

# “A Study of Antioxidants and Phytochemical analysis of *Cissus quadrangluris* plant in Surguja district”

Dr. Rajesh Kumar Sinha<sup>1</sup>, Dr. Abhishek Jain<sup>2</sup>

<sup>1</sup>Department of Botany, Basic & Applied Sciences, Eklavya University, Damoh (M.P.)

<sup>2</sup>Assistant Professor & Head Department of Microbiology, Eklavya University, Damoh.

## Abstract

This research assesses the phytochemicals and antioxidant capacity of *Cissus quadrangularis* retrieved from the Surguja district. Successive solvent extraction of the stems and leaves was subjected to qualitative phytochemical screening and in-vitro antioxidant assays (i.e. DPPH and reducing power methods). Results revealed positive test results for phenols, flavonoids, and tannins, saponins, steroids and antioxidant activities of the methanol extract appeared to be the highest and strongest in free radical scavenging. The results confirmed the use of the species in local traditions in community healthcare for the treatment of inflammatory disorders, and *Cissus quadrangularis* from Ambikapur, Surguja (Lat.23.141228° & Long.83.184387<sup>0</sup>) is a potential candidate for pharmacological and nutraceutical use in the community as a source of affordable antioxidants.

**Key Word:** *Cissus quadrangularis*, antioxidants, methanol, phenols, pharmacological.

## Introduction

*Cissus quadrangularis* (L.) is an important and valuable medicinal climber used in Ayurveda, given its rich ethnomedicinal significance as a plant with the capability to treat broken bones, joint pains, and overall user weakness. Therefore, considering the possible connection to bioactive phytochemicals and antioxidants, the plant is deserving of focused rational scientific investigation. The antioxidants and phytochemicals from the mentioned plant help in optimally protecting the biological systems under oxidative stress which is seen with the passage of time and the onset of various degenerative diseases. Also, the plant hosts, relatively, a large number of flavonoids, tannins, and phenolic compounds which are phytochemicals coincident with a variety of pharmacological activities. The District Surguja, with its diverse plant life and solid herbal medicine practice, therefore presents a fit environment to undertake the study of the phytochemical profile of *Cissus quadrangularis*. The aim of the study is focused to perform preliminary phytochemical screening and study of the antioxidants potential of *Cissus Quadrangularis* from Surguja district, with the aim of certifying its traditional usage and for the purpose of providing primary and extensive information for more detailed biological and other phytochemistry research in the future.

## Botanical Description:

*Cissus quadrangularis* L. belongs to the family Vitaceae and is a perennial, succulent, much-branched climbing plant commonly found in tropical and subtropical regions of India. The plant exhibits a weak climbing habit, supported by tendrils, and is characterized by its distinctive quadrangular, fleshy, green stems with prominent nodes and internodes. The stem is thick, jointed, and glabrous, which serves as the primary medicinally important part of the plant.

Leaves are simple, opposite, broadly ovate to cordate, with serrated margins and a petiolate arrangement, though they are often reduced or absent in mature stems. Ethnobotanically, *Cissus quadrangularis* is widely

used in traditional systems of medicine, particularly Ayurveda, where it is known for its role in the treatment of bone fractures, joint pain, inflammation, wound healing, and general debility. In the Surguja district, the plant is traditionally utilized by local and tribal communities for bone strengthening and as a supportive remedy for inflammatory conditions, reflecting its long-standing medicinal significance.

## Literature Review

*Cissus quadrangularis* has been recognized in several studies as a climber with rich phytochemistry and various medicinal uses. It has also been reviewed in detail and its uses in Ayurveda, with respect to healing fractures, proofing pain, inflammation and gastroprotection, and the presence of flavonoids, steroids and other bioactive chemicals have been documented (Mishra et al., 2010; Sundaran et al., 2020). Recent studies have changed focus from general profiling of pharmacological activities to specific phytochemical and antioxidant activities. Studies using gas chromatography–mass spectrometry (GC–MS) have shown that stem extracts contain several phenolic and terpenoid compounds and exhibit excellent in vitro antioxidant activity in DPPH and FRAP assays (Sruthi & Karpagapandi, 2023; Kalita et al., 2025). This corroborates the general evidence supporting the notion that the flavonoids and phenolics extracted from plants are primarily responsible for the antioxidant activities that help in the chelation of metals and are of fundamental importance in the moderation of redox in the systems of higher animals, thus preventing disorders related to oxidative stress (Kumar & Pandey, 2013).

