



UNIQUE JOURNAL OF AYURVEDIC AND HERBAL MEDICINES

Available online: www.ujconline.net

Research Article

MEDICINAL, CULINARY AND OTHER USES OF *CISSUS QUADRANGULARIS* (HEERESSA)

Samaranayake TDCL^{1*}, Ediriweera ERHSS², Weerasinghe KDCM³

¹MD Scholar, Department of Kayachikitsa, Institute of Indigenous Medicine, University of Colombo, Rajagiriya, Sri Lanka

²Professor, Department of Kayachikitsa, Institute of Indigenous Medicine, University of Colombo, Rajagiriya, Sri Lanka

³Ayurveda physician, Sri Lanka

Received 30-06-2015; Revised 29-07-2015; Accepted 28-08-2015

*Corresponding Author: **Samaranayake TDCL**

MD Scholar, Department of Kayachikitsa, Institute of Indigenous Medicine, University of Colombo, Rajagiriya, Sri Lanka

ABSTRACT

Cissus quadrangularis (Family: Vitaceae; Sinhala name: Heeressa) is a perennial plant of the grape family, commonly known as Devil's Backbone. The whole plant is used externally and internally to treat various ailments. It has been used as a medicinal plant by Ayurvedic and Sri Lankan traditional physicians since antiquity. It is used singly or in various formulations together with different medicaments according to Ayurveda and traditional medicine. Details are gathered from Ayurveda and Sri Lankan traditional medical books, books on plant science and other sciences, traditional physicians, civilians and web search. *C. quadrangularis* has the properties of Madhura (sweet) Rasa (taste); Laghu (easily digestible) and Ruksha (dry) Guna (quality); Amla Vipaka (post digestive effect is sour) and Ushna Virya (hot in potency). Further, it also has Kaphavatashamaka (mitigates Kapha and Vata Dosha) and Pittavardhaka (aggravates Pitta Dosha) properties. *C. quadrangularis* is also used in fracture healing, osteoarthritis, contusions, oedema due to trauma, Gout, wounds, skin diseases, alopecia, cracked heels, Gonorrhoea, Syphilis, bleeding, epistaxis, menorrhagia, anorexia, indigestion, gastritis, worm infection, diarrhoea, malabsorption, diseases in bowels, haemorrhoids, anemia, jaundice, ascites, hernia, bronchial asthma, cough, whooping-cough, fever, oedema, urine retention, earache, otorrhoea, deafness, toothache, pain, diseases due to Kapha and Vata Dosha, infertility and snake poisoning. In Sri Lankan traditional medicine, this is widely used in orthopedic treatment, especially in healing of fractures. It is concluded that *C. quadrangularis* has multifaceted medicinal values.

Keywords: *Cissus quadrangularis*, Heeressa, Pirandai, Medicinal uses, Culinary preparations.

INTRODUCTION

C. quadrangularis is a tendril climber with thick, quadrangular, jointed, green, fleshy stem. It is common in dry zone of Sri Lanka. Its quadrangular shape of the stem gives the name as Heeressa. It has many medicinal uses as well as scientifically proven bioactivities. It is a rich source of calcium, carotene, Vitamin C, Vitamin E and can be used as a nutritional food. In addition, *C. quadrangularis* is used in Sri Lankan traditional exorcise rituals (in Suniyam Shantikarma, Daha Ata Sanniya and Kohomba Yak Kamkariya). Farmers make a ring around Kamatha (Threshing floor of paddy) from a long stem of *C. quadrangularis* for protective purposes. A ring made from this plant is tied around the neck of diseased cow for its protection. It is also used in the treatment of horses, cows and elephants. The aims of this study are to record the existing knowledge of medicinal uses and other uses of this plant and promote its usage.

MATERIALS AND METHODS

Data were collected from authentic books, traditional medical books, books on plant science, animal and other sciences, traditional physicians, civilians and web search.

RESULTS AND DISCUSSION

Description of the plant:

(a) Taxonomy:

<u>Rank</u>	<u>Scientific name and common name</u>
Kingdom:	Plantae (plants)
Subkingdom:	Tracheobionta (vascular plants)
Superdivision:	Spermatophyta (seed plants)
Division:	Magnoliophyta (flowering plants)
Class:	Magnoliopsida (dicotyledons)
Subclass:	Rosidae
Order:	Rhamnales
Family:	Vitaceae (grape family)
Genus:	<i>Cissus</i> L.(treebine)
Species:	<i>Cissus quadrangularis</i> L. ¹

(b) Morphology:

C. quadrangularis (Family: Vitaceae, Sinhala name: Heeressa) is a tendril climber with a very long, green, glabrous, thick, fleshy, jointed, quadrangular stem and slender, long, simple stem tendrils; three variants of *C. quadrangularis* were reported as square-stemmed, round-stemmed and flat-stemmed²; in addition to normal roots, some aerial roots arising from the jointed nodes grow downwards and strike the soil; leaves simple, alternate, stipulate, distant, few, 2.5 - 5cm long, broadly ovate or rotundate-deltoid, truncate at base, very obtuse, distantly spinous-crenate, thick, glabrous, petioles 0.6-1.2 cm long, subquadrangular, stipules small, broadly oval, obtuse; flowers regular, bisexual, small, pedicellate in small umbels on branches of a short, paniculate cyme; sepals fused into a cup-shaped calyx, scarcely lobed; petals 4, distinct, valvate, ovate, acute, soon falling; fruit a globose, red, apiculate berry (Figure 1)³.

