

## Cultivation and Biomedical Application of *Cissus quadrangularis* L. in Bone Fracture

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### Abstract

*Cissus quadrangularis* L. ( veld grape) is a climber plant of *Vitaceae* family. It is cultivated in College Garden. A case study was undertaken to evaluate the effect of stem paste (soft pulp) of *Cissus quadrangularis* Linn on the healing process of accidentally fractured metatarsus bone of right foot of 52 Yr man (author) in February 2012. X ray examination confirmed the fracture of metatarsus bone in between *tarsus and phalanges*. Stem paste is administered twice a day and 10% solution 10ml was given oral once a day. X- ray observation of healing process of bone was re-examined after 21 days. Result was quite positive and the biomedical application of *Cissus quadrangularis* L. in healing of fractured bone. Healing was almost complete on twenty first day of fracture in the treated bone is recommended. The comfortable technique to administer the medicine is discussed along with plant biochemistry.

### Key words

*Cissus quadrangularis* L., Bone healing , Herbal treatment, Ethno medicines. Medicinal plants, Herbal medicine, Phytotherapy , Folk remedy.

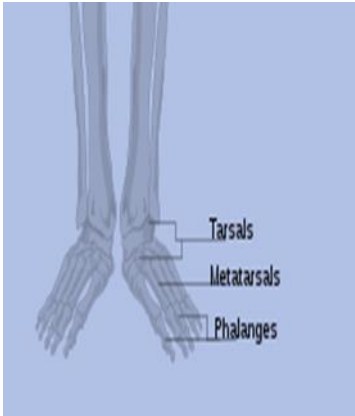
### 1. Introduction

#### 1.1 The metatarsus bone of the patient

The metatarsus or metatarsal bones are a group of five long bones in the foot located between the tarsal bones of the hind- and mid-foot and the phalanges of the toes. Lacking

individual names, the metatarsal bones are numbered from the medial side (side of big toe): the first, second, third, fourth, and fifth metatarsal.(1)

Fig 1 and fig 2 represent the position of *metatarsal* bones and fig 3 to 6 represent the patient , injury on right foot, x ray confirmation by side and surface views and fig 7 represents the physician's recommendations for chemotherapy.



