype L 0061788, Goenoeng Moerkele [= Gunung Murkele], Central Seran, [Sumbawa], Moluccas, Indonesia, 1000–1900 m. Syn. nov.

MATERIAL EXAMINED

Thailand. *Kerr 610* K 0000596120. Bangkok.

Malasysia. *UNESCO 420, 421* SING 0141326. Ulu Kelantan, Gua Musang, Malaya. *UNESCO Limestone expedition 1962 421* K s.n. Gua Muang, Ulu. *Native Collector/Synge 447* K s.n. Mount Dulit, Dulit Ridge, Sarawak, 1,240 m. *Haviland s.n.* SING 0141407. Sarawak. *Hewitt 15* SING 0141408. Sarawak. *Carr s.n.* SING 0141415. Mount Kinabalu, Koung, Sarawak, 400 m. *Henderson 332* SING 0141327. Kot Glanggi, Pahang. *Henderson 22446a* SING 0141321. Kota Glanggi, Pahang. *Mot Nur s.n*. SING 0141322. Bukit Sagu, Pahang, 300 m. *E Rostado s.n.* SING 0141323. Bundi, Tringganu. *R Denny 313* SING 0141324, 0141328. Sungli Rambai, Malacca. *Ridley 313* BM 000088324. Malacca. *R Derry s.n*. SING 0141326. Sungei Kesang. *Lugas 1489* K s.n. Sabah, Kampung Melangkap Tomis, Sekitar Kampung Melangkap Tomis, 400 m. *Carr 3659, SNF 27982* SING 0141402, SING 0022049 [spirit] Sabah, Bundu Tuhan, 1,400 m. *Carr SFN 26371* SING 0141401 Sabah, Dahobong River on label, Tahubant River in citation, 1,100 m. *Clemens 40924 B* s.n., E 00616203, K s.n. Sabah, Penibukan near Pinokkok Falls, 1,600–2,300 m. *Clemens 40822* BM 000088329, K s.n. Sabah, Penibukan, belos Pinokkok falls, 1,500 m. *Clemens 50240* B. s.n., BM 000088331, K s.n Sabah, Mount Kinabalu, Tenomopok, 1,650 m. *Clemens 40861* BM 000088330 Sabah, Mount Kinabalu Penibuka, Side Ridge E of camp, 1,350 m.

Papua New Guinea. *Carr 10494* CANB 61947, SING 0141467. Lala River, 1,770 m. *Carr 17128* BM 000088388. Kokoda. *Carr 17084* BM 000088410. Kokoda. *Carr 10494* BM 000088415. Lala River, 1,800 m. *Millar NGF 38328* CANB 212585, K s.n., SING 0141492. Watabung, Goroka subdistrict, Eastern Highlands, 2,300

m. *Millar NGF 38328* K s.n. Watabung, Goroka subdistricts, Eastern Highlands, 2,300 m. *Millar & Dockrill 22868* K s.n. Island of Kui Morobe, 15 m.

Singapore. *Ridley s.n.* BM 000088324. Krangi. *Ridley 2034* BM 000088337, MEL s.n., SING 0010910. Cahn ctran Kang, 23 m. *Ridley 2034a* BM 000088377, K s.n., MEL s.n., SING 0010908. Changi. *JJ Smith s.n*. SING 0010913. Suna Murai?. *JS Goodenough s.n*. SING 0010912. Krangi. *Ridley 10153* SING 0010907. Bukit Tumiak? Road. *Sinclair 5129* E00616464. Seletar forest behind Kee Soon Village.

Indonesia. *Balgooy 3669* K s.n. Lake Matano south, between Soroako and Matano, Sulawesi, 400 m. *SBGO 3291* SING 0141504. Sulawesi, Desa Baruppu, Kampong Bubuk, 1,600–1,700 m. *de Vogel 6062* K s.n. Selatan, N shore of Lake Matano, E of Nuha, Sulawesi, 450 m. *Vermeulen & Dustermaat 972* K s.n. interior zone, along trail Long Pa Sia–Long Samado, near crossing with S Malabid, Sabah, 1,300 m. *SBGO 3392* SING 0141501. Lower slopes of E flank Rantepao-Paloppo divide, Sulawesi, 300–400 m. *SGBO 3393* SING 0141503. Lower slopes of E flank Rantepao-Paloppo divide, Sulawesi, 300–400 m. *Alston 13852* BM 000088423. Kambahan, near Lubuksikaping, Sumatra, 300 m. *Haviland 841* K s.n., Borneo. *JJ Smith 22* SING 0141440. Tiibodas?, Java. *Zollinger s.n.* W Reichenbach 12598. Java, 500 m. *S. Darutan 355* BM 000088341. Borneo, 1 mile of Kahung, downstream, 430 m. *Everard Im Thurn 34* P 00310614. [Java] Drake Range, W of Matakin, Colo North, 1,300 m. *Comber 1395* K s.n. Java, Arjuno Weliran, NW above Trawas, 1,370 m. *Comber 1559* K s.n. Java, G Lamongan S of Probolinggo, 510 m. *Comber 1557* K s.n. Java, G Raung S., 1,100 m. *SFN 8155* SING 0141439. Java, Tjibodas on G Godela, 1,500 m. *Chaper s.n*. P 00364386. Borneo. *de Vogel & Vermeulen 7185* K s.n. Celebes, Utara Bolaang Mongondow, Gunung ambang Nature Reserve, Danau Mooat area, 1,000 m.

Phillippines. *Reillo 16* MO 799956. Luzon, Laguna.

Palau. *Canfield 666* US 3293387. Oreor [= Koror]. *Timberlake 3168* US 3293383. Aimeliik, Babeldaob (note: specimen is listed as coming from the island of Oreor [= Koror]; however, the State of Aimeliik is on the island of Babeldaob, which is just north of Koror). *Fosberg 25740* US 3293386. Babelthuap [= Babeldaob], 0–20 m. *Bowden-Kerby Lr 5796* US 3293385. Babelthuap [= Babeldaob], 0–10 m. *Evans 619* US 3293384. Aulupse'el = [Ulebsechel] ?, Risong Bay, Koror, 0–50 m. *Canfield 367* US 3293388. Ngatpang, Babelthuap [= Babeldaob], 5 m. *Hosokawa 9100* US 3726606. Babelthuap [= Babeldaob]. *Crain 134* US 3694789. Ngeruktabel, Koror. *Crain 198* US 3737901. Ngardok Nature Reserve, Melekeok, Babeldaob. *Canfield 366* US 3296687. Ngelobel (Ashakasengu) Island, S Koror Municipality, inlet on NW side of island, 1 m. *Timberlake 3168* US 32993383. Skillang's Paddok (Tulau), Imutsubech, Aimeliik State.

