INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Research Paper

Determination of Antioxidant Potential of Stem, Root and Callus Extract of *Caralluma stalagmifera* C.E.C. Fisch

T Veerabhadraiah*[*], A Sabitha Rani[2], G.Sulakshana[3], M Keerthi[4]

[1,2] *Department of Botany, University College for Science, Osmania University, Hyderabad, Telangana*
[3] *Department of Botany, Veeranari Chakali Illama Womens University, Koti, Hyderabad, Telangana*
[4] *Department of Botany, Telangana Social Welfare Residential Degree College for Women, Jagathgirigutta, Medchal-Malkajgiri, Telangana, India*

ARTICLE INFO

Published: 24 Nov 2025
Keywords:
Antioxidant activity; DPPH; Free radicals; Caralluma stalagmifera; Stem; Root; Callus culture; Bioactive compounds.
DOI:
10.5281/zenodo.17701493

ABSTRACT

Caralluma stalagmifera C.E.C. Fisch., an endemic medicinal plant of India, has been traditionally employed in the treatment of various ailments due to wide spectrum bioactive constituents such as pregnane glycosides, saponins, triterpenes, and steroids. In the present study, the antioxidant activity of methanolic extracts prepared from stem, root, and in vitro induced callus tissues was evaluated using DPPH free radical scavenging method. The results revealed significant variation in antioxidant potential among the different plant parts. The stem extract exhibited the highest free radical scavenging activity, followed by the root, while the callus extract showed comparatively lower activity. Thus, the present study on evaluation of antioxidant potential suggests C. stalagmifera can be a promising source of natural antioxidants for pharmaceutical industries.

INTRODUCTION

Medicinal plants are widely recognized as potential sources of natural antioxidants, which can neutralize free radicals and thereby prevent oxidative stress–related disorders such as diabetes, cancer, atherosclerosis and cardiovascular diseases. (Kishore, et al. (2010;Habibuddin et al., 2008; Marwah et al., 2006).

In the present investigation, the antioxidant potential of *Caralluma stalagmifera* stem, root, and callus extracts was evaluated *in vitro* using the DPPH free radical scavenging assay.(Gnanashree, et al,2018 Rajesh, B. et al. (2013). Rai, . et al. (2016). Kumari, et al..2018).

*Caralluma stalagmifera*C.E.C. Fisch. belongs to the family Apocynaceae, comprises nearly 200 genera and over 2500 species worldwide. In India,

***Corresponding Author:** T Veerabhadraiah
Address: *Department of Botany, University College for Science, Osmania University, Hyderabad, Telangana.*
Email : veerabhadra01988@gmail.com
Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

around 13 species and 7 varieties of *Caralluma* are recorded of which 11 are restricted to South India (Karuppusamy & Pulliah, 2007).(Sankaran et al., 2017) *Caralluma stalagmifera* is endemic to South India, bearing small dark-purple flowers and fleshy, leafless stems. Traditionally, *C. stalagmifera* has been employed in the treatment of diabetes, rheumatism, leprosy, fever, gastric problems, snake and scorpion bite and infections (Al-harbi et al., 1994; Tatiya et al., 2010; Bushnak et al., 2021). It exhibits various pharmacological properties such as antidiabetic, anti-inflammatory, antimicrobial, anticancer, and antioxidant activities (Bader et al., 2003; due to the presence of bioactive constituents like pregnane glycosides, saponins, flavonoids, triterpenes, and steroidal glycosides.(Veerabhadraiah et al 2024;Venkatesh et ,al,2012;Rana, et al. (2020).Rao, et al . 2012; Chaudhary & Singh, 2015)

Plants rich in phenols, flavonoids and steroidal saponins are of increasing demand as they are known to possess antioxidant compounds that can scavenge free radicals and play an important role in preventing diseases.; Although several synthetic antioxidants, such as butylated hydroxyanisole (BHA) and butylated hydroxytoulene (BHT) are commercially available, but are quite unsafe and their toxicity is a problem of concern. (Erel, 2004;). Hence, there is an increasing demand for plant-derived antioxidants.

In the present study, evaluation of antioxidant activity using methanolic extracts Raju et al., 2011).of stem, root, and callus extracts of *C. Stalagmifera* were assessed using DPPH free radical scavenging assay (Singleton et al., 1999; Nenadis et al., 2007;S). The findings showed variation in activity among different plant parts supporting its possible application in nutraceutical and pharmaceutical industries (Lanchhana et al., 2023; Deep et al., 2023; Wani et al., 2023; Ansari, et al,.2005.).

