Volume : 4 | Issue : 1 | January 2015 • ISSN No 2277 - 8179

Research Paper

Morphological Characterization in Vanda species

Botany

KEYWORDS : Vanda, morphological descriptors, orchids

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ABSTRACT

Vanda consists of more than 70 species of monopodial epiphytic orchids distributed in India, China, The Himalayas, Sri Lanka, Philippines and throughout South East Asia. These commercial orchids are grown in Thailand, Singapore, Malayasia and Hawai. All orchids having the same characteristics as the Vanda genus is called as a vandaceous orchid and they grouped together to form the Vanda Alliance. Genera like Vandas, Aerides, Ascocentrum, Renanthera, Rhyncostylis, Aranda, Mokara, Kagawara are included in the Vanda Alliance. Many of orchids under this group are called as 'Scorpion Orchids' or 'Spider Orchids'. They are ideal for hanging baskets, pots or tree logs. In the present investigation, 11 Vanda species viz. Vanda alpina, V. cristata, V. coerulea, V. parviflora, V. coerulescens, V. stangeana, Papilionanthe (Vanda) teres, V. bicolor, V. tassellata, V. pumila, and V. parishii were studied for development of morphological descriptors based upon UPOV guidelines and accordingly total 65 morphological descriptors of Vanda were developed.

Introduction

Orchids belong to family Orchidaceae, one of the largest family of flowering plants with both terrestrial and epiphytic members (Karasawa, 1996). Taxonomically, they represent the most highly evolved family among monocotyledons with more than 25,000 species and account for nearly 8% of the total species of flowering plant. More than 2,00,000 natural and manmade hybrids are on record and these include several multi generics involving three, four, five and even six genera. *Vanda* consists of more than 70 species of monopodial epiphytic orchids distributed in India, China, The Himalayas, Sri Lanka, Philippines and throughout South East Asia. These commercial orchids are grown in Thailand, Singapore, Malayasia and Hawai. The Vanda orchids are totally tropical and are easy to grow. Some species can be exposed to full sun. They are cross compatible with other genera like *Ascocentrum, Aerides, Rhyncostylis, Neofinetia, Renanthera* and even *Phalaenopsis*. All orchids having the same characteristics as the *Vanda* genus is called as a vandaceous orchid and they grouped together to form the *Vanda Alliance*. Genera like *Vandas, Aerides, Ascocentrum, Renanthera, Rhyncostylis, Aranda, Mokara, Kagawara* are included in the *Vanda Alliance*. Many of orchids under this group are called as 'Scorpion Orchids' or 'Spider Orchids'. They are ideal for hanging baskets, pots or tree logs. They are diversified in vegetative and reproductive growth. Based on leaf characters they grouped into four categories, e.g., strap shaped, terete, semi-terete and channeled. The lip of strap shaped leaves is very irregular while the terete leaves are of pencil thickness. The inflorescence arise from the axil of the leaves in strap leaved orchids whereas in case of terete leaved orchids inflorescence emerge from on the side of the stem of opposite leaf. The inflorescence is axillary, erect, and simple. The flowers are small to large, few to many , fleshy, heavy textured , long lasting and yellow, brown, purple, magenta, blue, lavender in colour. The flower size varies from 2.5 to 10 cm (De *et al*, 2014). Being of high socio-economic and cultural importance, The Plant Authority of India on March 27, 2010 notified three genera *Cymbidium Sw., Dendrobium Sw.* and *Vanda Jones ex R. Br.* for registration of their varieties and hybrids (Rao *et al*, 2011).

Materials and Methods

The morphological characterizations were done used for all vegetatively propagated species of *Vanda* of the family Orchidaceae.

Plant Material Required

For all species, two to three years old 20 full grown flower bearing plants of each of 11 species viz. *Vanda alpina, V. cristata, V. coerulea, V. parviflora, V. coerulescens, V. stangeana, Papilionanthe (Vanda) teres, V. bicolor, V. tassellata, V. pumila,* and *V. parishii* were studied for development of morphological descriptors based upon UPOV guidelines. Usually, healthy and insect pest and disease free plants are required for testing for taking morphological observations without any chemical and bio-physical treatment.

