CATTLEYAS IN SINGAPORE AND THE TROPICAL LOWLANDS: REVIEW AND RECOMMENDATIONS

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ABSTRACT

Orchids are important to many public gardens. Orchid-themed shows draw large crowds, and orchid collections are the focus of several gardens. Cattleyas refers to the orchid genus *Cattleya* and closely related, often cross-compatible genera. Cattleyas were once the archetypal orchids and grown extensively as cut flowers. Orchids are culturally and politically significant for Singapore, however Cattleyas are underrepresented in new orchid introductions and registered hybrids despite their charismatic appearance. More widespread cultivation and breeding of Cattleyas in Singapore faces challenges including a reduction in flower production and quality in the lowland tropical climate of Singapore. Information on Cattleyas is also spread across disparate sources. This capstone project is a consolidated resource for choosing and breeding Cattleyas suitable for Singapore and the tropical lowlands. It was developed through reviewing informative sources on Cattleyas both in the context of Singapore and in various countries. Key findings include lists of Cattleyas that are suitable for cultivation in Singapore, climate data of the native habitats of some Cattleyas, and recommendations for choosing and breeding Cattleya for Singapore.

BIOGRAPHICAL SKETCH

Paul Chong Ren Huang was born on June 11, 1997, in Singapore. He graduated from Anglo-Chinese School (Independent) in January 2016. After completing two years of National Service for Singapore, he began his undergraduate degree at Cornell University in the fall of 2018. He graduated *summa cum laude* with a Bachelor of Science, Plant Sciences in the spring of 2021. Over the summer of 2021, he worked as a research technician in the Frank Lab. In the fall of 2021, he began his Master of Professional Studies in Agriculture and Life Sciences, Field of Integrative Plant Science with a concentration in Public Garden Leadership.

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1 Introduction

Orchids are important to many public gardens. Orchid-themed shows draw large crowds and orchid collections are the focus of several gardens. Some public gardens name orchid hybrids after celebrities, dignitaries or sponsors as a show of goodwill (Whang and Liu 2019; "Longwood Cultivars" n.d.; "New York Botanical Garden Orchid Show Inspired by Singapore" n.d.).

Cattleyas, once the archetypal orchid, were grown extensively as cut flowers from the 1940s to the 1960s in the United States (A. A. Chadwick 2006, 31–35). They presently account for a small proportion of total orchid sales, and breeding has stagnated (A. E. Chadwick 2005, 668). Nonetheless, a well-flowered Cattleya has a commanding presence; a combination of individual flower volume, color, and fragrance that few other orchids can compare with.

This review is aimed at public gardens in the lowland tropics that aim to develop a Cattleya collection and breeding program. This review is also relevant for public gardens with controlled growing environments that match the climate of the tropical lowlands. Most conclusions of this review are in the context of Singapore, not only due to personal experience, but also as the climate of Singapore is highly averse to Cattleya cultivation. Hence, conclusions about Cattleya in Singapore can still be applicable for other areas in the lowland tropics further away from the equator but with relaxed pressure.

Orchids are organized into groups of closely related and cross-compatible genera known as alliances. Alliances are named after the genus that contains species which exemplify beauty standards and contribute overwhelmingly to hybrids within their respective alliances. The Cattleya Alliance and Vanda Alliance are two groups of interest for this guide. Examples of genera in the Cattleya Alliance are *Cattleya*, *Brassavola*, *Laelia* and *Rhyncholaelia*, while the

Vanda Alliance includes *Vanda, Arachnis, Papilionanthe, Renanthera*, among other genera (Teoh 2005, 79; Elliott 2005, 116–19). In this guide, I use "Cattleya(s)" or "Vanda(s)" when referring to the alliance as a whole, including intergeneric hybrids, and "*Cattleya"* or "*Vanda"* when referring to species and hybrids within the genera.

Hybridization is important in producing orchids that are easier to grow, flower more frequently and have improved flower quality compared to species ancestors. Hybridization also generates novel color combinations in flowers that may not be found in species. There are 28,484 species of orchids and 186,258 registered hybrids as of 9 March 2022 (Govaerts et al. 2017; Shaw pers. comm). Interspecific and intergeneric hybridization over multiple generations is relatively easy in orchids and is an important source of generating variation (Elliott 2005, 116–21; Teoh 2005, 79). Some hybrids are descended from as many as 31 species or species from eight different genera ("Fowlieara SunCoast Freckled Flamingos" n.d.; Royal Horticultural Society 2017).

Names of hybrid genera combining two and sometimes three natural genera are contractions of constitutive generic names, while hybrid genera of three or more genera are based on the originator's name or choice of name with the suffix -ara (Royal Horticultural Society 2017). Examples of these are given in **Table 1**.

TABLE 1. Examples of Vanda and Cattleya natural and hybrid genera

Alliance	Vanda	Cattleya
Natural Genera:	*Vanda, Arachnis, Papilionanthe, Renanthera…*	*Cattleya, Brassavola, Laelia, Rhyncholaelia…*
Hybrid Genera:	*Vanda* ×*Arachnis* *= Aranda* *Vanda* × *Arachnis* × *Papilionanthe* *= Papilandachnis* *Vanda* × *Arachnis* × *Renanthera* *= Holttumara*	*Cattleya* × *Rhyncholaelia* *= Rhyncholaeliocattleya* *Cattleya* × *Laelia* × *Rhyncholaelia* *= Rhyncatlaelia* *Cattleya* × *Brassavola* × *Laelia* × *Rhyncholaelia* *= Keyesara*

Source: Royal Horticultural Society (2017)

Singapore has strong traditions of orchid cultivation and hybridization: orchid cultivation is considered an intangible cultural heritage, Singapore had a prominent orchid cut-flower industry from 1955 to the 1980s, and local orchid hybridization has been extensive ("Orchid Cultivation" n.d.; Goh and Kavaljian 1989; Elliott 2005). Orchid hybrids originated in Singapore have gained recognition worldwide: *Papilionanda* (*Pda.*) Tan Chay Yan and *Papilionanthe* (*Ple.*) Miss Joaquim were both recognized with First Class Certificates (FCC) from the Royal Horticultural Society (Elliott 2005, 31, 125). Orchids also play an important role in Singapore's state symbolism. *Ple*. Miss Joaquim, the first orchid hybrid recorded from Singapore, is the National Flower (Elliott 2005, 125). In the practice of "orchid diplomacy", new hybrids are named after and presented to foreign dignitaries upon their visit as a sign of goodwill (Whang and Liu 2019).

However, Cattleya breeding in Singapore remains undeveloped compared to *Dendrobium, Phalaenopsis* and Vandas. As of 9 March 2022, a total of 3,217 orchid hybrids

have been registered from Singapore since 1893, but only 101 of these are Cattleyas (Shaw pers. comm).

Cultivation and breeding of Cattleyas face certain challenges in Singapore. Most *Cattleya*, the genus central for breeding within the alliance, are native to mountainous regions of the tropics and remain vegetative in the low-elevation, equatorial tropical climate of Singapore, although select species and hybrids flower consistently (Lee 1979, 64; Teoh 2005, 79). *Cattleya* growth and flowering cycles pose limitations to flower production compared to the more widely cultivated and extensively hybridized *Dendrobium*, *Phalaenopsis* and Vandas in Singapore. Each *Cattleya* pseudobulb produces flowers only once at a specific stage of pseudobulb maturity, most species undergo only one or two growth cycles a year, and flowering in several species is regulated by a combination of short days and low temperatures (Rotor 1951; A. A. Chadwick 2006). For some *Cattleya* species and the hybrids they influence, this threshold is rarely or never reached in Singapore (Lee 1979, 64; Teoh 2005, 79). In contrast, other groups of orchids have greater potential flower production: *Dendrobium* pseudobulbs have multiple bud primordia that can each develop into an inflorescence, and the indeterminate axis of *Phalaenopsis* and Vanda produce multiple bud primordia a year (Rotor 1951). Inflorescences of some *Phalaenopsis* may extend indeterminately and continue to bear flowers for years.

Cattleya flower quality is also negatively impacted by the environmental conditions of Singapore. Flower lifespan of *Cattleya* is as long as six weeks for *Cattleya wallisii* under cool, dry conditions, and *Cattleya* flowers obtain a larger size under milder temperatures (A. A. Chadwick 2006, 104; Teoh 2005, 79; Nash n.d.). Under the hot, humid climate of Singapore and torrential downpours, flower lifespan of *C. wallisii* is rarely more than two weeks, and flowers are generally smaller (Cheong pers. comm.; Teoh 2005, 323). In contrast, flowers on *Renanopsis*

Lion's Splendor, a Vanda hybrid, can last two months with full exposure to sun and rain, and about two or three inflorescences are initiated a year. Interaction between innate characteristics of numerous *Cattleya* species with the environmental conditions of Singapore results in limitations on growth and flower production, especially when compared to other orchids that are more widely cultivated.

However, the ancestors of many floriferous and renowned Vanda hybrids that originated in Singapore, including *Ple.* Miss Joaquim and *Pda.* Tan Chay Yan, had similar limitations on growth and flower production. Regarding *Ple. teres*, an ancestor of both hybrids, Holttum (1953a, 720) asserted that "most flowers of *V. teres* [*sic*] will flower moderately well in Singapore…undoubtedly they need a more pronounced dry season to make them flower really freely", while its offspring *Ple.* Miss Joaquim was described as "perpetual flowering" (Holttum 1953a, 720). On *Vanda sanderiana*, another ancestor of *Pda.* Tan Chay Yan, Holttum (1953a, 692–93) declared that "the very uniform climate of Singapore apparently does not suit it very well". Yet, *Pda.* Tan Chay Yan grows vigorously and flowers multiple times each year. Breeding Vandas in Singapore produced exemplary, highly adapted hybrids within a few generations and set the stage for the wide range of floriferous hybrids available to the contemporary consumer.

I believe that applying parallel breeding strategies, along with thoughtful selection of parental species and hybrids, will result in a diversity of quality Cattleyas adapted to Singapore and the tropical lowlands. I produced this review with the goal of contributing to this outcome. This review covers the following content: In **Background,** I provide information about the climate of Singapore, and an overview of the classification of *Cattleya* and flowering in Cattleyas. For **Cattleyas in Singapore**, I consolidate records of Cattleyas that have vigorous growth and regular flowering in Singapore and the lowlands of Malaysia and determine patterns

in the ancestry of these Cattleya. Under **Recommendations**, I provide suggestions for choosing and breeding Cattleyas for Singapore based on information presented in the previous chapters.

2 Background

2.1 Geography of Singapore

Singapore is a heavily urbanized, densely populated island-nation in Southeast Asia with a tropical climate that is uniformly hot, humid, and rainy throughout the year, ("Climate of Singapore" n.d.). Geographical information for Singapore is summarized in **Table 2**.

TABLE 2. Geographical information of Singapore

Coordinates	1.17°N, 103.48°E
Elevation	Average elevation: 15 m Highest point: 166 m
Daylength	12 h 5 min–12 hr 14 min
Temperature	23 C–33 C
Humidity	60%–100%
Rainfall	167 days/year, 2165.9 mm/year
Rainfall Distribution	Nov/Dec: 19 rain days, 250 mm/month Feb: 8 rain days, 100 mm/month

Source: Central Intelligence Agency (2022); "Sunrise and Sunset in Singapore" (n.d.); "Climate of Singapore" (n.d.); "Singapore | Facts, Geography, History, & Points of Interest | Britannica" (n.d.)

The geography of Singapore has negative implications for the cultivation of Cattleyas. *Cattleya* are mostly montane species found at higher latitudes and at elevations greater than the highest point in Singapore (Aulisi A. and Foldats 1990; A. A. Chadwick 2006). Temperatures in Singapore are higher and diurnal fluctuation lower than recommended ranges for optimum growth in Cattleyas, and the high temperatures are also detrimental to flower quality and longevity (Nash n.d.; A. A. Chadwick 2006). Flowering in Cattleyas is encouraged at daylengths and temperatures below the minimum in Singapore, and several species of *Cattleya* will not

flower above this threshold (Rotor 1951; Arditti 1980, 542–45). Many *Cattleya* require a period of lessened water for optimum growth and flowering, and reduced disease incidence (A. A. Chadwick 2006, 59, 75–76, 101). This is difficult to provide in Singapore due to the relatively uniformly distributed, heavy rainfall. General climatic trends will further reduce the hospitability of Singapore's climate to Cattleya cultivation.

2.2 Classification of *Cattleya*

This section summarizes the infrageneric classification of *Cattleya* by Van den Berg (2014) based on morphological characteristics in addition to nuclear, plastid and combined phylogenetic trees. Van den Berg (2014) grouped *Cattleya* into four subgenera; *Cattleya*, *Cattleyella*, *Intermediae*, and *Maximae*. Subgenus *Cattleya* comprises three sections: *Cattleya*, *Crispae* and *Lawrencenceana*. Section *Crispae* comprises five series: *Cattleyodes*, *Hadrolaelia*, *Parviflorae*, *Sophronitis* and *Microlaelia*. These section names will be used in this review. The classification of select species relevant to this review and notes on infrageneric classification according to Van den Berg (2014) are summarized in **Table 3**.