MATERIALS AND METHODS

The C. stalagmifera plants were collected from Medikonda village from Jogulamba Gadwal District, the southern part of Telangana state in India during the month of June-July in the year 2021. The plant was authenticated by the Department of Botany of Osmania University.

Drying & Extraction:

Preparation of extraction stem and root were collected from the field growing plants of *C. stalagmifera*. The plant parts thoroughly cleaned and cut into pieces, dried and powdered by mechanical grinder. The 50 gram powder sample was extracted with methanol by Soxhlet apparatus at 66-80 °Cfor analysis of presence of different phytochemicals.

Preparation of callus extraction:

Callus was initiated from the nodal explants of *C. stalgmifera* on MS medium in combination with 2.4-D (2, 4-Dichlorophenoxy acetic acid). Callus was induced from nodal explants within 10 days of inoculation Two monthold callus was collected, dried and extraction with Methanol inSoxhlet apparatus. antioxidant activity of methanol extract of in *vitro* callus was performed to know the important chemical compounds present in the callus.

Preparation of Extracts:

The powdered samples of stem, root and callus were subjected to extraction using methanol as solvent. Extraction was performed using Soxhlet apparatus and the filtrates were concentrated to dryness. The dried extracts were preserved in

airtight containers for evaluation of antioxidant activity.

DPPH Free Radical Scavenging Assay:

The antioxidant activity of methanolic extracts of stem, root, and callus was determined using DPPH free radical scavenging method. A stock solution of DPPH (0.3mM) was prepared in methanol and protected from light. Different concentrations of the extracts (15–200 µL) were prepared in DMSO. For each test, 150 µL of DPPH solution was added to 3 mL of methanol containing the extract, mixed well and incubated in the dark for 15 min. Absorbance was recorded at 516 nm using methanol as blank. Ascorbic acid served as the positive control.

The percentage of radical scavenging activity was calculated using the formula:

$$\% \text{ Antioxidant activity} = \left(\frac{\text{Control Absorbance} - \text{Sample Absorbance}}{\text{Control Absorbance}} \times 100\right)$$

RESULTS AND DISCUSSION

In the present study, a comparative analysis of the stem, root, and callus methanolic extracts of *Caralluma stalagmifera* was carried for evaluating the antioxidant potentia evaluated by DPPH assay.. The radical scavenging activity of the extracts was compared with that of the standard antioxidant, ascorbic acid.

1. Antioxidant Activity of Stem Extract:

Methanolic stem extract of *C. stalagmifera* displayed dose-dependent scavenging activity across the tested concentrations (15–200 µg/ml). The percentage inhibition increased gradually from 54.23% at15 µg/ml to 78.48% at 200 µg/ml. At intermediate concentrations, the activity was 62.87% (50 µg/ml) and 68.48% (100 µg/ml). The IC_{50} value of the stem extract was 98.6 µg/ml suggesting moderate antioxidant potential when compared with ascorbic acid (IC_{50} < 50 µg/ml).

2. Antioxidant Activity of Root Extract:

The methanolic root extract also exhibited strong scavenging potential, with inhibition values ranging from 58.47% at 15 µg/ml to 84.69% at 200 µg/ml. At 50 and 100 µg/ml, the activity recorded was 67.12% and 73.89%, respectively. The IC_{50} value of the root extract was 89.60 µg/ml, which is lower than that of the stem extract indicating that the root extract is relatively more efficient in free radical quenching.

3. Antioxidant Activity of Callus Extract:

The *in vitro*–derived callus extract demonstrated comparatively higher scavenging efficiency among the three extracts. The activity increased from 15 µg/ml (63.87%) to 200 µg/ml (87.12%) with intermediate concentrations showing 69.47% (50 µg/ml) and 76.87% (100 µg/ml). The IC_{50} value was 66.75 µg/ml, which was significantly lower than that of stem and root extracts highlighting the promising antioxidant capacity of callus cultures.

The antioxidant activity of all extracts followed a clear dose-dependent pattern. Among them, the callus extract exhibited the strongest radical scavenging activity (lowest IC_{50}), followed by the root extract and then the stem extract. Although ascorbic acid showed consistently higher scavenging potential across all concentrations, the results suggest that *C. stalagmifera* extracts, particularly from callus tissue, are effective natural antioxidants. The superior performance of callus cultures also indicates that in vitro propagation systems can be exploited for the sustainable production of antioxidant-rich bioactive

compounds, thereby reducing dependence on wild plant populations.

Table 1. Antioxidant activity of *Caralluma stalagmifera* stem,root and callus extract by DPPH assay.