(c) Distribution:

This plant grows in Sri Lanka, India, Malacca, Philippine Islands, Java, East Africa, Arab and Thailand. It is found in Mulativ (Jaffna District), Murunkan (Mannar District),

Periyankulama (Trincomalee District), Anuradhapura District, Kalpiti to Mampur bay area (Putlam District), Putlam to Palavi, Nikaweratiya (Kurunegala District), Elahera (Polonnaruwa District), Baticalo, Kalkuda Road (Baticalo District), along the coast of Buttawa, Embilikala bay, Palatupana, Hambantota to Tissamaharama (Hambantota District) of Sri Lanka⁴. Geographical distribution of *C. quadrangularis* is given below (Figure 2)⁵.



Figure 1: *Cissus quadrangularis*

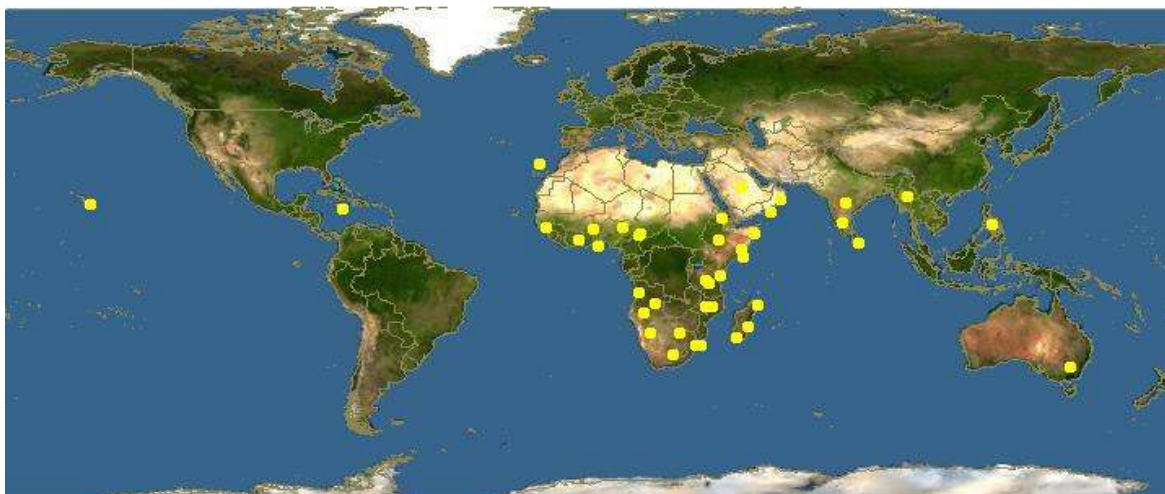


Figure 2: Geographical distribution of *C. quadrangularis*

(d) Synonyms:

Botanical names: *Cissus succulenta*, *Cissus tetragona*, *Vitis succulenta*, *Vitis quadrangularis*⁶.

Sanskrit names: Asthishrinkhala, Asthishrinkala, Vajjravalli, Asthisamhari, Asthisamharika, Asthisamhara, Granthimana, Vajrangi, Kandavalli, Asthisamyojaka, Kroshtughantika, Asthisamharaka, Asthisandhika, Amara, Kandalata, Kulisha, Shiralaka, Vajrakanta, Vajjrakand⁷, Prachibala⁸, Rava⁹.

Sinhala names: Heeressa, Heeressapalu, Viduranga, Vaduruwel, Sivres, Vadurukara, Thuruves, Bohonda, Heeres, Seeres, Amara, Ginikara, Amalaliya, Giriliya¹⁰.

English names: Adamant Creeper, Bone-setter, Devil's backbone, Edible-stemmed vine¹¹, cactus vine, climbing cactus, kangaroo vine, succulent-stemmed wild grape, veld grape, winged treebine, adamant creeper.

Tamil names: Pirandai, Purandai, Arungani, Indiravalli, Kiritti, Uchiradam, Uttanasanjeevi, Vachiravalli¹², Pirantai, Vajjravalli.

Hindi names: Hadjod, Hadjora, Hadsarihari, Harsankari, Kandvel.

Urdu names: Harjora, Hadsankal¹³.

Ayurveda Pharmacodynamic Properties:

Rasa (taste): Madhura (sweet)

Guna (qualities): Laghu (light), Ruksha (dry), Sara (laxative)

Veerya (potency): Ushna (hot in potency); But some authors are of opinion as Sheeta (cold).

Vipaka (post digestive effect): Amla (sour); But some authors are of opinion as Madhura (sweet).

Doshakarma (Effect on Dosha): Kaphavatashamaka (mitigates Kapha and Vata Dosha),

Pittavardhaka (aggravates Pitta Dosha)¹⁴

Karma (Actions): *C. quadrangularis* also has the properties such as Stambhana (stasis), Sandhaniya (healing fractures), Deepana (enhances appetite), Pachana (enhances digestion), Anulomana (aperient), Krimighna (wormicide), Raktashodhaka (purifies blood), Raktastambhana (haemostatic), Vrishya (aphrodisiac), Shukrala (enhances Shukradhatu), Vajeekarana, Raktavardhaka (enhances blood), Rasayana (rejuvenative)¹⁵, Arshoghna (cures haemorrhoids), Akshiroganashaka (cures eye diseases) and Vishapaharana (antipoisonous).

Indications of *C. quadrangularis* as mentioned in Ayurveda:

C. quadrangularis is indicated in treatment of Asthibhagna (fractures), Sandhigatavata (osteoarthritis), contusions, Abhigataja Shotha (oedema due to trauma), Vatarakta (Gout), Vrana (wounds), Charmoroga (skin diseases), Indralupta (alopecia), Vipadika (cracked heels), Phiranga (Gonorrhoea), Upadansha (Syphilis), Raktasrava (bleeding), Nasagataraktasrava (epistaxis), Pradara (menorrhagia)¹⁶, Agnimandya (anorexia), Ajeerna (indigestion), Amlapitta (gastritis), Krimi (worm infection), Atisara (diarrhoea), Grahani (malabsorption), Antraroga (diseases in bowels), Arshas (haemorrhoids), Pandu (anemia), Kamala (jaundice), Gulma, Udara (ascites), Vriddhi (hernia), Shwasa (asthma), Kasa (cough), Kukkurakasa/Kalakasa (Whooping cough), Jwara (fever), Shotha (oedema), Mutraghata (urine retention), Karnashoola (earache), Karnasrava (otorrhoea), Badheerya (deafness), Dantashoola (toothache), Vandhya (infertility), Vatashoola (pain), Kaphavatika Roga (diseases due to Kapha and Vata Dosha)¹⁷ and Sarpavisha (snake poisoning).