**Fig1** Foot bones



**Fig2** phalanges



**Fig.3** Patient (Author)



**Fig4** Injury (swelling)



**Fig.5** x-ray side view



**Fig6** x-ray surface view

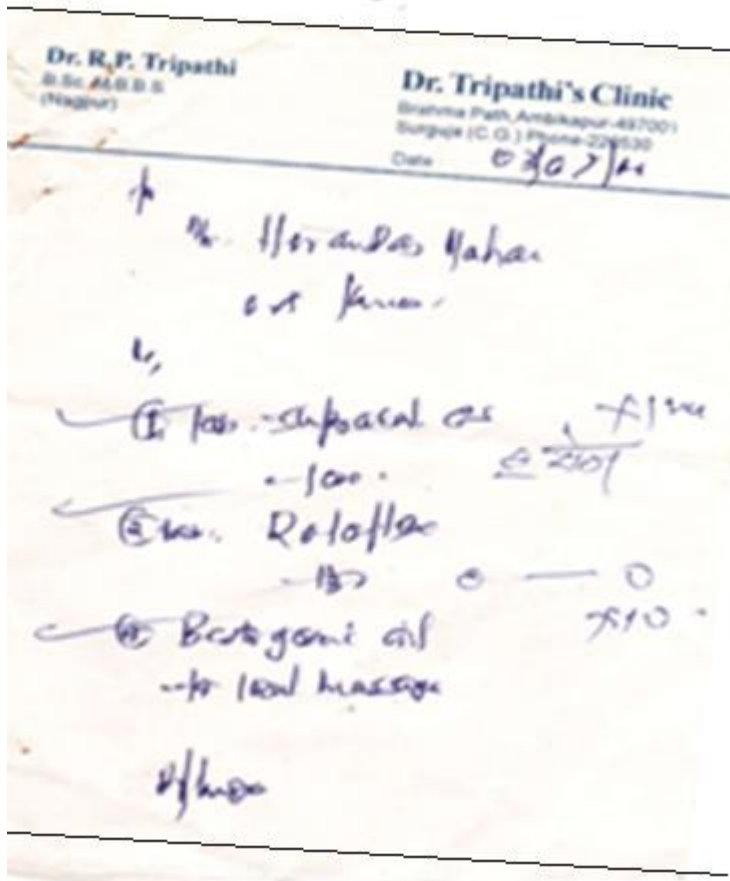


Fig. 7 Scanned copy of Doctor's prescription

## 1.2. Plant *Cissus quadrangularis* L

*Cissus quadrangularis* L is a perennial plant of the grape family *i.e.* *Vitaceae*. It is commonly known as Veld Grape or Devil's Backbone.(2) It is probably native to India or Sri Lanka, but is also found in Africa, Arabia, and South East Asia. It has been imported to Brazil and the southern United States. *Cissus quadrangularis* L has been used as a medicinal plant since antiquity. In *siddha medicine* it is considered a tonic and analgesic, and is believed to help heal broken bones, thus its names are also “*asthisamharaka*” *i.e.* which prevents the destruction of bones and “*Hadjod*” *i.e.* which joints the bones (5, 6, 15, 18).

Fig 8 and fig 9 represent *Cissus quadrangularis* L , a climber plant . It reaches up to a height of 11.5 m with sticky tendrils , on dense support of mango tree available. It has quadrangular-sectioned branches with internodes 8 to 10 cm long and 1.2 to 1.5 cm width. Along each angle is a leathery edge. Toothed trilobe leaves 2 to 5 cm wide appear at the nodes. Each node has a tendril emerging from the opposite side of the node. It is Perennial, stout climber, covered with a dense reddish or whitish romentum leaves. Leaves are serrate, orbicular-chordate, brownish tomentose

below. Flowers in axillary cymes, calyx 5-lobed, thin membranous, pubescent outside, petals ovate-oblong, Flowers are small, white, yellowish, or greenish in appearance . Berry globose, green, red at maturity, seeds 2-3, ovoid-oblong, irregularly rugose. Fruits are globular berries are red when ripe. The flowering – fruiting period is October-December. It is common climber in mixed forest area and scrub forests, although it can be cultivated in a garden.



Fig.8 Basal part of Plant

Fig 9 Areal part

Fig10. Hand grinding

### 1.3 Bentham and Hooker’s Taxonomy of *Cissus quadrangularis* L.

- Group - Dicotyledonae** ; - Climber habit and Reticulate leaf venation
- Class – Polypetalae** ; - Petals free
- Series -Disciflorae** ; - Nectar disc present below the ovary, Sepals free and Hypogynous flower
- Order - Celastrales** ; -Tumid nectar disc adnate to Calyx and Stamens are equal to number of petals.
- Family- Vitaceae** ; - Tendrilar climber, Dichasial cyme inflorescence. Antipetalous stamen and Fruit-berry
- Cissus quadrangularis* L;** - Perennial climber with quadra angular stem with clear node and internodes .

## 2. Methodology

Since *Cissus quadrangularis L* is a climber, so that it is planted beside a wall and near a big *Mengifera indica (Anacardiaceae)* tree for support . It's cultivation is quite simple, by taking the mature stem cutting with four or five node and internodes having about 30 cm to 40 cm . One or two internodes are pressed inside prepared gardening soil, vertically with a care that the cut stem be planted in same direction i.e. basal part of the stem cutting is dipped into the soil. Watering is not needed in rainy season, needed once a day in winter, twice in summer.

Fig 3 to Fig 7 represent a case study .The patient had fractured first metatarsal bone of second foot-finger of right foot .Fractured point is indicated by an arrow. For the comparative observation, photography of both feet and X ray examination of right (fractured) foot was done by the help of medical doctor and his prescription was taken.

Fig 8 to 19 represents administration methodology. Stem having one or two nodes and internodes, is washed with clean water and by gridding with common pestle and mortal method and stem pulp (paste) was made.

Fig 10 to Fig 17 represent the method of application .Since *Cissus quadrangularis L* is a fleshy climber The fresh pulp is found in semi liquid form and seems hard to stick at a point or not to be slipped off at external administration . So that the pulp be a semi solid paste to be sticky at first phalanges bones of second foot finger of right foot location as shown in fig 14 and Fig 15 .