New Caledonia. *Vieillard 3296* P 00081696, 00081697. *Whitmee s.n.* BM 000088469. Loyality Islands Lifu. *MacKee 21978* P 00081685. Oue Koura, haute de Dothio 40 m. *Le Rat s.n*. P 00081684. Sable Unio. *MacKee 26296* P 00081686. Kone, Mount Tandji, 800–900 m. *MacKee 31023* P 00081687. Col d'Amieu, mont Pembai, 800 m. *Hurliman 1163* P 00081683. Paoué valley, south flank, Tipindje, 500 m. *MacKee 33678* P 00081688. Hienghene, Kavatch, 200 m. *MacKee 42529* P 00081680. Noiumea, Haute Amoa, Pomanhou, 500 m. *Veillon 2123* P 00081690. Katrikoin, Launay, 300 m. *Dagostini & Barriere 1281* P 02102974. Tiebahi, 500 m. *Guillaumin 9866* P 00081682. Between Ponerihonen and Honaiton. *McPherson 2562* P 00081701. Mount Panié, 20 air km NW of Hienghénee, 500 m.

Vanuatu. *Macdonald 4* MEL 569474. Aneitum. *HF Moore 277* US 00241464. Maewo. *Morrison s.n*. K s.n. Efate Nudine Bay. *Morrison s.n.* K s.n. Hills between Unum & Anilgnkot/Anitzem. *Morrison s.n.* K s.n. Efate Hills Nudum Bay. *Whatley 104* K s.n. Pentecost Village, Ena, 290 m. *Smith 1485* K s.n., P 00310616. Vanua Mbalavu, 0–200 m. *Schmid 3624* P 00310683. Anatom. *Raynal 15994* P 00310684. Ikouroup Tanna.

Wallis and Futuna. *Veillon 5108* P 00310685 Futuna, Alofi, north slope 300 m. *Hoff 4053* P 00310687. Futuna, Mount Puke, 450–500 m. *Morat 7084* P 00310686 Mount Lulu.

Niue. *Williams 9598* MICH s.n. S of Alofi village, 20 m.

Samoa. *Le Guillou s.n*. P 00310618. *Sin. coll., s.n.* W 3066. Savaii approx. 100 m. *WA Whistler W2638* K s.n., US 00241470. Savai'i, W of Mauga Mu 1550 m. *Rechinger 1589* W Reichenbach 3063. Savaii Aopo, 300 m. *Rechinger 16* W Reichenbach 3064. Savaii, Lalatelle. *Rechinger 127* W Reichenbach 3062. Savaii, between Sassina and Aopo. *Graeffe s.n*. W Reichenbach 8372 W68800. Upolu. *HE Parks 16237a* US 00241481. Upolu, near Tiai, 720 m. *WA Whistler W204* US 00241469. Upolu. *F Reinecke 184* US 00241483. Upolu. *WA Whistler 3946* US 00241456. Namua. *Reinecke 184* E 00616504, WU s.n. Upolu, Vailale ridge. *Whistler 2906* K s.n. Tutuila, Mount Tau, 350 m. *Mansfeld 172* K s.n. Upolu, swamp near Tiavi, 720 m. *K & L. Rechinger s.n*. W Reichenbach 3065. Tutuila, Pago-Pago.

Tonga. *Parks 16237* MO 1035159. Eua, Plateau, exposed rocks. *Parks 16237A* BM 000088471, US 00241482. Eua, Plateau. *Yucker 15402* BM 000088470, US 00241473. Eua, above Riechelmann's Fuai plantation near center of island, 245 m.

Cook Islands. *A. Whistler 5825* US 01232921. Mangaia. *Sin. coll., s.n*. Reichenbach 37743 W68916. Mangaia Island. *WA Whistler W5038* US 00447248. Rarotonga, E of Ikurangi. *WR Phillipson 10132* US 00445241. *Luttril 350* K s.n. Rarotonga. *Cheeseman 675* K s.n. Rarotonga, central part of island. *Wilder 8* K s.n. Rarotonga.

Fiji. *Seemann 588* MEL s.n., BM 000088468, K s.n., P 00310615, W Reichenbach 37814. Navua and Manar. *Parham 1823* K s.n. Naitasiri, above Wamawaya, 50 m. *Daanu 82* K s.n. Kurovisilou, Serau, 100 m. *AC Smith 7075A* US 00241472. Viti Levu. *AC Smith 7469* US 00241471. Ovalau. *AC Smith 7551* US 00241465, K s.n. Ovalau, Valley of Mbureta and Lovin Rivers, 20–50 m. *AC Smith 8586* US 00241466, K s.n. Viti Levu, Namosi Hill, bordering Winavindrau Creek in vicinity of Wainimakutu, 150–200 m. *AC Smith 1485* US 00241479. Eastern Division, Vanua Balavu (Mbalavu). *AC Smith 5241* US 00241476. Viti Levu, Western Division. *AC Smith 5528* US 00241475, K s.n. Viti Levu, Western Division, Nandroga and Navosa, N portion of Rairaimatuku Plateau, between Nandrau and Nanga, 725–825 m. *AC Smith 5751* US 00241474, K s.n., P 00310613 [top specimen only]. Viti Levu, Central Division, Naitasiri, N portion of Rairaimatuku Plateau between mount Tomanivi/Victoria and Nsasonggo, 870–970 m. *Greenwood 1112* K s.n. Viti Levu, Naitasiri, near Nasinu. *Vaughan 3181* K s.n. Viti Levu, Tamavna Ridge, mile 6, 200 m. *Meebold 16813* K s.n. Suva, 9 miles above Suva. *Greenwood 1155* K s.n. Viti Levu, Lautoka, Mount Evans, 750 m. *Smith 1731* K s.n., P 00310617. Vanua Levu, Mbua Lower Winunu river valley, 0–200 m *Greenwood 209* K s.n. Mount Lautoka, 260 m *Tothill & Tothill 511* K s.n. Suva, Central Road. *Tothill & Tothill 883* K s.n. Viti Levu, Suva, Central Road. Parham 147 K s.n. Viti Levu, Rewa Province, Mount Korobaba, 260 m. *Vaughan 3181* BM 000088472. Tamavua Ridge, Mile 6, 200 m.

French Polynesia. Tahiti. *J Banks &*

DC Solander 430 US 00241463. *Banks & Solander s.n*. F 694765. *Expedition Novara 117* W68918. *Sin. coll., s.n.* W Reichenbach 11734 W68802. *Setchell & Parks 430* P 00310665. *Richard s.n.* P 00310674. *Pancher 3* P 00310663. *Vieillard 3* P 00310668. *Vesco s.n.* P 00310667. *Vesco s.n.* P 00310666. *Ribiourt 82* P 00310676. *Vieillard s.n.* P 00310672. *Vieillard s.n.* P 00402800. *Vieillard s.n.* P 00310673. *Morrenhout s.n.* P 00310677. *Lepine s.n*. P 00310678. *Lay & Collie s.n*. BM 000088474. *Sin. coll. s.n.* BM 000088473. *Shuttleworth s.n.* BM 000088473. *Grandjean s.n.* P 017712107. *WA Setchell & HE Parks 430* US 00241462. *Florence 2482* P 00310669. Mount Marau, Sentier du Pic Vert 1,240 m. *Hallé 6931* P 00310680. Tahiti, route of Mount Marau 700 m. *Hallé 6937* P 00310679. Riv. Vaihiria valley 50–60 m. *Hallé 6993* P 00310671. Punaahuia, S of Papeete, 300 m. *Raynal & Taureau 16546* P 00310664. Road of Aorai, between Fare Hamuta and le Belvedere 950 m. *Savatier s.n*. P 00310675, P 00310682. Vallée de la reine. *ML Grant 3613* US 01104522. Punaauia Diadem district, 491 m. *FR Fosberg 63613* US 00619673. 5–20 m. *FR Fosberg 62965* US 00619672. Papeete, headwater of Tipaerui River, 950–1,000 m. *Florence & Sykes 11342* US 00689598. Papeete, 80 m. *Balgooy 1677* MO 2228544. Mahina Valley, 700 m. *ML Grant 3613* P 00310653. Punaauia Diadem district, 491 m.

