International Journal of All Research Education and Scientific Methods (IJARESM),
ISSN: 2455-6211, Volume 11, Issue 10, October-2023, Available online at: www.ijaresm.com

# A Brief Review on Potential Flowering Plant in Plantaginaceae: Amazon Blue

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## ABSTRACT

**Amazon Blue popularly known as Brazilian snapdragon and is a introduced variety of blooming plant in India from Southeast Brazil. The purpose of this research was to write a concise review of 'Amazon Blue' based on the facts available. For this work, gathers all accessible data from various sources. It is generally cultivated as shrubby perennial ornamental plant having repeated year round blooming. Bright blue colour flowers are the eye catching feature of this plant, therefore normally we can use this as a pot plant, hanging plant, border plant or ground cover plant in public spaces and also the flowers can be used as cut flowers in vase and bouquets as fresh or in dried form. Only a few works were carried out related to this plant including its economical importance, micropropagation and phytochemical with pharmacological aspects. This study is vital for future reference and further exploration of the plant 'Amazon Blue, in the family Plantaginaceae.**

**Keywords: Amazon blue, Brazilian snapdragon, Phytochemical, Planataginaceae**

## INTRODUCTION

Gardening is an aesthetic hobby of raising and caring of plants generally ornamental plants. The beautiful plants create a relaxing and pleasant mood while also adding a pleasing aesthetic to the surroundings.

The majority of blooming plants are solely used for aesthetic purposes in gardens, and they are underutilised in other aspects. Some examples of decorative plants with medicinal benefits are lavender (Lavendula spp. ), marigold (Tagetes erecta), yarrow (Achillea millefolium), and others.

The flowering plant Amazon Blue also known as Brazilian Snapdragon was placed under plantaginaceae, most of the members of this family is flowering plants.

This plant is a favourite one to the gardeners due to their disease tolerant and year round blooming features, also plant produce more number of flowers when allow maximum sunlight and minimal care with proper drainage and pruning at regular intervels. Some studies of this plant carried out by researchers revealed the presence of secondary metabolites especially terpenoid compounds.

Secondary metabolites are the compounds have no function in primary metabolism but they have defensive function against insects, stress condition, diseases etc.(Heldt and Piechulla,2011) .

Secondary metabolites includes alkaloids, flavanoids,terpenes, glycosides etc., and these compounds are widely used in medicinal and pharmacological fields. Flower value of this plant is also important, therefore it can be also use in horticulture field too.

For this review article preparation, collects all the available information about the plant from the journals, books, internet sites. Collect the plant information such as family, genus, species, synonym and the morphological features such as habit, habitat, leaf, stem, flowers obtained from several internet sites. Data about Phytochemical compounds, biological properties and economic importance pick up from research articles from journals. General informations gathered from books.

Numerous articles read for this study. Content of the article papers examined for the relevance of the study. From the papers, select only few papers that closely related to the work. research articles of this plant are very few in number out of total articles. All collected informations are read and reviewed.

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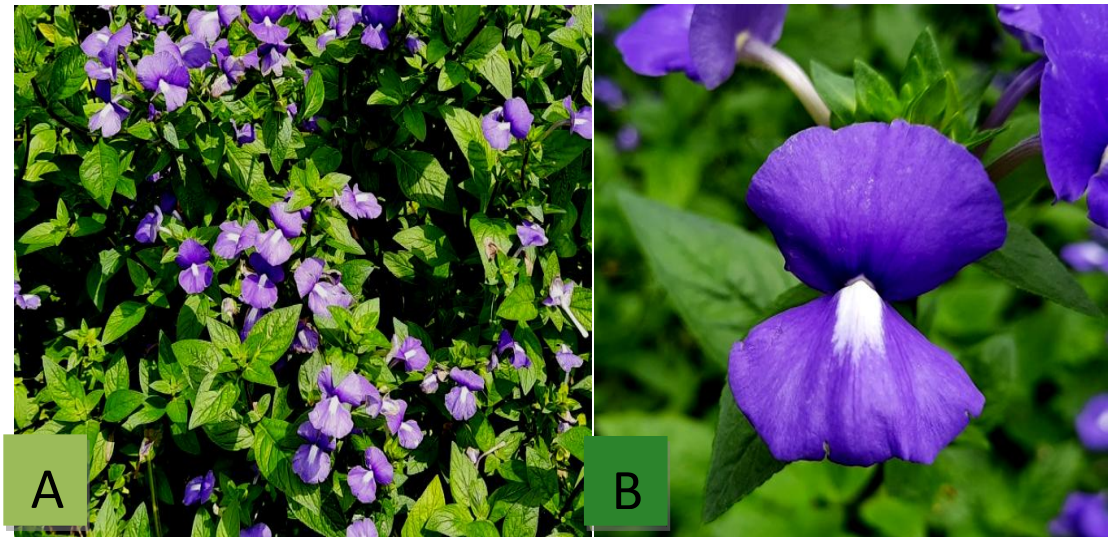


