REVIEW ARTICLE

A review on phytochemical and pharmacological aspects of *Cissus quadrangularis* L.

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Cissus quadrangularis L. (Vitaceae) is a common perennial climber, which is distributed throughout Bangladesh. Though almost all of its parts are used in traditional systems of medicines seeds, stem, roots and shoots are the most important parts which are used medicinally. The article reveals that wide numbers of phytochemical constituents have been isolated from the plant which possesses activities like anti-inflammatory, anti-tumor, gastro-protective, antioxidant, antimicrobial and various other important medicinal properties. The stem juice of plant is used in menstrual disorders, epistaxis and leaves is used against bowel infections. For the last few decades or so, extensive research work has been done to prove its biological activities and pharmacology of its extracts. The current review deals with the enormous amount of updated information of scientific research and reports available in different aspects of this plant involving phytochemical and pharmacology. This review also includes reports on taxonomy, morphology, monographs, distribution, tissue culture and traditional medicinal uses of the plant.

Key words: *Cissus quadrangularis*, phytochemical constituents, pharmacological activity, traditional uses

INTRODUCTION

The plant kingdom has been the best source of remedies for curing a verity of disease and pain. The drug discovery industry is equally dependent on natural products for new medicines[1] mainly because existing therapies exhibit many side effects that results in the recall of drugs, bringing huge losses to the pharmaceutical industries. Recently there has been a tremendous increase in the use of plant based health products in developing as well as developed countries resulting in an exponential growth of herbal products globally. According to the WHO more than 80% of the world's population relies on traditional herbal medicine for their primary health care.[2] Plants continue to serve as possible sources for new drugs and chemicals derived from various parts of plants.[3] However, due to over population, urbanization and continuous exploitation of these herbal reserves, the natural resources along with their related traditional knowledge are depleting day by day.[4]

In the present era of drug development and in discovery of newer drug; molecules of many plant products are evaluated on the basis of their traditional uses. One of the many plants which are being evaluated for their therapeutic efficacies is *Cissus quadrangularis* which is commonly known as Hadjod (Bengali) and Edible Stemmed Vine (English). It is an annual or perennial herb, entire leaves, buff colored with greenish ting and requires warm tropical climate and propagated by stem cuttings in months of June and July. Although it has many medicinal properties, it is particularly used to reduce body weight, anthelmintic, muscular pains, asthma, broken bones, antiulcer, antihemorrhoidal, antimicrobial etc., No systematic studies have been reported for its pharmacological and phytochemical study hence an effort has been made to establish the pharmacological as well as phytochemical study of *Cissus quadrangularis*.

Access this article online	
Quick Response Code:	Website: www.greenpharmacy.info
	DOI: 10.4103/0973-8258.104924

Taxonomy of *Cissus Quadrangularis*

Besides the usual botanical classification, medicinal plants can be classified according to the part used, habit, habitat, therapeutic value etc., But the botanical classification is the most comprehensive and scientific classification which is as following:

Kingdom	*Plantae* – Plants
Subkingdom	*Tracheobionta* – Vascular plants
Super division	*Spermatophyta* – Seed plants
Division	*Magnoliophyta* – Flowering plants
Class	*Magnoliopsida* – Dicotyledons
Subclass	*Rosidae*
Order	*Rhamnales*
Family	*Vitaceae* – Grape family
Genus	*Cissus* L. – Treebine
Species	*Cissus quadrangularis* L.

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Received: 14-08-2012; **Accepted:** 26-09-2012

Synonyms

Cissus succulent, *Cissus tetragona*, *Vitis quadrangularis*, *Vitis succulenta*

Plant Parts Used

The whole plant used specially leaves, roots and stem.

Monographs

Bengali Names	:	Hadjod, Harbhanga
English Names	:	Edible Stemmed Vine
Sanskrit	:	Asthisamdhani
Marathi	:	Kandvel
Tamil	:	Perandi
Scientific Name	:	*Cissus quadrangularis* L.
Family	:	*Vitaceae*
Duration	:	Perennial or annual
Growth habit	:	Herb
Bangladesh nativity	:	Native

Morphology

- Trees with simple leaves (entire leaves)
- Leaves are simple or lobed, cordate, broadly ovate or reniform, serrate, dentate, sometimes 3-foliate and glabrous
- Stem is buff colored with greenish ting, dichotomously branched, sub-angular, glabrous, fibrous and smooth. Drug occurs in various parts of the stem
- Internode measures 4-5 cm long and 1-2 cm thick, a tendril occasionally present at nodes
- Flowers are small, greenish white, bisexual, tetramerous, in umbellate cymes, opposite to the leaves
- Petals are 4-5, imbricate.
- Calyx is short, entire, deciduous and cup shaped.
- Fruit are globose or obovoid fleshy berries, succulent, very acrid, dark purple to black
- Roots are aerial, develop during rainy season
- Seeds are ellipsoid or pyriform, one seeded.

Distribution

Cissus quadrangularis is an annual or perennial herb with huge medicinal properties distributed throughout the tropical world. It requires warm tropical climate and propagated by stem cuttings in months of June and July. It is found throughout the hotter parts of Bangladesh, Thailand, Java, Philippines also India, West Africa and Ceylon.[5]

Phytochemistry

The plant contains potassium, calcium, zinc, sodium, iron, lead, cadmium, copper, calcium oxalate and magnesium. Other constituents of the plant are resveratrol, piceatannol, pallidol, parthenocissus, 31 methyl triacontanoic acid, taraxeryl acetate, taraxerol, iso-pentadecanoic acid, phenol, tannin, carotene and vitamin. It also contains 31 methyl tritiacontanoic acid and 7 –Oxo onocer-8-ene-3 β 21 α diol. The chemical constituents of *Cissus quadrangularis* are shown in Table 1.

