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Morphological Characterization of *Coelogyne asperata* Lindl. in Kuantan Singingi Regency, Riau Province, Indonesia

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Abstract

Coelogyne asperata Lindl. is a tropical orchid with distinctive vegetative and reproductive characteristics and considerable potential for ornamental cultivation and conservation. However, detailed morphological information on this species remains limited, particularly for populations in Riau Province, Indonesia. This study aimed to characterize the morphological traits of *C.* asperata based on quantitative characteristics of vegetative and reproductive organs. The study was conducted in Kuantan Singingi Regency, Riau Province, Indonesia, using a descriptive observational approach. Six healthy and mature individuals were selected through purposive sampling, with three measurement replicates. Morphological observations included roots, pseudobulbs, leaves, inflorescences, and flowers, following standard orchid taxonomic descriptors. The results showed that *C.* asperata exhibited relatively large vegetative structures, with mean leaf length and width of 55.00 ± 2.00 and 13.00 ± 1.50 cm, respectively. Mean pseudobulb length and width were 14.00 ± 1.30 and 7.00 ± 0.50 cm, respectively. The root system comprised 31.00 ± 2.00 primary roots with a mean length of 25.00 ± 2.00 cm and 24.00 ± 2.00 secondary roots with a mean length of 9.00 ± 1.10 cm. The inflorescences produced an average of 10.00 ± 1.00 flowers per stalk. Overall, the observed morphological characteristics were consistent with the established descriptions of *C.* asperata and indicated well-developed vegetative and reproductive structures. These findings provide baseline morphological data supporting species identification, documentation, conservation, and future research on the cultivation and utilization of *C.* asperata.

Keywords: *Coelogyne asperata*, Conservation, Morphological Characterization, Orchid, Pseudobulb, Root

1. Introduction

Coelogyne asperata Lindl. is a terrestrial and epiphytic orchid species distributed across several regions of Sumatra. The species is recognized for its attractive, pendulous inflorescences and distinctive flowers, particularly the prominent and ornamentally valuable labellum (Galingging et al., 2021). Compared with several other species within the genus *Coelogyne*, *C. asperata* is characterized by relatively large vegetative organs, including elongated leaves and conspicuous pseudobulbs. These morphological characteristics contribute to its potential value as an ornamental plant and make the species of particular interest for botanical, horticultural, and conservation studies.

Despite its distinctive morphological characteristics and potential economic value, detailed information concerning the morphological variation and phenotypic characteristics of *C. asperata* remains relatively limited. Comprehensive characterization of its vegetative and reproductive organs is particularly important because morphological traits provide fundamental information for species identification, taxonomic delimitation, and evaluation of phenotypic variation (Heriansyah & Marlina, 2021). The limited availability of detailed morphological data has also constrained the development of appropriate agronomic approaches for the propagation, cultivation, management, and potential utilization of this species.

Morphological characterization is therefore an essential initial step in understanding the biological characteristics of *C. asperata*. Quantitative assessment of important morphological traits, including leaf dimensions, pseudobulb size, root development, and flower production,

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can provide baseline information for describing the growth characteristics of the species. Such information may subsequently support the development of cultivation and propagation protocols and facilitate the selection of individuals with desirable characteristics for horticultural applications (YOH et al., 2022).

In addition to its potential as an ornamental orchid, the documentation and characterization of *C. asperata* may provide a foundation for investigating other potential uses of this species, including its possible development as a bioresource for medicinal or other biotechnological applications. However, the realization of these potentials requires reliable baseline information on the identity, morphological characteristics, and biological variation of the plant. Morphological characterization is also relevant to taxonomic studies because observable morphological traits remain important criteria for distinguishing and classifying orchid species, particularly when combined with other taxonomic and molecular approaches (Oos et al., 2001).

Therefore, systematic documentation of the morphological characteristics of *C. asperata* is necessary to establish a reliable baseline for further research on this species. Such information is expected to contribute to species identification, taxonomic characterization, conservation efforts, and the development of appropriate horticultural and agronomic practices.

The objective of this study was to characterize the morphological traits of *Coelogyne asperata* Lindl., with particular emphasis on quantitative characteristics of the leaves, pseudobulbs, roots, and flowers. The resulting morphological data are expected to provide baseline information for the identification and characterization of the species and to support future studies on its cultivation, conservation, and potential utilization.

2. Material and Methods

2.1. Study Area

Kuantan Singingi Regency, Riau Province, Indonesia. 0°31'40.6"S 101°33'21.6"E with elevation 55 meter above sea levels (MASL).

2.2. Research Design

This study employed a descriptive observational design to characterize the morphological traits of *Coelogyne asperata* Lindl. The study focused on documenting and describing both vegetative and reproductive morphological characteristics of mature and healthy individuals.

2.3. Sampling

Plant specimens of *Coelogyne asperata* were selected using purposive sampling based on predetermined morphological criteria. Only healthy, mature, and undamaged individuals exhibiting fully developed vegetative and reproductive structures were included in the study. Specimens showing signs of disease, severe physical damage, or incomplete morphological development were excluded. The selected individuals were used as observational units for morphological characterization.

