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Morphological and anatomical characterization of *Cissus Quadrangularis* L.

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ABSTRACT

Cissus quadrangularis L. is a widely utilized perennial succulent medicinal climbing plant in the family Vitaceae and commonly known as bone setter plant. Its medicinal properties have drawn interest globally because of its ability to cure metabolic ailments, bone fractures and joint disorders. The presence of several phytochemicals including tannins, proteins, carbohydrates, triterpenoids, glycosides, phytosterols, saponins, vitamin C, alkaloids, flavonides, resveratrol, calcium etc. makes this plant significant for medicine. It is very well established as a medicine for treating problems with the bones, muscles and ligaments. The morphological and anatomical characterization aimed to explore the structural characteristics of Cissus quadrangularis L. in order to understand its medicinal properties. Various morphological features including stem shape, root type and leaf arrangement were studied and documented. Furthermore, anatomical features like root anatomy, stem anatomy and leaf anatomy were investigated through microscopy techniques. The results obtained provided valuable insights into the morpho-anatomical properties of Cissus quadrangularis L. which could aid both pharmacological exploration and its botanical identification. These characteristics can be used to differentiate between two plant species and are useful in studying phytochemical analysis which is necessary for pharmacological uses. The plant anatomy determined the production and accumulation of chemical substances.

Keywords: Anatomy, Bone setter, Climber, Phytochemicals, Succulent

INTRODUCTION

Cissus quadrangularis L. is a significant annual herb used in medicine. It is a member of family Vitaceae and primarily found in tropical forests in Asia and Africa (Oben *et al.,* 2006). It is prevalent throughout India but its presence is dominantly observed in states such as Assam, Kerala, Odisha, Madhya Pradesh, Maharashtra, Tamil Nadu and Uttar Pradesh. India is a country full of flora and fauna and has an extensive tradition of exploiting its natural resources including both plants and animals as nutritional supplements and medicinal remedies. The existence of alternative medicine systems in India such as Siddha, Ayurveda, Unani, Naturopathy and Homoeopathy established the long term, safe and continuous use of herbs (Vaidya and Devasagayam, 2007).Medicinal plants are used to produce the majority of today's pharmaceuticals in direct and indirect manner (Namdeo and Patel, 2024). In India, *Cissus quadrangularis* L. is commonly known as bone setter plant or Asthisamdhani (Sanskrit) or Hadjod (Marathi) or Harjora (Hindi) or Pirandani (Tamil) because of its unique ability to join bones. As its name suggests, it is widely utilized in bone healing activities and has a long history of use in Ayurveda (Nagani *et al.,* 2011). It is a succulent climber with a quadrangular stem that is believed to treat bone fracture, swelling, joint pains, gout and asthma (Kaur and Malik, 2014). Since the beginning of human civilization, nature has been a source of medicinal products (Semwa and Kumar, 2014). The presence of several phytochemicals, including tannins, proteins, carbohydrates, triterpenoids, phytosterols, glycosides, saponins and vitamin C, alkaloids, flavonides, resveratrol, calcium etc. makes this plant significant for medicine.

It is extremely well established as a medication for the treatment related to the management of bone, muscles and ligaments. It is widely distributed in tropical and subtropical regions of the world and has been used continuously for centuries as medicine in India (Sundaran *et al.,* 2020). Traditionally, almost all aerial and underground parts have therapeutic value but the stem is frequently utilized. It plays an important pharmacological role as a bone setter and fractured bone healer. In addition, it has antimicrobial, anti-diabetic, anti-

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inflammatory, antiobesity, anti-oxidant effects, bone turnover, cardiovascular and hepatoprotective properties and many more (Kalita, 2023). The present investigation aimed to explore the morphological and anatomical characteristics of *Cissus quadrangularis* L. in order to understand its detailed structures and medicinal properties.

PLANT DESCRIPTION

Habitat

Cissus quadrangularis L. is widely found in dry habitat of tropical and subtropical regions and is very often found in coastal and lowland environments. The plant is very popular in Africa and India for its therapeutic properties. In India and the subcontinent of India such as Bangladesh, the bone setter plant can be found in thickets, open forests, shrub jungles, along forest boundries, on the banks of rivers and the wastelands at low and medium heights (Kalita, 2023)

Synonyms

This vigorously growing plant is identified by several international names and regional names. Some important synonyms of *Cissus quadrangularis* L. are adamant creeper, cactus vine, kangaroo vine, stemmed vine and veldt grape while the Indian regional names are Had-jod, Asthisamharaka, Pirandai and Hadsankal (Kalita, 2023)