Conduct of Test

The test was conducted for two similar flowering seasons at two different places. The species was considered for further examination at another appropriate test site or under special test protocol on request of the applicant if any essential characteristic of the variety is not expressed for visual observations at these places. It is always advised to test with at least 10 plants under greenhouse conditions ensuring satisfactory growth for the expression of the relevant characteristics of the variety and for the conduct of the examination. All observations were taken by measuring or counting made on 10 plants or parts taken from each of 10 plants. Additional tests for special purposes may be carried out. Normally, growth regulators are not applied.

Methods and Observations

The characteristics described in the Table of Characteristics (Table 1) were used for the characterization of species. All observations were taken from 10 plants or parts taken from each of 10 plants. For the assessment of Uniformity, a population standard of 1% and an acceptance probability of at least 95% was applied. In the case of a sample size of 10 plants, the maximum permissible number of off-types was considered 1. Characteristics indicated with (a), (b), (c), (d) and (e) in the first coloumn of the Table 1 of characteristics should be examined as indicated below:

(a) Observations on the leaf, pseudobulb and internode length should be made on the flowering pseudobulb.

(b) Observations on the inflorescence and the flower should be made at the time when 50% of the flowers on the inflorescence have opened, on the most recently fully opened flower on the in-

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florescence before the color starts to fade.

(c) Observations on the length and width of the flower and parts of the flower should be made on the extended organ.

(d) Observations on the color of the sepal, the petal and the lip should be made on the outer side and inner side at apex, mid and base portion.

(e) Observations on the colour of column should be made on the outer side and inner side at apex, mid and basal region.

For the assessment of colour characteristics, the Royal Horticultural Society (RHS) colour chart was used.

Characteristics and Symbols

A table of characteristics was used to assess the morphological characteristics and their states. Notes 1-9 (numbers) were used to explain the state of each character for the purpose of electronic data processing. (*) Characteristics that shall be observed during every growing season for all species, and shall always be included in the description of the species, except when the state of expression of any of these characters is rendered impossible by a preceding phenological characteristic or by the environment conditions of the testing region. Under such exceptional situation, adequate explanation shall be provided. **(+)** See explanations on the Table of Characteristics

Characteristics denoted with symbols QL, QN and PQ in the first column of the Table of Characteristics were described as Qualitative characteristic, Quantitative characteristic and Pseudo-qualitative characteristic, respectively. Type of assessment of characteristics indicated in column six of the Table of Characteristics were estimated by a single observation of a group of plants or parts of plants (MG), measurement of a number of individual plants or parts of plants (MS), visual assessment by a single observation of a group of plants or parts of plants (VG) and visual assessment by observations of individual plants or parts of plant (VS).