Conc. of Methanol Extract in (µg/ml)	Ascorbic acid (%RSA)	Stem extract (%RSA)	Root extract (%RSA)	Callus extract (%RSA)
	% of free radical scavenging activity			
15µl	70.85	54.23	58.47	63.87
25µl	73.24	58.42	62.53	68.14
50µl	78.59	62.87	67.12	69.47
100µl	85.14	68.48	73.89	76.87
150µl	92.51	72.98	78.54	83.94
200µl	99.81	78.48	84.69	87.12

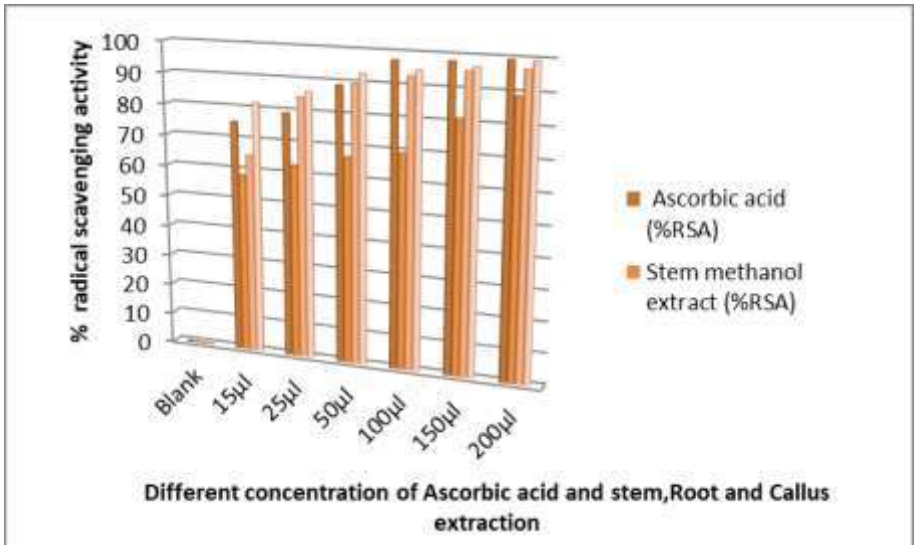

Fig1. Percentage radical scavenging activity of *Caralluma stalagmifera* stem, root and callus extract.

CONCLUSION

The antioxidant study of stem, root and callus of *C. stalagmifera* revealed that callus extract exhibited the strongest antioxidant activity suggesting the presence of higher concentrations of bioactive metabolites compared to the intact root and stem. The root extract showed moderate activity, while the stem demonstrated the least antioxidant potential. The study confirms that the *Caralluma stalagmifera* can be the most promising natural source for development of plant based antioxidant compounds. The callus cultures can be explored for large-scale production of antioxidant metabolites with potential applications in the pharmaceutical and neutraceutical industries.

ACKNOWLEDGEMENTS :

The author, T. Veerabhadraiah sincerely acknowledges CSIR UGC JRF (UGC No. 614, June 2019) for the financial support to carry out this research

REFERENCE

1. Kishore, K.N. et al. (2010). "Pregnane glycosides from Caralluma fimbriata." Phytochemistry Letters, 3(1): 27–30.
2. Habibuddin, M., Daghriri, H.A., Humaira, T., Al Qahtani, M.S. and Hefzi, A.A. (2008) Antidiabetic effect of alcoholic extract Caralluma sinaica L. on Streptozotocin-