Bora Bora. *D'Urville 1061* P 00310645. *D'Urville s.n*. P 00310650. *MMJ Balgooy 1942* CANB 00583505, K s.n. W slope of Pahia, 100 m. *Florence 12107* P 00360516. Faanui, Mount Pahia, E flank, 420 m.

Huahine. L Dunn 511 US 01076801. *Mouly 496* P 00592106. Flancs of the Vaiparao valley, 200 m. *J Florence & Tahuaitu 11583* P 00310656, US 00445241. Fare, Mount Mato Ereere, N crest, 425 m.

Florence & Tahuaitu 11566 P 00310655. Fare, Pipihaua valley, right flank, 130 m.

Moorea. HM Smith 8 US 00241458. *FR Fosberg 63663* US 00619701. *M-H Sachet 2542* US 00619665. *FR Fosberg 60957* P 00310569, US 00619674. Ridge above Le Belvedere, head of Hpunohu Valley. *Cronk et al. T62* E s.n. SW valleys, Patiri valley, 300 m. *Raynal 17930* P 00310648. Moo Afaretaitu. *Jolinon 1334* P 00310654. Vaiare hill summit. *Smith 8* P 00310660. Opunohu–Roroie District. *Florence 8318* P 00310661. Haapiti, crest between the high valleys of Vaianae and Atiha, 350 m. *Birnbaum 75* P 00310657. Afareiatu, Haute Nauroa 700 m.

Makatea. GP Wilder 1141 K s.n., US 00241480. 60 m. *Jones 861* K s.n., P 00310620. 100 m.

Meetia. St. John 14198 F 1438060, K s.n., MO 1638487, P 00310643, US 00241478, W Reichenbach 5315 W68919. Fatia-po to Fareura, 200 m.

Raiatea. *GH Gagné 1786* US 00619667. 475 m. *Welch et al. 26616* MO 5796911. Trail to Temehani Ute Ute, 450 m. *Welch et al. 26619* MO 5796913. Trail to Temehani Ute Ute, 400 m. *Moore 129* MO 2196179. Valley W of Uturoa, 280 m. *Moore 410* MO 2196301. Opua Valley, 100 m. *Morat 9683* P 00310649. Temehani ute, 150 m. *Florence 10351* P 003110658. Uturoa, Mount Tapioi, 230 m. *Mouly 377* P 00591985. Vaiaou valley, 200 m.

Funaauia. *Florence 8195* P 00310652. Punaruu valley, Fare Anani, 430 m.

Raupiti. *Raynal 17854* P 003106466, P 003106467. Mount Tiriano, 260 m.

Tahaa. *Florence 10631* P 00310662. Mount Purauti, SE crest, 245 m.

Austral Islands. Ruruto. *Hallé s.n*. B s.n. N part. *Hallé 7284* P 00310630. N of Avera. *Forence 5567* P 00310635. Unaa, N of Tetuanui plateau, high Vaire, 205 m. *Hallé 7163* P 00310628, US 00241452. Naairoa. *Hallé 7082* P 00310631. Prise d'eau de Tetuanui. *H St. John 16741* F 1438056. Arei, 75 m. *N Hallé 7239* P 00310629, US 00241451. Middle Vaitotai. *Florence 9240* P 00310623. Rurutu, Rairiri, East, below T Anaoeva, 110 m. *Florence 9180* P 00310622. Tetuanui Plateau, NW sector, 210 m. *Hallé 6648[b?]* K s.n. Middle Saitotai. *Forence 5703* P 00310636.

Raivavae. Anatonu, foot of the cliff below Mount Hiro, 160 m. *Florence & Sykes 11342* P 00310621. Vaiiuru, Turani valley, 80 m. *N Hallé 7082* CANB 8602862, K s.n., US 00241453. N of island, spring of Cetuanin.

Rapa. *G Paulay 85* US 00619675. 200 m. *Hallé 7694* P 00310632. SSE Pukumia, 185 m. *Hallé 7619* P 00310633. SSE Pukukia, 200 m. *Sykes 161* CHR 495761 K s.n. Valley behind Vairua. *John & Fosbert 15976* K s.n., P 00310634. Pic Rouge, S slope, 80 m.

Tubuai. *SH Shomer 6761* US 00241468. *SH Shomer 6692* US 00241467. 300–325 m. *Hallé 6648* K s.n., P 00310627, US 00241455. Below coffee plantation of Tamatoa, 25–35 m. *Hallé 6884* P 00310624. N of Mahu, 250 m. *Hallé 6673* P 00310626, US 00241454. Mahu. *Hallé 6755* P 00310625. Mont de la Prise d'eau de Mataura, 60–80 m. *St. John 16349* MO 1638532. Taitaa NE slope, 330 m.

REMARKS

In the genus *Oberonia*, the species epithet *equitans* is highly confused because it was introduced by several authors, with subsequent authors creating primary and secondary homonyms:

- *Epidendrum equitans* Forster = *Oberonia equitans* (Forster) Mutel, correct: Malaya to Western Pacific Islands.
- *Cymbidium equitans* Thouars = *Oberonia equitans* (Thouars) Lindley, synonym of *Oberonia disticha* (Lam.) Schltr.: East Africa.
- *Malaxis equitans* Blume = *Oberonia equitans* (Blume) Lindley, junior synonym of *Oberonia padangensis*: Malaya.

Subsequent authors have not always been aware of those homonyms, commonly adding the wrong authority to the record. The same also applies to identifications on herbarium specimens. This has led to widespread confusion regarding the identity and distribution of *Oberonia equitans*. Sometimes range indications of "*equitans*" were combined from multiple discrete taxa, leading to a cited distribution from East Africa to French Polynesia (e.g., Finet 1908).

The lectotype of *O. equitans* is labeled *Forster 170*, but in the publication it is erroneously referred to as *Forster 316* (Kores 1991). The lectotype designated by Kores (1989) at BM and the cited isolectotype at P could not be found in those collections during visits in 2016 and 2019, respectively. They are not recorded in the online databases either. The whereabouts of those specimens is currently unresolved. The only confirmed type known to exist is a *Forster s.n.* sheet at BM, which agrees with the commonly accepted species concept of *O. equitans* (Forster) Mutel.

Oberonia glandulosa is a well-established synonym of *O. equitans* (e.g. Cribb and Whistler 1996, 2011) and is not further discussed here.

Oberonia aurea is a synonym of *O. equitans*. The common attributes include the habit, the hairy rachis, the hairy pedicelled ovary, the hairs on the external surface of the floral bract and the sepals, the lip with small auricles, constricted mesochile, bilobed and incised epilobe, flower color from pale-green yellow turning to dull orange with maturation (Fig. 2).

