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Allamanda Blanchetti, Purple Bloom - A Review

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Abstract:

Allamanda blanchetti, is a perennial flowering shrub in the family Apocynaceae. This plant isnative to Brazil, but also found in various parts of the world. Its common name is purple allamanda or violet allamanda and it iscultivated as an ornamental plant. It contains secondary metabolites such as flavonoids, phenols, saponins, terpenoids, tannins, and alkaloids; some of which are employed in the traditional medicine. It has remarkable bioactivities such as antioxidant, cytotoxic, thrombolytic, anti-proliferate and antimicrobial activities as evident by ppharmacological studies. This review aims to elucidate the overviews of various biological activities and uses of *A.blanchetti,* which is a less known among allamanda species.

Keywords **— Allamanda, Purple-bloom, Bioactive, Antioxidant, Antibacterial**

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I. INTRODUCTION

The plant Allamanda which belongs to the family Apocynaceae is distributed throughout the world. It consists of 15 species (*A. augustifolia, A. blanchetti, A. caccicola, A. cathartica, A. doniana, A. laevis, A. martii, A nobilis, A. oenotherifolia, A. polyantha, A. puberula, A. schottii, A. setulosa, A. thevetifolia, and A. weberbaueri*) [1].*Allamanda blanchetii*. ADC. (Synonym: *Allamanda violacea Gardn.*), is an ornamental plant commonly known as purple allamanda or violet allamanda. The light green leaves are arranged in whorls on weak with sprawling stems. It can grow upto 2–8 m in length and much branches spread rapidly by layering. Its stem is greyish, cylindrical, and glabrous or puberulous. It has the capability to propagate both by seeds and vegetative [2,3]. It can be allowed to grow rapidly on arbor or other support; it also makes an attractive free-standing specimen shrub with careful pruning. Allamanda is used to grow over a wall and makes a beautiful hanging basket and also tohide the bottom of a mailbox or pole. The plant extract has extensive medicinal properties, but it may be noxious if the extract is not properly prepared. The ethanolic extracts of roots, stems and leaves of the plant have cytostatic and cytotoxic activity, whereas the floral extracts have anti-dyslipidemic, anti-diabetic and anti-oxidant activities [4,5].*A. blanchetti* is reported to produce plumericin, isoplumericin and 5, 6-dimethoxycoumarin (unckalin), which are responsible for its pharmacological properties[6].Among the allamanda species, *A. blanchetti* is less known, and hence this review was synthesized on available information on its bio-prospecting potential.

II. TAXONOMIC CLASSIFICATION

Domain: Eukaryota
Kingdom: Plantae
Phylum: Spermatophyta
Class: Dicotyledonae
Order: Gentianales
Family: Apocynaceae
Genus: Allamanda
Species: *Allamanda blanchetti*

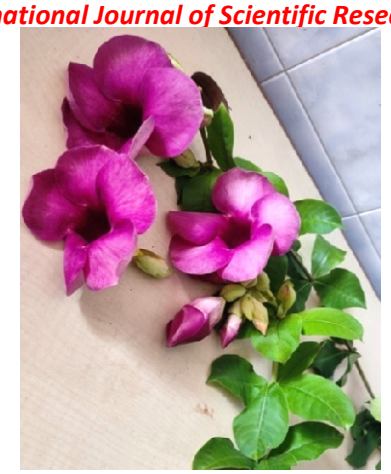
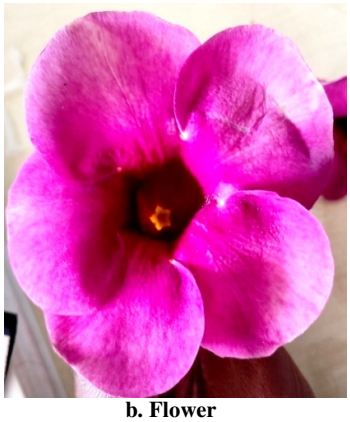