Indications of *C. quadrangularis* in various countries:

In addition to the above mentioned medicinal conditions, *C. quadrangularis* is used in various countries for numerous ailments.

- In India, an infusion of the plant is considered as a purgative.
- In Thailand, thin slices of the stem covered with banana pulp and swallowed without chewing (to prevent irritation of the mouth) as a remedy for hemorrhoids.
- In Senegal, a decoction of the stems and leaves is rubbed into the skin and also added to the water used for washing in patients suffering from fever and malaria.
- A root infusion is used for chest pain in Northern Kenya.
- In earache the juice of the stem is dripped into the ear in East Africa.
- An infusion of the leaves is drunk for sexually transmitted diseases in Central and West Africa.
- A decoction of the stem is applied for muscle pain and swellings in South Africa.
- In India, Thailand, Java and Southern Africa, the juice of the stem is applied for rheumatism and to relief pain in fractures. It also hastens the recovery of fractures.
- In India and Indonesia the root powder is used internally for fractures and indigestion¹⁸.
- Massai people of Kenya use *C. quadrangularis* as a herbal remedy for malaria.
- In Zimbabwe, pulp of the whole plant is applied for wounds with maggots.

Phytochemical Screening:

Phytochemical studies on methanol extract revealed the presence of triterpenes including α - and β - amyrins, β -sitosterol, ketosteroids, phenols, tannins, carotene and vitamin C. Seven alicyclic lipids constituents have also been reported from *C. quadrangularis*. Several unsymmetric tetracyclic triterpenoids such as d-amyrin, onocer-7-ene-3a, 21b-diol, d-amyrone and 3,3',4,4'-tetra hydroxyl biphenyl, 3,3',4,4'-tetrahydroxybiphenyl have been isolated from plant and were quantitatively determined by HPTLC and HPLC methods in samples collected from five different geographic zones of India.

Several other constituents such as flavonoids quercetin and kaemferol, and stilbene derivatives, quadrangularins A,B,C and many others e.g. pallidol, resveratrol, piceatanon, perthenocissi and phyto sterols have been isolated from plant. Stem extract contains a high percentage of calcium ions and phosphorus, both essential for bone growth¹⁹. The plant contains ascorbic acid 479mg and carotene 267mg per 100g freshly prepared paste, in addition to calcium oxalate²⁰. Analysis of the air-dried *C. quadrangularis* plant reported to contain moisture 13.1, protein 12.8, wax 1.0, fiber 15.6, carbohydrate 36.6, mucilage and pectin 1.2 and ash 18.2%. The root powder contain a rich source of mineral elements (mg/100g dry matter): potassium 67.5, calcium 39.5, zinc 3.0, sodium 22.5, iron 7.5, lead 3.5, cadmium 0.25, copper 0.5 and magnesium 1.15²¹. Analysis of the toxicants revealed the presence of oxalate, tannin, phytate, saponin contents (135, 0.3, 20, 0.16mg/100g of dry matter) respectively²². The ash formed from the plant contains mostly carbonates and to a smaller extent phosphates of sodium, potassium, magnesium and calcium. Presence of potassium tartarate is also reported²³. Stem of the plant is reported to contain a water-soluble glycoside, which produces a fall in blood pressure in anaesthetized cats. Fresh stem of *C. quadrangularis* produces irritating action on the skin, which may be attributed to the presence of calcium oxalate and 31 methyl tritriacontanoic acid along with taraxeryl acetate, taraxerol and iso-pentacosanoic acid²⁴. The stem extract of *C. quadrangularis* plant contains a high percentage of calcium ions (4% by weight) and phosphorous²⁵.

Chemical constituents in different parts and ash of *C. quadrangularis*:

Part	Constituents
Stem	Calcium ions and Phosphorus
Stem	Calcium oxalate, 31 methyl tritriacontanoic acid, taraxeryl acetate, taraxerol and iso-pentadecanoic acid
Stem	α and β -amyrins, β -sitosterol, ketosteroid, phenols, tannins, Vitamin, carotene
Stem	Saponins and phenol
Aerial parts	7-oxo-Onocer-8-ene-3 β 21 α diol
Root	Potassium, Calcium, Zinc, Sodium, Iron, Lead, Cadmium, Copper, Magnesium
Leaves	Resveratrol, piceatanon, pallidol, parthenocissus, alicyclic lipids ²⁶
Ash of plant	Sodium, Potassium, Magnesium, Calcium, Potassium tartarate.

Vitamins in *C. quadrangularis*:

Aerial parts unless otherwise specified contain Vitamin C at around 327mg per 100g and Vitamin E at around 696mg per 100g²⁷.

Scientifically proven bioactivities:

antibacterial, antifungal, antiprotozoal, antiplasmodial, antiviral, anti-inflammatory, antipyretic, antioxidant, anticancer action, analgesic, muscle relaxing effect, reducing the pain and size of hemorrhoids, anti ulcer effect, gastroprotective action, anthelmintic action, stimulates osteoblastogenesis, antiosteoporotic effect, increasing bone mass, fracture healing effect, increases mineralization, increases alkaline phosphatase activity, restore the biomechanical properties and structure of the bone, increases oestrogen, reduce body weight, reduce blood glucose levels, reduce serum lipids, alleviating Insulin resistance, hepatoprotective, central nervous system activity depressor and anticonvulsant activity are scientifically proven through various researches²⁸.