Botanical Description

The perennial herbaceous climber *Cissus quadrangularis* L. is comprised of thick quadrangular stem along with other aerial parts including tendrils, leaves, inflorescence, flowers and fruits. It reaches a height of 4.8 feet and has quadrangular sectioned branches with internodes 8-9 cm long and 1.2-1.4 cm width. A leathery edge runs along each angle. 2-4 cm wide toothed trilobed leaves appeared at the nodes and each has a tendril developed from the opposite side of the node. Racemes of tiny white, yellowish, or greenish flowers and globular berries that turns red when ripe (Kalita, 2023). The systematic position of *Cissus quadrangularis* L. is described as bellow:

Kingdom-Plantae
Sub-kingdom- Phanerogams
Division- Angiospermae
Order- Vitales
Family- Vitaceae
Genus- *Cissus*
Species- *quadrangularis*

Traditional Applications: A comprehensive review of the traditional literature available on *Cissus quadrangularis* L. in India as well as abroad revealed its worldwide use in the treatment of various issues of humans and animals (Warrier, 1993). The plant was widely utilized in the Indian ancient medical systems of Siddha and Ayurveda to treat "Asthi" or bone-related conditions such osteoporosis, rheumatoid arthritis, osteoarthritis, fracture, pain and inflammation (Nagori *et. al*., 2011). According to the traditional literature of other Indian subcontinents like Pakistan, Bangladesh, Sri Lanka and even other parts of the world also claimed the use of the plant in the treatment of swelling, hemorrhage, anorexia, flatulence, dyspepsia, colic, chronic ulcer, hemoptysis, convulsion, skin diseases and leprosy (Joseph and George, 2013).

Phytochemical Composition

It contains proteins, carbohydrates, triterpenoids, phytosterols, glycosides, saponins, vitamin C, alkaloids, flavonides, resveratrol, calcium etc. (Hamid and Patil, 2023)

Pharmacological Role

Cissus quadrangularis L. exhibits analgesic and anti-inflammatory activity, anti-diabetic and wound healing properties. In addition to fracture healing properties, it has antibacterial, antifungal, antioxidant, anthelmintic and anti-hemorrhoidal properties (Hamid and Patil, 2023). The pharmacological tenor is determined in medicinal plants due to the secondary metabolite present on it (Kavita Kumari *et. al.* 2024).

MATERIALS AND METHODS

Collection of Plant Sample

Cissus quadrangularis L. plant material was collected from the Cactus Garden of S.S.S.P.M's Arts, Science and Commerce College, Rahuri, Dist. Ahilyanagar, Maharashtra India and the morphological as well as anatomical studies were carried out from the freshly collected samples at the Department of