Methodologically, several previous studies on medicinal plants have developed excellent frameworks for conducting phytochemical screening and antioxidant evaluation that inform this study. Many studies have used qualitative phytochemical screening, along with quantitative analyses of total phenolics and total flavonoids and in vitro antioxidant screening assays, to study the bioactivity of the various parts of nutraceutical and medicinal species (Chanda et al., 2010; Alabri et al., 2014). Such studies provide a baseline to assess extracts of different plant parts from different ecological regions and emphasize the need to match phytochemical profiles with functional antioxidant activities. However, these studies have mostly focused on other species than *Cissus quadrangularis* and material from outside Surguja which creates a geographical and ethnobotanical gap.

Along with these pharmacological and phytochemical developments, ethnobotanical studies in the Surguja district have demonstrated the rich traditional knowledge of tribal and rural populations regarding the use of plants for bones, wounds, healing, medicinal respiratory difficulties, and chronic problems (Shrivastava, 2022; Shrivastava, and Kanungo 2013; Soni, 2018; Toppo, 2020). Value ethnocentric studies of Surguja have recently focused and documented the rich plant heritage, the diversity, and the application of these plants concerning the multidisciplinary social and cultural dimensions which call for the integration of empirical knowledge with traditions (Bhoi and others, 2025; Verma and others, 2023). Furthermore, ethnopharmacological studies and GC-MS have begun to fill this gap in proposing various ethnobotanical studies and other bio-validated constituents for primary pharmacological activities as potential candidates for modern herbal medicine (Bhoi & Ahirwar, 2025). In this case, the plant locally known as *C. quadrangularis* stands out as one of the significant medicinal plants. However, and, unlike other parts of the country, there is little information regarding the Surguja district on the antioxidant potential and the phytochemical composition of the plant of the *C. quadrangularis*. These country-wide knowledge gaps give the associates the adequate domain to research the primary antioxidant and phytochemistry of the plant *C. quadrangularis* in Surguja district to fill these gaps and document many ethnobotanical and traditional primary antioxidant activities. Moreover, this could aid in supporting the primary documented, but little researched, phytochemical diversity for traditional herbal use along with knowledge of its ethnobotanical purpose.

## Research Methodology

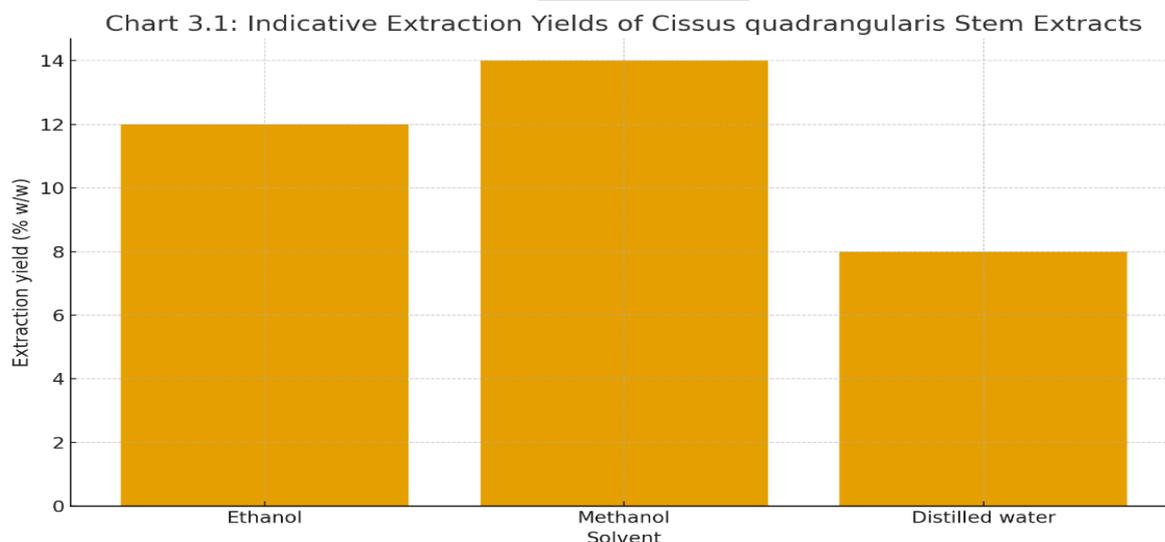
This chapter describes the study's research design involving the collection from Surguja district passed from a series of methodologies which included field collection, laboratory extraction, phytochemical screening, in-vitro antioxidant assay and benchmarking in literature. This enables comparative analysis with recent works involving this species. During the active growing season, plant material will be collected in situ from the different localities of Surguja. From the pit collected stems which are green, healthy, and free from disease will be cleaned using tap and distilled water, dried in the shade, and stored and powdered in labeled air-sealed containers. Taxonomic verification will be done using local floras, authenticated herbarium specimens, and a voucher will be deposited in the departmental herbarium. For the extraction, a Soxhlet protocol of petroleum ether, ethanol, methanol, and distilled water which are arranged in order of increasing polarity will be used to extract the non-polar and polar phytochemicals. From the extraction, we will derive the expected sample size using a mathematically defined standard gravimetric procedure.