Scientific researches:**(a) Clinical studies:**

(1) Gupta, A. K. *et al.*, (2012) had reported the antiosteoporotic activity of *C. quadrangularis*. A total of 12 patients of osteoporosis and osteopenia were administered Majja Basti (therapeutic enema) for 16 days as a Matra Basti with 60ml buffalo Majja (bone marrow of buffalo) along with *C. quadrangularis* pulp powder filled in capsules (500mg), two capsules three times daily for 3 months with milk. Effects on pain, tenderness, general debility and BMD (Bone Mineral Density) were observed. Marked improvement and mild improvement were found in 12.50% patients each, whereas moderate improvement was found in 75% patients and no patient remained unchanged. The effects of Majja Basti along with *C. quadrangularis* are encouraging in the management of osteoporosis and it also improves the general health of the patients²⁹.

(2) Oben, J. *et al.*, (2006) had reported that the use of a *C. quadrangularis* formulation in the management of metabolic syndrome, particularly weight loss and central obesity. The study was a randomized, double blind, placebo - controlled design involving 123 overweight and obese persons (47.2% male; 52.8% female; ages 19-50). The 92 obese (BMI > 30) participants were randomized into three groups; placebo, formulation/ diet (2100-2200 calories/ day). The 31 overweight participants (BMI = 25-29) formed a fourth (no diet) treatment group. All participants received two daily doses of the formulation or placebo and remained on a normal or calorie-controlled diet for 8 weeks. At the end of the trial, statistically significant net reduction in weight and central obesity, as well as in fasting blood sugar, total cholesterol, LDL- cholesterol, triglycerides, and C-reactive protein were observed in participants who received the formulation, regardless of diet. *C. quadrangularis* formulation appears to be useful in the management of weight loss and metabolic syndrome³⁰.

(b) Toxicological studies:

Various studies had conducted to observe the toxicity of *C. quadrangularis* in mice, rats, guinea pigs and human.

(1) Shah U., (2011) had reported that it does not produce any toxic effect on oral administration (1 mg/kg daily for 10 days) in mice, rats and guinea pigs, but on intravenous administration, the animals developed convulsions and died in five minutes. Toxicological evaluation of the plant revealed that the drug is safe even at higher dose for a prolonged duration of treatment³¹.

(2) Enechi, O. C. *et al.*, (2013) had revealed acute toxicity of *C. quadrangularis*. In this experiment sixteen adult albino rats (120-200g) of either sex were divided into four groups of four mice each. Group 1 received 100mg/kg body weight of the extract. Group 2 mice were treated with 1500mg/kg body weight of the extract. Group 3 received 2500mg/kg body weight of the extract and group four mice were given 5000mg/kg body weight of the extract. No mortality was observed in all the groups of mice that were given *C. quadrangularis* orally after 24h of treatment period. Therefore LD₅₀ value of *C. quadrangularis* was estimated to be above 5000mg/kg body weight. According to the results ethanol extract of *C. quadrangularis* is relatively safe³².

(3) Potu, B. K. *et al.*, (2010) had reported acute toxicity of the plant. Fasting rats were divided into groups of 10 each and 0.5% Carboxymethyl cellulose (CMC) or CQ (*C. quadrangularis*) at a dose of 500, 1000, 1500, 2500, 3000, 3500, 4000, 4500 or 5000mg/kg body weight was given orally. The rats were observed continuously for 2h, then, frequently up to 6 hours, and daily thereafter for 30 days, and mortality, if any was recorded. Administration of the petroleum ether extract of CQ stem up to a dose of 5000mg/kg body weight did not result in any mortality in the acute toxicity study³³.

(4) Mishra, G. *et al* (2010) had reported subchronic toxicity of *C. quadrangularis*. A study is conducted to evaluate the three month sub chronic toxicity of *C. quadrangularis* powder in five groups of 12 Wistar rats of each sex. Water control group received orally 10 ml of water/kg BW/day. The dried stem powder of the plant was given orally to the four treatment groups at the doses of 0.03, 0.3, 3.0 and 30g/kg BW/day, which were equivalent to 1, 10, 100 and 1000 fold of the therapeutic dose in human respectively, the last group is the recovery group. No difference of initial or final body weights between control and *C. quadrangularis* treated groups was detected. *C. quadrangularis* did not produce any significant dose related changes of hematological parameters of serum clinical chemistry and no histopathological lesion of any internal organ that could be due to toxic effect was observed³⁴.

(5) Kothari, S. C. *et al* (2011) had reported subchronic toxicity and genotoxicity of *C. quadrangularis*. In the subchronic study, Sprague Dawley rats (20/sex/group) were administered (gavage) *C. quadrangularis* extract (CQR-300) at doses of 0, 100, 1000 and 2500 mg/kg body weight (bw)/ day for 90 days. No treatment related clinical signs of toxicity, mortality or changes in body weights, body weight gain or food consumption were noted. Ophthalmological examination and functional observation tests did not reveal any changes. No toxicologically significant treatment related changes in hematological, clinical chemistry, urine analysis parameters and organ weights were noted. No treatment related microscopic and macroscopic abnormalities were noted at the

end of treatment. Mutagenicity studies as evaluated by Ames assay, *in vitro* chromosomal aberration and *in vivo* micronucleus assay did not reveal any genotoxicity of CQR-300. Based on the subchronic study, the no – observed – adverse – effect – level (NOAEL) for *C. quadrangularis* extract (CQR-300) determined as 2500mg/kg bw/day, the highest dose tested³⁵.