The paste was externally administered at fracture place of foot and safely a thin bandage is made and shocks put on in that manner, so that the medicine was not slip over. The paste is covered by polyethylene and cotton both side of pasted medicine, before having bandage and shocks. Fig 12 to 17 represents administration of medicine paste. 10 ml. of 10% aqueous solution of fresh stem pulp is taken orally twice a day as represented in Fig 18 and Fig 19.



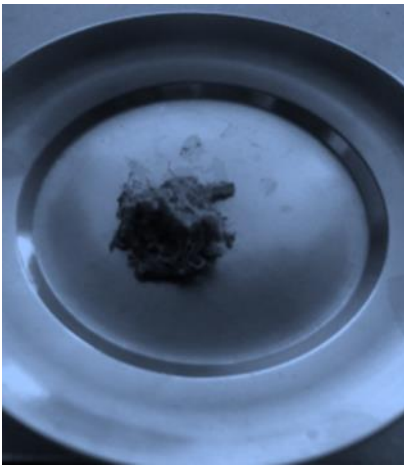


Fig 11 Stem pulp in cup



Fig 12 External administration



Fig 13 External administration



Fig 14 Support to medicene



Fig 15 Bandage



Fig 16 Bandage



Fig 17 Shocks cover



Fig 18 Juice extraction



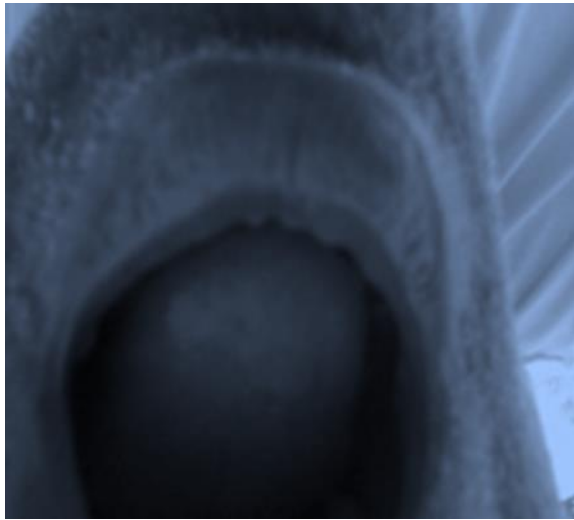
Fig 19 Oral application

The extract is filtered by pressing in a cloth as shown in fig 18 and Fig 19 . 10 % filtered extract is recommended for oral treatment to avoid shors cused by stem pulp.of *Cissus quadrangularis L* shown in Fig 20 and Fig 21 .

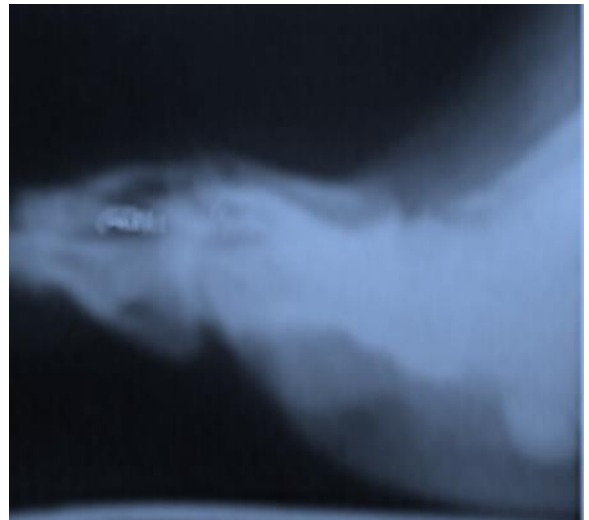
The Fracture of injured foot in *metatarsus* bone is jointed completely when it is examined in x-ray film after 21 days as represented in Fig 22 and Fig.23 ,It may be discussed to a biomedical phenomenon . *Cissus quadrangularis L* have a property to provide biomedicine for accumulation and precipitation of calcium from blood for bone recovery . Therefore blood veins and vessels are more wide for increased *calcium* metabolism(14)

### 3. Results and discussion

- 1 .After the cultivation and watering twice a day, the roots arise from nodes inside soil and newer leaves come within a week and plant reaches up to 2-5 m. height in one year in garden. Fig 8 to fig 9 represent full grown *Cissus quadrangularis L* plant .
2. The injured foot was seen a swellings represented in Fig 4. The stem pulp (paste) of *Cissus quadrangularis L* may cause scars on soft tissues by contact, as represented in fig 20 causing scars on soft tissues in between fingers and on tongue, upper lip and lower lip respectively represented in fig 21. This is the effectiveness of the medicine on the tissue so that should not worry about it
3. Contineuous administrations of stem pulp of *Cissus quadrangularis L* ,externally and orally result the healing of bone. Fig 22 and fig 23 represent the photographs of X ray of injured foot after 21 days .shown that the healing was almost 95% complete.



