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Comprehensive review on botany, phytochemistry, pharmacology and its uses of *Cissus quadrangularis*

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Abstract
Cissus quadrangularis is a juicy home home-grown plant having a place to family Vitaceae. It is plump and cactus in nature. It is also known as *Vitis quadrangularis*, *Lycopodium imbricatum*, or *Heliotropium indicum*. In Ayurveda, it is utilized as Pachana (stomach-related help), Sara (calms obstruction), Athiyuk (reinforces bones), Vrushya (Love potion), etc. In Unani, it is utilized to treat gastritis. The entire plant is used in the treatment of asthma, and powdered root is particularly utilized in the treatment of bone-related problems. The regular measurements of the powder are 30-40 grains. Clears out and youthful shoots are regularly taken with curry in Southern India. In Chennai, youthful shoots of the plant are dried, powdered, and burnt to fiery remains in a closed vessel. These fiery remains are managed in dyspepsia, acid reflux, and certain bowel complaints. Clears out and youthful shoots are moreover considered as effective choices in the gastrointestinal medicines. Juice of the stem is dropped into the ear in otorrhoea and into the nose in epistaxis. The plant has numerous restorative uses.

Keywords: *Cissus quadrangularis*, pharmacology uses, ayurveda, anti-hemorrhoid

Introduction
Cissus quadrangularis, commonly known as Hadjod, is a perennial plant belonging to the Vitaceae family. It is also called Adamant creeper, Square stalked vine, veldt grape, devil's backbone. Native to India, Bangladesh, and Sri Lanka, it is also found in Africa, Southeast Asia, and Adament Creeper introduced to Brazil and the southern United States. States. The maximum height of this climbing plant is 1.5 m, is distinguished by its quadrangular-sectioned branches with distinct internodes, which are 8 to 10 cm long and 1.2 to 1.5 cm wide with leathery edges at each angle.
The plant leaves are toothed trilobe, measuring from 2 to 5 cm wide, which appear at the nodes alongside tendrils on the opposite side. Adament Creeper produces white, yellowish, or greenish flowers, followed by globular berries which turn red during the ripening stage. Its distinct traits and widespread presence make it an important species in many regions. Due to its adaptability and unique features, *Cissus quadrangularis* has attracted interest for various potential uses and benefits. Overall, this Creeper is an interesting plant with a range of various applications.

Vernacular Names of *Cissus quadrangularis*
Cissus quadrangularis is known by various names in different languages and regions in India. Here are some of its vernacular names presented in Table 1.

Table 1: Vernacular names of *Cissus quadrangularis* in India

S. No.	Language/Region	Vernacular names
1	English	Edible stemmed vine, Adamant creeper, Bone setter
2	Hindi	Hadjod, Hadjora, Hadsarihari, Harsankari, Kandvel
3	Bengali	Har, Harbhanga, Hasjora, Horjora
4	Gujarati	Chodhari, Hadsand, Hadsankal, Vedhari
5	Kanada	Mangarahalli
6	Malayalam	Cannalamparanta, Peranta
7	Marathi	Horjora, Harsankar, Kandavel, Nalllar
8	Tamil	Piranti, Vajjravalli
9	Telugu	Nalleru, Nelleratiga, Vajravalli
10	Oriya	Hadavhanga
11	Urdu	Harjora, Hadsankal

Pharmacognosy of *Cissus quadrangularis*

Taxonomy of *Cissus quadrangularis*

Table 2: Taxonomy of *Cissus quadrangularis*

Kingdom	Plantae
Subkingdom	Tracheobionta
Super Division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Sub Class	Rosidae
Order	Vitales
Family	Vitaeceae
Genus	Cissus
Species	Quadrangularis

History

Cissus quadrangularis is a succulent vine found in Asia and Africa. In Thailand, it is among the most popular medicinal plants. It is traditionally used in Ayurveda and African medicine. The whole plant is used for medicinal purposes. It is often taken as ayurveda medicines. The term "Bone Setter" (Hadjod) comes from its traditional use in treating female health-related problems such as menopause, menstrual disorders, and bone disorders such as increasing bone mass or accelerating break mending rates. This has some other traditional uses which includes purported antiulcer, antihemorrhoid, torment-calming, and wound-recovery properties [2].

Traditional Uses

In Ayurveda

Cissus quadrangularis is credited with several benefits in conventional medicine, including Asthiyuk (reinforcing bones), Sara (improving mobility, reducing blockage, and promoting purgation, including diarrhea), Krumighna (treating contaminated wounds), Amaghna (reducing ama, a poisonous byproduct of poor absorption and metabolism). The Ayurvedic medicines such as Lakshadi Guggul (widely used in the Ayurvedic treatment for bone-related diseases and fracture healing and Panchajeeraka Gudam (An effective Ayurvedic medicine for post-natal care, useful in digestive and respiratory diseases. It is in herbal jam form) [13].