(c) Animal studies:

(1) Jainu, M., Mohan, K.V. and Devi, C.S.S. (2006) have reported that the gastroprotective activity of ethanol extract of *C. quadrangularis* could be mediated possibly through its antioxidant effect as well as by the attenuation of the oxidative mechanism and neutrophil infiltration. The present study evaluated the ethanol extract of *C. quadrangularis* against the gastric toxicity induced by aspirin in rats. The optimum protective dose of 500mg/kg of extract was selected by the pretreatment of gastric ulcers with different doses of ethanol extract of *C. quadrangularis* (250, 500 and 750mg/kg) for 7 days which showed ulcer protection by 40%, 71.2% and 72.6%, respectively, as compared to ranitidine (30mg/kg) by 71.9% in the aspirin model. In addition, results have shown that administration of aspirin increases lipid peroxidation status, xanthine oxidase, myeloperoxidase and decrease in selenium-glutathione peroxidase activities in the gastric mucosa, resulting in mucosal damage at both cellular and subcellular level³⁶.

(2) Potu, B. K. *et al.*, (2009) had reported antiosteoporotic activity of petroleum- ether extract of *C. quadrangularis*. In this study, healthy female Wistar rats were divided into four groups of six animals each. Group 1 was sham operated. All the remaining groups were ovariectomized. Group 2 was fed with an equivolume of saline and served as ovariectomized control (OVX). Groups 3 and 4 were orally treated with raloxifene (5.4mg/kg) and petroleum-ether extract of *C. quadrangularis* (500mg/kg), respectively for 3 months. The findings were assessed on the basis of animal weight, morphology of femur, and histochemical localization of alkaline phosphatase (ALP) (an osteoblastic marker) and tartrate resistant acid phosphatase (TRAP) (an osteoclastic marker) in upper end of femur. The study revealed for the first time that the petroleum-ether extract of *C. quadrangularis* reduced bone loss, as evidenced by the weight gain in femur, and also reduced the osteoclastic activity there by facilitating bone formation when compared to the OVX group. The osteoclastic activity was confirmed by TRAP staining, and the bone formation was assessed by ALP staining in the femur sections. The colour intensity of TRAP and ALP enzymes from the images were evaluated by image analysis software developed locally. The effect of *C. quadrangularis* was found to be effective on both enzymes, and it might be a potential candidate for prevention and treatment of postmenopausal osteoporosis. The biological activity of *C. quadrangularis* on bone may be attributed to the phytochemicals in it³⁷.

(3) Panthong A. *et al.*, (2013) have reported analgesic and anti-inflammatory activities as well as the venotonic effect of the methanol extract of *C. quadrangularis* in comparison with reference drugs. In the analgesic test, *C. quadrangularis* provoked a significant reduction of the number of writhes in acetic acid - induced writhing response in mice. *C.*

quadrangularis also significantly reduced the licking time in both phases of the formalin test. The results suggest peripheral and central analgesic activity of *C. quadrangularis*. In acute phase of inflammation *C. quadrangularis* elicited the inhibitory effect on the oedema formation of the rat's ear induced by ethyl phenylpropionate as well as on the formation of the paw oedema in rats induced by both carrageenin and arachidonic acid. It is likely that *C. quadrangularis* is a dual inhibitor of arachidonic acid metabolism. In addition, *C. quadrangularis* exerted venotonic effect on isolated human umbilical vein similarly to the mixture of bioflavonoids, i.e. 90% diosmin and 10% hesperidin. The results obtained confirmed the traditional use of *C. quadrangularis* for the treatment of pain and inflammation associated with hemorrhoid as well as reducing the size of hemorrhoids³⁸.

(4) Raj, J. S., (2011) had reported antioxidant and free scavenging potential of *C. quadrangularis*. Methanol extract of *C. quadrangularis* (CQE) was studied using the model of hepatotoxicity induced by carbon tetrachloride (CCl₄) in rats. CCl₄ administration exhibited significant inhibition in DPPH free radical formation, superoxide radical production and lipid peroxide production in erythrocytes associated with a marked elevation in the activities of aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP) and decrease in superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPX) and reduced glutathione (GSH), which was reverted by CQE pretreatment. The results obtained suggest that CQE showed inhibition of lipid peroxidation, free radical production and increase in antioxidant enzymes activities, which reveal its antioxidant property. It can be concluded that the free radical scavenging activity of the plant extract may be responsible for the therapeutic action against tissue damage³⁹.

(5) Niture, N. T. *et al.*, (2015) had reported antioxidant, anti-inflammatory and antiasthmatic activity of *C. quadrangularis* plant. In this study the stem of the plant extracted with methanol, ethanol and petroleum ether. The phytochemical investigation was carried out for the determination of presence of phytoconstituents. The *in vitro* antioxidant activity was carried out by using reducing power assay, hydrogen peroxide scavenging activity and DPPH (1,1-diphenyl- 2-picrylhydrazyl) scavenging activity; anti-inflammatory activity by using *in vivo* carrageenan induced paw edema, and *in vitro* antiasthmatic activity by using isolated tracheal chain preparation. All three extracts showed significant antioxidant, anti-inflammatory and antiasthmatic activity. The mechanism of action is hypothesized to be through relieving oxidation stress, inflammation and dilatation of smooth muscles⁴⁰.

(6) Mishra, G. *et al.*, (2010) had reported the parasympathomimetic activity of *C. quadrangularis*. Aqueous extract of the plant showed acetylcholine like activity on isolated ileum of rabbit and rat, uterus of rat, dog tracheal muscle and ileum in situ of dog. The responses on dog blood pressure were analogous to muscarinic and nicotinic actions of acetylcholine. It was ineffective on frog rectus muscle⁴¹.

(7) Shah, U., (2011) had revealed that the root extract of *C. quadrangularis* possess central nervous system depressant activity indicated by decrease in exploratory behavior. Methanol extract of roots contains saponins which show

potent sedative activity and inhibit spontaneous motor activity in mice⁴².

