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Pharmacognostical and Phytochemical Review of *Cissus quadrangularis* Linn. (Asthishrinkhala): Integrating Traditional Use with Modern Evidence

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Abstract
Cissus quadrangularis Linn., commonly known as Asthishrinkhala or Hadjod, is a succulent vine belonging to the Vitaceae family, widely distributed in India. Traditional Ayurvedic texts credit it with bone-healing, anti-inflammatory and wound-repairing properties. Modern research has identified diverse bioactive constituents—including triterpenoids, flavonoids, stilbenes and minerals—that underpin osteogenic, antioxidant and antimicrobial activities. Clinical and preclinical studies suggest that *C. quadrangularis* accelerates fracture healing and may benefit bone-loss conditions. Pharmacognostical characterisation (morphology, microscopy, powder analysis) provides firm means to authenticate the drug and prevent adulteration. This review synthesises botanical taxonomy, morphological features, phytochemistry, pharmacology and standardisation efforts of *C. quadrangularis*, highlighting its therapeutic potential and the imperative for quality control in herbal commerce.

Keywords: Asthishrinkhala, Cissus quadrangularis, pharmacognosy, phytochemistry, bone healing, herbal standardisation

Introduction
Pharmacognosy—the science of drugs of natural origin—serves as the cornerstone for identifying, authenticating and standardising botanical medicines. The therapeutic efficacy of any herbal drug depends crucially on correct identity, purity and quality of the plant material used. *Cissus quadrangularis* Linn. (Vitaceae), locally called Asthishrinkhala in Sanskrit and Hadjod in Hindi, has a long history of use in traditional medicine for fractures, joint disorders and general bone health. This succulent climbing plant thrives in tropical Indian plains, coastal regions, wastelands and up to elevations of about 500 m. It propagates readily from stem cuttings and flowers between June and December. Morphologically, its stem is distinctively quadrangular with four wings, internodes between 4-15 cm long and 1-2 cm thick. Leaves are simple, broadly ovate or reniform, often lobed, with small stipules. Flowers occur in cymes, and the fruits are red berries when ripe.

Fig 1: Plant of *Asrhishrinkhla*

Given the commercial demand and widespread usage, there is risk of adulteration, substitution or quality variation in raw materials. Hence, detailed pharmacognostical, phytochemical and pharmacological evaluations are essential. This review aims to integrate classical Ayurvedic descriptions with modern scientific research on *C. quadrangularis*, emphasising its morphology, chemistry, therapeutic actions and standardisation protocols.

Review of Literature

Botanical and Taxonomic Profile

Kingdom: Plantae; *Division:* Magnoliophyta; *Class:* Magnoliopsida; *Order:* Rhamnales; *Family:* Vitaceae; *Genus:* Cissus; *Species: C. quadrangularis* Linn.

The Vitaceae family comprises climbing shrubs or small trees often with tendrils, simple or lobed leaves, and typically juicy berries as fruits. *C. quadrangularis* is a xerophytic, succulent climber, widely distributed across tropical India, Sri Lanka, Malaysia and Africa.

Ethnobotany and Traditional Uses

In Ayurvedic lexicon the plant is listed under synonyms such as Asthisanhari, Vajravalli. Vernacular names across India include Hadjod (Hindi/Punjabi), Horjora (Bengali), Kandvel (Marathi) and Peranta (Malayalam). Traditionally it is employed in bone fracture healing, joint disorders, swelling, wound healing, gastrointestinal disturbances and as a general tonic.

Phytochemistry

Numerous studies have isolated a wide array of phytochemicals: triterpenoids (α-amyrin, β-amyrin), sterols (β-sitosterol, stigmasterol), stilbene derivatives (resveratrol, piceatannol, quadrangularins A-C), flavonoids (quercetin, kaempferol), minerals (calcium, phosphorus), saponins, phenols and alicyclic lipids. These compounds provide the biochemical basis for its bone-healing, antioxidant and anti-inflammatory actions.

Pharmacological Evidence

Preclinical and clinical studies support the plant's osteogenic potential. Animal experiments show accelerated callus formation, increased bone mineralisation, and enhanced biomechanical strength of healed bones. Human trials indicate reduced fracture-healing time and improved bone biomarkers. Other activities include antioxidant, antiulcer, antimicrobial, analgesic and anti-inflammatory effects. The safety profile is favourable with rare adverse effects reported.

Standardisation and Quality Control

Standardisation frameworks such as the Ayurvedic Pharmacopoeia of India (API) specify raw-drug parameters including foreign matter, ash values, extractive values, heavy-metal limits and microbial counts for *C. quadrangularis* stem. Additionally, pharmacognostical identification (macroscopic, microscopic, powder) and chromatographic fingerprinting are recommended to ensure authenticity and detect adulteration.

