

## ASSESSING THE MORPHOLOGICAL CHARACTERS FOR TAXONOMIC SIGNIFICANCE AMONG INTRASPECIFIC VARIATIONS OF *CATHARANTHUS ROSEUS*

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### ABSTRACT

*Catharanthus roseus* (L.) G. Don, which is an important alkaloid-yielding medicinal and ornamental plant belonging to family Apocynaceae. It is an evergreen shrub and found to grow in the world in many places around the country. The genus *Catharanthus* comprises 8 species, out of which seven species are endemic to Madagascar namely *C. roseus*, *C. coriaceus*, *C. lanceus*, *C. longifolius*, *C. ovalis*, *C. scitulus* and *C. trichophyllus* where as one is confined to India and Sri Lanka that is *C. pusillus*. The genus *Catharanthus* is well reported for producing biologically active terpenoid indole alkaloids (TIAs) with over 130 compounds isolated and identified. Alkaloids of this plant have a great medicinal importance to treat diabetes, malaria, menorrhagia, Hodgkin's disease, circulatory ailments, cancer etc. *C. roseus* has a high salt tolerance, up to 2000 ppm. Several scores of ornamental cultivars of *C. roseus* bred for differing shoot habit, time of blooming, petal coloration and suitability for cultivation in homes and gardens are in vogue worldwide. Though considerable variations can be observed in gardens around the world, attempts have not been made so far to study the morphological relations among different species of *Catharanthus*. In view of these facts the study was conducted for the identification of plant by doing assessment of morphological relationship between two selected species of *Catharanthus* using leaf – length, breadth, seed- colour, texture, stem- colour, texture, bark, etc., may be useful to legitimize conservancy of commercially important species. Thus a complementary method based on plant morphology for the identification of *Catharanthus* species of the region is essential and is provided. In this context, this work can lead to development of an efficient protocol to study the morphological relationship between two selected species of *Catharanthus* using morphological characters.

**Key words:** Intraspecific Variations, Medicinal Plant, Observing and Phenotypic Characters.

### INTRODUCTION

*Catharanthus roseus* (L.) G. Don (family Apocynaceae) is an ornamental plant with medicinal values. It is an evergreen shrub and found to grow in the world in many places around the country. Markgraf (1976) distinguishes 7 species (excluding *C. pusillus*) in

the genus *Catharanthus* which includes besides *C. roseus*, namely *C. coriaceus*, *C. lanceus*, *C. longifolius*, *C. ovalis*, *C. pusillus*, *C. scitulus* and *C. trichophyllus*, of which *C. pusillus* is endemic to India whereas others are endemic to Madagascar. *C. roseus* has a high salt tolerance, up to 2000 ppm, and water stress too. Several scores of ornamental cultivars of *C. roseus*, bred

for differing shoot habit, time of blooming, petal coloration and suitability for cultivation in homes and gardens are in vogue worldwide studied by Snoeijer (2001) and van der Heijden *et al.* (2004). An important breeding objective for the genetic improvement of ornamental cultivars is the incorporation of resistance towards the fungal pathogens *Pythium aphanidermatum* and *Phytophthora nicotinae* to which most of the ornamental cultivars are susceptible. *C. roseus* has potent secondary metabolism responsible for monoterpenoid glucosides and other terpenoid compounds, steroids, phenolics, flavanoids, anthocyanins and 130 terpenoid indole alkaloids (TIAs) observed by Facchini (2001), van der Heijden *et al.* (2004) and Pandey-Rai *et al.* (2006).

The widely used anticancer TIA drugs vinblastine and vincristine made by Leveque *et al.* (1996) are semisynthesized from their natural precursor's vindoline and catharanthine that are obtained from *C. roseus* root and shoot organs. Ajmalicine, a cardiactonic TIA drug is also extracted from *C. roseus* roots by Leveque *et al.* (1996). *C. roseus* is one of the highly investigated plant species, with genetic, proteomic, metabolomic and biotechnological studies in progress by various scientists like Kulkarni *et al.* (1999), van der Heijden *et al.* (2004), Jacobs *et al.* (2005), Memelink (2005), Ledue *et al.* (2006) and Rischer *et al.* (2006). Some of the features of *C. roseus* that make it a suitable genetic system are the biannual, seed cyclable, herbaceous perennial habit, diploidy ( $2n = 16$ ; 1500 Mbp =  $12 \times$  *Arabidopsis thaliana* genome) and amenability to controlled pollination and micropropagation investigated by Mishra and Kumar (2000), van der Fits *et al.* (2000) and Debnata *et al.* (2006). Many of the genes involved in TIA biosynthetic pathway of *C. roseus* have been cloned and sequenced for the analysis of their expression in various plant organs by Geerlings *et al.* (2001), van der Fits and Memelink (2001), Facchini and St-Pierre (2005) and Mahroug *et al.* (2006). Initially, this plant were grown as garden plants because of their beautiful flowers of different colours, such as pink, red, white etc. Nowadays, new and

improved varieties of *Catharanthus* are also available.

In view of these facts the study was conducted for the development of an efficient protocol to study the morphological relationship between two selected species of *Catharanthus* using morphological characters.

## MATERIALS AND METHODS

### **Collection of plant material:**

The fresh plant material of *Catharanthus roseus* was collected from three (3) different locations of departmental garden of Patna Science college campus, Patna University, Patna district, Bihar state, India, in the month of July 2014 (Fig. 1). The plants were identified, confirmed and authenticated by Dr. M. P. Trivedi, Associate Prof. in Botany of Patna Science College, Patna similar work done by Gopala Krishna Bhat (2004). After authentication of the plant, morphological studies carried out including parameters are height of plant, leaf length and breadth, diameter of flowers, flower's color, floral variations and others this was done by Barua *et al.* (2007) also on other plant.

### **Plant:**

Appearance of the 05 plants observed and categorized. Their height was recorded and means value was taken.

### **Stem:**

Stem colour, texture, length and width of 05 stems were measured.

### **Leaf:**

The length and width (broadest width) of 05 leaves were measured. The length was taken from the base of the leaf lamina to the leaf apex while the width was from one end of the broadest section to the other. Leaf Area, Colour-above, Below, Shape, Venation, Presentation and Type were also recorded.

### **Flower:**

The diameters of 05 flowers were measured. Flower colours were observed and its floral

variations were also recorded. Flower-Petal, Sepal, Androecia, Gynaecium and their Type were also recorded.

**Fruit:**

Five fruits obtained from each of the locations were used for the measurement. Their colour, shape, type and size were measured.

**Seed:**

Five seeds obtained from each of the locations were used for the measurement. The length of each seed was taken from the tip to the base while the width was taken from one end of the widest section to the other of the seed. Their colour, shape and size were also observed.

**Root:**

Five roots obtained from each of the locations were used for the measurement. Their texture and type were recorded.

**RESULTS AND DISCUSSION**

**Plant:**

*Catharanthus roseus* is an evergreen, perennial, glabrous and erect or decumbent much branched under shrub, often woody at base. It is an erect shrub that grows up to 1.05 meter in height and has cylindrical stems (Fig. 1 and Fig. 2).



**Figure 1: White plant of *Catharanthus roseus***

**Figure 2: Pink plant of *Catharanthus roseus***

**Stem:**

Stem is usually with white latex and an unpleasant smell, irregularly and nodular. Stems narrowly winged, green or red, shortly hairy to glabrous, often woody at base. It is an erect shrub that grows up to 1.05 meter in height and has cylindrical stems (Fig. 3 and Fig. 4).



