



AN OVERVIEW OF *CISSUS QUADRANGULARIS* L.

Amos Marume^{1,7}, Gift Matope¹, Star Khoza², Isaac Mutingwende^{5,7}, Takafira Mduluza^{3,6}, Tafadzwa Taderera⁸, Ashwell Rungano Ndhala⁴,

¹Department of Paraclinical Veterinary Studies, Faculty of Veterinary Science, University of Zimbabwe, MP167 Mt Pleasant, Harare, Zimbabwe

²Department of Clinical Pharmacology, College of Health Sciences, University of Zimbabwe, P.O. Box A178, Avondale, Harare, Zimbabwe

³Department of Biochemistry, Faculty of Sciences, University of Zimbabwe, MP167 Mt Pleasant, Harare, Zimbabwe

⁴Agricultural Research Council, Vegetable and Ornamental Plants (VOP), Private bag X923, Pretoria 0001, South Africa

⁵School of Pharmacy, College of Health Sciences, University of Zimbabwe, MP167, Mt Pleasant, Harare, Zimbabwe

⁶School of Laboratory Medicine and Medical Sciences, College of Health Sciences, University of KwaZulu Natal, Durban 4041, South Africa.

⁷Harare Institute of Public Health, East End Medical Centre, Suite C5, Tafara Building, 60 George Silundika Avenue, Harare, Zimbabwe

⁸Department of Physiology, College of Health Sciences, University of Zimbabwe, P.O.Box MP167, Mt Pleasant, Harare.

ABSTRACT

Cissus quadrangularis L. of the Vitaceae or grape family grows well in the tropics or arid regions of the world. It is native to many parts of sub-Saharan Africa and Asia. The plant has been used in humans and animals since antiquity for managing wounds, gastrointestinal disorders, bone fractures, haemorrhoids, anaemia, dehydration, tick infestations, helminthiasis, pain, diabetes, malnutrition and metabolic disorders among other applications. It has a phytoconstituent profile that include well known biological active chemicals or elements like tannins, flavonoids, vitamins, calcium, iron, magnesium, selenium, among other constituents. Many studies have demonstrated its safety and efficacies/pharmacological activities (antioxidant, free radical scavenging, anti-inflammatory, antibacterial, antifungal, antiosteoporotic, anticancer and antiviral properties/activities). The plant has also found new applications in the industry (cosmeceuticals, baking and chemical) and management of non-communicable diseases. It has relatively less stringent propagation (stem cuttings and in vitro regenerations) and growth requirements (less water, loose soils and quick response to nutrients). Thus with wider sustainable farming, characterisation and standardization; *C. quadrangularis* or extracts thereof; will be humanity's new wonder herb for managing several human and animal diseases as well as for various other industrial applications.

Key words: *Cissus Quadrangularis*, traditional uses, phytoconstituent profile.

Corresponding Author :- **Tafadzwa Taderera** Email: tadereratafadzwa@gmail.com

INTRODUCTION

Cissus Quadrangularis L. is a perennial large

Access this article online		
DOI: http://onlineijp.com/	Quick Response code 	
DOI: http://dx.doi.org/10.21276/ijp.2018.9.3.3		
Received:20.08.18	Revised:28.08.18	Accepted:10.09.18

climber of the Vitaceae or grape family (also known as *Vitis quadrangularis* (L.) Wall.ex Wight&Arn.) widely found in sub-tropical and tropical regions of Africa and Asia (Vijayalakshmi A *et al.*, 2013; Ogugua VN *et al.*, 2013; Gulzar H *et al.*, 2013; Ghouse MS, 2014). It is widely distributed in Zimbabwe and many other sub-Saharan countries as well as parts of Asia. The Vitaceae family has around 14 genera of about 900 species and they are all mostly distributed in the tropics and subtropics. In

the family *Vitisvinifera* is the most known because of its commercial importance i.e. production of wine and/or grapes (Sasidharan H and Varghese AP, 2016).

