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researchsubmission@hotmail.com

Research Paper

MORPHOLOGICAL CHARACTERIZATION IN *CYMBIDIUM* SPECIES

¹L.C. De, ²A.N. Rao, ³P.K. Rajeevan, ⁴Manoj Srivastava and ¹Geetamani Chhetri

¹NRC for Orchids, Sikkim;

²Centre for Orchid Gene Conservation of Eastern Himalayan Region,
Senapati District, Manipur State;

³Ex-Professor,
Department of Pomology and Floriculture,
College of Horticulture,

Kerala Agricultural University, Vellanikkara, Trichur;

⁴PPV & FRA, NASC Complex,
New Delhi

Abstract

Cymbidiums comprising of 70 species are among the most popular winter and spring blooming semi-terrestrial orchids originated from tropical and subtropical Asia covering North Eastern India, China, Japan, Malayasia, the Philippines, Borneo islands and North Australia, usually growing in cooler climates at high elevations. Cymbidiums are famous for its beautiful spikes derived from species and hybrids and used as cut flowers and potted plants. In the present investigation, 12 species of Cymbidium viz. 12 *Cymbidium* species viz. *Cymbidium lowianum*, *Cym. devonianum*, *Cym. pendulum*, *Cym. tigrinum*, *Cym. aloifolium*, *Cym. gammaenum*, *Cym. elegans*, *Cym. iridioides*, *Cym. erythraeum*, *Cym. dayanum* and *Cymbidium mastersii* were studied for development of morphological descriptors based upon UPOV guidelines and accordingly total 63 morphological descriptors of *Cymbidium* were developed.

Key words: Cymbidium, morphological descriptors.

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. Cymbidiums are among the most popular winter and spring blooming semi-terrestrial orchids originated from tropical and subtropical Asia covering North Eastern India, China, Japan, Malayasia, the Philippines, Borneo islands and North Australia, usually growing in cooler climates at high elevations. The important Cymbidium growing countries in the world are Australia, New Zealand, Japan, the Netherlands, the USA and England. Cymbidium consists of 70 semi-terrestrial and epiphytic orchids of tropical and subtropical Asia. The plants are characterized by short and stout pseudobulbs ensheathed by encircling leaf bases. Leaves are long, ribbon shaped, leathery or soft and lanceolate. The flower spikes develop from the base of the pseudobulbs. A plant has three types of bulbs. 1. Old back bulbs without leaves: These bulbs

act as a reserve food supply for emergencies. It is advisable to leave one of these on each divided plant. Back bulbs can make new plants but they may take years to flower. 2. Old bulbs with leaves: These bulbs support the new growth and may produce flowers for a number of years depending on the variety. When dividing, the plant must retain at least two old bulbs or have one back bulb attached to be able to reflower next year. 3. New leads or bulbs.: These are the youngest bulbs on the plant that the flowers and most new growth comes. When dividing, at least 1 old bulb and one back bulb must be retained with this bulb to ensure that the plant may flower the following year. The spikes are erect, arching or pendulous and arranged with 2 to 15 flowers. The individual florets are 1cm to 12.5cm across and are of various colours of shades of colour. Cymbidiums are famous for its beautiful spikes derived from species and hybrids. Among the orchids, Cymbidium ranks first and in floricultural crops it accounts for 2.7% of the total cut flower production. In India, it is cultivated in Sikkim, Darjeeling hills and Arunachal Pradesh. 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 *Cymbidium* of the family Orchidaceae.

Plant Material Required

For all species, four to five years old 20 full grown flower bearing plants of each of 12 species viz. *Cymbidium lowianum*, *Cym. devonianum*, *Cym. pendulum*, *Cym. tigrinum*, *Cym. aloifolium*, *Cym. gammiaenum*, *Cym. elegans*, *Cym. iridioides*, *Cym. erythraeum*, *Cym. dayanum* and *Cymbidium mastersii* 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 column 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 inflorescence 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, 12 *Cymbidium* species viz. *Cymbidium lowianum*, *Cym. devonianum*, *Cym. pendulum*, *Cym. tigrinum*, *Cym. aloifolium*, *Cym. gammaenum*, *Cym. elegans*, *Cym. iridioides*, *Cym. erythraeum*, *Cym. dayanum* and *Cymbidium mastersii* were studied for development of morphological descriptors based upon UPOV guidelines and accordingly total 63 morphological descriptors of *Cymbidium* were developed and out of 63 descriptors, Pseudobulb shape, Inflorescence length, number of flowers/inflorescence, Flower width, Flower longevity on plant, Flower predominant color, Lip ornamentation and Flowering season were used for grouping of species (Table 1).