Oberonia ciliolata is a clear synonym of *O. equitans* (Forster) Mutel. The type of *O. ciliolata* is confusing and requires some clarification. Hooker (1890) designated a specimen collected by Ridley without gathering number (*Ridley*) or repository as type. The specimen cited at Kew is the basis for Hooker's (1895, pl. 2318) figure.

Accordingly, this gathering (*Ridley*

375) can be considered the type gathering, with the Kew specimen constituting a syntype. The same gathering number was used twice by Ridley, and that is the type gathering of *Oberonia dissitiflora* Ridley.

The overall caulescent habit, the papillose rachis, papillose pedicelled ovary and papillose back of tepals, the deeply incised acute, acuminate bract, and the identical shape of sepals, petals and bract clearly show conspecificity of *O. ciliolata* and *O. equitans*. *Oberonia equitans* was applied to specimens from the Western Pacific Islands, while *O. ciliolata* was applied to specimens from the Malayan Archipelago.

Oberonia oxystophyllum has the same habit and floral characteristics as *O. equitans*, making the two synonyms. The hairy bracts, hairy column, hairy back of the sepals, the oblong shape of the petals, the lip with moderate auricles, constriction of the mesochile, and bifurcated epichile with incised apical lobes are all shared characters.

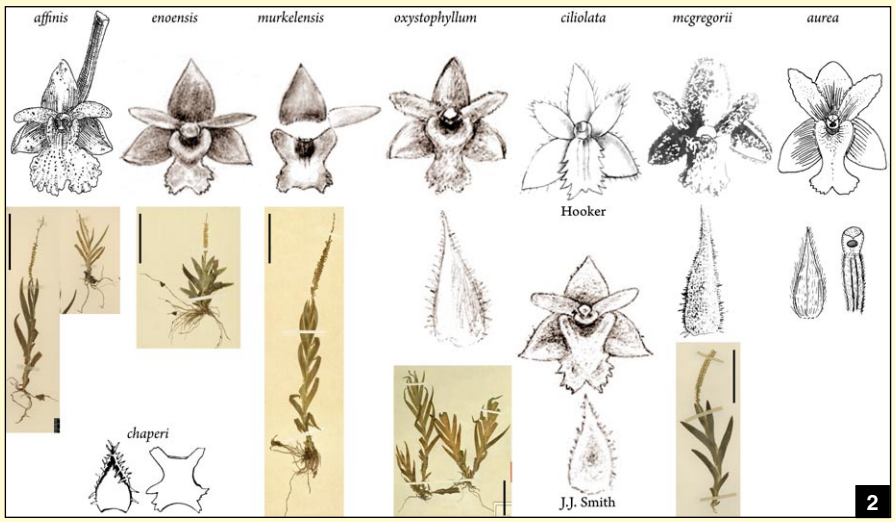
Oberonia flexuosa is a well-established synonym of *O. equitans* (e.g. Cribb and Whistler 1996, 2011) and is not further discussed here.

Oberonia mcgregorii shares the habit, the hairy backs of the flowers, the shape of the petals and every aspect of the lip shape with *O. equitans*, which makes the two synonymous. *Oberonia mcgregorii* has been cited for the Phillippines.

The illustration of *Oberonia equitans* var. *chaperi* clearly represents *O. equitans* s.s. (G. Forst.) Mutel. Finet (1908) thoroughly mixed the two *equitans* in his treatment (see above) and his diagnostic characters (hairs on pedicelled ovary, all tepals, bract) address the distinction of *Oberonia disticha* from East Africa and *O. equitans* from the Pacific region. Due to this elementary confusion, he did not describe a variety of *O. equitans* s.s., hence, his variety is unjustified.

Oberonia lampongensis has previously been recognized as a synonym of *O. ciliolata* (e.g., Comber 1990). With *Oberonia ciliolata* as a synonym of *O. equitans*, *O. lampongensis* becomes a new synonym of *O. equitans*.

Oberonia affinis is described in the protologue as having hairs on rachis, pedicelled ovary and back of sepals, all indicative of conspecificity with *O. equitans*; those characters unfortunately were not shown in the drawings. The shapes of the floral elements as well as the habit of the type is equally compatible with *O. equitans*. Accordingly, the two species are considered as synonyms.



[2] Synonyms of *Oberonia equitans*. *Oberonia affinis*: Drawing from protologue and habit of *O. affinis* syntypes AMES barcode 00101935. *Oberonia enoensis*: Flower illustration by J.J. Smith and habit of syntype. *Oberonia murkelensis*: Illustration of flower of *O. murkelensis* by J.J. Smith. Dissected floral parts digitally rearranged to match live position, and habit of *O. murkelensis* syntype. *Oberonia oxystophyllum*: Flower illustration by J.J. Smith and habit of syntype. *Oberonia ciliolata*: Stylized figure from Hooker (1895), drawing from type by J.J. Smith. *Oberonia mcgregorii*: Drawing from Ames (1908), and habit of AMES syntype. *Oberonia aurea*: Drawing of flower, bract and column from Schlechter (1923). *Oberonia equitans* var. *chaperi*: Drawing of lip and bract from Finet (1908). Scale bar for habits = 5 cm.

It is important not to confuse the type gathering of *Oberonia affinis Clemens 275* syntype of *O. affinis* with *Clemens 275A* syntype of *Oberonia triangularis*.

Oberonia palawensis is an overlooked taxon that has rarely been used after the introduction by Schlechter (1921). A neotype is here designated for *O. palawansis*. The syntype in B has been destroyed (Fosberg and Oliver 1991); no other syntypes are known to exist. The species has never been illustrated and it is difficult to ascertain the identity of a taxon from verbal descriptions alone. This is particularly true for species-rich groups of microfloral species such as *Oberonia* spp. We here clarify the identity of the name by designating a gathering from as near as possible from the locus typicus. The neotype matches the protologue (Schlechter 1921) in every detail.