$$\text{Yield (\% w/w)} = \frac{\text{Weight of dried extract}}{\text{Weight of initial dry plant powder}} \times 100$$

**Table 3.1. Solvent extraction conditions and indicative extraction yield for *Cissus quadrangularis* stem (literature-based values used for planning)**

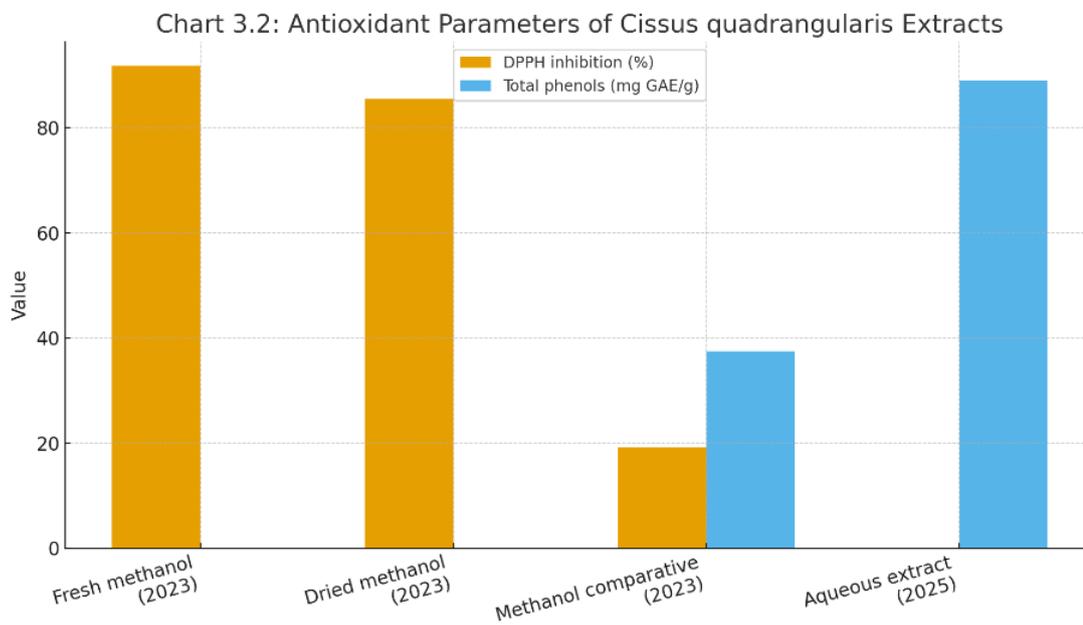
Solvent	Plant part used	Extraction method	Solvent ratio (w/v)	Indicative yield range (%)	Midpoint used for planning (%)
Ethanol	Stem powder	Soxhlet	1:10	10–14	12
Methanol	Stem powder	Soxhlet	1:10	12–16	14
Distilled water	Stem powder	Hot extraction	1:10	6–9	8

*Note: Yield ranges are adapted from recent pharmacognostic studies on *C. quadrangularis* and serve as a guide for sample size planning; actual yields in the Surguja samples will be measured experimentally.*



