



## Studies on 75 (Seventy five) morphological characters in orchids

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### Abstract

Orchids are the most diverse groups of angiosperms consisting of nearly 25,000-30,000 species belonging to 750-800 genera. They are monocot plants and epiphytic, terrestrial and lithophytic in nature. In the present investigation, all vegetatively propagated species and hybrids of commercially grown orchid genera viz. *Cattleya* Lindl., *Cymbidium* Sw., *Dendrobium* Sw., *Mokara* (*Arachnis* X *Ascocentrum* X *Vanda*), *Oncidium* Sw., *Paphiopedilum* Pfitz, *Phalaenopsis* Blume and *Vanda* Jones ex R. Br. And their alliances were used to study 75 morphological characters in orchids. Amongst different morphological descriptors of orchid genera under study, diversity in pseudobulb shape, leaf shape, inflorescence variation, colour pattern, curvatures and other descriptors of reproductive parts were studied in details.

**Keywords:** leaf, pseudobulb, internode, inflorescence, sepal, petal and lip

### Introduction

Orchids are the second largest families of flowering plants [1] and most diverse groups of angiosperms consisting of nearly 25,000-30,000 species belonging to 750-800 genera. The family orchidaceae is divided into five subfamilies (*Apostasioideae*, *Cypripedioideae*, *Vanilloideae*, *Orchidoideae*, *Epidendroideae*). Orchids account for c. 8% of angiosperm species diversity [2]. Till date, 29,199 species have been identified and accepted [3], although several hundred new species are added each year. By the end of 2017, the IUCN Global Red List included assessments for 948 orchid species, of which 56.5% are reported to be threatened [4]. Orchids are monocot plants. They may be epiphytic, terrestrial and lithophytic. About 70% of the worlds orchids are epiphytic and/or lithophytic, 25% are terrestrial and 5% of the worlds orchids grow in mixed substrates (both lithophytic, epiphytic and terrestrial) [5].

In addition to their geographical and taxonomic diversity, orchids are also widely used for a variety of reasons, both legally and illegally, sustainably and unsustainably [6]. One of the best-known plant groups in the global horticultural and cut flower trades [7, 8], orchids are also harvested, grown and traded for a variety of purposes, including as ornamental plants, medicinal products and food. They are rich in polysaccharides, alkaloids, and other chemical components. Besides, orchids are used in medical, food and beverage industries. They have great economic, aesthetic and cultural significance also.

According to Chinese literatures, the orchid is known as one of the "Four Gentlemen among the Flowers" along with the Chinese Plum, Chrysanthemum and Bamboo. Several local species of *Ascocentrum*, *Calanthe*, *Cymbidium*, *Dendrobium*, *Paphiopedilum* and *Vanda*, etc. are in great demand in international market for breeding materials [9]. Keeping in view of the development of economic globalization, scientists and breeders giving emphasis to develop new varieties with novel appearance, improved resistance and quality characteristics.

### Materials and Methods

The experiment was conducted using all vegetatively propagated species and hybrids of commercially grown

orchid genera viz. *Cattleya* Lindl., *Cymbidium* Sw., *Dendrobium* Sw., *Mokara* (*Arachnis* X *Ascocentrum* X *Vanda*), *Oncidium* Sw., *Paphiopedilum* Pfitz, *Phalaenopsis* Blume and *Vanda* Jones ex R. Br. and their alliances of the family Orchidaceae. For all the varieties and species, full grown 20 plants with at least two pseudobulbs/shoot were selected for study. Usually, healthy and insect pest and disease free plants are required for testing for taking morphological observations without any chemical and bio-physical treatment. The experiment was conducted for two similar flowering seasons at two different places under greenhouse conditions ensuring satisfactory growth for the expression of the relevant characteristics of the variety and species. All observations were taken by measuring or counting made on 10 plants or parts taken from each of 10 plants. Normally, growth regulators were not applied. All 75 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.

### 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 [10]. In the present investigation, 8 orchid genera, namely *Cattleya*, *Cymbidium*, *Dendrobium*, *Mokara*, *Oncidium*, *Paphiopedilum*, *Phalaenopsis* and *Vanda* and their alliances were used to study 75 morphological characters.

### Seventy five (75) morphological characters

Orchids are evergreen or deciduous herbaceous perennial. Due to inherent slow growth and reduced photosynthetic capacity some species like *Cypripedium calceolus* has long vegetative period [11]. Orchids are bilaterally symmetric (zygomorphic), many resupinate, one petal (labellum) is always highly modified, stamens and carpels are fused, and the seeds are extremely small.

- 1. Plant height (cm):** It is measured from base to the tip of the flowering shoot. This is small (<15 cm) in *Oncidium* 'Popki Red', *Cattleya* 'Ahmad Sheikh', *Dendrobium* 'Bangkok Blue'; medium (15-30cm) in *Oncidium* 'Sweet Sugar', 'Wildcat Bobcat', 'Wildcat Carmera', *Cattleya* 'Chia Lin New City', 'Purple Cascade Fragrant Beauty', *Dendrobium* 'Erika', 'Julie' and large (>30 cm) in *Oncidium* 'Taka Yellow', and *Dendrobium* 'Airy White', 'Emma White' and 'Big White 4N'.
- 2. Nature of shoot/pseudobulb:** Corms, rhizomes, or tuberoids are common in terrestrial orchids while storage organs in epiphytic orchids are enlarged stems called pseudobulbs. Pseudobulbs are found in *Cattleya*, *Cymbidium* and *Oncidium*. In *Cymbidium sinense* pseudobulbs are able to retain about 64% of their water content after 42 days of water stress conditions [13]. In *Oncidium* 'Goldiana', uptake of nitrate is reported highest during the formation of new pseudobulbs. In addition, it is observed that mineral allocation to pseudobulbs within connected shoots of *Oncidium* 'Goldiana' is most active during formation and development of a new pseudobulb [14]. Pseudobulb photosynthesis in *Oncidium* functions essentially for the refixation of respiratory carbon produced by the underlying massive parenchyma [15]. Enzymes within the tissue of the pseudobulb for carbon fixation are ribulose-1,5bisphosphate carboxylase/oxygenase and

phosphoenolpyruvate carboxylase. In the CAM orchid, *Laelia anceps*, photosynthesis of leaves is largely affected by irradiance of the pseudobulb [16]. Studies on both *Catasetum viridiflavum* [17] and *Oncidium* 'Goldiana' [14] have shown that carbohydrate reserves in orchid pseudobulbs are important in the initiation of new growth. The pseudobulb of *Oncidium* accumulates massive amounts of carbohydrates during vegetative development. These carbohydrate reserves are subsequently remobilised to support new shoot and inflorescence development.

- 3. Internode number:** Orchid pseudobulbs are of two types: heteroblastic or homoblastic. Heteroblastic pseudobulbs consists of only one internode, e.g. *Oncidium* and *Cattleya*. Homoblastic pseudobulbs consist of two or more internodes, e.g. *Dendrobium* [5].
- 4. Internode diameter (cm):** It is measured at widest part of flowering shoot. It is thin (<2cm) in *Dendrobium chrysanthum*, *Den. transparens*, *Den. nobile*, *Den. longicornu*, *Vanda* 'Motes Indigo', 'RBSD Black' and thick (2-4cm) in *Den.* 'Lervia', 'Big White 4N', 'Kating Dang'.
- 5. Pseudobulb size (length x breadth):** This was small (<30 cm<sup>2</sup>) in *Cym. ensifolium*, *Cym. mastersii*, *Cym.* 'September Sunset', *Cattleya* 'Guanmiao City', 'Purple Cascade Fragrant Beauty'; medium (30-60 cm<sup>2</sup>) in *Cym. gammieanum*, *Cym. tracyanum*, *Cym.* 'Sun Gold', *Cattleya* 'Ahmad Sheikh' and large (>60cm<sup>2</sup>) in *Cym.* 'Fire Storm Blaze', 'Valley Legend Steff'.
- 6. Pseudobulb shape:** Pseudobulbs may be cylindrical, clavate, globular in *Cattleya*; narrow cylindrical, round, ovoid, conical in *Cymbidium*; cane woody, cane cylindrical fleshy, cane clavate fleshy, bulbous round in *Dendrobium* and oblong, elliptic, ovate and grooved in *Oncidium* (Table 1).

**Table 1:** Pseudobulb shape in orchids

States	Example species/varieties
Round	<i>Cym. dayanum</i> , <i>Cym. gammieanum</i> , <i>Cym. tigrinum</i> , <i>Cym.</i> 'Lucky Rainbow', <i>Den. aggregatum</i>
Ovoid	<i>Cym. pendulum</i> , <i>Cym. hookerianum</i> , <i>Cym. erythraeum</i> , <i>Cym. tracyanum</i> , <i>Cym. aloifolium</i>
Conical	<i>Cym. elegans</i> , <i>Cym.</i> 'Luna Pink', <i>Cym. mastersii</i>
Cane woody	<i>Den. gibsonii</i> , <i>Den. bensoniae</i> , <i>Den. aphyllum</i> , <i>Den. ruckeri</i> , <i>Den. aduncum</i>
Cane clavate fleshy	<i>Den. primulinum</i> , <i>Den. nobile</i> , <i>Den. parishii</i> , <i>Den. pendulum</i>
Elliptic	<i>Colm. Wild Cat Carmera</i> , <i>Colm. Wildcat Bobcat</i>
Ovate	<i>ONC. Hawai Yellow</i> , <i>ONC. Ramsey Orange</i> , <i>Colm. Wildcat Yellow</i> , <i>ONC. Sweet Sugar</i>

- 7. Number of leaves/shoot or pseudobulb:** Epiphytic orchids are characterized by thick and succulent leaves with thick cell walls, cuticles and small substomatal chamber whereas those of terrestrial species are thin [12]. Usually mature leaves are photosynthetically active. Leaves are sites for reduction of transpiration, water storage organs, retention of rain or condensed water and absorption of water as liquid or vapour. Thick leaves of *Phalaenopsis* have Crassulacean Acid Metabolism (CAM), a very important adaptation to water stress. All thin orchid leaves show C3 photosynthesis. In monopodial orchids, the number of leaves on stem depends on the age of the plant while the orchid like *Paphiopedilum* has 2-6 leaves per flowering shoot, *Cattleya* has one or two leaf per pseudobulb, *Oncidium* has 2-4 leaves, *Cymbidium* and *Dendrobium* have 5-20 leaves per pseudobulb.