Fig.1.a. Plant of *Allamanda blanchetti*



b. Flower

C. Leaf and Stem

III. IDENTIFICATION

Botanical Name:
*Allamanda blanchetti*A.DC.
Synonym:
Allamanda violacea
Common Name:
Purple allamanda
International Common Name:
allamanda-roxa
Local Common Names:
Portuguese Brazil **-**alamanda-de-jacobina; allamanda-rosa; quatrapatacas
English – cherry allamanda, violet allamanda, purple trumpet flore, violet allamanda

IV. Botanical morphology:

A. Habitat:
Allamanda blanchetti has been introduced as an ornamental plant. This species is native to Brazil and found cultivated in Singapore, Puerto Rico, Laos, India, Colombia, the Lesser Antilles (Saba) and on several Pacific islands .*A. blanchetii* grows within the dry forest regionsand it isreferred to as the Caatinga, among its native distribution range in Brazil. It mostly occurs on rocky outcroppings [7]. It is usually found in forest edges, disturbed areas, abandoned gardens, roadsides, and farms. It is also found in secondary dry forests, mangrove swamps and lowland riverbanks [2].

B. Stem:
It has multi-trunked or clumping or climbing stems suckering from roots [3]. The stem can grow up to 2 m tall and 2-3 m wide. But it can grow up to 5 m in height when climbing over other vegetation [2]. It emits a milky white sap when stems are snapped, damaged or broken [8].

C. Flower:
A.blanchetti has numerous bisexual flowers with cymose terminal or axillar inflorescence. It has 5 rounded lobes (pink to reddish purple color) partially overlapped with each other with 1 cm long peduncle. The petals are 5 cm in diameter with 6-9 cm long campanulated corolla [8, 9] The inflorescence of this plant opens two flowers per day [7].The flowers produce an average of 36.6 µl of nectar, which attracts the floral visitors [10].

D. Foliage:

The leaves are arranged in whorls of 3 to 4; which has elliptical shape with acuminate apex, about 10 cm – 20 cm wide. It has acute base and entire leaf margins with a prominent mid-vein. The leaf surface is hairy, glabrous, shiny, and dark green. The lower surface of the leaf is thick and yellowish green in color; stipules aretransformed into 4 small glands, petioles are4-12 mm long[3,11]

E. Fruits:

The fruits of *A.blanchetti* are globose. It has ellipsoidal follicles, enclosed with spines, which contain numerous flattened seeds. The seeds are equipped with a membranous wing [2].

V. Physiology:

Usually, between February to July, *A. blanchetii* produces flowers, which will be high in March-April. Following the flowering, fruits are produced and continued until September [10].

VI. Reproductive biology:

Because of the tubular hermaphrodite flowers with strong herkogamy *A.blanchetii* is unable to perform self-pollination. Mostly the flowers are pollinated by insects, especially by the bees and butterflies. The main pollinator of this species is the euglossine bee (*Eulaemanigrita*). The pollen grains are deposited on the upper side of the style head. Some of the secondary pollinators are listed from the genera Anteos, Phoebis and Epargyreus [10].

6. Genetics:

The reported chromosome numbers for *A. blanchetii* is 2n = 18 (in India) [46]; 2n = 18, 36 (in Brazil) [47]; 2n = 36 (in Thailand) [12].

VII. Chemical constituents:

Allamanda blanchetii contains variety of phytochemicals. Each plantpart contains various phytoconstituents; of which, iridoid lactones, plumericin and isoplumericin are predominant. The ethanolic extracts of *A.blanchetti* are successively fractionated with hexane, dichloromethane, ethyl acetate and butanol. The eluted fractions from leaf and stem extracts contain β-sitosterol, stigmasterol, 5,7,4'-tri-hydroxyisoflavone, kaempferol, kaempferol-3-Oβ-arabinofuranoside, quercetin-3-O-glucose. The fractions of root extract contain p-coumaric acid and eudesmane compounds [13].5,6-Dimethoxy-7-Hydroxycoumarin also called Umckalinis reported to bepresent inethanol extract of the root bark of *A.blanchetii*. [6]. Both aqueous and methanolic extracts of this plant species possess higher amount of polyphenol, flavonoids and polysaccharides, highlighted as follow.

