

# A Phytochemical and Pharmacological Review of An Indian Plant: *Cissus quadrangularis*

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**Abstract:** *Cissus quadrangularis* is a common perennial succulent climber plant belonging to the Vitaceae family. The plant is having a strong pharmacological profile with a variety of phytoconstituents and is geographically distributed throughout tropical and subtropical regions of the world. Prominently found in India, Pakistan, and Bangladesh. In India plant was found all over but dominantly in states namely Assam, Kerala, Odisha, Madhya Pradesh, Tamil Nadu, and Uttar Pradesh. The plant in India is popularly called 'Hadjod' or 'Asthisamharaka' and is very well established as a medicine related to the management of bone, muscles, and ligament issues. Traditionally almost all aerial well as underground parts are having medicinal value but the stem is most commonly used. Phytochemicals studies performed on the plant revealed the presence of a variety of constituents viz Tannins, proteins, carbohydrate, phenol flavonoids, triterpenoids, phytosterols, glycosides, Saponins, vitamin C, and alkaloids. Besides these plant is also a rich source of calcium. The systematic review also established the pharmacological role of the plant as a bone setter and fractured bone healer, antimicrobial, anti-diabetic, anti-inflammatory, anti-obesity, anti-oxidant, bone turnover, cardiovascular and hepatoprotective, and many more. The current review article had made a detailed discussion of its phytochemical and pharmacological potential.

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## 1. Introduction

India is a country full of fauna and flora and holds a strong tradition of using this flora and fauna as food supplements and medicines. As per the available data, it was estimated that the total higher plant species found on earth are 2, 50,000, and out of it approximately more than 70,000 are medicinal. In India alone, over 45000 plant species exist making India as world's 12th biodiversity center [1, 2]. In addition to this rich fauna and flora, the very existence of an alternative system of medicines namely Siddha, Ayurveda, Unani, Naturopathy, and homeopathy in India had established the fact of very long, safe and continuous uses of herbs officially [3,4]. As of now through systematic literature study, it was evident that India had presented about 8000 medicinal plant species from different alternative systems of medicines. In terms of numbers if we present then around 700 medicinal plant species were reported from Ayurveda, 600 species from Sidhha, 600 species of plant from Amchi, 700 medicinal plant species from Unani, 67 medicinal plant species from Rigveda, 81 medicinal plant species from Yajurveda, and many more like this [1, 2]. Apart from the prescription drugs of alternative systems, plants are popularly being used by millions of Indians as a health food, spices, home

remedies, and over-the-counter (OTC). The market for medicinal plants in India stood at Rs. 4.2 billion (US\$ 56.6 million) in 2019 and is expected to increase at a CAGR of 38.5% to Rs. 14 billion (US\$ 188.6 million) by 2026. The total world herbal trade is currently assessed at US\$ 120 billion [2,5].

The present review study is designed by considering the rich tradition of India's medicinal plant's existence. The study was having a prime focus to introduce one of the important plants of Ayurveda named *Cissus quadrangularis* popularly called 'Had-Jod' or 'Asthisamharaka'. The article makes an effort to present the detailed Phytochemicals and pharmacological potential of the plant with superficial information about traditional claims and future perspectives of the plant.

## 2. Plant Description:

### 2.1. Habitat:

*Cissus quadrangularis* is a common plant of the arid habitat of tropical and subtropical regions very often found in coastal and lowland areas. The plant is very well-known in Africa and India for its medicinal uses. In India and the subcontinent of India like Pakistan and Bangladesh, the *Cissus* plant occurs in thickets, open forests, scrub jungles, along forest borders, on riverbanks, and wastelands at low and medium elevations [6].

### 2.2. Synonyms:

This aggressively growing plant was identified by several international names and regional names some important international names of *Cissus quadrangularis* are Veldt grape, Adamant creeper; Cactus vine; Kangaroo vine; Stemmed vine; Veldt-grape; winged treebine and the Indian regional names are Had-Joad, Asthisamharaka, Pirandai and Hadsankal [6,7,8]

### 2.3. Botanical Description:

It is a perennial herbaceous climber comprised of a thick quadrangular stem along with other aerial components like tendrils, leaves, inflorescence, flowers, and fruits. The detailed description of the *Cissus quadrangularis* part-wise is described below;

#### 2.3.1. Stem:

The stem of the plant is moist, thick, Long, fleshy, deep green, glabrous, quadrangular, angles winged, constricted at nodes, and slightly downy. The stem when young show branches sharply angular or winged, tendrils long, simple, and almost leafless when old.