FOLK REMEDIES AND TRADITIONAL USES

Traditionally, the roots and stems are most useful for healing of fracture of the bones. The plant has been documented in Ayurveda for the treatment of osteoarthritis, rheumatoid arthritis and osteoporosis. The stem juice of plant is used to treat scurvy, menstrual disorders, otorrhoea and epistaxis. The herb is fed to cattle to induce flow of milk. The stout fleshy quadrangular stem is traditionally used for treatment of gastritis constipation, eye diseases, piles and anemia. Various traditional uses of the herb are mentioned in Table 2.

PHARMACOLOGY

Following the folk and traditional uses of the plant, it has been investigated scientifically to validate the potential

Table 1: Chemical constituents of *Cissus quadrangularis*

Part used	Constituents	References
Stem	Calcium ions and phosphorus	[6]
Stem	Calcium oxalate, 31 methyl tritiacontanoic acid, taraxeryl acetate, taraxerol and iso-pentadecanoic acid	[7,8]
Stem	A and β-amyrins, β-sitosterol, ketosetosterol, phenols, tannins, vitamin, carotene	[9]
Stem	Saponins and phenol	[10]
Aerial parts	7-Oxo-Onocer-8-ene-3 β 21 α diol	[11-13]
Root powder	Potassium, calcium, zinc, sodium, iron, lead, cadmium, copper and magnesium	[5,14,15]
Ash of plant	Sodium, potassium, magnesium and calcium, potassium tartrate	[16]
Leaves	Resveratrol, piceatanon, pallidol, parthenocissus, alicyclic lipids	[17]

Table 2: Folk remedies and traditional uses of *Cissus quadrangularis*

Part used	Uses	References
Stem	Broken bones	[18]
Stem	Muscular pains	[19]
Stem juice	Treat scurvy, menstrual disorders, otorrhoea and epistaxis	[19]
Stem	Asthma, burns and wounds, bites of poisonous insects	[20,21]
Stem	Stomachic	[22]
Stem	Wound	[23]
Sap with tamarind	Gonorrhea	[24]
Ash of plant	Substitute for baking powder	[19]
Shoots	Anthelmintic	[19]
Leaves	Bowel infections	[18]
Aerial parts	Wounds, lumpy skin disease and as tick repellent	[25]

of the plant in cure of variety of ailments. Some of the reported pharmacological activities of *C. quadrangularis* are mentioned in Table 3.

Toxicological Study

Several study showed that the *Cissus quadrangularis* extract does not produce any toxic effect has been reported.[60,61]

Miscellaneous Activity

Proteolytic activity against cysteine protease and molluscicidal activity has been reported.[56,62]

Tissue Culture of *Cissus Quadrangularis*

At first the establishment of callus tissue and effect of growth regulators on enhanced sterol production in *Cissus quadrangularis* L. by using different concentration of auxin and cytokinin (BAP, IAA, NAA and 2, 4-D) has been reported.[63]

But the first successful and standard protocol has reported for *in vitro* multiplication and plantlet regeneration of *Cissus quadrangularis* from different *in vitro* grown explants (shoot tip, nodal explant and *in vivo* shoot tip) by using different hormonal concentration (Zeatin, BAP, IAA and IBA).[64]

Table 3: Pharmacological activities of *Cissus quadrangularis*

Pharmacological activity	References
Increases estrogen	[26]
Anti-inflammatory	[27-29]
Osteoblastogenesis	[30]
Increases mineralization	[31]
Increases alkaline phosphatase activity	[30]
Restore the biomechanical properties and structure of the bone	[32,33]
Anti-tumor properties	[34,35]
Analgesic properties	[27,29,36]
Reduce body weight	[37-39]
Reduce blood glucose levels and serum lipids	[40]
Alleviating insulin resistance	[41]
Gastroprotective	[42,43]
Hepatoprotective	[44]
Suppresses chronic ulcers	[45,46]
Antihemorrhoidic activity	[27]
Antioxidant	[47,48]
Antiosteoporotic activity	[49]
Antibacterial	[50-54]
Antiprotozoal	[55]
Antiplasmodial	[56]
Antiviral activity	[57]
Antipyretic activity	[36]
Antifungal activity	[52,53]
CNS activity depressor	[58]
Anticonvulsant properties	[59]

CONCLUSION

Phytochemical and pharmacological investigations carried out in the plant reveals its multidisciplinary usage. The plant was found to be very useful in reduced body weight, anti-inflammatory, gynecological disorders like menstrual problems, gonorrhea etc., Antitumor potential is the exciting aspects of the plant. Several investigators have reported the plant as a valuable antibacterial, antifungal and also active against other plant pathogens.

It is very essential to have a proper documentation of medicinal plants and to know their potential for the improvement of health and hygiene through an eco-friendly system. A detailed and systematic study is required for identification, cataloguing and documentation of plants, which may provide a meaningful way for the promotion of the traditional knowledge of the herbal medicinal plants. The present review reveals that the *Cissus quadrangularis* is used in treating various ailments.

Next level of investigations involving modern instruments like HPLC, HPTLC and NMR must be carried out in order to isolate and elucidate the active principles present in different fractions as an aid to the preliminary phytochemical analysis. The pharmacological experiments performed in the plant must be extended to the next level of clinical trial to generate novel drugs. This might prove helpful to use its immense therapeutic efficacy as a potent phytomedicine.

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How to cite this article: Sen MK, Dash BK. A review on phytochemical and pharmacological aspects of *Cissus quadrangularis* L.. Int J Green Pharm 2012;6:169-73.

Source of Support: Nil, **Conflict of Interest:** None declared.