



DUS testing of cut-flower orchids

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Abstract

Distinctiveness, Uniformity and Stability (DUS) testing provides rights for breeders to exploit or develop new plant varieties, to allow access to foreign varieties with widen gene pool, to promote intensive breeding activities and to prevent unauthorized varieties exploitations. In the present investigation, 41, 14, 11, 9, 50 and 40 hybrids of *Cymbidium*, *Dendrobium*, *Vanda*, *Cattleya*, *Phalaenopsis* and *Oncidium*, respectively, were studied for development of DUS test guidelines using common descriptors. In *Cymbidium*, out of 66 characteristics, pseudobulb size, inflorescence length, number of flowers, flower width, flower duration, flower predominant color, lip ornamentation, blooming time; in *Dendrobium*, among 60 characteristics, plant height, internode length and number, inflorescence length, flower width, lip colour, and ornamentation and flowering time and in *Vanda*, among 66 characteristics, plant type, internode length, leaf type, spike length, flower number, inflorescence colour, sepal and petal ornamentation, lip shape, colour and ornamentation, spur length and flowering time were used for grouping of hybrids. In *Cattleya*, among 53 common descriptors developed, plant height, leaf number/ pseudobulb, flower width in front view, petal predominant colour, lip predominant colour and lip colour pattern and in *Phalaenopsis*, among 58 common descriptors developed, plant size, flower width in front view, petal predominant colour and colour pattern, predominant colour and colour pattern of apical lobe of lip whereas in *Oncidium* among 60 common descriptors, plant type, leaf number per basal leaves /pseudobulb, flower width in front view, petal main colour, petal colour pattern, lip main colour and lip colour pattern were used for grouping of hybrids.

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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 man made hybrids are on record and these include several multi generics involving three, four, five and even six genera.

The orchids are one of the distinctive plants of nature and highly priced in the international flower trade due to their incredible range of diversity in size, colour, shape, forms, appearance and long lasting qualities of flowers. They are considered as high value flowering plants as cut flowers well as potted plants. Out of 1331 species of orchids of India, 856 species are found in North Eastern Hill Region due to their congenial climatic conditions, diversified topography and altitudinal variation. Among flower crops, orchids contribute 10% share in international trade. In addition, the Sikkim Himalayan region is the centre of origin of an important species like *Cymbidium*. Other valuable genera of commercial importance used as cut flowers are *Dendrobium*, *Vanda*, *Phalaenopsis*, *Cattleya*, *Oncidium* and *Paphiopedilum*.

In 1930, the Plant Patent Act was enacted for protection of vegetatively propagated plants covering fruits and ornamental plants and the U.S. was the only country to issue plant patents. The Association of Plant Breeders for the protection of plant varieties (ASSINSEL) led to an 'International Convention for the Protection of New Varieties of Plants in Paris during 1961 for protection of rights of Plant Breeders and farmers ant to encourage the development of new varieties of plants. The International Union for the Protection of New Varieties of Plants, UPOV, an inter-governmental organization with headquarter in Geneva, Switzerland was constituted in Paris Convention of 1961, to set the basic rules and principles for plant variety protection. DUS

(Distinctiveness, Uniformity and Stability) testing is an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants and for the benefit of society. It protects rights for breeders to exploit or develop new plant varieties, to allow access to foreign varieties with widen gene pool, to promote intensive breeding activities and to prevent unauthorized varieties exploitations (Gautam *et al.* 2012). 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.* and on April, 2014, notified *Cattleya Lindl.* and *Phalaenopsis Blume* for registration of their varieties and hybrids. The present investigation was carried out to develop DUS Test Guidelines of *Cymbidium*, *Dendrobium*, *Vanda*, *Phalaenopsis*, *Cattleya* and *Phalaenopsis* using common morphological descriptors.

Materials and methods

These test guidelines were used for all vegetatively propagated varieties and hybrids of *Cymbidium Sw.*, *Dendrobium Sw.*, *Vanda Jones ex R. Br.*, *Cattleya Lindl.* and (Withnar & Harding, 2004) of *Oncidium Sw.* (Higuchi, 1983) the family Orchidaceae.