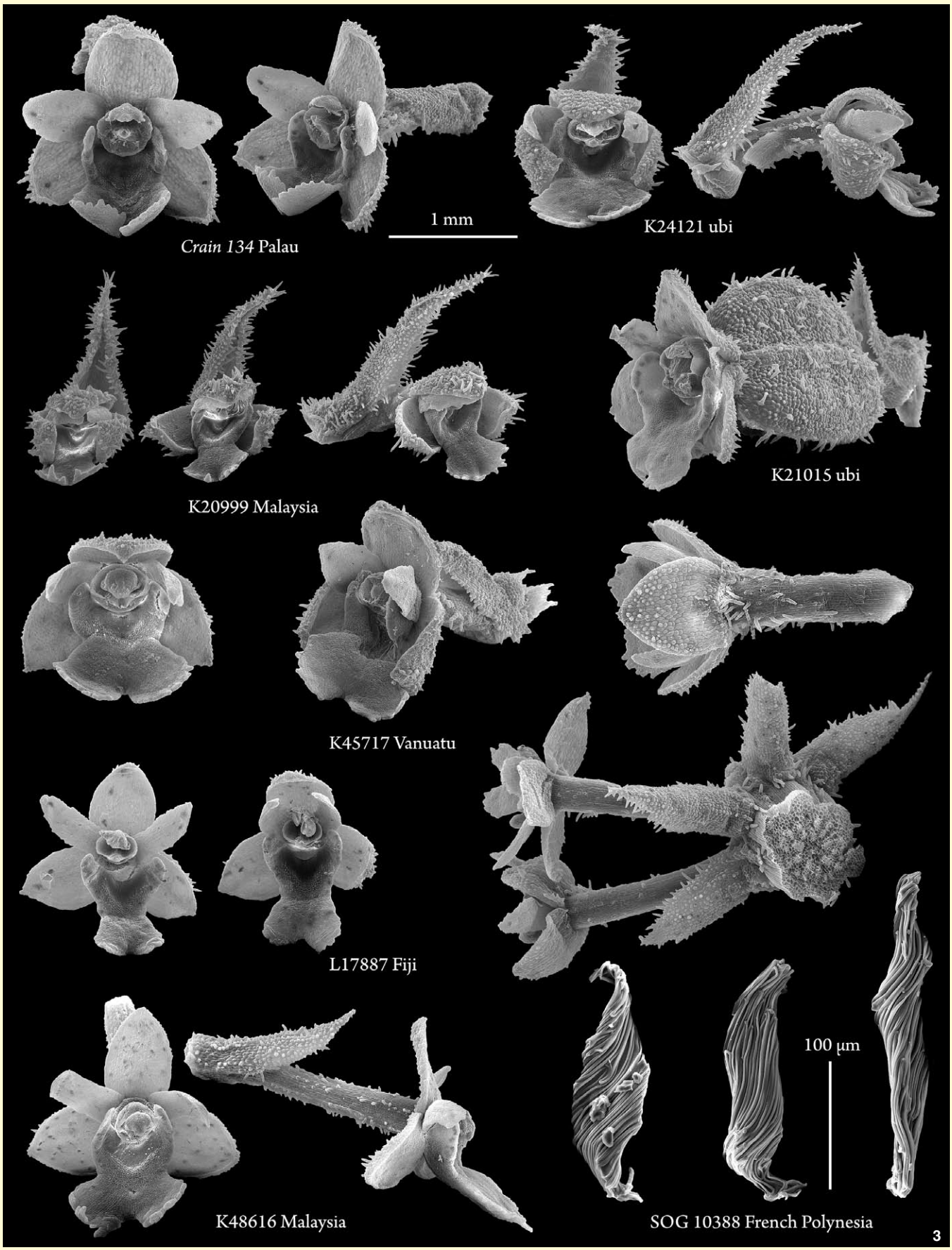
Oberonia palawensis is a clear synonym of *O. equitans*. The protologue indicates the erect habit with triangular leaves, the papillose rachis of the inflorescence, papillose pedicelled ovary, papillose flowers, and papillose lanceolate-acuminate bract, and also specifies the narrow oblong petals.

The cited commonalities offer abundant evidence for conspecificity. The shape of the petals shows some intraspecific variability from more narrow oblong so somewhat broader triangular. Once a large number of specimens have been examined, it becomes clear that those are merely the extremes of a continuous character state distribution, and accordingly, are of no taxonomic importance. It is merely intraspecific variability.

The drawing of *Oberonia enoensis* is indistinguishable from those of *O. oxystophyllum*, *O. murkelensis*, and *O. ciliolata*, all drawn by J.J. Smith. The habits of the type specimens of those respective taxa is equally congruent. Smith (1928a) noted the similarity of his *O. enoensis* with *O. lampongensis* [= *O. ciliolata*]. Congruent characters cited in the protologue are the hairy pedicelled ovary, bracts, and sepals, as well as the light yellow color of the flowers. *Oberonia enoensis* is a synonym of *O. equitans*.

Smith (1928b) placed *O. murkelensis* in section *Otoglossum* (= *Menophyllum*), but the spreading epichile of the lip and the hairs on the pedicelled ovary place the species in *Adenorachis*.

As noted above, *Oberonia murkelensis* is indistinguishable based on floral shape and habit of the type. The protologue compared the new species to *Oberonia subanajamensis* (= *Oberonia punctata*: see Geiger 2019a) and noted the hairy bracts as well as the yellow color of the flower,



[3] *Oberonia equitans* flowers from throughout its distributional range, demonstrating intraspecific variability. Scale bars: flowers = 1 mm. Scale bar seeds = 100 µm. For details see text.

all compatible with *O. equitans*. The species was described from a herbarium specimen only. The drawing of the flower indicates that the specimen was not in the best condition, which explains why some of the finer details of flower morphology were not given. For instance, the sepals were not described as hairy, but not as glabrous either, hence, the absence of additional confirming characters cannot be taken as disconfirming.

INTRASPECIFIC VARIABILITY With the combined morphological–molecular approach we can demonstrate extensive intraspecific variability. Flowers and sequence data from *Crain 134* from Palau and the sequences from French Polynesia serve as anchor points; both are found in a large polytomy with short terminal branches. The flowers of *Crain 134* (Fig. 3) are typical *O. ciliolata* morphs with a rather narrowly constricted mesochile, more flared epichile lobes, and extreme pubescence all over the flower. From French Polynesia, only *O. equitans* is known, with a less constricted mesochile, a less flared epichile with fewer points, and somewhat less pubescence overall (Fig. 2: K45717 Vanuatu, K 21015), and K21015 showing additionally the turgid flower on an already developing seed capsule commonly seen in *O. equitans*. The few samples with multiple flowers (K12099 Malaysia and L17887 Fiji), demonstrate within sample variability in number and degree of point formation on the epichile, and degree of constriction of the mesochile. Absolute size also appears to be somewhat variable as shown by the smaller flowers of K20999 from Malaysia. While those flowers were not entirely open, they appear to be approximately one-third smaller compared to the average size of the remainder. L17887 from Fiji is somewhat intermediate between the above-cited sample from Malaysia and the others.

Extensive intraspecific variability is increasingly recognized in *Oberonia*. Bunpha et al. (2019) correctly synonymized two well-established names, *Oberonia falcata* King & Pantl. under *Oberonia anthropophora* Lindl. Those were distinguished based on size-dependent habit, flower size, and length of epichile lobes. The floristic characters vary extensively, and additional synonyms will be added to *O. anthropophora*. Horticultural data from plants grown over multiple years further support extensive intraspecific variability (Geiger 2018, unpubl. data). While minute differences are generally considered significant in the systematics of orchids including *Oberonia* (e.g., Averyanov et al. 2019), it becomes increasingly clear that Comber's (1990, p. 149) remarks on the "annoying variability" of *Oberonia* were correct.

That variability extends to the vegetative portion of the plant. Cameron (2005) demonstrated that major lineages within Malaxideae can be separated using vegetative characters. However, that discriminating power does not extend to the species level in *Oberonia*. Our illustrations can only show a limited sample of the range of morphologies. The extensive material examined (see above for listing) has shown every conceivable intermediate between those few samples shown and even further variation. The variability includes size of stem at flowering (5–20 cm), proportion of leaf length to leaf width (wider in smaller specimen, more narrow in larger specimens), leaf curvature (almost straight to distinctly falcate), and angle of spread of leaves (~10°–35°). No groupings can be formed, and there are no trends of covariation between vegetative and floral morphology. The simplest answer of a single species supported by a polytomy in our molecular analysis is the best explanation for all observations. We acknowledge that significant intraspecific variability in Orchidaceae goes against commonly held views, yet the available, multipronged, data-rich evidence clearly supports our conclusion.