- 8. Leaf length (cm):** Leaves were short (<10 cm) in *Den. transparens*, *Den. gibsonii*, *Den. aggregatum*, *Den. aphyllum*; medium (10-20cm) in *Den. thyrsiflorum*, *Den. formosum*, *Den. chrysanthum*, *Den. moschatum*; long (20-30 cm) in Mokara 'Chark Kuan Red', 'Kultana Gold', 'Happy Beauty', *Vanda* 'RBSD Red', *Vanda coerulescens*, *Vanda coerulea* and very long (>30 cm) in *Oncidium*, *Cymbidium* and *Paphiopedilum*.
- 9. Leaf width (cm):** Leaves were narrow (<2cm) in *Den. lonicornu*, *Den. aggregatum*, *Den. cathcartii*, *Den. gibsonii*, *Den. transparens*, *Cym. mastersii*, *Cym. pendulum*, *Cym. gammieanum*; medium (2-4 cm) in *Cym. ensifolium*, *Cym. tracyanum*, *Cym. iridoides*, Mokara 'Happy Beauty', 'Kultana Gold', *Oncidium*, *Vanda* and broad (>4cm) in *Phalaenopsis*, *Den.* Kating Dang, 'Lervia', *Cattleya* 'Ahmad Sheikh', 'Purple Cascade Fragrant Beauty', 'Chia Lin New City'.

- 10. Leaf orientation:** Leaves were erect in *Onc.* ‘Sweet Sugar’, ‘Sharry Baby Sweet Fragrance’, *Vanda teres*, *Vanda* ‘Sansai Blue’, semi-erect in *Onc.* ‘Wildcat Carmera’, ‘Wildcat Bobcat’, horizontal in *Vanda* ‘Berniece Miller’, *Vanda coeruleascens*, *Vanda* ‘RBSD Red’, arching in *Mokara* ‘Kultana Gold’.
- 11. Leaf shape:** Like most monocots, orchids generally have simple leaves with parallel veins, although some Vanilloideae have a reticulate venation. They may be linear, oblong, ovate, lanceolate, or orbiculate and very variable in size (Table 2). Lanceolate is common in

*Dendrobium moschatum*, *Den. densiflorum*, *Den. aphyllum*, *Den. gibsonii*, *Den. bulbosiflorum*, *Den. thyrsiflorum*, *Den. farmeri*; linear in *Cymbidium pendulum*, *Coelogyne graminifolia*, *Eria bamboosifolia*; oblong in *Paphiopedilum*, *Dendrobium nobile*, *Vanda tessellata*, *Renanthera imschootiana*; Elliptic in *Epidendrum* spp., *Cattleya* hybrids; Oblanceolate in *Zygopetalum maculatum*, *Coelogyne nitida*, *Dendrobium aggregatum*, *Oncidium* hybrids, narrow obovate in *Phalaenopsis* and linear-oblong in *Cymbidium* hybrids [22].

**Table 2:** Leaf types in orchids

Characters	Example varieties/ species
Linear	<i>Cymbidium pendulum</i> , <i>Coelogyne graminifolia</i> , <i>Eria bamboosifolia</i>
Linear -oblong	<i>Cym.</i> ‘Soul Hunt’, <i>Cym.</i> ‘Fire Storm’, <i>Cym.</i> Bob Marlin ‘Lucky’, <i>Cym.</i> ‘Winter Beach Sea Green’, <i>Cym.</i> ‘Madrid Forest King’
Lanceolate	<i>Dendrobium moschatum</i> , <i>Den. densiflorum</i> , <i>Den. aphyllum</i> , <i>Den. gibsonii</i> , <i>Den. bulbosiflorum</i> , <i>Den. thyrsiflorum</i> , <i>Den. farmeri</i>
Oblong	<i>Paphiopedilum</i> , <i>Dendrobium nobile</i> , <i>Vanda tessellata</i> , <i>Renanthera imschootiana</i>
Ob-lanceolate	<i>Zygopetalum maculatum</i> , <i>Coelogyne nitida</i> , <i>Dendrobium aggregatum</i>
Elliptic	<i>Epidendrum</i> spp., <i>Cattleya</i> hybrids,
Terete	<i>Vanda teres</i> , <i>V.</i> ‘John Clubb’, <i>V.</i> ‘Miss Joaquim
Channelled	<i>anda sanderiana</i> , <i>Vanda lamellate</i>
Strap	

- 12. Leaf colour:** Leaves were green in *Dendrobium*, *Vanda*, *Mokara*, bicolor in *cattleya*; anthocyanin pigmentation in *Phalaenopsis*; golden yellow in *Cymbidium*, *Oncidium* and variegated in *Paphiopedilum*.
- 13. Leaf margin:** Leaves were found folded in *Mokara*, twisting in *Oncidium* and entire in *Paphiopedilum*, *Dendrobium*, *Phalaenopsis* and *Cattleya*.
- 14. Leaf apex:** Leaf apexes were acute in *Cymbidium*, *Dendrobium*, notched or obtuse in *Phalaenopsis*, retuse or praemorse in *Vanda* and forked in *Paphiopedilum*.

- 15. Inflorescence/ bulb or cane:** Orchids are arranged with flowers on an inflorescence, which is a spike, a raceme or a panicle. Some orchids like *Paphiopedilum* produce single flower. The origin of the inflorescence varies depending upon genera and species. In most of the terrestrial orchids, the inflorescence was terminal while majority of epiphytic orchids produce flowers on lateral inflorescence.
- 16. Inflorescence orientation:** Inflorescence was mostly erect in hybrids, and arching or pendulous mostly in species (Table 3).

**Table 3:** Inflorescence orientation in orchids

States	Exmple species
Erect	<i>Renanthera imschootiana</i> , <i>Vanda coerulea</i> , <i>Vanda tessellata</i>
Arching	<i>Cymbidium erythraeum</i> , <i>Cym. hookerianum</i> , <i>Cym. tracyanum</i> , <i>Dendrobium nobile</i> , <i>D. bensoniae</i>
Drooping/pendulus	<i>Cym. devonianum</i> , <i>Cym. aloifolium</i> , <i>Cym. lowianum</i> , <i>Cym. Elegans</i> , <i>Cym. dayanum</i> , <i>Dendrobium densiflorum</i> , <i>D.thyrsiflorum</i> , <i>Vanda parishii</i>

- 17. Number of flowers/ inflorescence:** It varied depending upon species and varieties. One to six in *Cattleya* hybrids, 6-20 in *Cymbidium* hybrids, 8- 250 in *Oncidium* hybrids, 8-20 in *Dendrobium* hybrids, one to four in *Paphiopedilum* hybrids, 8-12 in *Vanda* hybrids and 8-15 in *Phalaenopsis*.
- 18. Inflorescence branching:** This was absent in *Cymbidium*, *Dendrobium* and *Cattleya* but present in

*Mokara*, *Oncidium*, *Paphiopedilum*, *Phalaenopsis* and *Vanda*.

**19. Inflorescence length (cm):** It was short (<30 cm) in *Cattleya* hybrids, *Cym. eburneum*, *Cym. erythraeum*, *Cym. tigrinum*, Medium (30-60 cm) in *Mokara* hybrids, *Paphiopedilum* hybrids, *Vanda* hybrids and long (>60 cm) in *Cym. lowianum*, *Cym. aloifolium*, *D.* ‘Lervia’, *D.* ‘Big White 4N’, *Onc.* ‘Sharry Baby ‘Sweet Fragrance’, *Onc.* ‘Taka Yellow’ (Table 4).

**Table 4:** Inflorescence length in orchids

States	Example hybrids	States	Example species
Short (<75cm)	<i>Cymbidium</i> ‘Soul Hunt’, <i>Cym.</i> ‘Stanley Fouraker White Magic’, <i>Cym.</i> ‘Yankilla’, <i>Cym.</i> ‘Ammesbury’, <i>Cym.</i> ‘Fire Storm’, <i>Cym.</i> Bob Marlin ‘Lucky’, <i>Cym.</i> ‘W.W. Wondrous’, <i>Cym.</i> ‘Sleeping Nymph’	Short (< 30cm)	<i>Cymbidium devonianum</i> , <i>Cym. eburneum</i> , <i>Cym. erythraeum</i> , <i>Cym. tigrinum</i> ,
Medium (75-90 cm)	<i>Cym.</i> ‘Hawtescens’, <i>Cym.</i> ‘Winter Beach Sea Green’ <i>Cym.</i> Valley Legend Steff	Medium (30-60 cm)	<i>Cym. gammieanum</i> , <i>Cym. elegans</i>
Long (>90cm)	<i>Cym.</i> ‘Red Star’, <i>Den.</i> ‘Lervia’, <i>Den.</i> ‘Big White 4N’, <i>ONC.</i> ‘Sharry Baby ‘Sweet Fragrance’, <i>ONC.</i> ‘Taka Yellow’	Long (> 60cm)	<i>Cym. concerto</i> , <i>Cym. lowianum</i> , <i>Cym. aloifolium</i> , <i>Cym. tracyanum</i>

**20. Inflorescence type:** It was found in solitary in Paphiopedilum, raceme in Dendrobium, Cymbidium,

Vanda and Phalaenopsis hybrids and panicle in *Onc.* 'Taka Yellow', *Onc.* 'Sweet Sugar' (Table 5).

**Table 5:** Inflorescence types in orchids

States	Example species/ hybrids
Solitary	<i>Paphiopedilum venustum</i> , <i>Paph. insigne</i> , <i>Paph. villosum</i> , <i>Paph. spicerianum</i>
Raceme	Dendrobium hybrids, Cymbidium hybrids, Phalaenopsis hybrids
Panicle	<i>Onc.</i> 'Taka Yellow', <i>Onc.</i> 'Sweet Sugar', <i>Onc.</i> 'Sharry Baby Sweet Fragrance'

**21. Peduncle length(cm):** It was recorded short (<15 cm) in *Cattleya*, *Dendrobium* species; medium (15-30cm) in *Mokara*, *Phalaenopsis*, *Paphiopedilum*, *Dendrobium* and long (>30 cm) in *Cymbidium*.

**22. Peduncle thickness (cm):** It was observed thin (<0.5cm) in *Cym. ensifolium*, *Cym. erythraeum*, *Cym. mastersii*, *Phal. manii*, and thick (> 0.5cm) in *Cym. gammieanum*, *Cym. tracyanum*, *Cym. iridoides*, *Cym. 'PCMV'*, *Cym. 'H.C. Aurora'*, *Cym. 'Firestorm Blaze'*, *Cym. 'Winter Beach Sea Green'*, *Cym. 'Ensikhan'*, *Phal. 'Detroit'*.

**23. Peduncle colouration:** In peduncle, anthocyanin colouration was present in *Phalaenopsis*, *Paphiopedilum*, *Oncidium* and *Cymbidium* and absent in *Dendrobium*, *Mokara* and *Vanda*.

**24. Floral bract length (cm):** It was medium (2-4cm) in *Paph. insigne*, *Paph. spicerianum*, *Paph. venustum*, *Paph. 'Y.Y. Twinkling Star'* and long (>4cm) in *Paph. villosum*, *Paph. 'Michael Bertosz'*, *Paph. Michael Koopowitz*.

**25. Floral bract width (cm):** It was narrow (<2 cm) in *Paph. 'Y.Y. Twinkling Star'*, *Paph. venustum*, medium (2-4cm) in *Paph. spicerianum*, *Paph. 'Michael Koopowitz'*, *Paph. 'Michael Bertosz'*.

**26. Floral bract shape:** It was broadly ovate in *Paph. venustum*, *Paph. 'Y.Y. Twinkling Star'*, *Paph. spicerianum*, *Paph. insigne*, *Paph. 'Michael Koopowitz'*; elliptic in *Paph. villosum*.