(8) Shah, U., (2011) had reported the bone healing activity of *C. quadrangularis*. Paste of alcoholic extract of the plant was locally as well as intramuscularly facilitates rapid healing of fracture in albino rats. Ethanol extract (95%) enhances the development of cortical bone and trabeculae in fetus, which may be related to rich content of calcium, phosphorus and phytoestrogenic steroids and shown to influence early regeneration and quick mineralization of bone fracture healing process. Ethanol extract (95%) of whole plant possess antiosteoporotic activity in ovariectomized rat model of osteoporosis at two different dose levels of 500 and 750 mg per kg per weight⁴³.

(9) Subhashri, S. *et al.*, (2013) had revealed the anti - epileptic activity of *C. quadrangularis* plant. *In-vivo* study of aqueous extract of the plant to evaluate antiepileptic activity was carried out using the maximal electroshock. When 250mg/kg and 500mg/kg of extract of *C. quadrangularis* (CQE) administered to adult male Swiss mice, they were protected against maximal electroshock seizure, and also delay in the onset time of seizures in isonicotinic hydrazide acid induced mice was observed. The paw licking time was delayed and showed a noticeable smooth muscle relaxant activity. The results showed that the aqueous extract of the plant possess smooth muscle relaxant action⁴⁴.

(d) Microbiological studies:

(1) Raj, J. S., (2011) had revealed that ethyl acetate and methanol extracts of *C. quadrangularis* have antibacterial activity, particularly against Gram - positive bacteria, such as *Bacillus subtilis*, *Sin shadow boxing bacteria* and *Staphylococcus aureus*⁴⁵.

(2) Shah, U., (2011) had reported antimicrobial and antibacterial activity of *C. quadrangularis*. Methanol extract (90%) and dichloromethane extracts of stems possess antibacterial activity against *S. aureus*, *E. coli* and *P. aeruginosa* and mutagenicity against *Salmonella microsoma*. Antimicrobial activity has been reported from stem and root extract. The alcoholic extract of aerial part was found to possess antiprotozoal activity against *Entamoeba histolytica*. Alcoholic extract of the stem showed activity against *E. coli*. Methanol and dichloromethane extract of whole plant were screened for *in vitro* antiplasmodial activity⁴⁶.

(e) Ongoing research on osteoarthritis:

The authors of this paper are conducting a research on “Clinical evaluation of Yogavasti, Pinda Sweda and Kashaya of Heeressa (*Cissus quadrangularis* Linn) in Sandhigatavata (osteoarthritis)” as the research of MD (Ayu)2012/2015 of the first author.

Pharmaceutical Preparations:

Many pharmaceutical preparations are described in authentic texts. These preparations are prepared singly or in combination with various medicaments. These preparations are administered internally and externally.

(a) Single pharmaceutical preparations:

(1) Heeressapalu 12 Kalan Kashaya - One Palam (60g) of the stem of *C. quadrangularis* should be cut into small pieces and mixed with 8 Patha (1920ml) of water and it should be reduced to one Patha (240ml). The dosage is 120ml twice a

day before meals. This is indicated internally in treatment of Amlapitta (gastritis), Sandhigatavata (osteoarthritis), Bhagna (fractures), Asthigatavata (osteoporosis and other bone diseases) and Mandam Roga (malnutrition).

(2) Heeressa Churna - Entire plant of *C. quadrangularis* should be dried and powdered. This powder is administered internally to treat patients suffering from Sandhigatavata (osteoarthritis), Bhagna (fractures), Asthigatavata (osteoporosis and other bone diseases) and Mandam Roga (malnutrition).

(3) Vajjiravalli Kshara - It is beneficial for Amlapitta (gastritis). It is a Bhashma (ash) which is prepared by burning the entire plant using Antardhuma dagdha method describe in Ayurveda. In this method pieces of dried stems of *C. quadrangularis* are put into earthen pot. This is covered with another earthen pot and joint is sealed with clay. This is kept in a small pit dug in the ground and covered with dried chips of cow dung. A fire is built by lighting the chips. After about three hours, pot is unearth, open and resultant ash is taken out and powdered.

(4) When kept on fire, stem of *C. quadrangularis* will turn black and become brittle. Then it should be crushed by hand and sifted. A teaspoonful of this powder should be taken in the morning and evening for gastritis.

(5) Stem of *C. quadrangularis* should be put in a pan and kept on fire until it become black and brittle. It should be powdered. A teaspoonful of this powder should be taken in the morning and evening for gastritis.

(6) Stem of *C. quadrangularis* should be heated in fire. Then these stems should be chopped, and squeezed using a piece of cloth and the juice is extracted. This juice should be heated in a pot. The resultant powder could be used in treatment of gastritis.

(7) Heeressa pulp - 40g of fresh stem parts of the plant should be kept near a fireplace until it becomes blackish dark colour by the heat. Small parts of the pulp without hard outer coverings should be swallowed. It is administered in gastritis.

(b) Compound pharmaceutical preparations:

(1) Heeressa juice with milk - 25g of Fresh stem of *C. quadrangularis* is cut into small pieces and pounded well. Juice is extracted by squeezing. 15ml of juice mixed with 250ml of fresh cow's milk and boiled. This is given orally in the treatment of Sandhigatavata (osteoarthritis), Bhagna (fractures), Asthigatavata (osteoporosis and other bone diseases) and Mandam Roga (malnutrition).

(2) Heeressa fomentation

(I) Fifty grams each of stem of *C. quadrangularis*, whole plant of Pota (*Pothos scandens* L.), grated coconut and fresh rhizome of *Curcuma longa* and 10gms of common salt are pounded together and prepared boluses⁴⁷ using a cotton cloth. These boluses are steamed. Then fomentation is carried out after applying suitable warmed oil over the affected area. This is applied in Sandhigatavata (osteoarthritis), Bhagna (fractures), for strengthen loosen joints and Asthigatavata (osteoporosis and other bone diseases).