Morphological characters of *asthishrinkhala*[40]

Habitat: Found throughout the hotter parts of India alongside hedges, neighbouring countries like Pakistan, Bangladesh, Sri Lanka and Malaysia. It can be cultivated in plains coastal areas, jungles and wastelands up to 500m elevation.

Habit: A large succulent plant.
Roots: are aerial, develop during rainy season.
Stem: is buff coloured with greenish ting, dichotomously branched, sub-glabrous, fibrous and smooth.

Fig 2: Stem of *Asthishrinkhala*

Tendril: occasionally present at nodes.
Internodes: measures 4-5 cm long and 1 2 cm thick.
Leaves: are simple or lobed, cordate, broadly ovate or reniform, serrate, de Tate, sometimes 3-foliate.

Fig 3: Leaf of *Asthishrinkhala*

Flowers: are small, greenish white, bisexual, tetramerous, in umbellate cymes, opposite to the leaves. Petals are 4-5, imbricate.

Fig 4: Flower of *Asthishrinkhala*

Calyx: is short, entire, deciduous and cup shaped.
Fruit: are globose or obovoid fleshy berries, succulent, very acrid, dark purple to black.

Fig 5: Fruit of *Asthishrinkhala*

Seeds: are ellipsoid or pyriform, one seeded, flowering and fruiting time - post rain and autumn season.

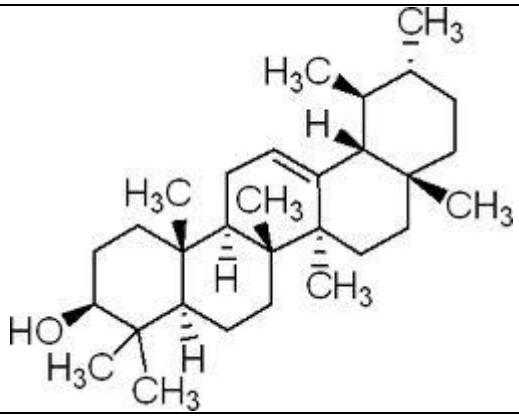
Fig 6: Seed of *Asthishrinkhala*

Methodology
This narrative review was compiled through an extensive search of peer-reviewed literature in PubMed, PMC, ScienceDirect, Scopus and Google Scholar (up to 2025). Search terms included "Cissus quadrangularis", "Asthishrinkhala", "bone healing", "phytochemistry", "pharmacognosy", "herbal standardisation". Inclusion criteria: English-language articles evaluating botanical, phytochemical or pharmacological aspects of *C. quadrangularis*. Data extraction focused on taxonomy, morphology, phytochemical profiles, therapeutic studies and standardisation guidelines. Comparative synthesis of traditional and modern evidence was undertaken.

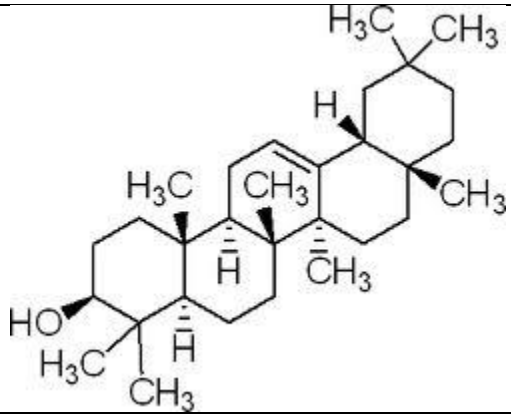
Results
Botanical and Morphological Features

- ***Habitat & Habit*:** Widely found in India's warmer zones, plains and wastelands up to 500 m elevation. Propagated from stem cuttings.
- ***Stem*:** Succulent, quadrangular in cross section with four wings; internodes 4-15 cm long, 1-2 cm thick; smooth, glabrous surface with a buff-green hue tinged with reddish-brown wings.
- ***Leaves*:** Simple, broadly ovate/reniform or 3-7 lobed, 2.5-5 cm long; denticulate margins; petioles 6-12 mm.
- ***Inflorescence & Fruit*:** Short-peduncled cymes; petals 4; berry globose or obovoid ~6 mm, red when ripe, one-seeded.