**27. Floral bract colour pattern:** It was observed mixed in *Paph. spicerianum*, shaded and striped in *Paph. 'Y.Y. Twinkling Star'*, *Paph. 'Michael Koopowitz'*; uniform in *Paph. venustum*, blotched in *Paph. 'Michael Bertosz'* and spotted in *Paph. insigne*.

**28. Floral bract main colour:** It was recorded purple in *Paph. venustum*, green in *Paph. 'Y.Y. Twinkling Star'*, *Paph. spicerianum*, *Paph. villosum*, *Paph. insigne* and greenish white in *Paph. 'Michael Koopowitz'*.

**29. Floral bract no. of colour:** It was noticed two in *Paph. venustum*, *Paph. 'Y.Y. Twinkling Star'*, *Paph. spicerianum*, *Paph. villosum*, *Paph. insigne*, *Paph. 'Michael Bertosz'* and three in *Paph. 'Michael Koopowitz'*.

**30. Flower length (cm):** It was measured from tip of dorsal sepal to tip of lip. Short flower length (<4cm) was found in *Onc.* 'Sweet Sugar', 'Taka Yellow', Sharry Baby Sweet Fragrance', *Den. aggregatum*, *Den. cathcartii*, *Den. gibsonii*, *Den. chrysanthum*; medium (4-8cm) in *Den. 'Madam Pink'*, *Madam Pompadour*, 'Emma White', 'A.Abraham', 'Big White 4N', *Phal. 'Casa Blanca'*, 'Shih Hua Long First Love', *Cattleya 'Queen Sirikhit'*, *Mokara 'Chark Kuan Red'*, 'Kultana Gold', 'Jitti Orange', 'Happy Beauty', *Cym. 'September Sunset'*, *Cym. ensifolium* and long (>8cm) in *Cym. 'Fire Storm Blaze'*, *Cattleya 'Ahmad Sheikhi'*,

'Chia Lin New City', 'Hsinying Catherine', *Den. 'Airy White'*,

**31. Flower width (cm):** It was measured between tips of two petals. It was observed short (<4cm) in *Onc. 'Sweet Sugar'*, 'Taka Yellow', *Den. longicornu*, *Den. aggregatum*, *Den. cathcartii*, *Den. gibsonii*, *Den. transparens*, medium (4-8cm) in *Cym. 'Sun Gold'*, *Den. 'Erika'*, 'Thongchai Gold', 'Lervia', 'Big White 4N', 'A. Abraham', 'Kating Dang', *Phal. 'Manchester'*, 'Shih Hua long First Love' and long (>8cm) in *Cattleya 'Ahmad Sheikhi'*, 'Chia Lin New City', *Cym. 'MT Gold'*, 'HC Aurora', 'Fire Storm Blaze', 'Red Star', 'Valley Legend Steff', *Den. 'Airy White'*, *Den. formosum*, *Phal. 'Detroit'*, 'Hsin Yang Fortune', *Paph. venustum*, *Paph. 'Y.Y. Twinkling Star'*, *Vanda 'Sansai Blue'*, 'RBSD Red'.

**32. Flower longevity on plants:** It was measured from days to flower opening upto days of senescence of last florets. This was observed short (< 15 days) in *Den. devonianum*, *Den. aphyllum*, *Den. fimbriatum*, *Den. densiflorum*, *Den. cathcartii*, *Den. gibsonii*, *Den. moschatum*, *Den. formosum*; medium (15-30 days) in *Cattleya 'Chinese Beauty Orchid Queen'*, 'Purple Cascade Fragrant Beauty', 'Guanmiao City'; *Den. 'Julie'* and long (> 30 days) in *Cymbidium*, *Paphiopedilum* and *Vanda* hybrids.

**33. Flower fragrance:** It was present in *Den. chrysotoxum*, *Den. chrysanthum*, *Cym. 'September Sunset'*, *Cattleya bowringiana*, 'Chia Lin New City', *Onc. Sharry Baby Sweet Fragrance'*.

**34. Flower orientation on inflorescence:** It was found facing in one direction in *Cym. 'Fire Storm Blaze'*, 'Winter Beach Sea Green', *Vanda 'Pure Wax'*, 'RBSD Black', facing in all directions in *Cym. 'H.C. Aurora'*, 'Bob Marlin Lucky', 'Red Star', *Vanda 'Prao Sky Blue'*, 'Pat Delight', 'Sansai Blue', 'Motes Indigo', 'Pakchong Blue'; arrangement of petals were open in *Phal. Shih Hua Long First Love*, 'Memoria Francis Hunter', and touching in *Phal. 'Strawberry'*, 'Dtps. Ox Prince Thunder'.

**35. Flower main colour:** It was recorded green in *Cym. 'Winter Beach Sea Green'*, 'Madrid Forest King'; white in *Cym. 'Saina White'*, *Den. 'Emma White'*, 'Big White 4N', 'Airy White', *Mokara 'Walter Ouame White'*, *Phal. 'Casa Blanca'*, *Cattleya 'Queen Sirikhit'*; yellow in *Cym. 'PCMV'*, 'September Sunset', 'Valley Legend Steff'; *Onc. 'Taka Yellow'*, 'Sweet Sugar', *Den. 'Thongchai Gold'*, *Mokara 'Kultana Gold'*; pink in *Cym. 'Soul Hunt 6'*, Bathurey Pink', Corolta Pink', *Den. 'Madam Pink'*, *Phal. 'Manchester'*; red in *Cym. 'Fire Storm Blaze'*, 'Fire Storm Ruby', *Den. 'Kating Dang'*, *Onc. 'Wild Cat Bobcat'*, 'Sharry Baby Sweet Fragrance'; purple in *Cattleya 'Chia Lin New New City'*, Purple Cascade Fragrant Beauty, *Vanda 'Pat*

- Delight' and blue-violet in *Vanda* 'Pakchong Blue', 'Sansai Blue', 'Motes Indigo'.
- 36. Dorsal sepal length (cm):** It was observed short (<3cm) in *Den.* 'Madam Pompadour', 'Madam Pink', 'Julie', *Phal.* 'Manchester', 'Buenos Aires', 'Strawberry', *Onc.* 'Sweet Sugar', 'Wildcat Carmera', 'Taka Yellow', medium (3-6 cm) in *Phal.* 'Shih Hua Long First Love', 'Detroit', 'Kaleidoscope', *Cym.* 'September Sunset', 'Ensikhan', 'Amesbury', Bertha Peterson', *Den.* 'Airy White', 'Emma White', 'Kating Dang', *Vanda* 'Sansai Blue', 'RBSD Red' and long (>6cm) in *Cattleya* 'Chia Lin New City', 'Ahmad Sheikhi', *Den. formosum*, *Cym.* 'Winter Beach Sea Green', Samurai Hee Haw Sagun' 'Bob Marlin Lucky', 'Soul Hunt 6' and 'Platinum Gold'.
- 37. Dorsal sepal width (cm):** It was found narrow (<3cm) in *Cattleya* 'Queen Sirikhit', 'HsinYing Catherine', 'Purple Cascade Fragrant Beauty', *Cym.* 'Ensikhan', 'Sun Gold', 'Red Star', *Den.* 'Madam Pompadour', 'Madam Pink', 'Julie', 'Emma White', medium (3-6 cm) in *Cattleya* 'Ahmad Sheikhi', 'Chia Lin New City', *Cym.* 'MT Gold', 'PCMV', 'H.C. Aurora', 'Firestorm Blaze', *Paph. spicerianum*, and broad (>6cm) in *Paph.* 'Y.Y. Twinkling Star', *Paph. venustum*, *Paph.* 'Michael Bertosz'.
- 38. Dorsal sepal shape:** It ranges from linear, lanceolate, elliptic, oblong, obovate, ovate, cordate, round to orbicular. Linear was found in *Cymbidium aloifolium*, *Cym.* 'Yankilla', *Onc.* 'Sweet Sugar'; lanceolate in *Cattleya* 'Hsin Ying Catherine', 'Queen Sirikhit', *Onc.* 'Taka Yellow', elliptic in *Cym.* 'MT Gold', 'PCMV', 'Sun Gold', 'H.C. Aurora', 'Fire Storm Blaze', 'Bob Marlin Lucky', *Den.* 'Airy White', 'Emma White', oblong in *Cattleya* 'Ahmad Sheikhi', 'Purple Cascade Fragrant Beauty', 'Chia Lin New City', *Cym.* "Red Star", 'Amesbury', *Den.* 'Madam Pompadour', 'Madam Pink', 'Julie', 'Big White 4N', obovate in *Mokara* 'Happy Beauty', 'Jitti Orange', 'Kultana Gold', Walter Ouame White', 'Chark Kuan Red', ovate in *Phal.* 'Hsin Ying Fortune', "Buenos Aires", *Paph.* 'Michael Koopwitz', cordate in *Paph. venustum*, orbicular in *Paph.* 'Y.Y. Twinkling Star', *Paph. spicerianum*, *Paph.* 'Michael Bertosz' and round in *Vanda* 'Sansai Blue', 'RBSD Red', 'Berniece Miller'.
- 39. Dorsal sepal apex:** This was recorded as acute in *Cattleya* 'Queen Sirikhit', 'Chia Lin New City', 'Purple Cascade Fragrant Beauty', *Cym.* 'September Sunset', notched in 'Ahmad Sheikhi', *Mokara* 'Chark Kuan Orange', obtuse in '*Cym. pendulum*, Samuuri Hee Haw Sagun', 'Amesbury', *Mokara* 'Chark Kuan Red', Kultana Gold', 'Jitti Orange', truncate in *Vanda* 'Roberts Delight Blue'; bilobed in *Vanda* 'Prao Sky Blue', 'Pures Wax', 'RBSD Black', 'Motes Indigo', 'Pakchong Blue', acuminate in *Den. formosum*, 'A. Abraham', *Paph.* 'Michael Koopwitz'.
- 40. Dorsal sepal curvature:** It ranges from incurved, straight, concave, convex to reflexed (Fig.1). Incurved was found in *Cattleya* 'Queen Sirikhit', 'Purple Cascade Fragrant Beauty', 'Chia Lin New City', *Cym.* 'MT Gold', 'PCMV', 'Sun Gold', 'H.C. Aurora', 'Fire Strom Blaze', straight in *Mokara* 'Happy Beauty', 'Jitti Orange', *Onc.* 'Wildcat Bobcat', *Phal.* Chian Xen Magpie', 'Manchester', 'Hsin Yang Fortune', reflexed in *Cattleya* 'Ahmad Sheikhi', *Cym.* 'Ensikhan', *Phal.* 'Taida Salu', weakly concave in *Mokara* 'Chark Kuan Orange', 'Happy Beauty', weakly convex in *Mokara* 'Chark Kuan Red', 'Kultana Gold', strongly convex in *Mokara* 'Walter Ouame White', moderately incurving in *Onc.* 'Wildcat Carmera', moderately recurving in *Onc.* 'Sweet Sugar', 'Taka Yellow', 'Sharry Baby Sweet Fragrance'.
- 41. Dorsal sepal margin:** It was entire in *Phal.* 'Casa Blanca', 'Detroit', 'Shih Hua Long First Love', 'Buenos Aires', 'Hsin Yang Fortune', 'Manchester', *Paph.* 'Michael Koopwitz', *Paph. venustum*, *Paph.* 'Y.Y. Twinkling Star', *Onc.* 'Wildcat Carmera', 'Wildcat Bobcat' and undulate in *Paph. spicerianum*, *Paph.* 'Sheetal-1', *Onc.* 'Sweet Suagar', 'Sharry Baby Sweet Fragrance'.
- 42. Dorsal sepal dominant colour:** Green colour was recorded in *Onc.* 'Sweet Suagar', *Paph. villosum*, *Paph.* 'Michael Bertosz'; white in *Mokara* 'Walter Ouame White', *Phal.* 'Kaleidoscope', 'Miki Wata Nabe', *Den.* 'Big White 4N', 'Emma White'; *Paph. spicerianum*, *Paph. insigne*; yellow in *Onc.* "Wildcat Carmera", 'Taka Yellow', *Cym.* 'September Sunset', *Mokara* 'K.P. Suan x Rasri Gold', Dtps. 'Shih Hua Long First Love', *Den.* 'Thongchai Gold', *Paph.* 'Michael Koopwitz'; pink in *Cym.* 'Corolta Pink', 'Soul Hunt 6'; Red in *Onc.* 'Popki Red', *Mokara* 'Chark Kuan Red', *Den.* 'Kating Dang'; purple in *Onc.* 'Sharry Baby Sweet Fragrance', 'Wildcat Bobcat', *Mokara* 'Happy Beauty', *Phal.* 'Strawberry', *Den.* 'Abraham', 'Bangkok Blue', 'Madam Pink'; Blue in *Vanda* 'Roberts Delight Blue', 'Prao Sky Blue', 'Sansai Blue', 'Pakchong Blue' and violet in *Vanda* 'Pures Wax', 'Motes Indigo'.
- 43. Dorsal sepal colour pattern:** Uniform colour was found in *Cym.* 'LDVB', 'Yankilla', Dtps. 'Hsin Yang Fortune', *Phal.* 'Memoria Francis Hunter', *Den. moschatum*, *Den. formosum*; spotted in *Cym.* 'Soul Hunt', 'Amesbury', 'Winter Beach Sea Green', *Mokara* 'Walter Ouame White', 'Chark Kuan Orange', 'Chark Kuan Red'; blotched in *Onc.* 'Big White', *Vanda* 'Roberts Delight Blue'; streaked and striped in *Cym.* 'Red Star', 'Madrid Forest King', 'Fire Storm', *Den.* 'Erika', 'Thongchai Gold', 'Madam Pink', 'Emma White', *Phal.* 'Kaleidoscope'; netted in *Den.* 'A. Abraham', 'Bangkok Blue', 'Kating Dang', *Mokara* 'Happy Beauty', 'Jitti Orange', *Paph.* 'Michael Bertosz'; shaded in *Onc.* 'Popki Red', 'Sharry Baby Sweet Fragrance', *Phal.* 'Miki Wata Nabe', Dtps. 'Shih Hua Long First Love'; brindled in *Onc.* 'Wildcat Carmera', 'Taka Yellow', edged in *Onc.* 'Wildcat Bobcat', *Phal.* 'Strawberry'; tessellated in *Vanda* 'Prao Sky Blue', 'RBSD Black', 'Pat Delight', 'Sansai Blue', 'Motes Indigo', 'Pakchong Blue' and mixed in Dtps. 'Chian Xen Magpie', *Den.* 'Julie'.
- 44. Dorsal sepal: no. of colours:** Single colour was noticed in Dtps. 'Hsin Yang Fortune', *Phal.* 'Memoria Francis Hunter', *Vanda* 'Pat Delight', 'Pakchong Blue'; double colour in Dtps. 'Plum Rose x Ox Black Jack', 'Shih Hua Long First Love', 'Ox Prince Thunder', *Phal.* 'Strawberry', 'Kaleidoscope', *Vanda* 'Sansai Blue', 'Motes Indigo', *Paph. venustum* and triple or more number of colours in Dtps. 'Chian Xen Magpie', *Paph. spicerianum*, *Paph.* 'Michael Koopwitz', *Paph.* 'Y.Y. Twinkling Star'.