Plant material

For all the varieties, full grown 20 plants (10 for each Centre) with at least two pseudobulbs/shoot were selected for DUS testing. 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 variety or hybrid shall be 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 1 of Characteristics were used for the testing of varieties for their DUS. For the assessment of Distinctiveness and Stability, 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. All observations were taken of the shoot on the flowering shoot, of the leaf on the longest leaf of a flowering shoot, of the inflorescence and the flower at the time when 50% of the flowers on the inflorescence have opened and on the most recently fully opened flower on the inflorescence before fading of colour, of the length and width of the flower and parts of the flower in the spread out position, of the colour of sepal, petal, lip and column on the inner side. For the assessment of colour characteristics, the Royal Horticultural Society (RHS) colour chart was used.

Grouping of varieties and hybrids

The varieties and hybrids of common knowledge were selected to be grown in the trial with the candidate varieties and the way in which these varieties or hybrids are divided into groups to make easy for the assessment of distinctiveness is supported by the use of grouping characteristics. Grouping characteristics are defined as the documented states of expression, even where produced at different locations, can be used, either individually or in combination with other such characteristics: (a) by choosing varieties and hybrids of common knowledge that can be excluded from the growing trial used for examination of distinctiveness;

and (b) by conducting the growing trial so that similar varieties or hybrids are grouped together (Table 1).

Characteristics and symbols

A table of characteristics can be used to assess Distinctiveness, Uniformity and Stability of 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 was observed during every growing season for varieties and hybrids and included in the description of the varieties and hybrids, 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 places. Under such exceptional situation, adequate explanation is required. (+) indicates the 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. Characteristics indicated with (a), (b), (c), (d) and (e) in the first column of the Table of Characteristics (Table 2, 3, 4, 5, 6) were observations on the leaf made on the longest leaf of flowering plant (a), on the inflorescence and the flower made at the time when 50% of the flowers on the inflorescence have opened and the most recently fully opened flower on the inflorescence before the color starts to fade (b), on the length and width of the flower and parts of the flower made on the spread out positions (c), on the color of the sepal, the petal and the lip made on inner side at apex, mid and base portion (d) and on the colour of column made on inner side at apex, mid and basal region (e). 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 variety 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).

Table 1. Morphological descriptors and grouping characteristics of different orchid genera.

Sl.No.	Genera	No. of hybrids	Total No. of morphological descriptors	of Grouping characteristics
1.	<i>Cymbidium</i>	41	66	Pseudobulb shape & size , Inflorescence length, number of flowers/inflorescence, Flower width, Flower duration, Flower predominant color, Lip ornamentation , Blooming time
2.	<i>Dendrobium</i>	14	60	Plant height, Internode length, Inflorescence length, Flower width, Lip colour, Lip ornamentation, Flowering time
3.	<i>Vanda</i>	11	66	Plant type , Internode length , Leaf type, Spike length, Flower number, Inflorescence colour, Sepal & petal ornamentation, Lip: shape, colour, ornamentation, Spur length , Flowering time
4.	<i>Cattleya</i>	9	53	Plant: height, Leaf: number/ pseudobulb, Flower width in front view, Petal: predominant colour, Lip predominant colour , Lip colour pattern
5.	<i>Phalaenopsis</i>	50	58	Plant size , Flower width in front view, Petal predominant colour, Petal colour pattern, Lip predominant colour, Lip Predominant colour of apical lobe, Lip colour pattern of apical lobe
6.	<i>Oncidium</i>	40	60	Plant type, Number of basal leaves/pseudobulb, Flower width in front view, Petal main colour, Petal colour pattern, Lip main colour, Lip colour pattern

Table 2. Pseudobulb and leaf shape in *Cymbidium*.