#### 2.3.2. Leaves:

Leaves on the stem of the plant are simple ovate or reniform, entire or cordate, serrulate dentate, or crenate-serrate, 3-7 lobed, terminal lobe triangular or sub-spathulate, subacute or  $\pm$  cuspidate, membranous, glabrous on both sides, 3-5 x 5-3 cm; stipules ovate or cuneate, obtuse, deciduous.

#### 2.3.3. Inflorescence:

The Inflorescence found on plant Umbellate cymes with peduncles 1-2.5 cm long. Stem shows the presence of tendrils that are long, slender, and simple.

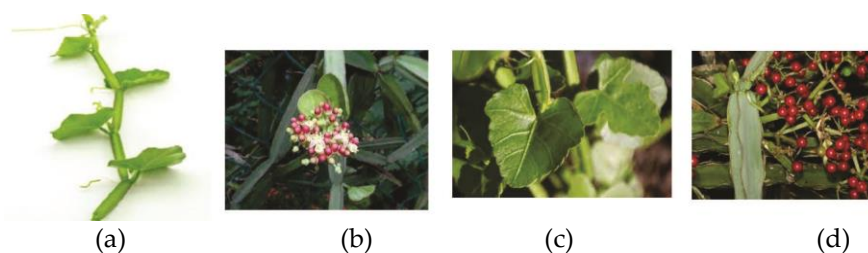
#### 2.3.4. Flower:

Stem bears a flower of pink to white color and is approximately 2 mm long. the hypanthium of the flower was cup-like, truncate or obscurely lobed, green in color, and 2 mm wide. Petals are four in number and distinct, ovate-oblong, acute, and hooded at the apex. The size of the petal is 1.5 mm in length. Flower had Disc and is longer than the

ovary. The ovary present in the flower is glabrous, with a slender style and small stigma.

### 2.3.5. Fruit:

The fruit of the plant is berries that are globose, red, succulent, very acidic, 6-10 mm in diameter, and single-seeded. The seeds are obovoid smooth, 4-8 mm across. The flowering and fruiting time was identified as June –July [6,8]



**Figure 1.** *Cissus quadrangularis* plant parts( a) stem bearing all parts of the plant, (b) flower and Inflorescence, (c) typical leaf of the plant and(d) fruits of the plant .

### 3. Phytochemical Profile:

The aerial portion very particularly the stem of *Cissus quadrangularis* demonstrated the presence of several important primary and secondary metabolites. The study performed for the presence of preliminary phytoconstituents was done on extract prepared using different solvents and found to have the presence of important primary metabolites namely lipids (cyclic and acyclic), fatty acids, methyl esters, protein, amino acid, iridoids, gums, mucilage. The extracts of the plant also showed the presence of a few important secondary metabolites namely alkaloids, flavons and flavonoids, Saponins, Phytosterols, steroids, stilbenes, triterpenoids, tannins, carotene, cardiac glycosides, vitamins (especially vitamin C) [9,10]. On another hand, the extracts prepared from the underground parts of the plant using the different solvents when examined for phytochemical profile showed a wide array of compounds namely alkaloids, Saponins, Tannins, Flavonoids, Glycosides [11]

### 4. Traditional Uses:

The detailed study of traditional literature available on *Cissus quadrangularis* in India and abroad had established its use in the management of several issues of humans and animals in all parts of the world [12]. The Indian traditional system of treatment, namely Siddha and Ayurveda, had extensively used the plant for the management of "Asthi" i.e. bones related issues like fracture, pain, inflammation, osteoporosis, rheumatoid, and osteoarthritis [2, 7]. The traditional literature of other Indian subcontinents like Pakistan, Bangladesh, Sri Lanka, etc, and even other parts of the world had also claimed the use of the plant in the treatment of swelling, hemorrhage, anorexia, flatulence, dyspepsia, colic, chronic ulcer, hemoptysis, convulsion, skin diseases, leprosy, and helminthiasis [7,9, 14].

