

The Comparative Morphology Study of Three *Allamanda* L. Species (Apocynaceae)

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Abstract- In the present study three *Allamanda* species were characterized based on morphological traits. The species *Allamanda blanchetii* A.DC., *Allamanda cathartica* L. and *Allamanda schottii* Pohl were collected from certain regions of Kanyakumari District. A comparative taxonomic account of each species has been given along with quantitative and qualitative characters. The major morphological variations of the *Allamanda* species are shape and size of the leaves and shape, color and size of the flowers. The three *Allamanda* species were distinguished based on its vegetative and floral characters. *Allamanda blanchetii* has the climbing habit with ovate leaves and light pink to red flowers. *Allamanda cathartica* has the climbing habit with lanceolate to elliptic shaped leaves and yellow flowers. *Allamanda schottii* is a shrub, with elliptic to obovate leaves and small yellow flowers.

Indexed Terms- *Allamanda*, *Apocynaceae*, *Morphology*, *Ornamental*

I. INTRODUCTION

The Apocynaceae family belongs to the Gentianales order with about 5,000 species. It is one of the ten largest families of angiosperms, and also one of the most popular ornamental plants. Apocynaceae is an extremely diverse family in morphological terms, represented by trees, shrubs, herbs and climbers, with single leaves usually opposite, rarely alternate or whorled. They have five-merous sympetalous flowers, mainly insect-pollinated. The gynoecium usually consists of two carpels and is syncarpous or secondarily apocarpous. Fruit types include berries, drupes and follicles, and seed features to be found in the family include wings, comas and arils.

Allamanda L. (1771) belongs to the family Apocynaceae, it is a small genus mostly restricted to

Brazil, with a few native species in Venezuela, Colombia, and Peru (Sakane & Shepherd, 1986). The genus name is named by Linnaeus in honor of the Swiss doctor and botanist, Dr Frédéric-Louis Allamand, who visited Guyana in the early 18th century. *Allamanda* is probably one of the most horticulturally popular genera in Apocynaceae. *Allamanda* can be recognized by the following combination of characters: whorled type of leaf arrangement, infundibuliform corolla, hairs within the corolla tube and above the anthers, style-head with an annular ring at the base, dehiscent capsular fruits, commonly echinate on the external surface, and winged seeds.

Morphology has been traditionally most important source of information in plant taxonomy (Simpson, 2006). Taxonomic identification of Angiosperms is mainly done based on visible morphological aspects and characters of the plants. Majority of taxonomic groups recognized floral morphology. Cervantes and Diego (2010) state that, the description of the morphological characteristics are fundamental part of botanical study and as a key to taxonomy or systematics. The analysis of variance of morphological characters revealed significant differences of the tested traits, indicating there was variability among the *Allamanda* species. The objective of this study was to compare the morphological characteristics of the *Allamanda* species, to identify their distinguishing features.

II. MATERIALS AND METHODS

The investigated *Allamanda* species were collected freshly from some point of Kanyakumari District and the morphological characteristics of the specimen were studied and the photographs were taken. Morphological characters of all floral parts were studied in the laboratory under dissecting microscope.

Position of flowers in inflorescence, structure of flowers, structure of separate floral parts and position of nectary were studied. The qualitative and quantitative morphological features were studied.

III. RESULT

A total of three *Allamanda* species were collected from Kanyakumari District and studied the morphological characters. The studied *Allamanda* species are *Allamanda blanchetii* A.DC., *Allamanda cathartica* L. and *Allamanda schottii* Pohl. *Allamanda blanchetii* is an evergreen climbing shrub that can reach heights of upto 3 metres. In tropical and subtropical areas of the world, it is grown as an ornamental. Species name is honored to its collector, the Swiss Botanist and Naturalist Jacques Samuel Blanchet. *Allamanda cathartica* is an evergreen, woody, perennial climber, but may also be pruned as a shrub, 2–8 meters in length. The species name indicates digestive properties of the plant. *Allamanda schottii* is a shrub, which typically grows more shrub-like than *Allamanda cathartica*. It reach 2.5 meters (8.2 ft) in height and bears large yellow flowers. Specific epithet may honor Richard van der Schot.

The investigated general information was described below (Table 1). The qualitative and quantitative morphological features are showed in Table 2 & 3. The morphological images are given in Plate 1–9. The habit of the selected species (Plate 1), leaves (Plate 2), flower (Plate 3), calyx (Plate 4), corolla cut open (Plate 5), androecium (Plate 6) gynoecium (Plate 7).

• Classification

- Kingdom : Plantae
- Clade : Tracheophytes
- Clade : Angiosperms
- Clade : Eudicots
- Clade : Asterids
- Order : Gentianales
- Family : Apocynaceae
- Subfamily : Rauvolfioideae
- Tribe : Plumerieae
- Subtribe : Allamandinae
- Genus : *Allamanda*

Table 1 Description of the *Allamanda* species

| S. No | Species Name | Common Name | Habit | Propagation | Native | Flowering & Fruiting |
|-------|-----------------------------------|------------------------------------|---------|-------------|----------------------------|----------------------|
| 1 | <i>Allamanda blanchetii</i> A.DC. | Cherry Allamanda, Purple Allamanda | Climber | Vegetative | Brazil | Throughout the year |
| 2 | <i>Allamanda cathartica</i> L. | Golden Trumpet, Yellow Allamanda | Climber | Vegetative | America, Brazil, Venezuela | Throughout the year |
| 3 | <i>Allamanda schottii</i> Pohl | Bush Allamanda | Shrub | Vegetative | Brazil | Throughout the year |

IV. COMPARATIVE MORPHOLOGY

STEM

The mature stem was brown color in all species. The young stem is green and violet in *Allamanda blanchetii* and *Allamanda cathartica*, brownish green in *Allamanda schottii*. It was pubescent in *Allamanda blanchetii* and glabrous in *Allamanda cathartica* and *Allamanda schottii*.

Plate 1. Habit

Allamanda blanchetii A.DC. *Allamanda cathartica* L. *Allamanda schottii* Pohl



LEAVES

The leaf arrangement was whorled type in all species. The number of leaves in a whorl is 3–4 in *Allamanda blanchetii* and *Allamanda cathartica*, while it was five in *Allamanda schottii*. The shape of the leaves are ovate to elliptic in *Allamanda blanchetii*, elliptic to lanceolate in *Allamanda cathartica* and elliptic to obovate in *Allamanda schottii*. The leaf margin is entire in *Allamanda blanchetii* and *Allamanda schottii*, revolute and undulate in *Allamanda cathartica*. The leaf apex is acuminate in *Allamanda cathartica* and *Allamanda schottii*, cuspidate and acuminate in *Allamanda blanchetii*. Leaf base was rounded and obtuse in *Allamanda blanchetii*, cuneate and acute in *Allamanda cathartica* and cuneate in *Allamanda schottii*. The leaf was green to dark green in all species. It was pubescent in *Allamanda blanchetii* and *Allamanda schottii* and glabrous in *Allamanda cathartica*. The petiole color is light green to green in all species. The petiole is glabrous in *Allamanda cathartica* and *Allamanda schottii*, pubescent in *Allamanda blanchetii*. The leaves have pinnate venation. *Allamanda schottii* has the largest number of secondary veins (15–19) and lowest is *Allamanda blanchetii* (10–12). *Allamanda cathartica* was recorded for its largest leaves (13–18.1 cm) and *Allamanda blanchetii* was recorded smallest leaves (5–10 cm).

Plate 2. Leaves

Allamanda blanchetii *Allamanda cathartica* L. *Allamanda schottii* Pohl
A.D.C.



INFLORESCENCE

The inflorescence type was terminal cyme in *Allamanda blanchetii* and *Allamanda cathartica*, cymose panicle in *Allamanda schottii*. The peduncle color is green to violet in all species. It was pubescent in all species. It has two flower buds in each node. *Allamanda blanchetii* was recorded for the longest peduncle (5–16 cm) and *Allamanda schottii* was recorded as the shortest peduncle (3.7–4 cm). The bract was light green and green in all species. It was

pubescent in *Allamanda blanchetii* and *Allamanda schottii*, while it is glabrous in *Allamanda cathartica*. The longest bract was observed in *Allamanda blanchetii* (1.1–1.2 cm) and the shortest was recorded in *Allamanda cathartica* (0.1–0.2 cm).

FLOWER

The flowers are trumpet shaped with yellow color in *Allamanda cathartica* and *Allamanda schottii*, light pink to red in *Allamanda blanchetii*. Based on the length and width, *Allamanda blanchetii* have the largest flowers (12–13.8 × 10.8–12.6 cm) and *Allamanda schottii* has the smallest flowers (6.2–7.8 × 2.8–4.4 cm). The pedicel was light green to green in all species. It was pubescent in *Allamanda blanchetii* and *Allamanda schottii*, glabrous in *Allamanda cathartica*. *Allamanda blanchetii* has the largest pedicel (0.5–1.4 cm) and *Allamanda schottii* have the smallest pedicel (0.2–0.6 cm).

Plate 3. Flower: CL- Corolla Lobe; CT- Corolla Tube; Ca- Calyx; Ped- Pedicel

Allamanda blanchetii *Allamanda cathartica* L. *Allamanda schottii* Pohl
A.D.C.

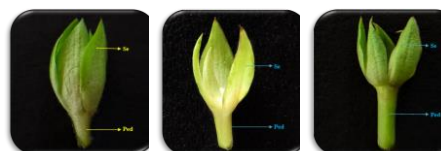


CALYX

The calyx has the quincuncial aestivation in all species. Calyx apex is acute to acuminate in all species. It was pubescent in *Allamanda blanchetii* and glabrous in *Allamanda cathartica* and *Allamanda schottii*. Calyx color is light green to green in all species. *Allamanda blanchetii* has the largest sepal (1.9–3.6 × 0.6–2.4 cm) and *Allamanda schottii* has the smallest sepal (0.5–0.8 × 0.3–0.4 cm).

Plate 4. Calyx: Se- Sepal; Ped- Pedicel

Allamanda blanchetii *Allamanda cathartica* L. *Allamanda schottii* Pohl
A.D.C.



COROLLA

The corolla was sympetalous, with funnel shaped corolla tube. The corolla has twisted aestivation and overlapping to the left. The shape of the corolla lobe was obtuse in *Allamanda blanchetii*, rounded or obtuse in *Allamanda cathartica* and orbicular in *Allamanda schottii*. Based on the length and width, *Allamanda blanchetii* has the largest corolla (11.7–13.3 × 10.8–12.6 cm) and *Allamanda schottii* has the smallest corolla (5.8–7.3 × 2.8–4.4 cm). *Allamanda blanchetii* was recorded as the largest corolla tube (7–8 cm) while the smallest is *Allamanda schottii* (4–5 cm). The cylindrical and swollen corolla tube was glabrous in both sides of all species. The cylindrical corolla tube was yellow color in *Allamanda blanchetii* and *Allamanda cathartica*, lavender and light green in *Allamanda schottii*. The swollen corolla tube was yellow in *Allamanda cathartica* and *Allamanda schottii*, reddish pink and yellowish pink in *Allamanda blanchetii*. The interior of the swollen corolla tube has the nectar guides, it was light pink to violet color in *Allamanda blanchetii*, orange in *Allamanda cathartica* and lavender in *Allamanda schottii*. The throat of the cylindrical corolla tube has white hairs, which was placed above the anthers.

Plate 5. Corolla cut open: PL- Petal lobe; Co- Corolla; An- Anther; CT- Corolla Tube
Allamanda blanchetii *Allamanda cathartica* L. *Allamanda schottii* Pohl
 A.D.C.



ANDROECIUM

The androecium was situated at the base of the swollen corolla tube, anthers form a cone and cover the stigma. The androecium consists of five epipetalous stamens. The anthers are sagittate, yellow and glabrous in all species. The filament was absent, but base of each anther has white hairs that resemble a filament. The androecium length range from 0.3 to 0.7 cm.

Plate 6. Androecium: An- Anther; FH- Filament like hairs



GYNOECIUM

The gynoecium consists of two carpels. *Allamanda cathartica* has the largest gynoecium (4.2–4.5 cm) and *Allamanda schottii* has the smallest gynoecium. The stigma was drum shaped, green and yellow in all species. The style was slender and white. The ovary was superior and light green in all species. The nectary disc was surrounded the ovary, which was light green in *Allamanda blanchetii* and *Allamanda cathartica*, while yellow in *Allamanda schottii*.

Plate 7. Gynoecium: Sti- Stigma; Sty- Style; O- Ovary; ND- Nectary Disc; Ped- Pedicel
Allamanda blanchetii *Allamanda cathartica* L. *Allamanda schottii* Pohl
 A.D.C.

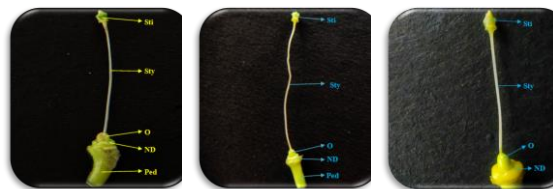


Table 2 Qualitative Morphological Features of the *Allamanda* species

| Plant species | <i>Allamanda blanchetii</i> A.D.C. | <i>Allamanda cathartica</i> L. | <i>Allamanda schottii</i> Pohl |
|------------------|------------------------------------|--------------------------------|--------------------------------|
| Latex Color | White | White | White |
| Young Stem Color | Brownish Violet | Green | Brownish Green |
| Petiole Color | Light Green | Light Green | Green |
| Blade Color | Dark Green | Dark Green | Dark Green |
| Peduncle Color | Brownish Violet | Green | Green |

| | | | |
|--------------------|----------------|-------------|-------------|
| Flower Color | Yellowish Pink | Yellow | Yellow |
| Pedice l Color | Green | Green | Green |
| Bract Color | Green | Light green | Green |
| Calyx Color | Light Green | Green | Green |
| Corolla Tube Color | Yellow | Yellow | lavender |
| Anther Color | Yellow | Yellow | Yellow |
| Stigma Color | Green | Green | Green |
| Style Color | White | White | White |
| Ovary Color | Light Green | Green | Light Green |

Table 3 Quantitative Morphological Features of the *Allamanda* species

| Plant species | <i>Allamanda blanchetii</i> A.DC. | <i>Allamanda cathartica</i> L. | <i>Allamanda schottii</i> Pohl |
|-----------------|-----------------------------------|--------------------------------|--------------------------------|
| Blade Length | 5.9–7.3 | 5.1–5.8 | 8.7–11.5 |
| Blade Width | 3.2–3.9 | 1.1–1.9 | 2.4–3.7 |
| Petiole Length | 0.1–0.2 | 0.3–0.4 | 0.2–0.3 |
| Peduncle Length | 7–13 | 5.5–8 | 3.7–4 |
| Flower Length | 10.6–12.8 | 9.1–10.3 | 6.2–7.8 |
| Flower Width | 9.1–11.4 | 4.7–6.1 | 2.8–4.4 |
| Pedice l Length | 0.5–0.9 | 0.5–0.8 | 0.2–0.6 |
| Bract Length | 0.7–0.8 | 0.3–0.4 | 0.2–0.4 |
| Sepal Length | 1.7–1.9 | 0.9–1.3 | 0.5–0.8 |
| Sepal Width | 0.9–1.2 | 0.5–0.6 | 0.3–0.4 |
| Corolla Length | 9.7–11.5 | 8.5–9.4 | 5.8–7.3 |

| | | | |
|---------------------|---------|---------|---------|
| Corolla Tube Length | 5.5–6.9 | 5.5–6.1 | 4–5 |
| Androeci um Length | 0.5–0.7 | 0.4–0.5 | 0.3–0.4 |
| Gynoeci um Length | 3.2–3.6 | 3.5–3.8 | 1.6–1.8 |

- Similarities between the *Allamanda* species
The selected three *Allamanda* species have some common attributes. The leaf and floral morphology similarities are whorled type of leaf arrangement, simple leaves, entire margin, pinnate venation, dark green leaves, trumpet shaped flowers, green color pedicel, calyx quincuncial aestivation, corolla twisted aestivation and overlapping to the left side, nectar guides, androecium position, anther shape and color, filament like hairs, stigma shape and color, style color, superior ovary and the nectary disc.

- Dissimilarities between the *Allamanda* species
The dissimilarities between the *Allamanda* species are shape and size of the leaves, color, shape and size of the flowers and size and color of the floral parts. Most of the floral and vegetative parts are pubescent in *Allamanda blanchetii* and *Allamanda schottii*, glabrous in *Allamanda cathartica*. The comparative differentiations of the three *Allamanda* species are *Allamanda schottii* have the largest leaves while *Allamanda cathartica* have smallest leaves. *Allamanda blanchetii* with the largest flowers and *Allamanda schottii* with smallest flowers. *Allamanda cathartica* and *Allamanda schottii* have yellow colored flowers whereas *Allamanda blanchetii* have the red to yellowish pink color flowers. These are the major morphological differences of the *Allamanda* species.

CONCLUSION

Study of the external structure helps to identify and distinguish the species. The major morphological variations of the *Allamanda* species are shape and size of the leaves and shape, color and size of the flowers. The three *Allamanda* species were distinguished based on its vegetative and floral characters. *Allamanda blanchetii* has the climbing habit with ovate leaves and light pink to red flowers. *Allamanda cathartica* has the

climbing habit with lanceolate to elliptic shaped leaves and yellow flowers. *Allamanda schottii* is a shrub, with elliptic to obovate leaves and small yellow flowers. Based on these findings, the *Allamanda* species can be distinguished from one another.

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