A. Leaves

The aqueous leaf extract contains 1.4018 mg/gm tissue of polyphenols, 1.0366 mg/gm tissue of flavonoids, 231.7242 mg/gm tissue of polysaccharides. Methanolic leaf extract contains 2.7438 mg/gm tissue of polyphenols, 2.1530 mg/gm tissue of flavonoids, 231.7242 mg/gm tissue of polysaccharides [14].

B. Flower

The aqueous flower extract contains 4.5054 mg/gm tissue of polyphenols, 14.9961 mg/gm tissue of flavonoids, 932.4809 mg/gm tissue of polysaccharides. Methanolic flower extract contains 3.1074 mg/gm tissue of polyphenols, 19.6349 mg/gm tissue of flavonoids, 725.1162 mg/gm tissue of polysaccharides [14].

C. Stem

The aqueous stem extract contains 0.6814 mg/gm tissue of flavonoids, 67.3245 mg/gm tissue of polysaccharides. Methanolic stem extract contains 1.2744 mg/gm tissue of polyphenols, 1.3990 mg/gm tissue of flavonoids, 86.2138 mg/gm tissue of polysaccharides [14].

TABLE 1: BIO-POTENTIAL OF *A.BLANCHETTI* AND OTHER *ALLAMANDA* SPECIES

Species	Extracts	Activity	Author & Year
A.Blanchetii	Flower,leaf,stem (methanolic extracts)	Antioxidant activity	Gosh and Banerjee,2018 [14]
	Leaf,Stem,root (Ethanolic extracts)	Anti-proliferative Activity	Gosh et al 2019 [31]
	Floral extracts	Hypo-lipidemic and hypoglycaemic activity	Sethi et al 2012 [5]
	Leaf extracts	Disease Resistant activity	Oliviera et al 2019 [15]
	Aqueous Leaf Extracts	Antimicrobial Silver nanoparticles	Supriya and Navyashree [16]
	ligno-cellulosic stalk fiber	Thermal analysis of cellulosic fiber	Subramanian et al 2021 [17]
	stem extracts	Dye degradation	Sujitha and Kunta,2019 [18]
	floral extracts	Corrosion control	Anand and Balsubramaian 2011 [19]
	Leaf extract	Brine shrimp lethality assay, Thrombolytic activity, Membrane stability activity, Antimicrobial & antioxidant activity	Tasnua Sharmin et al 2013 [49]
A.cathartica	Leaf extract	Anti-oxidant and anti-proliferate activity	Amjad et al 2014 [21]
	Flower extract	anti-inflammatory activity	Hema,2014 [22]
	Leaf extract	Wound healing activity	Shivananda,2006 [23]
	Leaf extract	membrane stabilizing activity	R ehan et al 2014 [24]
	Leaf extract	thrombolytic activity	Rehan et al,2012 [25]
	Whole plant	anti-dermatitis activity	Ainun et al 2010 [26]
	Plant extract	anti-fertility activity	Singh and Singh,2018 [27]
	Flower and root extract	hepato-protective activity	Nisha and Jyoti,2014 [28]
	Plant extract	toxic studies	Rajamanickam and Sudha,2013 [29]
	Leaf and flower extract	anti-microbial activity	Hema and Krishnaveni,2014 [30]
	Leaf extract	Antioxidant activity	Conrad, 2013, [56] Sarker, 2014 [70] ,Omonhinmin, 2015 [67],
	Leaf,flower,root	Antioxidant activity	Mannan, 2017[59]
	Leaf extract	Cytotoxic activity	Hameed,2014 [69],Victor 2015 [68],Kupchan1974 [65],Tiwari 2002 [63], Sarker 2012 [62],Mehta 2017 [55],Mannan 2017[59]
	Latex extract	Cytotoxic activity	Das Nelaturi, 2017 [64]
	Bark	Nematicidal activity	Alen 2000 [57]
	Leaf and stem	Nematicidal activity	Fabiyi,2014[58]
	Flowers	Antidepressant activity	Bonomini, Tiago, 2017[50]
	Aerial plant parts	Antidiabetic activity	Chaithra Amin, 2017[51]
	Flowers	Anti-hyperlipidaemic activity	Bonomini, Tiago, 2017 [50]
	Leaves	Purgative effect	Akah,