Traditional Medicine for the following health conditions

- Gout, Obesity, syphilis, and venereal diseases
- Leucorrhea, worm infestation, anorexia, and diabetes
- hemorrhoids, Peptic ulcers and high cholesterol

Additional Uses of Adamant Creeper

- It is used as a Bodybuilding supplement which is taken by gym aspirants
- It is consumed as Vegetable in North Eastern Indian cuisine (stem)
- Widely used as Siddha medicine applications ex, treating Bone fracture healing, Piles treatment, Anti-aging properties, Asthma and cough relief

Usage of *Cissus quadrangularis* in ayurvedic preparations

In Southern India, the stems of the plant are consumed as a pickle to strengthen bones and aid in the recovery of epithelial cells following any injury. Furthermore, it is also taken as a soup, which helps in the bone healing process. Particularly in Tamil Nadu, a chutney is made with coconut and served as a side dish, which is utilized to enhance immunity. In Kerala, it is considered a traditional healer, applying its paste to fractured or displaced joints [4]. The stem is fried and given with the milk for its wound-healing properties

In Unani

Cissus quadrangularis is a plant that can grow in the warmer regions of India. The powdered root serves as a remedy for bone fractures, exhibiting effects similar to those of external plasters. The recommended dosage of the powder is between 30 to 40 grains. In Southern India, the leaves and young shoots are often consumed with curry. In Chennai, the young shoots of the plant are dried, ground into powder, and then burned to ashes in a sealed container, which is subsequently used to treat dyspepsia, indigestion, and various bowel issues. Additionally, the leaves and young shoots are regarded as potent alternatives. The juice extracted from the stem is mainly used for ear, such as dropping it in the ear for otorrhoea and in the nose for epistaxis. Furthermore, it is also useful for irregular menstruation. A paste made from the beaten stem is utilized in the treatment of asthma [9].

Dosage of *Cissus quadrangularis* in unani Medicine

Decoction of dried stem

1. Take 10-30 ml twice a day.
2. Stem Juice: 10-20 ml twice a day.
3. Stem powder**:** 3-6 gms twice a day.

Chemical Constituents

Cissus quadrangularis is a rich source of differing phytochemicals, which can be categorized into a few classes:

Triterpenes and Steroids

- **α- and β-amyrins:** Potential anti-inflammatory and antioxidant properties
- **β-sitosterol:** A phytosterol with cholesterol-lowering and anti-inflammatory effects
- **Ketosteroids:** A class of steroids with potential hormonal and metabolic regulatory roles

Phenolic Compounds

- **Phenols:** A broad class of compounds with antioxidant and antimicrobial properties
- **Tannins:** Polyphenolic compounds with astringent and antioxidant effects
- **Flavonoids:** Quercetin and kaempferol, known for their antioxidant, anti-inflammatory, and potential anticancer properties

Stilbene Derivatives

- **Resveratrol:** A polyphenol with antioxidant, anti-inflammatory, and potential anti-aging properties
- **Quadrangularins A-C:** Stilbene derivatives with potential antioxidant and anti-inflammatory effects
- **Piceatannol and pallidol:** Stilbene derivatives with potential antioxidant and anti-inflammatory properties

Other Compounds

- Carotene: a antecedent to vitamin A, fundamental for vision, safe work, and skin health
- Vitamin C: a water-soluble vitamin with antioxidant properties and immune-boosting effects
- Alicyclic lipids: a class of lipids with potential biological activities
- Calcium and phosphorus: fundamental minerals for bone development and advancement

Quantitative Analysis

- HPTLC (High-Performance Thin-Layer Chromatography) and HPLC (High-Performance Liquid Chromatography) methods have been used to quantify various phytochemicals in *Cissus quadrangularis* samples from different geographic zones of India.
- The diverse array of phytochemicals in *Cissus quadrangularis* may contribute to its traditional uses and potential health benefits [12].

In Medicinal Plants

In traditional medicine, various parts of the *Cissus quadrangularis* plant are used to treat different health issues, including respiratory issues like asthma, gastrointestinal problems, and external applications for injuries and infections. The stem of *Cissus quadrangularis* is used for the treatment of gastritis, bone fractures, skin infections, constipation, eye diseases, piles, anaemia, and asthma.. The powder of dried shoots is useful in digestive problems and has healing properties.

Stem paste is useful for muscular pains, burns, wounds, bites from poisonous insects and sores. In case of bone fracture, the stem is fried in oil and applied to the site of fracture before application of splint/cast [2]. This plant has the function of doing early ossification and remodelling of bones. The oral intake of plants helps in the quick healing of fractures by stimulating metabolism and increasing the uptake of minerals such as calcium, sulphur and strontium by the osteoblasts in fractured bone [8].