Results and Discussion

A variant can be registered if it essentially fulfils the criteria of Distinctiveness, Uniformity and Stability (DUS) which means that the candidate variety must be distinguishable by at least one essential characteristic from a variety which is sufficiently uniform in expression of its essential characteristics which should remain fixed even after repeated multiplication. The variety should also have a single and distinct denomination (Henke, 2008). In the present investigation, 11 *Vanda* species viz. *Vanda alpina, V. cristata, V. coerulea, V. parviflora, V. coerulescens, V. stangeana, Papilionanthe (Vanda) teres, V. bicolor, V. tessellata, V. pumila,* and *V. parishii* were studied for development of morphological descriptors based upon UPOV guidelines and accordingly total 65 morphological descriptors of *Cymbidium* were developed and those are plant type, internode length (cm), stem diameter (cm), root location, leaf type, leaf breadth (cm), leaf length(cm), leaf apex, leaf orientation, leaf colour, leaf sheath pigmentation, number of spikes/plant at a time, number of spikes /plant/year, infloresence length (cm), peduncle length (cm), inflorescence orientation, inflorescence nature, number of flowers/inflorescence, orientation of flowers, flower length (cm), flower width (cm), flower fragrance, flower longevity on plants, flower predominant colour, dorsal sepal size (cm), dorsal sepal shape, dorsal sepal curvature, dorsal sepal apex, lateral sepal size (cm), lateral sepal shape, lateral sepal curvature, lateral sepal apex, inside sepal colour, outside sepal colour, colour ornamentation in sepals, petal size, petal shape, petal curvature, petal apex, petal margin, inside petal colour, outside petal colour, inside petal ornamentation, outside petal ornamentation, lip length (cm), lip width (cm), lip mid lobe shape, lip lateral lobe shape, lip curvature, lip apex, keels no.s, inside lip colour, outside lip colour, inside lip ornamentation, outside lip ornamentation, column length (cm), inside coloumn colour, outside coloum colour, inside column ornamentation, outside column ornamentation, pedicellate ovary length (cm), spur type, spur length (cm) and flowering season and out of 65 descriptors, Leaf type , Inflorescence length, Flower number, Flower predominant colour, Sepal ornamentation, Petal ornamentation, Lip mid lobe shape, Lip main colour, Lip ornamentation, Spur length and Flowering season were used for grouping characteristics of species (Table 1). The *Vanda* species which contributed for production of useful and showy hybrids are *amnesiana, batemanni, coerulea, coerulescens, dearci, denisoniana, hookeriana, insignis, lamellata, loatica, limbata, liouvillei, luzonica, marvillii, parviflora, roeblingiana, rozburghii, sanderiana, spathulata, stuavis, sumatrana, teres* and *tricolor.*

The first Vanda hybrid 'Miss Joaquim' which developed from a cross between *V. teres* and *V. hookeriana* (Teoh Eng Soon, 1998). An albino form of *Vanda* 'Miss Joaquim' was produced by crossing the alba varieties of both the parents. *Vanda* 'Miss Joaquim' is said to have taken the form of *V. hookeriana* and the colour of *V. teres* (Tim Wing Yam, 2001). Fuchs (1997) reported that *Vanda sanderiana* and *V. coerulea* are the two important vandal species found in the background of most of the vandaceous hybrids. *V. sanderiana* gives full form, whereas *V. coerulea* imparts the rich blue violet colouration, lobely tessellation as well as the long inflorescence. The genus *Vanda* is cross compatible with other allied groups like *Aerides, Arachnis, Ascocentrum, Doritis, Neofinetia, Phalaenopsis, Renanthera, Trichoglottis and Vandopsis.* Some of the important hybrids of Vanda which contributed as parent plant for production of many more hybrids are "Amoene', 'Betsy Summer', 'Bull Sutton', 'Eisenhower', 'Ellen Noa', 'Emily Notley', ' Ernest', Fujinaga', 'Frank Crook', 'Haledena', 'Helen Reynolds', 'Hilo Blue', 'Honolulu', 'Jennie Hashimoto', 'Josephine Van Bero', 'Kapolio', 'Manila', 'Manisaki', 'Miss Joaquim', Noel', 'Nora Potter', 'Norbert Alphanso', Onomea', 'Poepoe', 'Rubella', 'Ruby Prince', ' Tan Chay Yan', 'Tatzeri', 'Trimerrill', 'Trisher', 'Venus' and 'Waipuna' (De and Bhattachrjee, 2011).

Table 1. Grouping characteristics in *Vanda*

S No.	Characteristics	States	Notes	Example species	Type of Assessment
1. * (+) PQ (a)	Leaf type	Terete	1	Vanda teres	VG
		Semi -terete	3		
		Channelled	5		
		Strap	7	*Vanda alpina, Vanda coerulea, Vanda cristata, Vanda parviflora, Vanda coerulescens, Vanda tassellata, V. stangeana, Vanda alpina*	
2. * QN (b)	Inflorescence length	Short (<15cm)	3	Vanda teres, Vanda cristata, Vanda parviflora, Vanda tassellata, Vanda alpina	MS
		Medium (15cm-30cm)	5		
		Long (>30cm)	7	*Vanda coerulea, Vanda coerulescens, Vanda alpina, Vanda stangeana*	