### 5. Pharmacological Profile:

This review highlights some of the phytochemical and pharmacological aspects of *Cissus quadrangularis*. The prominent traditional actions of the plant are fracture healing, antibacterial and antifungal, antioxidant, anthelmintic, anti-hemorrhoidal, and analgesic. The other potential medical effects, includes Gastroprotective activity, NSAID, and antioxidant in Lipid metabolism and oxidative stress. All these above-mentioned versatile uses and various therapeutic activities made the plant a valuable medicinal herb [15]. The details of pharmacological activities are explained in detail in the following discussion.

### 5.1. Actions related to bones:

The plant *Cissus quadrangularis* is a well-established herb in the management of bone-related ailments, and in line, with this fact, several studies are conducted using different animal models and even human subjects. All these studies had now established that the plant had a potential role in the management of bone fracture, osteoporosis, and maintenance of bone density. The core understanding of all these studies proposes that plants had unidentified anabolic steroids that are responsible for action through the estrogenic receptor of the bone. The efficacy of plants for early ossification and remodeling of bones is an act of better stimulation of metabolism and fast uptake of minerals viz calcium, sulfur, and strontium by osteoblast [15].

### 5.2. Analgesic and anti-inflammatory activity:

The plant had tested for Analgesic and anti-inflammatory activity using extract prepared using a different solvent. The summaries of all are as follows;

Methanolic extract demonstrated analgesic and anti-inflammatory activity. The study performed on mice showed a noteworthy reduction in the number of writhes in mice induced by acetic and also showed considerably reduced licking time in both phases of the formalin test. These responses in mice were suggestive of the peripheral and central analgesic activity of the plant. The rat model plant showed an effective anti-inflammatory property and showed an inhibitory effect on the edema formation induced by ethyl phenylpropionate in rat ears as well as paw edema by carrageenin and arachidonic acid [16].

The ethanolic extract of the plant was also evaluated for analgesic, anti-inflammatory, and antipyretic activity in an albino rat model, and the result demonstrated a significant reduction in the edema produced by carrageenan as well as showed analgesic activity in the formalin test. The study suggested that ethanolic extract may have central and peripheral effects and that will be the mechanism of analgesia and anti-inflammation [17]. The plant *Cissus quadrangularis* was also evaluated in connection with its ability to inhibit the enzyme cyclooxygenase –I (COX-1) which is one of the important components in pain and inflammation reactions [18]. The extract of the plant was assessed for inhibition of COX-I using COX-1 assay and the response of inhibition was reported in percentage [14]. In one more study, different extract of *Cissus quadrangularis* was evaluated and found to have an inhibitory action on cyclooxygenase (COX-1), cyclooxygenase (COX-2), and 5-lipoxygenase (5-LOX) enzyme activity. The spectroscopic and polarographic methods were employed for the determination of the inhibition of enzymes.

Acetone extract had the most promising results and when Western blot analysis was done it demonstrated downregulation of pro-inflammatory mediators as well as upregulation of phase-II enzymes. The determined IC<sub>50</sub> values of acetone extract for enzyme inhibition were 7 µg/ml, 0.4 µg/ml, and 20 µg/ml for COX-1, COX-2, and 5-LOX respectively. The extract showed anti-inflammatory activity on the cell line (RAW 264.7) with an IC<sub>50</sub> value of 65 µg/ml. Furthermore, it showed inhibition of pro-inflammatory mediators like iNOS and TNF $\alpha$ , along with translocation of Nrf-2 and upregulation of HO-1 [18].