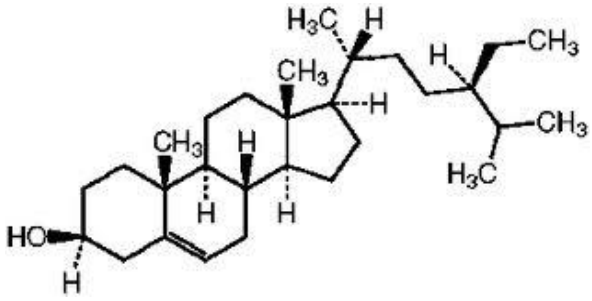
Pharmacognostical Characteristics
Microscopic stem analysis reveals: single-layered epidermis with thick cuticle, parenchymatous cortex, sclerenchymatous patches at wing margins, vascular bundles close to wing edges with sclerenchyma caps, prominent pith. Powder microscopy shows xylem fibres, vessel elements (scalariform pits), parenchyma fragments, cyclocytic stomata, abundant calcium oxalate raphides and druses.



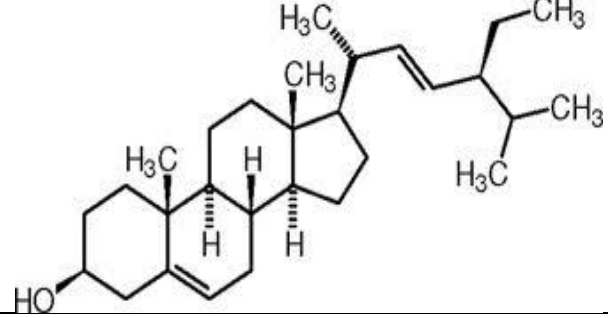
α-amyrine



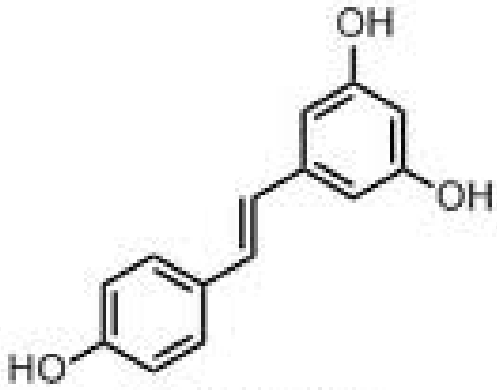
β-amyrine



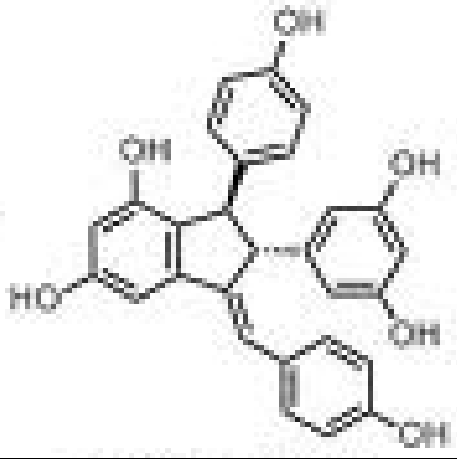
β-Sitosterol



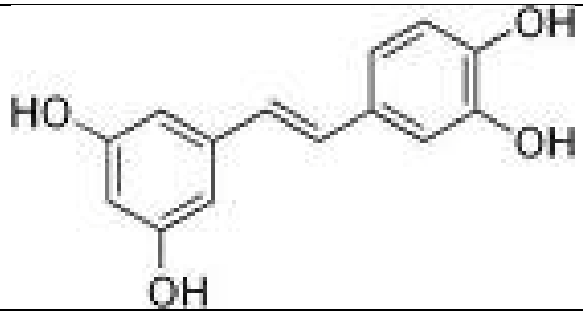
Stigmasterol



Resveratrol



Quadrangularis A



Piceatannol

Chemical Constituents of *Cissus quadrangularis*		
Part used	**Constituents**	**References**
Stem	Calcium ions and phosphorus	62
Stem	Calcium oxalate, 31 methyl, tritiacontanoic acid, taraxeryl acetate, taraxerol and iso-pentadecanoic acid	63, 64
Stem	A and β-amyrins, β-sitosterol, ketosetosterol, phenols, tannins, vitamin, carotene	65
Stem	Saponins and phenol	66
Aerial parts	7-Oxo-Onocer-8-ene-3 β 21 α diol	67, 68
Root powder	Potassium, calcium, zinc, sodium, iron, lead, cadmium, copper and magnesium	69, 70, 71
Ash of plant	Sodium, potassium, magnesium and calcium, potassium tartrate	72
Leaves	Resveratrol, piceatanon, pallidol, parthenoCissus, alicyclic lipids	73