Fig



20 scars in fingers

Fig 21 scars on lips

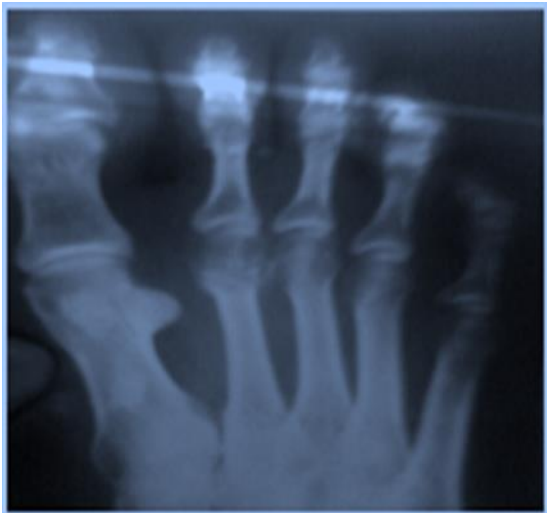


Fig 22 x-ray after 21 days (Side )

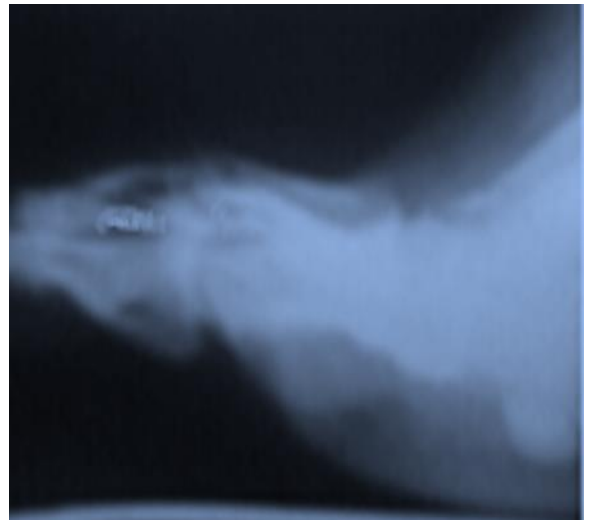


Fig 23 x ray after 21 days (Surface)

### 3.1 Action of *Cissus quadrangularis* L :



- 1 **Accelerates fracture healing:** *Cissus quadrangularis L* ensures early ossification (bone formation) and fortifies bone tensile strength, which accelerate fracture healing.(9,13)
- 2 **Increases bone mineral density:** *Cissus quadrangularis L* increases bone mineral density by stimulating bone metabolism and increasing the uptake of minerals calcium, phosphorus, sulfur, and strontium by osteoblasts (bone-forming cells). The action is also helpful in preventing osteoporosis-related fractures.(15,18)
- 3 **Relieves pain and inflammation:** *Cissus quadrangularis L* relieves pain and inflammation associated with fractures.(11,12)
4. **decreases obesity :** *Cissus quadrangularis L* combination drugs for treating obesity ( 8,16,17, 19).

*Cissus quadrangularis* had been studied for its effects in a rat model for osteoporosis.(11) It has been studied in animal models of bone fracture(18) Its bactericidal effects on *Helicobacter pylori* indicate a potential use for treating gastric ulcers (3,) It has also antibacterial, antioxidant, anthelmintic, antihemorrhoidal and analgesic activities (10,13,).