2.4. Morphological Observation

Morphological characterization was conducted by examining vegetative and reproductive structures. Vegetative characteristics included root morphology, pseudobulb shape and dimensions, number and arrangement of leaves, and leaf shape, size, and other relevant diagnostic features. Reproductive characteristics included inflorescence type and dimensions, flower arrangement, flower size, and the morphological characteristics of individual floral parts, including the sepals, petals, lip (labellum), column, and other diagnostically relevant structures.

Morphological characters were recorded following standard taxonomic descriptors for orchids, with reference to established orchid taxonomic literature, including Comber (2001). Terminology and character states were standardized to facilitate comparison with previously published descriptions of *C. asperata*.

2.5. Data Collection

Quantitative morphological traits were measured directly using a ruler and measuring tape, with measurements recorded in centimeters (cm) or millimeters (mm), as appropriate. Each measurement was taken from fully developed and representative plant structures to minimize variation associated with immature or damaged organs.

Qualitative morphological characters, including shape, color, texture, arrangement, and surface characteristics, were documented through direct field observation. Photographic documentation was conducted for each specimen to provide a visual record of the observed morphological characters and to support subsequent identification and comparison with taxonomic references.

2.6. Data Analysis

The morphological data were analyzed using descriptive statistics and qualitative comparative analysis. Quantitative characters were summarized using descriptive measures, including the range and mean where sufficient observations were available. Qualitative characters were organized according to their diagnostic states and compared with descriptions provided in authoritative taxonomic literature and relevant published studies.

The resulting morphological profile was subsequently compared with previously reported characteristics of *Coelogyne asperata* to assess the consistency of the observed specimens with existing taxonomic descriptions and to identify potentially diagnostic morphological characters.

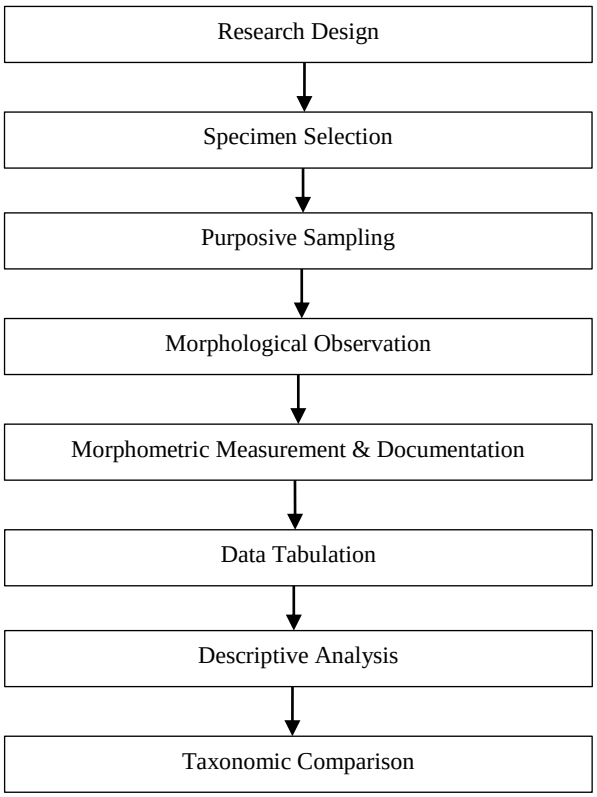


Figure 1. Research flow diagram

3. Results and Discussion

3.1. Morphological Characteristics of *Coelogyne asperata* Lindl.

The morphological characteristics recorded for Coelogyne asperata Lindl. indicate that this species possesses a relatively large vegetative architecture, characterized by elongated leaves, conspicuous pseudobulbs, and a well-developed root system. The mean values obtained for leaf length, leaf width, pseudobulb length, and pseudobulb width were 55.00 ± 2.00 cm, 13.00 ± 1.50 cm, 14.00 ± 1.30 cm, and 7.00 ± 0.50 cm, respectively. These characteristics are consistent with the general morphological description of C. asperata, which is recognized as a large-sized, pseudobulbous epiphytic orchid. According to Flora Malesiana, the species has lanceolate leaf blades measuring approximately 26–110 cm in length and 4.5–20 cm in width, while the pseudobulbs may reach 7–25 cm in length and 3–5.6 cm in width (Besi et al., 2023).

The relatively long leaves observed in the present study may represent an important adaptive characteristic of C. asperata. As an epiphytic orchid occurring naturally in wet tropical forests, the species grows on substrates where water and mineral nutrients may be intermittently available. Its broad and elongated leaves provide a relatively large photosynthetic surface, potentially facilitating carbon assimilation under shaded forest conditions. The species is reported to occur primarily in wet tropical habitats and is commonly associated with forest environments, including shaded montane habitats. The leaf dimensions recorded in this study therefore fall within the known morphological range of the species and support its identification based on vegetative characteristics (Hartati et al., 2021).

The pseudobulb dimensions, with a mean length of 14.00 ± 1.30 cm and width of 7.00 ± 0.50 cm, further demonstrate the prominent vegetative structure of C. asperata. Pseudobulbs are characteristic storage organs in many epiphytic orchids and play important roles in the storage of water and assimilated carbohydrates. In Coelogyne, pseudobulbs are conspicuous structures produced along a creeping rhizome and generally consist of a single internode. In C. asperata, the pseudobulbs are described as broadly conical to ovate-lanceolate and may be relatively large. The relatively substantial pseudobulb size observed in the present material may consequently contribute to the plant's capacity to maintain physiological activity during periods of fluctuating water availability, which is particularly relevant to an epiphytic growth habit (Heriansyah et al., 2025).

Tabel Karakter Morpologi Tanaman Anggrek *Coelogyne asperata* Lindl

No	Variable	Measurement
1	Leaf length (cm)	55.00 ± 2.00
2	Leaf width (cm)	13.00 ± 1.50
3	Pseudobulb length (cm)	14.00 ± 1.30
4	Pseudobulb width (cm)	7.00 ± 0.50
5	Number of primary roots	31.00 ± 2.00
6	Root length (cm)	25.00 ± 2.00
7	Number of secondary roots	24.00 ± 2.00
8	Secondary root length (cm)	9.00 ± 1.10
9	Number of flowers per inflorescence	10.00 ± 1.00

Sample Size: Six specimens, with three independent replicates per specimen

The root characteristics also indicate a relatively vigorous below-ground support and absorption system. The plants examined had an average of 31.00 ± 2.00 primary roots, with an average root length of 25.00 ± 2.00 cm. In addition, the number and length of secondary roots were 24.00 ± 2.00 and 9.00 ± 1.10 cm, respectively. Although

root number and secondary-root development can be influenced by plant age, nutritional status, substrate characteristics, moisture availability, and environmental conditions, the relatively high number of primary roots observed suggests a well-developed root system. This is biologically relevant for an epiphytic orchid because roots perform multiple functions, including anchorage to the host substrate, water acquisition, and nutrient absorption.

The root system of C. asperata is particularly important because the species is primarily epiphytic. Flora Malesiana describes its roots as approximately 0.3–0.5 cm in diameter and reports that the species occurs as an epiphyte in forest environments. In an epiphytic habit, extensive root development can increase the surface area available for absorbing water and dissolved nutrients from rainwater, organic debris, and the immediate substrate. The development of secondary roots may further increase the absorptive interface and improve mechanical attachment. Therefore, the relatively high number of primary and secondary roots recorded in the present study may reflect an adaptation associated with maintaining water and nutrient acquisition in an epiphytic environment (Rosanti & Widianjaya, 2018).

The reproductive characteristics provide additional evidence of the vigorous growth and reproductive potential of the species. The observed mean number of flowers per inflorescence was 10.00 ± 1.00 flowers per stalk. This value is within the broad range reported for C. asperata. Flora Malesiana records inflorescences containing approximately 6–35 flowers, while other taxonomic descriptions report that the species may produce numerous flowers in an arching inflorescence. Thus, the number of flowers observed in the present study is consistent with the known reproductive morphology of C. asperata, although it represents the lower-to-middle portion of the reported species range (Besi et al., 2023).

The relatively consistent values indicated by the small variation around the means may suggest that the sampled plants exhibited comparatively uniform morphological development (Indrawanis & Heriansyah, 2026). For example, leaf length varied only around 55 cm, whereas pseudobulb width showed a variation of approximately 0.50 cm. However, morphological uniformity should be interpreted cautiously because the magnitude of variation is dependent on the sample size, plant developmental stage, growing environment, and the statistical measure represented by the ± values. Differences among individuals may arise from genetic variation as well as environmental factors such as light intensity, humidity, temperature, water availability, nutrient supply, and substrate conditions.

Overall, the morphological profile obtained in this study—particularly the elongated leaves, relatively large pseudobulbs, extensive primary and secondary root systems, and multi-flowered inflorescences—is consistent with the established botanical characteristics of Coelogyne asperata Lindl. The combination of substantial vegetative organs and a well-developed root system can be interpreted as advantageous for an epiphytic orchid inhabiting humid tropical forest environments. The results also reinforce the importance of integrating vegetative and reproductive characters when evaluating morphological variation in C. asperata. Nevertheless, further studies involving a larger number of individuals, multiple populations, and standardized environmental conditions would be necessary to distinguish genetically determined morphological traits from phenotypic responses to environmental variation.



Figure 2. Morphological Characteristics of Coelogyne asperata Lindl.

4. Conclusion

Coelogyne asperata Lindl. showed distinct vegetative and reproductive morphological characteristics, including leaves, pseudobulbs, roots, and inflorescences. The species exhibited leaf length of 55.00 ± 2.00 cm, pseudobulb length of 14.00 ± 1.30 cm, and 10.00 ± 1.00 flowers per inflorescence. The morphological characterization provides baseline data for identification, documentation, and conservation of *C.* asperata in Kuantan Singingi Regency, Riau Province, Indonesia.

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[Catatan: Nama penulis pada data awal tertulis "James Boughtwood Comber". Dalam format APA, nama tersebut saya susun sebagai **Comber, J. B.**]

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