COMPARISON There are several species with bifid epichile lobes bearing points. We include select comparisons to species with available material.

[4] *Oberonia punctata* habit (Andy's Orchid plant), portion of inflorescence (DLG 680/HOAG 196) and SEM images of flowers (E00233059).

Oberonia punctata J.J.Sm. (Fig. 4) is overall smaller with more leaves of more or less equal lengths along the stem; the bract lacks hairs on the dorsal surface and along the margin, the pedicelled ovary and the back sides of the tepals lack hairs, and the epichile lobes separate at an acute angle from the mesochile.

Oberonia aporophylla Rchb.f. (= *Oberonia longirepens* J.J.Wood; Fig. 5) has much shorter leaves on the elongated stems, forms creeping stolons, and has white flowers.

Oberonia dubia J.J.Sm. (Fig. 6) has an acaulescent, fan-shaped habit with much more elongated leaves, auricles with some projections, and more elaborately fringed epichile lobes.

Oberonia disticha (Lam.) Schltr. (Fig. 7) is restricted to the East African province, is generally smaller, has more fleshy leaves, lacks hairs on rachis and back of tepals, and has an only slightly erose bract without distinct hairs.

Lewis and Cribb (1989) suggested that *Oberonia kaniensis* Schltr. [junior synonym of *Oberonia imbricata* (Blume) Lindl.] may be a synonym of *O. equitans*. The former is in the section *Labidous*, characterized by revolute sepals and a dual sac, while the latter is in section *Adenorachis* with spread sepals and a single sac. Accordingly, that suggested synonymy is in error.

ECOLOGY The ecological data are consistent with a broad synonymy of the

taxa in question. The available elevation data are shown in two groups, one for the Western Pacific Islands records, the traditional *O. equitans*, and one for the Malayan region, traditionally referred to as *O. ciliolata*. For the remaining taxa, there are too little data available to make meaningful frequency-based assessments. Those minor species are all known from the range of elevations covered by *O. equitans* s.l. For instance, *O. palawanesis* was described from 50 m elevation (Schlechter 1921).

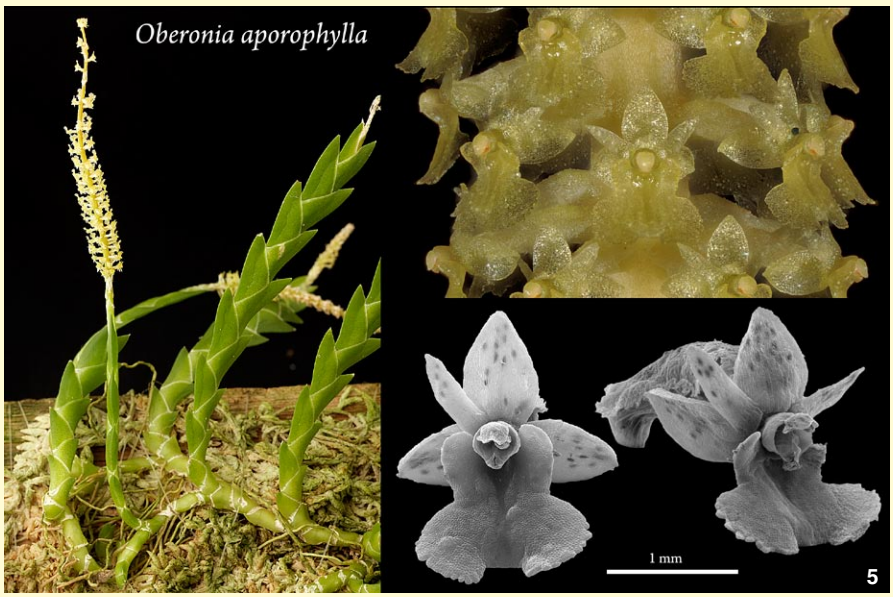
The frequency distributions are remarkably similar. The observations near sea level are somewhat less frequent than at lower to intermediate elevations (~1,000 m), after which they drop rather steeply. There are fewer reports and records of the species at higher elevations in the Western Pacific. This can be explained in part by the overall lower elevations of the Western Pacific islands, particularly French Polynesia.

The phenology data show the species flowering throughout the year in both broad areas of its distribution. Phenology data in other species can show marked seasonality (Geiger 2016, unpubl. data). *Oberonia equitans* occurs on both sides of the equator, which may obscure seasonality patterns. However, seasonality is less pronounced around the equator, which lends credence to a true continuous phenology pattern. With respect to the Palau specimens (*Crain 134,* neotype *Crain 198*), they were found flowering in May and October, respectively; Schlechter's type was in bud in March and most likely would have flowered in April, the relative peak flowering time of *O. equitans* in the Malayan region.

Oberonia equitans has a distribution range that includes Thailand, Singapore, Malaysia, Indonesia, New Guinea, Palau, New Caledonia, Vanuatu, Niue, Wallis and Futuna, Tonga, Cook Islands, Fiji, French Polynesia, and the Austral Islands. Dispersal abilities seem to be pronounced as evidenced by samples from Palau, French Polynesia and Samoa all being found in a major polytomy in our molecular phylogeny. *Oberonia* has the smallest seeds in the Orchidaceae (~100 µm; Barthlott et al. 2014; Geiger 2014, unpubl. data), facilitating wind dispersal and making microendemism less likely. The seeds of *O. equitans* are slightly larger at 150–200 µm, but still small enough to permit wind dispersal over extensive distances (Fig. 3).

DISCUSSION The recent work on the alpha taxonomy of the overlooked genus *Oberonia* (Bunpha et al. 2019; Geiger, 2016, 2019a, in press, unpubl. data) shows that critical global revisions are needed to clean up the accumulation of duplicate names in minor orchid groups. If the scale of overnaming in the genus *Oberonia* alone is taken as an indicator for orchids in general, then global orchid diversity could be overestimated by around one-third. The issue more likely affects diminutive or cryptic species, however, due to difficulties in field identification.

It is important to note that the issues stem not only from poorly known older names, but also from contemporary authors that continue to introduce a plethora of excess names. As a recent example, *Oberonia khuongii* Aver. & V.C.Nguyen in Averyanov et al. (2019) is identical to *Oberonia griffithiana* Lindl. (Geiger, in press), a fact communicated to one of the coauthors well prior to publication. They compared their *O. khuongii* only to *O. cavaleriei*, a very different species with terete leaves, while *O. griffithiana* was only mentioned by name as another similar species without any further discussion of characters. A critical problem is that new species are not compared to the most similar species, but to seemingly random species occurring in the same geographic area, which is most likely due to the authors not being sufficiently familiar with the group in question. Formal synonymies for recent names will be detailed elsewhere



[5] *Oberonia aporophylla* habit (DLG 394/HOAG 49), portion of inflorescence (DLG 599/HOAG 50) and SEM images of flowers (DLG 394/HOAG 49, DLG 599/HOAG 50).