The species like *C. pumilum*, *C. devonianum* and *C. ensifolium* are small flowered types and cross easily with the large flowered Himalayan species. Most of the hybrids in *Cymbidium* are evolved through the utilization of the eight of the large flowered species viz. *Cymbidium iridioides* (syn. *C. giganteum*), *C. eburneum*, *C. hookerianum* (syn. *C. grandiflorum*), *C. sanderae*, *C. lowianum*, *C. tracyanum*, *C. insigne* and *C. erythrostylum*). Some of the hybrids like 'Balkis', 'Cleo Sheraton', 'Desiree A'logann', 'Early Bird', 'Joan of Arc', 'Kurun', 'Lucy', 'Lustrous', 'Mayfair', 'Miretta', 'Nam Khan', 'October', 'Oiso', 'Ortin', 'Redwood', 'Remus', 'Rio Rita', 'Rosanna', 'Shiraj', 'Stanley Fouraker', 'Swallow', 'Vieux Rose' are outstanding and largely utilized as parent plants for production of many spectacular hybrids (De and Bhattacharjee, 2011).

Cymbidium 'Alexanderi' a cross between *C. 'Eburneo-Lowianum'* and *C. insigne*, the progenies of the cross were diploid but clone 'Westtonbrit' proved to be tetraploid. In fact this hybrid changed the world of cut flower cymbidiums. *Cymbidium* 'Alexanderi' was producing everything that was required where quality was concerned (Keith, 2000). This hybrid became popular because of its large white flowers and as parent for pestal coloured popular hybrids. The Japanese and Chinese species of *Cymbidium* are utilized for breeding of miniature types. Miniature hybrids are good as pot plants and slightly tolerant to warmer conditions. The first miniature hybrid in *Cymbidium* was evolved in England in the year 1944, which was a cross between *C. 'Lousie Sander'* x *C. pumilum*. The variety 'Lousie Sander' is a cross between 'Alexanderi' x 'Ceres'. *C. munronianum* has been used as parent in several breeding programmes for contributing scent characters to the offsprings.

Table 1. Morphological characteristics in *Cymbidium*

S. No.	Characteristics	States	Notes	Example species	Type of Assessment
1. * QN (a)	Pseudobulb size (length x breadth)	Small (<30cm ²)	3	<i>Cym. pendulum</i> , <i>Cym. aloifolium</i> , <i>Cym. tigrinum</i> , <i>Cym. dayanum</i> , <i>Cym. gammieanum</i> , <i>Cym. elegans</i>	MS
		Medium (30-60cm ²)	5	<i>Cym. lowianum</i>	
		Large (>60cm ²)	7		
2. * PQ (+) (a)	Pseudobulb shape	Narrow cylindrical	1		VG
		Round	3	<i>Cym. dayanum</i> , <i>Cym. gammieanum</i> , <i>Cym. tigrinum</i>	
		Ovoid	5	<i>Cym. pendulum</i> , <i>Cym. elegans</i> , <i>Cym. hookerianum</i> , <i>Cym. erythraeum</i> , <i>Cym. tracyanum</i> , <i>Cym. aloifolium</i> , <i>Cym. irridioides</i>	
		Conical	7	<i>Cym. elegans</i> ,	
3. QN	Number of leaves at flowering pseudobulb	Few (<3)	3		VG
		Medium (3-6)	5	<i>Cym. pendulum</i> , <i>Cym. aloifolium</i> , <i>Cym. devonianum</i> , <i>Cym. tigrinum</i> , <i>Cym. dayanum</i>	
		Many (>6)	7	<i>Cym. lowianum</i> , <i>Cym. gammieanum</i> , <i>Cymb. elegans</i> , <i>Cym. lancifolium</i> , <i>Cym. erythraeum</i>	
4. * QN (a)	Leaf length	Short (<40cm)	3	<i>Cym. tigrinum</i> , <i>Cym. aloifolium</i> , <i>Cym. pendulum</i> , <i>Cym. devonianum</i>	VG
		Medium (40-80cm)	5	<i>Cym. hookerianum</i> , <i>Cym. lowianum</i> , , <i>Cym. dayanum</i> , <i>Cym. elegans</i> , <i>Cym. iridioides</i> ,	
		Long (>80cm)	7	<i>Cym. erythraeum</i> , <i>Cym. ensifolium</i> ,	
5. QN (a)	Leaf width	Narrow (<1.5cm)	3	<i>Cym. dayanum</i>	VG
		Medium (1.5-3.0cm)	5	<i>Cym. lowianum</i> , <i>Cym. pendulum</i> , <i>Cym. gammieanum</i> , <i>Cym. elegans</i> , <i>Cym. iridioides</i>	
		Broad (>3.0cm)	7	<i>Cym. devonianum</i> , <i>Cym. aloifolium</i>	
6. * (+) PQ (a)	Leaf shape	Linear	1	<i>Cym. hookerianum</i> , <i>Cym. pendulum</i> , <i>Cym. lowianum</i> , <i>Cym. aloifolium</i> , <i>Cym. erythraeum</i> , <i>Cym. irrioides</i> ,	VG
		Linear-oblong	3	<i>Cym. devonianum</i> , <i>Cym. dayanum</i> , <i>Cym. lancifolium</i> ,	
		Lanceolate	5	<i>Cym. gammieanum</i> , <i>Cym. erythraeum</i> , <i>Cym. elegans</i> , <i>Cym. tigrinum</i> , <i>Cym. iridioides</i> , <i>Cym. lancifolium</i>	
7. PQ (a)	Leaf petiole	Absent	1	<i>Cym. gammieanum</i> , <i>Cym. erythraeum</i> , <i>Cym. elegans</i>	VG
		Present	9	<i>Cym. devonianum</i> , <i>Cym. tigrinum</i> , <i>Cym. lancifolium</i> ,	