Cissus Quadrangularis is the most common of about 350 species in the genus (Mohanambal E *et al.*, 2011). Its other synonyms are *Cissus succulenta* (Galpin) Burt Davy, *Cissus cactiformis* Gulg, *Cissus tetragona* Harv., and *Vitissucculenta* Galpin (Sen MK *et al.*, 2012). It is a succulent vine, fleshy, cactus like liana known by several names Veldt Grape or Devil's Backbone, Hadjod (bone setting in Hindi), Muvengahonye (Shona; literally meaning it hates maggots speaking to its powerful wound healing properties; other Shona names are Murunjuruju or Renja), Asthisamhari, Climbing cactus, edible-stemmed vine, kangaroo vine, Winged Treebine. The plant has a thick fleshy stem (Figure 1) that has four sides (tetragonal/quadrangular) and prefers warmer and drier regions of the world. The leaves which grow on its nodes are usually 8cm long and 6cm wide and it grows to 2m or more. It is usually leafless when old. Numerous simple tendrils (Figure 1) which also grows on the nodes opposite to leaves and are useful for twining the plant to a suitable support. Leaves are simple or lobbed, flowers are bisexual and fruits are ovoid fleshy berries (Figure 1) with one seed (Shah U, 2011).

The plant grows on its own or as a result of deliberate planting, propagation is often through stem cuttings and the utilization of poly-bags (in nurseries). Mature stems are more efficient for rapid propagation and they are easy to cut from the main plant. The plant responds well to nutrients especially when grown in arid conditions. Commercial cultivation is being done in fields with well-draining soils in many areas especially in India (Karadbhaje S *et al.*, 2014; Patel DK, 2015). The plant can also be propagated or grown through *in vitro* multiplication, plantlet regeneration or tissue cultures where conditions are altered to encourage production of wanted phytoconstituents like sterols.

Classification

Kingdom: Plantae

Subkingdom: Tracheobionta

Super division: Spermatophyta

Division: Magnoliophyta

Class: Magnoliopsida

Subclass: Rosidae

Order: Vitales

Family: Vitaceae

Genus: *Cissus*

Species: *quadrangularis* (*Cissus Quadrangularis* L.) (Kumar R *et al* 2007).

Pharmacology and Applications

Cissus Quadrangularis has many applications in traditional medicine. It is useful for haemorrhoids, diabetes, obesity, asthma, malaria, gastrointestinal upsets,

peptic ulcer disease, ear and eye diseases, cardiovascular diseases, high cholesterol, menstrual disorders, bone fractures, scurvy, anti-flatulence, bodybuilding supplementation in place of anabolic steroids and bone strengthening (Raj JS *et al.*, 2011; Jainu MK *et al.*, 2005)). It is used in oral rehydration e.g. in Cameroon and anaemia management (Ruskin RS *et al.*, 2014). The plant is thought to be more effective on wounds that are on the white tissues of the body e.g. on tendons and ligaments. Other applications of *C. quadrangularis* include; use in sprains, rheumatism, irregular growth of teeth, anthrax, haematuria, elephantiasis, dislocation of the hip (Ruskin RS *et al.*, 2014). It has also been used to manage gout, syphilis and other venereal diseases, leucorrhoea and as an aphrodisiac. The plant is fed to cattle to encourage milk production and its ash is used as a substitute of baking powder. Other applications include as a drench for sick horses by the Zulu people and its aerial parts are useful in the management of animal wounds, lumpy skin disease and tick management (Ruskin RS *et al.*, 2014). Modern applications of *C. quadrangularis* include management of obesity and other metabolic disorders as an oral formulation with other active ingredients. It is also part of human and animal diets in some parts of the world including India (Vijayalakshmi G *et al.*, 2011).

Extract or parts thereof have antioxidant, anti-inflammatory, antiulcer or cytoprotective, antiosteoporotic, cardiogenic, androgenic, anthelmintic, analgesic, antipyretic, anticancer, antibacterial and antifungal properties (Kashikar ND and George I, 2006). A study done in India demonstrated that alcoholic extracts have anthelmintic properties (through the induction of paralysis and death) comparable to drugs like piperazine. Ruskin demonstrated that ethanol, methanol and ethyl acetate extracts of whole aerial parts of *C. quadrangularis* have powerful antibacterial properties. In the same study they also demonstrated some *in vitro* anticancer activity of the ethyl acetate extract of *C. quadrangularis* stem (Ruskin RS *et al.*, 2014). Gulzar *et al* also demonstrated some antibacterial (against both gram positive and negative bacteria e.g. *Staphylococcus aureus* and *Salmonella paratyphi* respectively), antifungal (e.g. *Candida albicans*) and anticancer properties.