TABLE 3. Classification of *Cattleya* by Van den Berg (2014)

Subgenus	**Section**	**Series**	**Species**
Cattleya	*Cattleya*		
	C. labiata species complex and species with "smaller flowers and narrower sepals and petals": *C. luteola*, *C. iricolor* and *C. mooreana* (Van den Berg 2014). Flowers normally light pink to lavender. Exceptions to this color scheme are *C. dowiana*, *C. aurea* (considered by some authors as conspecific with *C. dowiana*), *C. rex*, and the species with "narrower sepals and petals". These have a base color of yellow or cream (A. A. Chadwick 2006). Members of this series are vegetatively similar and originate from mountainous regions of Peru, Ecuador, Colombia, Venezuela, Eastern Brazil (Van den Berg 2014). In addition, *C. dowiana* is native to Costa Rica and eastern Panama (Pupulin 2015).	*aurea*
			dowiana
			gaskelliana
			iricolor
			jenmanii
			labiata
			luteola
			mendelii
			mooreana
			mossiae
			percivaliana
			quadricolor
			rex
			schroederae
			trianae
			warneri
			warscewiczii

	Crispae	*Cattleyodes*	
	Includes all former "Brazilian *Laelia*", "rupiculous *Laelias* or *Hoffmannseggella*", and the predominantly red-flowered "*Sophronitis*" (Van den Berg 2014).	Mostly large-flowered (>10 cm wide) species that have narrower sepals and petals and a more tubular lip compared to section *Cattleya*. Plants have large clavate (club-shaped) pseudobulbs (Van den Berg 2014).	*lobata*
			perinii
			purpurata
			tenebrosa
			xanthina
		Hadrolaelia	
		Pink, purple or mauve flowers; plants with conduplicate ("folded" along the middle) leaves more than 4 cm long (Van den Berg 2014).	*alaorii*
			pumila
			sincorana
		Microlaelia	
		Plants have two terete leaves (Van den Berg 2014).	*lundii*
		Parviflorae	
		Flowers generally less that 6 cm wide, plants mostly rupicolous or terrestrial with cylindrical or subcylindrical pseudobulbs, or epiphytic plants with long, slender pseudobulbs (Van den Berg 2014).	*briegeri*
			crispata
			esalqueana
			harpophylla
			longipes
			milleri
			rupestris
			sanguiloba

<table>
<tr><td rowspan="6"></td><td rowspan="4"></td><td colspan="2">Sophronitis</td></tr>
<tr><td rowspan="3">Red, orange, yellow or pink flowers that generally have sepals and petals in one flat plane and are large in proportion to miniature plant size.</td><td>alagoensis</td></tr>
<tr><td>cernua</td></tr>
<tr><td>coccinea</td></tr>
<tr><td colspan="2">Lawrenceanae</td></tr>
<tr><td colspan="2" rowspan="3">Species native to warmer areas; from low elevations (<400 m asl) in the Amazon (northern Brazil and Venezuela) or from lowland, dry habitats in Venezuela. Species in this section also have anomalous morphologies compared to section Cattleya: C. lawrenceana has a tubular lip and small column resembling Guarianthe, C. lueddemanniana has conspicuous projections at its column apex, and C. lueddemanniana and C. wallisii are vegetatively smaller and have more erect leaves that are narrower at the base than series Cattleya (Van den Berg 2014).</td><td>lawrenceana</td></tr>
<tr><td>lueddemanniana</td></tr>
<tr><td>wallisii</td></tr>
<tr><td colspan="3">Cattleyella</td></tr>
<tr><td colspan="2">A morphologically distinct species, with conflicting molecular results that placed it as sister to either the remainder of the genus or to C. maxima, to which it does not resemble (Van den Berg 2014).</td><td>araguaiensis</td></tr>
</table>

Intermediae	
Flowers tend to have waxier texture, firmer substance, greater variation in color including spots and proportionally smaller "isthmus" midlobe compared to series *Cattleya* (Rogerson 2004). Referred to as "bifoliate cattleya", pseudobulbs usually have two or three leaves, are narrower and have greater interspecific variation in height compared to series *Cattleya* (Rogerson 2004; Van den Berg 2014).	*aclandiae*
	amethystoglossa
	bicolor
	elongata
	forbesii
	granulosa
	gutttata
	harrisoniana
	intermedia
	kerrii
	loddigesii
	nobilior
	schilleriana
	tigrina
	violacea
	walkeriana
Maximae	
Morphologically considered a relative of the *C. labiata* complex, although it produces more flowers per inflorescence with distinctive lip markings, and narrower petals and sepals than the C. *labiata* complex (A. A. Chadwick 2006). Flowers are more like those of species in series *Cattleyodes* such as *C. purpurata*; but with only four pollinia, pseudobulbs of lowland race are like series I*ntermediae*; but unifoliate, discordant placement in plastid and nuclear topologies (Van den Berg 2014).	*maxima*

Sources: Data from Rogerson (2004); A. A. Chadwick (2006); Van den Berg (2014)

2.3 Growth and Flowering in Cattleyas

2.3.1 Summary

Cattleya species have different optimal growth temperatures and flowering seasons (A. A. Chadwick 2006, 205). *Cattleya* flower only once from the apex of a pseudobulb, and flowering seasons in *Cattleya* species results from interactions among the timing of new pseudobulb initiation, pseudobulb growth rate, stage of pseudobulb maturity that flowers are initiated, and environmental conditions (Rotor 1951; A. A. Chadwick 2006). Initiation of flowers may occur during development of the pseudobulb, or immediately to several months after pseudobulb maturity (Aulisi A. and Foldats 1990; Rogerson 2004; A. A. Chadwick 2006). Generally, long days and higher night temperatures stimulate vegetative growth, while short days and low night temperatures encourage flowering, although there are some species-specific interactions with photoperiod and temperature (Rotor 1951; Arditti 1980, 542–45).

There is no consistent relationship among flowering season, stage of pseudobulb maturity that flowers are initiated, and photoperiodic response for *Cattleya* species based on available information. The only generalization is that most *Cattleya* which flower from a developing growth have a flowering season spanning May to July in the northern hemisphere, while *Cattleya* that flower from a mature growth and with a rest period have a flower season that span the other months of the year.

Experimental studies on flower regulation in Cattleyas involve daylengths well below the minimum in the native habitats of Cattleyas and Singapore, and at temperatures lower than the minimum in Singapore. There is insufficient information to conclude if daylength is a limitation on flowering in Cattleya in Singapore, although temperatures are strongly limiting. Preferred growing conditions and flowering season are hereditary in Cattleyas, but inheritance of seasonality in hybrids is complex and poorly understood. Please refer to **Appendix A** for a

consolidated table of flowering behavior, flowering season, and preferred growing temperatures for several species of *Cattleya.*

2.3.2 Recommended Temperatures

General recommended temperatures for Cattleyas are 24–29 C during the day and 13–24 C at night ("Care of Your Hausermann Orchid Cultures" n.d.; "Cattleya Alliance Care Sheet" n.d.; Clarke n.d.). A 27 C day and 16 C night is optimal, while temperatures above 29 C, particularly above 32 C, reduce plant growth and shorten flower lifespan, although short periods usually do not damage plants (A. A. Chadwick 2006, 204; Clarke n.d.; Nash n.d.). A diurnal temperature fluctuation of 8–14 C is required to ensure proper growth and flowering, and without night temperatures below 21 C, many Cattleyas remain vegetative ("Care of Your Hausermann Orchid Cultures" n.d.; "Cattleya Alliance Care Sheet" n.d.; Nash n.d.). Temperatures in Singapore are higher and diurnal fluctuation lower than recommended ranges for optimum growth in Cattleyas.

Species may have more unique temperature preferences resulting from selection under native climatic conditions. These temperature requirements are hereditary. Aulisi A. and Foldats (1990) provided geographic data of Venezuelan *Cattleya*. This is summarized in **Appendix B**. A. A. Chadwick (2006, 205) identified categories of optimal night temperatures for several *Cattleya* species; cool (14–16 C), intermediate (17.2–17.8 C) and warm (18 C–21 C) (**Appendix A**). Most Cattleyas with series *Sophronitis* in their ancestry require 18 C–24 C, and lower at night ("Cattleya Alliance Care Sheet" n.d.). Temperatures in Singapore range from 23 C–33 C and are expected to be warmer in urban areas ("Climate of Singapore" n.d.). *Cattleya* species that are native to areas with warmer night temperatures, and their hybrids are expected to have better growth and flower production in Singapore compared to *Cattleya* that require cooler temperatures.

2.3.3 Growth, "Rest Period" and Flowering

Cattleya can be categorized according to the stage of pseudobulb maturity that flower buds appear. Flower buds can appear while a pseudobulb is still in active growth, as soon as pseudobulbs are mature, or after a delay known as a **rest period** (A. A. Chadwick 2006, 50–51). As examples, *C. dowiana* produces flowers from a developing pseudobulb, *C. gaskelliana* as soon as the pseudobulb is mature, and *C. mossiae* after a rest period of 5-6 months from mature pseudobulbs (A. A. Chadwick 2006, 51). *Cattleya* species without a rest period develop roots from mature pseudobulb while *Cattleya* with a rest period produce roots from a developing pseudobulb (Rogerson 2004).

Most *Cattleya* which flower from a developing growth have a flowering season spanning May to July in the northern hemisphere, while *Cattleya* that flower from a mature growth and with a rest period tend to flower in other months (**Appendix A**). On the whole, flowering season is not a strong indicator of whether a plant has a rest period or duration of rest period; as different species of *Cattleya* grown under similar conditions will initiate new pseudobulbs at points in the year and have different rates of pseudobulb growth, which are also influenced by environmental factors (Rotor 1951; A. A. Chadwick 2006).

2.3.4 Influence of Photoperiod and Temperature on Growth and Flowering

In *Cattleya* with a rest period, the apical meristem of a developing pseudobulb forms a bud primordium surrounded by bracts. This bud primordium remains dormant until a threshold of daylength and low temperature triggers the resumption of meristematic activity, resulting in elongation of the inflorescence axis and differentiation of floral bud primordia. However, in *Cattleya* without a rest period, flower bud initiation occurs before pseudobulb maturity, yet there may still be a dependence on daylength and low temperature to ensure flowering (Rotor 1951).

In most Cattleyas, long-days (LDs) and high night temperatures stimulate vegetative growth, while flowering is increased by or requires short-days (SDs) and low night temperatures, although there are several species-specific interactions with photoperiod and temperature (Rotor 1951; Arditti 1980). For *C. gaskelliana* and *C. labiata*, night temperatures have a greater influence on flowering than daylength. For *C. percivaliana* and *C. trianae*, daylength has a greater influence on flowering than night temperature. *C. warscewiczii* and *C. mossiae* require both SDs and low night temperatures to flower (Rotor 1951). Flowering in *Gurianthe skinneri* may be enhanced by SD (Rotor 1951). Continuous LDs of 16 hr. inhibited flowering in *Gur. bowringiana*, 14 hr days did not prevent flowering, while continuous SDs hastened flowering but reduced the number of flowers per inflorescence (Arditti 1980, 543; Bhattacharjee 1980).

The findings of Rotor (1951) suggest that among the studied *Cattleya*, flowering season and stage of pseudobulb maturity that flowers are initiated does not correlate strongly with photoperiodic and temperature response. *C. gaskelliana* and *C. labiata* have a similar response to photoperiod and temperature, but *C. gaskelliana* flowers in May–June from a developing pseudobulb, while *C. labiata* flowers from Sept–Oct after a rest period of one month (A. A. Chadwick 2006, 51). *C. warscewiczii* and *C. mossiae* require short days and low temperatures to flower, but *C. warscewiczii* flowers in June–July from a developing pseudobulb, and *C. mossiae* flowers from February–May after a 5–6 month rest period (A. A. Chadwick 2006, 51).

In contrast to results for the plant growth experiments, daylength during flower bud initiation suggest certain *Cattleya* species are LD plants. Rotor (1951) sampled pseudobulbs at different stages of maturity to determine the dates of flower bud initiation. The results of Rotor (1951), who conducted the experiments in Ithaca, New York, together with daylength in Ithaca on those dates and the approximate shortest daylength in the range of the *Cattleya* are provided

in **Table 4**. Information on the distribution of *Cattleya* was obtained from Rotor (1951) and "Plants of the World Online | Kew Science" (n.d.), while daylength was calculated using "Day Length Calculator" (n.d.) and inputting the location and the date, including the year. To obtain the shortest daylength in the native range of species, I inputted the solstice dates for respective hemisphere.

TABLE 4. Flower initiation dates in Cattleyas, daylength during initiation, and shortest daylength in native range

Species	1949	1950	Daylength in Ithaca (hr.:min)	Shortest daylength in native range (approximate)
C. gaskelliana	-	Mar. 1	11:10	11:29
C. labiata	June 25	June 25	15:14/15:54	10:41
C. percivaliana	Sept. 3	Sept. 1	13:01/13:08	11:37
C. trianae	Sept. 3	Sept. 15	13:01/12:28	11:40
C. mossiae	Nov. 15	Nov. 1	09:44/10:18	11:29
Gur. skinneri	Jan. 28	-	09:47	11:30

Source: Rotor (1951), daylength calculated using "Day Length Calculator" (n.d.) and distributions from Rotor (1951) and "Plants of the World Online | Kew Science" (n.d.)

C. labiata, *C. percivaliana* and *C. trianae* initiated flower buds when the natural daylength exceeded 12 hours. This suggests that they are LD plants, in contrast to their responses under experimental conditions. Due to these conflicting results, further investigations into the photoperiodism of *Cattleya* are warranted, potentially through night period interruption. The shortest days in the native habitats of most *Cattleya* is around 11 hr., 30 min. Therefore, the critical photoperiod for flower production probably does not lie beyond 12±1 hours.

Inheritance of photoperiodicity is poorly understood in hybrids. Cattleya hybrids generally have a similar flowering season, and flower from a stage of pseudobulb maturity or with a rest period similar to that of species ancestors, especially if a species appears recently or repeatedly in its ancestry (Hackney 2004; A. A. Chadwick 2006). Flowering in hybrids bred from *C. labiata* can be delayed with LDs (Urmstom 1949). This suggests that hybrids have a similar response to environmental cues as species ancestors. However, the primary hybrid of two LD species, *C.* Enid (*C. mossiae* × *C. warscewiczii*) flowered independently of daylength and temperature, and 16 ½ hr photoperiods delayed but did not prevent flowering in *C.* Bow Bells, which is bred from species have flowering inhibited by long days: *C. mossiae*, *C. trianae* and *C. gaskelliana* (Rotor 1951; Arditti 1980, 540, 543). Hager (1953) reported *Cattleya* seedlings flowering when grown under continuous daylength of 16 hours. A possible explanation for these conflicting observations is that hybrid populations show a range of flowering seasons and photoperiodic responses, but commercial breeders selected for hybrids that flowered in a specific season or with a photoperiodic response that enabled control of flowering.

3 Cattleyas in Singapore

3.1 Summary

This chapter consolidates records of Cattleyas that demonstrate regular flowering in Singapore and the lowlands of Malaysia and provides heuristics for determining which Cattleyas can be expected to do so. I produced consolidated records of Cattleyas suitable for Singapore and Malaysia from three main sources: first; literature on cattleyas, second; records of flowering Cattleyas displayed at the Orchid Society of South East Asia (OSSEA) monthly meetings (**Appendix C**), and third; Singapore-based Cattleya hybrids registered with the RHS (**Appendix D**). By analyzing the growth habits of the Cattleya species, the ancestry of hybrids, and with the information covered in under **Background**, I present the following observations:

Cattleya species and the major species ancestors of hybrids that are cultivated in Singapore are usually warmer-growing and flower while pseudobulbs are still developing, with a short rest period, or multiple times a year. Based on available information, such flowering behavior does not necessarily indicate a particular photoperiodic or temperature response or lack thereof but does correlate with flowering season in the northern hemisphere. Cattleya hybrids which flower on a developing pseudobulb or with a short rest period generally have a summer to fall flowering season, while Cattleya hybrids with a longer rest period flower from winter to spring.

Latitude and elevation are not consistent indicators of temperature ranges experienced by species in their native habitat, as several species that come from high elevations such as *C. percivaliana* and *C. quadricolor*, as well as relatively high latitudes such as *Rl. digbyana* are found in cultivation in Singapore.

Hybrids can show large improvement over species ancestors with regards to growth and flowering in Singapore. In several hybrids, most species ancestors are considered poorly suitable

for cultivation in Singapore, or only a small proportion of species ancestors have records of cultivation and flowering.