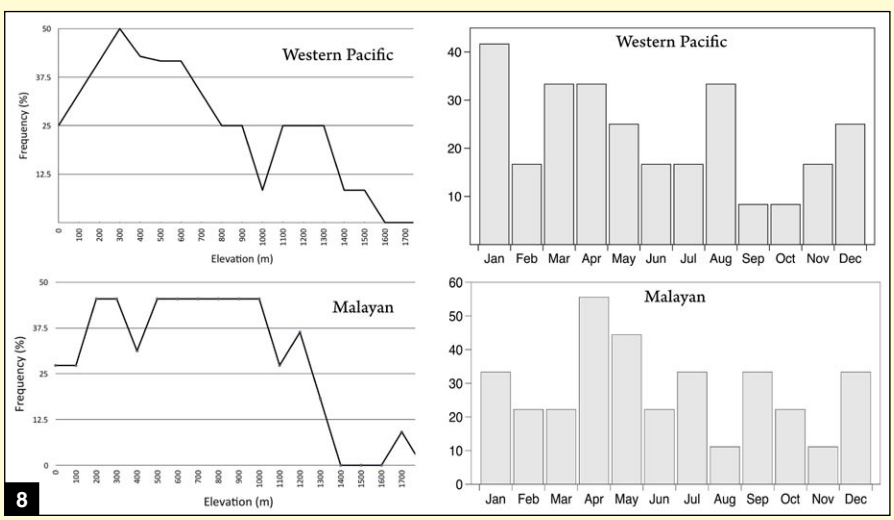
[6] *Oberonia dubia* habit (DLG 692/HOAG 272), portion of inflorescence (DLG 692/HOAG 272) and SEM images of flowers (DLG 692/HOAG 227).

(Geiger, in press).

Another contributing factor, particularly in microfloral groups, is the outdated reliance on drawings and single-shot photographs to document morphology. While in systematic zoology (e.g., entomology, malacology), z-stack photography and electron microscopy have been considered standards for <5-mm specimens for at least two to three decades, those 21st century techniques are only rarely employed in systematic botany. Misleading drawings are a serious problem as shown with the case of *Oberonia carprina* Gilli, a synonym of *O. punctata* J.J.Sm. (Geiger 2019a).

Orchid systematics is still too 18th-century typological, where species are considered immutable and minute differences of individual specimens are considered diagnostic at the species level. Population thinking and explicit consideration of intraspecific variability is hardly taken into account when assessing biodiversity. Bunpha et al. (2019) doubted Geiger's (2019a) synonymization of *Oberonia fungumolens* Burkill under *O. padangensis* Schltr. due to slight differences in leaf shape and lip-to-sepal length ratio of 1.4× vs. 1.6×, which Geiger (2019a) was faulted for not explicitly addressing. Differences in vegetative shape were explicitly discussed under *O. rufilabris* by Geiger (2019a) as a proxy for range of variability in the genus overall. Variability in vegetative parts of *O. equitans* is clearly documented here and further supported by examination of the cited herbarium specimens. Proportional differences of floral parts can easily reach one-quarter to one-third among flowers on the same inflorescence (e.g., *Oberonia acaulis* Griff., *Oberonia ferruginea* C.S.P.Parish ex Hook. f., *O. cavaleriei*; Geiger, unpubl.), hence, proportional differences of <15 percent are clearly meaningless for taxonomy in *Oberonia*. Accordingly, the crystal-clear synonymy between *O. padangensis* and *O. fungumolens* is maintained. The complementary study of cultivated specimens and wild-collected material was noted by Geiger (2018), particularly considering intraspecific variability and genotype × environment effects. Intraspecific variability in *Oberonia* was discussed by Geiger (2019b). The "annoying variability" of *Oberonia* spp. had previously been noted by Comber (1990, p. 149).

Last but not least, in today's scientific climate of measurements of academic achievements, synonymizations are possibly the least recognized activity



[7] *Oberonia disticha* habit (DLG 635/HOAG 14: yellow variant), portion of inflorescence (DLG 424/HOAG 12: orange variant) and SEM images of flowers (DLG 424/HOAG 12).

[8] Elevation and phenology data for *Oberonia equitans*. The y-axis shows frequency of cited occurrence. Elevation data for *O. equitans* from Western Pacific Islands from Cribb and Whistler (1996), Hallé (1977), Lewis and Cribb (1989), Wood and Cribb (1994), Schlechter (1906: as *O. flexuosa*), Fleischmann and Rechinger (1910), Brown (1931), Christophersen (1935), Kores (1989), Streitmann (1983), Sykes (2016), and various herbarium records. For Malayan region (as *O. ciliolata*) from O'Byrne (1994: as *O. aurea*, 2001), Beaman et al. (2001), Comber (1990), Wood and Cribb (1994), Carr (1930, 1935: as *O. lampongensis*), Schuiteman and de Vogel (2006: as *O. aurea*), Schlechter (1911: as *O. aurea*, 1921: as *O. palawensis*) and various herbarium records. Phenology data for *O. equitans* from Western Pacific Islands from Hallé (1977), Anonymous (1995), Guillaumin (1957), Kränzlin (1898), Schlechter (1906, 1910), Ames (1933), Brown (1931), Christophersen (1935), Yuncker (1959) and various herbarium records. For Malaysian region from Carr (1930, 1935: as *O. lampongensis*), Schuiteman and de Vogel (2006: as *O. aurea*), O'Byrne (1994: as *O. aurea*), Schlechter (1911: as *O. aurea*, 1921: as *O. palawensis*), Schlechter in Schumann and Lauterbach (1905: as *O. aurea*), and various herbarium records.

in systematics. While the introduction of a new name, including a synonym, and even the transfer of a species to a different genus, adds recognition, the cleanup of excessive taxonomic splitting garners far less recognition. No malus is attached to introducing synonyms either. Cleanup of superfluous names can have further implications beyond the raw tally of names. Recognizing *Oberonia attenuata* Dockrill, considered endemic to Queensland, Australia, and either extinct or at least critically endangered, as a southern range of the widespread *Oberonia insectifera* Hook.f. changes the outlook of the species' survival and conservation needs (Geiger 2019a).

A significant number of clear synonymies remain to be formally addressed in *Oberonia*. Furthermore, there are several names that are extremely difficult to assess due to limited verbal descriptions, lack of any illustrations, and unknown (lost or destroyed?) types. Examples include *Oberonia tahitensis* Lind., *Oberonia werneri* Schltr., and *Oberonia zimmermanniana* J.J.Sm. Those nomina dubia are still listed as correct names in databases and inventories. Accordingly, the cleanup and revision of the genus will continue for several more years to help alleviate many of the issues discussed above.

Acknowledgments

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A little trick I learned a few years ago: to catch those nasty bush snails which do not seem to respond to any other method: cut a piece of yellow sticky card and insert it into the orchid pot. If you have bush snails they will be attracted to the card and get stuck. You will not get them all but you will get an amazing number of them.