8. (+) PQ (a)	Leaf apex	Acute	1	<i>Cym. lowianum, Cym. dayanum, Cym. elegans, Cym. gammieanum,</i>	VG
		Obtuse	3	<i>Cym. pendulum, Cym. devonianum</i>	
		Forked	5	<i>Cym. aloifolium,</i>	
9. QN (b)	No. of flower spike / pseudobulb	One	1	<i>Cym. tracyanum</i>	MS
		Two	3	<i>Cym. lowianum, Cym. elegans, Cym. eburneum</i>	
		> Two	5	--	
10. PQ (b)	Inflorescence orientation	Erect	1	<i>Cym. eburneum,</i>	VG
		Horizontal / Arching	3	<i>Cym. erythraeum, Cym. hookerianum, , Cym. tracyanum, Cym. iridioides,</i>	
		Drooping/ Pendulus	5	<i>Cym. devonianum, Cym. aloifolium, Cym. lowianum, Cym. dayanum, Cym. elegans, Cym. pendulum,</i>	
11. PQ (b)	Inflorescence type	Dense	1	<i>Cym. devonianum, Cym. elegans,</i>	VG
		Lax (Sparsely arranged)	3	<i>Cym. pendulum, Cym. iridioides,</i>	
12. * QN (b)	Length of inflorescence	Short (<30 cm)	3	<i>Cym. devonianum, Cym. eburneum, Cym. erythraeum, Cym. tigrinum, Cym. pendulum, Cym. dayanum</i>	MS
		Medium (30-60cm)	5	<i>Cym. gammieanum, Cym. elegans</i>	
		Long (>60cm)	7	<i>Cym. concerto, Cym. lowianum, Cym. aloifolium, Cym. eburneum, Cym. tracyanum</i>	
13. QN (b)	Peduncle length	Short (<30cm)	1	<i>Cym. devonianum, Cym. pendulum, Cym. iridioides,</i>	MS
		Medium (30-60cm)			
		Long (>60cm)	3		
14. QN (b)	Peduncle thickness	Thin (<0.5cm)	1	<i>Cym. pendulum, Cym. devonianum, Cym. aloifolium, Cym. tigrinum, Cym. dayanum,</i>	MS
		Medium (0.5-0.8 cm)	3	<i>Cym. lowianum, Cym. elegans, , Cym. irrioides,</i>	
		Thick (>0.8cm)	5		
15. * QN (b)	Number of flowers/inflorescence	<12	1	<i>Cym. pendulum, Cym. irridiodes</i>	VS
		12-20	3	<i>Cym. devonianum</i>	
		>20	5	<i>Cym. lowianum, C. devonianum, C. aloifolium, Cym. tigrinum, Cym. elegans, Cym. gammieanum</i>	
16. QL (b)	Anthocyanin coloration in peduncle	Absent	1	<i>Cym. lowianum, Cym. pendulum, Cym. devonianum, Cym. dayanum, Cym. elegans, Cym. erythraeum, Cym. irridioides,</i>	VG
		Present	9	<i>Cym. devonianum, Cym. aloifolium, Cym. tigrinum,</i>	
17.	Peduncle bract	Absent	1	<i>Cym. lowianum</i>	VG