induced diabetic Rabbits. Journal of Ethnopharmacology, 117, 215-220 .
3. Marwah, R.G., Fatope, M.O., Mahrooqi, R., Varma, G.B., Al badi, H. and Al-Burtamani, S.K. (2006) Antioxidant capacity of some edible and wound healing plants in Oman. Food chemistry, 101, 465-470
4. Gnanashree, R. and Sirrajudeen, M. (2018). "Phytochemical screening and in vitro antioxidant activity of Caralluma indica." International Journal of Pharmaceutical Sciences and Research, 9(12): 5218–5223.
5. Rajesh, B. et al. (2013). "Antioxidant and analgesic activities of Caralluma attenuata." Indian Drugs, 50(4): 27–31.
6. Rai, M. et al. (2016). "In vitro and in vivo antioxidant properties of plants: a review." Pharmacognosy Reviews, 10(20): 112–119.
7. Kumari, N. and Singh, R. (2018). "Antioxidant activity of callus and field-grown plants of Caralluma stalagmifera." International Journal of Pharmaceutical Sciences Review and Research, 50(2): 101–105.
8. Karuppusamy, S., & Pulliah, T. (2007). In vitro propagation of Caralluma stalagmifera C.E.C. Fisch. var. longipetala. Indian Journal of Biotechnology, 6, 122–124.
9. Sankaran, K. V., Narayanan, C., & Kumar, A. S. (2017). Flora of the Eastern Ghats: Hill ranges of South East India. Botanical Survey of India.
10. Al-harbi, M.D., Quershi, S., Raza, M., Ahmed, M.M., Afzal, M. and Shah, A.H. (1994) Evaluation of Caralluma tuberculata pretreatment for the protection of Rat gastric mucosa against toxic damage. Toxicology and Applied Pharmacology, 128, 1-8
11. Tatiya, A.U., Kulkarni, A.S., Surana, S.J. and Bari, N.D. (2010) Antioxidant and hypolipidemic effect of Caralluma adscendens Roxb. in Alloxanized Diabetic Rats. International Journal of Pharmacology, 6, 400-406
12. Bushnak R, El Hajj M, Jaber A (2021). A review on the antidiabetic potential of medicinal plants. Journal of Medicine and Health, 4: 172-189.
13. Bader, A., Braca, A., De Tommasi, N. and Morelli, I. (2003) Further constituents from Caralluma negevensis. Phototherapy, 62, 1277-1281.
14. Veerabhadraiah, T. Sabitha Rani, A. Prabhakar, G. and Keerthi, M. (2024). "Phytochemical analysis of Caralluma stalagmifera C.E.C. Fisch, an endemic and important medicinal plant." Journal of Pharmacognosy and Phytochemistry, 13(3): 504–508.
15. Venkatesh, D. and Rao, P.S. (2012). "Isolation and characterization of steroidal glycosides from Caralluma stalagmifera C.E.C. Fisch." Natural Product Research, 26(10): 887–891.
16. Rana, S.S. et al. (2020). "Phytochemical constituents and pharmacological potential of Caralluma species: a review." Journal of Applied Pharmaceutical Science, 10(2): 102–111.
17. Rao, P.K. et al. (2011). "A review on genus Caralluma and its medicinally important species." International Journal of Pharmaceutical Sciences Review and Research, 10(1): 110–118.
18. Chaudhary, P. and Singh, M. (2015). "Comparative evaluation of antioxidant and hepatoprotective activity of root and stem extracts of Caralluma stalagmifera." Journal of Herbal Medicine and Toxicology, 9(1): 41–45.
19. Erel, O. (2004). A novel automated direct measurement method for total antioxidant capacity using a new generation, more stable

ABTS radical cation. Clinic Biochemistry, 37, 277-285.

20. Raju, J. et al. (2011). "Biochemical and antioxidant status of root and callus cultures of Caralluma fimbriata." Journal of Medicinal Plants Research, 5(29): 6496–6501.
21. Singleton, V.L., Orthofer, R. and Lamuela-Raventos, R.M. (1999) Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteu Reagent. In: Packer, L., Ed., Methods in Enzymology, Academic Press, Harcourt Brace & Company, San Diego, London, New York, Tokyo, 152-178.
22. Nenadis, N., Lazaridou, O. and Tsimidou, M.Z. (2007) Use of reference compounds in antioxidant activity assessment. Journal of Agriculture and Food Chemistry, 55, 5452-5460.
23. Souri E, Amin G, Farsam H, Jalalizadeh H, Barezi S. (2008). Screening of thirteen medicinal plant extracts for antioxidant activity. Iranian Journal of Pharmaceutical Research, (2008); 7(2):149-154.
24. Lanchhana DS, Ranjit M, Kumar MS (2023). Anticancer activity study of some selected Indian medicinal plants used traditionally. Journal of Pharmaceutical Negative Results 14(2): 1123-1132.
25. Deep A, Kumar D, Bansal N, Narasimhan B, Marwaha RK, (2023). Understanding mechanistic aspects and therapeutic potential of natural substances as anticancer agents. Phytomedicine Plus, (2023); 3(2): 100418.
26. Wani AK, Akhtar N, Mir TU, Singh R, Jha PK,(2023) Targetingapoptotic pathway of cancer cells with phytochemicals and plant-based nanomaterial. Biomolecules, (2023); 13(2): 194.
27. Ansari, N.M., Houlihan, L. Hussain, B. and Pieroni, A. (2005) Antioxidant activity of five vegetables traditionally consumed by South-Asian Migrants in Bradford, Yorkshire, UK. Phytopherapy, 19, 907-911.

HOW TO CITE: T Veerabhadraiah, A Sabitha Rani, G. Sulakshana, M Keerthi, Determination of Antioxidant Potential of Stem, Root and Callus Extract of Caralluma Stalagmifera C.E.C. Fisch, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 11, 3916-3921. https://doi.org/10.5281/zenodo.17701493