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RESEARCH ARTICLE

Development of Morphological Descriptors of Some Orchid Species

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Abstract

Amongst different morphological descriptors of commercially grown orchid genera, diversity in pseudobulb shape, leaf shape, inflorescence variation, and floral characteristics was studied in detail. Morphological descriptors of 42 orchid species namely *Acampe rigida, Acampe papillosa*, *Aerides rosea, Arachnis labrosa, Arundina graminifolia*, *Ascocentrum ampullaceum, Calanthe masuca, Cattleya maxima,* *Coelogyne elata, Coelogyne flaccida, Coelogyne fuscescens, Coelogyne nitida, Coelogyne ovalis, Coelogyne suaveolens, Coelogyne orchracea, Coelogyne graminifolia, Coelogyne cristata, Coelogyne barbadense, Cleisocentron trichonum, Cottonia peduncularis, Cymbidium cyperifolium, Dendrobium nobile alba, Dendrobium farmerii, Diplomeris hirsuta, Epidendrum radicans, Epidendrum secundatum, Epidendrum xanthium, Eria bambusifolia, Eria coronaria, Eria flava, Eria suaveolens, Gastrochilus bellinis*, *Lycaste cruentus, Lycaste macrophylla Paphilionanthe vandarum, Paphiopedilum spicerianum, Phaius flavus, Phaius wallichii, Phalaenopsis mannii, Renanthera imschootiana, Thunia marshalliana* and *Vanda motesiana* developed which could be useful for identification of unique germplasm for pot plants, medicinal orchids, breeding materials and preparation of value added products.

Keywords: Descriptors, Hybrids, Orchid, Species.

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Introduction

Orchids are the second-largest family of flowering plants (Willis, 2017) and are distributed throughout the world. The family Orchidaceae is divided into five subfamilies (*Apostasioideae, Cypripedioideae, Vanilloideae, Orchidoideae, Epidendroideae*). Orchids account for approximately 8% of angiosperm species diversity (*Chase et al*., 2015). To date, 29,199 species have been identified and accepted (Govaerts *et al*., 2017), 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 (IUCN, 2017). Orchids are monocot plants. They may be epiphytic, terrestrial, and lithophytic. About 70% of the world's orchids are epiphytic and/or lithophytic, 25% are terrestrial, and 5% of the world's orchids grow in mixed substrates (both lithophytic, epiphytic, and terrestrial) (Arditti, 1992). In international trade, among the top ten cut flowers, orchids rank the sixth position and among orchids, Cymbidium ranks first in floricultural crops (De *et al*., 2014).

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 (Fay, 2015). One of the best-known plant groups in the global horticultural and cut flower trades (De, 2015; FloraHolland, 2015), orchids are also harvested, grown, and traded for a variety of purposes, including as ornamental plants, medicinal products, and food. Orchid species are also admired for their unusual growth habits (e.g., leafless orchids, such as species

of *Dendrophylax* Rchb.f. and *Chiloschista* Lindl.), miniature size (e.g., species of *Platystele* Schltr. and *Bulbophyllum moniliforme* F. Muell.), scent (e.g., species of *Cattleya* Lindl. and *Dendrochilum glumaceum* Lindl.), patterned leaves (e.g., jewel orchids in the genera *Anoectochilus* Blume, *Goodyera* R.Br., *Ludisia* A.Rich. and *Macodes* Lindl.) and as cut flowers (*Renanthera imschootiana*, *Vanda coerulea*). Several local species of *Ascocentrum, Calanthe, Cymbidium, Dendrobium, Paphiopedilum,* and *Vanda,* etc., are in great demand in the international market for breeding materials (Kumar *et al*., 2007).

In monopodial orchids, the stem emerges from a single bud, elongates, and produces leaves from the apex each year. The flower stem emerges from the base of the uppermost leaves, e.g., *Phalaenopsis*, *Vanda,* and *Vanilla*. The base of the stem of sympodial epiphytes, or in some species essentially the entire stem, may be thickened to form what is called a pseudobulb that contains nutrients and water for drier periods, e.g., *Cymbidium, Cattleya, Dendrobium, Oncidium* (De, 2020). Epiphytic and most lithophytic orchids have clinging roots for anchorage, absorbing roots that penetrate the humus on bark and the aerial roots hang free in the air and help in the absorption of moisture (De, 2020). Orchids generally have simple leaves with parallel veins, although some Vanilloideae have a reticulate venation. They may be ovate, lanceolate, or orbiculate and very variable in size. Epiphytic orchids are characterized by thick and succulent leaves with thick cell walls, cuticles, and small substomatal chambers, whereas those of terrestrial species are thin (Sailo *et al*., 2014). Orchids are monocotyledonous plants bearing flowers with seven floral parts- three sepals, three petals and the column or gynostemium. The orchid flowers consist of three outermost floral parts- the sepals are similar in appearance. The inner whorl of three segments is called the petals. The two lateral petals are alike and the other one, called the lip or labellum, is highly modified and enlarged. The labellum is the most prominent and distinctive part of the orchid flower. The column or gynostemium is located at the center of the flower and is the unique structure distinguishing the orchids from all other kinds of plants. It is the reproductive part of the flower formed by the union of the male and female organs (De, 2020).