3. QN (b)	No. of flowers / inflorescence	Few (<5)	1	*Vanda tassellata, Vanda teres, Vanda alpina*, *Vanda pumila*,	VG
		Medium (5-10)	3	*Vanda parviflora, Vanda bicolor, Vanda parishi, Vanda stangeana*,	
		Many (>10)	5	Vanda coerulea, Vanda cristata, , Vanda coerulescens, V. stangeana	
4. * QL (b)	Flower predominant colour (as per RHS colour chart)	White	1	Vanda pumila	VS
		Pink	2		
		Yellow	3	Vanda cristata, Vanda stangeana, Vanda parviflora, Vanda tassellata	
		Green	4	Vanda alpina, Vanda cristata, Vanda stangeana, Vanda tassellata	
		Red	5		
		Blue	6	Vanda coerulea, Vanda coerulescens, Vanda parishi	
		Violet	7		
		Purple	8	Vanda teres	
5. * QL (d)	Colour ornamentation in sepals	Uniform	1		VS
		Spot	3	*Vanda cristata, Vanda coerulescence,*	
		Blotch	5	*Vanda parviflora*,	
		Streak/Stripe/ shaded	7	*Vanda cristata, Vanda coerulescens*, *Vanda alpina, Vanda teres,*	
		Tessellated / Netted	9	*Vanda coerulea*, *Vanda coerulescens, Vanda stangeana, Vanda tassellata, Vanda cristata* ,	
		Deflexed with incurved apex	9		
6. * QL (d)	Inside petal ornamentation (As per RHS colour chart)	Uniform	1	Vanda cristata, Vanda parviflora, Vanda alpina, Vanda teres	VG
		Spotted	2		
		Blotch	3		
		Streaked/Striped	4		
		Tassellated	5	*Vanda coerulescens* (yellow green), *Vanda tassellata* (grey brown)	
		Netted	6	*V. stangeana* (red purple),	
7. QL (d)	Outside petal ornamentation	Uniform	1	*Vanda coerulescens*, , *Vanda cristat*a, *Vanda parviflora*, *Vanda tassellata*	VG
		Spotted	1		
		Blotch	3		
		Streaked/Striped/ shaded	5	*Vanda alpina* (purple shaded), *Vanda teres* (purple shaded)	
		Tassellated	7	Vanda stangeana	
		Netted	9		
8. * (+) PQ (c)	Lip: mid- lobe shape	Ovate	1	Vanda alpina, Vanda pumila	VG
		Oblong-lanceolate	3	*Vanda coerulea, Vanda parviflora*, , *Vanda coerulescens*,	
		Sub-orbicular	5		
		others	7	*Vanda cristata*, *Vanda stangeana, Vanda teres, Vanda tassellata*	
9. QL (d)	Inside lip colour	Base	1	*Vanda coerulescens, Vanda stangeana, Vanda cristata*, (white), *Vanda parviflora* (Yellow orange), *Vanda alpina* (purple), *Vanda teres* (yellow), *Vanda tassellata* (white yellow)	VG
		Middle	3	*Vanda coerulescens*, *Vanda cristata* (yellow), *Vanda parviflora* (Yellow orange), *Vanda alpina* (purple), *Vanda teres* (yellow), *Vanda tassellata* (white violet)	
		Apex	5	*Vanda coerulescens* (white), *Vanda stangeana* (grey orange), *Vanda cristata* (yellow), , *Vanda parviflora* (red purple), *Vanda alpina* (purple), *Vanda teres* (red purple), *Vanda tassellata* (white violet)	
10. QL (d)	Outside lip colour	Base	1	*Vanda coerulescens*, *Vanda stangeana* (white), *Vanda cristata* (yellow green), *Vanda parviflora* (yellow orange), *Vanda alpina* (green), *Vanda teres* (red purple), *Vanda tassellata* (white)	VG
		Middle	3	*Vanda coerulescens* (violet), *Vanda cristata*, (purple), *Vanda stangeana* (grey orange) *Vanda parviflora* (yellow orange), *Vanda alpina* (purple), *Vanda teres* (red purple), *Vanda tassellata* (white)	
		Apex	5	*Vanda coerulescens* (violet), *Vanda stangeana* (grey orange), *Vanda cristata* (yellow), *Vanda parviflora* (Red purple), *Vanda alpina* (purple), *Vanda teres* (red purple), *Vanda tassellata* (white)	