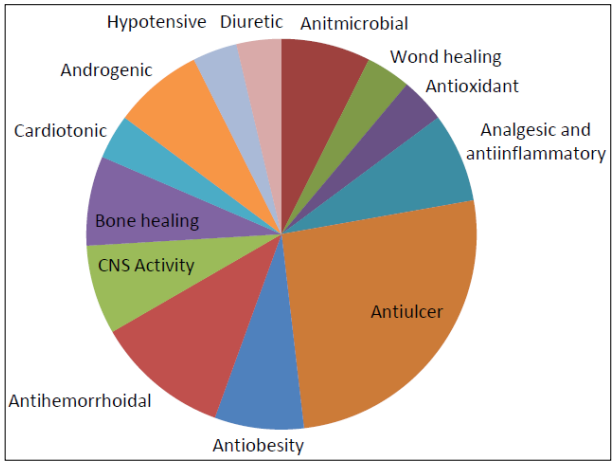
Folk Remedies and Traditional uses of *Cissus quadrangularis*		
Part used	**Uses**	**References**
Stem	Broken bones	74
Stem	Muscular pains	75
Stem juice	Treat scurvy, menstrual disorders, otorrhoea and epistaxis	76
Stem	Asthma, burns and wounds, bites of poisonous insects	77, 78
Stem	Stomachic	79, 80
Stem	Wound	81, 82
Sap with tamarind	Gonorrhea	83
Ash of plant	Substitute for baking powder	84
Shoots	Anthelmintic	85
Leaves	Bowel infections	86
Aerial parts	Wounds, lumpy skin disease and as tick repellent	87

Phytochemical & Pharmacological Findings

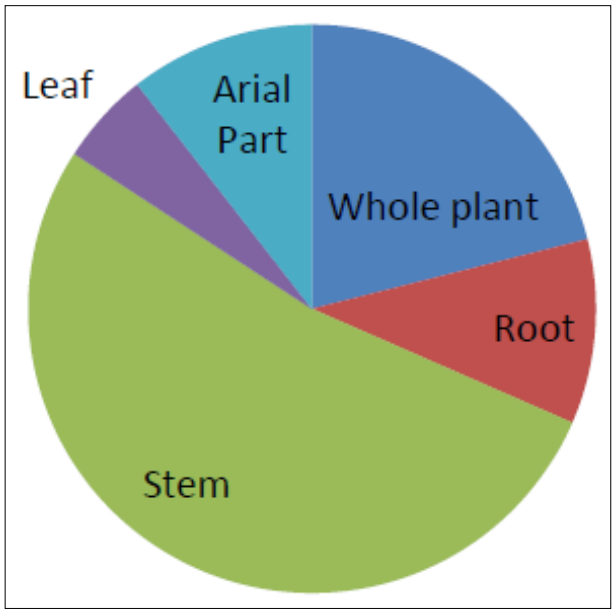
Active compounds: triterpenoids, sterols, flavonoids, stilbenes, calcium/ phosphorous. Pharmacology: accelerated fracture healing (animal/human), increased osteoblast proliferation, enhanced mineral deposition, reduced bone-loss in osteoporotic models, antioxidant and anti-inflammatory actions.

Quality Standards

API reports foreign matter ≤1 %, total ash ≤5 %, acid-insoluble ash ≤1 %, alcohol-soluble extractive ≥3 %, water-soluble extractive ≥23 %, fixed oil ≥3 %, moisture ≤5 %, heavy-metal and microbial limits defined. Verified chromatographic fingerprints and pharmacognostic diagnostics ensure drug authenticity.



Graph 1: Biological Activity of *Cissus quadrangularis*



Graph 2: Work Carried Out on *Cissus quadrangularis*

Discussion

The integration of classical Ayurvedic usage with modern scientific evidence provides robust validation for *C. quadrangularis*. Its morphological uniqueness (quadrangular stem) simplifies field identification; microscopic diagnostics (collenchymatous wings, calcium oxalate crystals) secure lab authentication. Pharmacologically, the bone-healing and anti-osteoporotic effects meet traditional claims of *sandhāna karma* and *asthi-vriddhi*.

Standardisation is crucial: Adulteration and substitution undermine efficacy and safety. Pharmacognostical and chromatographic baseline data enable reliable raw-drug quality. Despite substantial evidence, limitations exist: many human trials are small, dose-response relationships lack clarity, and mechanistic pathways require further elucidation.

Future research should focus on large-scale human clinical trials, standardised extract formulations, mechanistic studies (e.g., MAPK, RANKL/osteoclastogenesis), and supply-chain traceability to ensure consistent therapeutic outcomes.

Conclusion

Cissus quadrangularis Linn. (Asthishrinkhala) stands out as a validated herbal drug combining strong traditional use with growing modern scientific support. Pharmacognostical, phytochemical and pharmacological data converge to affirm its value in bone-health, fracture-healing and broader therapeutic domains. Standardisation and quality-assurance frameworks are essential for safeguarding its efficacy and safety. With continued research and integration into evidence-based practice, *C. quadrangularis* offers promising contribution to herbal medicine and global health.

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