Other reported pharmacological activities include elevation of blood oestrogen levels, anti-inflammatory, osteoblastogenesis, mineralization promotion, increased alkaline phosphatase activity, restoration of the biomechanical properties and structure of the bone, anti-tumour properties, analgesic properties, reduction of body weight, reduction of blood glucose and lipids levels, alleviation of insulin resistance, gastroprotective, hepatoprotective, suppression of chronic ulcers, antihemorrhoidic activity, antioxidant and free radical scavenging properties, antiosteoporotic activity, antibacterial, antiprotozoal, antiplasmodial, antiviral activity, antipyretic activity, antifungal activity, depressant

activities to the CNS, anticonvulsant properties, muscle relaxation properties and parasympathomimetic activity (Marume A *et al.*, 2017; Mishra G *et al.*, 2010; Srivastava AK *et al.*, 2011; Teware K *et al.*, 2010; Kumar R *et al.*, 2005).

Phytochemistry

Cissus quadrangularis has an array of phytoconstituents that have wide ranging biological effects. These phytochemicals include; ascorbic acid (Vitamin C), carotene, anabolic steroidal substances, calcium, β -sitosterol, δ -amyrine, δ - amyrone, flavonoids, tannins, triterpenoids alkaloids, asarone ($C_{12}H_{16}O_3$), 7-Oxo-Onocer-8-ene-3 β 21 α diol, 4-hydroxy 2 methyl-tricos-2 ene -22- one, 9-methyloctadec- 9-ene,anthroquinones, resveratrol, piceatannol, pallidol, parthenocissin, quadrangularins (A, B, C etc.), flavonoid (quercetin), other vitamins, enzymes, heptadecyl-octadecanoate, icosanylicosanoate, 31-methyl tritriacontan-1-ol, 7- hydroxy- 20- oxo- docosanyl cyclohexane and 31-methyl tritriacontanoic acid, taraxeryl acetate, friedelan-3-one, taraxerol, isopentacosanoic acid, nicotinic acid, tyrosine, and triterpenoids (Manikandan VG *et al.*, 2013; Chanda S *et al.*, 2013; Rasale PL, 2014; Kumar ST *et al.*, 2012; Maiti K *et al.*, 2007). Figure 2; shows structures of selected phytochemicals found in various extracts of *C. quadrangularis*. Apart from calcium highlighted above various analysis have demonstrated the presence of nutrients and many trace elements justifying it as a good vegetable for human as well as animal consumption. Examples of nutrients and elements in *C. quadrangularis* include proteins, fats, fibres, potassium, zinc, sodium, iron, lead, cadmium, copper, oxalates and magnesium (Marume A *et al.*, 2017).

Many phytoconstituents of *C. quadrangularis* apart from medicinal properties have gained applications in the wide industries for example squalene (used in

cosmetics as a natural moisturizer), oleic acid ($C_{18}H_{34}O_2$ - emulsifying or solubilizing agent), stearic acid (an ingredient in making candles, plastics, dietary supplements, oil pastels, cosmetics, and softening rubber), omega-3 and -6 (essential fatty acids) and phytol ($C_{20}H_{40}O$ – a precursor for vitamins E and K₁) (Manikandan VG *et al.*, 2013). Stems especially the young ones are being made into curries and chutneys, leaves and shoots as well as stem pulp are consumed as part of various diets. The plant's powders and/or extracts have been formulated into biscuits and cookies (Vijayalakshmi G *et al.*, 2011).

Safety of *Cissus quadrangularis* L.

The safe dose of *C. quadrangularis* exceeds 2000mg/kg body weight in rats (Marume A *et al.*, 2017) which is way higher than the doses in humans or animals. Many other authors have reported on the safety of *C. Quadrangularis* (Sen MK *et al.*, 2012). Oral administration of relatively high doses for a prolonged period does not have any observed toxic effects in mice, rats and guinea pigs but intravenous administration has been shown to lead to convulsions and sudden death (Sen MK *et al.*, 2012). Some oral sub-chronic toxicity studies have shown that *C. quadrangularis* does not lead to any dose-related haematological parameter changes or any histological lesions to any internal organ. Some researchers have reported possible mutagenicity and/or genotoxicity effects (Karadbhajne S *et al.*, 2014). The presence of oxalates in fresh plant may however limit its applications especially in its fresh form. The fact that it is an edible vegetable for many communities (Kalpana 2013) also supports its safety claims. Given the high safety levels reported, the underutilization of the plant can only be explained by a general lack of awareness or knowledge and/or wide sustainable cultivation (Karadbhajne S *et al.*, 2014).