**Figure 1 A shows the habit of Amazon Blue; Figure 1 B shows the blue colour flower of the plant**

**Morphological And Taxonomical Information**

Amazon Blue belongs to the family Plantaginaceae and it is previously placed under Scrophulariaceae family (Ronse,2001). Past years Plantaginaceae was a small family with few generas but molecular analysis (DNA sequence studies) of Scrophulariaceae family leads to the enlargement of Plantaginaceae (Paul E. Berry, 2021; Albach et al., 2005). Some internet sites and databases are currently shows Amazon Blue belongs to Scrophulariaceae and others are shown as plantaginaceae. The plant bloommed throughout the year with delightful blue colour snapdragon like flowers have striking central white spot. The spikes of blue flowers have the elongate and slender floral tube with bilabiate corolla arranged as upper and lower fan shaped petals. Its flowers are long lasting for several weeks (Billiet, F**.** 1991) so now it is used as cut flowers. It is an evergreen shrublet grown in full sun or partial sun and slightly drought tolerant. This plant grow anywhere always with minimum care. Trimming of deadheaded flowers and withered or shrivelled leaves to keep it tidy and aesthetically pleasing. Plants will spring back after a hard prune. Generally free from serious diseases and pest attacks. There is no too much informations regarding morphotaxonomical features of this plant in published research articles.

**Table I Shows the common names, binomial and synonyms of the plant**

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|---|---|
| BINOMIAL WITH SYNONYMS | Stemodia azurea Linden.(1862)<br>Otacanthus caeruleus Lindl. (1864)<br>Tetraplacus taubertii Mez (1890)<br>Otacanthus azureus(Linden) Ronse. (2001)<br>Achetaria azurea(Linden) V.C.Souza (2009)<br>Matourea azurea (Linden)Colletta & V.C Souza (2020) |
| COMMON NAMES | Amazon Blue, Brazilian Snapdragon |

Stemodia azurea Linden. Cat.Pl.Exot.(Linden.) 17: 6 (1862) - Achetaria azurea (Linden) V.C.Souza, Pesquisas, Bot. 60: 90 (2009)- Otacanthus caeruleus Lindl., Ann. Gén. Hort. xv. (1862 ?) 53:J. Gén. Hort. 15: 53 (1864). Otacanthus azureus (Linden) Ronse, Brittonia 53(1): 144 (2001). Matourea azurea (Linden) Colletta & V.C.Souza, Taxon 69(6): 1356 (2020). Tetraplacus taubertii Mez, Bot. Jahrb. Syst. 12(1-2, Beibl. 27): 16 (1890).

According to J. S Gamble, family plantaginaceae contains plants with spicate small bracteates flowers with four sepals and salver shaped corolla with four stamens inserted on the corolla tube. Filaments are capillary and persistant. Versatile anther and superior ovary with one to four cell have one or more ovules in each cell. Filiform style with sigmatic hairs, fruit is capsule, seeds are peltate and cylindric embryo. Amazon blue has 2 fan shaped corolla with stamen inside the corolla tube have 4 sepals. Hypgynous ovary have hairs but do not observe any seed formation, normally this plant propagated through cuttings.Taxonomic positions of amazon blue showing on the following table II based on different classifications.

| | |
|---|---|
| **Five Kingdom Classification** | Kingdom : Plantae<br>Sub Kingdom : Viridiplantae<br>Infra Kingdom : Streptophyta<br>Super division : Embryophyta<br>Division : Tracheophyta<br>Class : Magnoliopsida<br>Super order : Asteranae<br>Order : Lamiales<br>Family : Plantaginaceae<br>Genus : Otacanthus<br>Species : Otacanthus caeruleus Lindl. |
| **APG IV Classification** | Domain : Eukaryota<br>Kingdom : Plantae<br>Clade : Angiosperms<br>Clade : Eudicots<br>Clade : Core eudicos<br>Clade : Superasterids<br>Clade : Asterids<br>Clade : Euasterids I<br>Order : Lamiales<br>Family : Plantaginaceae<br>Tribe : Gratioleae<br>Genus : Otacanthus Lindl.<br>Species :Otacanthus caeruleus Lindl. |
| **Benthm and Hooker Classification** | Kingdom : Plantae<br>Class : Dicotyledonae<br>Sub class : Gamopetalae<br>Series : Biarpellatae<br>Order : lamiales<br>Family : Plantaginaceae<br>Genus : Otacanthus<br>Species : Otacanthus caruleus Lindl. |

**Phytochemical And Medicinal Information**

Studies of Eloisa Andrade et al.,(2006) indicated that the Amazon Blue essential oil is terpenoid composition. Their research revealed that compound trans – pinocarveol is one of the significant monoterepene and β-Copaen-4α-ol significant sesquiterpene, also both are found in leaves, stems and flowers of Amazon Blue. More trans – pinocarveol has been found in leaves than in stems or flowers, while more of sesquiterpene compound β-Copaen-4α-ol has been found in flowers than leaves or stems. Terpenoids are regarded as a commercially important compound found in essential oils of plants (Saxena et al.,2013). Based on the quantity of their isoprene unit building blocks, terpenes are divided as hemiterpenes, monoterpenes, sesquiterpenes, diterpenes, triterpenes, and tetraterpenoids. Terpenes are crucial for a variety of functions, including plant defence, pollinator attraction, therapeutic qualities, and other processes.