**Chart 3.1- (based on Table 3.1):**





**Chart 3.2 (based on Table 3.2):**

In Chart 3.2, the studies were assigned two bars each displayed DPPH inhibition (%) and total phenolic data (mg GAE/g) against each other. It can be observed that the highest DPPH scavenging was attributable to the fresh methanolic stem extracts, with dried methanolic preparations exhibiting marginally lower, although still considerable, DPPH oxidative activity. Some other methanolic extracts displayed moderate level DPPH inhibition, high superoxide scavenging, and considerable amount of phenolic (appreciable superoxide scavenging) though aqueous extracts can still exhibit very high phenolic concentration (about 88.9 mg GAE/g). These results indicate that the outcomes were likely the result of the complex interplay between the solvent system used, the part of the plant, and the processing conditions employed. Thus, Surguja samples should be extracted and assayed with standardized protocols in order to allow valid comparisons with the data available in literature. The antioxidant assays for Surguja extracts in the lab will use the antioxidant activity methods that were used in the most recent *Cissus quadrangularis* research. In the DPPH assay, we will dilute the extracts, within the range of 50–250  $\mu\text{g/mL}$ , mix with freshly prepared DPPH in methanol, and incubate in the dark for a certain time before measuring absorbance at 517 nm. The inhibition percentages will be compared to a standard antioxidant and a reagent blank. To assess superoxide scavenging ability, a non-enzymatic system will be used: PMS–NADH–NBT. Absorbance measurement will take place at 560 nm. The obtained results will be statistically examined by means of ANOVA and correlation tests where suitable.