Most hybrids within *Cattleya* that have records of flowering in Singapore are not hybrids solely of *C.* section *Cattleya*; the montane species. Although Holttum (1953a, 464–86) recommended primary hybrids within this section, especially with *C. dowiana* as a parent, average temperatures in Singapore were likely lower when this recommendation was made. *Cattleya* hybrids cultivated or originated in Singapore generally have a high contribution of *C.* subg. *Intermediae* or "bifoliate" *Cattleya* in their ancestry (parent or grandparent) or are hybrids solely of *C.* subg. *Intermediae*. This is especially true of white *Cattleya*, possibly because *C. mossiae* is heavily involved in breeding white hybrids and it requires on short days and low temperatures for flowering.

However, there is a gap between the *C.* subg. *Intermediae* species most suitable for Singapore and the *C.* subg. *Intermediae* that make up the ancestry of hybrids cultivated or originated in Singapore. The most frequently displayed *C.* subg. *Intermediae* species at monthly meetings are *C. violacea*, C. *walkeriana* and *C. forbesii*. On the contrary, the ancestry of Singapore-registered hybrids and particularly hybrids recommended in literature as suitable for Singapore include *C. intermedia, C. guttata* and *C. loddigesii*. These species are likely not optimal for Singapore as they did not appear at monthly meetings, their hybrids produce drastically fewer number of flowers per inflorescence in Singapore compared to when cultivated in other countries, and while *C. guttata* is a direct parent of two hybrids originated in Singapore, *C. intermedia* and *C. loddigesii* are not.

Regarding intergeneric Cattleya hybrids, *Brassavola* hybrids perform well in Singapore even if the other parent is not particularly suitable to the climate of Singapore, such as in the

hybrids *Brassocattleya* (*Bc*.) Gulfshore's Beauty (*B. nodosa* × *C. dormaniana*), *Bc*. Katherine H Chatham (*B. nodosa* × *C. labiata*) and *Procatavola* Wufong Jade (*Ctyh*. Siam Jade × *B. nodosa*). *Rl. digbyana*, even if it was only introduced into hybrid ancestry multiple generations prior, is associated with improved performance of a hybrid within a line relative to those that only have *Cattleya* in their ancestry. Hybrids with *Guarianthe* (*Gur*.) *aurantiaca* and *Gur. bowringiana* are well represented in the ancestry of hybrids in Singapore, although the former species does not appear to be suitable to Singapore and generally appears further back in the ancestry of hybrids it is involved in compared to *Gur. bowringiana*. *Gur. aurantiaca* and *Gur. bowringiana* and their hybrids produce fewer flowers per inflorescence in Singapore compared to when they are cultivated in more seasonal and cooler climates. *Caularthron bicornutum*, *Encyclia cordigera* and *Laelia rubescens* and their hybrids are strongly supported as suitable for Singapore.

3.2 Review of Singapore-based Literature on Cattleyas

I reviewed available literature on the growth and flowering of Cattleyas in Singapore and the lowlands of Malaysia, and analyzed the ancestry of certain hybrids. I excluded descriptions of Cattleya performance in Java, the highlands of Malaysia or vague localities. I updated species names and hybrid genera combinations provided by the reviewed literature to the most current at the time of writing, as per Kew's World Checklist of Selected Plant Families (WCSP), and the RHS orchid hybrid lists (Govaerts et al. 2017; Royal Horticultural Society 2017). Where relevant, I included and indicated outdated or dubious names with "[*sic*]" or "former", and current classification with "present".

On a cautionary note, the compiled historical information is not a definitive predictor on whether a particular Cattleya can be successfully cultivated in Singapore due to genetic variation within a species or hybrid population, and the interaction of this variation with a grower's

microclimate and cultural practices. Additionally, since the publication of several literature sources, the climate of Singapore has warmed and the frequency of heavy rain has increased ("Past Climate Trends" n.d.). This change in climate likely decreased the hospitability of Singapore's climate to Cattleya cultivation. Conversely, selection and propagation of the most vigorous individuals may have increased the suitability of certain species and hybrids for cultivation in Singapore.

Holttum (1953a, 464–86; 1953b, 228–32) remarked on the growth and flowering of some species and hybrids under cultivation in Singapore, Java, and present-day Malaysia. I grouped species suitability into four main categories based on Holttum's remarks:

1. Most suitable; vigorous growth and free-flowering habit when cultivated in Singapore and lowlands of Malaysia
2. Moderately suitable; cultivation of these species had caveats such as growing well but flowering poorly, being better suited for a cooler or more seasonal climate, or having limited records
3. Not suitable; species only cultivable at elevations well above sea level
4. No cultivation information provided, but mentioned in text

Brassavola cordata, *Broughtonia sanguinea*, *Cattleya gaskelliana*, *Cattleya lueddemanniana*, *Guarianthe bowringiana*, *Prosthechea cochleata* and *Rhyncholaelia digbyana* belong to the first category (Holttum 1953a, 464–86). Of the species in the fourth category, several have since proven appropriate for cultivation in Singapore since the time of the work but are included as a record for development of knowledge in this field. The species are grouped according to their summarized remarks in **Table 5**.

TABLE 5. Suitability of Cattleya species in Singapore according to Holttum (1953a, 464–86)

Suitability for Singapore and the lowlands of Malaysia	Species
Most Suitable	*Brassavola cordata, Broughtonia sanguinea, Cattleya lueddemanniana, C. gaskelliana, Guarianthe bowringiana, Prosthechea cochleata, Rhyncholaelia digbyana*
Moderately suitable	*Cattleya bicolor, C. dowiana, C. guttata, C. intermedia, C. labiata, C. mossiae, C. perrinii, C. purpurata, C. trianae, Caularthron bicornutum, Encyclia cordigera, Encyclia hanburyi, Epidendrum ciliare, Epidendrum radicans, Epidendrum stamfordianum, Guarianthe skinneri, Laelia* (former *Schomburgkia*) *crispa, L. undulata, Myrmecophila tibicinis, Prosthechea fragrans*
Not suitable	*Cattleya dormaniana, C. flava, C. gouldiana, C. grandis, C. mendelii, C. pumila, C. warscewiczii, C. xanthina, Euchile citrina, Laelia superbiens*
No information available	*Brassavola acaulis, B. cucullata, B. nodosa, Cattleya amethystoglossa, C. forbesii, C. granulosa, C. harrisoniana, C. lawrenceana, C. leopoldii, C. loddigesii, C. maxima, C. percivaliana, C. rex, C. schilleriana, C. × victoria-regina, C. violacea, C. wallisii, C. warneri, Rhyncholaelia glauca, Sophronitis* [*sic*] (presently *Cattleya*)

Source: Holttum (1953a, 464–86)

Hybrid ancestry is important in determining the propensity of a hybrid to thrive in Singapore and the lowlands of Malaysia, and hybrids of "moderately suitable" species often had increased vigor relative to their ancestor species that enabled their cultivation. Holttum (1953b, 231) advised choosing the warmest-growing plants when importing *Cattleya* hybrids from cooler climates, but intermediate-growing plants were still satisfactory in Singapore and the lowlands of Malaysia. Holttum (1953a, 480; 1953b, 231) regarded most primary "labiate" (presently *C.* section *Cattleya*) hybrids, particularly those with *Cattleya dowiana*, as moderately strong-growing and free-flowering in Singapore and the lowlands of Malaysia and recommended the following hybrids: *Cattlianthe* Mantinii (*Gur. bowringiana* × *C. dowiana*), *Cattleya* Hardyana

(*C. dowiana* × *C. warscewiczii*) and *C.* Ashtoni [*sic*]. *C.* Ashtoni [*sic*] most likely is *C.* Ashtoniana (1893) (*C. harrisoniana* × *C. warscewiczii*).

Hybrids which incorporated *Cattleya* from higher altitudes and latitudes are generally not free-flowering in Singapore and the lowlands of Malaysia (Holttum 1953a, 480). Holttum (1953a, 474; 1953b) described "yellow and bronze hybrids", which likely refers to early hybrids of *C. dowiana*, *C. bicolor,* and several yellow-flowered *Cattleya* species from higher elevations in Brazil, as more difficult to cultivate (A. A. Chadwick 2006, 181–85). On the contrary, hybrids of *Rl. digbyana*, a species already considered most suitable, grew strongly and flowered well in the lowlands of Malaysia (Holttum 1953a, 484). Holttum (1953a, 485–86) did not describe individual species of series *Sophronitis*.

Epidendrum radicans and its hybrid *Epi*. O'Brienianum grow vigorously in the lowlands but growth, flower production and flower quality are superior at higher elevations (Holttum 1953a, 470–72; 1953b, 231–32). Holttum (1953b, 231–32) recommended that *Epidendrum radicans* hybrids should be raised locally from seed to select for plants most adapted to the local climate. Lastly, Holttum (1953a, 480) concluded that most *Cattleya* hybrids grew and flowered better at elevations of about 2000 to 4000 feet (approximately 600 to 1200 m asl) compared to at or near sea level.

Henderson (1963) excluded cattleya hybrids from their description of orchid hybrids produced and grown in Malaysia and Singapore, on account of limited local breeding in Cattleyas.

Lee (1979, 64) stated that breeding of cattleyas was not active in Malaysia, with most plants in cultivation originating from overseas, and recommended breeding locally free-flowering cattleyas together to sustain local interest in this group of orchids. Lee (1979, 64)

cautioned that some cattleyas that were free flowering in their countries of origin may not be free-flowering in Malaysia, as these required short days and low temperatures for flower bud initiation. Lee (1979, 63–65) provided tables of Cattleya hybrids that were moderately free flowering in Singapore and Malaysia, grouped according to their petal and sepal color. These are compiled in **Table 6**.

TABLE 6. Moderately free flowering Cattleyas in Singapore and Malaysia according to Lee (1979, 63–65)

Genus	Species/Grex	Parentage	Color
Cattleya	Eade	*C.* (Invicta × Corisande)	Mauve to red
	Ishtar	*C.* (Sargon × Fabia)	
	Stalin	*C.* (Angus × Gloriette)	
Rhyncholaeliocattleya	Fire Glow	*Rlc.* Norman's Bay × *C. coccinea*	
	Fred Stewart	*Rlc.* (Mem. Crispin Rosales × Norman's Bay)	
	Magic Island	*C.* Rainbow Hill × *Rlc.* Wendell Hoshino	
	Norman’s Bay	*Rlc*. Hartland × *C.* Ishtar	
	Nortela	*C.* Tela × *Rlc*. Norman's Bay	
Cattleya	Bob Betts	*C.* (Bow Bells × *mossiae*)	White
	Bow Bells	*C.* (Edithiae × Suzanne Hye)	
	Candace Beth Shaffer	*C.* (Louise Georgianna × Bow Bells)	
	Crown Princess Michiko	*C.* (Marion Patterson × Bob Betts)	
	intermedia		
	Little Dorene	*C.* (Little Angel × Dorene)	

	Louise Georgianna	*C.* (*intermedia* × Souvenir de Louis Sander)	
	Margaret Degenhardt	*C.* (*intermedia* × Bob Betts)	
	Queen Sirikit	*C.* (Bow Bells × O'Brieniana)	
	Ruth M. Johnston	*C.* (Bob Betts × General Patton)	
	Snowflower	*C.* (Claesiana × White Blossom)	
	Venie	*C.* (Intermediette × Bob Betts)	
Rhyncholaeliocattleya	Déesse	*Rlc.* Ferrières × *C.* Lamartine	
Cattleya	Hardyana	*C.* (*dowiana* × *warscewiczii*)	White (with colored lip, various colors possible)
	Phyl Cotton	*C.* (Edythe Wood × Mem. Paul T. Yamada)	Yellow (possible error, should be white based on parentage)
	Malworth	*C.* Charlesworthii × *Rlc.* Malvern	Yellow
	Amber Glow	*C.* (Derna × Anne Walker)	Yellow (with red lip)
	Dorset Gold	*C.* (Derna × Mrs. Medo)	

Source: Data from Lee (1979, 63–65)

A notable hybrid in the background of six of the eight cattleya in the "Mauve to red" color category is *C.* Sargon. *C.* Sargon is a parent of *C.* Corisande (*C.* Sargon × *C.* Katadin) which is the parent of *C.* Eade (*C.* Invicta × *C.* Corisande). *C.* Sargon is also the parent of *C.* Ishtar (*C.* Sargon × *C.* Fabia). C. Ishtar is the parent of *Rlc.* Norman's Bay (*C.* Hartland × *C.*

Ishtar), which is itself a parent of three of the four *Rhyncholaeliocattleya* (*Rlc.* Fire Glow, *Rlc.* Fred Stewart and *Rlc.* Nortela). *Rlc*. Norman's Bay also introduces *Rl. digbyana, C. warneri* and *C. percivaliana* through *C.* Hartland, while contributing additional *C. dowiana* and *C. labiata*. **Figure 1.** provides the ancestry of *Rlc.* Norman's Bay, *C.* Sargon and *C*. Ishtar.

Ancestry of *Rlc.* Norman's Bay

Rlc. Norman's Bay = *Rlc.* Hartland × *C.* Ishtar
- *C.* Hartland = *Rlc.* Hannibal × *C.* Leda
  - *Rlc.* Hannibal = *C.* Digbyano-Warneri × *C.* Fabia
    - *Rlc*. Digbyano-Warneri = *Rl. digbyana* × *C. warneri*
    - *C.* Fabia = *C. dowiana* × *labiata*
  - *C.* Leda = *C. dowiana* × *C. percivaliana*
- *C.* Ishtar = *C.* Sargon × *C.* Fabia
  - *C.* Sargon = *C.* Lustre × *C.* Hardyana
    - *C.* Lustre = *C.* Callistoglossa × *C. lueddemanniana*
      - *C.* Callistoglossa = *C. warscewiczii* × *C. purpurata*
    - *C.* Hardyana = *C. dowiana* × *C. warscewiczii*
  - *C.* Fabia = *C. dowiana* × *C. labiata*

Figure 1. Ancestry of *Rlc*. Norman's Bay ("Rhyncholaeliocattleya Norman's Bay" n.d.)

Cattleyas that flower from a developing or newly matured pseudobulb, without a rest period, feature heavily in the ancestry of *Rlc.* Norman's Bay: *C. dowiana, C. warscewiczii, C. lueddemanniana, C. warneri* and *Rl. digbyana*. Even the two "mauve to red" CA without *C.* Sargon in their ancestry, *C.* Stalin and *Rlc*. Magic Island, feature *C. warneri* as the third and fourth most influential *Cattleya* in their ancestry respectively. In addition, *C. dowiana, C. lueddemanniana* and *Rl. digbyana* are warm growing. Therefore, beyond what these species contribute to floral characteristics, they appear important in imparting a tolerance of warm

temperatures and flowering requirements that are compatible with the climate of Singapore and Malaysia.