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11. * QL (d)	Inside lip ornamentation (As per RHS colour chart)	Uniform	1		VG
		Spotted	2	*Vanda parviflora*(Red purple), *Vanda teres* (red purple)	
		Blotch	3	*Vanda cristata*(red purple),	
		Streaked/Striped	4	*Vanda alpina*, , *Vanda cristata* (red purple) *Vanda coerulescens* (white), *Vanda alpina* (green), *Vanda teres* (red purple),	
		Tassellated	5	*Vanda tassellata* (purple violet)	
		Netted	6		
12. QL (d)	Outside lip ornamentation (As per RHS colour chart)	Absent	1	*Vanda coerulescens*, *Vanda stangeana, Vanda alpina*	VG
		Spotted	2	*Vanda parviflora* (Red purple)	
		Blotch	3	*Vanda cristata*,	
		Streaked/Striped	4	*Vanda cristata* (red purple), V. *Vanda teres* (red purple),	
		Tassellated	5	*Vanda tassellata* (purple violet)	
		Netted	6		
13. QN (c)	Spur length	Short (<0.5cm)	3		MS
		Medium (0.5-1.0cm)	5	*Vanda coerulea, Vanda cristata, Vanda pumila, Vanda tassellata, , Vanda stangeana, Vanda coerulescens, Vanda parviflora*	
		Long (>1.0cm)	7	Vanda teres	
14. * PQ	Flowering season	Winter season (Nov-January)	1	Vanda coerulea	VG
		Spring season (February-April)	3	*Vanda coerulescens*, *Vanda bicolor*, *Vanda cristata*, *Vanda stangeana*	
		Summer season (May-July)	5	*Vanda teres*, *Vanda cristata, Vanda parishi, Vanda stangeana, Vanda pumila, Vanda parviflora, , Vanda alpina, Vanda tassellata*	
		Rainy season (August-Oct)	7	Vanda alpina, Vanda coerulescens, Vanda parishi, Vanda stangeana, Vanda tassellata	

Explanations for individual characteristics

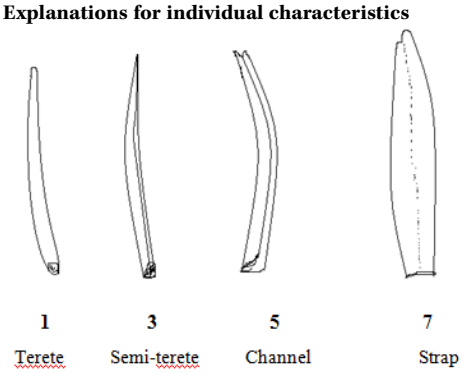


Fig.1 Leaf type

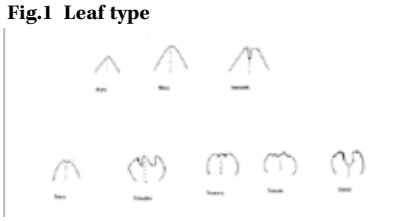


Fig. 2 Apexes for leaf, dorsal sepal, lateral sepal, petal and lip

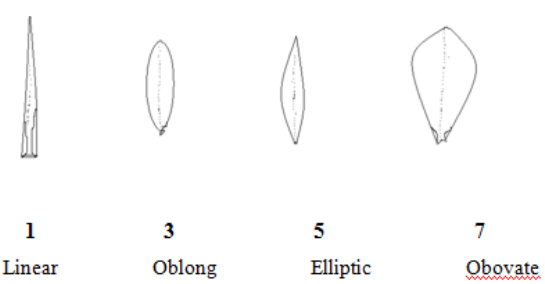


Fig.3 Sepal shape

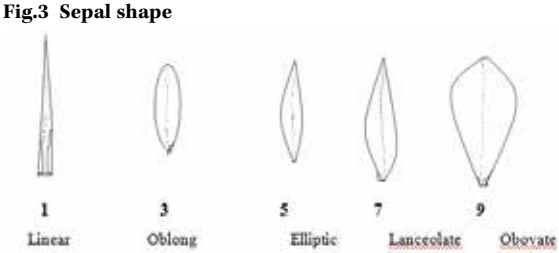
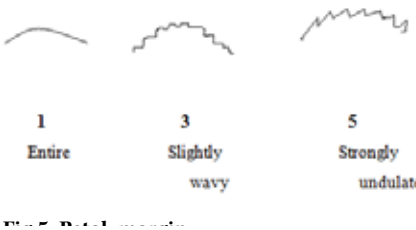