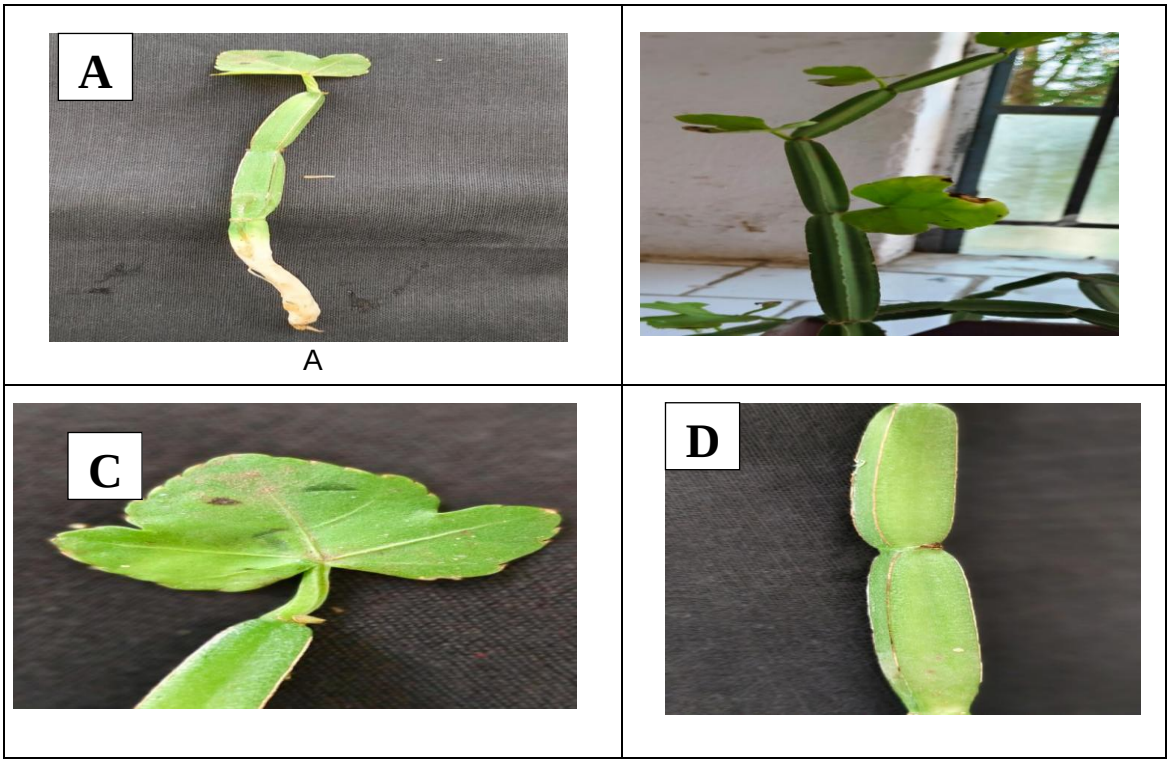

Figure 1: Morphological structures of *C. quandragularis*- A-Primary plant body with root, B- Stem and Leaf, C-Leaf, D- Stem

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Identification

An authentic taxonomic literature was used to identify the specimens.

Morphological Study

The morphological characters of *Cissus quadrangularis* L. were studied with respect to habit, stem, leaf, root, internodal length and stomatal type. The size, shape, color and type of the root, height, thickness, color and surface characters of stem, size, shape, margin, color, venation of leaf and its phyllotaxy as well as structure of tendrils on the stem were studied.

Anatomical Study

Leaf peeling was examined under the microscope to determine the stomatal type. Free hand transverse sections of root, stem and leaf of *C. quadrangularis* L. were taken, stained with safranin for two minutes while excess stain was removed using water and mounted in glycerin and observed under compound microscope and images were captured at 10X and 40X. The presence of vascular tissues, cortex, pith, types of stomata, epidermal cells and mesophyll tissues in the transverse sections of root, stem and leaves were studied.

RESULTS AND DISCUSSION

Morphological Characters

Habit: Perennial, succulent, climbing herb which climbs with the support of tendrils.

Root: Thickened, tuberous roots in old plants

Stem: The stem of the plant is moist, thick, long, fleshy, dark green in color and capable of photosynthesis. It is glabrous, quadrangular, angel-winged and constricted at nodes. When the stem is young, its branches have acute angles or winged. The long, slender and simple tendrils found on stem.

Leaves: Leaves are simple, entire, trilobed, alternate and appeared at the nodes, petiolate and exstipulate. The leaf surface has a smooth texture.

Tendrils: Tendrils are slender, unbranched and coiled, arise opposite to the leaves and help plant to climb over support.