PQ (b)		Present	9	<i>Cym. pendulum, Cym. devonianum, Cym. dayanum, Cym. elegans, Cym. erythraeum, Cym. irridiodes,</i>	
18. QN (b)	No. of inflorescences / plant	Few (<5)	3	<i>Cym. dayanum, Cym. hookerianum, Cym. lowianum, Cym. lancifolium,</i>	VG
		Medium (5-10)	5	<i>Cym. devonianum, Cym. aloifolium, Cym. pendulum, Cym. tigrinum, Cym. iridioides,</i>	
		Many (>10)	7		
19. * QN (c)	Flower length (Tip of dorsal sepal to tip of lip)	Small (<2cm)	3	<i>Cym. elegans</i>	MS
		Medium (2cm-4cm)	5	<i>Cym. pendulum, Cym. devonianum, Cym. gammieanum, Cym. iridioides, Cym. lowianum</i>	
		Large (>4cm)	7	<i>Cym. tigrinum, Cym. dayanum, Cym. aloifoliu, Cym. dayanum</i>	
20. * QN (c)	Flower width (Tip distance of two lateral petals)	Small (<2cm)	3	<i>Cym. aloifolium, Cym. dayanum</i>	MS
		Medium (2cm-4cm)	5	<i>Cym. pendulum, Cym. elegans, Cym. devonianum, Cym. dayanum</i>	
		Large (>4cm)	7	<i>Cym. lowianum, Cym tigrinum, Cym. gammieanum, Cym. aloifolium</i>	
21. QL (b)	Flower fragrance	Absent	1	<i>Cym. devonianum, Cym. pendulum, Cym. lowianum, Cym. dayanum</i>	VG
		Present	9	<i>Cym. eburneum, Cym. tracyanum, Cym. hookerianum, Cym. tigrinum, Cym. aloifolium,</i>	
22. * QN	Flower longevity on the plant	Short (<20 days)	1	<i>Cym. ensifolium</i>	VG
		Medium (20-40 days)	3	<i>Cym. erythraeum, Cym. devonianum, Cym. elegans, Cym. mastersii, Cym. pendulum, Cym tigrinum, Cym. tracyanum</i>	
		Long (> 40 days)	5	<i>Cym. hookerianum, Cym. lowianum, Cym. aloifolium,</i>	
23. PQ (b)	Flower orientation on inflorescence	Facing one side	1		VG
		Facing all directions	3	<i>Cym. devonianum, Cym. pendulum</i>	
24. QL (b)	Flower predominant colour	White	1	<i>Cym. mastersii, Cym. affine</i>	VG
		Pink	2		
		Yellow	3	<i>Cym. tracyanum, Cym. lowianum, Cym. elegans</i>	
		Green	4	<i>Cym. lowianum, Cym. hookerianum</i>	
		Red	5	<i>Cym. pendulum, Cym. iridioides</i>	
		Brown	6		
		Maroon	7		
25. QN (c)	Dorsal sepal size (length x breadth)	Small (<4cm x <1.5cm)	3	<i>Cym. pendulum, Cym. devonianum, Cym. aloifolium, Cym. tigrinum, Cym. dayanum</i>	MG

		Medium (4cm-8cm) x (1.5-3.0cm)	5	<i>Cym. lowianum, Cym. irridoides, Cym. erythraeum, Cym. hookerianum</i>	
		Large (>8cm x >3.0cm)	7		
26. (+) PQ (c)	Dorsal sepal shape	Linear	1	<i>Cym. pendulum, Cym. aloifolium,</i>	VG
		Oblong	3	<i>Cym. hookerianum, Cym. tigrinum</i>	
		Elliptic	5	<i>Cym. devonianum</i>	
		Obovate	7	<i>Cym. lowianum, Cym. gammiaeum, Cym. erythraeum,</i>	
27. (+) PQ (c)	Dorsal sepal curvature	Incurved with deflex apex	1	<i>Cym. gammiaeum, Cym. elegans, Cym. pendulum, Cym. tigrinum</i>	VG
		Incurved without deflex apex	3	<i>Cym. lowianum</i>	
		Straight	5		
		Deflexed	7	<i>Cym. dayanum, Cym. aloifolium, Cym. devonianum, Cym. iridoides</i>	
28. (+) PQ (c)	Dorsal sepal apex	Acute	1	<i>Cym. hookerianum, Cym. devonianum, Cym. tigrinum, Cym. dayanum, Cym. irridoides,</i>	VG
		Obtuse	3	<i>Cym. pendulum, Cym. aloifolium,</i>	
		Truncate	5	<i>Cym. truncata, Cym. pendulum,</i>	
		Emarginate	7		
29. QN (c)	Lateral sepal size (length x breadth)	Small (<4cm x <1.5cm)	3	<i>Cym. pendulum, Cym. devonianum, Cym. aloifolium, Cym. tigrinum, Cym. dayanum, Cym. elegans,</i>	MG
		Medium (4cm-8cm) x (1.5-3.0cm)	5	<i>Cym. lowianum, Cym. erythraeum,</i>	
		Large (>8cm x >3.0cm)	7		
30. (+) PQ (c)	Lateral sepal shape	Linear	1	<i>Cym. pendulum, Cym. aloifolium, Cym. tigrinum</i>	VG
		Oblong	3		
		Elliptic	5		
		Obovate	7	<i>Cym. erythraeum, Cym. concerto, Cym. gammiaeum,</i>	
31. (+) PQ (c)	Lateral sepal curvature	Incurved with straight apex	1	<i>Cym. elegans,</i>	VG
		Incurved	3	<i>Cym. devonianum, Cym. lowianum,</i>	