### 3.2 Biochemistry of *Cissus quadrangularis L*.

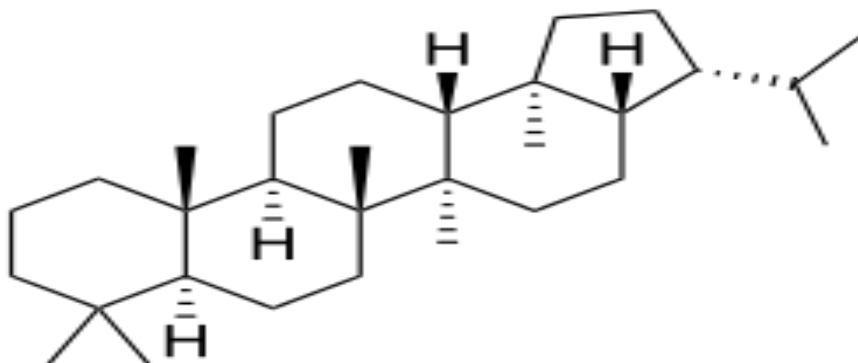
*Cissus quadrangularis* has been found to contain carotenoids, triterpenoids, and quadrangularin-A (7,9,12,23) Carotenoids belong to the category of tetraterpenoids (i.e., they contain 40 carbon atoms, being built from four terpene units each containing 10 carbon atoms). Structurally, carotenoids take the form of a polyene hydrocarbon chain which is sometimes terminated by rings, and may or may not have additional oxygen atoms attached.

Carotenoids with molecules containing oxygen, such as lutein and zeaxanthin, are known as xanthophylls. The unoxygenated (oxygen free) carotenoids such as  $\alpha$ -carotene,  $\beta$ -carotene, and lycopene, are known as carotenes. Carotenes typically contain only carbon and hydrogen ( hydrocarbons ), and are in the subclass of unsaturated hydrocarbons. (4, 9)

Triterpenes are a class of chemical compounds composed of three terpene units with the molecular formula  $C_{30}H_{48}$ ; they may also be thought of as consisting of six isoprene units. Animals, plants and fungi all create triterpenes, with arguable the most important example being squalene as it forms the basis of almost all steroids.

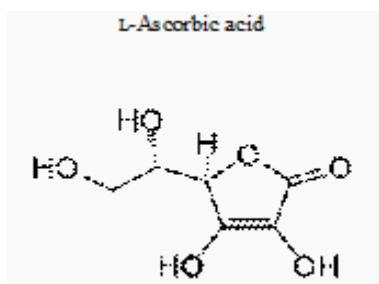
Triterpenes exist in a huge variety of structures with nearly 200 different skeletons known from natural sources or enzymatic reactions. These may be broadly divided according to the

number of rings present; although in general pentacyclic structures (5 rings) tend to dominate. *Cissus quadrangularis* has adequate amount of triterpene (23) . Following structural formula represents a typical triterpene known as Hopane.



Hopane: An example of a pentacyclic triterpene

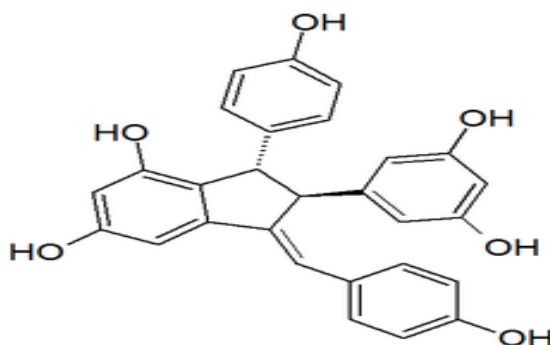
Ascorbic acid is *Vitamin C*. It's IUPAC name is (5*R*)-[(1*S*)-1,2-Dihydroxyethyl]-3,4 dihydroxy-furan-2(5*H*)-one



**Ascorbic acid** is a naturally occurring organic compound with antioxidant properties. It is a white solid, but impure samples can appear yellowish. It dissolves well in water to give mildly acidic solutions. Ascorbic acid is one form ("vitamer") of vitamin C. It was originally called L-hexuronic acid, but, when it was found to have vitamin C activity in animals The new name, ascorbic acid, is derived from *a-* (meaning "no") and *scorbutus* (scurvy), the disease caused by a deficiency of vitamin C. Because it is derived from glucose, many non-human animals are able to produce it, but humans require it as part of their nutrition. Vitamin C is found in *Cissus quadrangularis* (7)