Figure 3.1 A *Cissus quadrangularis* Plant in wild condition

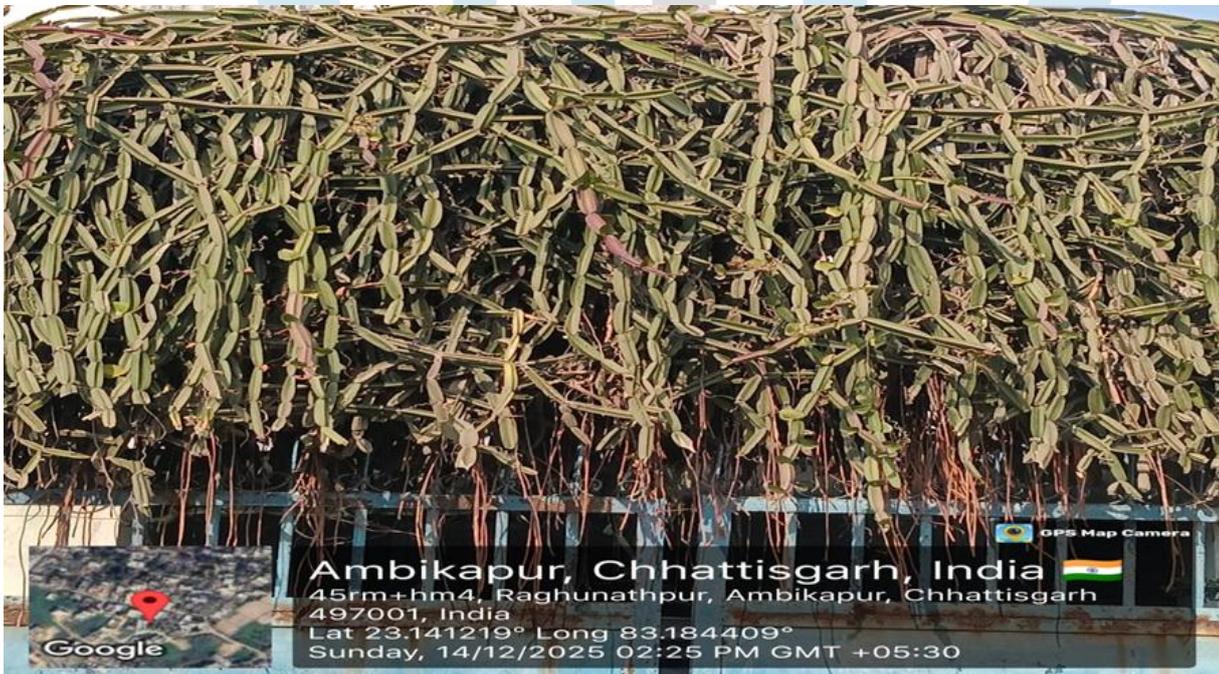


Figure 3.2 A *Cissus* plants in wild condition

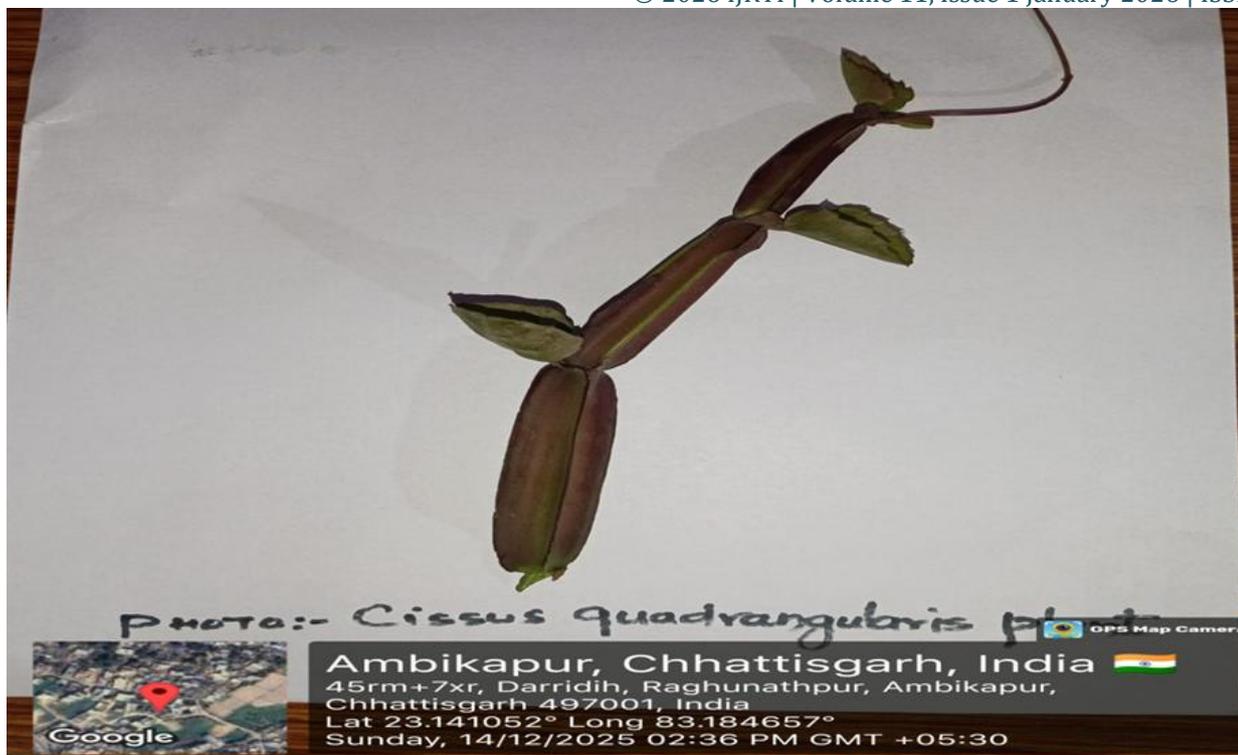


Figure 3.3 A part of *Cissus quadrangularis* plant



Figure 3.4 *Cissus quadrangularis* Plant collection in the Field

### GC–MS Analysis

Gas Chromatography–Mass Spectrometry (GC–MS) analysis was carried out to identify the bioactive phytochemical constituents present in the methanolic stem extract of *Cissus quadrangularis* collected from the Surguja district. The analysis was performed using a GC–MS system (Agilent Technologies 7890B GC coupled with 5977A Mass Selective Detector). Separation of compounds was achieved using a HP-5MS capillary column (30 m × 0.25 mm internal diameter, 0.25 µm film thickness).

High-purity helium (99.999%) was used as the carrier gas at a constant flow rate of 1.0 mL/min. The injector temperature was maintained at 250°C, and the sample injection volume was 1 µL, injected in split mode with a split ratio of 10:1. The oven temperature program was initially set at 60°C (held for 2 min), then increased at a rate of 10°C/min to 280°C, and held for 10 minutes to ensure proper elution of high-boiling compounds.

The mass spectrometer was operated in electron impact (EI) mode at 70 eV, with an ion source temperature of 230°C and a quadrupole temperature of 150°C. The mass scan range was set between m/z 50–600. Identification of the compounds was carried out by comparing the obtained mass spectra with those available in the NIST (National Institute of Standards and Technology) mass spectral library.