Large white Cattleya hybrids are bred primarily from *C. mossiae*, *C. trianae* and *C. gaskelliana,* and some have influence from *C. labiata*, *C. lueddemanniana*, *C. schroederae* and *C. warneri* (Hackney 2004; A. A. Chadwick 2006; Allen-Ikeson 2018) *C.* Bow Bells and its offspring *C.* Bob Betts were breakthroughs in breeding white cattleya, and it is unsurprising that they are recommended by Lee (1979, 63–65). The ancestry of *C.* Bow Bells is outlined in **Figure 2**.

Ancestry of *C.* Bow Bells

C. Bow Bells = *C.* Edithiae × *C.* Suzanne Hye

C. Edithiae = *C.* Suzanne Hye × *C. trianae*

C. Suzanne Hye = *C. gaskelliana* × *C. mossiae*

Figure 2. Ancestry of *C.* Bow Bells ("Cattleya Bow Bells" n.d.)

C. mossiae and C. *trianae* feature heavily in the ancestry of *C.* Bow Bells. These species are considered only moderately suitable for Singapore by Holttum (1953a, 464–86) and did not appear at recent monthly meetings (**Appendix C**) or as direct parents of Singapore registered hybrids (**Appendix D**). These species are also native to high elevations, and *C. mossiae* requires both short days and temperatures below 12.3 C to flower, while *C. trianae* requires short days (Rotor 1951). The remaining species ancestor of C. Bow Bells is *C. gaskelliana*, which is considered highly suitable for Singapore and flowers from a developing pseudobulb (Holttum 1953a, 464–86; A. A. Chadwick 2006, 121). Another possible explanation for the suitability of *C.* Bow Bells for the tropics is that the parentage of *C.* Bow Bells may be that of *C.* Joyce Hannington, which has *C. labiata* and C. *lueddemanniana* as ancestors (Hackney 2004, 80).

These species are slightly more suitable than *C. mossiae* and *C. trianae* for Singapore. The ancestry of *C.* Joyce Hannington is outlined in **Figure 3**.

Ancestry of *C.* Joyce Hannington

C. Joyce Hannington = *C.* Barbara Dane × *C.* Snowdon
C. Barbara Dane = *C. labiata* × *C.* Phoebe Snow
C. Phoebe snow = *C.* Cappei × *C. lueddemanniana*
C. Cappei = *C. schroederae* × *C. trianae*
C. Snowdon = *C. labiata* × *C.* Suzanne Hye
C. Suzanne Hye = *C. gaskelliana* × *C. mossiae*

Figure 3. Ancestry of *C.* Joyce Hannington ("Cattleya Joyce Hannington" n.d.)

While the parentage of *C.* Bob Betts is registered as *C.* Bow Bells × *C. mossiae*, its actual parentage is *C.* Bow Bells × C. × *gravesiana*, the natural hybrid between *C. mossiae* and *C. lueddemanniana* (Hackney 2004, 9). *C. lueddemanniana* is consider highly suitable for Singapore and is a warm-growing *Cattleya* that produces flowers on a developing pseudobulb (Holttum 1953a, 464–86; A. A. Chadwick 2006, 81). This could explain why more of recommended white *Cattleya* hybrids by Lee (1979) have *C.* Bob Betts as an immediate parent compared to *C.* Bow Bells (4 vs. 2). The two white *Cattleya* without *C.* section *Intermediae* ancestry, *C.* Crown Princess Michiko (*C.* Marion Patterson × *C.* Bob Betts) and C. Ruth M. Johnston (*C.* Bob Betts × *C.* General Patton) both have *C.* Bob Betts as an immediate parent. Thus, *C.* Bob Betts and its hybrids are more strongly recommended for Singapore and Malaysia compared to those of *C.* Bow Bells.

Aside from *C.* Bob Bells, *C.* Bob Betts, *C.* Crown Princess Michiko and Rlc Déesse, all other white *Cattleya* have *C.* section *Intermediae* influence, mainly of *C. intermedia* and *C.*

loddigesii. Please refer to **Figure 4** for the partial ancestry of these *Cattleya* until the *C.* section *Intermediae* generation.

Partial ancestry of recommended white *Cattleya*

C. Beth Shaffer = *C.* Louise Georgianna × *C.* Bow Bells
C. Louise Georgianna = *C. intermedia* × *C.* Souvenir de Louis Sander

C. Margaret Degenhardt = *C. intermedia* × *C.* Bob Betts

C. Little Dorene = *C.* Little Angel × *C.* Dorene
C. Little Angel = *C.* O'Brieniana × *C. loddigesii*
C. O'Brieniana = *C.* × *dolosa* × *C. loddigesii*
C. × *dolosa* = *C. loddigesii* × *C. walkeriana*

C. Queen Sirikit = *C.* Bow Bells × *C.* O'Brieniana

C. Snowflower = *C.* Claesiana × *C.* White Blossom
C. Claesiana = *C. intermedia* × *C. loddigesii*

C. Venie = *C.* Intermediette × *C.* Bob Betts
C. Intermediette = *C.* Henrietta Japhet × *C. intermedia*
C. Henrietta Japhet = *C.* Eucharis × *C. loddigesii*

Figure 4. Ancestry of white *Cattleya* recommended by Lee (1979, 63–65) with *C.* section *Intermediae* ancestors ("OrchidRoots" n.d.)

White *Cattleya* hybrids bred purely from section *Cattleya* are generally not as suitable for cultivation in Singapore and Malaysia, especially compared to mauve to red Cattleya hybrids. Bifoliate *Cattleya* ancestry is associated with better suitability of white hybrids but with a reduction in flower size and ideal lip shape. However, the number of flowers per inflorescence

produced by hybrids with *C. intermedia* and *C. loddigesii* ancestry in Singapore is much less compared to plants grown in temperate regions.

Rlc. Déesse is the only mentioned white *Rhyncholaeliocattleya*. *Rlc*. Déesse has *Rl. digbyana* and *C. trianae* as grandparents. The remaining species ancestors of the hybrid are predominantly *Cattleya* species that flower while a new pseudobulb is developing and bloom in the summer: *C. dowiana*, *C. warscewiczii* and C. *gaskelliana*. I therefore recommend choosing and breeding hybrids from *Rlc.* Déesse, and other white hybrids with similar parentage for Singapore and the lowland equatorial tropics. The ancestry of *Rlc*. Déesse is provided in **Figure 5**.

Ancestry of *Rlc*. Déesse

Rlc. Déesse = *Rlc.* Ferrières × *C*. Lamartine
Rlc. Ferrières = *Rl. digbyana* × *C*. Dionysius
C. Dionysius = *C*. Fabia × *C*. *warscewiczii*
C. Fabia = *C*. *dowiana* × *C*. *labiata*
C. Lamartine = *C*. Lord Rothschild × *C*. *trianae*
C. Lord Rothschild = *C*. *dowiana* × *C*. *gaskelliana*

Figure 5. Ancestry of *Rlc*. Déesse ("Rhyncholaeliocattleya Déesse" n.d.)

Lee (1979, 63–65) classified *C.* Hardyana as having white sepals and petals, although this hybrid occurs in a range of colors. Holttum (1953a) also recommended *C.* Hardyana (*C. dowiana* × *C. warscewiczii*), and it is a hybrid between two species that flower from a developing pseudobulb. Both parents are considered only moderately suitable for Singapore by Holttum (1953a), so the hybrid might not reach its full potential. Lee (1979, 63–65) listed *C.* Phyl Cotton as a yellow hybrid, however it has no species with yellow flowers in its background.

Rlc. Malworth has yellow sepals and petals and a yellow lip with a rose margin. The identity of its seed parent remains controversial and so it is excluded from this parentage analysis (Hackney 2004; Odom's Orchids, Inc. 2016). *C. dowiana* is prominent in the ancestry of *Rlc.* Malvern; *C. xanthina* and *Rl. digbyana* to a smaller extent, and *C. bicolor* and *C. wallisii* many generations prior. The ancestry of *Rlc.* Malworth is provided in **Figure 6**.

Ancestry of *Rlc.* Malworth

Rlc. Malworth = *C.* Charlesworthii (?) × *C.* Malvern
- *C.* Malvern = *Rlc*. The Baroness × *C*. Canberra
  - *Rlc*. The Baroness = *C.* Mrs. J. Leeman × *C*. Ophir
    - *C*. Mrs. J. Leeman = *Rl*. *digbyana* × *C*. *dowiana*
    - *C*. Ophir = *C*. *dowiana* × *C*. *xanthina*
  - *C*. Canberra = *C*. Litana × *C*. Venus
    - *C*. Litana = *C*. Thyone × *C*. Sibyl
      - *C*. Thyone = *C*. Ophir × *C*. *dowiana*
      - *C*. Sibyl = *C*. *dowiana* × *C*. Iridescens
        - *C*. Iridescens = *C*. *bicolor* × *C*. *wallisii*
    - *C*. Venus = *C*. *dowiana* × *C*. Iris
      - *C*. Iris = *C*. *dowiana* × *C*. *bicolor*

Figure 6. Ancestry of *Rlc*. Malworth ("Rhyncholaeliocattleya Malworth" n.d.)

C. Amber Glow and *C.* Derna were classified by Lee (1979, 63–65) as having yellow sepals and petals, but unlike *Rlc.* Malworth both hybrids have a richly colored purple-to-red lip more reminiscent of *C. dowiana*. Both have strong *C. dowiana* influence in their ancestry, with the species crossed into their lineage multiple times. *C.* Amber Glow is the offspring of *C.* Derna. The ancestries of *Rlc. C.* Amber Glow and *C.* Derna are provided in **Figure 7**.

Ancestries of *C.* Amber Glow and *C.* Derna

C. Amber Glow = *C.* Derna × *C.* Anne Walker
- *C.* Derna = *C.* Nugget × *C. dowiana*
  - *C.* Nugget = *C.* Canberra × *C.* Mrs Medo
    - *C.* Canberra = see **Figure 6**.
    - *C.* Mrs. Medo = *C.* Luminosa × *C.* Venus
      - *C.* Luminosa = *C. dowiana* × *C. tenebrosa*
      - *C.* Venus = see **Figure 6**.
- *C.* Anne Walker = *C.* Carmencita × *C.* Goldfish
  - *C.* Carmencita = *C.* Luminosa × *C. dowiana*
  - *C.* Goldfish = *C.* Goldfinch × *C.* Sylvia
    - *C.* Goldfinch = *C.* Warnhamensis × *C. dowiana*
      - *C.* Warnhamensis = *C. trianae* × *C. cinnabarina*
    - *C.* Sylvia = *C. dowiana* × *C.* Fabia
      - *C.* Fabia = *C. dowiana* × *C. labiata*

Figure 7. Ancestries of *C.* Amber Glow and *C.* Derna ("Cattleya Amber Glow" n.d.)

Singapore Orchids Pte Ltd was a commercial enterprise that bred and produced orchids for export as cut flowers (Ede 1985, 1). Mandai Gardens was a showcase for its hybrids and landscaping with orchids in Singapore (Ede 1985, 1). Ede (1985, 65) described two cattleya hybrids cultivated at Mandai Gardens: *Myrmecocattleya* (former *Lyonara*) Fiesta and *Caulophila* (former *Schombodiacrium*) Ipo (*Myrmecophila tibicinis* × *Caularthron bicornutum*).

Unfortunately, the photo labelled as *Myrmecocattleya* Fiesta appears to show a different hybrid. Based on the parentage of *Myrmecocattleya* Fiesta [*Cattleya* Issy (*guttata* × *tenebrosa*) × *Myrmecophila thomsoniana*], one would expect pink to dark colored flowers with a tubular labellum that encircles the column. However, the photo purportedly of *Myc.* Fiesta is more reminiscent of a *Caularthron* hybrid due to light-colored flowers with exposed columns and a flat, spotted labellum.

Teoh (2005, 81) outlined several *Cattleya* (former *Laeliocattleya*) hybrids suitable for cultivation in the tropical lowlands: *Cattleya* Derna Anderson [*sic*] (likely referring to *C.* Derna 'Anderson'; 'Anderson' is the clonal name), *C.* Amber Glow and *C.* Dorset Gold. *C.* Derna and *C.* Amber Glow were also mentioned by Lee (1979, 64). These hybrids are bred from and reminiscent of the *C. dowiana* color scheme: yellow sepals and petals with a red labellum. In addition, Teoh (2005, 81) described three *Cattleya* hybrids that perform "extremely well" in Singapore: *C.* Hawaiian Wedding Song, *Rhyncholaeliocattleya* (*Rlc.*) Pink Diamond and *Rlc.* Alma Kee.

Both *C.* Hawaiian Wedding Song and *Rlc*. Pink Diamond have *C. loddigesii* and *C. intermedia* in their ancestry. In addition, *Rlc*. Pink Diamond has *Rlc*. Norman's Bay in its ancestry.

Rlc. Alma Kee has the same color scheme as *C.* Derna, *C.* Amber Glow and *C.* Dorset Gold. However, *Rlc*. Alma Kee is less influenced by *C. dowiana* and has a greater diversity of species in its background, including *C. schroderae, C. gaskelliana, C. warscewiczii, C. mossiae* and *cinnabarina* from its Alma parent, and perhaps most importantly *Rl. digbyana* and *C. lueddemanniana* through its grandparent *Rlc*. Norman's Bay, which has already been described and its ancestry presented in **Figure 1**. Crosses between *Rlc*. Norman's Bay and a strongly *C.*

dowiana influenced hybrid, as per *Rlc.* Alma Kee's parent *Rlc.* Cheah Bean-Kee (*C.* Los Angeles × Rhyncholaeliocattleya Norman's Bay) normally produce dark-purple, to almost red flowers (Hackney 2004). However, only the clone *Rlc.* Alma Kee 'Tipamalee' is in widespread circulation, so its appearance might have been a rare outcome. The ancestry of *Rlc.* Alma Kee is provided in **Figure 8**.

Ancestry of *Rlc.* Alma Kee

Rlc. Alma Kee = *C.* Alma × *Rlc.* Cheah Bean-Kee
- *C.* Alma = *C.* Appam × *C.* Helius
  - *C.* Appam = *C.* Scylla × *C. dowiana*
    - *C.* Scylla = *C.* Cappei × *C.* Lord Rothschild
      - *C.* Cappei = *C. warscewiczii* × *C. cinnabarina*
      - *C.* Lord Rothschild = *C. dowiana* × *C. gaskelliana*
  - *C.* Helius = *C.* G. S. Ball × *C. mossiae*
    - *C.* G. S. Ball = *C. schroederae* × *C. cinnabarina*
- *Rlc.* Cheah Bean-Kee = *C.* Los Angeles × *Rlc.* Norman's Bay
  - *C.* Los Angeles = *C.* Golden West × *C.* S. J. Bracey
    - *C.* Golden West = *C.* Orion × *C.* Triumphans
      - *C.* Orion = *C.* Haroldiana × *C. dowiana*
        - *C.* Haroldiana = *C.* Hardyana × *C. tenebrosa*
      - *C.* Triumphans = *C. dowiana* × *C. rex*
    - C. S.J. Bracey = *C.* Mrs. Medo × *C.* Thebes
      - *C.* Mrs. Medo = see **Figure 7**
      - *C.* Thebes = *C.* Adula × *C. dowiana*
        - *C.* Adula = *C. bicolor* × *C.* Hardyana
  - Rlc. Norman's Bay = see **Figure 1**

Figure 8. Ancestry of *Rlc.* Alma Kee ("Rhyncholaeliocattleya Alma Kee" n.d.)