Sl. No.	Characteristics	States	Notes	Example Varieties /hybrids	Type of Assessment
1.	Pseudobulb shape	Narrow	1		VG
*		Round	3	Cym. 'Lucky Rainbow'	
(+)		Ovoid	5	Cym. 'Soul Hunt' , Cym. 'Fire Storm', Cym. Bob Marlin 'Lucky', Cym. 'Winter Beach Sea Green', Cym. 'Madrid Forest King', Cym. 'Show Girl', Cym. 'Sleeping Nymph'	
PQ		Conical	7	Cymb. 'Luna Pink'	
(a)					
2.	Leaf shape	Linear	1	Cym. 'Yankilla', Cym. 'Soul Hunt', Cym. 'Fire Storm', VG	VG
*				Cym. Bob Marlin 'Lucky', Cym. 'Winter Beach Sea Green', Cym. 'Madrid Forest King', Cym. 'W.W. Wondrous', Cym. 'Sleeping Nymph'	
(+)		Linear-oblong	3	Cym. 'Lucky Rain Bow', Cym. 'Sainte Lapine'	
PQ		Lanceolate	5	Cym. 'Stanley Fouraker White Magic'	
(a)					

In the present investigation, 41 hybrids of *Cymbidium*, 14 hybrids of *Dendrobium*, 11 hybrids of *Vanda*, 9 hybrids of *Cattleya*, 50 hybrids of *Phalaenopsis* and 40 hybrids of *Oncidium* were studied for development of DUS test guidelines using common descriptors.

In *Cymbidium*, out of 66 characteristics, pseudobulb size, inflorescence length, number of flowers, flower

width, flower duration, flower predominant color, lip ornamentation, blooming time; in *Dendrobium*, out of 60 characteristics, plant height, internode length and number, inflorescence length, flower width, lip colour, and ornamentation and flowering time and in *Vanda*, out of 66 characteristics, plant type, internode length, leaf type, spike length, flower number, inflorescence colour, sepal and petal ornamentation, lip shape, colour and ornamentation, spur length and

flowering time were used for grouping of hybrids. In *Cattleya*, out of 53 common descriptors developed, plant height, leaf number/ pseudobulb, flower width in front view, petal predominant colour, lip predominant colour and lip colour pattern and in *Phalaenopsis*, out of 58 common descriptors developed, plant size, flower width in front view, petal

predominant colour and colour pattern, predominant colour and colour pattern of apical lobe of lip whereas in *Oncidium* out of 60 common descriptors, plant type, leaf number per basal leaves /pseudobulb, flower width in front view, petal main colour, petal colour pattern, lip main colour and lip colour pattern were used for grouping of hybrids.

Table 3. Leaf and spur type in *Vanda*.

S. No.	Characteristics	States	Notes	Example Varieties /hybrids	Type of Assessment
1. * PQ (+)	Leaf type	Terete (Round)	1	V. 'John Clubb' V. 'Miss Joaquim'	VG
		Semi-terete	3	V. Ruby	
		Channelled	5	--	
		Strap (Flat)	7	V. 'KS.SD', V. 'Prao Sky Blue', V. 'Pures Wax', V. 'RBSD Black', V. 'PAT D', V. 'Sansai Blue', V. 'Motes Indigo', V. 'Pakchong Blue', V. 'Roberts Delight Blue'	
2. * PQ (+) ©	Spur type	Saccate	1	-	VG
		Conical	3	V. 'KS.SD', V. 'Prao Sky Blue', V. 'Pures Wax', V. 'RBSD Black', V. 'PAT D', V. 'Sansai Blue', V. 'Motes Indigo', V. 'Pakchong Blue', V. 'Roberts Delight Blue'	
		Cylindric	5	-	
		Tubular	7	-	

Table 4. Grouping characteristics in *Cattleya*.