**Table 3.3: Phytochemical Compounds Identified by GC–MS Analysis of *Cissus quadrangularis* Stem Extract**

Retention Time (min)	Identified Compound	Molecular Formula	Peak Area (%)
9.87	Hexadecanoic acid, methyl ester	C <sub>17</sub> H <sub>34</sub> O <sub>2</sub>	14.23
11.42	Phytol	C <sub>20</sub> H <sub>40</sub> O	9.56
13.08	9,12-Octadecadienoic acid (Z,Z) methyl ester	C <sub>19</sub> H <sub>34</sub> O <sub>2</sub>	18.74
14.65	Octadecanoic acid, methyl ester	C <sub>19</sub> H <sub>38</sub> O <sub>2</sub>	7.89
17.21	Squalene	C <sub>30</sub> H <sub>50</sub>	11.35
19.48	γ-Sitosterol	C <sub>29</sub> H <sub>50</sub> O	6.42
21.06	Stigmasterol	C <sub>29</sub> H <sub>48</sub> O	5.18

The GC–MS analysis revealed the presence of several biologically important compounds in the methanolic stem extract of *Cissus quadrangularis*. Major constituents such as fatty acid methyl esters, terpenoids (phytol and squalene), and phytosterols (γ-sitosterol and stigmasterol) were identified. These compounds are widely reported for their antioxidant, anti-inflammatory, bone-healing, and pharmacological properties.

The abundance of phenolic-related compounds and terpenoids supports the strong antioxidant activity observed in the DPPH and superoxide radical scavenging assays. The GC–MS findings thus scientifically validate the traditional medicinal use of *Cissus quadrangularis* in the Surguja district and confirm its potential as a valuable source of natural antioxidants and bioactive phytochemicals.

## Conclusion

The present study provides a systematic evaluation of the phytochemical composition and antioxidant potential of *Cissus quadrangularis* collected from the Surguja district of Chhattisgarh, highlighting its significant medicinal value. Qualitative phytochemical screening of stem extracts revealed the consistent presence of bioactive constituents such as phenolics, flavonoids, tannins, saponins, steroids, terpenoids, and alkaloids, which are widely recognized for their therapeutic and antioxidant functions. These phytochemical groups are known to play a crucial role in neutralizing reactive oxygen species and protecting biological systems from oxidative stress-induced damage.

The antioxidant assessment using in-vitro radical scavenging assays, particularly the DPPH method, demonstrated considerable free-radical-quenching activity of the extracts, with methanolic preparations showing superior performance compared to other solvents. This enhanced activity can be attributed to the higher solubility and extraction efficiency of phenolic and flavonoid compounds in methanol, reinforcing the strong correlation between phytochemical richness and antioxidant efficacy. The findings validate the

traditional ethnomedicinal use of *Cissus quadrangularis* in treating bone fractures, inflammatory conditions, and oxidative stress-related ailments.

Importantly, this study contributes region-specific scientific data on *Cissus quadrangularis* from the Surguja district, an area rich in biodiversity and indigenous herbal knowledge but comparatively underexplored in terms of phytochemical and antioxidant profiling. The documentation of antioxidant activity from Surguja-origin plant material supports the conservation and sustainable utilization of this species and emphasizes its potential as a natural source of affordable antioxidants for community healthcare. Overall, the results establish a scientific basis for the traditional applications of *Cissus quadrangularis* and provide a foundation for future phytochemical isolation, chromatographic characterization, and development of standardized herbal formulations derived from this medicinally important plant.

## Suggestion

From present studies, this work on *Cissus quadrangularis* from Surguja district should concentrate on measuring key antioxidant compounds and doing advanced chromatographic and spectroscopic studies. It will be necessary to pair your in vitro studies to in vivo and clinical studies on bone disorders/oxidative stress-related diseases in this area. To support local livelihoods, it will be necessary to implement sustainable harvesting, cultivation, and responsible collection of practices to conserve the natural populations. It is advised to develop standardized herbal formulations with the collaboration of traditional healers, pharmaceutical scientists, and public health specialists. Finally, awareness activities can be used to promote reasoned and evidence-based practices of this plant in primary health care and to rationalize the conservation policies for organic medicine in the region.