Rlc. (Country Road × Orchid Library) [*sic*] is a large, white flower with an open yellow lip that flowers once a year from February to March (Teoh 2005, 82). However, there is no Cattleya hybrid registered as "Orchid Library", and this could be the clonal name of *Rlc*. Country Road or the other parent of the hybrid (e.g. *Rlc.* California Girl 'Orchid Library').

Teoh (2005, 85–86) recommended several "bifoliate" *Cattleya* hybrids that flower multiple times a year in a warm, tropical climate. These hybrids were yellow, red, or both, colors desired by Southeast Asian growers (Teoh 2005, 85). The hybrids were: *Rhyncholaeliocattleya* Haw Yuan Moon, *Rlc.* Haadyai Delight, *Rhyncattleanthe* Free Spirit, *C*. Redzac, *C*. Rimfire, and *Laeliocattleya* Tutti [*sic*]. However, *C*. Redzac and *Rlc*. Haadyai Delight do not have substantially more *C*. section *Intermediae* in their ancestry than the previously mentioned *C. dowiana*-influenced *C.* Derna, *C.* Amber Glow and *C.* Dorset Gold. *Lc.* Tutti [*sic*] does not match the name of any registered hybrid. The Cattleya hybrids with the most similar names are *Rhyncattleanthe* Tutti Frutti and *Rhyncholaeliocattleya* Nobile's Tutti Frutti, both registered many years after Teoh (2005) was published.

Rhyncattleanthe Burana Beauty, which does have substantial *C*. section *Intermediae Cattleya* influence, was an example of a *Cattleya* hybrid that maintains its flower quality in Singapore, in contrast to *Rhyncholaeliocattleya* Alma Kee and an unnamed *Cattleya* hybrid awarded an FCC/AOS, which both had reduced flower quality Teoh (2005, 85–86).

Regarding other Cattleya species and hybrids, Teoh (2005, 84) observed *Epidendrum radicans* cultivated in local nurseries. *Encyclia cordigera* and *E. tampensis* were described as growing "quite well" in Singapore, and Teoh (2005, 84) recommended hybrids between *Cattleya* and *Encyclia* (former "pseudobulbous *Epidendrum*") for their delicate, round flowers and attractive lips. Teoh (2005, 88) overviewed *Caularthron* (former *Diacrum*), *Broughtonia* and

Schomburgkia [*sic*]. Intergeneric hybrids between *Caularthron* and *Cattleya* are suitable for tropical lowland cultivation, with *Caulocattleya* Chasity as a particular example. *Broughtonia sanguinea* and *Schomburgkia* [*sic*] species flower in Singapore. *Schomburgkia* [*sic*] was described as a "Mexican genus" with "large pseudobulbs which serve as a nesting place for ants…". This would presently be members of *Myrmecophila*, and Teoh did not describe the performance of the former-*Schomburgkia Laelia* in Singapore.

Teoh (2005, 88–89) presented photos of the following Cattleya hybrids : *Brassocattleya* Memoria Vida Lee, *Brassanthe* Maikai, *Brassocattleya* Hot Spice [*sic*], *Epidendrum* Hokulea, *Epicattleya* Roman Holiday [*sic*], *Brassocattleya* Binosa [*sic*], *Guaritonia* Why Not and *Epidendrum* (Star Valley × Joseph Lii) [*sic*] (Now registered as *Epi.* Pom Pom). Even considering changes to genera names and combinations, several of the photos do not match their purported hybrids. *Bc.* Hot Spice [*sic*] is not a registered grex name and the photo is of *Vaughnara* Golden Spice. The photo of *Epicattleya* Roman Holiday depicts round, lavender flowers with a deeper colored lip, reminiscent of a *Catcyclia* hybrid. The only Cattleya hybrid registered as Roman Holiday is *Brassocatanthe* Roman Holiday (*Cattlianthe* Chocolate Drop × *Brassavola nodosa*), which has yellow to red, stellate flowers. The photo might instead be of *Enanthleya* Roman Ruby. The photo of *Brassocattleya* Binosa appears to show *Bc.* Keowee 'Vi Galaxy'.

3.3 Cattleyas displayed at the OSSEA Monthly Meetings

The Orchid Society of South East Asia (OSSEA) was established in Singapore in 1928 and holds monthly meetings where members display their flowering orchids. I compiled monthly records of displayed Cattleyas from November 2018 to June 2022, and this is presented in **Appendix C**. No meetings were held from February 2020 to December 2021 due to the due to

the COVID-19 pandemic. While many interrelated factors influence how frequently an orchid is displayed at meetings, the relative frequency of appearance of a particular species or grex gives a general indication of ease of cultivation, freedom of flowering and popularity.

Of the 282 individual plants displayed over this period, the genera that appear most frequently were *Brassocattleya* (60; 21.3%), *Cattleya* (55; 19.5%), *Brassavola* (25; 8.9%), *Cattlianthe* (23; 8.2%) and *Rhyncholaeliocattleya* (19; 6.7%). *Brassocattleya* Katherine H. Chatham (*B. nodosa* × *C. labiata*) is the most displayed *Brassocattleya* hybrid; a total of 14 times.

Cattleya appeared in the background of 199 plants; 83 if *Brassocattleya* and *Cattleya* are excluded, demonstrating the central role of this genus to intergeneric hybrids. The number of times a *Cattleya* appeared is provided in brackets after its name. *Cattleya* species were displayed 28 times: *C. forbesii* (6), *C. walkeriana* (6), *C. cernua* (4), *C. lueddemanniana* (4), *C. quadricolor* (2), *C. aclandiae* (2), *C. violacea* (2), *C. labiata* (1) and *C. dowiana* (1). *C. walkeriana* and *C. loddigesii* are ancestors of 7 displayed *Cattleya* (*C. walkeriana* was not counted as an ancestor of *C.* Hawaiian Wedding Song), while C. *intermedia* (5) and *C. violacea* (5). When only unique grexes are considered, *C. loddigesii* appeared as an ancestor 6 times, *C. walkeriana* (5), C. *intermedia* (4), *violacea* (4) and *forbesii* (2)

Several primary *Cattleya* hybrids had at least one species parent that was not displayed, demonstrating an improvement in progeny performance over the parents. This aligns with the observations of Holttum (1953a, 480; 1953b, 231) that primary hybrids showed improvement over their species ancestors.

Despite only three displayed plants of *Guarianthe* species; Gur. *bowringiana* (2) and *Gur.* × *laelioides* (1), 52 intergeneric hybrids had *Guarianthe* in their background. These hybrids

tended to have *Gur*. *bowringiana* as a parent and *Gur*. *aurantiaca* as a grandparent. This is likely due to the desirable shape and vigorous growth in Singapore of the former compared to the cupped, smaller flowers and inferred less vigorous growth of the latter ("Hereditary Influences of the Cattleya Alliance" n.d.; Holttum 1953a).

3.4 Singapore-registered Cattleya Hybrids

As of 9 March 2022, a total of 102 Cattleya hybrids have been registered from Singapore. This list of hybrids is provided in **Appendix D**. Singaporean registered- and originated- hybrids are a useful dataset for determining species ancestors and hybrid parentage that enable the production of hybrids adapted to the Singapore climate. This assumes that the parents of a hybrid were grown for a long enough period for flowerings to coincide and were in sufficient health to carry a seed capsule to maturity. In addition, the offspring of the cross had to grow for several years to reach flower size in Singapore.

Several scenarios place limitations on these assumptions. Firstly, as registrant and originator may be different entities; the hybrid may have been produced overseas. Secondly, the parents of a hybrid could have been imported in bud and the cross made in Singapore. Nonetheless, a Singapore-registered hybrid does indicate that the hybrid was able to flower in Singapore, albeit less can be said about the adaptability of the parents. Lastly, the originators and registrants may have grown the hybrid or at least one of the parents under controlled conditions, such as artificial cooling or daylength manipulation. While these limitations reduce the strength of the assumption regarding adaptability of the hybrid and its parents, these scenarios overall constitute a small proportion of the total registered hybrids.

4 Recommendations

This chapter provides recommendations on choosing and breeding Cattleyas for Singapore based on information presented in the previous chapters.

C. *jenmanii, C. lawrenceana*, and *C. percivaliana* should be trialed for more widespread cultivation as their recommended temperature ranges and flowering behavior corresponds with Cattleyas that are presently cultivated in Singapore.

Species from high elevations that experience temperature extremes in their native habitats, including temperatures above the maximum in Singapore, have potential as parents of hybrids for Singapore, especially considering climate change.

When importing Cattleya hybrids from temperate regions, those with summer to fall flowering seasons or that flower multiple times a year should be prioritized, as these are more likely to have temperature requirements and flowering behavior that enable vigorous growth and regular flowering in Singapore due to associated species ancestry.

In addition, the ancestry of potential hybrid choices should be scrutinized. The following species ancestors would be associated with better growth and flowering of hybrids in Singapore: *Rl. digbyana, C. lueddemanniana, C. forbesii, C. violacea*, *C. walkeriana*, *C. cernua* and *C. aclandiae,* while the following species are unfavorable: *C. mossiae*, C. *schroederae*, C. *mendelli*, C. *trianae* and other *C.* section *Sophronitis*. Other species lie somewhere in-between on this continuum. Local breeding of Cattleya hybrids should also incorporate species of the former category.

As hybrids show large improvements over species ancestors in growth and flowering in Singapore, and many hybrids in Singapore are descended from species that are suboptimal for the climate, there is potential in choosing and breeding hybrids from species more inherently

adapted to Singapore's climate to achieve better performing hybrids. One example would be having *C. walkeriana* in the ancestry of white and pink Cattleyas, as opposed to *C. intermedia* and *C. loddigesii*.

Intergeneric and intersectional hybrids should be the focus when breeding Cattleya hybrids for Singapore, as hybrids solely of *C.* section *Cattleya* do not have a strong recent record of growth and flowering in Singapore. However, one must consider the regularity of chromosome pairing at meiosis in intergeneric and to a lesser extent intersectional hybrids when breeding over multiple generations.

Appendix A

Flowering behavior, flowering season in the northern hemisphere, and recommended night temperatures for several species of Cattleya. Data compiled from Rogerson (2004) and A. A. Chadwick (2006).

Species	Rooting Period Relative to Flowering	Northern Hemisphere Flowering Season	Flowering Behavior or Rest Period (mths.)	Recommended Night Temperature (C)
aurea	After	July–Sept.		18–21
dowiana	After	June–late July, Aug.	Active growth	18–21
gaskelliana	After	July, May–June	Immediately when mature	14–16
rex	After	July	Active growth	14–16
warneri	After	May, May–June	Immediately when mature	17.2–17.8
warscewiczii	After	June–July	Active growth	14–16
bicolor	After	Aug.–Sept.		
elongata	After	Sept.		
forbesii	After	Apr.–May		
granulosa	After	May–early June		
gutttata	After	Sept.		
harrisoniana	After	June–July		
schilleriana	After	Apr.–May		
tigrina	After	June–July		
lueddemanniana	After	Mar., Mar.–Apr.	Active growth, may flower twice a year	17.2–17.8
wallisii	After	July	Active growth, may flower twice a year	18–21
iricolor	Before	Apr.–May.		14–16
jenmanii	Before	Dec.–Jan., Oct.–Nov.	2–3	17.2–17.8
labiata	Before	Oct.–Nov., Sept.–Oct.	1	14–16
luteola	Before	Apr.–May		
mendelii	Before	Apr.–June, Apr.–May	6	14–16
mooreana	Before	Nov.		

mossiae	Before	Apr.–May, Feb.–May	5–6	14–16
percivaliana	Before	Dec.–Jan., Dec.	2–3	14–16
quadricolor	Before	Late Dec.–Jan.	4	14–16
schroederae	Before	Feb., Mar.–Apr.	4	14–16
trianae	Before	Dec.–Feb., Jan.–Febr.	4	14–16
lawrenceana	Before	Mar.–Apr., Mar.	4	18–21
amethystoglossa	Before	Jan.–Feb.		
intermedia	Before	Mar.–May		
loddigesii	Before	Nov.–Mar.		
maxima	Before	July–Nov., Nov.	2–3	17.2–17.8
walkeriana		Dec.–Apr.		
lobata		Fall		14–16
perinii		Apr.–May		14–16
grandis		Spring		18–21
purpurata		May–June	Short	14–16
tenebrosa		Late spring to early summer	Several weeks	14–16
aclandiae		Apr.–May, re-flowering over summer		
nobilior		Mar.–Apr., Mar.		
violacea		May, re-flowering over summer		

APPENDIX B

Geographic data, flowering season in native range and flowering behavior of Venezuelan *Cattleya* species. Data compiled from Aulisi A. and Foldats (1990).

Species	Latitude	Elevation (m.a.s.l.)	Temperature (C)	Flowering Season
C. gaskelliana	10 °N	800–1500	15–30	Apr.–July, sometimes twice
C. jenmanii	4–5 °N	800–1200	15–23	Feb.–Apr., Sept.–Oct.
C. lawrenceana	4–6 °N	400–1850	15–26	Feb.–Apr.
C. lueddemanniana	10–11 °N	0–700	18–30, beyond this range possible; xeric	Jan.–Mar., Aug.–Oct.
C. mossiae	9–11 °N	800–1500	12–27 C, nights potentially colder	Feb.–May or Apr.–July depending on the population. Multiple growths produced during growing season will flower at the same time.
C. percivaliana	7–10 °N	1000, 1400–2000	10–30 C, potentially higher temperatures during the day, nocturnal condensation	Aug.–Oct., herbarium specimens show Aug.–Mar., plants flower only once a year.
C. violacea	14 °S–9 °N	<600	15–29 C	Jan.–Sept., probably all year round

Appendix C

Cattleyas exhibited at OSSEA monthly meetings. Data compiled from OSSEA monthly bulletins.