(ii) Fifty grams each of stem of *C. quadrangularis* and fresh rhizome of *Curcuma longa* are pounded together and prepared boluses using a cotton cloth. These boluses are steamed and fomentation is carried out after applying suitable warmed oil

over the affected area. This is beneficial for Sandhigatavata (osteoarthritis).

(iii) Fifteen grams each of *Garcinia*, stem of *C. quadrangularis*, rhizome of *Alpinia cakarata* Roscoe and *Asparagus recemosus* Willd are pounded together and prepared boluses. Using steamed boluses, fomentation is carried out after applying suitable warmed oil over the affected area. This is also beneficial for Sandhigatavata (osteoarthritis).

(3) Heeressa paste - 10 to 20g of the paste, prepared with stems of the plant is mixed with its juice and equal quantity of sesame oil. This medicinal preparation should be taken by a women who desires a birth of a son⁴⁸.

(c) Medicinal preparations mentioned in authentic Ayurveda texts:

In Ayurveda *C. quadrangularis* (Asthisamhara) is used to prepare numerous medicines such as Asthisamhara Taila, PeerandaKayama, Lakshaguggulu, Asthisamharadi Churna, Dasyadi Kvatha, Darvi Kvatha, Wickrama Taila⁴⁹, Yamadevaraja Taila⁵⁰, Yakshaduvili Taila, Chandanadee Taila, Grahani Taila, Maha Henaraja Taila, Himagiriraja Taila, Arunkaradi Taila⁵¹ and Heeressa Kulambuva.

Veterinary medical practices of *C. quadrangularis*:

(a) Calves are made to bath with medicated water prepared with *C. quadrangularis* as a fly repellent and to destroy fleas. This medicated water is prepared by mixing ground stems with water.

(b) Stem and leaves are used as a food for livestock to stimulate lactation in Guinea.

(c) Paste prepared by the root of the plant and other ingredients is applied to the wounds of elephants⁵².

(d) Roots of *C. quadrangularis*, *Aristolochia indica*, *Eclipta prostrata* and *Asteracantha longifolia* should be crushed together. Ground cloves of garlic, rhizome of *Acorus calamus*, latex of *Ferula foetida*, fruits of *Piper longum* should be added to the above and whole mixture should be mixed with castor oil. One seed of *Xylocarpus rumphii* is to be rubbed on a stone with human urine so as to make a cream and mixed with all above. Then the mixture should be squeezed and excreted juice is used in Nasya Karma (errhine therapy) in treatment of elephants for all diseases⁵³.

(e) The expressed juice of the stem and the leaves is a good remedy for colic in horses⁵⁴.

(f) Paste made of pounded root of *C. quadrangularis*, *Aristolochia indica*, *Eclipta prostrata* and *Asteracantha longifolia*, mixed with ground cloves of garlic, fruits of *Piper longum* and latex of *Ferula foetida* and mixed with castor oil is administered internally for constipation in elephants⁵⁵.

(g) In veterinary medicine the entire plant is being used in irregular growth of teeth, broken horn, dislocation of hip, fractures, cracked tail, sprains, rheumatism, anthrax, haematuria, elephantiasis and wounds.

Culinary preparations of *C. quadrangularis*:

In culinary preparations where tender parts are mentioned, only the two uppermost stem parts and the leaves are taken.

(a) Herbal gruel - Herbal gruel can be made with tender stems of *C. quadrangularis* in the following manner.

Outer hard skin and the ridges from tender stems of *C. quadrangularis* are removed. 25gms of soft heart thus

obtained is finely chopped. 25gms of raw red rice is well boiled in 1500ml of water. When the rice has become very soft, 240ml of thick freshly prepared coconut milk is to be added and heated. When boiling, chopped stems of *C. quadrangularis* are added and boiled well until a thin gruel is obtained. A pinch of salt could be added to taste, when drinking.

(b) Heeressa milk - 30ml of fresh juice of *C. quadrangularis* boiled with 240ml of cow's milk can be used as a refreshing drink.

(c) Heeressa pulp - Stems of *C. quadrangularis* are kept near the fireplace close to fire. After sometimes out skin will turns black. The stems are then removed and the soft interior (jell - like portion) is scrapped out and eaten as a remedy for gastritis.

(d) Salad - Twenty five grams of fresh tender leaves of the plant, two green chilies and 5- 6 red onions are cut into small pieces and mixed with fifteen grams of scrapped coconut. Salt and lime juice could be added to the taste.

(e) Twenty five grams of fresh tender stem parts and leaves of *C. quadrangularis*, 1 teaspoonful of red chili powder, one green chili and 5 - 6 red onions are pounded. Lime juice and salt could be added to the taste.

(f) Pickle - Fifty grams of tender stem parts are cut into small pieces. Three green chilies divided into two, 5-6 red onions, small amount of ground mustard seeds and black pepper with pieces of stem part of the plant are added to heated thick tamarind juice and boiled while mixing. Pinch of salt could be added to the taste.

(g) Mellum - 100gms of tender stems and leaves are cut into small pieces and mixed with small quantities of powdered black pepper, garlic, onions and 75gms of scrapped coconut and heated in a pan while mixing until cooked. Little coconut oil can be added to improve the taste.

(h) Curry - 100gms of tender stems and leaves are slightly boiled and strained, (to remove the irritation to the mouth caused by calcium oxalate), then cut into small pieces. This can be cooked with 500ml of thick fresh coconut milk or tempered with coconut oil with spices added to the taste. Some people prepare this without boiling and straining. Some others remove the rough outer skin and ridges before cooking.

(i) Chutney - Chutney can be made with tender leaves and stem heart of *C. quadrangularis*. 25gms of chopped tender leaves and hearts of tender stem (2 uppermost stem parts) of *C. quadrangularis*, 40gms of scraped coconut, half teaspoonful of sugar, half teaspoonful of mustard seeds, one chopped green chili are ground together and kept aside. Another half teaspoonful of mustard seeds are popped in coconut oil. Few pieces of curry leaves and half a teaspoonful of turmeric powder are added and heated while mixing until curry leaves are roasted. This is added to the previously prepared ground mixture and mixed well. Salt could be added to the taste.