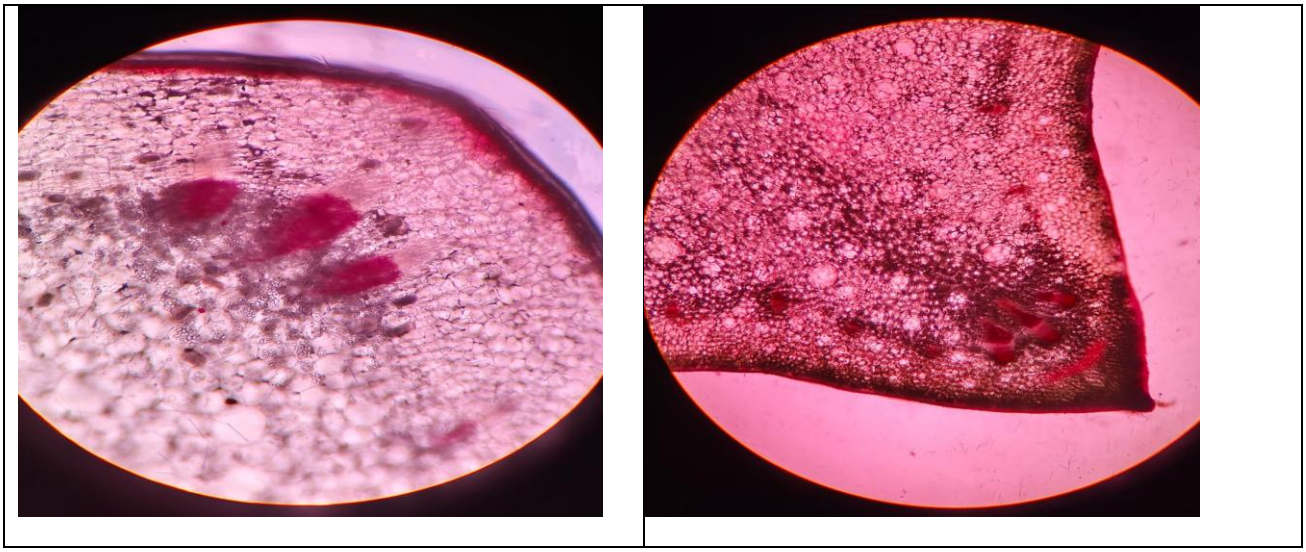

Figure 2: Anatomical structures of *C. quandragularis*- A-T.S. of Root, B- T.S. of Stem

Anatomical Characters

Free hand sections of root, stem and leaf of *C. quadrangularis* L. were prepared and observed under compound microscope Figure- 2 and the results observed are as follows:

Table 1: Morphological characters of *Cissus quadrangularis* L.

Sr.No.	Character	*Cissus quadrangularis* L.
1.	Habit	Climber
2.	Stem	Quadrangular
3.	Root	Thickened, tuberous roots in old plants
4.	Leaf	simple, entire, trilobed with alternate phyllotaxy
5.	Tendril	Long, stout, slender and leaf-opposed

Transverse Section of *C. quadrangularis* L. Root

Transverse section of *C. quadrangularis* root showed three major zones: periderm, vascular tissue and pith. It has single epidermis with root hairs. The epidermis and cortex have been divided into phellum, phellogen and phelloderm. Phellum and phellogen were observed as a single layer, but phelloderm was made up of 5-6 layer of chlorenchymatous tissue that followed by a 2-3 layers of chlorenchymatous tissue. It has parenchymatous pith. The vascular bundles found radially arranged with alternating xylem and phloem strands.

Transverse Section of *C. quadrangularis* L. Stem

The transverse section of stem was somewhat triangular in shape and showed three zones namely cortex, vascular bundle and pith. It is made up of a single layered epidermis surrounded by cuticle. Epidermis was followed by 5-6 layered chlorenchymatous hypodermis that had patches of collenchyma embedded in the hypodermis. Presence of mucilage cells were observed in the cortex. Three vascular bundles inhabited each of the stem's three corners that were collateral, open and endarch. Cambium was found between xylem and phloems as well as medullary rays were observed between each vascular bundle. The pith was parenchymatous and contained mucilage cells.

Transverse Section of *C. quadrangularis* L. Leaf

Transverse section of *C. quadrangularis* L. leaf revealed an outer epidermis, a collenchymatous zone, a parenchymatous ground zone and a centrally placed vascular zone. The epidermal cell in the abaxial surface and adaxial protuberance region were simillar in size, square to rectangular in shape and 2-6 layer of collenchyma cells were observed in the abaxial surface. Mucilage cells were also observed in the midrib region and the vascular bundles were located centrally. The vascular bundles were open, collateral and endarch. Stomata were found anomocytic.

Cissus quadrangularis L. is a well- known medicinal plant that has the ability to heal bone fractures. The present study focused on the morphological and anatomical features of *C. quadrangularis* L. that revealed detailed external and internal structures of the plant which is very crucial for the range of phytochemical and pharmacological activities. A taxonomic analysis of differences within *Cissus quadrangularis* L. in Kenya was done by Robert *et. al.*(2001). Nagori *et al.* (2011) made awareness on Allopathic, Ayurvedic and Homeopathic system of medicine in Chhattisgarh, India. Earlier works reported that anatomical differences can be used to distinguish the medicinal plant varieties (Josiane *et al.,* 2013). Kaur and Malik (2014) made a review on Botany, Chemistry and medicinal importance of *Cissus quadrangularis* L.

Ansarali *et. al.,* (2018) studied comparative morphological and phytochemical analyses of three variants of *Cissus quadrangularis* in Tamil Nadu. Previous studies have demonstrated that plants with identical morphological characteristics can differ in their metabolic characteristics. The anatomical studies of root, stem and leaf were conducted because the morphological characters showed little differences.

The anatomical studies of the root revealed three major zones namely periderm, vascular tissue and pith. The epidermis and cortex have been disintegrated into phellum, phellogen and phelloderm. The transverse section of stem was somewhat triangular in shape and showed three zones namely cortex, vascular bundle and pith. T.S. of leaf revealed an outer epidermis, a collenchymatous zone, a parenchymatous ground zone and a centrally placed vascular zone. The vascular bundles were open, collateral and endarch.

CONCLUSION

The present study dealt with the study of morphological and anatomical features of *C. quadrangularis* L. that revealed detailed external and internal structures of the plant which is very crucial for the range of phytochemical and pharmacological activities. The present morpho-anatomical study aimed to explore the structural characteristics of *Cissus quadrangularis* L. in order to understand its medicinal properties. Various morphological features including stem shape, root type and leaf arrangement were studied and documented. Furthermore, anatomical features like root anatomy, stem anatomy and leaf anatomy were investigated through microscopy techniques. The results obtained provide valuable insights into the morpho- anatomical properties of *Cissus quadrangularis* L. which could aid both pharmacological exploration and its botanical identification.

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REFERENCES

Ansarali S., Manikandan S., Alagu Lakshmanan G. M. (2018) Comparative morphological and phytochemical analyses of three variants of *Cissus quadrangularis* in Tamil Nadu. International *Journal of Pharmacy and Biological Sciences* 8 3: 579-592.

Hamid H.S. and Patil S. A. (2023) Phytochemical and Pharmacological Review of an Indian Plant: *Cissus quadrangularis*. Med. Sci. Forum.https://doi.org/10.3390/ECB2023-14557.

Joseph B. and George J. (2013) *Cissus quadrangularis* in the Treatment of Osteoporosis. WJPR. 2: 596–605.

Josiane *et al.* (2013) Evaluation of morpho-anatomical and chemical differences between varieties of the medicinal plant *Casearia sylvestris* Swartz. *Annals of the Brazilian Academy of Sciences*. **85**4: 1253-1265.

Kalita, P. (2023) A critical examination on *Cissus quadrangularis* L. as a herbal remedy. Pharmagenesis. DOI:10.13140/RG.2.2.30752.35849

Kaur K. and Malik C.P. (2014) *Cissus quadrangularis* L - Its Botany, Chemistry and Medicinal Importance: A Review. International *Journal of Pharmaceutical and Clinical Research*.**6**1: 27-35

Kavita Kumari, Arun Kumar and Vinay Oraon. (2023) Phytochemical and GC-MS Analysis of *Cuscuta reflexa* Roxb: a parasitic plant collected from host *Vitex negu*. *Annals of Plant and Soil Research* 26(3): 449-455.

Nagani Krunal, Vignesh Kevalia J, Sumitra Chanda V. (2011) Pharmacognostical and phytochemical evaluation of stem of *Cissus quadrangularis* L. International *Journal Pharmaceutical Sciences and Research*, 211: 2856-2862

Nagori K. *et al.* (2011) General Awareness on Allopathic, Ayurvedic and Homeopathic System of Medicine in Chhattisgarh, India. *Int. J. Pharm. Pharm. Sci.* 3:159–162.

Namdeo K. J. and Patel S.K. (2024) Diversity of Medicinal Weeds in Kabir Nagar region of Raipur city, Chhattisgarh, Central India. *Annals of Plant and Soil Research* 26(3): 530-536

Oben J. (2006) Lipid health Disease, 5: 24 PMID: 16948861.

Robert G.W., Qing-feng, W.,Yong W. and You-hao, G. (2001) A Taxonomic Investigation of Variation within *Cissus quadrangularis* L. Vitaceae in Kenya. *Wuhan Univ. J. Nat. Sci.* 6: 715–724.

Semwa, Alok, and Senthil Kumar M. (2014) Development of quality control parameters for the standardization of Leaves and bark of *Sida acuta* Burm. Indian *Journal of Pharmaceutical and Biological Research*, 2 4: 89- 93.

Sundaran J., Begum R., Vasanthi M., Kamalapathy, M., Bupesh, G. and Sahoo, U. (2020) A short review on pharmacological activity of *Cissus quadrangularis*. Bioinformation, 168: 579-585.

Vaidya A.D. and Devasagayam T.P. (2007)Current Status of Herbal Drugs in India: An Overview. *J. Clin. Biochem.Nutr.* **41**1: 1–11.

Warrier P.K., Nambiar V.P.K. and Ramankutty C. (1993) Indian Medicinal Plants: A Compendium of 500 Species, 1st ed.; *Orient Blackswan: Hyderabad, India.* 2:112–115.