Fig 1. Stems, leaves, tendrils, flowers and fruits of *C. quadrangularis*



CONCLUSION

Cissus quadrangularis has been used for many applications (medicinal or dietary) in various communities for years speaking to its claimed efficacy and safety. Its phytochemical profile also justifies the applications and safety. The plant is gaining applications in the management of diseases of the future (i.e. non-communicable e.g. diabetes, hypertension, hyperlipidaemia, cancer, etc.). It has also found new several industrial applications (cosmeceuticals, baking, chemical, etc.). The propagation (stem cuttings and in vitro regenerations) and growth requirements (less water, loose soils and quick response to nutrients) means that wider sustainable farming of the plant is within the humanity's reach. With wider sustainable farming,

characterisation and standardization of the *C. quadrangularis*, parts or extracts thereof; humans could have a new wonder herb for managing several human and animal diseases as well as various other industrial applications.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the National Research Foundation (South Africa, Pretoria) for the mobility of ARN to project sites, the UZ research fund and technicians from Veterinary Science department for making this research work possible.

CONFLICT OF INTEREST

No Interest

REFERENCES

- Chanda S, Yogesh B and Krunal N. Spectral Analysis of Methanol Extract of *Cissus Quadrangularis* L. Stem and Its Fractions. *Journal of Pharmacognosy and Phytochemistry*, 2(4), 2013, 149–57.
- Ghouse MS. A Pharmacognostical Review on *Cissus Quadrangularis* Linn.” *International Journal of Research in Pharmacy and Biosciences*, 2(7), 2015, 28–35.
- Gulzar H, Irfan AC, Mohammad NA, Arif BSMA. Phytochemical Screening, Antimicrobial and Anticancerous Activities of Two Different Plant Extracts. *Journal of Medicinal Plants Studies*, 3(6), 2013, 76–81.
- Jainu MK, Mohan V, Devi CS. Protective Effect of *Cissus Quadrangularis* on Neutrophil Mediated Tissue Injury Induced by Aspirin in Rats. *Journal of Ethnopharmacology*, 104(3), 2005, 302–5.
- Karadbhajne S, Kumbhare V, Bombaywala MA. Application of *Cissus Quadrangularis* Linn. (Hadjor) in Nutraceutical Food (Bakery) Products. *International Journal of ChemTech Research*, 6(4), 2014, 2263–70.
- Kashikar ND, George I. Antibacterial Activity of *Cissus Quadrangularis* Linn. *Indian Journal of Pharmaceutical Sciences*, 68(2), 2016, 245–47.
- Kumar R, Sharma AK, Saraf SA, Gupta R. CNS Activity of Aqueous Extract of Root of *Cissus Quadrangularis* Linn. (Vitaceae). *Journal of Dietary Supplements*, 7(1), 2005, 1–8.
- Kumar S, Anandan TA, Jegadeesan M. Identification of Chemical Compounds in *Cissus Quadrangularis* L. Variant-I of Different Sample Using GC-MS Analysis. *Archives of Applied Science Research*, 4(4), 2008, 1782–87.
- Kumar ST, Anandan A, Jegadeesan M. Identification of Chemical Compounds in *Cissus Quadrangularis* L. Variant-I of Different Sample Using GC-MS Analysis. *Archives of Applied Science Research*, 4(4), 2012, 1782–87.
- Manikandan VG, Muhammad MHI. A Study on Antioxidant, Proximate Analysis, Antimicrobial Activity and Phytochemical Analysis of *Cissus Quadrangularis* by GC-MS. *International Journal of Biology, Pharmacy and Allied Sciences*, 2(12), 2013, 2230–36.
- Marume A, Khoza S, Matope G, Nyakudya TT, Mduluzi T, Ndhkala AR. Antioxidant Properties, Protein Binding Capacity and Mineral Contents of Some Plants Traditionally Used in the Management of Animal Wounds. *South African Journal of Botany*, 111, 2017, 23–28.
- Mishra G, Srivastava S, Nagori BP. Pharmacological and Therapeutic Activity of *Cissus Quadrangularis*: An Overview.” *International Journal of PharmTech Research*, 2(2), 2010, 1298–1310.
- Maiti K, Saravanan B, Singh GR, Kumar N, Hoque M, Lal J. Evaluation of the Herb, *Cissus Quadrangularis* in Accelerating the Healing Process of Femur Osteotomies in Dogs. *Journal of Applied Animal Research*, 31(1), 2007, 47–52.
- Mohanambal E, Shobana K, Sree MS, Kusuma GM, Satish K, Vijayakumar B. Isolation of Alcoholic Extract of *Cissus Quadrangularis* and Evaluation of *in-Vitro* Anthelmintic Activity. *International Journal of Novel Trends in Pharmaceutical Sciences*, 1(1), 2011, 6–9.
- Ogugua VN, Anaduaka EG, Egba SI, Apeh VO, Nriagu MC. Does *Cissus Quadrangularis* Linn. Contain Nutritive and Medicinal Constituents? *World Journal of Pharmacy and Pharmaceutical Sciences*, 2(6), 2013, 4404–14.
- Patel DK. Mass Vegetative Propagation of *Cissus Quadrangularis* L. in Herbal Garden.” *The Pharma Innovation Journal*, 4(10), 2015, 9–12.
- Raj JS, Joseph B. Pharmacognostic and Traditional Properties of *Cissus Quadrangularis* Linn -an Overview. *International Journal of Pharma and Bio Sciences*, 2(1), 2011, 131–39.
- Rasale PL. Phytochemical and Pharmacological Review of Fracture Healing Drug *Asthisamharak* Used in Ancient Indian