Fig.4 Petal shape



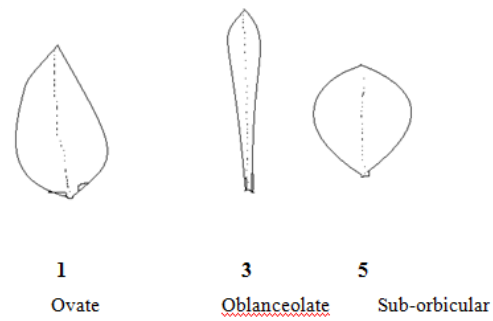


Fig.6. Lip shape

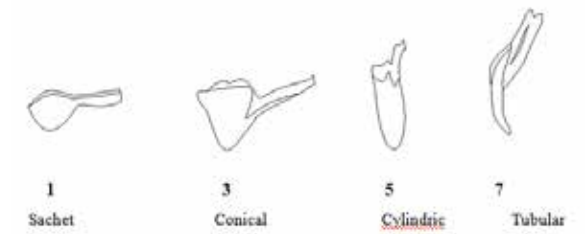


Fig.7. Spur type

Digitalization in some Vanda species

Vanda coerulea

				
General appearance of flower	Color & shape of dorsal & lateral sepals	Color & shape of petal	Color & shape of Lip	Column color & anther cap

Flower size : 7.0 x 7.6 cm.
Sepal size & color :Dorsal sepal: 3.8 x 1.7 cm; Lateral sepals: 4.0 x 2.3 cm; Inside: violet-blue (RHS- 91C) at base, (RHS- 91A) at apex and (RHS- 90B) at margins; Outside: violet-blue (RHS- 91C) at base, violet (RHS- N 87A) at apex and violet-blue (RHS- 91C) at margins with violet-blue (RHS- 91A) netted at both sides.
Petal size & color : 3.8 x 2.0 cm; Inside: violet-blue (RHS- 91D) at base, (RHS- 91B) at apex and (RHS- 91A) at margins with violet blue (RHS- 91A) netted; Outside: violet-blue (RHS- 91C) at base, violet (RHS- N87C) at apex and violet-blue (RHS- 91C) at margins with violet blue (RHS- 92A) netted & violet (RHS- N 87A) stripe.
Lip size & color : 1.9 x 0.8 cm; Inside: violet (RHS- N 87A) at base, apex of apical lobe violet (RHS- N 87A) & apex of lateral lobes violet (RHS – 91D); and margin of apical lobe violet (RHS- N 87C) & margin of lateral lobes violet (RHS – 91D) and base violet-blue (RHS- 91D).
Lip callus : present (3)
Column length & color : 0.7 cm; Inside: white; Outside: violet (RHS- N 87D) at base and white at apex & margins.
Mentum/spur length : 5.5 cm.

Vanda bicolor

				
General appearance of flower	Color & shape of dorsal & lateral sepals	Color & shape of petal	Color & shape of Lip	Column color & anther cap

Flower size : 5.1cmX4.5cm
Sepal size & color :2.4cmX1.4cm (dorsal) &2.6cmX1.5cm (lateral),grayed yellow (RHS-160B) &tasseled color of (RHS-166C) grayed orange
Petal size & color : 2.2cmX1.2 cm,grayed yellow (RHS-160B) &tasseled color of (RHS-166B) grayed orange
Lip size & color : 1.3cmX0.7cm,purple violet (RHS-N82A), white shaded(RHS155D)& red purple striped (RHS60A) & white (RHS155D)
Lip callus : present
Column size : 0.7cm
Mentum/spur size: 0.7cm