Date of exhibition	Genus	Grex	Parentage
Feb-19	*Barkeria*	*obovata*	
Apr-22	*Brassanthe*	Elise White	*Gur aurantiaca* × *B subulifolia*
Nov-19	*Brassanthe*	Island Stars	*B* Little Stars × *Bsn* Maikai
Jul-19	*Brassanthe*	Maikai	*B nodosa* × *Gur bowringiana*
Oct-19	*Brassanthe*	Maikai	*B nodosa* × *Gur bowringiana*
Dec-19	*Brassanthe*	Maikai	*B nodosa* × *Gur bowringiana*
Jan-19	*Brassanthe*	Maikai 'Mayumi'	*B nodosa* × *Gur bowringiana*
May-21	*Brassavola*	*ceboletta*	
Mar-19	*Brassavola*	*cebolleta*	
Aug-19	*Brassavola*	*cucullata*	
Mar-21	*Brassavola*	*cucullata*	
Feb-19	*Brassavola*	Great Egret	*B* (Lady Of The Night × *subulifolia*)
Dec-19	*Brassavola*	Great Egret	*B* (Lady Of The Night × *subulifolia*)
Apr-19	*Brassavola*	Great Egret	*B* (Lady Of The Night × *subulifolia*)
Aug-19	*Brassavola*	Great Egret	*B* (Lady Of The Night × *subulifolia*)
Apr-19	*Brassavola*	Lady Of The Night	*B (subulifolia* × *grandiflora)*
Sep-19	*Brassavola*	Lady Of The Night	*B (subulifolia* × *grandiflora)*
Oct-19	*Brassavola*	Lady of the Night	*B (subulifolia* × *grandiflora)*
Oct-19	*Brassavola*	Little Stars	*B (nodosa* × *subulifolia)*
Nov-19	*Brassavola*	Little Stars	*B (nodosa* × *subulifolia)*
Jan-19	*Brassavola*	*nodosa*	
Sep-19	*Brassavola*	*nodosa*	
Dec-19	*Brassavola*	*nodosa*	
May-21	*Brassavola*	*nodosa*	
May-22	*Brassavola*	*nodosa*	
Jan-19	*Brassavola*	*nodosa* 'Panana Soire' AM/AOS	
Jan-20	*Brassavola*	Singapura	*B* (*martiana* × *nodosa*)
Sep-21	*Brassavola*	*subulifolia*	

Feb-22	*Brassavola*	*subulifolia*	
Jun-22	*Brassavola*	*tuberculata* syn. *perrinii*	
Nov-19	*Brassavola*	*venosa*	
Sep-19	*Brassavola*	Little Stars	*B* (*nodosa* × *subulifolia*)
Apr-22	*Brassocatanthe*	Kina Hamaya	*Bsn* Maikai × *Ctt* Porcia
Jun-22	*Brassocatanthe*	Roman Holiday	*Ctt* Chocolate Drop × *B nodosa*
Dec-18	*Brassocatanthe*	Yuan Nan Mini	*Ctt* Chocolate Drop × *Bc* Richard Mueller
Jan-19	*Brassocattleya*	Air Mososa	*C* Moscombe × *B nodosa*
May-19	*Brassocattleya*	Air Mososa	*C* Moscombe × *B nodosa*
Jun-22	*Brassocattleya*	Amethyst	*C purpurata* × *B appendiculata*
Feb-22	*Brassocattleya*	Beautiful Morning	*Bc* Morning Glory × *C* Bonanza Queen
Jan-22	*Brassocattleya*	Carnival Kids syn. Gulfshore's Beauty	*B nodosa* × *C dormaniana*
Dec-18	*Brassocattleya*	Chariya	*C forbesii* × *B venosa*
May-19	*Brassocattleya*	Chariya	*C forbesii* × *B venosa*
Jul-19	*Brassocattleya*	Chariya	*C forbesii* × *B venosa*
Oct-19	*Brassocattleya*	Chariya	*C forbesii* × *B venosa*
Oct-21	*Brassocattleya*	Chariya	*C forbesii* × *B venosa*
Jan-22	*Brassocattleya*	Chariya	*C forbesii* × *B venosa*
Jun-22	*Brassocattleya*	Chariya	*C forbesii* × *B venosa*
Jul-21	*Brassocattleya*	Diego Maradona	*C* Amazing Match × *B grandiflora*
Jul-21	*Brassocattleya*	Diego Maradona	*C* Amazing Match × *B grandiflora*
Jan-22	*Brassocattleya*	Diego Maradona	*C* Amazing Match × *B grandiflora*
Apr-22	*Brassocattleya*	Diego Maradona	*C* Amazing Match × *B grandiflora*
Feb-22	*Brassocattleya*	Diego Maradona	*C* Amazing Match × *B grandiflora*
Jul-19	*Brassocattleya*	Hybrid (U/R)	*B grandiflora* × *C labiata*
Sep-19	*Brassocattleya*	Hybrid (U/R)	*B grandiflora* × *C labiata*
Jan-22	*Brassocattleya*	Hybrid (U/R)	*Bc* Little Stars × *C violacea*
Oct-19	*Brassocattleya*	Jairak Kiku	*C loddigesii* × *B* Little Stars
Jan-22	*Brassocattleya*	Jairak Kiku	*C loddigesii* × *B* Little Stars
May-22	*Brassocattleya*	Jairak Kiku	*C loddigesii* × *B* Little Stars

Nov-18	*Brassocattleya*	Katherine H. Chatham 'Alexandra'	*B nodosa* × *C labiata*
Jul-21	*Brassocattleya*	Katherine H. Chatham 'Becky'	*B nodosa* × *C labiata*
Jul-19	*Brassocattleya*	Katherine H. Chatham	*B nodosa* × *C labiata*
Sep-19	*Brassocattleya*	Katherine H. Chatham	*B nodosa* × *C labiata*
Sep-19	*Brassocattleya*	Katherine H. Chatham	*B nodosa* × *C labiata*
Nov-19	*Brassocattleya*	Katherine H. Chatham	*B nodosa* × *C labiata*
Feb-22	*Brassocattleya*	Katherine H. Chatham	*B nodosa* × *C labiata*
Feb-22	*Brassocattleya*	Katherine H. Chatham	*B nodosa* × *C labiata*
Nov-19	*Brassocattleya*	Katherine H. Chatham	*B nodosa* × *C labiata*
Apr-19	*Brassocattleya*	Katherine H. Chatham 'Alexandra'	*B nodosa* × *C labiata*
Aug-19	*Brassocattleya*	Katherine H. Chatham 'Alexandra'	*B nodosa* × *C labiata*
Mar-21	*Brassocattleya*	Katherine H. Chatham 'Alexandra'	*B nodosa* × *C labiata*
Jan-22	*Brassocattleya*	Katherine H. Chatham 'Suckers'	*B nodosa* × *C labiata*
Jun-22	*Brassocattleya*	Katherine H. Chatham 'Suckers'	*B nodosa* × *C labiata*
Oct-19	*Brassocattleya*	Keowee	*C* Lorraine Shirai × *B nodosa*
Jan-22	*Brassocattleya*	Lim Guat Bee	*C harrisoniana* × *B grandiflora*
Apr-21	*Brassocattleya*	Nakornpathome Silver	*Bc* Binosa × *B nodosa*
Apr-22	*Brassocattleya*	Nakornpathome Silver	*Bc* Binosa × *B nodosa*
May-19	*Brassocattleya*	Pim Little	*C guttata* × *B grandiflora*
May-19	*Brassocattleya*	Pim Little	*C guttata* × *B grandiflora*
Nov-18	*Brassocattleya*	Pim Little	*C guttata* × *B grandiflora*

Jan-22	*Brassocattleya*	Richard Mueller	*B nodosa* × *C milleri*
Apr-19	*Brassocattleya*	Star Ruby	*B nodosa* × *C* Batalinii
Aug-19	*Brassocattleya*	Star Ruby	*B nodosa* × *C* Batalinii
Mar-21	*Brassocattleya*	Star Ruby	*B nodosa* × *C* Batalinii
Jul-21	*Brassocattleya*	Star Ruby	*B nodosa* × *C* Batalinii
Dec-19	*Brassocattleya*	Theresa Ricci	*Bc* Hippodamia × *C aclandiae*
Dec-18	*Brassocattleya*	Yellow Bird	*B nodosa* × *Bc* Richard Mueller
Sep-19	*Brassocattleya*	Yellow Bird	*B nodosa* × *Bc* Richard Mueller
Oct-19	*Brassocattleya*	Yellow Bird	*B nodosa* × *Bc* Richard Mueller
Jul-21	*Brassocattleya*	Yellow Bird	*B nodosa* × *Bc* Richard Mueller
Oct-21	*Brassocattleya*	Yellow Bird	*B nodosa* × *Bc* Richard Mueller
Jun-22	*Brassocattleya*	Yellow Bird	*B nodosa* × *Bc* Richard Mueller
Nov-19	*Brassocattleya*	YU Toung Star	*Bc* (Tetradip × Morning Glory)
Dec-19	*Brassocattleya*	YU Toung Star	*Bc* (Tetradip × Morning Glory)
Jan-20	*Brassocattleya*	YU Toung Star	*Bc* (Tetradip × Morning Glory)
Oct-21	*Brassocattleya*	YU Toung Star	*Bc* (Tetradip × Morning Glory)
Nov-18	*Brassolaelia*	Suzette Chaney	*B nodosa* × *L rubescens*
Sep-19	*Brassolaelia*	Suzette Chaney	*B nodosa* × *L rubescens*
Jan-20	*Brassolaeliocattleya*	Petite Stars	*Bc* Richard Mueller × *L rubescens*
Apr-21	*Broughtonia*	*sanguinea*	
Feb-22	*Cattleya*	× *labendziana*	*C (nobiliior* × *violacea)*
Jan-22	*Cattleya*	*aclandiae*	
May-22	*Cattleya*	*aclandiae*	
Jan-21	*Cattleya*	Aileen Chew	C (*violacea* × *amethystoglossa*)
Jan-19	*Cattleya*	Breautiana	*C* (*loddigesii* × *violacea*)
Mar-19	*Cattleya*	Bright Winter 'Star'	*C (intermedia* × Winter Gift)
Apr-21	*Cattleya*	Brymeriana (1896)	*C (wallisii* × *violacea)*
Jul-21	*Cattleya*	Brymeriana (1896)	*C (wallisii* × *violacea)*
May-22	*Cattleya*	Canhamiana	*C (mossiae* × *purpurata)*
Nov-18	*Cattleya*	*cernua*	
Aug-19	*Cattleya*	*cernua*	
Dec-19	*Cattleya*	*cernua*	
May-21	*Cattleya*	*cernua*	
Jun-22	*Cattleya*	Dakao 'Flammea Enami'	*C* (Flirtatious Okami × *walkeriana*)

Apr-19	*Cattleya*	Dominiana (1859)	*C (intermedia × maxima)*
Jul-19	*Cattleya*	*dowiana*	
Nov-18	*Cattleya*	Elaine Chew Cheo 周虔心	*C* (Tahoe Rose × *lueddemanniana*)
Nov-19	*Cattleya*	Elaine Chew Cheo 周虔心	*C* (Tahoe Rose × *lueddemanniana*)
Dec-19	*Cattleya*	Elaine Chew Cheo 周虔心	*C* (Tahoe Rose × *lueddemanniana*)
Dec-18	*Cattleya*	Elegans (1879)	*C (tigrina × purpurata)*
Jan-20	*Cattleya*	Elegans (1879)	*C (tigrina × purpurata)*
Jan-19	*Cattleya*	*forbesii*	
Feb-19	*Cattleya*	*forbesii*	
Dec-19	*Cattleya*	*forbesii*	
Apr-22	*Cattleya*	*forbesii*	
Jun-22	*Cattleya*	*forbesii*	
Aug-19	*Cattleya*	*forbesii*	
Apr-21	*Cattleya*	Gemma	*C (schilleriana × xanthina)*
Apr-19	*Cattleya*	Hawaiian Wedding Song	*C* (Angel Bells × Claesiana)
Sep-21	*Cattleya*	Hawaiian Wedding Song	*C* (Angel Bells × Claesiana)
Jan-22	*Cattleya*	Jungle Beau	*C (*Jungle Elf × Beaufort)
Jan-22	*Cattleya*	*labiata*	
Jan-22	*Cattleya*	*lueddemanniana*	
Feb-22	*Cattleya*	*lueddemanniana*	
Feb-22	*Cattleya*	*lueddemanniana*	
Nov-18	*Cattleya*	*lueddemanniana*	
Mar-19	*Cattleya*	Madame Edith Bongo 'Sweet Lip'	*C (*Memoria Robert Strait × Shellie Compton)
Sep-21	*Cattleya*	Michelle Fiene	*C (x dolosa × jenmanii)*
Apr-21	*Cattleya*	Oh Hock Neo	*C* (*forbesii × percivaliana)*
Feb-19	*Cattleya*	*quadricolor*	
May-19	*Cattleya*	*quadricolor*	
Apr-21	*Cattleya*	Sea Siren	*C (warneri × nobilior)*
May-19	*Cattleya*	Sea Siren	*C (warneri × nobilior)*
Jul-19	*Cattleya*	Summer Mystery	*C* (*lueddemanniana* × Mysterious Night)
Jan-20	*Cattleya*	Tangerine Fire	*C (cernua* × Pink Flash*)*

Jan-20	*Cattleya*	Tanya Danilchick	C (Sallieri × *wallisii*)
Apr-22	*Cattleya*	*violacea*	
May-22	*Cattleya*	*violacea*	
Nov-18	*Cattleya*	*walkeriana*	
Nov-18	*Cattleya*	*walkeriana*	
Nov-18	*Cattleya*	*walkeriana*	
Feb-19	*Cattleya*	*walkeriana*	
Aug-19	*Cattleya*	*walkeriana*	
Sep-19	*Cattleya*	*walkeriana*	
Jun-19	*Cattleya*	x *dolosa*	*C* (*loddigesii* × *walkeriana*)
Jun-19	*Cattleya*	Sallieri	*C (loddigesii* × *purpurata)*
Aug-19	*Cattleytonia*	Happy Face	
Mar-21	*Cattlianthe*	Azul Madoka	*C walkeriana* × *Ctt* Mary Elizabeth Bohn
Nov-19	*Cattlianthe*	Gay Wan Guay	*Gur bowringiana* × *C lueddemanniana*
Aug-19	*Cattlianthe*	Hybrid (U/R)	*Ctt* Portia × *C violacea*
Nov-19	*Cattlianthe*	Hybrid (U/R)	*Ctt* Portia × *C violacea*
Jun-19	*Cattlianthe*	Little Fairy	*C* Netrasiri Beauty × *Ctt* Kauai Starbright
Jun-22	*Cattlianthe*	Mary Elizabeth Bohn	*Ctt* Blue Boy × *Gur bowringiana*
Jul-19	*Cattlianthe*	Meadii	*Gur bowringiana* × *C forbesii*
May-22	*Cattlianthe*	Meadii	*Gur bowringiana* × *C forbesii*
Jul-19	*Cattlianthe*	Memoria Lily Peter	*Gur bowringiana* × *C* Mari's Song
Dec-18	*Cattlianthe*	Molly Tyler	*Ctt* Mrs. W. N. Elkins × *C* Leda (1900)
Oct-21	*Cattlianthe*	Portia	*Gur bowringiana* × *C labiata*
Dec-18	*Cattlianthe*	Rojo	*Gur aurantiaca* × *C milleri*
Feb-19	*Cattlianthe*	Sagarik Wax	*C* Summerland Girl × *Ctt* Chocolate Drop
Apr-19	*Cattlianthe*	Sagarik Wax	*C* Summerland Girl × *Ctt* Chocolate Drop
Sep-19	*Cattlianthe*	Sagarik Wax	*C* Summerland Girl × *Ctt* Chocolate Drop
Mar-19	*Cattlianthe*	Tan Khim Ser	*C purpurata* × *Ctt* Trick or Treat
Apr-21	*Cattlianthe*	Tan Khim Ser	*C purpurata* × *Ctt* Trick or Treat
Sep-21	*Cattlianthe*	Tiny Treasure	*Ctt* Porcia × C *longipes*
May-22	*Cattlianthe*	Tiny Treasure	*Ctt* Porcia × *C longipes*
Aug-19	*Cattlianthe*	Trick or Treat	*C* Icarus × C*tt* Chit Chat
Jun-19	*Cattlianthe*	Tristar Bouquet	*C* Rosette Warland × *Ctt* Chocolate Drop
Mar-21	*Cattlianthe*	Tristar Bouquet	*C* Rosette Warland × *Ctt* Chocolate Drop
Jun-22	*Cattlianthe*	Tristar Bouquet	*C* Rosette Warland × *Ctt* Chocolate Drop