Materials and Methods

The experiment was conducted using all vegetatively propagated plants of 42 orchid species namely *Acampe rigida, Acampe papillosa*, *Aerides rosea, Arachnis labrosa, Arundina graminifolia*, *Ascocentrum ampullaceum, Calanthe masuca, Cattleya maxima, Coelogyne elata, Coelogyne flaccida, Coelogyne fuscescens, Coelogyne nitida, Coelogyne ovalis, Coelogyne suaveolens, Coelogyne orchracea, Coelogyne graminifolia, Coelogyne cristata, Coelogyne barbadense, Cleisocentron trichonum, Cottonia peduncularis, Cymbidium cyperifolium, Dendrobium nobile alba, Dendrobium farmerii, Diplomeris hirsuta, Epidendrum radicans, Epidendrum secundatum, Epidendrum xanthium, Eria bambusifolia, Eria coronaria, Eria flava, Eria suaveolens, Gastrochilus bellinis*, *Lycaste cruentus, Lycaste macrophylla Paphilionanthe vandarum, Paphiopedilum spicerianum, Phaius flavus, Phaius wallichii, Phalaenopsis mannii, Renanthera imschootiana, Thunia marshalliana* and *Vanda motesiana*.

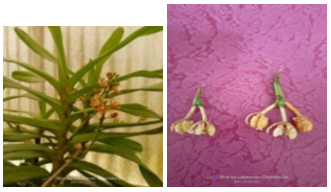
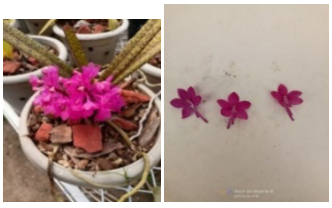
For all the species, full-grown 20 plants with at least two pseudobulbs/shoots were selected for study. Usually, healthy and insect pest and disease-free plants are required for testing, for taking morphological observations without any chemical and bio-physical treatment. The experiment was conducted 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 on 10 plants or parts taken from each of the 10 plants. Normally, growth regulators are not applied. All observations were taken of the shoot on the flowering shoot, of the leaf on the longest leaf of a flowering shoot, of the inflorescence and the flower at the time when 50% of the flowers on the inflorescence have opened and on the most recently fully opened flower on the inflorescence before fading of colour, of the length and width of the flower and parts of the flower in the spread out position, of the colour of sepal, petal, lip and column on the inner side. For the assessment of colour characteristics, the Royal Horticultural Society (RHS) colour chart was used.

Results and Discussion

A unique landrace or farmer variety can be registered if it fulfils essentially the criteria of Distinctiveness, Uniformity, and Stability, which means the candidate variety or species must be distinguishable by at least one essential characteristic from a variety that is sufficiently uniform in its expression of its essential characteristics, which should remain fixed even after repeated propagation. The variety should also have a single and distinct denomination (Henke, 2008). In the present investigation, morphological descriptors of 42 orchid species namely *Acampe rigida, Acampe papillosa*, *Aerides rosea, Arachnis labrosa, Arundina graminifolia*, *Ascocentrum ampullaceum, Calanthe masuca, Cattleya maxima, Coelogyne elata, Coelogyne flaccida, Coelogyne fuscescens, Coelogyne nitida, Coelogyne ovalis, Coelogyne suaveolens, Coelogyne orchracea, Coelogyne graminifolia, Coelogyne cristata, Coelogyne barbadense, Cleisocentron trichonum, Cottonia peduncularis, Cymbidium cyperifolium, Dendrobium nobile alba, Dendrobium farmerii, Diplomeris hirsuta, Epidendrum radicans, Epidendrum secundatum, Epidendrum xanthium, Eria bambusifolia, Eria coronaria, Eria flava, Eria suaveolens, Gastrochilus bellinis*, *Lycaste cruentus, Lycaste macrophylla Paphilionanthe*

vandarum, Paphiopedilum spicerianum, Phaius flavus, Phaius wallichii, Phalaenopsis mannii, Renanthera imschootiana, Thunia marshalliana and *Vanda motesiana* were studied (Table 1).

Table 1: Morphological characteristics of some orchid species

Name of the species	*Characteristics*	*Illustrations*
Acampe rigida	Plants are robust with oblong, rigid horizontal clasping leaves measuring 22.5 to 32 cm length and arranged with 3 to 7 erect and dense inflorescences bearing 20-36 scented flowers. Flowers are yellow, 1-1.3 cm across and last for 15-30 days (Table 2).	
Arachnis labrosa	These are monopodial epiphyte, with leathery strap shaped leaves, 30-60 cm tall bearing branched or simple raceme inflorescence. Inflorescence is 110-115 cm long bearing 57-60 yellow scented flowers (Table 3).	
Ascocentrum ampullaceum	These are dwarf monopodial epiphytes and characterized by large spur hangs from the tip. The plants are small, compact with small strap shaped leaves and short stalked erect and cylindrical covered with many closely spaced flowers. Flowers are 1.3 to 2.2 cm diameter, rose-purple in colour (Table 4).	
Calanthe masuca	An evergreen species with elliptic –ovate to lanceolate leaves. Inflorescence is axillary or terminal, 55-64 cm tall crowded with 14 to 25 small blue violet flowers. Flowers are 3.0 to 3.5 cm long and 5.0 to 5.5 cm width (Table 5).	
Cattleya maxima	The plants possess elongated pseudobulbs and may be of unifoliate or bi-foliate. The leaves are thick and leathery. Plants are 30-35 cm tall arranged with 20cm long inflorescence bearing 2-3 flowers per inflorescence. Flowers are 11.0-11.5 cm long and 9.5-10 cm wide undulate crisped lips and are purple in colour	
Coelogyne barbadense	These are sympodial and ovoid pseudobulbous orchids. The pseudobulbs are topped by 2 to 4 lanceolate leaves, slender in size and arranged along with creeping rhizomes. The leaves are coriaceous, thick and leathery with pronounced stalks. Inflorescences are 70-75 cm long, arching or pendulous bearing white flowers with brown lips (Table 6).	
Cottonia peduncularis	A tropical epiphyte with strap shaped arching leaves and horizontal inflorescence bearing 4 to 6 bee shaped flowers. Flowers are yellow with purple-brown lips (Table 7).	

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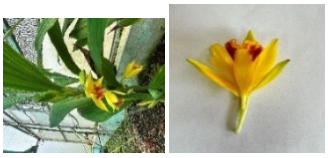
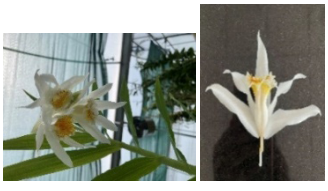
Cymbidium cyperifolium	Plants are arranged with conical pseudobulbs and linear leaves, bearing greenish-yellow flowers with red spotted lips. Sepals and petals are lanceolate. Inflorescence 40-50 cm long bearing 6 to 9 flowers. Flowers are 3.6 to 4.0 cm long and 1.5 to 1.7 cm wide, scented.	
Dendrobium nobile alba	Plants are 35-45 cm tall with clavate fleshy pseudobulbs. The pseudobulbs are arching or erect with caduceus, leathery, glossy green leaves with 5-20 inflorescences. Inflorescence is 1 to 3 flowered, short and arises from the upper nodes of the old leafless pseudobulbs. The flowers are fragrant, long lasting, 6.5 to 7.5 cm in diameter, waxy, and lip with white margin.	
Dendrobium farmerii	Plants are 22-25 cm tall with 4 angled club shaped pseudobulbs and 2-3 lance or elliptic shaped leaves. Inflorescences borne on the cylindric pendulous racemes arise from the apices of the mature new growth. Flowers are 3.5 to 5.0 cm in diameter with white sepals and petals and orange lips.	
Eria cruenta	Plants are 25-35cm tall with conical peudobulb bearing 2 leaves. Leaves are lanceolate shaped, 20-25 cm long. The inflorescence is 25-30 cm tall arranged with 10-15 flowers. Flowers are white, 3-35cm across (Table 8).	
Paphiopedilum spicerianum	Plants are 15-20 cm tall bearing 4-5 leaves. The leaves are broad, linear oblong, dark green with wavy margins and purple on the underside. The inflorescence is 20-30 cm long, purple, slender and erect. The flowers are 7.5-8.0 cm across, glossy and long lasting. The dorsal sepal is broad, pure white and greenish at the base. The petals are deflexed, yellowish green with speckles and a red central line. The lip is bell shaped and crimson brown in colour.	
Phaius flavus	Plants are 45-60 cm tall and arranged with 8-10 lanceolate leaves. Flowers are borne terminally, yellow with a reddish-brown banded lip, scented. Pseudobulbs are conical, topped with 60-70 cm long plicate variegated leaves.	
Phalaenopsis mannii	Plants are small, arranged with 22-28 cm long narrow obovate leathery leaves bearing raceme inflorescence. Flowers are 2.8 3.0 cm in diameter, deep red and dark golden yellow, the white lip is highlighted by yellow throat markings.	
Thunia marshalliana	These are terrestrial sympodial orchids. Plants are 50-60 cm tall having 15-20 fleshy canes 20-25 cm long horizontal lanceolate leaves. Inflorescence is 15-20 cm long bearing 5-10 flowers in one direction. Flowers are borne terminally, pendulous, white, 7-9 cm in diameter.	

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Vanda motesiana	Leaves are strap shaped, 28-30 cm long inflorescence, 35-40 cm long develop from the leaf axils with 5 to 10 flowers. The flowers are 4-6 cm across, greenish yellow, with spotted sepals and petals, and striped or streaked lips.	

Table 2: Morphological descriptors of *Acampe rigida*

S. No.	*Characters*	*Acampe rigida*
1	Internode length	3.0–4.0 cm
2	Stem diameter	1.5–1.7 cm
3	Root location	All along the stem
4	Leaf type	Strap
5	Leaf length	22.5–32.0 cm
6	Leaf breadth	4.3–5.5 cm
7	Leaf shape	Oblong
8	Leaf apex	Acute
9	Leaf orientation	Horizontal
10	Leaf colour	Green
11	Leaf sheath pigmentation	Green
12	No. of inflorescences/year/ plant	03–07
13	Inflorescence length	22.5–25.5 cm
14	Peduncle length	3.0–6.5 cm
15	Inflorescence orientation	Erect
16	Inflorescence nature	Dense
17	No. of flowers/inflorescence	20–36
18	Orientation of flowers	Facing all directions
19	Flower width	1.0–1.3 cm
20	Flower fragrance	Present
21	Flower longevity on the plant	15–30 days
22	Flower predominant colour	Yellow (7-D)
23	Dorsal sepal size (l × b)	1.1–1.4 × 1.2–1.5 cm^2
24	Dorsal sepal shape	Elliptic
25	Dorsal sepal curvature	Incurved
26	Dorsal sepal apex	Obtuse
27	Lateral sepal length (l × b)	1.0–1.2 × 0.6–0.7 cm^2
28	Lateral sepal shape	Elliptic
29	Lateral sepal curvature	Incurved
30	Lateral sepal apex	Obtuse
31	Sepal colour (nos.)	Two
32	Sepal colour pattern	Brindled
33	Petal size (l × b)	1.0–1.1 × 0.4–0.5 cm^2
34	Petal shape	Obovate
35	Petal curvature	Incurved with a straight apex
36	Petal apex	Obtuse
37	Petal margin	Entire
38	Petal colour (nos.)	Two
39	Petal colour pattern	Brindled
40	Lip length	1.0 cm
41	Lip width	0.4–0.6 cm
42	Lip: apical lobe shape	Ovate
43	Lip: lateral lobe shape	Orbicular
44	Lip curvature	Deflexed
45	Lip apex	Obtuse
46	Keels no.	Two
47	Lip surface	Glabrous
48	Lip colour (nos.)	Two
49	Lip colour pattern	Blotched
50	Column length	0.3 cm
51	Column colour pattern	Uniform
52	Pedicel length	1.1–1.5 cm
53	Spur type	Conical
54	Spur length	0.3–0.5 cm

Cont...

Table 3: Morphological descriptors of *Arachnis labrosa*

S. No.	*Characters*	*Arachnis labrosa*
1	Internode length	3.0 cm
2	Stem diameter	1.0 cm
3	Root location	All along stem
4	Leaf type	Strap
5	Leaf length	28.5 cm
6	Leaf breadth	28 cm
7	Leaf apex	Retuse
8	Leaf orientation	Arching
9	Leaf colour	Green
10	Leaf sheath pigmentation	Absent
11	No. of inflorescences/year/plant	05
12	Inflorescence length	114 cm
13	Peduncle length	42 cm
14	Inflorescence orientation	Horizontal
15	Inflorescence nature	Lax

Cont...

S. No.	*Characters*	*Arachnis labrosa*
16	No. of flowers/inflorescence	57
17	Orientation of flowers	Facing all directions
18	Flower width	1.9 cm
19	Flower fragrance	Present
20	Flower longevity on the plant	15–30 days
21	Flower predominant colour	Yellow
22	Dorsal sepal size (l × b)	1.6 × 0.3 cm^2
23	Dorsal sepal shape	Linear
24	Dorsal sepal curvature	Incurved with a straight apex
25	Dorsal sepal apex	Obtuse
26	Lateral sepal length (l × b)	2.0 × 0.3 cm^2
27	Lateral sepal shape	Linear
28	Lateral sepal curvature	Deflexed
29	Lateral sepal apex	Acute
30	Sepal colour (nos.)	Double
31	Sepal colour pattern	Blotched
32	Petal size (l × b)	1.4 × 0.3 cm^2
33	Petal shape	Obovate
34	Petal curvature	Incurved with a straight apex
35	Petal apex	Acute
36	Petal margin	Entire
37	Petal colour (nos.)	Double
38	Petal colour pattern	Blotched
39	Lip length	1.1 cm
40	Lip width	0.3 cm
41	Lip: mid lobe shape	Lanceolate
42	Lip: lateral lobe shape	Orbicular
43	Lip curvature	Straight
44	Lip apex	Obtuse
45	Keels no.	Absent
46	Lip surface	Glabrous
47	Lip colour (nos.)	Two
48	Lip colour pattern	Streaked/ Shaded
49	Column length	0.5 cm
50	Column colour pattern	Uniform
51	Pedicel length	2.3 cm
52	Spur type	Conical
53	Spur length	0.4 cm
54	Flowering season	Rainy

Table 4: Morphological descriptors of *Ascocentrum ampullaceum*

S. No.	*Characters*	*Ascocentrum ampullaceum*
1	Internode length	0.6–0.8 cm
2	Stem diameter	1.5–1.8 cm
3	Root location	Only at stem base
4	Leaf type	Strap
5	Leaf length	12.0–14.0 cm
6	Leaf breadth	2.0–2.2 cm
7	Leaf apex	Praemorse
8	Leaf orientation	Straight
9	Leaf colour	Green
10	Leaf sheath pigmentation	Present
11	No. of inflorescences/year/ plant	03–06
12	Inflorescence length	10.0–11.5 cm
13	Peduncle length	1.5–2.0 cm
14	Inflorescence orientation	Erect
15	Inflorescence nature	Dense
16	No. of flowers/inflorescence	20–26
17	Orientation of flowers	All directions
18	Flower width	1.3–2.2 cm
19	Flower fragrance	Absent
20	Flower longevity on the plant	15–30 days
21	Flower predominant colour	Red purple (72-B)
22	Dorsal sepal size (l × b)	0.9–1.2 × 0.6–0.8 cm^2
23	Dorsal sepal shape	Elliptic
24	Dorsal sepal curvature	Straight
25	Dorsal sepal apex	Acute
26	Lateral sepal length (l × b)	1.0–1.1× 0.6–0.7 cm^2
27	Lateral sepal shape	Elliptic
28	Lateral sepal curvature	Incurved with a straight apex
29	Lateral sepal apex	Acute
30	Sepal colour (nos.)	Single
31	Sepal colour pattern	Uniform
32	Petal size (l × b)	1.1–1.2 × 0.6–0.7 cm^2
33	Petal shape	Elliptic
34	Petal curvature	Incurved with straight apex
35	Petal apex	Obtuse
36	Petal margin	Entire
37	Petal colour (nos.)	Single
38	Petal colour pattern	Uniform
39	Lip length	0.6–0.7 cm
40	Lip width	0.8–0.25 cm
41	Lip: mid lobe shape	Oblong
42	Lip: lateral lobe shape	Lanceolate

Cont...

S. No.	Characters	Ascocentrum ampullaceum
43	Lip curvature	Straight
44	Lip apex	Obtuse
45	Keels no.	Absent
46	Lip surface	Smooth
47	Lip colour (nos.)	Single
48	Lip colour pattern	Uniform
49	Column length	0.2 cm
50	Column colour pattern	Uniform
51	Pedicel length	1.5–1.8 cm
52	Spur type	Tubular
53	Spur length	0.9–1.0 cm
54	Flowering season	Spring

Table 5: Morphological descriptors in *Calanthe masuca*

S. No.	Characters	Calanthe masuca
1	Plant height	32.5–68.5 cm
2	Nature of bulb	Conical
3	Bulb size (l × b)	3.0–3.1 × 2.2–3.0 cm^2
4	No. of leaves	07–08
5	Leaf length	30–47 cm
6	Leaf width	13.5–14.0 cm
7	Leaf apex	Acuminate
8	Leaf shape	Elliptic
9	Inflorescence no./plant	01–02
10	Inflorescence orientation	Erect
11	Inflorescence length	55–64 cm
12	Peduncle length	35–48 cm
13	Peduncle bract	Present
14	Peduncle colour	Green
15	Peduncle diameter	0.5–0.9 cm
16	No. of flowers/inflorescence	14–26
17	Flower length	2.9–3.5 cm
18	Flower width	5.0–5.5 cm
19	Flower bract	Present
20	Flower fragrance	Absent
21	Dorsal sepal length	2.5–4.6 cm
22	Dorsal sepal width	1.0–1.1 cm
23	Dorsal sepal shape	Lanceolate
24	Dorsal sepal apex	Acute
25	Dorsal sepal curvature	Reflexed
26	Lateral sepal length	2.5–3.1 cm
27	Lateral sepal width	1.0–1.1 cm
28	Lateral sepal shape	Lanceolate
29	Lateral sepal apex	Acuminate
30	Lateral sepal curvature	Reflexed
31	Sepal main colour	Purple (84-A)
32	Sepal curvature	Deflexed
33	Petal length	2.0–2.4 cm
34	Petal width	0.8–0.9 cm
35	Petal shape	Elliptic
36	Petal apex	Acute
37	Petal main colour	Purple (84-A)
38	Petal colour no.	Single
39	Petal colour pattern	Shaded
40	Petal curvature	Straight
41	Apical lip length	2.0 cm
42	Apical lip width	1.5–1.7 cm
43	Apical lip shape	Orbicular
44	Apical lip apex	Lobed
45	Lip curvature	Straight
46	Lip lobation	Present
47	Lip main colour	Purple (N81-A)
48	Lip colour no.	Two
49	Lip colour pattern	Shaded
50	Lateral lip length	0.8–1.0 cm
51	Lateral lip width	0.3 cm
52	Lateral lip shape	Lanceolate
53	Lateral lip apex	Obtuse
54	Lip emargination	Shallow
55	Lip callus	Present
56	Lip surface texture	Glabrous
57	Column length	0.3–0.5 cm
58	Column width	0.4–0.5 cm
59	Column main colour	White (153-C)
60	Column colour pattern	Uniform
61	Anther cap colour	White
62	Pedicel ovary length	3.9–4.0 cm
63	Flowering season	Rainy
64	Flower longevity on the plant	15–30 days
65	Spur/mentum length	3.4–4.4 cm

Hundreds of natural inter-generic, inter-specific, or intra-specific natural hybrids of commercially important orchid species are found in nature. Most of the Indian orchid species studied have great potential in breeding programmes, especially in producing primary hybrids due to their inherent attractiveness coupled with their ability to transmit these characteristics to hybrids. In epiphytic orchids, offspring of reciprocal crosses show variations in characteristics like cane length and flower colour, flower size, flowering season, and flower yield (Mc Connel and Kamemoto 1983; De 2020). In some orchid species, fragrance is the most

Table 6: Morphological descriptors of some *Coelogyne* species

S. No.	*Characters*	*Coelogyne barbadense*	*Coelogyne cristata*	*Coelogyne flaccida*
1	Pseudobulb size (l × b)	7.5 × 3.5 cm^2	10.5–12.6 × 1.6–2.0 cm^2	6.8–8.9 × 1.3–2.7 cm^2
2	Pseudobulb shape	Ovoid	Clavate	Conical
3	No. of leaves/pseudobulb	02	02	02
4	Leaf length	47 cm	32.8–40.1 cm	12.7–22.6 cm
5	Leaf width	5.9 cm	4.0–4.7 cm	2.9–3.8 cm
6	Leaf shape	Lanceolate	Lanceolate	Lanceolate
7	Leaf apex	Acute	Acute	Acute
8	Inflorescence no./plant	10	08–09	01–06
9	Inflorescence orientation	Arching	Pendulous	Pendulous
10	Inflorescence length	72 cm	26.5–30.9 cm	21.7–26.8 cm
11	Peduncle length	50 cm	8.5–9.9 cm	4.0–6.5 cm
12	Peduncle bract	-	Present	Present
13	Peduncle colour	-	Greenish brown	Light brown
14	Peduncle diameter	-	0.6–0.7 cm	0.5–0.6 cm
15	No. of flower/ inflorescence	11	08–09	08–11
16	Flower length	6.0 cm	5.9–6.2 cm	3.5–3.8 cm
17	Flower width	8.5 cm	6.3–6.5 cm	3.9–4.0 cm
18	Flower fragrance	Present	Present (mild)	Present
19	Dorsal sepal length	5.0 cm	3.1–3.4 cm	2.0–2.3 cm
20	Dorsal sepal width	1.5 cm	1.0–1.1 cm	0.8–0.9 cm
21	Dorsal sepal shape	Lanceolate	Lanceolate	Lanceolate
22	Dorsal sepal apex	Acute	Acute	Acute
23	Lateral sepal length	4.7	3.3 cm	2.2–2.6 cm
24	Lateral sepal width	1.4	1.0 cm	0.7–0.8 cm
25	Lateral sepal shape	Lanceolate	Lanceolate	Lanceolate
26	Lateral sepal apex	Acute	Acute	Acute
27	Sepal main colour	White (155-C)	White (155-C)	Yellow (11-C)
28	Sepal colour pattern	Uniform	Uniform	Uniform
29	Sepal curvature	Deflexed with straight apex	Incurved with reflexed apex	Incurved with straight apex
30	Petal length	4.6	3.0 cm	2.1–2.3 cm
31	Petal width	0.5	0.7–0.8 cm	0.4 cm
32	Petal shape	Linear	Lanceolate	Narrow lanceolate
33	Petal apex	Acute	Acute	Acute
34	Petal main colour	White (155-C)	White (155-C)	Yellow (11-C)
35	Petal colour pattern	Uniform	Uniform	Uniform
36	Petal curvature	Reflexed	Reflexed	Reflexed
37	Lip length	4.0 cm	2.7–2.8 cm	2.1–2.2 cm
38	Lip width	3.0 cm	2.5–2.6 cm	1.9 cm
39	Lip shape	Orbicular	Ovate	Ovate
40	Lip apex	Obtuse	Acute	Acute
41	Lip curvature	Reflexed	Reflexed	Reflexed
42	Lip lobation	Present	Present	Present
43	Lip margin	Entire	Entire	Entire
44	Lip main colour	White (155-C)	White (155-C)	White (155-C)

Cont...

S. No.	Characters	Coelogyne barbadense	Coelogyne cristata	Coelogyne flaccida
45	Lip colour pattern	Striped/Shaded	Striped/streak	Striped/streak
46	Lip callus/keels	03	03	03
47	Lip no. of colour	Double	Double	Triple
48	Lip surface texture	Pubescent	Glabrous	Glabrous
49	Column length	2.5 cm	2.0–2.1 cm	1.4–1.6 cm
50	Column width	0.7	0.8 cm	0.4–0.6 cm
51	Column main colour	White (155-C)	White (155-C)	White (155-C)
52	Column colour pattern	Uniform	Striped	Striped/streak
53	Anther cap colour	-	White + Brown	Light yellow
54	Pedicel ovary length	1.7 cm	2.7–2.8 cm	1.5–1.9 cm
55	Spur/mentum	Absent	Absent	Absent
56	Flower longevity on plant	15–30 days	15–30 days	15–30 days
57	Flowering season	Autumn (Sept-Oct)	Spring (March)	Spring (March)

Table 7: Morphological descriptors of *Cottonia peduncularis*

S. No.	Characters	Cottonia peduncularis
1	Internode length	0.1–1.2 cm
2	Stem diameter	0.6–0.7 cm
3	Root location	All along stem
4	Leaf type	Strap
5	Leaf length	10.2–10.7 cm
6	Leaf breadth	1.3–1.5 cm
7	Leaf apex	Retuse
8	Leaf orientation	Arching
9	Leaf colour	Green
10	Leaf sheath pigmentation	Absent
11	No. of inflorescences/year/plant	01–02
12	Inflorescence length	16.7–17.5 cm
13	Peduncle length	13.9–14.2 cm
14	Inflorescence orientation	Horizontal
15	Inflorescence nature	Lax
16	No. of flowers/inflorescence	04–06
17	Orientation of flowers	All directions
18	Flower width	1.1–1.4 cm
19	Flower fragrance	Absent
20	Flower longevity on the plant	>30 days
21	Flower predominant colour	Yellow
22	Dorsal sepal size (l × b)	1.1–1.2 × 0.6–0.7 cm
23	Dorsal sepal shape	Obovate
24	Dorsal sepal curvature	Straight
25	Dorsal sepal apex	Obtuse
26	Lateral sepal length (l × b)	1.1 × 0.6–0.7 cm^2
27	Lateral sepal shape	Elliptic
28	Lateral sepal curvature	Incurved with straight apex
29	Lateral sepal apex	Obtuse
30	Sepal colour (nos.)	02
31	Sepal colour pattern	Streak/Striped
32	Petal size (l × b)	1 × 0.4 cm^2
33	Petal shape	Obovate
34	Petal curvature	Incurved with straight apex
35	Petal apex	Obtuse
36	Petal margin	Entire
37	Petal colour (nos.)	02
38	Petal colour pattern	Streak/Striped
39	Lip length	1.4–1.5 cm
40	Lip width	1.1 cm
41	Lip: mid lobe shape	Orbicular
42	Lip: lateral lobe shape	Orbicular
43	Lip curvature	Straight
44	Lip apex	Bilobed
45	Keels no.	01
46	Lip surface	Glabrous
47	Lip colour (nos.)	Two
48	Lip colour pattern	Uniform
49	Column length	0.6 cm
50	Column colour pattern	Blotched
51	Pedicel length	1.6–2.0 cm
52	Spur type	Absent
53	Spur length	-
54	Flowering season	Rainy

Cont...

Table 8: Morphological descriptors of *Eria cruenta*

S. No.	*Characters*	*Eria cruenta*
1	Plant height	31–35 cm
2	Nature of bulb	Conical
3	Number of leaves/shoot	02
4	Leaf length	20–25 cm
5	Leaf width	3.8–5.0 cm
6	Leaf shape	Lanceolate
7	Leaf apex	Acute
8	Inflorescence number/plant	01–02
9	Inflorescence orientation	Arching
10	Inflorescence length	30 cm
11	Peduncle length	5.5 cm
12	Peduncle bract	Present
13	Peduncle colour	Green
14	Peduncle diameter	0.3 cm
15	Flower no./ Inflorescence	10–15
16	Flower length	1.5–3.0 cm
17	Flower width	3.0–3.4 cm
18	Flower fragrance	Present
19	Dorsal sepal length	2.0–2.5 cm
20	Dorsal sepal width	0.4–0.5 cm
21	Dorsal sepal shape	Narrow lanceolate
22	Dorsal sepal apex	Acuminate
23	Lateral sepal length	2.0–2.3 cm
24	Lateral sepal width	0.4–0.5 cm
25	Lateral sepal shape	Narrow lanceolate
26	Lateral sepal apex	Acuminate
27	Sepal main colour	White (155-C)
28	Sepal colour pattern	Spotted
29	Sepal curvature	Straight
30	Petal length	1.7–2.0 cm
31	Petal width	0.4 cm
32	Petal shape	Narrow lanceolate
33	Petal apex	Acuminate
34	Petal main colour	White (155-C)
35	Petal colour pattern	Uniform
36	Petal curvature	Incurved
37	Lip length	1.2–1.3 cm
38	Lip width	0.6–0.7 cm
39	Lip shape	Oblong
40	Lip apex	Acute
41	Lip curvature	Deflexed
42	Lip lobation	Present
43	Lip main colour	White (155-C)
44	Lip colour (nos.)	02
45	Lip colour pattern	Striped/Shaded
46	Lip callus	Present
47	Lip surface texture	Glabrous
48	Column length	0.8 cm
49	Column width	0.3–0.4 cm
50	Column main colour	White (155-C)
51	Column colour pattern	Striped/Shaded
52	Anther cap colour	White
53	Pedicel ovary length	1.0–1.2 cm
54	Flowering season	Rainy
55	Flower longevity	15–30 days
56	Spur/Mentum length	0.5 cm

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important characteristic sought after by breeders (Singh, 1984). Thomas (2001) viewed the requirements for flower forms of commercial orchids as strong, self-supporting, erect inflorescences, long duration of blooms, compact plant size, wide temperature tolerance, disease resistance, firm substances and consistency of colours.

Conclusion

A good morphological study is required for the conservation and utilization of endangered orchids. Native species can be effectively utilized for the development of inter-generic, inter-specific, or intra-specific natural hybrids of commercial orchid genera like *Ascocentrum*, *Cattleya, Cymbidium, Dendrobium, Mokara, Oncidium, Paphiopedilum, Phaius, Phalaenopsis,* and *Vanda* and their compatible alliances, which would be market-driven, having export value as well as being tolerant to biotic and abiotic stresses. Investigations on the morphological diversity of indigenous species could open up avenues for the identification of new and elite germplasm for pot culture, cut flowers, dry flowers, herbal preparations, and exhibits for market displays.

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