**Figure 3: Stem of *Catharanthus roseus* white**



**Figure 4: Stem of *Catharanthus roseus* pink**

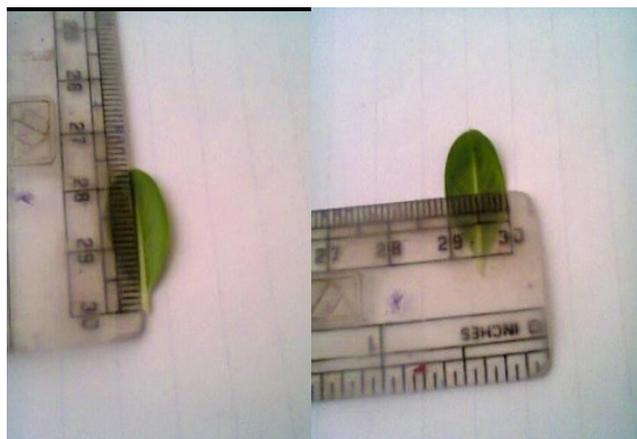
**Leaves:**

Leaves decussately opposite, simple and entire; stipules 2–4 at each side of the leaf base; petiole 2.5–11.07 mm long, green or red; blade elliptical to obovate or narrowly obovate, 2.53–8.59 cm × 1–5 cm, base cuneate, apex obtuse or acute with a mucronate tip, herbaceous to thinly leathery, glossy green above and pale green below, sparsely shortly hairy to glabrous on both sides. Leaves herbaceous to thinly coriaceous, opposite, mucronate, with a fringe of intra- and interpetiolar colleters ; secondary veins forming an angle of at least 45 ° with the costa .secondary veins more or less conspicuous, 7-15 on each side; tertiary venation inconspicuous (Fig. 5 and Fig. 6).

**Figure 5: leaves *Catharanthus roseus* white**



**Figure 6: leaves of *Catharanthus roseus* pink**



**Flowers:**

Inflorescence terminal, but apparently lateral, 1–2-flowered. Flowers bisexual, 5-merous, regular, almost sessile; sepals slightly fused at base, (2–)3.5–5.9 mm long, erect, green; corolla tube cylindrical, 1.9–3.5 cm long, widening near the top at the insertion of the stamens, laxly shortly hairy to glabrous outside, with a ring of hairs in the throat and another lower down the tube, greenish, lobes broadly obovate, 1–2(–3) cm long, apex mucronate, glabrous, spreading, pink, rose-purple or white with a purple, red, pink, pale yellow or white centre; stamens inserted just below the corolla throat, included, filaments very short; ovary superior, consisting of 2 very narrowly oblong carpels, style slender, 13–25 mm long, with a cylindrical pistil head provided at base with a reflexed transparent frill and with rings of woolly hairs at base and apex, stigma glabrous ( Fig. 7 and Fig.8).



**Figure 7: Flower of *Catharanthus roseus* white**

**Figure 8: Flower of *Catharanthus roseus* pink**

**Fruit:**

Fruit green, also when mature, composed of two follicles, 2–5 cm long, sometimes one aborted or reduced, erect or slightly spreading with an angle up to 60°. Fruit is, laxly shortly hairy to glabrous, green, dehiscent, 10–20-seeded. Seeds oblong, 2–3.5 mm long, grooved at one side, black. Seedling with epigeal germination. Follicle cylindrical, striate, 4.5-15.5 x as long as wide, 1.1-3.9 x 0.1-0.5 cm, inside glabrous, dehiscent at the adaxial side, seeds numerous. (Figure 9 and Figure 10).



**Figure 9: Fruit of *Catharanthus roseus* white**

**Figure 10: Fruit of *Catharanthus roseus* pink**

**Seed:**

Seed black, oblong; testa rugose; hilum lateral; cotyledons flat, shorter than the radicle; endosperm scanty. Seed grooved at one side, 1-3 x 0.5-0.9 mm; cotyledons slightly shorter than the radical (Figure 11).



**Figure 11: Seed of *Catharanthus roseus***

**Root:**

Its roots are tuberous with pale brown cork, roots up to 90 cm long deep into soil (Figure12).



**Figure 12: Root of *Catharanthus roseus***

### CONCLUSION

Morphological evaluation of *Catharanthus roseus* is for whole plant provided specific parameters that will be useful in scientific evaluation, identification and authentication of the plant and also the survival of this important medicinal plant. Due to its high demand over the world market the genuine plant (i.e. *Catharanthus roseus*) is in very high demand. The roots of this species are mainly explored rather than other parts. The analytical UV spectroscopy data revealed that secondary alkaloids are also present in leaf, stem and root of both the variety. So other parts of both the variety can be explored for the isolation of bioactive compound. Further this commercial plant can be minimized from over exploitations.

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