Nov-18	*Caularthron*	*bicornutum*	
Apr-22	*Caularthron*	*bicornutum*	
Dec-18	*Caulocattleya*	Chantilly Lace	*C* El Dorado Splash × *Cau bicornutum*
Apr-21	*Claudehamiltonara*	Hidden Gold	*Grt* Why Not × *Bc* Richard Mueller
May-21	*Claudehamiltonara*	Hidden Gold	*Grt* Why Not × *Bc* Richard Mueller
Mar-21	*Claudehamiltonara*	Hidden Gold	*Grt* Why Not × *Bc* Richard Mueller
Jun-22	*Claudehamiltonara*	Hidden Gold	*Grt* Why Not × *Bc* Richard Mueller
Apr-19	*Encyclia*	*cordigera*	
May-19	*Encyclia*	*cordigera*	
Oct-19	*Encyclia*	*cordigera*	
Mar-21	*Encyclia*	*cordigera*	
Feb-22	*Encyclia*	*cordigera*	
Oct-19	*Encyclia*	Dave's Dazzler	*E* (*randii* × *alata*)
Jul-21	*Encyclia*	Ginger Snap	*E(*Gail Nakagaki × Orchid Jungle)
Oct-19	*Encyclia*	*tampensis*	
Mar-19	*Encyvola*	William Wan	*B* Little Stars × *E tampensis*
Aug-19	*Encyvola*	William Wan	*B* Little Stars × *E tampensis*
Mar-21	*Epicatanthe*	Volcano Trick	
Jul-21	*Epicatanthe*	Volcano Trick	*Ctt* Trick or Treat × *Epi stamfordianum*
Feb-22	*Epicatanthe*	Volcano Trick	*Ctt* Trick or Treat × *Epi stamfordianum*
Mar-19	*Epicatanthe*	Volcano Trick	*Ctt* Trick or Treat × *Epi stamfordianum*
Dec-18	*Epicattleya*	Dark Fire	*Epc* Rene Marques × *Epi melanoporphyreum*
Oct-21	*Epicyclia*	Serena O'Neill	*Epy* Mabel Kanda × *E cordigera*
Apr-21	*Epidendrum*	*carpophorum*	
May-22	*Epidendrum*	*ciliare*	
Dec-19	*Epidendrum*	*difforme*	
Feb-19	*Epidendrum*	*difforme*	
Aug-19	*Epidendrum*	*difforme*	
Feb-19	*Epidendrum*	Joseph Lii	*Epi (Orange Glow × cinnabarinum)*
Feb-19	*Epidendrum*	*nocturnum*	
Mar-19	*Epidendrum*	*nocturnum*	
Oct-19	*Epidendrum*	*nocturnum*	
Nov-19	*Epidendrum*	*nocturnum*	
Jan-22	*Epidendrum*	*stamfordianum*	
Jan-19	*Epidendrum*	*sympetalostele*	
Dec-19	*Guarianthe*	*bowringiana*	
Jan-20	*Guarianthe*	*bowringiana*	

Feb-22	*Guarianthe*	x laelioides syn. Guarianthe × guatemalensis	*Guarianthe (aurantiaca × skinneri)*
Nov-18	*Guaricattonia*	Hybrid (U/R)	*Ctna* Why Not × *Ctt* Portia
Dec-19	*Guaritonia*	Why Not	*Gur aurantiaca × Bro sanguinea*
Jan-22	*Laelia*	*rubescens*	
Jan-20	*Laeliocattleya*	Good Days	*Lc* Happy Essence × *C walkeriana*
Mar-21	*Laeliocattleya*	Good Days	*Lc* Happy Essence × *C walkeriana*
May-22	*Laeliocattleya*	Good Days	*Lc* Happy Essence × *C walkeriana*
Jun-22	*Laeliocattleya*	Jairak Taffy	*L rubescens × C walkeriana*
May-21	*Meiracyllium*	*wendlandii*	
Jan-19	*Myrmecatavola*	Frances Fox	*Bc* Polka Dot × *Mcp tibicinis*
May-19	*Myrmecatavola*	Frances Fox	*Bc* Polka Dot × *Mcp tibicinis*
Jan-20	*Myrmecatavola*	Frances Fox	*Bc* Polka Dot × *Mcp tibicinis*
Nov-19	*Myrmecophila*	*thomsoniana*	
Nov-19	*Myrmecophila*	*tibicinis*	
Dec-19	*Procatavola*	Wufong Jade	*Ctyh* Siam Jade × *B nodosa*
Jan-20	*Procatavola*	Wufong Jade	*Ctyh* Siam Jade × *B nodosa*
May-21	*Procatavola*	Wufong Jade	*Ctyh* Siam Jade × *B nodosa*
Jan-19	*Prosthechea*	*boothiana*	
Jan-19	*Prosthechea*	*cochleata*	
Oct-21	*Prosthechea*	*cochleata*	
Dec-19	*Prosthechea*	fragrans syn. Encyclia fragrans	
Jan-20	*Rhyncanthe*	Jim Chew	*Gur bowringiana × Rl digbyana*
Dec-18	*Rhyncattleanthe*	Burana Beauty	*Rth* Netrasiri Starbright × *C* Netrasiri Beauty
Nov-19	*Rhyncattleanthe*	Chialin Black Flower	*Rth* Guanmiau City × *Rlc* Sunstate Colorchart
Mar-19	*Rhyncattleanthe*	Li Jiuan Love	*C* Cherry Chip × *Rth* Hsinying Catherine
Oct-19	*Rhyncattleanthe*	Lois McNeil	*Rth* Victoria × *Ctt* Portiata
Apr-19	*Rhyncattleanthe*	STK Doll	*Ctt* Netrasiri Doll × *Rth* Free Spirit
Sep-19	*Rhyncattleanthe*	STK Doll	*Ctt* Netrasiri Doll × *Rth* Free Spirit
Nov-18	*Rhyncattleanthe*	STK Doll	*Ctt* Netrasiri Doll × *Rth* Free Spirit
Jan-19	*Rhyncattleanthe*	Young-Min Orange	*Rth* Viola Nuggett × *Ctt* Trick or Treat
May-22	*Rhynchobrassoleya*	Copper Queen	*Rlc* Toshie Aoki × *Bc* Richard Mueller
Dec-18	*Rhynchobrassoleya*	Humming Bird	*B nodosa* × *Rlc* Waikiki Gold
Apr-19	*Rhynchobrassoleya*	Humming Bird	*B nodosa* × *Rlc* Waikiki Gold

Aug-19	*Rhynchobrassoleya*	Hybrid (U/R)	*Rby* Golden Tang × *Bc* Richard Mueller
Sep-19	*Rhynchobrassoleya*	Hybrid (U/R)	*Rby* Golden Tang × *Bc* Richard Mueller
Dec-19	*Rhynchobrassoleya*	Hybrid (U/R)	*Rby* Golden Tang × *Bc* Richard Mueller
Sep-21	*Rhynchobrassoleya*	Mikawa Palette	*B nodosa* × *Rlc* Creation
Jan-22	*Rhynchobrassoleya*	Mikawa Palette	*B nodosa* × *Rlc* Creation
Apr-21	*Rhyncholaelia*	*digbyana*	
Jul-21	*Rhyncholaelia*	*digbyana*	
Oct-21	*Rhyncholaelia*	*digbyana*	
Feb-22	*Rhyncholaelia*	*digbyana*	
Feb-22	*Rhyncholaeliocattleya*	Amazing Thailand 'Rainbow'	*Rlc* Haadyai Delight × *C* Brazilian Treasure
Jun-19	*Rhyncholaeliocattleya*	Duh's Fantasy	*Rlc (*Sally Taylor × Duh's Orange)
Feb-22	*Rhyncholaeliocattleya*	Duh's Fantasy	*Rlc* (Sally Taylor × Duh's Orange)
Aug-19	*Rhyncholaeliocattleya*	Green Taipower	*Rlc* (Greenwich × Chianhao Beauty)
Nov-19	*Rhyncholaeliocattleya*	Green Taipower	*Rlc* (Greenwich × Chianhao Beauty)
Jul-19	*Rhyncholaeliocattleya*	Greenwich	*C* Ann Follis × *Rlc* Lester McDonald
Jan-19	*Rhyncholaeliocattleya*	Haadyai Delight	*Rlc* (Angkinantana × Destiny)
Sep-21	*Rhyncholaeliocattleya*	Lucky Strike	*Rlc* Memoria Crispin Rosales × *C* Bonanza (Bracey)
Aug-19	*Rhyncholaeliocattleya*	Memoria Buranapan Nikom	*Rlc* Haadyai Delight × *C* Tainan City
May-22	*Rhyncholaeliocattleya*	Memoria Nancy Ginocchio	*C violacea* × *Rl digbyana*
Dec-18	*Rhyncholaeliocattleya*	Pathom Gold	*Rlc* (Actress Charm × Chomthong Delight)
Sep-19	*Rhyncholaeliocattleya*	Pink Diamond	*Rlc* (Ewart McDonald × Queen Sirikhit)
Jan-20	*Rhyncholaeliocattleya*	Pink Diamond	*Rlc* (Ewart McDonald × Queen Sirikhit)
Jan-20	*Rhyncholaeliocattleya*	Ports of Paradise	*Rlc* Fortune × *Rl digbyana*
Jun-22	*Rhyncholaeliocattleya*	Queen Déesse	*C* Queen Sirikhit × *Rlc* Déesse
Nov-18	*Rhyncholaeliocattleya*	Rolling Thunder	*Rlc* Chesty Puller × *C* Old Whitey
Feb-22	*Rhyncholaeliocattleya*	Super Storm	*Rlc* (Shinfong Green × Apricot Flare)
Dec-18	*Rhyncholaeliocattleya*	Three Suns	*Rlc* (Green Fantasy × Memoria Helen Brown)
May-22	*Rhyncholaeliocattleya*	Triumphal Coronation	*C* Drumbeat × *Rlc* Pamela Hetherington
Mar-19	*Rhynchovola*	David Sander	*B* cucullata × *Rl* digbyana
Jun-19	*Rhynchovola*	David Sander	*B* cucullata × *Rl* digbyana
Aug-19	*Rhynchovola*	Jimminey Cricket	*B nodosa* × *Rl digbyana*

Nov-19	*Rhynchovola*	Jimminey Cricket	*B nodosa* × *Rl digbyana*
Sep-19	*Sergioara*	Hybrid (U/R)	*Epi porpax* × *Rth* Young-Min Orange

APPENDIX D

Cattley hybrids registered from Singapore. Data courtesy of Julian Shaw, RHS.

Genus	Grex	Parentage	Date Registered	Registrant/(Originator)
Rhyncholaeliocattleya	Gracia Lewis	{C.} [{Lc.}] Charles Futterman × {Rlc.} [{Blc.}] Caligula	1953	Mrs Gracia Lewis (Rivermont)
Rhyncholaeliocattleya	Memoria Lazarus Rayman	{Rlc.} [{Blc.}] Golden Crown × {Rlc.} [{Blc.}]Golden Queen	1959	Mrs Gracia Lewis
Encyclia	Imon	{E.} [{Epi.}] {cordigera} [cordigerum] × {E.} [{Epi}] {plicata} [plicatum]	1963	S.Y.Alsagoff (W.G.Moir)
Cattleya	Gunilia Tjernlund	{C.} [{Lc.}] Cabazon × {C.} [{Lc.}] Ishtar	1964	Bun (Wm.Kirch Orchids)
Cattleya	May Woo	{C.} [{Lc.}] O'Dell Morgan × {C.} [{Lc.}] Windermere	1965	Bun (Wm.Kirch Orchids)
Encyclia	Yat Ying	{E.} [{Epi.}] Twyla × {E.} [{Epi.}] {cordigera} [cordigerum]	1977	S.Y.Alsagoff
Caulocattleya	Celina Toh	{Clty.} [{Diaca.}] Chastity × {C.} Hardyana (1896)	1981	C.Y.Mok
Rhyncholaeliocattleya	Koh Sock Khee	{Rlc.} [{Blc.}] Herons Ghyll × {C.} [{Lc.}] Kathryn Leahey	1990	Koh Keng Hoe
Rhyncholaeliocattleya	Fock Siew Tong	{Rlc.} [{Blc.}] Lucky Strike × {C.} Gertrude (1898)	1991	Fock Siew Tong (K Boonchoo)
Cattlianthe	Meadite	{C.} [{Lc.}] Aphrodite (1894) × {Ctt.} [{C.}] Meadii	1992	Singapore BG
Enanthleya	Percy McNiece	{Ctt.} [{Lc.}] Meadite × {E.} [{Epi.}] {plicata} [plicatum]	1992	Singapore BG
Rhyncholaeliocattleya	Adeline Chan Yimfong	{Rlc.} [{Blc.}] Pamela Hetherington × {Rlc.} [{Bc}] Pink Cloud	1994	David Lim
Caulocattleya	See Luan	{C.} Orglade's Blaze × {Cau.} [{Diacm.}] {bicornutum}	1995	Harold Johnson
Caulocattleya	Ptolemy	{C.} Baby Kay × {Cau.} [{Diacm.}] {bicornutum}	1995	Harold Johnson
Cattleya	Ching Li Sa	{C.} {walkeriana} × {C.} {forbesii}	1996	Harold Johnson (O/U)
Caulocattleya	Don Roberts	{C.} Ching Li Sa × {Cau.} [{Diacm.}] {bicornutum}	1996	Harold Johnson
Guarthroleya	Diana Roberts	{Ctt.} [{C.}] Meadii × {Cau.} [{Diacm.}] {bicornutum}	1996	Harold Johnson
Rhyncholaeliocattleya	Lady Olga	{Rlc.} [{Blc.}] Waikiki Gold × {Rlc.} [{Blc.}] Vicky Gold	1996	Koh Keng Hoe
Cautonleya	Martina Theresa Johnson	{Ctna.} [{Lctna.}] Jamfest × {Cau.} [{Diacm.}] {bicornutum}	1997	Harold Johnson
Epidendrum	Lucky	{Epi.} O'Brienianum × {Epi.} {fulgens}	1997	Harold Johnson
Rhyncholaeliocattleya	Kichisaburo Okada	{C.} {guttata} × {Rlc.} [{Blc.}] Waikiki Sunset	1997	Koh Keng Hoe