Anti-hemorrhoidal Activity

Cissus quadrangularis contains flavonoids, including diosmin and hesperidin, which have shown potential in treating hemorrhoids and varicose veins due to their anti-inflammatory, analgesic, and venotonic effects. The Adament Creepers bioflavonoids, such as luteolin and β-sitosterol, may contribute to its anti-inflammatory properties. Given its similar mechanisms of action to diosmin and hesperidin, it is mainly useful when combined with its analgesic effects, which could provide relief for painful haemorrhoids [5].

Antioxidant Activity

The methanol extract of *Cissus quadrangularis* exhibits potent antioxidant and free radical-scavenging properties, both in laboratory tests and living systems, likely attributed to its β-carotene content. This antioxidant activity helps protect cells from damage caused by free radicals [10].

Anti-microbial and antibacterial activity

Methanol and dichloromethane extracts of stems exhibit antibacterial activity against *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*. Stem and root extracts have demonstrated antimicrobial activity. As well, the alcoholic extract of the aerial part shows antiprotozoal activity against *Entamoeba histolytica*, and the alcoholic extract of the stem is active against E. coli.

Antiplasmodial Activity

Methanol and dichloromethane extracts of the whole plant have been tested for antiplasmodial activity, suggesting potential effectiveness against malaria-causing parasites [11].

Anti-ulcer activity

The methanol extract of *Cissus quadrangularis* exhibits significant antiulcer activity by reducing gastric secretions and enhancing glycoprotein levels, thereby promoting healing in experimentally induced ulcers in rats. Its antioxidative mechanism also protects against aspirin-induced gastric mucosal damage. The presence of triterpenoids and β-sitosterol in the extract contributes to its anti-lipid peroxidation effect, which helps prevent gastric damage [7].

Analgesic, anti-inflammatory and stimulatory activity

Methanol extract possesses analgesic, anti-inflammatory, and venotonic effects associated with haemorrhoids anti Anti-inflammatory activity is due to flavonoids, especially luteolin, and β-sitosterol. B-sitosterol present in the methanol extract has the ability to reduce the enzymes MPO, indicating a reduction of neutrophil influx in the inflamed tissue. Ethanol extract exhibits a protective effect on neutrophil-mediated tissue injury induced by aspirin in rats 34. Methanol extract (90%) and dichloromethane extract of stems possess anti-inflammatory activity against COX-2. The stimulatory effect of the extract is probably due to vitamins and is greater than that of the anabolic hormone durabolin [14].

Bone healing activity and Antiosteoporotic Activity

Cissus quadrangularis extracts have shown potential in bone healing and for the osteoporosis treatment. In bone healing, the paste of alcoholic extract applied locally or intramuscularly accelerated fracture healing in albino rats. Ethanol extract (95%) promoted cortical bone and trabeculae development in fetal femur, possibly due to its high content of calcium, phosphorus, and phytoestrogenic steroids. With regard to antiosteoporotic activity, ethanol extract (95%) of the whole plant demonstrated antiosteoporotic effects in ovariectomized rats with osteoporosis, at doses of 500 and 750 mg/kg body weight [6].

Central Nervous System Activity

The root extract possesses central nervous system depressant activity, indicated by a decrease in exploratory behaviour. Methanol extract of roots contains saponins, which show potent sedative activity and inhibit spontaneous motor activity in mice [2]. Miscellaneous activity: Acetone and dichloromethane extract of the plant possesses proteolytic activity against cysteine protease. Extract of the plant has wound healing activity and molluscicidal activity. The extract of the plant exhibits cardiotonic and androgenic properties. Ethanol extract (50%) of aerial parts possesses hypotensive activity, and the stem extract possesses diuretic activity. The plant formulation is used in the management of weight loss, metabolic syndrome, and cardiovascular problems [8].

Conclusion

There has been a notable surge in the ethnobotanical and traditional uses of natural substances in recent years. Plant derivatives are thought to be safe for human consumption. It is significant to mention that the plant *Cissus quadrangularis*'s root and stem extracts have antibacterial, antioxidant, and wound-healing qualities. These extracts are frequently used to speed up the healing of fractured bones. Because of its many medical uses, this plant is considered a multifaceted medicinal resource in both Ayurvedic practices and modern pharmaceutical development. They should be investigated using modern scientific techniques, such as phytochemical analysis, biotic evaluation with experimental animal models, toxicity assessments, investigation of the molecular mechanisms of action of isolated phytochemical components, and clinical trials. This article clearly states an example of a traditional method for finding novel lead compounds to cure a variety of illnesses. In order to discover a lead chemical from natural resources, future research must assess the separated principles from *Cissus quadrangularis* scientifically, utilizing certain experimental animal models and clinical trials to comprehend the molecular mechanism of action.

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