			Peter,1992 [52]
	Stem powder	Tyrosine inhibitory activity	Yamauchi, 2011 [53]
	Leaves	Amylase inhibitory activity	Nguyen, 2015 [54]
	Leaves	Anti-rabies activity	Mehta, 2017 [55]
	Leaves	Antimalarial activity	Conrad, 2013 [56]
	Leaves and flowers	Pesticidal activity	Mannan, 2017 [59]
	Leaves and flowers	Pesticidal activity	Radhakrishnan, 2014 [60]
	Leaf, branch and stem	Anti-haemorrhagic activity	Otero, 2000 [61]
A.Polyantha	Seed extract	Antifungal activity	Bresciani et al,2020 [35], Bresciani and Regina,2013 [37] ,Isar Betrina,2014 [38]
A.Puberula	Leaf extract	Antibacterial activity	Nascimento et al 2020 [39]
	Pollen grain cell extract	Cell imaging	Sahana et al 2012 [40], Lohar et al 2013 [41], Sahana et al ,2013[42]
A.Schottii	Plant extracts	Cytotoxic activity	Nascimento et al 2014 [43]
	Plant extract	Anti-mitotic activity	Sousa et al 2009 [44]
	Flowers	Bio ethanol production	Rekha et al 2018 [45]

VIII. Pharmacological activities

A. Anti-oxidant potential

A.blanchetii has anti-oxidant potential as evident by DPPH(1, 1–Diphenyl-2-picrylhydrazyl) radical scavenging assay. The aqueous and methanolic extracts of flower has higher anti-oxidant activity than leaf and stem extracts [14].

B. Anti-proliferate activity

A.blanchetti is reported to have anti-proliferate activity. Ethanolic root extract of the plant species exhibits higher cytostatic and cytotoxic activity against K-562(cell line derived from Chronic Myeloid Leukemia in blastic crisis), BMEC (primary bone marrow endothelial cells)and HUVEC (primary human umbilical cord endothelial cells and BMEC) than the leaf and stem extracts [13].

C. Hypolipidemic and hypoglycemic activity

A.blanchetti is reported to have hypolipidemic and hypoglycemic activity as evaluated intwo different models, one is the triton WR-1339 induced hyperlipidemic in rats, and another one is the fructose-rich high fat diet (HFD). The floral extracts of *A.blanchetti*, in particular, the ether and chloroform fractions, have high potential for lipid and blood glucose management [5].

D. Mechanism of defence to disease in sugarcane

Leaf extract of *A.blanchetii* is reported to trigger disease resistant mechanism of smut-susceptible sugarcane variety. The test plants are sprayed with leaf extract of *A.blanchetii* and acibenzolar-S-metil (ASM - One of the most common elicitors which is used in the control of plant disease through induction of resistance) and then analysed for resistant gene expression. The plant resistance gene expression is found to be significantly greater in the treatment with *A.blanchetii* extract than that with ASM inducer. Peroxidase, chitinase and

SCNPR1genes are expressed as the same as of ASM [15].