- Medicine. *International Journal of Pharma Medicine and Biological Sciences*, 3(3), 2014, 28–35.
- Ruskin RS, Kumari VMP, Gopukumar ST, Praseetha PK. Evaluation of Phytochemical, Anti-Bacterial and Anti-Cancerous Activity of *Cissus Quadrangularis* from South-Western Ghats Regions of India. *International Journal of Pharmaceutical Sciences Review and Research*, 28(1), 2014, 12–15.
- Sasidharan H and Varghese AP. Taxonomy of Selected Species of *Cissus* (Vitaceae) from Thrissur District. *South Indian Journal Of Biological Sciences*, 2(1), 2016, 222–28.
- Sen MK, Dash BK. A Review on Phytochemical and Pharmacological Aspects of *Cissus Quadrangularis* L. *International Journal of Green Pharmacy*, 6(3), 2012, 169–73.
- Shah U. *Cissus Quadrangularis* L, Phytochemicals, Traditional Uses and Pharmacological Activities - A Review. *International Journal of Pharmacy and Pharmaceutical Sciences*, 3(4), 2011, 41–44.
- Srivastava AK, Srivastava P, Mishra JN, Singh MP, Sharma AK. Antidiabetic Activity of the Stem Extracts of *Cissus Quadrangularis* Linn. *Journal of Pharmacy Research*, 4(11), 2011, 3873–74.
- Srivastava AK, Srivastava P, Tiwari BN, Mishra JN, Behera BR, Shrivastava AK. A Plant (*Cissus Quadrangularis*) with Various Ethnopharmacological Action: A Review. *Journal of Pharmacy Research*, 4(6), 2011, 1887–90.
- Teware K. HPLC Analysis of Extract of in Vivo Medicinally Important Climber *Cissus Quadrangularis* L. (HADJOD). *International Research Journal of Pharmacy*, 4(2), 2010, 140–42.
- Vijayalakshmi A, Kumar PR, Priyadarsini SS, Meenaxshi C. Pharmacognostic and Phytochemical Investigation of the Aerial Parts of *Cissus Quadrangularis* Linn . *Journal of Scientific and Innovative Research*, 2(5), 2013, 872–79.
- Vijayalakshmi G, Aysha OS, Valli S. Antibacterial and Phytochemical Analysis of *Cissus Quadrangularis* on Selected UTI Pathogens and Molecular Characterization for Phylogenetic Analysis of *Klebsiella Pneumoniae*. *World Journal of Pharmacy and Pharmaceutical Sciences*, 4(11), 2011, 1702–13.