- 45. Lateral sepal length (cm):** This was recorded short (<3cm) in *Onc.* 'J.R. Brown', *sphacelatum*, 'Sweet Sugar', 'Taka Yellow', 'Sharry Baby Sweet Fragrance', *Phal.* 'Strawberry', 'Buesnos Aires', 'Manchester'; medium (3-6cm) in *Cattleya* 'Queen Sirikhit', Mokara 'Happy Beauty', 'Kultana Gold', *Onc.* 'Wildcat Carmera', *Paph.* *villosum*, *insigne*, *spicerianum*, *venustum*, 'Michael Koopwitz', 'Y.Y. Twinkling Star', *Phal.* 'Casa Blanca', 'Detroit', *Vanda* 'Sansai Blue' and long (>6cm) in *Cattleya* 'HsinYing Catherine', 'Ahmad Sheikhi', *Cym.* 'Samuari Hee Haw Sagun', 'Winter Beach Sea Green', 'Soul Hunt-6', 'H.C. Aurora', 'Valley Legend Steff' and *Paph.* 'Michael Koopwitz'.
- 46. Lateral sepal width (cm):** Narrow (<2cm) lateral sepal was studied in *Onc.* 'J.R. Brown', *sphacelatum*, 'Sweet Sugar', 'Taka Yellow', 'Sharry Baby Sweet Fragrance', *Phal.* 'Strawberry', 'Buesnos Aires', 'Manchester', *Cattleya* 'Queen Sirikhit'; medium (2-4cm) in *Paph.* *villosum*, *insigne*, *spicerianum*, *venustum*, 'Michael Koopwitz', 'Y.Y. Twinkling Star', *Phal.* 'Casa Blanca', 'Detroit', *Mokara* 'Happy Beauty', 'Kultana Gold' and broad (>4cm) in *Cym.* 'Samuari Hee Haw Sagun', 'Winter Beach Sea Green', 'Valley Legend Steff, Bob Marlin Lucky', *Vanda* 'Sansai Blue' and 'RBSD Red'.
- 47. Lateral sepal shape:** It ranges from linear, lanceolate, oblong, elliptic, obovate, triangular, ovate, semi-orbicular, orbicular to round. Linear lateral sepal is observed in *Cym.* 'Yankilla'; lanceolate in *Cattleya* 'Chia Lin New City', 'Guanmiao City', *Cym.* 'Red Star', *devonianum*, *Onc.* 'Taka Yellow', 'Sharry Baby Sweet Fragrance'; oblong in *Cattleya* 'Purple Cascade Fragrant Beauty', *Cym.* *ensifolium*, *gammieanum*, *erythraeum*, 'September Sunset', Amesbury'; elliptic in *Cym.* 'Ensikhan', 'MT Gold', 'HC Aurora', 'Fire Storm', 'Valley Legend Steff', 'Bob Marlin Lucky', 'Platinum Gold', 'Soul Hunt 6', 'Saturn Doll', 'Winter Beach Sea Green', *Phal.* 'Detroit', *Den.* 'Airy White'; obovate in *Cym.* 'PCMV' 'Sun Gold', *Den.* 'Kating Dang', 'Ear Sakul', 'Julie', *Mokara* 'Chark Kuan Red', 'Happy Beauty', 'Walter Oumae White', 'Kultana Gold', 'Jitti Orange', *Onc.* 'Sweet Sugar', 'J.R. Brown', *Vanda* *coerulea*, *teres*; triangular in *Den.* 'Madam Pompadour', 'Madam Pink', 'Emma White', 'A. Abraham', 'Big White 4N', 'Lervia'; ovate in Dtps. 'Hsin Yang Fortune', 'Shih Hua Long First Love', *Phal.* 'Casa Blanca', 'Strawberry', 'Manchester', *Onc.* 'Wildcat Carmera'; semi-orbicular in *Paph.* 'Y.Y. Twinkling Star', 'Sheetal-1'; orbicular in *Vanda* 'Prao Sky Blue', 'Motes Indigo', 'Pat-Delight' and round in *Vanda* 'Sansai Blue', 'RBSD Red' and *Vanda* *stangeana*.
- 48. Lateral sepal curvature:** It varies from incurved, straight, deflexed, convex, concave to recurving types (Fig.1). Incurved lateral sepal was noticed in *Cym.* *devonianum*, 'Saturn Doll', 'Platinum Gold', 'Amesbury', 'Bob Marlin Lucky', 'Valley Legend Steff', 'Red Star', 'Fire Storm', 'PCMV', *Vanda* 'Sansai Blue', *Cattleya* 'Chinese Beauty Orchid Queen', 'Queen Sirikhit', straight in *Cym.* 'September Sunset', *pendulum*, 'Samurai Hee Haw Sagun', 'Bertha Peterson', 'Winter Beach Sea Green', *lowianum*, *ensifolium*, *Cattleya* 'Ahmad Sheikhi'; deflexed in *Cattleya* 'Hsin Ying Catherine', 'Chia Lin New City', *Onc.* 'Big White', *Cym.* 'H.C. Arora', 'Ensikhan' and *Vanda* 'Kalsom', 'Berniece Miller', 'RBSD Black'; incurving in *Onc.* 'Wildcat Carmera', 'Popki Red'; recurving in *Onc.* 'Sweet Sugar', 'Sharry Baby Sweet Fragrance', 'Taka Yellow'; weakly convex in *Mokara* 'Kultana Gold', 'Walter Oumae White', 'Chark Kuan Red'; strongly convex in *Mokara* 'K.P. Suan x Rasri Gold'; weakly concave in *Mokara* 'Chark Kuan Orange', and strongly concave in *Mokara* 'Jitti Orange'.
- 49. Lateral sepal apex:** Acute lateral sepal apices were noticed in *Cym.* 'Valley Legend Steff', 'Bob Marlin Lucky', 'Platinum Gold', 'Soul Hunt-6', 'Winter Beach Sea Green', 'Saturn Doll', *devonianum*, 'Ensikhan', 'September Sunset', *Den.* 'Julie', 'Lervia', *Paph.* 'Michael Bertosz', *villosum*; obtuse in *Cym.* 'Amesbury', 'Samurai Hee Haw Sagun', *pendulum*, *aloifolium*, *Mokara* 'K.P. Suan x Rasri Gold', 'Happy Beauty', 'Jitti Orange', 'Kultana Gold', 'Chark Kuan Red', *Paph.* *venustum*, *insigne*, 'Sheetal-1', 'Y.Y. Twinkling Star' and *Vanda* 'Sansai Blue', 'RBSD Red'; truncate in *Vanda* 'Motes Indigo', 'Pakchong Blue', 'Roberts Delight Blue'; notched in *Cattleya* 'Ahmad Sheikhi', 'HsinYing Catherine', *Mokara* 'Walter Oumae White' and acuminate in *Den.* 'A. Abraham', 'Triple Pink', 'Ear Sakul' and *Paph.* 'Michael Koopwitz'.
- 50. Lateral sepal main colour:** Sepal main colour ranges from green to white, yellow, pink, red, purple, blue and violet. Green lateral sepal were present in *Cym.* 'Winter Beach Sea Green', 'Forty Niner', *Den.* 'Dang Saard', *Onc.* 'Sweet Sugar', 'Wild Cat Carmera' and *Paph.* *spicerianum*, 'Y.Y. Twinkling Star', *venustum*, 'Michael Bertosz' and *Cattleya* 'Queen Sirikhit'; white in *Cattleya* 'HsinYing Catherine', *Mokara* 'Walter Oumae White', *Den.* 'Airy White', 'Emma White', *Phal.* 'Kaleidoscope', 'Ox Prince Thunder', 'Miki Wata Nabe'; yellow in *Cattleya* 'Ahmad Sheikhi', *Cym.* 'September Sunset', 'Saturn Doll', 'PCMV', *Onc.* 'Taka Yellow', *Mokara* 'K.P. Suan x Rasri Gold', 'Kultana Gold', Dtps. 'Shih Hua Long First Love', *Paph.* Michael Koopwitz'; pink in *Cym.* 'Rocky Creek Pebbles', 'Soul Hunt-6', 'Samurai Hee Haw Sagun', 'Everett Stockstill Bullai', 'Buthurey Pink'; red in *Cattleya* 'Chinese Beauty Orchid Queen', *Onc.* 'Popki Red', *Mokara* 'Chark Kuan Red', *Den.* 'Kating Dang', *Cym.* 'Red Beauty Evening Star', 'Bob Marlin Lucky', 'Firestorm'; purple in *Cattleya* 'Purple Cascade Fragrant Beauty', *bowringiana*, 'Chia Lin New City', *Onc.* 'Sharry Baby Sweet Fragrance', 'Wildcat Bobcat', *Mokara* 'Happy Beauty', *Den.* 'A. Abraham', 'Madam Pink', 'Triple Pink', 'Ear Sakul', *Phal.* 'Strawberry', blue in *Vanda* 'Roberts Delight Blue', 'Prao Sky Blue', 'Sansai Blue', 'Pakchong Blue' and violet in *Cattleya* 'Guanmiao City', 'Motes Indigo' and 'Pures Wax'.
- 51. Lateral sepal colour pattern:** Uniform colour pattern was recorded in *Cattleya* 'Purple Cascade Fragrant Beauty', 'Chia Lin New City', 'Ahmad Sheikhi', 'Queen Sirikhit', *Cym.* 'September Sunset', *mastersii*, *Onc.* 'Taka yellow'; mixed in 'Dtps. Plum Rose x Ox Black Jack', Dtps. 'Hsin Yang Fortune', 'Shih Hua Long First Love' *Phal.* 'Miki Wata Nabe', 'Strawberry', 'Kaleidoscope'; spotted in *Cattleya* 'Guanmiao City',