(j) Chips - Stems of *C. quadrangularis* are cut into thin slices, mixed with salt and pepper and deep fried. This could be eaten like chips or papad.

(k) Battered plant - 100gms of stem is taken and the outer skin and ridges are removed. Then the stems are cut into one inch pieces and mixed with powdered salt and pepper. A thick

batter is prepared with powdered chick peas, coconut milk, turmeric powder, salt and pepper powder. The prepared stems of *C. quadrangularis* are coated with the batter and deep fried.

(i) Fried plant in ghee – The stem of the plant is fried in ghee and consumed⁵⁶.

(m) Dessert topping - *C. quadrangularis* is used as a dessert topping⁵⁷.

(n) Herbal tea - Dried leaves can be used as a herbal tea.

(o) Baking powder - Ash of the plant can be used as a substitute for baking powder⁵⁸.

Usage of *C. quadrangularis* in Sri Lankan traditional exorcise rituals:

(a) According to the folklore Kohombam is the deity of threshing floor. It is believed that he makes threshing floor to swallow the paddy. To prevent this a wooden board made out of Kohomba (margosa) and a loop made out of *C. quadrangularis* is kept centre of the threshing floor⁵⁹.

(b) In the Vedi Yak Neteema (a devil dance), of Kohomba Yak Kankariya (the ritual dance of Kohomba demons), during the Vangedi Samayama (a ritual using a motar), *C. quadrangularis*, along with other items, is kept on a corner of the mat where patient sits⁶⁰.

(c) In the Daha Ata Sanniya or Sanni Yakuma (a traditional exorcism ritual consisting 18 dances which is conducted to make the patients free from the demon's interferences) also *C. quadrangularis* is kept on the patient's mat in the similar manner.

These offerings to the devils are believed to cure ill effects arising from evil spirits⁶¹.

(d) Vel Walalu Pelandeema is one of traditional exorcism rituals. Here the patient is tied with 108 (Hundred and eight) loops (or rings) made out of specific types of veins in such a way that he is unable to move his limbs. *C. quadrangularis* is one of the types of veins used in this process. Then devil dancer cut these loops one by one while chanting. It is believed that this process cures the ailments caused by wicked forces⁶².

Miscellaneous uses of *C. quadrangularis*:

C. quadrangularis is cultivated as an ornamental plant in home gardens and also as a pot plant. In Zimbabwe, it is used as a live fence and also cultivated to stabilize dunes. In India and Kenya strong fibers are extracted from the stem. Fibers are used for wound dressing in East Africa. Ash of stems and sliced stem parts are used as fish poison in Senegal and Central Africa. In India, stem and leaves extracts are used for controlling leafhoppers and mites⁶³. In Turkana of Northern Kenya, a root infusion is used as a pesticide for termites. It is also a powerful rust remover and floor polish.

DISCUSSION

It is clear that *C. quadrangularis* is a plant which has many potential medicinal values and used to treat humans, elephants, cows and horses. This plant is administered to patients suffering from various ailments in the form of fresh juice, decoction, powder, paste, oil and ash. It is also used in culinary purposes and exorcise rituals. This plant is claimed to be used to treat malaria, fever, fractures, osteoarthritis, contusions, oedema due to trauma, Gout, wounds, skin

diseases, alopecia, cracked heels, Gonorrhoea, Syphilis, bleeding, epistaxis, menorrhagia, anorexia, indigestion, gastritis, worm infection, diarrhoea, malabsorption, diseases in bowels, haemorrhoids, anemia, jaundice, ascites, hernia, asthma, cough, whooping cough, oedema, urine retention, earache, otorrhoea, deafness, toothache, infertility, pain, diseases due to Kapha and Vata Dosha and snake poisoning. *C. quadrangularis* is also used in Panchakarma therapy, that is in Vasti Karma (enema therapy) for humans and in Nasya karma (errhine therapy) for elephants. Antibacterial, antifungal, antiprotozoal, antiplasmodial, antiviral, anti inflammatory, antipyretic, antioxidant, anticancer action, analgesic, muscle relaxing effect, effect of reducing the pain and size of hemorrhoids, anti ulcer effect, gastroprotective action, anthelmintic action, stimulates osteoblastogenesis, antiosteoporotic effect, increasing bone mass, fracture healing effect, increases mineralization, increases alkaline phosphatase activity, restore the biomechanical properties and structure of the bone, increases oestrogen, reduce body weight, reduce blood glucose levels, reduce serum lipids, alleviating Insulin resistance, hepatoprotective, central nervous system activity depressor and anticonvulsant activities have been scientifically proven. Researchers have reported that *C. quadrangularis* has no toxic effects. It is cultivated as an ornamental plant in home gardens. It is cultivated as a live fence and to stabilize dunes. This plant is used as a fly repellent and to destroy fleas. It is a food for livestock to stimulate lactation. Fibers of the stem are used for wound dressing and making ropes. Ash and sliced parts of the stem are used as fish poison. It is used for controlling leafhoppers and mites and used as a pesticide for termites. It can be used as a rust remover and a floor polish.

CONCLUSION

C. quadrangularis is a plant with multifaceted values including medicinal and nutritional values which are used especially for bone diseases.

REFERENCES

1. Plants database. (cited 05. 08. 2015); available from plants.usda.Gov
2. Kumar TS. Identification of chemical compounds in *Cissus quadrangularis* L. Variant – I of different sample using GC-MS analysis. Scholars research Library, 2012; 4(4): 1782-1787.
3. Jayaweera DMA. Medicinal plants used in Ceylon. The National Science Foundation, