Short Communication

# Evaluation of floral characters of selected indigenous sympodial epiphytic orchids of Western Ghats

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**Abstract**

Evaluation of quantitative and qualitative floral characters of seven indigenous sympodial epiphytic orchids of Western Ghats was conducted at the Department of Floriculture and Landscape Architecture, College of Agriculture, Vellanikkara during 2019-2020. The study evaluated quantitative and qualitative floral characters of indigenous sympodial epiphytic orchid accessions such as *Dendrobium densiflorum, D. fimbriatum, D. ovatum, D.crumenatum, D. moschatum, Eria fragrans* and *Pholidota imbricata*. Significant variation was observed with respect to floral characters of orchid accessions studied. The accession *P.imbricata* (VKA/NOR-29) recorded the highest spike length (49.66 cm) and number of florets per spike (63.33). The largest showy flower among the accessions was observed in *D.moschatum* (VKA/NOR-37) with a maximum flower size of 54.37 sq.cm. Wide variation was also observed with respect tospike orientation, petal shape, petal curvature, lip shape and colouration of flowers. Among the accessions, fragrant flowers were noted in *D.crumenatum* (VKA/NOR-34), *D. fimbriatum* (VKA/NOR-27)*, D.moschatum* (VKA/NOR-37) and *E. fragrans*(VKA/NOR-25).

**Keywords**: Epiphytic, Floral characters, Orchidaceae, Spike, Sympodial orchids.

Orchidaceae is one of the largest families among angiosperms containing more than 25,000 species. Orchids are known for their magnificent flowers of various size, shape and colours. Globally they are marketed as cutflowers and potted flowering plants. India is home to 1,331 species of orchids, including 400 endemic species (Misra and Misra, 2007). Indian orchids represent about six per cent of the world orchid flora and seven per cent of the flowering plants in India (De et al*.,* 2014). In India, Western Ghats region is a known mega biodiversity centre and therefore one of the richest orchid habitats in the world. Western Ghats alone harbors the highest number of endemic orchid species found in Peninsular India, in which, Kerala, a part of the Western Ghats has maximum number of endemic orchids (Abraham and Valsala, 1981; Jalal and Jayanthi, 2012).

Orchids are perennials and are well adapted to various habitats. They can be terrestrial, epiphytic, lithophytic or saprophytic (Amesand Correll, 1985). Epiphytic orchids grow on host trees, terrestrial orchids grow in the ground, lithophytes grow on exposed rock and saprophytes grow on dead organic matter like decaying leaves (Zhang et al., 2018). Orchids are found to exhibit two type of growth habits such as monopodial and sympodial type of

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growth. Monopodials are having straight upward growth and sympodials are producing pseudo stems from the sides of main stem. Sympodial orchids show very limited upward growth. Presence of aerial roots are other feature of monopodial orchids while it is absent in sympodial orchids. Sympodial orchids produce pseudobulbs which are the bulb like stem acting as storage organ of moisture and nutrients (Biswas and Singh, 2019).

A large number of Indian indigenous orchids are important parents for producingmany excellent hybrids. Some of the Indian orchid species with ornamental potential used for breeding purpose are *Aerides multiflorum, A. odoratum, Coelogyne elata, C. flavida, Cymbidium aloifolium, Dendrobium nobile, D. chrysanthum, D. densiflorum, D. moschatum, D. fimbriatum, Renanthera imschootiana, Rhynchostylis retusa* and *Vanda cristata* (Singh,1990).In spite of the high diversity of orchid flora in Kerala, only very few indigenous species were evaluated for their ornamental and commercial traits. Hence the evaluation of floral characters of indigenous orchids will hasten their use in research and crop improvement programmes, and also facilitate the conservation of valuable genetic resources.

Assessment of floral characters of seven indigenous sympodial epiphytic orchids was conducted in the Department of Floriculture and Landscape Architecture, College of Agriculture, Vellanikkara, from July 2019 to June 2020. Quantitative and qualitative floral characters of the seven indigenous sympodial epiphytic orchids were evaluated during their blooming period. The quantitative characters recorded were number of spikes, number of florets per spike, spike length, flower size, petal length, lip length, lip width and column length. The qualitative floral characteristics such as spike orientation, petal shape, petal curvature, lip shape, lip lobation, and flower fragrance were recorded based on the descriptors of National Research Centre for Orchids, Sikkim. Flower colour was recorded using RHS colour chart.

The floral characters of orchids exhibit wide diversity in size, shape, form and colouration (Dressler, 1993). A wide range of variation with respect to the floral characters of orchids was reported by Abbas (2016) while evaluating orchid accessions collected from Central Western Ghats.

The observations on seven indigenous sympodial epiphytic orchid accessions were recorded at blooming phases. The accessions flowered were *D. densiflorum* (VKA/NOR-22), *D. fimbriatum* (VKA/NOR-27), *D. ovatum* (VKA/NOR-60), *D. crumenatum* (VKA/NOR-34), *D. moschatum* (VKA/NOR-37), *E .fragrans* (VKA/NOR-25) and *P imbricata* (VKA/NOR-29).

The quantitative floral characters recorded for sympodial orchid accessions are given in Table1. Considerable variation was observed among the accessions with respect to flowering time. Among them single season flowering was observed in *D. densiflorum* (VKA/NOR-22) (February), *D.*

*Table 1.* Quantitative floral characters of orchid accessions

| Sl. No. | Accession code | Scientific name | Flowering time/season | Number of spikes | Number of florets per spike | Spike length (cm) | Flower size ( sq.cm) | Petal length (cm) | Lip length (cm) | Lip width (cm) | Column length (cm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | VKA/NOR-22 | *Dendrobium densiflorum* | February | 1.00 | 16.00 | 13.00 | 4.61 | 1.24 | 1.66 | 1.68 | 0.40 |
| 2 | VKA/NOR-27 | *Dendrobiumf imbriatum* | April | 1.00 | 4.00 | 13.25 | 14.04 | 2.05 | 2.05 | 1.89 | 0.55 |
| 3 | VKA/NOR-60 | *Dendrobiu movatum* | January- February | 3.33 | 6.80 | 4.33 | 2.45 | 0.76 | 0.91 | 0.43 | 0.22 |
| 4 | VKA/NOR-34 | *Dendrobium crumenatum* | April - May, October, December- January | 5.76 | 3.75 | 25.50 | 15.74 | 1.82 | 2.75 | 1.66 | 1.78 |
| 5 | VKA/NOR-37 | *Dendrobium moschatum* | April | 2.00 | 7.50 | 16.65 | 54.37 | 3.98 | 2.48 | 2.28 | 1.20 |
| 6 | VKA/NOR-25 | *Eria fragrans* | May- October | 1.75 | 9.41 | 18.76 | 11.72 | 2.16 | 1.06 | 0.39 | 0.59 |
| 7 | VKA/NOR-29 | *Pholidota imbricata* | June- July | 2.66 | 63.33 | 49.66 | 0.31 | 0.46 | 0.55 | 0.45 | 0.27 |
| | CD (0.05) | | | 1.524 | 6.583 | 6.316 | 3.755 | 0.450 | 0.152 | 0.093 | 0.045 |

*fimbriatum* (VKA/NOR-27) (April), *D. moschatum* (VKA/NOR-37) (April), *P. imbricata* (VKA/NOR-29) (June- July), *E. fragrans* (VKA/NOR-25) (May-Oct) and *D. ovatum* (VKA/NOR-60) (January-February). Three flowering seasons among the accessions was noted in *D. crumenatum* (VKA/NOR-34) (April-May, October, December-January). *E. fragrans* (VKA/NOR-25) recorded long flowering season from May to October compared to all other indigenous orchid accessions. Wang et al. (2019) stated that, in some orchids the flowering is influenced by changes in ambient temperature. It was found that *D. crumenatum* (VKA/NOR- 34) bloomed when lower temperature,resulted after a rain (Meesawat and Kanchanapoom, 2007).

Number of spikes is an important ornamental quality of a plant. Since each spike produces florets, more number of spikes will impart more showiness to the plant. Significant difference was observed with respect to number of spikes per plant produced by the orchid accessions. *D. crumenatum* (VKA/NOR-34), produced significantly higher number of spikes (5.76). Minimum number of spikes per plant was observed in *D. fimbriatum* (VKA/NOR-27) (1.00) and *D. densiflorum* (VKA/NOR-22) (1.00). Similarly, variation in number of spikes was also reported by Mehraj et al. (2014) among *Dendrobium* varieties, and Thomas and Lekha Rani (2008) among monopodial orchids.

The flower bud initiation takes place only when spike attained an appropriate length (Lee and Lin, 1984). The number of flowers per inflorescence is an important character in orchid breeding (Connel and Kamemoto, 1983; Donald, 1991). More number of florets per spikes enhances the beauty of the spike. The results showed that *P. imbricata* (63.33) had maximum number of florets per spike. All other accessions were found on par with respect to number of florets per spike. Minimum number of florets per spike among the accessions was recorded in *D. cruenatum* (VKA/NOR- 34) (3.75). The traits like spike length and florets per spike are greatly influenced by genetic characters.

Spike length of orchids are important while selecting orchids as cut flowers. Distinguishable difference was observed with respect to spike length recorded amongindigenous orchid accessions (Table 1). Maximum spike length was recorded in *P. imbricata* (VKA/NOR-29) (49.66 cm), this was followed by *D. crumenatum* (VKA/NOR-34) (25.50 cm). The minimum spike length was recorded in *D. ovatum* (VKA/NOR-60) (4.33 cm). Similar variation in number of spikes was reported by Sugapriya et al. (2012) among different varieties of *Dendrobium.,* Barman et al. (2007) in *Cymbidium* hybrids and Thomas and Lekha Rani (2008) among different varieties of monopodial orchids.

Quantitative parameters such as flower size, petal length, lip length, lip width etc.influences ornamental value of orchid flower. Maximum flower size was recorded in *D. moschatum* (VKA/NOR-37) (54.37 sq.cm), and it was significantly superior to all other accessions. The smallest floret size was recorded in *P. imbricata* (VKA/NOR-29) (0.31 sq.cm). *D. moschatum* (VKA/NOR-37) was also significantly superior to all other accessions with respect to petal length (3.98cm), followed by *E. fragrans* (VKA/NOR-25) (2.16 cm), *D. fimbriatum* (VKA/NOR-27) (2.05 cm) and *D. crumenatum* (VKA/NOR-34) (1.82 cm) were found on par with respect to petal length. The shortest petal length among the sympodial accessions was recorded for *P. imbricata* (VKA/NOR-29) (0.46 cm). Variability with respect to size of flower was also reported by Moniruzzaman and Ara (2012) while evaluating floral characters of native *Dendrobium* orchids.

Lip (labellum) is amodified petal, which is the most attractive par to fan orchid flower and it acts as the landing area for pollinators (Biswas and Singh, 2019). Significant variation was observed with respect to lip length among the orchid accessions (Table 2). Maximum lip length was recorded for *D. crumenatum* (VKA/NOR-34) (2.75 cm) and minimum lip length was in *P. imbricata* (VKA/NOR-29)(0.55 cm). Variation was also recorded

with respect to lip width. *D. moschatum* (VKA/NOR-37) was significantly superior to all the other orchid accessions. *D. moschatum* (VKA/NOR-37) recorded maximum lip (labellum) width of 2.28 cm, which was followed by *D. fimbriatum* (VKA/NOR-27) (1.89 cm). *E. fragrans* (VKA/NOR-25) was found to have minimum lip width (0.39cm).

Column is the single reproductive structure of the orchid flowers formed by the fusion of stamens and pistils (De and Bhattacharjee, 2011). Column length and width are important in hybridization programmes for considering effective pollination. Variation in the length of column recorded among the indigenous orchid accessions are shown in Table 2. *D. crumenatum* (VKA/NOR-34) recorded the highest value (1.78 cm) and *D. ovatum* (VKA/NOR-60) recorded lowest value (0.22 cm) for column length.

A wide range of variations could be observed also for qualitative floral characteristics among the accessions (Table 2). Spike orientation in all the accessions showed considerable variation Three type spike orientation was observed, *viz.,* pendulous, drooping and erect to arching type. The spikes in *D.densiflorum* (VKA/NOR-22), *D. fimbriatum* (VKA/NOR-27), *D. moschatum* (VKA/NOR-37) were oriented in pendulous manner. Drooping spikes were observed in *P. imbricata* (VKA/NOR-29), while in *D. crumenatum* (VKA/NOR-34), *E. fragrans* (VKA/NOR-25) and *D. ovatum* (VKA/NOR-60) the spikes were oriented in erect to arching manner.

Different petal shapes were observed in indigenous sympodial orchid accessions. Petal shape was ovate in *D.ovatum* (VKA/NOR-60) and *D. moschatum* (VKA/NOR-37), while it was sub orbicular in *D. densiflorum* (VKA/NOR-22). *E. fragrans* (VKA/NOR-25) was found to have lanceolate petals. *P imbricata* (VKA/NOR-29) recorded oblong petals. *D. fimbriatum* (VKA/NOR-27) and *D. crumenatum* (VKA/NOR-34) were found to have elliptic petal shape.

Petal curvature also showed noticeable variation among the accessions. *E. fragrans* (VKA/NOR-25) and *D. ovatum* (VKA/NOR-60) were having deflexed petals, while incurved with straight petal apex was noticed in *D. fimbriatum* (VKA/NOR-27), *D. moschatum* (VKA/NOR-37) and *P. imbricata* (VKA/NOR-29). The petals of *D. crumenatum* (VKA/NOR-34) were straight with slightly deflexed apex. Incurved curvature for petals was recorded in *D. densiflorum* (VKA/NOR-22).

Flower fragrance is another attractive feature of flowers. Among the accessions flower fragrance was noted for the accessions like *D. fimbriatum* (VKA/

*Table 2.* Qualitative floral characters of orchid accessions

| Sl. No. | Accession code | Scientific name | Spike orientation | Flower fragrance (presence/ absence) | Petal shape | Petal curvature | Lip shape | Lip lobation (presence/ absence) |
|---|---|---|---|---|---|---|---|---|
| 1 | VKA/NOR-22 | *Dendrobium densiflorum* | Pendulous | Absent | Sub orbicular | Incurved | Orbicular | Absent |
| 2 | VKA/NOR-27 | *Dendrobium fimbriatum* | Pendulous | Present | Elliptic | Incurved with straight apex | Orbicular | Absent |
| 3 | VKA/NOR-60 | *Dendrobium ovatum* | Erect to arched | Absent | Ovate | Deflexed | Ovate | Present |
| 4 | VKA/NOR-34 | *Dendrobium crumenatum* | Erect to arched | Present | Elliptic | Straight with deflexed at apex | Ovate towards tip | Present |
| 5 | VKA/NOR-37 | *Dendrobium moschatum* | Pendulous | Present | Ovate | Incurved with straight apex | Hemispherical open- mouthed pouch | Absent |
| 6 | VKA/NOR-25 | *Eria fragrans* | Erect to arched | Present | Lanceolate | Deflexed | Oblong | Present |
| 7 | VKA/NOR-29 | *Pholidota imbricata* | Drooping | Absent | Oblong | Incurved with straight apex | Saccate | Present |

NOR-27), *D. crumenatum* (VKA/NOR-34), *D. moschatum* (VKA/NOR-37) and *E. fragrans* (VKA/NOR-25). Among them *D. crumenatum* (VKA/NOR-34) was strongly fragrant compared to all other accessions. Frowine (2005) listed out many orchid species having strong fragrance such as *Acampepapillosa*, *Aeridesfalcata*, *Cattleya loddigesii*, *Coelogynepandurata*, *Dendrobium aureum, etc*. Meesawat and Kanchanapoom (2007) also reported strongly fragrant flowers in *D.crumenatum* while studying its flowering behaviour.

A wide diversity was existed in qualitative characters of lip. Orbicular, ovate, oblong, obovate were the lip shapes observed among the accessions (Table2). Unique type of lip shape was exhibited by *D. moschatum* (VKA/NOR-37) and *P. imbricata* (VKA/NOR-29). It was hemispherical, open mouthed pouch in *D. moschatum* (VKA/NOR-37) and sac like in *P. imbricata* (VKA/NOR-29). Chen and Wood (2009) also stated sac like (saccate) lip conditionin *P. imbricata* (VKA/NOR-29) while explaining floral characters of twelve *Pholidota* species. In *D. moschatum* (VKA/NOR-37) the hemispherical, open mouthed pouch shaped lip condition was observed by Gogoi and Borah (2010) while explaining the characteristics of orchid species collected from Joypur Reserve Forest, Dibrugarh (Assam). Peculiar shape of floral parts especially lip is more important in commercial point of view.

Presence of lobes on lip is also another feature observed on lip which contribute to the attractiveness of the floret. The lip can be with or without lobes. It was observed that all the accessions except *D. densiflorum* (VKA/NOR-22), *D. fimbriatum* (VKA/NOR-27) and *D. moschatum* (VKA/NOR-37) were having lobed lips.

The colour of floral parts is one of the attractive features of the orchid flowers. Flower colour and colour pattern are one of the important plant characteristics used for development of varieties (Bhattacharjee and Das, 2008). Among the accessions, majority possess white colouration for the floral parts *viz*., petal, and lip. Moniruzzaman and Ara (2012) evaluated native *D.*orchids and reported wide range of colours of flower and, they were categorized into white, yellow, red, blue, green and intermediate colours. The variation in flower colour was also studied by Chhetri et al. (2013) in seven species of *Vanda* W. Jonesex R. Brown with the help of RHS colour chart.

The colour of floral parts such as petal colour and lip colour, showed considerable variation among the accessions. The predominant colour groups observed were yellow, orange and white.The variation in petal colour of the accessions observed are shown in Table 3. Colours observed for petals were RHS-13C (Yellow group 13, brilliant yellow C) in *D. densiflorum* (VKA/NOR-22), RHS-21C (Yellow orange group 21, brilliant yellow C) in *D. fimbriatum* (VKA/NOR-27), RHS-24D (Orange group 24, orange yellow D) *D. moschatum* (VKA/NOR-37), RHS-NN 155D (White group 155, white D) in *D. crumenatum* (VKA/NOR-34), RHS-158B (Yellow white group 158, pale yellow B) in *P. imbricata* (VKA/NOR-29) RHS-155C (White group 155, greenish white C) in *E. fragrans* (VKA/NOR-25) and *D. ovatum* (VKA/NOR-60).

Different lip colour observed were RHS-N 25C (Orange group N25, strong orange C) in *D. densiflorum* (VKA/NOR-22) and RHS-23A (Yellow orange group 23, vivid orange yellow A) in *D. fimbriatum* (VKA/NOR-27). *D. moschatum* (VKA/NOR-37) was found to have RHS-N 25C (Orange group N25, strong orange C) on the inner side and RHS-22B (Yellow orange group 22, light orange yellow B) towards tip. RHS- NN155D (White group 155, white D) was observed in *D. crumenatum* (VKA/NOR- 34); and RHS-NN 155A (White group 155, yellowish white A) was observed in *P. imbricata* (VKA/NOR-29). RHS-155C (White group 155, greenish white C) was recorded in *E. fragrans* (VKA/NOR-25), and *D.ovatum* (VKA/NOR-60) recorded two colours *viz*., RHS-N144C

*Table 3.* Qualitative floral characters of orchid accessions -contd.

| Sl. No. | Accession code | Scientific name | Petal colour | Lip colour |
|---|---|---|---|---|
| 1 | VKA/NOR-22 | *Dendrobium densiflorum* | RHS-13C (Yellow group 13, brilliant yellow C) | RHS-N 25C (Orange group N25, strong orange C) |
| 2 | VKA/NOR-27 | *Dendrobium fimbriatum* | RHS-21C (Yellow orange group 21, brilliant yellow C) | RHS-23A (Yellow orange group 23, vivid orange yellow A) |
| 3 | VKA/NOR-60 | *Dendrobium ovatum* | RHS-155C (White group 155, greenish white C) | Inner side :RHS-N144C (Yellow green group N144, strong yellow green C)Towards tip; RHS-155C (White group 155, greenish white C) |
| 4 | VKA/NOR-34 | *Dendrobium crumenatum* | RHS-NN 155D (White group 155, white D) | RHS-NN 155D (White group 155, white D) |
| 5 | VKA/NOR-37 | *Dendrobium moschatum* | RHS-24D (Orange group 24, orange yellow D) | Inner side: RHS-N 25C (Orange group N25, strong orange C)Towards tip: RHS-22B (Yellow orange group 22, light orange yellow B) |
| 6 | VKA/NOR-25 | *Eria fragrans* | RHS-155C (White group 155, greenish white C) | RHS-155C (White group 155, greenish white C) |
| 7 | VKA/NOR-29 | *Pholidota imbricata* | RHS-158B (Yellow white group 158, pale yellow B) | RHS-NN 155A (White group 155, yellowish white A) |

(Yellow green group N144, strong yellow green C) towards inner side and RHS-155C (White group 155, greenish white C) towards tip of the lip (Table3). Double colouration on lip was observed in *D.ovatum*, *D .moschatum*, *D. fimbriatum* and *D. crumenatum*.

The present study on evaluation of floral characters of selected indigenous sympodialepiphytic orchid flora revealed high degree of variability. The variability was observed for both quantitative as well as qualitative floral characters. *D. ovatum* recorded maximum number of spikes, while *P. imbricata* recorded maximum spike length as well as number of floret sper spike. *D. moschatum* had the largest flower among the accessions. *D. crumenatum* was superior with respect to lip length and column length. Flower fragrance was noted in all the accessions except *D. densiflorum, D. ovatum* and *P. imbricata*. Variability also existed with respect to qualitative characters such as spike orientation, petal shape, petal curvature, lip shape, and colouration of the floral parts. Evaluation of the floral features will be helpful for identifying accessions with commercial value as well as for conservation of rare and endemic orchid flora.

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