The compound trans – pinocarveol present in oil of amazon blue also reported some other plants such as, aerial part of Ageratum conyzoides, seed of Coriandrum sativum, rhizome of Curcuma amada, tuber of Cyperus rotundus, seed of Lantana camera, flower of Magnolia grandiflora, leaves of Mentha arvensis etc. The trans – pinocarveol is sterioiosmer form of pinocarveol compound with molecular formula $C_{10}H_{16}O$ (www.Pubchem). Copaenes are tricyclic sesquiterpenes, generally **α-copaene**, is the common chemical name of an oily liquid hydrocarbon and it is found in a number of essential oil-producing plants (www.Pubchem). No further work occurs related to this compound.

According to the Pooter et al.,(1989) studies essential oil of Amazon Blue contains monoterpenes such as Myrtenal, myrtenol and sesquiterpene α humulene along with trans – pinocarveol and copaenes. Myrtenal also found in – cardamom, orange, lemon, spearmint, pepper, thyme, juniper, calamus, ginger, myrtle, lemon balm, calabash, nutmeg, parsley seed and other plant oils (www.Pubchem). Myrtenol found in citrus oils, ginger, peppermint, hops, black tea,

black pepper, raspberries, blackberries, and myrtle(www.pubchem). Humulene is the characteristic terpene of hops, Humulus lupulus, but it is also found in cannabis, sage, and ginseng (pubchem).

Emeline Houel et al.,(2013) reveals that the essential oil of Amazon Blue have antidermatophytic activity against fungi that causing human dermatomycosis. Most of the reported phytochemical studies carried out by using their essential oils and not use the pure extract studies.

**Economical And Horticultural Importance**

Floriculture is a branch of horticulture, it includes the cultivation of ornamental plants, foliage plants, ornamental and lawn grasses, cut flowers etc. In India flowers used for religious and cultural purposes , interior decorations in houses, auditoriums, apartments, offices, shops etc., women hair braiding, special occasions like birthdays, wedding, anniversaries, meetings etc. and also used in commercial and industrial sectors such as perfume, essential oil extraction, cosmetic, food and beverage industries.

Amazon blue can be commercially cultivate with floriculture aspects. The fragrance and compounds in flowers and leaves of this plant useful in the perfume, cosmetic, food and beverages sections for making useful products. Based on the studies of Geerston(1990) and Anderson R.G(2004), they are states that, the flower spike of Amazon Blue used as cut flowers in bouquets, vase flower,floral baskets and other arrangements. Also states that,vase with sugar containing solution helps to increase the vase life of the flower. We can also use this flower in dry flower industry, making of resin floral jewellery by using live or dried flowers.

**Micropropagation And Developed Varieties**

In vitro propagation investigations of Otacanthus caeruleus Lindl were undertaken by Anne C Ronse and Maurice P. De Proft (1992). Explants of leaves and stems were used. They provide different growth regulators for the experiment and the plants are propagated in both MS medium and the Nitsch mediums with the addition of NAA and 2,4-D and micropropagation studies of Ronse et al., (1997) states that in vitro growth and morphology of Otacanthus caeruleus influenced by micro environmental factors such as,macro nutrients,irradiance,temperature. In 2005, inventor Carsten Leth developed and patented (USPP17501P2) a new cultivar variation of Otacanthus called 'Calanda' in the United States. Calanda is a bushy, compact shrub with a distinctive appearance.

## CONCLUSION AND FUTURE SCOPE

We can use this plant as a possible source for pharmaceutical products because the presence of secondary metabolites in it implies that it has therapeutic value. Its blossoms are attractive and it can be commercially cultivated based on floriculture aspects in India. This plant only need very minimal care and almost a pest free plant, so it is a good choice for gardeners. Overall, we may conclude that it is a medicinally valuable but underutilised aesthetically pleasing plant. Only a very less studies were implemented related to this plant including plant description and phytochemical aspects. So this work is crucial for the future reference as well as scope of studies of the plant Amazon Blue.

## ACKNOWLEDGEMENTS

The authors are grateful to the Head of the Department, Department of Botany, TKMCAS, Kollam, Kerala, for providing study facilities. They also thank the Head of the Department, Department of Botany, Kariavattom Campus, University Of Kerala, Thiruvananthapuram, Kerala, for identifying and depositing plant material in the herbarium.

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