

Morphological and Anatomical studies on traditionally used medicinal plant, *Cissus quadrangularis* L.

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Abstract

Cissus quadrangularis is the most common species, belonged to the family Vitaceae, grows in hot, dry regions of India. Medicinal plants are the backbone of the traditional medicines. Medicinal plants extracts are rich source of compounds or secondary metabolites like tannins, terpenoids, alkaloids, flavanoids. *Cissus quadrangularis* was collected from Ponnanthittu village, Cuddalore District, Tamil Nadu, India. The collection was made from June to September 2016. *Cissus quadrangularis* possesses various morphological, anatomy and medicinal uses as discussed in present paper.

Keywords: *Cissus quadrangularis*, Morphology, Anatomy and Medicinal plant.

INTRODUCTION

Medicinal plants are the backbone of the traditional medicines (Farneceworth, 1994). In many countries, including India and China, thousands of tribal communities still use folklore medicinal plants for the cure of various diseases. The great interest in the use and the importance of medicinal plants in many developing countries has led to intensified effort on the documentation of ethno medicinal data of medicinal plants (Dhar *et al.*, 1968; Waller, 1993). Millions of people in the world prefer herbal medicines, because they believe in them and regard as "their" medicines in contrast to western allopathic drugs. About 85 per cent of traditional medicines involve the use of plant extracts.

Herbal medicine is based on the promise that plants contain natural substances which can promote health and alleviate illness (Azmi *et al.*, 2011). Moreover, herbal medicines are considered to be less toxic and more free from side effects than synthetic ones. The chemical compounds found in plants or natural products that have pharmacological and biological activity and hence, they are generally used in drug discovery and drug design. Herbal medicine practice plays an important role in the primary healthcare delivery system in Ghana and in most developing countries. The world health organization (WHO) estimates that 80 percentage of the population living in rural areas uses and depends on herbal medicine

for its health needs (WHO-Traditional Medicine Strategy, 2002).

In addition to that the natural products such as herbs, fruits and vegetables become popular in recent years due to public awareness and increasing interest among consumers and scientific community (Thaipong *et al.*, 2006). Natural products which contain antioxidant properties such as phenolics include flavanoids and phenolic acids (Klimczak *et al.*, 2007), carotenoids, terpenoids and vitamins (Rupasinghe *et al.*, 2007). Epidemiological evidence has provided that the constituents in natural products show many biological and pharmacological activities, including anti-oxidative, anti-inflammatory, anticancer and antiviral effects (Pawlowska *et al.*, 2008). Moreover, medicinal plants extracts are rich source of compounds or secondary metabolites like tannins, terpenoids, alkaloids, flavanoids, etc. They exhibit a new potential source of remedy against anti-infectious pathogens and are cheaper than modern drugs used against infectious pathogens, such as bacteria, fungi viruses and nematodes that cause serious infection (Lee *et al.*, 2007).

India has a very long, safe and continuous usage of many herbal drugs in the officially recognized alternative systems of health viz. Ayurveda, Yoga, Unani, Siddha, Homeopathy and Naturopathy. India has rich biodiversity with the twelve major diversity centers. Southern India includes the two major biogeographic zones the Western Ghats and the Eastern Ghats. The Western Ghats region is known for its wealth in biodiversity and known as one of the 18 hot spots of biodiversity, which has recognized access to the globe. It is estimated to harbour approximately

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2,000 known medicinal species. Nearly 1,800 species of higher plants listed in red data book, 171 are known from Tamil Nadu botanical survey of India (BSI, 1988).

In the recent years, there has been growing interest in alternative therapies and the therapeutic use of natural products, especially those derived from plants (Goldfrank et al., 1982). Plant chemicals are often classified as primary and secondary metabolites. Primary metabolites are widely distributed in nature, occurring in one form or the other in all organisms. In higher plants such compounds are often concentrated in seeds and vegetative organs and are required for physiological functions because of their role in basic cell metabolism (Harbone, 1998).