- Cym.* ‘Amesbury’, *Mokara* ‘K.P. Suan x Rasri Gold’, ‘Walter Oumae White’, ‘Chark Kuan Orange’, *Vanda* ‘Pures Wax’, ‘RBSD Black’, ‘Pat Delight’; blotched in *Onc.* ‘Big White’, *Vanda* ‘Roberts Delight Blue’; streaked and striped in *Cym.* ‘Ensikhan’, *ensifolium*, *gammieanum*, *tracyanum*, *lowianum*, *irioides*, ‘M.T. Gold’, ‘PCMV’, ‘Sun Gold’, ‘H.C. Aurora’, ‘Firestorm Blaze’, ‘Red Star’, ‘Valley Legend Steff’, ‘Saturn Doll’, *Paph.* *spicereanum*, ‘Y.Y. Twinkling Star’; netted in *Den.* ‘A. Abraham’, ‘Bangkok Blue’, ‘Kating Dang’, ‘Triple Pink’, *Mokara* ‘Happy Beauty’, ‘Jitti orange’; edged in *Onc.* ‘Wildcat Bobcat’; shaded in *Cattleya* ‘Chinese Beauty Orchid Queen’, *Den.* ‘Madam Pink’, ‘Lervia’, *Dtps.* ‘Ox Prince Thunder’; brindled in *Onc.* ‘Sharry Baby Sweet Fragrance’, ‘Wildcat Carmera’ and tessellated in *Vanda* ‘Prao Sky Blue’, ‘RBSD Black’, ‘Pat Delight’, ‘Sansai Blue’, ‘Pakchong Blue’ and ‘Motes Indigo Blue’.
- 52. Petal length:** Short petal length (<3cm) was studied in *Cym.* *aloifolium*, *devonianum*, *pendulum*, *Den.* ‘Julie’, *chrysanthum*, *Onc.* ‘Sharry Baby Sweet Fragrance’, ‘Taka Yellow’; medium (3-6cm) in *Cattleya* ‘Queen Sirikhit’, ‘Guanmiao City’, ‘Purple Cascade Fragrant Beauty’, *Cym.* ‘September Sunset’, ‘Ensikhan’, ‘Bertha Peterson’, ‘Amesbury’, ‘Red Star’, *Den.* ‘Madam Pompadour’, ‘Madam Pink’, ‘Airy White’, ‘Emma White’, ‘Kating Dang’, ‘A. Abraham’, ‘Big White 4N’, ‘Lervia’, ‘Thongchai Gold’, *moschatum*, *Mokara* ‘Happy Beauty’, *Phal.* ‘Detroit’, ‘Casa Blanca’, *Vanda* ‘Sansai Blue’, ‘RBSD Red’ and long in *Cattleya* ‘Chia Lin New City’, ‘Ahmad Sheikhi’, *Cym.* ‘Samurai Hee Haw Sagun’, ‘Winter Beach Sea Green’, ‘Soul Hunt 6’, *lowianum*, ‘Platinum Gold’, ‘Bob Marlin Lucky’ and *Den.* *formosum*.
- 53. Petal width:** Petal width was seen narrow in *Cattleya* ‘Guanmiao City’, ‘Purple Cascade Fragrant Beauty’, *Cym.* ‘September Sunset’, ‘Ensikhan’, ‘Bertha Peterson’, ‘Amesbury’, ‘Red Star’, *aloifolium*, *devonianum*, *pendulum*, *Den.* ‘Julie’, *chrysanthum*, *Onc.* ‘Sharry Baby Sweet Fragrance’, ‘Taka Yellow’; medium (2-4cm) in *Cattleya* ‘Queen Sirikhit’, *Cym.* ‘Samurai Hee Haw Sagun’, ‘Winter Beach Sea Green’, ‘Soul Hunt 6’, ‘Platinum Gold’, ‘Bob Marlin Lucky’, *Den.* ‘Madam Pompadour’, ‘Madam Pink’, ‘A. Abraham’, ‘Big White 4N’, ‘Lervia’, ‘Kating Dang6’, ‘Thongchai Gold’, *moschatum*, *Phal.* ‘Detroit’, ‘Casa Blanca’, *Vanda* ‘Sansai Blue’ and broad (>4cm) in *Cattleya* ‘Chia Lin New City’, ‘HsinYing Catherine’, ‘Ahmad Sheikhi’, *Den.* ‘Airy White’, *formosum* and *Vanda* ‘RBSD Red’.
- 54. Petal curvature:** It varies from incurved, straight, deflexed, incurving, recurving to convex. Incurved petals were prevalent in *Cym.* ‘September Sunset’, *aloifolium*, ‘Winter Beach Sea Green’, ‘Soul Hunt 6’, ‘Platinum Gold’, ‘Bob Marlin Lucky’, ‘H.C. Aurora’, ‘Sungold’, ‘Pine Clash Moon Venus’, ‘M.T. Gold’, *irioides*, *tracyanum*, *erythraeum*, *gammieanum*, *ensifolium*, *Paph.* ‘Y.Y. Twinkling Star’, *Phal.* ‘Kaleidoscope’, ‘Miki Wata Nabe’; straight in *Cym.* ‘Ensikhan’, ‘Red Beauty’, ‘Hawtescans’, *devonianum*, *pendulum*, *lowianum*, *Onc.* ‘Wildcat Carmera’, ‘Wildcat Bobcat’, ‘Popki Red’, *Mokara* ‘Happy Beauty’, ‘Jitti Orange’, *Paph. venustum*; deflexed in *Cym. mastersii*, ‘Valley Legend Steff’, *Den.* ‘Madam Pompadour’, ‘Madam Pink’, ‘Julie’, ‘Airy White’, ‘Emma White’, ‘Kating Dang’, ‘A. Abraham’, ‘Big White 4N’, ‘Lervia’; incurving in *Onc.* ‘Taka Yellow’, ‘Sharry Baby Sweet Fragrance’; recurving in *Onc.* ‘Wildcat Yellow’, ‘Big White’, ‘Sweet Suagar’, and convex in *Mokara* ‘KP Suan x Rasri Gold’, ‘Kultana Gold’, ‘Walter Oumae White’.
- 55. Petal apex:** Acute apexes were common in *Cym.* ‘September Sunset’, *aloifolium*, ‘Ensikhan’, *devonianum*, ‘Bertha Peterson’, ‘Winter Beach Sea Green’, ‘Soul Hunt 6’, *Den.* ‘Emma White’, ‘Bangkok Blue’, ‘Madam Pink’, *Paph. venustum*, ‘Michael Bertosz’; obtuse in *Cym. pendulum*, ‘Samurai Hee Haw Sagun’, *Den.* ‘Big White 4N’, ‘Julie’, *Mokara* ‘KP Suan x Rasri Gold’, ‘Jitti oRange’, *Paph.* ‘Y.Y. Twinkling Star’, *insigne*, *villosum*; praemorse in *Cym.* ‘Stanley Fourraker White Magic’; bilobed in *Vanda* ‘Pures Wax’, ‘Roberts Delight Blue’, ‘Pat Delight’, ‘Sansai Blue’; acuminate in *Den.* ‘A. Abraham’, ‘Ear Sakul’, *Paph.* ‘Michael Koopowitz’; notched in *Paph. spicerianum*; retuse in *Den.* ‘Erika’, ‘Lervia’, ‘DangSard’, ‘Big White Jumbo’, *Mokara* ‘Happy Beauty’ and truncate in *Vanda* ‘Motes Indigo Blue’, and ‘Pakchong Blue’.
- 56. Petal shape:** It varies from linear, oblong, elliptic, lanceolate, obovate, oblanceolate, round, spatulate, sub-orbicular, ovate to orbicular. It was found linear in *Cym.* ‘Yankilla’, ‘Red Star’, *tracyanum*, *mastersii*, *erythraeum*, *gammieanum*, *Den. longicornu*’ oblong in *Cym.* ‘Ensikhan’, *pendulum*, ‘PCMV’, *irioides*, *Den. cathcartii*, *Paph. spicerianum*, *insigne*; elliptic in *Cattleya* ‘Purple Cascade Fragrant Beauty’, ‘Guanmiao City’, *Cym.* ‘Amesbury’, ‘Valley Legend Steff’, ‘Firestorm’, *Den. fimbriatum*, *nobile*, *aphyllum*, *Onc.* ‘Sharry Baby Sweet Fragrance’, ‘Wildcat Bobcat’; lanceolate in *Cym.* ‘September Sunset’, ‘Samuari Hee Haw Sagun’, ‘Bertha Peterson’, ‘Winter Beach Sea Green’, *lowianum*, ‘Platinum Gold’, ‘H.C. Aurora’, *ensifolium*, *Paph. venustum*, ‘Michael Koopowitz’, *Vanda cristata*; obovate in *Cym. devonianum*, ‘Saturn Doll’, ‘Soul Hunt 6’, ‘Bob Marlin Lucky’, ‘Sun Gold’, ‘MT Gold’, *Den.* ‘Madam Pink’, ‘Emma White’, ‘Kating Dang’, ‘A. Abraham’, ‘Big White 4N’, ‘Lervia’, ‘Thongchai Gold’, ‘Erika’, *formosum*, *chrysanthum*, *Onc.* ‘Wildcat Carmera’, ‘Popki Red’, ‘Sweet Suagar’, *Mokara* ‘Happy Beauty’, ‘Jitti Orange’, ‘Kultana Gold’; Oblanceolate in *Paph.* ‘Y.Y. Twinkling Star’, ‘Michael Bertosz’, *villosum*, ‘Sheetal-1’; round in *Vanda* ‘Sansai Blue’, ‘RBSD Red’, ‘Bermiece Miller’; spatulate in *Den.* ‘Julie’, ‘Mokara ‘Chark Kuan Red’; sub-orbicular in *Dtps.* ‘Hsin Yang Fortune’, ‘Shih Hua Long First Love’; ovate in *Cattleya* ‘Queen Sirikhit’, ‘Chia Lin New City’, ‘Chinese Beauty Orchid Queen’, *Den. moschatum*, *transparens*, *gibsonii*, *aggregatum*, *densiflorum*, *Phal.* ‘Miki Wata Nabe’, ‘Strawberry’, ‘Kaleidoscope’ and orbicular in *Den.* ‘Madam Pompadour’, ‘Airy White’, *Vanda teres*, ‘Prao Sky Blue’, ‘Motes Indigo Blue’ and ‘Pat Delight’ (Fig.1).

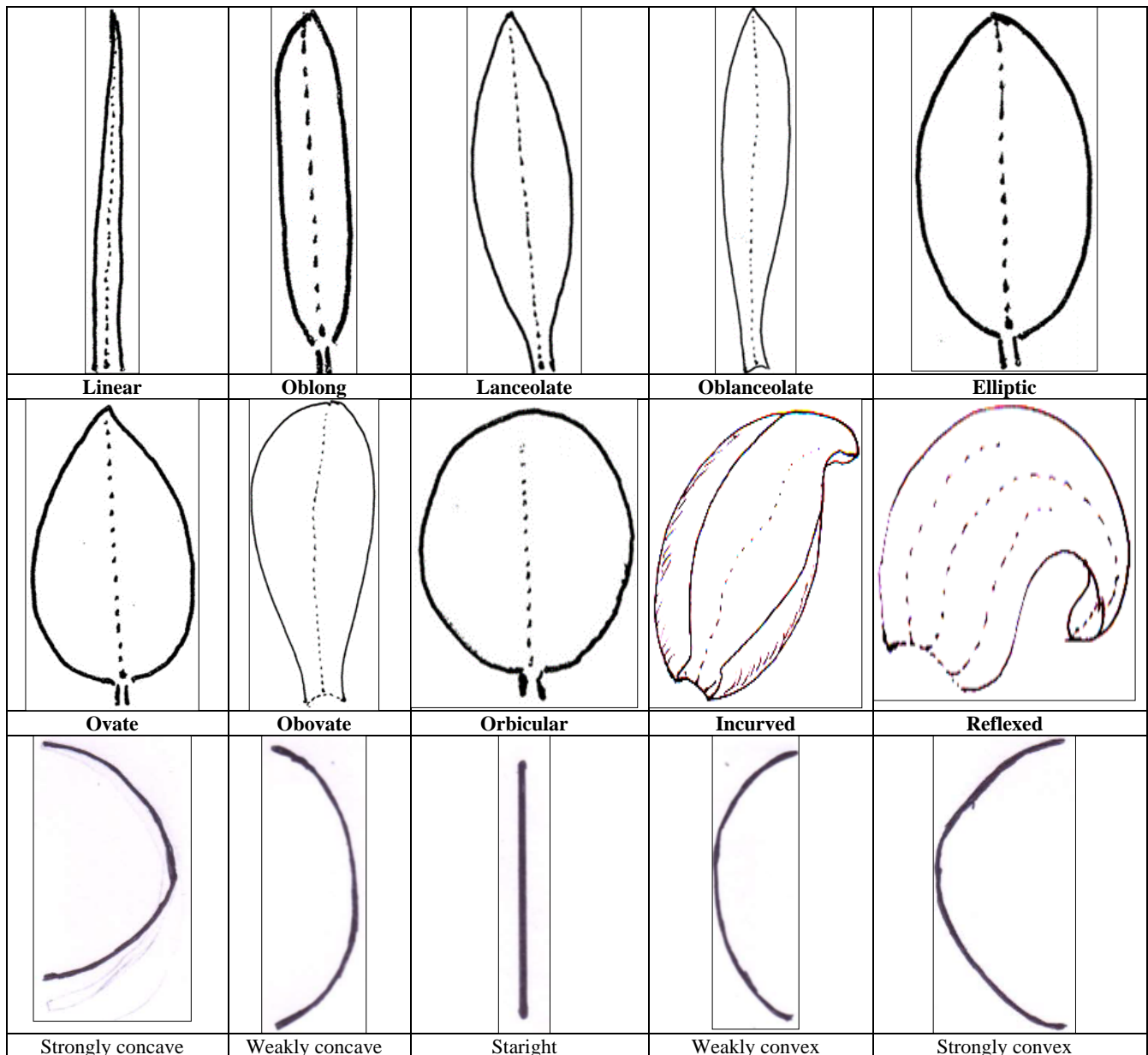


Fig 1: Various shapes and curvatures of sepal and petal in Orchids

**57. Petal margin:** It ranges from entire, undulate, undulate crisped to erose. Entire margin was common in *Cym. gammianum*, *aloifolium*, *devonianum*, *pendulum*, *lowianum*, 'September Sunset', 'Ensikhan', 'Saturn Doll', 'Samuari Hee Haw Sagun', 'Winter Beach Sea Green', 'Soul Hunt 6', 'Platinum Gold', 'Amesbury', *Phal.* 'Kaleidoscope'; undulate in *Cattleya* 'Purple Cascade Fragrant Beauty', *Cym.* 'Red Star', 'Fire Storm', *Onc.* 'Wildcat Carmera', Sharry Baby Sweet Fragrance', *Dtps.* 'Plum Rose x Ox Black Jack', 'Chian Xen Magpie', *Phal.* 'Miki Wata Nabe', *Vanda* 'Pures Wax', 'RBSD Black', 'Pat Delight', 'Motes Indigo Blue', 'Roberts Delight Blue'; undulate crisped in *Cattleya* 'Queen Sirikhit', 'Hsinging Catherine', 'Chinese Beauty Orchid Queen' and erose in *Vanda* 'Prao Sky Blue' and 'Sansai Blue'.

**58. Petal orientation:** It could be of open, touching, horizontal to arching. Open types were prevalent in *Dtps.* 'Plum Rose x Ox Black Jack', 'Hsin Yang Fortune', Shih Hua Long First Love', 'Chian Gen Magpie', *Phal.* 'Miki Wata Nabe'; touching in *Dtps.*

'Ox Prince Thunder', 'Strawberry'; horizontal in *Paph. spicerianum*, *insigne*, *villosum*, *venustum* and arching in *Paph.* 'Y.Y. Twinkling Star', 'Michael Koopowitz', 'Michael Bertosz' and 'Sheetal-1'.

**59. Petal main colour:** It varied from green, white, yellow, pink, red, purple, brown, blue to violet. Green petal was observed in *Den. bulbosorum*, *Den. acinaciformae*, *Paphiopedilum fairrieanum* *Paph. spicerianum*; white in *Den. formosum*, *longicornu*, *amoenum*, *devonianum*, *pendulum*, *aphyllum*, *secundum*, *bensoniae*, *draconis*, *tranparens*, *falconerii*; yellow in *Den. ruckerii*, *jenkensii*, *williamsonii*; pink in *Den.* 'Madam Pink', 'Triple Pink', 'Ear Sakul'; red in *Cym.* 'Fire Storm Blaze', 'Bob Marlin Lucky', 'Red Beauty Evening Star', *Den.* 'Kating Daang'; purple in *Cym. devonianum*, *Den. aduncum*, *nobile*, *parishii*, *primulinum*; brown in *Onc.* 'Sharry Baby Sweet Fragrance', blue in *Den.* 'Thongchai Blue', *Vanda* 'Roberts Delight Blue' and violet in *Den. kingianum*, 'Bangkok Blue', *Vanda* 'Sansai Blue', *Vanda* 'Pakchong Blue'.