Sl. No.	Characteristic	State	Note	Example Varieties /hybrids	Type of Assessment
1. (* QN	Plant height (cm) (From base to the tip of the flowering shoot)	Small (< 15)	3	Lc 'Manriner Far Horizon x <i>L. anceps coerulea</i> , Lc 'Ahmad MS Sheikhi'	MS
		Medium (15-30)	5	Lc 'Purple Cascade Fragrant B', Blc 'Mem Ann Balmores Convess', C. 'Queen Sirikhit', Blc 'Hsinging Catherine', Blc 'Chinese Beauty Orchid Queen', Blc 'Guanmiau City'	
		Large (> 30)	7	--	
2. (* QN (a)	Number of leaves/ pseudobulb	One (Unifoliate)	1	Lc 'Purple Cascade Fragrant B', Blc 'Mem Ann Balmores Convess', VG Blc 'Hsinging Catherine', Blc 'Chinese Beauty Orchid Queen', Blc 'Guanmiau City', Lc 'Manriner Far Horizon x <i>L. anceps coerulea</i> , Lc 'Ahmad Sheikhi'	MS
		Two (Bifoliate)	9	C. 'Queen Sirikhit',	
3. (* QN (c)	Flower breadth (cm) in front view (distance between tips of two lateral petals)	Narrow (<8)	3	C. 'Queen Sirikhit'	MS
		Medium (8-16)	5	Lc 'Purple Cascade Fragrant B', Blc 'Mem Ann Balmores Convess', Blc 'Hsinging Catherine', Blc 'Chinese Beauty Orchid Queen', Blc 'Guanmiau City', Lc 'Manriner Far Horizon x <i>L. anceps coerulea</i> , Lc 'Ahmad Sheikhi'	
		Broad (>16)	7	--	
4. (* QL (d)	Predominant colour of petal	Green	1	--	VG
		White	2	C. 'Queen Sirikhit', Blc 'Hsinging Catherine'	
		Yellow	3	Blc 'Mem Ann Balmores Convess', Blc 'Chinese Beauty Orchid Queen', Lc 'Ahmad Sheikhi'	
		Pink	4	--	
		Red	5	--	
		Purple	6	Lc 'Purple Cascade Fragrant B', Lc 'Manriner Far Horizon x <i>L. anceps coerulea</i>	
5. (* QL (d)	Predominant colour of lip	Green	1	--	VS
		White	2	--	
		Yellow	3	Blc 'Mem Ann Balmores Convess', C. 'Queen Sirikhit', Lc 'Ahmad	

		Sheikhi'			
	Pink	4	--		
	Red	5	Blc 'Chinese Beauty Orchid Queen',		
	Purple	6	Lc 'Purple Cascade Fragrant B', Blc 'Hsinging Catherine', Blc 'Guanmiau City', Lc 'Manriner Far Horizon x <i>L. anceps coerulea</i>		
	Blue	7	--		
	Violet	8	--		
6. (*) QL (d)	Colour pattern of lip	Uniform	1	--	VG
		Mixed	3	--	
		Spotted	5	Blc 'Guanmiau City', Lc 'Ahmad Sheikhi'	
		Striped/ Shaded	7	Lc 'Purple Cascade Fragrant B', Blc 'Mem Ann Balmores Convess', C. 'Queen Sirikhit', Blc 'Hsinging Catherine', Blc 'Chinese Beauty Orchid Queen', Lc 'Manriner Far Horizon x <i>L. anceps coerulea</i>	
		Netted	9	--	

Table 5. Lip colour pattern of apical lobe in *Phalaenopsis*.

Sl. No	Characteristics	States	Notes	Example Varieties /Hybrids	Type of Assessment
1. (*) QL (d)	Lip: color pattern of apical lobe	Uniform	1	Dtps. Plum Rose x Ox Black Jack, Dtps. Acker's Sweetie, P. Champion Porter, P. Strawberry, P. Big White Pink Stripe, P. Medium Pink, P. Brother Girl, P. Carlotta, Dtps. Gan Lin Fairy 'GL'	VG
		Shaded	2	Dtps. Younghome Orange Lip, Dtps. Hsin Yang Fortune, Dtps. Big Red Robe, Dtps. Mount Lip Taisuco, P. Miki Wata Nabe, P. Amabilis, , Dtps. Shih Hua Long First Love, P. Taida Salu, Dtps. Tying Shin Zebra, Dtps. Taida Salu Red, P. Kaleidoscope, P. Luchia Pink, P. Jin Cheng Sun, P. Sin Yuan Golden Beauty, Dtps. Chian Xen Magpie, P. Little Gem Stripe, Dtps. Lian Her Happy, P. Leodora, P. Magic Kiss, P. Roxanne, P. Ivory pearl, P. Memoria Francis Hunter, Dtps. Ox Prince Thunder, Dtps. Leopard Princess M611, P. Shu Long Spotted Deer, P. Ho's Little Caroline, Dtps. Sogo Soft, Dtps. Gan Lin Beauty Hsiung, Dtps. Shulong Sun Beauty, P. Chian Xen Pearl 'Cx#1', Dtps. Shu Long Pearl	
		Edged	3	P. Timothy Christopher Dtps. Happy UFO	
		Striped	4	--	
		Netted	5	--	
		Spotted	6	P. Surf Song, Goldie, P. Lucyna, Dtps. Chin Ann Diamond 'Alisun', Dtps. Gan Lin Diamond.	
		Mixed (specify)	7	--	