Genus	Grex	Parentage	Date Registered	Registrant/(Originator)
Rhyncholaeliocattleya	Jadena-Jadelle	{C.} Hardyana (1896) × {Rlc.} [{Blc.}] Malvern	1998	Schering AG (Koh Keng Hoe)
Rhyncholaeliocattleya	Ivan Sng	{Rlc.} [{Blc.}] Gloria Schmidt × {C.} [{Lc.}]Memoria Sangah Chit	1999	T.Sng
Epidendrum	Lion's Mane	{Epi.} King Valley × {Epi.} Orange Glow [Acis]	2001	Singapore BG
Epidendrum	Lion's Pride	{Epi.} Jay Yamada × {Epi.} Hokulea	2001	Singapore BG
Rhyncattleanthe	Golden Erica	{C.} [{L.}] {crispata [flava]} [flava] × {Rth.} [{Pot.}] Netrasiri Starbright	2001	Tan Kok Wee
Cattleya	Kiyoko Obata	{C.} Summer Stars × {C.} Queen Sirikhit	2002	Koh Keng Hoe
Cattleya	Stephen Corday	{C.} Summer Stars × {C.} Empress Bells	2002	Koh Keng Hoe
Epidendrum	Spirit of Volunteerism	{Epi.} Michael's Rubelite × {Epi.} {cinnabarinum}	2002	Singapore BG
Rhyncattleanthe	Golden Erwin	{C.} [{Slc.}] Orient Amber × {Rth.} [{Pot.}] Netrasiri Starbright	2002	Tan Kok Wee
Epidendrum	Saint Nicholas	{Epi.} {ibaguense} × {Epi.} [{Oe.}] Dainty Lady	2003	Lee Foong Ying (Chua Hong Hor)
Rhyncholaeliocattleya	Tommy Sng	{Rlc.} [{Blc.}] Green Fantasy × {C.} [{Lc.}] Joan Haig	2003	T.Sng
Brassavola	Singapura	{B.} {martiana} × {B.} {nodosa}	2004	How Wai Ron
Stellamizutaara	Lion's Harvest Time	{Ctna.} Maui Maid × {Bc.} [{Bl.}] Richard Mueller	2004	Singapore BG
Brassoepidendrum	Kan Yuet Him	{B.} {nodosa} × {Epi.} {cinnabarinum}	2005	Woon Leng Nurs.
Cattleya	Wong Siew Kwun	{C.} Interglossa × {C.} {walkeriana}	2005	S.K.Wong (O/U)
Rhyncholaeliocattleya	Choo Han Teck	{Rlc.} [{Blc.}] Wendy Tanaka × {C.} [{Lc.}] Mari's Song	2005	Lucy Yi-Ming Leong (O/U)
Epidendrum	Ivan Gasparovic	{Epi.} {cinnabarinum} × {Epi.} Spirit of Volunteerism	2007	Singapore BG
Cahuzacara	Zhang-Hng	{Rth.} [{Pot.}] Golden Erwin × {B.} {nodosa}	2008	Tan Kok Wee
Cattleya	Memoria Yusbenny Dharmakadar	{C.} Hawaiian Wedding Song × {C.} [{Lc.}] Memoria Robert Strait	2008	How Wai Ron
Epidendrum	Spirit of Giving	{Epi.} {radicans} × {Epi.} Spirit of Volunteerism	2008	Singapore BG
Guaricattonia	Rising Sun Erica	{Ctt.} [{C.}] Chongkolnee × {Grt.} [{Ctna.}] Why Not	2008	Tan Kok Wee
Rhyncholaeliocattleya	Wong Oi Kwan	{Rlc.} [{Blc.}] Eleanor Nedjar × {C.} [{Lc.}]William Miles	2008	S.K.Wong (O/U)
Cattlianthe	Tan Khim Ser	{C.} [{L.}] {purpurata} × {Ctt.} [{Lc.}] Trick or Treat	2009	Woon Leng Nurs.
Brassocatanthe	Hope of a Better Age	{Ctt.} [{Lc.}] Rojo × {B.} {subulifolia} [cordata]	2010	C.R.Ong & X.H.Lim

Genus	Grex	Parentage	Date Registered	Registrant/(Originator)
Epicatanthe	Memoria Ng Soo Peng	{Epi.} {ciliare} × {Ctt.} [{Lc.}] Tan Khim Ser	2010	OSSEA (Woon Leng nurs.)
Rhyntonleya	Annie Wong	{Ctna.} Maui Maid × {Rlc.} [{Blc.}] Mahina Yahiro	2010	C.Wong (Kultana)
Cahuzacara	Hanh Sang	{Rlc.} [{Blc.}] Pink Diamond × {Bsn.} [{Bc.}] Maikai	2011	Singapore BG
Cattleya	CapitaLand	{C.} [{Lc.}] Memoria Robert Strait × {C.} [{Lc.}] Mari's Song	2011	How Wai Ron
Enanthleya	Zachary Jackson Levon Furnish-John	Ctt.} [{Lc.}] Secret Love × {Cty.} [{Epc.}] Purple Glory	2011	Gardens by the Bay (Yee Peng Orch.)
Epicaulaelia	Princess Carolina di Borbone	{Epi.} {stamfordianum} × {Cll.} [{Dial.}] Snowflake	2011	Woon Leng Nurs.
Rhyncattleanthe	Mocca's Love	{Ctt.} [{Lc.}] Secret Love × {Rth.} [{Pot.}] Golden Erwin	2011	Tan Kok Wee
Enanthleya	Kee Seng Grace	{Ctt.} [{Lc.}] Sagarik Wax × {E.} [{Epi.}]{cordigera} [cordigerum]	2012	X.H.Lim & C.R.Ong
Encyleyvola	Gilbert and Virginia Wong	{Bc.} Binosa × {E.} [{Epi.}] {cordigera} [cordigerum]	2012	S.K.Wong (O/U)
Kiattanara	Serzh Sargsyan	{Chz.} [{Blc.}] Hanh Sang × {Myc.} [{Smbc.}]Memoria Louise Fuchs	2012	Singapore BG
Rhyncattleanthe	Brown Tone	{Rlc.} [{Blc.}] Memoria Helen Brown × {Ctt.} [{Lc}] Loog Tone	2012	Singapore BG (O/U)
Rhyncattleanthe	Juan Manuel Santos Calderon	{Rlc.} [{Blc.}] Haadyai Delight × {Rth.} Brown Tone	2012	Singapore BG
Rhyncholaeliocattleya	Maria Cavaco Silva	{Rlc.} [{Blc.}] Haadyai Delight × {Rlc.} [{Blc.}]Pure's Delight	2012	Singapore BG
Rhyncholaeliocattleya	Amy Wan	{Rlc.} [{Bc.}] Leprechaun Legend × {C.} Wong Siew Kwun	2012	S.K.Wong
Cattleya	Oh Hock Neo	{C.} {forbesii} × {C.} {percivaliana}	2013	E.M.K-A.Chew
Myrmecatavola	Lee Siew Ying	{Mcv.} [{Recc.}] Frances Fox × {B.} {nodosa}	2013	L.F.Ying
Rhyncattleanthe	Mari Pangestu	{Rlc.} [{Blc.}] Toshie Aoki × {Ctt.} [{Slc.}] Barefoot Mailman	2013	Woon Leng Nurs. (B. Zhao)
Rhyncholaeliocattleya	Gardens By The Bay	{Rlc.} [{Pot.}] Duh's Fantasy × {Rlc.} Duh's Peace	2013	Gardens by the Bay (Shao Jye Duh)
Rhyncholaeliocattleya	Ong Siew Hong	{Rlc.} [{Blc.}] Goldenzelle × {Rlc.} [{Pot.}] Cristy Harry	2013	K.W.Tan (F.Smith)
Volkertara	Samantha Marko	{Rth.} [{Blc.}] Orange Nuggett × {Grt.} [{Ctna.}]Why Not	2013	Ng Joo Hiong (Ah Chat Orch.)
Brassocatanthe	Gabrielle Gan	{C.} Brymeriana (1896) × {Bsn.} [{Bc.}] Maikai	2014	How Wai Ron
Cattleya	Irene Teo Lai Kheng	{C.} [{Lc.}] Aloha Case × {C.} [{S.}] {coccinea}	2014	Woon Leng Nurs.

Genus	Grex	Parentage	Date Registered	Registrant/(Originator)
Cattleya	Queen's Wedding Song	{C.} Queen Sirikhit × {C.} Hawaiian Wedding Song	2014	Tan Kok Wee
Cattleya	Ai Lin Chew Tan	{C.} {forbesii} × {C.} {lueddemanniana}	2015	E.M.K-A.Chew
Cattleya	Aileen Chew	{C.} {violacea} × {C.} {amethystoglossa}	2015	E.M.K-A.Chew
Cattleya	Mariel Huien Tan	{C.} {forbesii} × {C.} {nobilior}	2015	E.M.K-A.Chew
Cattlianthe	Anna Hui Chew	{C.} [{Lc.}] Sallieri (1895) × {Gur.} [{C.}] {bowringiana}	2015	E.M.K-A.Chew
Cattlianthe	Ernest Chew	{Gur.} [{C.}] {bowringiana} × {C.} {nobilior}	2015	E.M.K-A.Chew
Guarthron	Teal Azalea	{Ctt.} [{Slc.}] Kauai Starbright × {Cau.} [{Diacm}] {bicornutum}	2015	Harold Johnson
Rhyncanthe	Jim Chew	{Gur.} [{C.}] {bowringiana} × {Rl.} [{B.}] {digbyana}	2015	E.M.K-A.Chew
Rhynchobrassoleya	David Kim San Tan	{B.} Little Stars × {Rlc.} [{Bc.}] Déesse	2015	E.M.K-A.Chew
Rhynchobrassoleya	Selene Chew	{Rlc.} [{Blc.}] Ports of Paradise × {B.} {nodosa}	2015	E.M.K-A.Chew
Cattleya	Tanya Danilchick	{C.} [{Lc.}] Sallieri (1895) × {C.} {wallisii} [eldorado Linden]	2016	E.M.K-A.Chew
Cattlianthe	Gay Wan Guay	{Gur.} [{C.}] {bowringiana} × {C.} {lueddemanniana}	2016	E.M.K-A.Chew
Encyvola	Merpig	{B.} Singapura × {E.} [{Epi.}] {tampensis}	2016	Lim & Yong
Encyvola	William Wan	{B.} Little Stars × {E.} [{Epi.}] {tampensis}	2016	S.K.Wong (Chua Hong Hor)
Epitonanthe	Noor Qamah	{Epi.} {radicans} × {Grt.} [{Ctna.}] Why Not	2016	Toh Garden
Brassocattleya	Chariya	{C.} {forbesii} × {B.} {venosa}	2017	E.M.K-A.Chew
Cattleya	Looi Eng San	{C.} [{Lc.}] Pink Favourite × {C.} [{L.}] {longipes}	2017	David Lim
Cattlianthe	Matthew Chong Yean Tan	{C.} [{Lc.}] Canhamiana × {Ctt.} [{Lc.}] Blue Boy	2017	E.M.K-A.Chew
Myrmecavola	Edward L. Waldin, Jr.	{B.} {nodosa} × {Mcp.} {christinae}	2017	OSSEA (Neo Cheng Soon)
Rhyncattleanthe	GB Cloud	{C.} {maxima} × {Rth.} [{Blc.}] Young-Min Orange	2017	Gardens by the Bay
Rhynchobrassoleya	Robert and Jenny Gay	{Rlc.} [{Blc.}] Tainan Gold × {B.} {nodosa}	2017	E.M.K-A.Chew
Rhyncholaeliocattleya	Lynn Goh Ling Ling	{Rlc.} [{Blc.}] Koh Sock Khee × {Rlc.} [{Blc.}] Lucky Strike	2017	B-K.Ng
Guarvolclia	Miss Endeavour	{E.} [{Epi.}] {hanburyi} × {Bsn.} [{Bc.}] Island Stars	2018	L.F.Ying (Endeavour P.S.)
Rhyncholaeliocattleya	Rosalind and Stewart Wong	{Rlc.} [{Blc.}] Kichisaburo Okada × {Rlc.} [{Blc.}] Waikiki Gold	2018	Koh Keng Hoe
Brassocattleya	SG Ballerina	{C.} [{L.}] {purpurata} × {B.} {martiana}	2019	SG Orch.

Genus	Grex	Parentage	Date Registered	Registrant/(Originator)
				(How Wai Ron)
Brassocattleya	Lim Guat Bee	{C.} {harrisoniana} [harrisoniae] × {B.} {grandiflora}	2019	E.M.K-A.Chew
Cattleya	Florence Stokes	{C.} {schilleriana} × {C.} {nobilior}	2019	E.M.K-A.Chew
Laeliocattleya	Sze Wei Valerie	{C.} Peckaviensis × {L.} {rubescens}	2019	Tan Sze Wei
Brassocattleya	Pim Little	{C.} {guttata} × {B.} {grandiflora}	2020	E.M.K-A.Chew
Brassocattleya	Diego Maradona	{C.} Amazing Match × {B.} {grandiflora}	2020	Neo Tuan Hong (Anh Tuan Nguyen)
Cattleya	Elaine Chew Cheo 周虔心	{C.} [{Lc.}] Tahoe Rose × {C.} {lueddemanniana}	2020	E.M.K-A.Chew
Rhyncanthe	Emrys Chew	{Gur.} {hennisiana} [patinii] × {Rl.} [{B.}] {glauca}	2020	J.B.Tay
Brassavola	Great Egret	{B.} Lady Of The Night × {B.} {subulifolia} [cordata]	2021	Neo Tuan Hong
Brassocattleya	Tim and Grace	{Bc.} Green Bird × {C.} [{L.}] {purpurata}	2022	OSSEA (Neo Cheng Soon)

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