A study with ethyl acetate extract of *Cissus quadrangularis* had also somewhat similar potential and the results of this study showed potent inhibition of lipopolysaccharide (LPS)-induced nitric oxide (NO) production. The plant showed suppression of expression of mRNA and protein inducible nitric oxide synthase (iNOS) and the inhibitory effects of plant NO production was abrogated by an HO-1 inhibitor, zinc protoporphyrin IX (ZnPP) [19]

### 5.3. Anti-diabetic activity

The anti-diabetic potential of *C. quadrangularis* stem extract is mediated through the modulation of the antioxidant defense system. The ethyl acetate fraction is rich in quercetin supplementation of the plant might be beneficial as a food supplement for the attenuation of diabetic complications. Further, the antidiabetic activity of the plant is associated with potentiating the antioxidant defense system and suppressing inflammatory responses [20].

#### 5.4. Wound healing activity:

The methanolic and total aqueous extracts of the plant when analyzed for wound healing activity in rat animal models and found to have good wound healing activity probably due to phenols constituents present in it. The activity was evaluated on ointment formulation made with 2% (w/w) of the methanolic and 2% (w/w) of the total aqueous extract and both formulations exhibited significant wound healing activity [21].

## 6. Conclusion:

The plant *Cissus quadrangularis* is a vine that grows in Africa and parts of Asia including India. It is one of the most commonly used medicinal plants in Thailand and is also used in traditional African and Ayurvedic medicine. All parts of the plant are used for medicine. Phytochemical investigation of the plant shows the presence of many important primary and secondary metabolites such as lipids (cyclic and acyclic), fatty acids, methyl esters, protein and amino acid, iridoids, gums and mucilage, alkaloids, flavonoids and flavons, Saponins, phytosterols, flavonoids, steroids, stilbenes, and triterpenoids tannins, carotene, enzymes, nicotinic acid, tyrosin, cardiac glycosides, Saponins, and vitamins, especially vitamin C. Traditional literature on Indian systems of medicine, as well as the literature across the world, suggests that plants had proven efficacy in treating various ailments such as osteoporosis, bone, and muscle fracture, ligament damage, pain, and inflammation. The Scientific investigation using animals and humans also established the plant as a good wound and fracture healer. Major pharmacological activities established about plants include antimicrobial, anti-diabetic, anti-inflammatory, anti-obesity, anti-oxidant, bone turnover, cardiovascular and hepatoprotective. Further, the most extensive clinical studies using standardized extracts of *Cissus* alone or in combination with other ingredients involve weight loss and the regulation of blood glucose and lipids. Thus, *Cissus quadrangularis* appears worthy wound healer.

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## References:

- (1) India has 8,000 medicinal plants but climate change and biodiversity loss have put them under threat. Available online: <https://scroll.in/article/954167/india-is-home-to-over-8000-species-of-medicinal-plants-and-theyre-increasingly-under-threat> (accessed 2021 -06 -07).