		without deflex apex			
		Straight	5	<i>Cym. pendulum</i> ,	
		Deflexed	7	<i>Cym. tigrinum</i> , <i>Cym. aloifolium</i> , <i>Cym. devonianum</i>	
32. (+) PQ (c)	Lateral sepal apex	Acute	1	<i>Cym. lowianum</i> ,	VG
		Obtuse	3	<i>Cym. tigrinum</i> , <i>Cym. aloifolium</i> , <i>Cym. devonianum</i> ,	
		Truncate	5	<i>Cym. pendulum</i>	
		Emarginate	7		
33. QL (d)	Colour ornamentation in sepals	Absent	1		VG
		Uniform	2	<i>Cym. hookerianum</i> , <i>Cym. tigrinum</i> , <i>Cym. lancifolium</i> , (Green), <i>Cym. eburneum</i> (White), <i>Cym. aloifolium</i> (Yellow), <i>Cym. erythreaum</i> (Green)	
		Spotted	3		
		Blotch	4		
		Streak/striped	5	<i>Cym. erythreaum</i> , <i>Cym. tracyanum</i> , <i>Cym. irridoides</i> , (Red brown), <i>Cym. pendulum</i> (Red), <i>Cym. devonianum</i> , <i>Cym. pendulum</i> ,(Purple)	
		Mottled	6	<i>Cym. devonianum</i> (Pale yellow to green with purplish brown)	
Colour of ornamentation as per RHS colour chart					
34. QN (c)	Petal size (length x breadth)	Small (<4cm x <1.5cm)	3	<i>Cym. pendulum</i> , <i>Cym. devonianum</i> , <i>Cym. aloifolium</i> , <i>Cym. dayanum</i> , <i>Cym. elegans</i> , <i>Cym. lancifolium</i> , <i>Cym. tigrinum</i>	MG
		Medium(4 cm-8cm) x (1.5-3.0cm)	5	<i>Cym. lowianum</i> , <i>Cym. eburneum</i> ,	
		Large (>8cm x >3.0cm)	7		
35. * PQ (c)	Petal shape	Linear	1	<i>Cym. pendulum</i> , <i>Cym. dayanum</i> , <i>Cym. concerto</i> , <i>Cym. irridoides</i> ,	VG
		Oblong	3	<i>Cym. hookerianum</i> , <i>Cym. erythreaum</i> , <i>Cym. aloifolium</i> , <i>Cym. tigrinum</i>	
		Elliptic	5	<i>Cym. lancifolium</i> , <i>Cym. devonianum</i> , <i>Cym. gammieanum</i> ,	
		Lanceolate	7	<i>Cym. lowianum</i> ,	
		Obovate	9	<i>Cym. hookerianum</i> ,	
36. (+) PQ	Petal curvature	Incurved with deflex	1		VG

(c)		apex			
		Incurved with straight Apex	3	<i>Cym. dayanum</i> ,	
		Straight	5	<i>Cym. pendulum</i> , <i>Cym. elegans</i> ,	
		Deflexed	7	<i>Cym. devonianum</i> , <i>Cym. lowianum</i>	
		Deflexed with incurved apex	9		
37. (+) PQ (c)	Petal apex	Acute	1	<i>Cym. lancifolium</i> , <i>Cym. lowianum</i> , <i>Cym. tigrinum</i> , <i>Cym. dayanum</i> , <i>Cym. erythreum</i> , <i>Cym. irridoides</i> ,	VG
		Obtuse	3	<i>Cym. pendulum</i> , <i>Cym. aloifolium</i> , <i>Cym. elegans</i>	
		Truncate	5	<i>Cym. devonianum</i>	
		Emarginate	7		
38. (+) PQ (c)	Petal margin	Entire	1	<i>Cym. pendulum</i> , <i>Cym. tigrinum</i> , <i>Cym. dayanum</i> ,	VG
		Slightly undulated /wavy	3	<i>Cym. lowianum</i> , <i>Cym. devonianum</i> , <i>Cym. gammieanum</i>	
		Strongly undulated / wavy	5		
39. QL (d)	Inside petal colour	Base	1	<i>Cym. pendulum</i> , <i>Cym. devonianum</i> (Red Purple)	VG
		Margin	3	<i>Cym. elegans</i> , <i>Cym. gammieanum</i> , <i>Cym. iridoides</i> , <i>Cym. pendulum</i> (Yellow), <i>Cym. erythraeum</i> , (White), <i>Cym. devonianum</i> , (Yellow green)	
		Apex	5	<i>Cym. pendulum</i> , <i>Cym. devonianum</i> , (red purple)	
40. QL (d)	Outside petal colour	Base	1	<i>Cym. pendulum</i> , <i>Cym. devonianum</i> , (red purple),	VG
		Margin	3	<i>Cym. devonianum</i> (Yellow green), <i>Cym. pendulum</i> (purple)	
		Apex	5	<i>Cym. pendulum</i> , <i>Cym. devonianum</i> , (Red purple),	
41. QL (d)	Inside petal ornamentation	Absent	1		VG
		Spotted	3		
		Blotch	5		
		Streaked/ Striped	7	<i>Cym. devonianum</i> (purple), <i>Cym. pendulum</i> (red purple)	
42. QL (d)	Outside petal ornamentation	Absent	1		VG
		Spotted	3		
		Blotch	5		