Finally, phytochemistry evolved from natural products, chemistry is confined to the study of products elaborated by plants, and it has developed as a distinct branch discipline between natural product organic chemistry and plant biochemistry. The task of the phytochemical study is compounded in accomplishing the characterization of very small quantity of the compounds isolatable from plants. Phytochemistry is also helpful in the application of modern research for the scientific investigation in all fields.

Cissus quadrangularis

Cissus quadrangularis is the most common species, belonged to the family Vitaceae, commonly known as "Hadjod." It is probably native to Bangladesh, India or Sri Lanka, but it also found in Africa, Arabia and Southeast Asia. It has also been imported from Brazil and the Southern United States. *Cissus quadrangularis* grows natively in hot, dry regions of India. It is a herb and tendril climber reaching a height of 1.5 m, and has quadrangular-sectioned branches with internodes 8 to 11 cm long and 1.2 to 1.5 cm wide. It can be cultivated in plains coastal areas, jungles and wastelands up to 500m elevation. Plant is propagated using stem cuttings (Anonymous 1992) in the months of June and July. Plant flower in the month of June – December (Guhabakshi and Sersuma 2001).

Medicinal uses

The root and stems are bitter; and it is given internally, applied topically to cure broken bones and used in complaints of the back and spine. It has been prescribed in Ayurveda as an alternative, anthelmintic, dyspeptic, digestive, tonic, analgesic in eye and ear diseases and in the treatment of irregular menstruation and asthma. In some part of world, the whole plant is used in oral re-hydration, while the leaf, stem and root extracts of the plant are important in the management of various ailments (Rastogi and Mehrota, 1993). Some other

reports on *Cissus quadrangularis* justifies its effectiveness in management of obesity and complication associated with metabolic disorders. The leaves and young shoots are powerful alternatives. Powder is administered in treatment of hemorrhoids and certain bowel infections. The juice of the stem is useful for scurvy, stem paste boiled in lime water is given to asthma patients. It is also used as the stomachic (Oben et al., 2006). Notably *Cissus quadrangularis* has potent fracture healing property and anti-microbial, antiulcer, antioxidative, gastroprotective, cholinergic activity as well as beneficial effects on cardiovascular diseases (Klimczak et al., 2007). Additionally medicine for the Ayurveda treatment of piles, anorexia, indigestion, chronic ulcers, wounds and in augmenting fracture healing process, The root in cuts, wounds; root compounded with stem: bone fractures; stem compounded with leaf in labour pain (Agarwal, 1997; Rajpal, 2002).

MATERIALS AND METHODS

In the present study morphological and anatomical characters of *Cissus quadrangularis* were studied. The plants were collected from Ponnanthittu village, Cuddalore District, Tamil Nadu, India. The collection was made from June to September 2016.

Morphology

The macroscopic studies were carried out by naked eye in terms of taxonomical description. The organoleptic evaluation of different parts of the plants including colour, size, odour, appearance, taste, smell, texture and other characters (Evans, 2008; Wallis, 2005) was made.

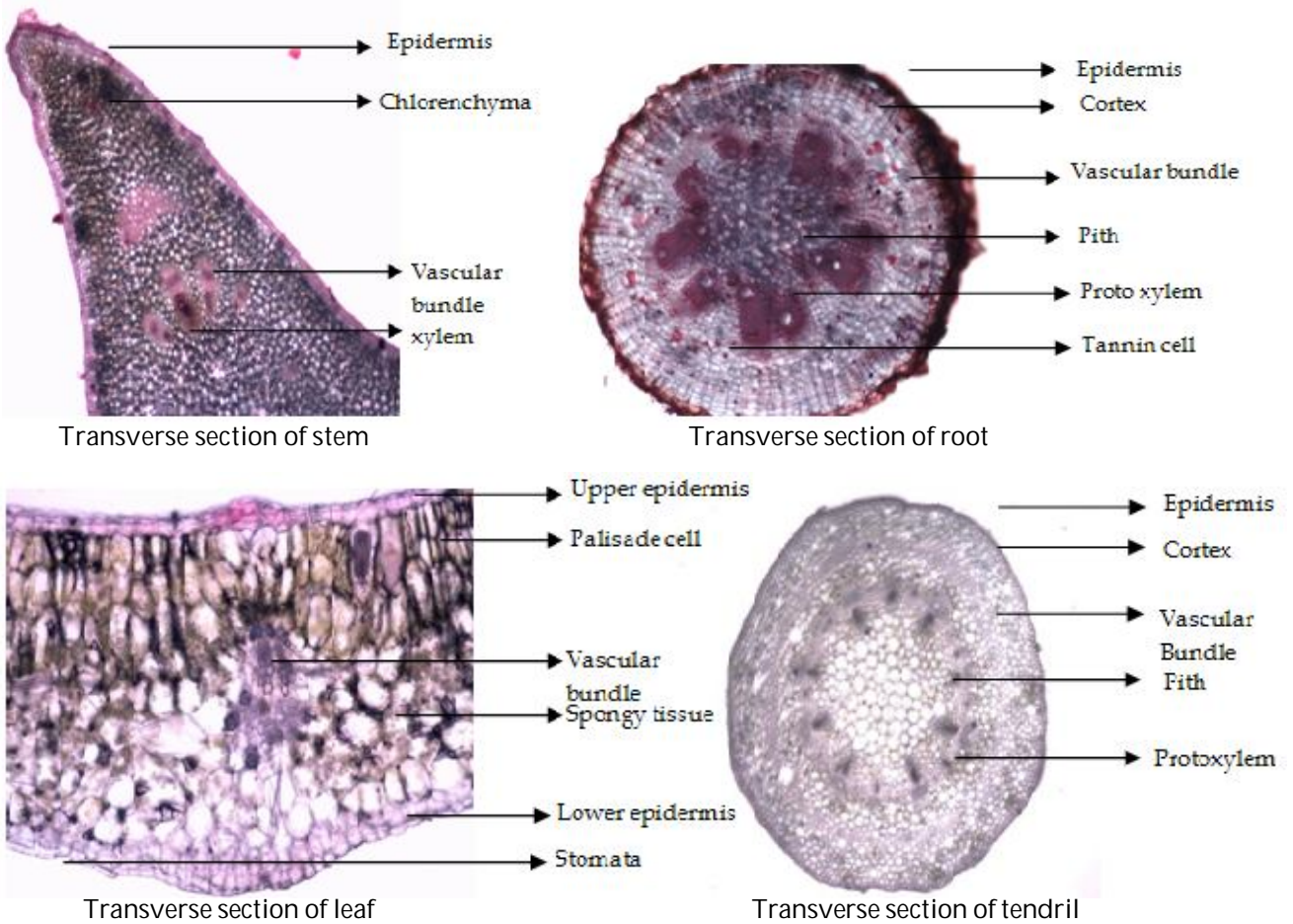
For studying stomatal morphology, venation pattern and trichome distribution, paradermal sections as well as clearing of the leaf with 5% sodium hydroxide or epidermal peeling by partial maceration employing Jeffrey's maceration fluid were employed. Glycerine mounted temporary preparations were made for macerated materials. Powdered materials of different parts were cleared with NaOH and mounted in glycerine medium after staining. Different cell components were studied and measured. Photographs (Olympus SP-350. Digital compact camera, 8.0 megapixels) were taken as observed under phase contrast microscope.

Anatomy

Microscopic descriptions of tissues were supplemented with micrographs wherever necessary. Photographs of different magnifications were taken with Nikon Lab hot 2 microscopic unit. For normal observations bright



Fig.1. Morphology of *Cissus quadrangularis* L.



field was used. For the study of crystals, starch grains and lignified cells, polarized light was used as they appear bright against dark background. Magnifications of the figures were indicated by the scale bars. Descriptive terms of the anatomical features are as given in the standard anatomy books (Esau, 1964).

RESULTS AND DISCUSSION

In the present investigation an attempt has been made to study the morphological, anatomical and medicinal uses of the plant *Cissus quadrangularis*.

Morphological characters

Figure -1 shows that the stem quadrangular, 4-winged, internodes 4-15cm long and 1-2 cm. It is rich source of ascorbic acid, carotene, anabolic steroid substance and calcium. The surface is smooth, glabrous, buff colored with greenish tinge, angular portion reddish-brown, no taste and odour. Leaves are simple 2.5-5 cm long, broadly ovate or reniform, sometimes 3-7 lobed, denticulate, glabrous, cordate, rounded and truncate at the base, leafless when old; petioles 6-12 mm long; stipules small broadly ovate, obtuse. Tendril occasionally present at nodes aerial roots developing during the rainy season, numerous tendrils grow out of the plants nodes. Flowers are in cymes with spreading umbellate branches. Calyx is cup shaped, truncate or very obscurely lobed. Petals are 4, ovate-oblong, short, stout. Berry is obovoid in shape, succulent, very acrid, pea sized, and one seeded. Root is fibrous. Many researchers discussed *C. quadrangularis* plant has morphological characters especially of stem, leaf and tendril and season of flowering of *C. quadrangularis* are noted differently in different floras and treatises on medicinal plants. The existence of variants in this species is recorded in many botanical literatures. Earlier works indicated that stem of the species is nearly leafless or leafless when old (Kirthikar and Basu, 2001). Moreover, the new leaves and branches appear during rainy season (Kannan and Jegadeesan, 1999). Leaves being caducous, the stem appears almost leafless in other seasons (Kumbhojkar *et al.*, 1991), which are of two varieties, but regarded as 'cultivars' (Kumbhojkar *et al.*, 1991). Another study revealed the formation of three sided branches from the four-sided variety (Warrier *et al.*, 1994).

Anatomical studies

Figure-2 shows the transverse section of the stem of *C. quadrangularis*. Epidermis is single layered inter many stomata all over the epidermis. Hypodermis consists of few layers of chlorenchyma cells. Ground tissue is collenchymatous. Vascular bundles arranged in the form ring around the ground tissue. Each

vascular bundle is having a distinct single layered bundle sheath. Xylem consists of only a few elements. Vessels are hexagonal in outline, phloem is distinct and differentiated from xylem in having well developed cambium. Leaf is dorsiventral. Upper epidermis single layered with thick cuticle. Some bulliform cells are seen in the upper epidermis. Mesophyll is differentiated into in palisade and spongy tissue. Palisade tissue consists of two layers of palisade cells. Spongy tissue consists of loosely arranged parenchyma cells. Vascular bundle consists of a few vessels which are hexagonal in outline. Lower epidermis is single layered with many stomata.

Tendril in transverse section is circular in outline. Epidermis is single layered with thick cuticle. Cortex is paranchymatous with intercellular spaces. Vascular bundles are arranged in the form of ring. Xylem consists of one or two lines of vessels, which are all hexagonal in outline and the protoxylem is endarch, and no distinct bundle sheath. Pith consists of large parenchyma cells which are compactly arranged. Root is circular in outline in transverse section. Periderm is with many layer of paranchyama cells and are compactly arranged. In between parenchyma cells many tannin cells are seen. Many vascular bundles are arranged in the form of ring. Xylem consists of one or two vessels with many tracheids and protoxylem is endarch. Bundle sheaths are not distinct. Pith is paranchymatous and the cells are compactly arranged without any inter cellular spaces. Anatomical characters of stem, petiole, leaf and tendril of the two variants do not show any marked variations. Presence of pearl glands has been report ed in earlier works (Metcalf and Chalk, 1957) and (Janardhanan *et al.*, 1981) , but was not observed in the specimens of the present work. The present study also spports the findings of Anoop Austin *et al.* (2004) on *C. quadrangularis* with reference to anatomical character and morphology details.

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