I came to this solution sort of by accident; I do not like to use chemical solutions if I do not have to and bush snails are almost impossible to get rid of. I had stuck a piece of a yellow card in a pot to catch fungus gnats and was amazed to see about 20 bush snails on the card as well. Now I try to keep a card in every one of my pots.

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Where to Place Baskets

MY NEW YEAR'S resolution was to enhance my skills and become knowledgeable about my orchid collection. Lately, I have been rearranging my orchids by cultural requirements and creating growing environments that will promote better vigor and growth in my plants. I am at the point where I am not killing my plants but they are just not growing or blooming as well as I would like them to.

As a result, I have been organizing some of my orchids into wire baskets. The medium-to-high light-loving orchids hang from the ceiling of my greenhouse with a retractable plant pulley (available from Amazon for about $10.00/2-pack) so they are easy to pull down to check on them. My shade-tolerant orchids are in baskets sitting on the floor. Plants are further segregated by potting medium: moss vs bark. I water my bark baskets more often than my moss baskets. I am learning more about the individual requirements of my collection with this system plus I can fit more orchids into a small space. Who would not love that!

— Cindy Jepsen (email: cindyjepsen@cox.net).

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Epiphytic Orchids North of the 49th Parallel

Text and photographs by Sasha Kubicek

VANCOUVER ISLAND IS the second largest island on the west coast of the Americas and is a bit larger than the state of Massachusetts. The island is part of the province of British Columbia, Canada, with the capital city of Victoria located at the 49th parallel. The province is home to over 40 taxa of native orchid species with the island hosting about half of these species. The island's geography is varied from coastal temperate rainforests to glacier-topped mountains. Orchids can be found in all these areas from the ocean shore line with the elegant platanthera (*Platanthera elegans*) to the mountain alpine with Chamisso's orchid (*Platanthera chorisiana*).

The exploration for this article occurred on the west coast of the island in the area of Clayoquot Sound. This area receives an astonishing average amount of rainfall a year of 10.3 feet (3.2 m), but only about 20 percent falls between May and September. The average annual temperature is 49 F (9.4 C). Annual trips in June have yielded sightings of great patches of modoc bog orchid (*Platanthera stricta*) growing along stream banks and seepages along with the showy northern rice root (*Fritillaria camschatcensis*), round leaved sundew (*Drosera rotundifolia*) and common butterwort (*Pinguicula vulgaris*).

While exploring a new campsite on a lakeshore during my annual trip in June 2019, we found the rattlesnake plantain (*Goodyera oblongifolia*) growing entirely epiphytically on a moss-covered branch.

The colony on the branch consisted of previously bloomed mature growths with spent seed capsules, current-year mature growths in spike and an assortment of seedlings. The seedlings were inches away from the tops of the last year's seed capsules. Mature plants produce up to eight green-blue basal leaves, which form a rosette, and have a prominent white stripe down the middle with varying degrees of white netlike patterning. Some clones can have very pronounced patterns while others will just have the the central white stripe. This leaf stripe distinguishes this orchid from *Goodyera tesselata*. When flowering in late summer or early fall, over 40 white flowers are held on an erect inflorescence. Dorsal sepals are transluscent white with green striping centrally, lateral sepals are white-green to light brown and the lip is a waxy-white. Flowers can self-pollinate or not open fully in dry conditions.


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2


3


4

Goodyera oblongifolia is an extremely widespread North American species ranging from Alaska to northern Mexico. It is found up and down the entire west coast as well as the eastern maritime provinces of Canada and Maine in the United States. In the Great Lakes region, it is found in all bordering Canadian provinces and Wisconsin and Michigan in the United Sates. On Vancouver Island, I have seen this species growing terrestrially at sea level in Douglas fir (*Pseudotsuga menziesii*) coastline forests to subalpine forest floors. I have observed this species outside its normal terrestrial habit, growing on rotting logs fallen on the forest floor as well as on moss-covered

rocks. This colony, however, growing above the lake on the living tree branch was a first.

On further exploration of the area, no *Goodyera oblongifolia* was encountered on the ground in its usual terrestrial habitat. Instead, an additional three other epiphytic locations were found, some as high as 30 feet (9.1 m) up the tree on moss-covered branches. All plants were growing on red alder (*Alnus rubra*) and were only found at the lakeshore. Beyond the alder trees at the lakeshore was an intact, old-growth forest consisting of western red cedar (*Thuja plicata*) and western hemlock (*Tsuga heterophylla*).

The dominant moss associated with the orchids was yellow moss (*Homalothecium fulgescens*). The plants would have received good humidity from the lake water as well as good air circulation. Even more important might be the close proximity to the ocean where consistent summer fogs keep the plants moist. This summertime fog phenomenon is known locally as "Fogust." This is truly a perfect microclimate north of the 49th parallel to sustain several colonies of one of our most adaptable orchid species epiphytically.

No other orchid has such an epiphytic habit this far north in North America. The green fly orchid (*Epidendrum magnoliae*) is the only other documented epiphytic orchid outside of the state of Florida. This frost-tolerant species can be found as far north as North Carolina. Large colonies can be found growing on a variety of trees, primarily deciduous, but growth as a lithophyte has also been also observed. This orchid produces two-to-three green leaves and up to 20 green flowers on a terminal inflorescence. Dorsal sepal and lateral sepals are green-brown; petals and lip are jade green. The primary habitat for *Epidendrum magnolia* is swampy habitats, which share the constant water, humidity and air circulation that the rattlesnake plantain (*Goodyera oblongifolia*) colonies enjoy.

With four different trees hosting mature colonies of *Goodyera oblongifolia*, in some cases over 30 feet (9.2 m) off the ground, I feel this cannot be a chance occurrence. These plants had multiple generations of plants and new seedlings, which translates to long-term residence in this habitat. I am already looking forward to what next summer's return visit will reveal now that I know epiphytes are not just a southern phenomenon. If you are on the west coast of British Columbia, do not forget to look up!

[1] Clayoquot Sound on the west coast of Vancouver Island.
[2] The elegant platanthera, *Platanthera elegans*, inhabits the coastal shoreline.
[3] Platanthera chorisiana, commonly known as Chamisso's orchid, is an alpine species.
[4] The author examining the first colony of the rattlesnake plantain, *Goodyera oblongifolia*, found growing completely epiphytically on a moss-covered branch.
[5] Close-up of the thriving epiphytic colony.

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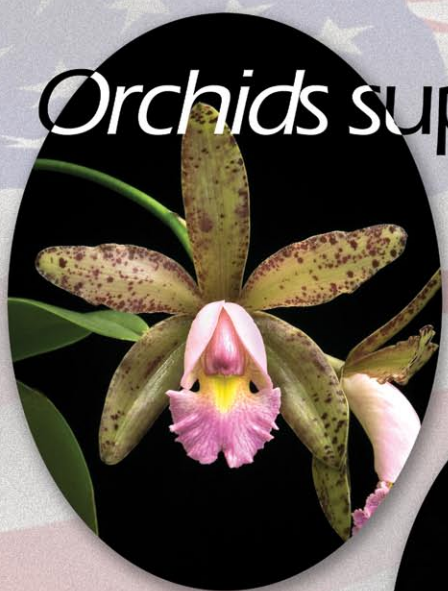

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