Table 6. Grouping characteristics in *Oncidium*.

Sl. No.	Characteristic	State	Note	Example Varieties /hybrids	Type of Assessment
1. (*) QN	Plant type	without pseudobulb	1	Tolu. Jairak Firm Ruddy, Tolu. Jairak Firm 'Fuscous', Tolu. Jairak Firm 'Deep Red', Ianopsis Utriculariodes, Tolu. Jairak Firm 'Butterfly', Tolu. Jairak Firm 'Chocolate Drop', Tolu. Jairak Rainbow 'Coral', Tolu. Jairak Rainbow 'Rosy', Tolu. Popoki, ONC. Baipai, Tolu. Jairak Rainbow 'Charming', Tolu. Jairak Firm 'Strawberry', ONC. Popki Red	VG
		with pseudobulb	9	ONC. Sharry Baby Sweet Fragrance, ONC. Sweet Sugar, Colm. Wildcat Carmera, Colm. Wildcat Bobcat, ONC. Taka Yellow	
2. (*) (+)QN	Number of basal leaves/ pseudobulb	very few (<2)	3	ONC. Sweet Sugar, ONC. Pink/Yellow, ONC. Sharry Baby Sweet Fragrance	VG
		few (2-4)	5	ONC. Ramsey Orange, Colm. Wildcat Yellow, ONC. Kampangsean Snow, ONC. Big White, ONC. Blue, ONC. Red, ONC. Pink Small Flower, ONC. Red Mini Little Cherry, ONC. Taka, Colm. Wild Cat Carmera, Colm. Wildcat Bobcat	
		many (more than 4)	7	ONC. Hawai Yellow, Brassidium Butterfly	
3. (*)	Flower width (cm) in front view	narrow (<3)	1	ONC. Hawai Yellow, ONC. Ramsey Orange, ONC. Kampangsean Snow, ONC. Red Mini Little Cherry, ONC. Taka, ONC. Popki Red	MS

QN (c)	medium (3-6)	3	Colm. Wildcat Yellow, ONC. Sweet Sugar, ONC. Red, ONC. Pink Small Flower, ONC. Pink/Yellow, Ianopsis Utriculariodes, ONC. Sharry Baby Sweet Fragrance, Colm. Wild Cat Carmera, Colm. Wildcat Bobcat		
	broad (>6-9)	5	ONC. Lucky Goldstar, Brassidium Butterfly		
	very board (>9)	7	ONC. Big White, ONC. Blue, ONC. Royal Robe		
4. (* (d)	Petal main colour PQ as per RHS colour chart	Green	1	ONC. Sweet Sugar	VG
		White	2		
		Yellow	3	Colm. Wild Cat Carmera, ONC. Taka Yellow	
		Pink	4		
		Red	5	ONC. Popki Red	
		Purple	6	ONC. Sharry Baby Sweet Fragrance, Colm. Wildcat Bobcat	
		Blue	7		
		Violet	8		
5. (* (+)-QL (d)	Petal pattern	uniform	1	ONC. Hawai Yellow, Colm. Wildcat Yellow, ONC. Sweet Sugar, Brassidium Butterfly, ONC. Big White, ONC. Pink Small Flower, ONC. Pink/Yellow	VG
		shaded	2	ONC. Kampangsean Snow, ONC. Blue, ONC. Red, Ianopsis Utriculariodes, ONC. Red Mini Little Cherry, ONC. Sharry Baby Sweet Fragrance, ONC. Popki Red	
		blotched	3	ONC. Big White, ONC. Blue, ONC. Lucky Goldstar, ONC. Baipai	
		brindled	4	ONC. Hawai Yellow, ONC. Ramsey Orange, Colm. Wildcat Yellow ONC. Sweet Sugar, Brassidium Butterfly, Colm. Wild Cat Carmera	
		striped	5	ONC. Pink Small Flower, Ianopsis Utriculariodes, ONC. Red Mini Little Cherry	
		edged	6	ONC. Red Mini Little Cherry, Colm. Wildcat Bobcat	
6. (* (d)	Lip main colour as PQ per RHS colour chart	green	1		VG
		white	2	ONC. Sharry Baby Sweet Fragrance	
		pink	3		
		yellow	4	ONC. Sweet Sugar, Colm. Wild Cat Carmera, ONC. Taka Yellow	
		red	5	ONC. Popki Red	
		purple	6	Colm. Wildcat Bobcat	
		blue	7		
		violet	8		
7. (* (+)-QL (d)	Lip colour pattern	uniform	1	ONC. Hawai Yellow, ONC. Ramsey Orange, Colm. Wildcat Yellow, ONC. Red Mini Little Cherry, Colm. Wildcat Bobcat	VG
		shaded	2	ONC. Sweet Sugar, ONC. Kampangsean Snow, ONC. Big White, ONC. Blue, ONC. Red, ONC. Pink Small Flower, ONC. Pink/Yellow, Ianopsis Utriculariodes, ONC. Taka, ONC. Sharry Baby Sweet Fragrance, ONC. Popki Red	
		blotched	3	ONC. Hawai Yellow, ONC. Ramsey Orange, Colm. Wildcat Yellow, ONC. Big White, ONC. Blue, ONC. Red, ONC. Pink Small Flower, Colm. Wild Cat Carmera	
		brindled	4	ONC. Big White	
		edged	5		

In breeding programme, selection of good and healthy plant and flower by visual observation accounts to a great extent. Evidences of natural hybridizations occurring among wild members were noticed (Abraham and Vatsala, 1981). Hundreds of natural inter-generic, inter-specific or intra-specific

natural hybrids of *Dendrobium* are found in nature. Most of Indian species of *Cymbidium*, *Dendrobium* and *Vanda* studied have been recognized in breeding programme specially to produce primary hybrids due to their inherent attractiveness coupled with their ability to transmit these characters to hybrids. In

Dendrobium, offsprings of reciprocal crosses show variations in characters like cane length and flower colour, flower size, flowering season and flower yield (Mc Connel and Kamemoto, 1983; Kamemoto *et al.*,1989). Selection of flower size and flower colour are effective in *Dendrobium* improvement programme. In *Cymbidium*, fragrance is the most important character sought after by breeders (Singh, 1984). A hybrid genera *Potinarra* which is a tetrageneric hybrid combined *Cattleya*, *Laelia*, *Brassavola* and *Sophrontis* was registered for the first time in 1922 (Bhattacharjee and Das, 2008). One of the prominent hybrids used extensively for blue *Cattleya* breeding is *Laeliocattleya* 'Canhamiana', a cross between *C. mossiae* and *Laelia purpurea*. Among *Brassavola*, *B. cucullata*, *B. cordata*, *B. nodosa* and *B. perrinii* are extensively used in

hybridization as studied by Mathews (1996). Herman (1997) reported that the large flowered *Cattleya* hybrids are the results of breeding involving fifteen *Cattleya* species, two *Laelia* and *Brassavola digbyana*. Thomas (2001) viewed the requirements for flower forms of commercial growers of *Phalaenopsis* like strong self -supporting erect inflorescences, long duration of blooms, compact plant size, wide temperature tolerance, disease resistance, firm substances and consistency of colours. Some of the outstanding hybrids of *Oncidium* which have proved as proven parent plants for production of more and more attractive hybrids are 'Angnes Ann', 'Ann Rosa', 'Catherine Wilson', 'Delight', 'Golden Glow', Helen Brown', 'Lovely', 'organ Mountains', 'St. Anne', and 'Waikiki Sunset' (Bhattacharjee and De, 2003).