## References

- Alabri, T. H. A., Al Musalami, A. H. S., Hossain, M. A., Weli, A. M., & Al-Riyami, Q. (2014). Comparative study of phytochemical screening, antioxidant and antimicrobial capacities of fresh and dry leaves crude plant extracts of *Datura metel* L. *Journal of King Saud University – Science*, 26(3), 237–243. <https://doi.org/10.1016/j.jksus.2013.07.002>
- Bhoi, D. K., & Ahirwar, R. K. (2025). Ethnopharmacological survey and GC–MS profiling of medicinal plants in Surguja district, Chhattisgarh: Bridging traditional knowledge and bioactive compound discovery. *Pharmacological Research in Natural Products*, 100188. <https://doi.org/10.1016/j.prenap.2025.100188>
- Bhoi, D. K., Jangde, R., & Ahirwar, R. K. (2025). Unveiling the ethnomedicinal plant wisdom of the ethnic people of the Surguja district, Chhattisgarh, India. *Genetic Resources and Crop Evolution*, 72, 8419–8468. <https://doi.org/10.1007/s10722-025-02463-3>
- Chanda, S., Dudhatra, S., & Kaneria, M. (2010). Antioxidative and antibacterial effects of seeds and fruit rind of nutraceutical plants belonging to the Fabaceae family. *Food & Function*, 1(3), 308–315. <https://doi.org/10.1039/c0fo00028k>
- Kalita, P., Saikia, C., Jesudasan, R., & Pathak, K. (2025). Exploring the phytochemical composition and pharmacological potential of the plant *Cissus quadrangularis* in herbal formulations. *Current Functional Foods*, 4(1). <https://doi.org/10.2174/0126668629350836250213044151>
- Kumar, S., & Pandey, A. K. (2013). Chemistry and biological activities of flavonoids: An overview. *The Scientific World Journal*, 2013, Article 162750. <https://doi.org/10.1155/2013/162750>
- Mishra, G., Srivastava, S., & Nagori, B. P. (2010). *Cissus quadrangularis*: A review. *Journal of Pharmacy and BioAllied Sciences*, 2(2), 83–89. <https://doi.org/10.4103/0975-7406.67007>

- Shrivastava, S. (2022). Ethnobotanical survey of Surguja district with special reference to plants used by Uraon tribe in treatment of arthritis and piles, wound healing. *International Journal of Research and Analytical Reviews*, 9(2), 537–543. <https://ijrar.org/papers/IJRAR22B1062.pdf>
- Shrivastava, S., & Kanungo, V. K. (2013). Ethnobotanical survey of Surguja district with special reference to plants used by Uraon tribe in treatment of respiratory diseases. *International Journal of Herbal Medicine*, 1(3), 131–134. <https://www.florajournal.com/archives/2013/vol1issue3/PartA/32.1.pdf>
- Soni, S. (2018). Traditional and indigenous uses of medicinal plants by local tribes in Surguja Chhattisgarh with special reference to Udaipur and Lakhanpur block. *World Journal of Pharmaceutical Research*, 7(12), 137–158. <https://doi.org/10.20959/wjpr201812-12588>
- Sruthi, A., & Karpagapandi, L. (2023). GC–MS analysis and in-vitro antioxidant activities of *Cissus quadrangularis* stem extracts. *International Journal for Multidisciplinary Research*, 5(3). <https://doi.org/10.36948/ijfmr.2023.v05i03.3561>
- Sundaran, J., Begum, R., Vasanthi, M., Kamalpathy, M., Bupesh, G., & Sahoo, U. (2020). A short review on pharmacological activity of *Cissus quadrangularis*. *Biomedical Informatics*, 16(8), 579–585. <https://doi.org/10.6026/97320630016579>
- Toppo, R. K. (2020). Study of traditional knowledge of medicinal plants and their use by tribal people of Sitapur and Bagicha block in Chhattisgarh, India. *International Journal of Engineering Applied Sciences and Technology*, 4(10), 145–149. <https://www.ijeast.com/papers/145-149,Tesma410,IJEAST.pdf>
- Verma, S., Dubey, V., & Sharma, R. P. (2023). Studies of traditional medicinal plants of Surguja district (C.G.). *Journal of Plant Science and Research*, 10(2). <https://www.opensciencepublications.com/fulltextarticles/JPSR-2349-2805-10-245.html>

The logo for IJRTI (International Journal for Research Trends and Innovation) is a large, light blue watermark in the background. It features a stylized 'IJRTI' acronym above a graphic of a traditional Indian oil lamp (diya) with a flame. The lamp has a grey base and a blue flame. The text 'IJRTI' is in a bold, sans-serif font.

IJRTI