

Review Article

Phytochemical and Micropropagation of *Caralluma diffusa* (Wight) N.E.Br.-A Review

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Abstract: *Caralluma* Genus belongs to family Apocynaceae host a number medicinally important succulent and non-succulent plant. These are perennial plants with a number of useful phytochemical constituents. *Caralluma diffusa* (Wight) N.E.Br. is one of this genus member which is less explored and little work was carried till now. It is also a succulent, perennial plant with flavonoids, saponins, pregnane glycosides etc. It can play a significant role in treating diabetes, inflammation, skin diseases, fevers and by acting as an antioxidant. The Present paper consists of the review of the complete phytochemical work and micropropagation protocols reported by various researchers regarding *C. diffusa*, till now.

Keywords: *Caralluma diffusa*, phytochemical constituents, antioxidant.

Introduction

Caralluma Genus consists of succulent and non-succulent plants belonging to family Apocynaceae. These are distributed in Asia, African and Mediterranean regions. Many of these family members secrete milky latex and are edible with medicinal significance (Bader *et al.*, 2003; Bensuzan, 2009). They are perennial and have useful pharmacological secondary metabolites like flavonoids, saponins, triterpenes, pregnane glycosides, tannins, phenols etc., Due to the presence of these phytochemicals; they possess many medicinal properties and are proved to treat number of diseases. These species are having antidiabetic, anticancer, antioxidant, antimicrobial, anti-inflammatory, hypolipidemic, analgesic, hepatoprotective activities (Venkatesh *et al.*, 2003; Latha *et al.*, 2004; Abdel-Sattar *et al.*, 2007; Habibuddin *et al.*, 2008; Medikundu *et al.*, 2010; Kumar *et al.*, 2011; Maheshu *et al.*, 2012; Shanmugam *et al.*, 2013).

Caralluma diffusa (Wight) N.E.Br. is a endemic, threatened succulent plant (Henry *et al.*, 1979; Srinivasan, 1987; IUCN, 2010). Plants are 60-70cm tall, quadrangular, leafless plants. Flowers are brick red or purple in colour, with yellowish stripes inside. Fruits are follicles with comose seeds. They flower throughout the year (Kumar *et al.*, 2013). Prabu *et al.*, (2013) has attempted to investigate the phytochemical constituents of this plant and later done Gas chromatography-Mass Spectrometry (GC-MS) studies. In their investigations they have used aerial parts of *C. diffusa* washed thoroughly with running tap water and rinsed with sterile distilled water. Chopped and shade dried into fine powder and stored in air tight plastic container for further use.

For phytochemical screening they have used petroleum ether, methanol, acetone and aqueous extracts. For GC-MS studies they have used methanol extract in the preliminary studies they have reported the presence of alkaloids, steroids, carbohydrates, terpenoids, glycosides,

saponins, flavonoids, phenols, fixed oils and fatty acids. Methanol extract was found to show more number of phytochemical when compared with other extracts. GC-MS chromatogram showed 18 peaks and representing 18 phytochemical constituents.

Prabhu *et al.*, (2013a) also reported the presence of 2-Furancarboxaldehyde 5-(hydroxymethyl) (28.6%) which has antimicrobial property; 1,5-Anhydro-6-deoxyhexo-2,3-diulose (17.19%); 1,3-Propanediol, 2-ethyl-2-(hydroxymethyl) (11.89%), n-Hexadecanoic acid (8.32%) and Oleic Acid (6.21%) as major constituents. Heptanoic acid, 6-oxo is a fatty acid which has antiviral activity; Tetradecanoic acid has antioxidant, lubricant, hypocholesterolemic, nematocide and cancer preventive. Hexadecanoic acid and Oleic acids have haemolytic, pesticide, antioxidant, anti-inflammatory, antiandrogenic, dermatitogenic and insectifuge properties.

Kalimuthu *et al.*, (2013) conducted GC-MS using the ethanolic extract of *C. diffusa* aerial parts. They have reported 21 compounds in their investigation. The major compounds found in their observations are 2-(3',4'-Dimethoxybenzoylmethyl) benzoic acid, [(E)-1-butyl-2-hex-2-enylidene] cyanamide, 6-[(N-Cyclohexylimino-N'-cyclohexylamino) methyl] benzimidazo [1,2-a] benzimidazole and some of the bioactive components are Neophytadiene, 2-Hexadecen-1-ol, 3,7,11,15-tetramethyl-, [R-[R*,R'-(E)]]- Hexadecanoic acid, Methyl ester (CAS). They have attributed the likelihood of antioxidant, antifeedant, antibacterial, anti-inflammatory activities for these isolated compounds. Neophytadiene existence can help for treatment of headache, skin diseases and rheumatism.