- 60. Petal colour (Nos.):** Single colour petals were present in *Cym.* 'September Sunset', 'Sun Gold', *mastersii*, *Den.* 'A. Abraham', 'Big White 4N', 'Kating Dang', 'Madam Pink', *Vanda* 'Pat Delight', 'Sansai Blue', 'Pakching Blue', *Dtps.* 'Hsin Yang Fortune', *Paph. venustum*; double in *Cym. gammieanum, devonianum, pendulum*, 'Amesbury', 'Ensikhan', 'Bertha Peterson', 'Red Star', 'Winter Beach Sea Green', *Den.* 'Kating Dang', 'Julie', Mokara 'Jitti Orange', 'Happy Beauty', 'KP Suan x Rasri Gold', *Phal.* 'Miki Wata Nabe', 'Strawberry', *Vanda* 'Pures Wax', 'Sansai Blue' and more than two in *Dtps.* 'Chian Xen Magpie', *Paph. Micheal Koopowitz*, 'Michael Bertosz', *Vanda* 'Motes Indigo Blue' and 'RBSD Black'.
- 61. Petal colour pattern:** It varied from uniform, mixed, spotted, striped/shaded, netted, edged, brindled to tessellated. Uniform colored petals were recorded in *Onc.* 'Sweet Suagar', *Dtps.* 'Hsin Yang Fortune', *Cattleya* 'Queen Sirikhit', 'Purple Cascade Fragrant Beauty', 'Ahmad Sheikhi', *Cym.* 'September Sunset', *mastersii*, *Den.* 'Big White 4N', 'Emma White', 'Big White Jumbo', *Paph. venustum* (Clone-1); spotted in *Cattleya* 'Guanmaiu City', *Cym.* 'Winter Beach Sea Green', 'Red Star', 'H.C. Aurora', 'Amesbury', 'Samuaro Hee Haw Sagun', *Vanda* 'Pures Wax', 'RBSD Black', 'Pat-D', 'Roberts Delight Blue'; striped and shaded in *Cattleya* 'Chinese Beauty Orchid Queen', *Cym.* 'Firestorm', 'Bob Marlin Lucky', 'Winter Beach Sea Green', 'H.C. Aurora', 'Soul Hunt 6', 'Ensikhan', *ensifolium, gammieanum, lowianum, tracyanum, Den.* 'Thongchai Gold', 'Lervia', 'Madam Pink'; Netted in *Den.* 'Kating Dang', *Dtps.* Chian Xen Magpie, Mokara 'Happy Beauty', 'Jitti Orange'; edged in *Onc.* 'Wildcat Bobcat', *Phal.* 'Strawberry'; blotched in *Onc.* 'Big White', 'Lucky Gold Star'; brindled in *Onc.* 'Wildcat Carmera'; tessellated in *Vanda* 'Prao Sky Blue', 'Sansai Blue', 'Motes Indigo Blue', 'Pakchong Blue' and mixed in *Den.* 'Bangkok Blue', 'Ear Sakul', 'Julie', *Phal.* 'Memoria Francis Hunter', *Dtps.* 'Plum Rose x Ox Black Jack', 'Shih Hua Long First Love' and *Paph.* 'Y.Y. Twinkling Star', 'Michael Bertosz'.
- 62. Lip length:** Short lip length (< 2cm) was studied in *Cym. aloifolium, devonianum, pendulum, Den.* 'Madam Pompadour', *chrysanthum, Onc.* 'Sharry Baby Sweet Fragrance', *sphacelatum, Renanthera imschootiana, Vanda* 'Kalsom', *coerulescens, tessellata*; medium (2-4cm) in *Cattleya* 'Purple Cascade Fragrant Beauty', *Cym. gammieanum, 'September Sunset', 'Bertha Peterson', Den.* 'Madam Pink', 'Airy White', 'Emma White', 'A. Abraham', 'Big White 4N', 'Lervia', 'Erika', 'Thongchai Gold' *moschatum, Onc.* 'Sharry Baby Sweet Fragrance', 'Taka Yellow', 'Wildcat Carmera', 'Sweet Sugar', *Vanda* 'Sansai Blue' and long (>4cm) in *Cattleya* 'Queen Sirikhit', 'Chmad Sheikhi', 'Chia Lin New City', *Cym.* 'Ensikhan', 'Samurai Hee Haw Sagun', 'Saturn Doll', 'Winter Beach Sea Green', 'Soul Hunt 6', *lowianum, 'Platinum Gold', 'Amesbury', 'Bob Marlin Lucky', 'Red Star', Paph. spicerianum, 'Y.Y. Twinkling Star', venustum* (Clone-1), 'Michael Koopowitz' and *Den. formosum*.
- 63. Lip width:** Narrow lip width (<2cm) was noticed in *Cym. aloifolium, devonianum, pendulum, Den.* 'Madam Pink', 'Julie', 'A.Abraham', *chrysanthum, Onc. sphacelatum, Vanda coerulea, 'Sansai Blue', 'Kalsom',*
- 'RBSD Red', *coerulescens, 'Bermiece Miller', tessellata*; medium (2-4 cm) in *Cattleya* 'Purple Cascade Fragrant Beauty', *Cym. gammieanum, lowianum, 'September Sunset', 'Ensikhan, 'Bertha Peterson', 'Amesbury', 'Red Star', Den.* 'Airy White', 'Emma White', 'Big White 4N', 'Lervia', 'Thongchai Gold', 'Erika', *moschatum, Onc.* 'Wildcat Carmera', 'Sweet Sugar', *Paph. spicerianum, 'Y.Y. Twinkling Star', venustum* (Clone-1), 'Michael Koopowitz' and broad (>4cm) in *Cattleya* 'Queen Sirikhit', 'Chia Lin New City', 'Ahmad Sheikhi', *Cym.* 'Samuari Hee Haw Sagun', 'Winter Beach Sea Green', 'Soul Hunt 6', 'Platinum Gold', 'Bob Marlin Lucky', 'Valley Legend Steff' and *Den. formosum*.
- 64. Lip curvature:** It was incurved in *Den. chrysanthum, moschatum, Onc.* 'Taka Yellow', 'Sharry Baby Sweet Fragrance', *Dtps.* 'Shih Hua Long First Love', Plum Rose x Ox Jack Black; straight in *Den.* 'Madam Pompadour', 'Julie', 'Airy White', 'Emma White', 'Kating Dang', 'Thongchai Gold', 'Erika', *'formosum, gibsonii, thrysiflorum, cathcartii, aggregatum, Onc.* 'Wildcat Carmera', 'Wildcat Bobcat', *Vanda* 'Prao Sky Blue', 'Pures Wax', 'PAT D', 'Sansai Blue', 'Pakchong Blue', 'Roberts Delight Blue' and reflexed in *Cym. gammieanum, aloifolium, devonianum, lowianum, pendulum, 'September Sunset', 'Ensikhan', Samuaro Hee Haw Sagun', 'Bertha Peterson', 'Soul Hunt-6', 'Platinum Gold', 'Amesbury', 'Bob Marlin Lucky', 'Valley Legend Steff'.*
- 65. Lip shape (Apical lobe):** It differed from lanceolate, ovate, obovate, orbicular, elliptic, deltoid, obdeltoid, rhombic, pitchers, oblong, bowl to semi-circular. Lanceolate lip shape of apical lobe was common in *Vanda* 'Prao Sky Blue', 'Pures Wax', 'Sansai Blue', 'Motes Indigo', 'Roberts Delight Blue'; ovate in *Cym. erythraeum, gammieanum, irioides, mastersii, lowianum, tracyanum, ensifolium, 'MT Gold', 'H.C. Aurora', 'Firestorm Blaze', 'Red Star', September Sunset', 'Samuari Hee Haw Sagun', Onc.* Sweet Suagar', 'Taka Yellow' sphacelatum; obovate in *Cym.* 'Ensikhan'; orbicular in *Cym.* 'PCMV', 'Sun Gold', 'Valley Legend Steff', 'Bob Marlin Lucky', 'Winter Beach Sea Green', 'Saturn Doll', 'Bertha Peterson', 'RBSD Red'; elliptic in *Dtps.* 'Hsin Yang Fortune', *Phal.* 'Carlotta'; deltoid in *Phal.* 'Leodora'; obdeltoid in *Phal.* 'Memoria Francis Hunter'; rhombic in *Dtps.* 'Plum Rose x Ox Black Jack', 'Shia Hua Long First Love', 'Chian Xen Magpie', *Phal.* 'Kaleidoscope', 'Strawberry'; pitchers in *Paph. insigne, villosum, venustum, spicerianum, fairreanum, 'Michael Koopowitz', 'Y.Y. Twinkling Star', 'Michael Bertosz'; oblong in Cattleya 'Hsinging Catherine', 'Ahmad Sheikhi', 'Chinese Beauty Orchid Queen'; bowl in Paph. concolor and semi-circular in Onc. 'Sweet Sugar', 'Wildcat Bobcat'.*
- 66. Lip margin:** It was found shallow in *Onc.* 'Wildcat Carmera', 'Wildcat Bobcat'; medium in *Onc.* 'Taka Yellow', 'Sweet Sugar', deep in *Onc.* 'Sharry Baby Sweet Fragrance', 'Popki Red'; entire in *Den.* 'Madam Pompadour', 'Madam Pink', 'Julie', 'Airy White', 'Emma White', 'Lervia', 'Thongchai Gold', 'cathcartii', 'Amar'; undulate in *Cattleya* 'Purple Cascade Fragrant Beauty', *Den. aphyllum, aggregatum, formosum, nobile, transparent, 'Erika', 'Kating Dang';*