		Streaked/ Striped	7	<i>Cym. pendulum</i> <i>Cym. devonianum</i> (red purple),	
Colour of ornamentation as per RHS colour chart					
43. QN (c)	Lip length (Spread out)	Small (< 3cm)	3	<i>Cym. devonianum</i> , <i>Cym. aloifolium</i> , <i>Cym. pendulum</i> , <i>Cym. dayanum</i> , <i>Cym. tigrinum</i>	MG
		Medium (3cm-5cm)	5	<i>Cym. lowianum</i>	
		Large (>5cm)	7		
44. QN (c)	Lip width	Small (<3cm)	3	<i>Cym. pendulum</i> , <i>Cym. aloifolium</i> , <i>Cym. devonianum</i> , <i>Cym. tigrinum</i> , <i>Cym. dayanum</i>	MG
		Medium (3cm-5cm)	5	<i>Cym. lowianum</i>	
		Large (>5cm)	7		
45. * (+) PQ (c)	Lip shape (Spread out)	Ovate	1	<i>Cym. iridioides</i>	VG
		Oblong-lanceolate	2		
		Sub-orbicular	3		
		Circular	4		
		Obovate	5	<i>Cym. eburneum</i> , <i>Cym. devonianum</i>	
		Others	6	<i>Cym. pendulum</i>	
46. (+) PQ (c)	Lip apex	Acute	1	<i>Cym. devonianum</i> , <i>Cym. iridioides</i> ,	VG
		Obtuse	3	<i>Cym. pendulum</i>	
		Notched	5		
47. (+) PQ (c)	Lip curvature	Straight	1		VS
		Reflexed with straight apex	3	<i>Cym. lowianum</i> , <i>Cym. devonianum</i> , <i>Cym. aloifolium</i> , <i>Cym. pendulum</i> , <i>Cym. dayanum</i> ,	
		Reflexed with curved apex	5	<i>Cym. Pendulum</i> , <i>Cym. iridioides</i> ,	
48. PQ (c)	Lip lobation	Absent	1	<i>Cym. pendulum</i> , <i>Cym. aloifolium</i> , <i>Cym. dayanum</i> , <i>Cym. elegans</i> .	VS
		Present	9	<i>Cym. concerto</i> , <i>Cym. erythraeum</i> , <i>Cym. iridoides</i> , <i>Cym. devonianum</i> , <i>Cym. tigrinum</i> , <i>Cym. hookerianum</i> , <i>Cym. lowianum</i> ,	
49. PQ (c)	Shape of lip lateral lobe	Auricular	1	<i>Cym. devonianum</i> , <i>Cym. pendulum</i> , <i>Cym. tigrinum</i> , <i>Cym. lancifolium</i> ,	VG
		Triangular	3	<i>Cym. hookerianum</i> , <i>Cym. lowianum</i> ,	
50. PQ (c)	Shape of middle lobe	Ovate	1	<i>Cym. hookerianum</i> , <i>Cym. iridioides</i>	VS
		Orbicular	3	<i>Cym. iridioides</i> , <i>Cym. tigrinum</i> ,	
		Triangular	5	<i>Cym. devonianum</i> <i>Cym. pendulum</i> ,	
51.	No of lobes/keels	Absent	1	<i>Cym. devonianum</i>	VS

* QN (c)	per lip	Two	3	<i>Cym. pendulum</i> , <i>Cym. erythraeum</i> , <i>Cym. tigrinum</i> , <i>Cym. lancifolium</i> , <i>Cym. lowianum</i> , <i>Cym. aloifolium</i> , <i>Cym. dayanum</i>	
		Three	5	<i>Cym. eburneum</i>	
		Four	7		
52. PQ (c)	Lip surface texture	Glabrous (Smooth)	1	<i>Cym. devonianum</i> , <i>Cym. pendulum</i>	VS
		Pubescence (Hairy)	9	<i>Cym. erythraeum</i> , <i>Cym. hookerianum</i> , <i>Cym. lowianum</i> , <i>Cym. eburneum</i> ,	
53. (+) QL (d)	Inside lip colour	Base	1	<i>Cym. gammiaeum</i> , <i>Cym. iridioides</i> , <i>Cym. pendulum</i> , <i>Cym. devonianum</i> , (Red Purple), <i>Cym. hookerianum</i> (Yellow),	VG
		Middle	3	<i>Cym. aloifolium</i> , <i>Cym. dayanum</i> , <i>Cym. elegans</i> , (Yellow), <i>Cym. irridioides</i> , <i>Cym. devonianum</i> (Red Purple), <i>Cym. pendulum</i> (grey yellow)	
		Apex	5	<i>Cym. pendulum</i> , <i>Cym. devonianum</i> , (red purple)	
54. QL (d)	Outside lip colour	Base	1	<i>Cym. pendulum</i> (grey yellow) <i>Cym. devonianum</i> (red purple)	VG
		Middle/ Margin	3	<i>Cym. pendulum</i> (grey yellow) <i>Cym. devonianum</i> , (purple)	
		Apex	5	<i>Cym. pendulum</i> , <i>Cym. devonianum</i> , (purple)	
55. QL (d)	Inside lip ornamentation	Absent	1		VG
		Spotted	3	<i>Cym. pendulum</i> (red purple), <i>Cym. hookerianum</i> (red), <i>Cym. tigrinum</i> (brown red), <i>Cym. devonianum</i> (red purple)	
		Blotch	5	<i>Cym. pendulum</i> , <i>Cym. devonianum</i> (red purple)	
		Streaked/ Striped	7		
56. QL (d)	Outside lip ornamentation	Absent	1		VG
		Spotted	3	<i>Cym. pendulum</i> , <i>Cym. devonianum</i> (red purple),	
		Blotch	5	<i>Cym. pendulum</i> , <i>Cym. devonianum</i> (red purple)	
		Streaked/ Striped	7		
Colour of ornamentation as per RHS colour chart					
57. QN (c)	Column length	Short (<2cm)	3	<i>Cym. devonianum</i> , <i>Cym. pendulum</i> , <i>Cym. aloifolium</i> , <i>Cym. dayanum</i>	MS
		Medium (2cm-4cm)	5	<i>Cym. erythraeum</i> , <i>Cym. hookerianum</i> , <i>Cym. lowianum</i> , <i>Cym. tigrinum</i>	
		Long (>4cm)	7		