Bellamakondi *et al.*, (2014) attempted for in vitro cytotoxicity testing using *Caralluma* species (*C. umbellata*, *C. diffusa*, *C. attenuate* and *C. clasiantha*) on 9 different cell lines. Cell lines used for their study are Rat skeletal muscle cell line (L6), Human colon cancer cell line (Caco2) Human lung adenocarcinoma epithelial cell line (A549), Human prostate cancer cell line (PC 3), Human colon adenocarcinoma cell line (HT29), Human breast cancer cell line (MCF 7), Human cervix adenocarcinoma cell line (HeLa), African green monkey kidney cell line (Vero), Rat liver cell line (BRL3A). They performed MTT assay (3-(4,5-dimethyl thiazol-2-yl)-5-diphenyl tetrazolium bromide) and trypan blue dye exclusion experiments. In their in vitro cytotoxicity assays found that all *Caralluma* species tested have exhibited moderate toxicity and dose dependent response, against tested cell lines.

Prabu *et al.*, (2013b) have attempted for the in vitro propagation of *C. diffusa* using nodal segments of mature plant. They have sterilized washing thoroughly under running tap water for 20-30 minutes (min), and treated with the detergent Tween-20 (1% v/v) for 10 min and washed thoroughly with distilled water. Treated with Carbendazim (0.1% w/v) for 20 min. In laminar chamber then dipped in ethanol (60% v/v) for 1 min and finally treated with mercuric chloride (HgCl₂) (0.01% w/v) for 5 min. Washed 6-8 times with sterile double distilled water. They placed these explants on MS medium (Murashige and Skoog's, 1962) containing different concentration of Phytoregulators like BAP (6-benzylaminopurine); Kn (Kinetin); 2,4-D (2, 4-Dichlorophenoxy acetic acid); IAA (Indole acetic acid) and NAA (Naphthalene acetic acid). They have reported callus formation from the nodal explants after 30 days when placed on the MS medium containing BAP (0.5mg/l) + NAA (2.0mg/l) + Kn (0.25mg/l) with 83.3% as highest percentage of callus production. Callus colour was pale yellow to brown, compact to friable.

For shoot multiplication they have reported BAP (2.5mg/l) as best growth regulator with 6.40±0.34 shoots and 6.61±1.01cm shoot length. They have reported MS medium with BAP

(2mg/l) + NAA (0.5mg/l) +Kn (0.25 mg/l) as better combination for shoot regeneration using callus cultures. With this combination they have reported 6.3 ± 0.28 shoots and a shoot length of 6.2 ± 0.05 cm after 20 days of callus subcultures. For rooting they have used NAA, IBA (Indole-3-butyric Acid) combinations and finally reported half strength MS medium containing IBA (0.5mg/l) + NAA (0.5mg/l) as best. Completely formed plantlets were later acclimatized to field with 98% survival rates.

Kalimuthu *et al.*, (2014) reported *in vitro* propagation of *C. diffusa* using nodal explants. They have sterilized under tap water for 15 min, followed by Tween 20 detergent treatment for 10 min. washed thoroughly and treated with 70% ethanol in laminar chamber. Rinsed with sterilized double distilled water and treated with HgCl_2 0.12% for 3 min. rinsed 4-5 times with sterilized water. They have used MS medium containing different combinations of BAP, Kn, TDZ (Thidiazuron), NAA individually or in combinations. They have reported highest number of shoots (4.16 ± 0.30) on MS + BAP ($4.44 \mu\text{M}$) + TDZ ($0.90 \mu\text{M}$) medium. Further subculturing on to the same medium increased, shoot number to 17.33 ± 0.33 with shoot length of 4.17 ± 0.03 cm and 90.16% response. Shoots of 5-6cm were separated and placed on the rooting medium containing different concentrations of NAA. Best rooting response was observed with NAA ($5.37 \mu\text{M}$) and showed 90.33% response. Rooted plants were acclimatized, when transferred to pots containing red soil (1): sand (1): compost (1) ratio. They have recorded a survival rate of 93.83%.

Conflicts of interest

The author declares no conflict of interest.

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