- undulate-criped in *Cattleya* 'Hsinging Catherine', 'Ahmad Sheikhi', 'Chinese Beauty Orchid Queen', 'Guanmaiu City', 'Queen Sirikhit' and fimbriate in *Den. chrysanthum*, *moschatum*, *gibsonii*, *thyrsiflorum*, *densiflorum*, *fimbriatum*, *farmeri*, *longicornu* and 'Airy White'.
- 67. Lip main colour:** It could be of green, white, yellow, pink, red, brown, purple, blue to violet. Lip colour was green in *Paph. insigne*, *spicerianum*, 'Michael Bertosz'; white in *Den.* 'Airy White' 'Emma White', 'Big White 4N', *formosum*, *longicornu*, *Mokara* 'Walter Oumae White', *Onc.* 'Sharry Baby Sweet Fragrance', *Phal.* 'Miki Wata Nabe'; yellow in *Den.* 'Thongchai Gold', *chrysanthum*, *moschatum*, *thyrsiflorum*, *cathcartii*, *farmerii*, *Mokara* 'KP Suan x Rasri Gold', 'Kultana Gold', *Onc.* 'Taka Yellow', Wildcat Carmera', 'Sweet Sugar', *sphacelatum*, *Paph.* 'Michael Koopowitz'; pink in *Den. transparens*; red in *Cattleya* 'Chinese Beauty Orchid Queen', *Den.* 'Kating Dang', *Dtps.* 'Hsin Yang Fortune', *Onc.* 'Popki Red', brown in *Mokara* 'Chark Kuan Red'; purple in *Den.* 'Pompadour', 'Madam Pink', 'Julie', 'A. Abraham', *Mokara* 'Happy Beauty', 'Jitti Orange', 'Chark Kuan Orange', *Paph.* 'Y.Y. Twinkling Star', *venustum*, *villosum*, *Phal.* 'Kaleidoscope', 'Strawberry'; blue in *Vanda* 'Pakchong Blue', 'Prao Sky Blue' and violet in *Vanda* 'Motes Indigo', 'Pures Wax', *Den.* 'Lervia', 'Erika' and *Cattleya* 'Guanmaiu City'.
- 68. Lip colour pattern:** It ranges from uniform, shaded/striped, edged, streaked/striped, netted, spotted, blotched, brindled to mix. Uniform lip colour was present in *Cym.* 'September Sunset', *Den.* 'Madam Pink', 'Big White 4N', 'Amar', *densiflorum*, *thyrsiflorum*, *Onc.* 'Wildcat Bobcat', *Phal.* 'Strawberry', *Dtps.* 'Plum Rose x Ox Black Jack', *Vanda* 'RBSD Red', 'Kalsom'; shaded and striped in *Cattleya* 'Hsinging Catherine', 'Ahmad Sheikhi', 'Purple Cascade Fragrant Beauty', 'Queen Sirikhit', 'Chia Lin New City', *Cym. mastersii*, *Den.* 'Julie', 'Airy White', 'Emma White', 'Kating Dang', 'A. Abraham', *Phal.* 'Kaleidoscope', *Dtps.* 'Shih Hua Long First Love'; edged in *Phal.* 'Timothy Christopher'; streaked and striped in *Cym. aloifolium*, *devonianum*, *gammieanum*, *erythraeanum*, *tracyanum*, 'Rocky Creek Pebbles', *Vanda coerulea*, *coerulescens*, *teres*, *stangeana*, *tessellata*, 'Prao Sky Blue', 'RBSD Black', 'Berniece Miller'; netted in *Den.* 'Madam Pompadour', 'Lervia', 'Erika', *Mokara* 'Chark Kuan Red', *Paph.* 'Michael Bertosz', *Vanda* 'Sansai Blue'; spotted in *Cym. lowianum*, *pendulum*, 'Platinum Gold', 'Sun Gold', 'Levis Duke Bella Vista', 'Winter Beach Sea Green', *Cattleya* 'Guanmaiu City', *Paph.* 'Sheetal-I'; blotched in *Cym.* 'Ensikhan', 'Samurai Hee Haw Sagun', 'Bertha Peterson', 'Soul Hunt 6', 'Amesbury', 'Bob Marlin Lucky', 'Valley Legend Steff', 'Red Star', 'Firestorm', 'H.C. Aurora', 'PCMV', *Onc.* 'Wildcat Bobcat', *Vanda cristata*; brindled in *Onc.* 'Big White' and mixed in *Den. aggregatum*, *cathcartii*, *fimbriatum*, *gibsonii*, *nobile*, *Paph. insigni*, *villosum*, *spicerianum*, 'Y.Y. Twinkling Star', 'Michael Koopowitz'.
- 69. Pedicel length:** Short pedicel length (<2cm) was measured in *Cym. aloifolium*, *devonianum*, *Onc. Sphacelatum*; medium (2-4cm) in *Cym. gammieanum*, *mastersii*, *erythraeanum*, *ensifolium*, 'Sun Gold', *Onc.* 'Sharry Baby Sweet Fragrance', 'Taka Yellow', Sweet Sugar', 'Wildcat Carmera', *Vanda cristata*, *tessellata*, *Renanthera imschootiana* and long (>4 cm) in *Cattleya* 'Queen Sirikhit', 'Chia Lin New City', *Cym.* 'Ensikhan', *lowianum*, *Paph. spicerianum*, *villosum*, *venustum*, 'Y.Y. Twinkling Star', 'Michael Koopowitz', 'Michael Bertosz', 'Sheetal-1', *Vanda coerulea*, 'Sansai Blue', 'RBSD Red', 'Berniece Miller', 'Motes Indigo', 'Prao Sky Blue'.
- 70. Column size:** Small size column (> 1 cm x < 0.5cm) was observed in *Onc.* 'Sharry Baby Sweet Fragrance', 'Taka Yellow', *sphacelatum*, *Mokara* 'Chark Kuan Red', 'Jitti Orange', 'Walter Oumae White', *Paph. spicerianum*, *venustum*, *insigne*, *villosum*, 'Sheetal-I'; medium (1-2cm x 0.5-1.0 cm) in *Mokara* 'KP Suan x Rasri Gold', 'Happy Beauty', 'Kultana Gold', *Onc.* 'Wildcat Carmera', *Paph.* 'Y.Y. Twinkling Star', 'Michael Koopowitz', 'Michael Bertosz' and large (> 2cm x >1.0 cm) in *Cattleya* 'Queen Sirikhit', 'Ahmad Sheikhi', 'Chinese Beauty Orchid Queen', *Cym.* 'Firestorm', 'Red Star', 'H.C. Aurora', 'Bob Marlin Lucky', 'Winter Beach Sea Green', 'Soul Hunt-6', 'Platinum Gold', 'Valley Legend Steff'.
- 71. Column main colour:** It varied from green, white, yellow, pink, red to purple. Green column was noticed in *Paph. hirsutissimum*, *spicerianum*, *venustum*, *fairreanum*; white in *Den.* 'Emma White', 'Lervia', *Mokara* 'Walter Oumae White', *Onc.* 'Wildcat Carmera', *Phal.* 'Miki Wata Nabe', 'Kaleidoscope', 'Memoria Francis Hunter'; yellow in *Cym.* 'Sun Gold', 'H.C. Aurora', *Mokara* 'Rasri Gold', 'Jitti Orange', 'Kultana Gold', *Onc.* 'Sweet Sugar', 'Taka Yellow'; pink in *Mokara* 'Happy Beauty'; red in *Den.* 'Julie', *Mokara* 'Chark Kuan Red', *Onc.* 'Popki Red' and purple in *Den.* 'A. Abraham', 'Sharry Baby Sweet Fragrance', 'Wildcat Bobcat', *Phal.* 'Strawberry', *Dtps.* 'Plum Rose x Ox Black Jack'.
- 72. Column colour pattern:** Colour pattern was recorded from uniform, spotted, blotched, shaded to streaked and striped. It was prevalent uniform in *Cym. pendulum*, *mastersii*, 'Sun Gold', 'September Sunset', *Den.* 'A. Abraham', 'Airy White', 'Amar', 'Emma White', 'Julie', 'Thongchai Gold', *chrysanthum*, *gibsonii*, *thyrsiflorum*, *densiflorum*, *nobile*, *longicornu*, *Mokara* 'KP Suan x Rasri Gold', 'Kultana Gold', 'Walter Oumae White'; spotted in *Cattleya* 'Guanmaiu City', '*Cym. aloifolium*, *gammieanum*, *lowianum*, *tracyanum*, 'Samuaro Hee Haw Sagun', 'Bertha Peterson', 'Soul Hunt 6', 'Amesbury', 'Bob marlin Lucky', 'Valley Legend Steff', 'Red Star'; blotched in *Cym. devonianum*, 'Winter Beach Sea Green', 'Firestorm Blaze', *Den.* 'Kating Dang', *cathcartii*, *trans parens*; shaded in *Cattleya* 'Ahmad Sheikhi', 'Chia Lin New City', 'Purple Cascade Fragrant Beauty', *Cym.* 'Platinum Gold', *Den.* 'Madam Pompadour', 'Madam Pink', 'Big White 4N', 'Lervia', *farmerii*, *Mokara* 'Happy Beauty' and streaked and striped in *Cym. ensifolium*, *erythraeanum*, 'Ensikhan', *Den.* 'Erika', *aphyllum*, *aggregatum*, *formosum*, *moschatum*, *fimbriatum*.
- 73. Spur type:** These are hollow, tubular or conical or saccate projections formed at the base of the lip which contain nectar rewards for pollinators. Tubular spur was found in *Vanda parviflora*; conical in *Mokara* 'KP Suan

x Rasri Gold', 'Happy Beauty', 'Walter Oumae White', 'Jitti Orange', *Vanda coerulea, tessellata*, 'Prao Sky Blue', 'Pures Wax', 'RBSD Black', 'PAT D', 'Sansai

Blue', 'Motes Indigo', 'Pakchong Blue', 'Roberts Delight Blue' and saccate in *Vanda alpina* (Fig.2).

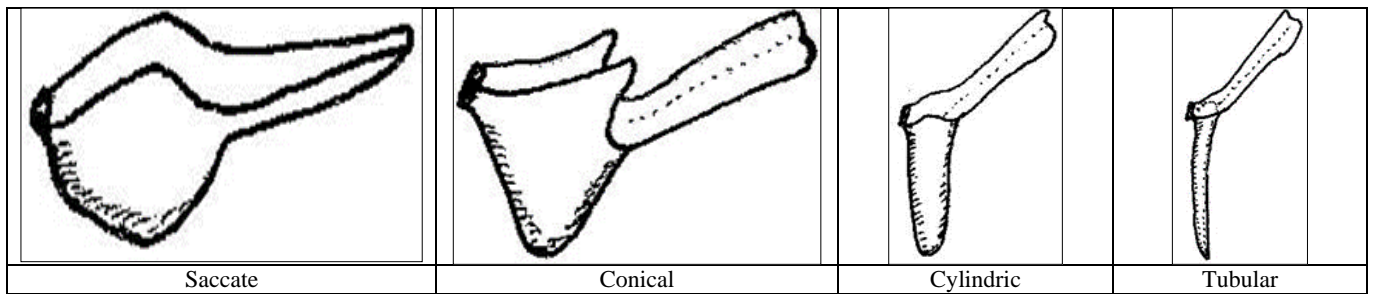


Fig 2: Spur types in orchids

**74. Spur length:** Short spur (<0.5cm) were available in *Den.* 'Julie', 'Kating Dang', 'A. Abraham', *thyrsiflorum, aggregatum, densiflorum, fimbriatum, farmerii, nobile, aphyllum*; medium(0.5-1.0 cm) in *Den.* 'Madam Pompadour', 'Madam Pink', 'Emma White', 'Big White 4N', 'Erika', *chrysanthum, gibsonii, transparens, Vanda* 'Pures Wax', 'RBSD Black', 'PAT D', 'Pakchong Blue', 'Roberts Delight Blue', and long (> 1.0 cm) in *Den.* 'Airy White', 'Lervia', *formosum, moschatum, longicornu, Mokara* 'KP Suan x Rasri Gold', 'Happy Beauty', 'Walter Oumae White', 'Jitti Orange', *Vanda* 'Prao Sky Blue', 'Sansai Blue', 'Motes Indigo'.

**75. No of keels/lip:** These were absent in *Vanda alpina, cristata*; two in *Cym. aloifolium, dayanum, lancifolium, lowianum, pendulum, tessellata*, 'September Sunset', 'Ensikhan', 'Winter Beach Sea Green', 'Soul Hunt 6', 'Platinum Gold', 'Amesbury', 'Bob Marlin Lucky', 'Valley Legend Steff'; three in *Cym. eburneum, Mokara* 'Chark Kuan Red', *Vanda parviflora, stangeana, Prao Sky Blue, 'Sansai Blue', 'RBSD Red* and More Than Three in *Vanda coerulea, Mokara* 'KP Suanx Rasri Gold', 'Chark Kuan Orange', 'Jitti Orange', 'Kultana Gold', 'Walter Oumae White', and 'Bermiece Miller'.

Hundreds of natural inter-generic, inter-specific or intra-specific natural hybrids of *Dendrobium* and *Cymbidium* are found in nature. Most of Indian species of *Cymbidium*, *Dendrobium*, *Paphiopedilum* 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 [18]. In *Cymbidium*, fragrance is the most important character sought after by breeders [19]. Herman [20] reported that the large flowered *Cattleya* hybrids are the results of breeding involving fifteen *Cattleya* species, two *Laelia* and *Brassavola digbyana*. Thomas [21] 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.

### Conclusions and Recommendations

A good morphological study of native species and farmers varieties is required for conservation and utilization of

endangered orchids. Native species can be effectively utilized for development of inter-generic, inter-specific or intra-specific natural hybrids of commercially orchid general like *Cattleya, Cymbidium, Dendrobium, Mokara, Oncidium, Paphiopedilum, Phalaenopsis* and *Vanda* and their compatible alliances which would be market driven having export value, medicinal properties as well as tolerant to biotic and abiotic stresses. Investigations on morphological diversity could open up new ideas for identification of new and elite germplasm for pot culture, cut flowers, dry flowers, herbal preparations and exhibits for market displays.

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