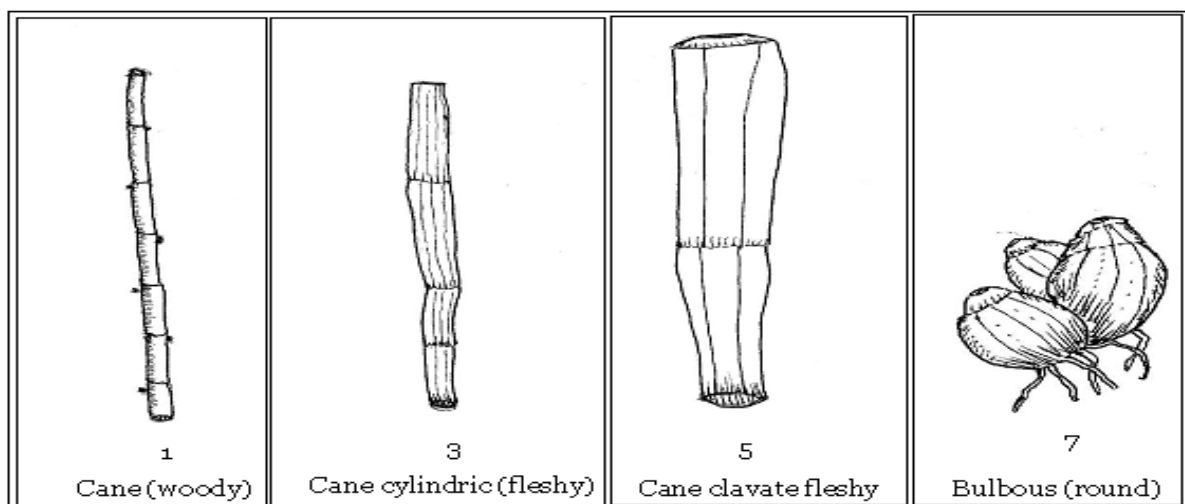


Fig. 1. Nature of stem in *Dendrobium*.

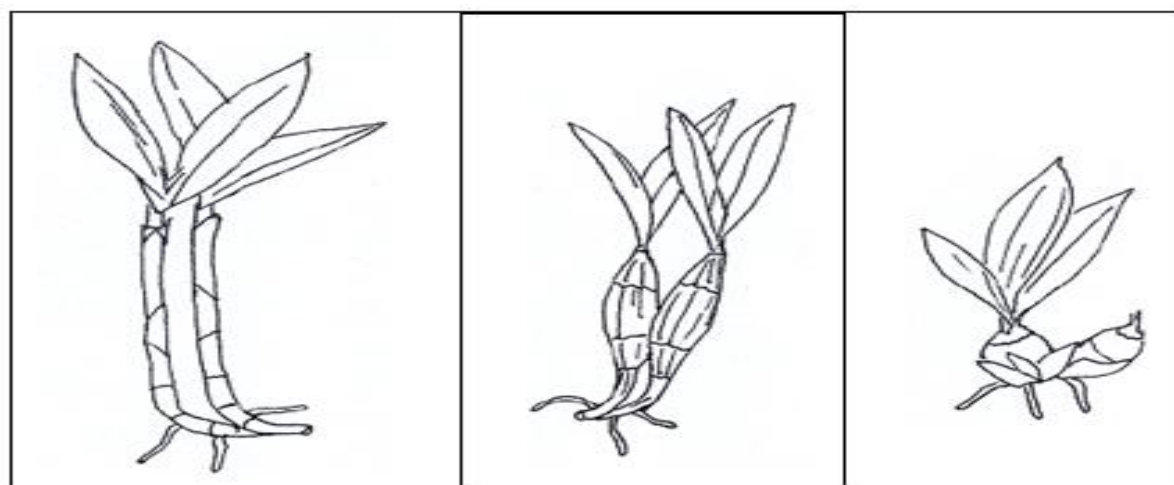


Fig. 2. Nature of pseudobulb in *Cattleya*.