58. QL (d)	Inside column colour	Base	1	<i>Cym. devonianum</i> (purple), <i>Cym. pendulum</i> (red purple)	VG
		Margin	3	<i>Cym. pendulum</i> , <i>Cym. devonianum</i> (Yellow green)	
		Apex	5	<i>Cym. erythraeum</i> (purple), <i>Cym. pendulum</i> (Red Purple), <i>Cym. devonianum</i> (Yellow green)	
59. QL (e)	Outside column colour	Base	1	<i>Cym. pendulum</i> (Red Purple) <i>Cym. devonianum</i> (Yellow Green),	VG
		Margin	3	<i>Cym. pendulum</i> (Red purple),	
		Apex	5	<i>Cym. pendulum</i> , <i>Cym. devonianum</i> (Red Purple)	
60. QL (e)	Inside column ornamentation	Absent	1		VG
		Spotted	3	<i>Cym. pendulum</i> (Red Purple),	
		Blotch	5	<i>Cym. devonianum</i> (purple), <i>Cym. pendulum</i> (red purple),	
		Streaked /Striped	7		
61. QL (e)	Outside column ornamentation	Absent	1		VG
		Spotted	3	<i>Cym. pendulum</i> , (Red Purple),	
		Blotch	5		
		Streaked/s triped	7	<i>Cym. devonianum</i> (purple)	
Colour of ornamentation as per RHS colour chart					
62. QN (c)	Pedicel length	Short (<4cm)	3	<i>Cym. pendulum</i> , <i>Cym. elegans</i> , <i>Cym. erythraeum</i> , <i>Cym. devonianum</i> , <i>Cym.erythraeum</i> , <i>Cym. hookerianum</i> ,	MS
		Medium (4cm-8cm)	5	<i>Cym. iridioides</i> , <i>Cym. concerto</i> , <i>Cym. lowianum</i> ,	
		Long (>8cm)	7		
63. * PQ	Flowering season	Winter season (Novembe r-January)	1	<i>Cym.elegans</i> , <i>Cym. lowianum</i> , <i>Cym. erythraeum</i> , <i>Cym. iridioides</i> , <i>Cym. tracyanum</i> , <i>Cym. giganteum</i> <i>Cym ensifolium</i>	VG
		Spring season (February-April	3	<i>Cym. hookerianum</i> ,, <i>Cym. eburneum</i> , <i>Cym. pendulum</i> , <i>Cym. devonianum</i> , <i>Cym.lowianum</i> , <i>Cym. tigrinum</i>	
		Summer season (May-July)	5	<i>Cym.devonianum</i> , <i>Cym. eburneum</i> ,	
		Rainy season (August-October)	7	<i>Cym. lancifolium</i> <i>Cym.elegans</i> , <i>Cym. erythraeum</i> , <i>Cym. iridioides</i>	

Explanations for individual characteristics

Characteristic 2: Pseudobulb shape



1

3

5

7

Narrow

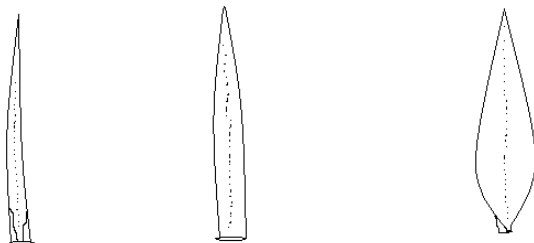
Round

Ovoid

Conical

Cylindrical

Characteristics 6: Leaf shape



1

3

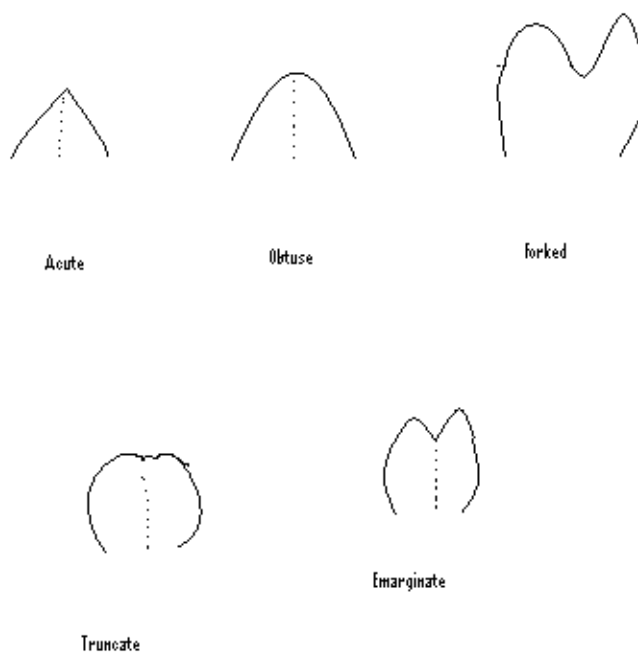
5

Linear

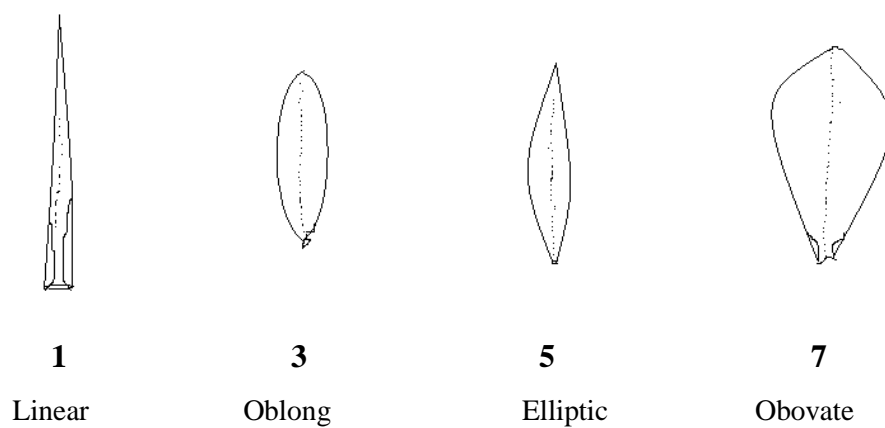
Linear-
oblong

Lanceolate

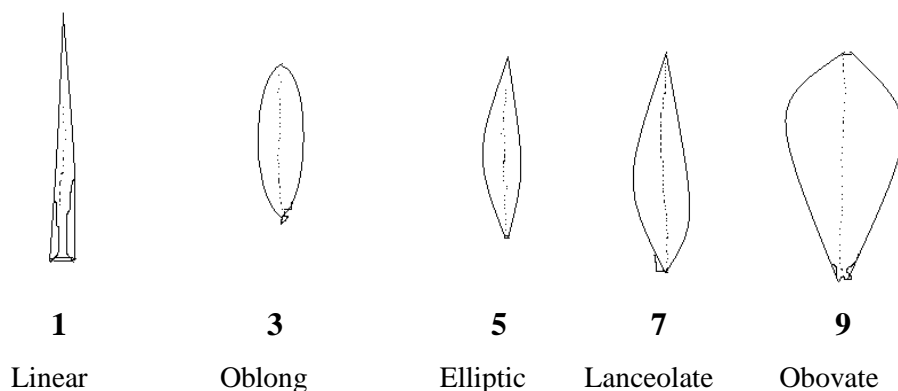
Characteristics 8, 28, 32, 37 & 46: Apexes for leaf, dorsal sepal, lateral sepal, petal and lip



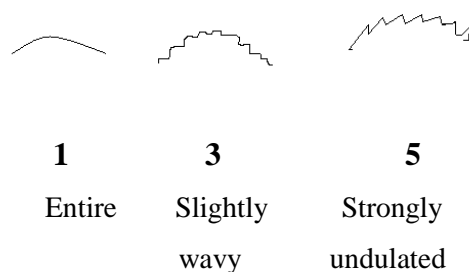
Characteristics 26 & 30 : Dorsal and lateral sepal shape



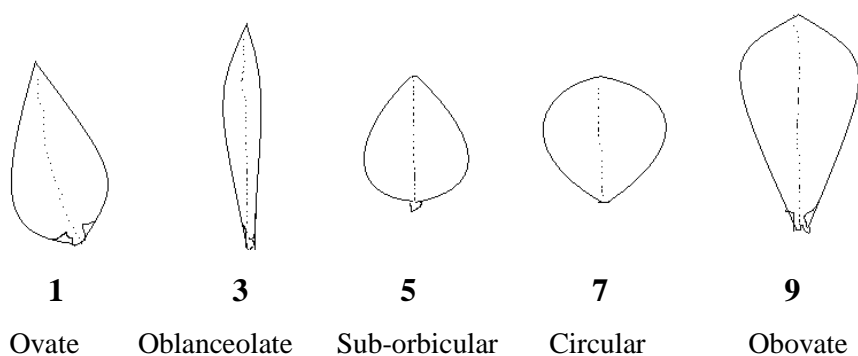
Characteristics 35: Petal shape



Characteristics 38: Petal margin



Characteristics 45: Lip shape



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