E. Silver nanoparticle synthesis

The antimicrobial and antifungal properties of silver nanoparticles produced by the aqueous extracts of *A.blanchetii* are reported based on the Kirby Bauer disk diffusion method. The antibacterial and antifungal activity was evaluated against the fungus *Aspergillus nig*er and *Rhizopus stolonifera* followed by the bacteria *Escherichiacoli* and *Bacillus subtillis.* Based on the results, the aqueousleaf extract of *A.blanchetii* leaves is capable of producing silver nanoparticles, which have an excellent antimicrobial activity [16].

IX. INDUSTRIAL APPLICATIONS

A. Thermal analysis of cellulosic stalk fiber

Vegetable fibers of plant origin always have high demand to substitute the synthetic fibers in textile industries. Aligno-cellulosic stalk fiber extracted from *A.blanchetii* is thermally more stable than the raw fibers, because of the digestion of the hemicellulosic and other low temperature degrading components. This study indicates that the stalk waste of the *A.blanchetii* plant can be a promising source for the cellulosic fiber for textile composite and conductive carbon production applications [17].

B. Removal of malachite green dye

Malachite green is one of the most used industrial dyes. This dye can cause serious health hazards to aquatic fauna, flora and human beings, once it enters into the water bodies. The dye can be removed from the water bodies using active carbons, extracted from stem parts of *A.blanchetii* as evident byusing a statistical optimization modeling. Thisdye removal efficiency is retained by 80% even after five regenerations. This method was proved for its utility with real dye polluted industrial effluent samples [18].

C. Controlling corrosion of mild steel

Aqueous floral extract of *A.blanchetii* is reported to be efficient in corrosion inhibition and this efficiency is known to be higher with corrosion caused bysulphuric acid than citric acid [19].

X. OTHER SPECIES OF ALLAMANDA AND ITS IMPORTANCE

Allamanda is a genus of flowering plants being cultivated as ornamental plants for their large, colorful flowers [20]. Apart from *A.blanchetii* there are 13 to 15 valid species of Allamanda. They are *Allamanda angustifolia* Pohl, *Allamanda calcicole*, *Allamanda cathartica* L, *Allamanda doniana* Müll.Arg, *Allamanda laevis*Markgr, *Allamanda martii* Müll.Arg, *Allamanda nobilis* T.Moore, *Allamanda oenotherifolia* Pohl, *Allamanda polyantha* Müll.Arg, *Allamanda puberula* A.DC, *Allamanda schottii* Pohl, *Allamanda setulose* Miq, *Allamanda thevetifolia* Müll.Arg, *Allamanda weberbaueri* Markgr [1]. Most of the works have been carried out with *Allamanda cathartica,* which is reported foranti-oxidant and anti-proliferate activity [21], anti-inflammatory activity [22], wound healing activity [23], membrane stabilizing activity [24], thrombolytic activity [25], anti-dermatitis activity [26], anti-fertility activity [27], hepato-protective activity [28], toxicity [29] and anti-microbial activity [30]. The leaves and flowers of *A.cathartica* has traditionally been used as medicine to cure jaundice, malaria and enlarged spleen, because of presence of high levels of bioactive compounds in the plant species [31].The bioactive compounds commonly present in the Allamanda plants are isoplumericin, pulmericin, scoparone, allamandin, scopletin, pinoresinol and allamcin [13, 32, 33, 34, 48]. Seedsof *A.polyantha* have very good anti-fungal property against *Cryptococcus neoformans* and *C. gattii* [35,36,37,38].The leaves of *A.puberula* has significant antibacterial property due the presence of a variety of bioactive compounds which act as antibiotic [39]. Pollen grain of this species also is used in cell imaging of N_3 ions in the contaminated living cells using fluorescent probes [40, 41, 42]. *A.schottii* possesses pharmacological activities as

evident by several studies that include screening of bioactive compounds [33], evaluation of cytotoxicity[43], anti-mitotic activity towards sea urchin eggs [44] and production of bio-ethanol from flowers [45].

XI. Acknowledgements

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