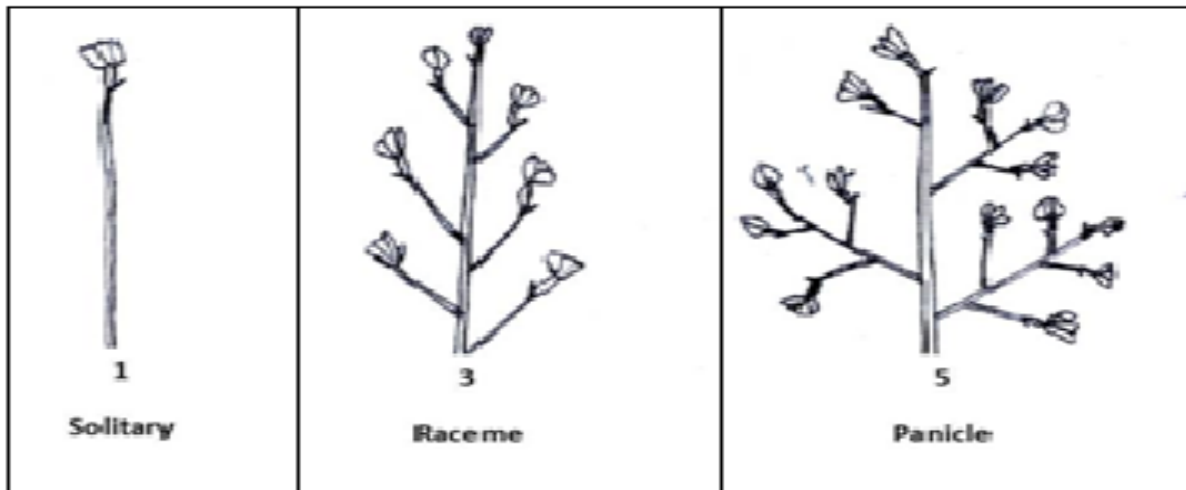


Fig. 3. Inflorescence type in *Phalaenopsis*.

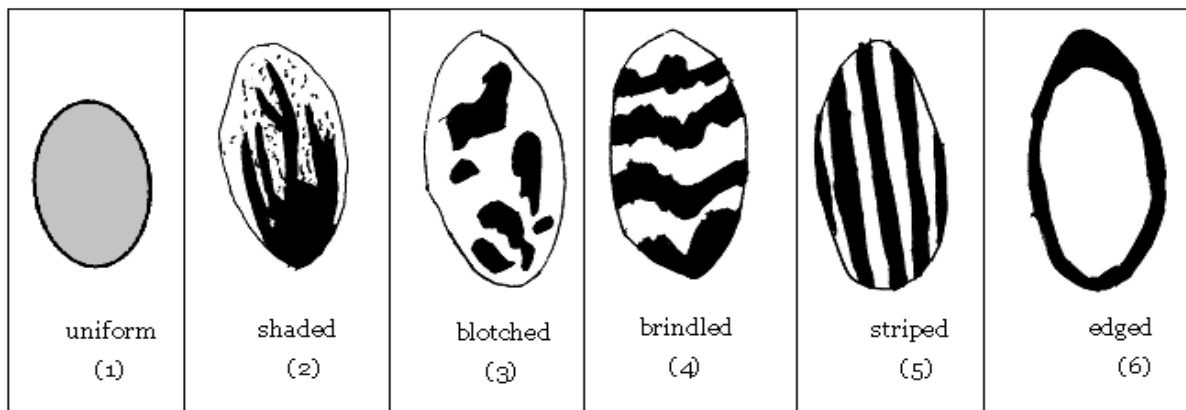


Fig. 4. Lip colour pattern in *Oncidium*.

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