Quadrangularin-A is an oligostilbene found in *Cissus quadrangularis*. It is a resveratrol dimer. It's IUPAC name is (1*E*,2*R*,3*R*)-2-(3,5-dihydroxy phenyl)-3-(4-hydroxy phenyl)-1-[(4-hydroxy phenyl) methylidene]-2,3-dihydroindene-4,6-diol. It is suggested to be significant chemical to joint bones and healing bone fracture.(22)

### Quadrangularin-A



World wide studies of *Cissus quadrangularis* have results that it is an important climber biomedical plant , which has antiulcerogenic and antibacterial activities (2,3,10), *Cissus quadrangularis* also reduces obesity and obesity-induced oxidative stress, (8,16,17,) and it may applied for the management of weight loss and metabolic syndrome .

### Conclusion

The stem pulp is quite effective for joint of fractured bone might be used externally and orally It's nature is sharp pungent and makes scars in soft tissues at contact for long time therefore might be applied carefully. The application of stem pulp 10% oral and external application of semisolid paste would result healing completely in 21 days or hardly within one month So that it might be strongly recommended for treatment of bone fractures .

*Cissus quadrangularis* has been used as a medicinal plant since antiquity. It has been used in various Ayurvedic classical medicines to heal broken bones and injured ligaments and tendons. In *siddha medicine* it is considered a tonic and analgesic, and is believed to help heal broken bones, thus its name *asthisamharaka* (that which prevents the destruction of bones). It is also an important component of antibacterial, antifungal, antioxidant, anthelmintic, antihemorrhoidal and analgesic medicines. The cultivation and application of *Cissus quadrangularis* is very simple and its result is very sure for healing of bone fracture. It is also a component for ayurvedic medicines of arthritis (24).

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## References

1. [http://en.wikipedia.org/wiki/Bone\\_facts](http://en.wikipedia.org/wiki/Bone_facts). Retrieved on 20-10-2015
2. [http://en.wikipedia.org/wiki/Cissus\\_quadrangularis](http://en.wikipedia.org/wiki/Cissus_quadrangularis)^ Pharmacological and therapeutic activity of *Cissus quadrangularis*: Retrieved on 20-10-2015
3. Austin, A.; Jegadeesan, M. and Gowrishankar, R. "Helicobactericidal Activity of *Cissus quadrangularis* L. Variant I"; Korean Society of Pharmacognosy, *Natural Product Sciences* 10 (5): 217-219. 2004
4. Brian H. Davies, "Carotenoid metabolism as a preparation for function". *Pure & Applied Chemistry*, Vol. 63, No. 1, pp. 131-140, (1991). Available online. Accessed April 30, 2010.
5. Chopra, S. S; Patel, M. R. and Awadhiya, R. P. "Studies of *Cissus quadrangularis* in experimental fracture repair: a histopathological study"; *Indian Journal of Medical Researches* 64(9): 1365-1368 1976
6. Deka, D.K., Lahon L.C.; Saikia J. and Mukit, A. "Surgery and Radiology and Veterinary Pathology", *Journal of Veterinary Science*, Assam Agricultural University, Khanapara, Guwahati – pp.78-122 (2005)
7. Davies, Michael B.; Austin, John; Partridge, David A.. "Vitamin C: Its Chemistry and Biochemistry." *The Royal Society of Chemistry*. p. 48, 1991 ISBN 0-85186-333-7.
8. Greenway, F. L. and Bray, G. A, "*Cissus quadrangularis* combination drugs for treating obesity". *Current Diabetes Reports* 10 (2): 108–15, 2010.  
*doi:10.1007/s11892-010-0096-4. PMID 20425569.*
9. Jaw, F. S; Yu, S. N; Lee, J. C; Tsao, H. W; Yu, H. J and Yen, C. T. "Interactive program for spectral and area analysis of compound action potentials of A-fiber and C-fiber". *Journal of neuroscience methods*, 40 (2–3): 121–126, 1991
10. Jainu Mallika and Shyamala Devi, "Tent antiulcerogenic activity of methanolic extract of *Cissus quadrangularis* by antioxidative mechanism"; *Journal of Clinical Biochemistry and Nutrition*, 34; 43-47. 2003
11. Jainu, M.; Mohan, K. V. and Devi, C. S. S.. "Protective effect of *Cissus quadrangularis* L on neutrophil mediated tissue injury induced by aspirin in rats ". *Journal of*

*Ethnopharmacology* 104(3): 302–5, 2006

doi:10.1016/j.jep.2005.08.076. PMID 16338111.