- (2) Nagori, K.; Sharma, M.; Agrawal, A.; Agarwal, A. K.; Sharma, A.; Verma, H.; Tripathi, D. K. General Awareness on Allopathic, Ayurvedic and Homeopathic System of Medicine in Chhattisgarh, India. *Int J Pharm Pharm Sci*, **2011**, 3(4), 159-162. 1  
2  
3
- (3) Vaidya, A. D. B.; Devasagayam, T. P. A. Current Status of Herbal Drugs in India: An Overview. *J Clin Biochem Nutr* 2007, 41 (1), 1–11. 4  
5
- (4) Patil, J.K.; Jalalpure, S.S.; Hamid, S.; Ahirrao, R. A. In-vitro Immunomodulatory Activity of Extracts of *Bauhinia vareigata* Linn Stem bark on Human Neutrophils. *IJPT*, **2010**, 9(2), 41-46. 6  
7
- (5) High Demand for Medicinal Plants In India. Available Online- 8  
<https://www.ibef.org/blogs/high-demand-for-medicinal-plants-in-india> (accessed 2021 -06 -07). 9
- (6) Robert, G. W.; Qing-feng, W.; Yong, W.; You-hao, G. A. Taxonomic Investigation of Variation Within *Cissus Quadrangularis* L. (Vitaceae) in Kenya. Wuhan Univ. *J. Nat. Sci.* **2001**, 6 (3), 715–724. 10  
11
- (7) *Cissus Quadrangularis*. Available Online-[https://en.wikipedia.org/wiki/Cissus\\_quadrangularis](https://en.wikipedia.org/wiki/Cissus_quadrangularis).(accessed 2021 -06 -07). 12  
13
- (8) Plant Details - Information about *Cissus quadrangularis* Plant. 14  
<https://www.efloraofgandhinagar.in/succulents/cissus-quadrangularis>. (accessed 2021 -06 -07). 15
- (9) Joseph, B.; George, J. *Cissus Quadrangularis* in the Treatment of Osteoporosis. *WJPR*, **2013**, 2 (3), 596-605. 16
- (10) Prabhavathi R. M.; Prasad M. P.; Jayaramu M. Studies on Qualitative and Quantitative Phytochemical Analysis of *Cissus Quadrangularis*. *Advances in Applied Science Research*, **2016**, 7 (4), 11–17. 17  
18
- (11) Enechi, O.; Odonwodo, I. An Assessment of the Phytochemical and Nutrient Composition of the Pulverized Root of *Cissus Quadrangularis*. *Bio-Research*. **2003**, 1(1), 63-68 19  
20
- (12) Warriar P. K.; Nambiar V. P. K.; Ramankutty C. *Indian Medicinal Plants: A Compendium of 500 Species*, First ed.; Orient Blackswan, India, **1993**, Vol-2, pp-112-115. 21  
22
- (13) Intagrofarms *Cissus Quadrangularis*, Asthisamharaka, Pirandai Live Plant: Amazon.in: Garden & Outdoors 23  
available 24  
Online-<https://www.amazon.in/Intagro-Cissus-Quadrangularis-Asthisamharaka-Pirandai/dp/B07LGB9NNQ> 25  
(Accessed 2020 -10 -17). 26
- (14) Buddhadev, S.; Buddhadev, S. A Review Update on Plant *Cissus quadrangularis* L. *Punarnav*, **2014**, 2, 01–10. 27
- (15) Mishra, G.; Srivastava, S.; Nagori, B. P. Pharmacological and Therapeutic Activity of *Cissus Quadrangularis*: An Overview. *IJPRIF*, **2010**, 2(2), 1298-1310. 28  
29
- (16) Panthong, A.; Supraditaporn, W.; Kanjanapothi, D.; Taesotikul, T.; Reutrakul, V. Analgesic, Anti-Inflammatory and Venotonic Effects of *Cissus Quadrangularis* Linn. *J Ethnopharmacol*, **2007**, 110 (2), 264–270. 30  
31
- (17) Vijay, P.; Vijayvergia, R. Analgesic, Anti-Inflammatory and Antipyretic Activity of *Cissus Quadrangularis*. *J. Pharm. Sci. & Res.*, **2010**, 2(1), 64-71 32  
33
- (18) Bhujade, A. M.; Talmale, S.; Kumar, N.; Gupta, G.; Reddanna, P.; Das, S. K.; Patil, M. B. Evaluation of *Cissus Quadrangularis* Extracts as an Inhibitor of COX, 5-LOX, and Proinflammatory Mediators. *Journal of Ethnopharmacology*, **2012**, 141(3), 989–996. 34  
35  
36

- 
- (19) Srisook, K.; Palachot, M.; Mongkol, N.; Srisook, E.; Sarapusit, S. Anti-Inflammatory Effect of Ethyl Acetate Extract from *Cissus Quadrangularis* Linn May Be Involved with Induction of Heme Oxygenase-1 and Suppression of NF-KB Activation. *Journal of Ethnopharmacology*. **2011**, 133 (3), 1008–1014. 1  
2  
3
- (20) Zaki, S.; Malathi, R.; Latha, V.; G, S. A Review on Efficacy of *Cissus Quadrangularis* in Pharmacological Mechanisms. *International Journal of Clinical Microbiology and Biochemical Technology*, **2020**, 3 (1), 049–053. 4  
5
- (21) Matadeen B.; Borane K. ; Amrita Singhasiya A. Evaluation of wound healing activity of *Cissus quadrangularis*. *WJPPS*, **2014**, 3(6 ), 822-834. 6  
7