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Vanda stangeana

				
General appearance of flower	Color & shape of dorsal & lateral sepals	Color & shape of petal	Color & shape of Lip	Column color & anther cap

Flower size : 4.7 x 4.8 cm.
Sepal size & color : Dorsal sepal: 2.1 x 1.9 cm; Lateral sepals: 2.3 x 1.8 cm; Inside: red-purple (RHS-59A) at base and yellow-green (RHS- 153C) at apex and margins with red purple (RHS- 59A) netted pattern throughout. Outside: green-yellow (RHS 1D) at base and yellow-green (RHS- 153A at apex & 153D) at margins.
Petal size & color : 2.2 x 1.5 cm; Inside: red-purple (RHS- 59A) at base, yellow-green(RHS- 153C at apex and 153D at margins with red purple (RHS- 59A) netted pattern throughout. Outside: green-yellow(RHS-1D) at base and yellow-green (RHS- 153B at apex and 153D at margins).
Lip size & color : 2.3 x 1.5 cm; white (RHS-155B) at base, greyed-purple (RHS- 163C) at apex. Margins white towards base and greyed-orange (RHS- N 170C) towards apex.
Lip callus : Present (3)
Column length & color : 0.7 cm; white.
Mentum/spur length : 0.6 cm.

Vanda testacea (V. parviflora)

				
General appearance of flower	Color & shape of dorsal & lateral sepals	Color & shape of petal	Color & shape of Lip	Column color & anther cap

Flower size : 1.6 x 2.0 cm.
Sepal size & color : Dorsal sepal: 1.1 x 0.5 cm; Lateral sepals: 1.0 x 0.5 cm; Yellow-orange (RHS- 18B) at base and margins and red purple (RHS- 72B) at apex.
Petal size & color : 1.0 x 0.4 cm; yellow orange (RHS- 18B) at base and margins and (RHS- 18A) at apex.
Lip size & color : 0.6 x 0.5 cm; Inside: yellow-orange (RHS 18B) at base and margins and red-purple (RHS- 72B) at apex; Outside: yellow-orange (RHS 18A) at base and margins and red-purple (RHS- 72B) at apex.
Lip callus : Present (3).
Column length & color : 0.2 cm; Inside: yellow-orange (RHS- 18C); Outside: yellow-orange (RHS- 18B).

Mentum/spur length: 0.2 cm.
Mentum/spur length: 0.2 cm. Mentum/spur length: 0.2 cm.

Vanda tessellata

				
General appearance of flower	Color & shape of dorsal & lateral sepals	Color & shape of petals	Color & shape of Lip	Column color & anther cap

Flower size : 4.0 x 4.5 cm.
Sepal size & color : Dorsal sepal: 2.3 x 1.2 cm; Lateral sepals: 2.3 x 1.5 cm; Inside: white at base, grey-brown (RHS- N 199 A) at apex and green-white (RHS- 157A) at margins with grey-brown (RHS- N199A) tessellation throughout; Outside: green-white (RHS- 157D at base & RHS- 157A at apex) and grey-brown (RHS- N199A) at margins.
Petal size & color : 2.2 x 1.2 cm; Inside: white at base, grey-brown (RHS- N 199 A) at apex and green-white (RHS- 157A) at Margins with grey-brown (RHS- N199A) tessellation throughout; Outside: green-white

(RHS- 157D at base & RHS- 157A at apex) and grey-brown (RHS- N199C) at margins.

Lip size & color : 1.9 x 1.0 cm; Inside: white with yellow (RHS16A) shade at base, apex white (lateral lobe) violet (RHS- 86B)(mid lobe) and margins white (lateral lobe) violet (RHS- N 87D) mid lobe: Outside: white at base, apex of lateral lobe white & apex of mid lobe violet (RHS- 86D) and margins of lateral lobe white and margins of mid lobe white at base and violet (RHS- N87D) at apex.

Lip callus : Present (2)

Column length & color : 0.9 cm; white.

Mentum/spur length : 1.0 cm.

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