12. Juanjuan Chen, Shan He, Hui Mao, Cuirong Sun and Yuanjiang Pan, “Characterization of polyphenol compounds from the roots and stems of *Cissus quadrangularis* by high-performance liquid chromatography/tandem mass spectrometry. Rapid Column Mass Spectrum., Chemie International Edition, volume 23, pages 737–744, 2009
13. Kashikar, N. D. and George Indu " Antibacterial activity of *Cissus quadrangularis* Linn"; *Indian Journal of Pharmaceutical Sciences* 68 (2): 245-247, 2006.  
doi:10.4103/0250-474X.25727.s
14. Larsson L. and Ohman, S. "Serum ionized calcium and corrected total calcium in borderline hyperpara- thyroidism". *Clin. Chem.* **24** (11): 192–195, November 1978.  
PMID 709830. <http://www.clinchem.org/cgi/pmidlookup?view=long&pmid=709830>.
15. Mishra G., Srivastava S. and Nagori B.P. “Pharmacological and therapeutic activity of *Cissus quadrangularis*: An overview” *International Journal of Pharm. Tech. Research* 2:2 ; 1298-1310, 2010
16. Oben, Julius; Damaris Mandob, Enyegue; Fomekong, Gilles I; Soukontoua, Yves B; Agbor, Gabriel A. "The effect of *Cissus quadrangularis* (CQR-300) and a *Cissus* formulation (CORE) on obesity and obesity-induced oxidative stress". *Lipids in Health and Diseases* **6**: 4. 2007  
doi:10.1186/1476-511X-6-4. PMC 1800848. PMID 17274828.
17. Oben, Julius; Kuate, Dieudonne; Agbor, Gabriel; Momo, Claudia; Talla, Xavio. "The use of a *Cissus quadrangularis* formulation in the management of weight loss and metabolic syndrome". *Lipids in Health and Diseases* **5**: 24. 2006  
doi:10.1186/1476-511X-5-24. PMC 1570348. PMID 16948861.
18. Potu, B. K.; Rao, M. S.; Nampurath, G. K.; Chamallamudi, M. R.; Prasad, K.; Nayak, S. R.; Dharmavarapu, P. K.; Kedage, V.; Bhat, K. M. R. ^ "Effect of *Cissus Quadrangularis* in Accelerating Healing Process of Experimentally Fracture *Radius-Ulna* of dog A Preliminary Study" (PDF). *Indian Journal of Pharmacology* **26**: 44–45, 2009.
19. Sahelian, Ray “The use of a *Cissus quadrangularis* formulation in the management of weight loss and metabolic syndrome"; *Lipids in Health and Diseases* 5: 24, 2006
20. Syst. nat. ed. [www.amse-modeling.org](http://www.amse-modeling.org) ,12, 2:124; Mant. pl. 1:39 ("*quadrangulus*"), 1767
21. USDA, ARS, GERMPLASM RESOURCES INFORMATION NETWORK. *Cissus quadrangularis* in the *Germplasm Resources Information Network (GRIN)*, U.S. Department of Agriculture Agricultural Research Service. [www.amse-modeling.org](http://www.amse-modeling.org) , Accessed on 08-Apr-12, 2015
22. Wenling Li; Hao Li; Ying Li and Zijie Hou. "Total Synthesis of (±)-Quadrangularin A". *Angewandte Chemie International Edition* **45** (45): 7609–7611, 2012  
doi:10.1002/anie.200603097

23. Xu, Ran; Fazio, Gia C.; Matsuda, Seiichi P.T. "On the origins of triterpenoid skeletal diversity". *Phytochemistry* **65** (3): 261–291, February 2004.  
*doi:10.1016/j.phytochem.2003.11.014.*
24. Mahar, H. D, "Herbalism for arthritis cure in tribal area of Surguja forest in CG India" UGC National Conference on " Emerging trends in Value addition plants and plant products" St. Josef Autonomous College for Women Vishakhapatnam AP India 5300004, Paper No. 25 Proc. 140-145 ,July, 24-25; 2014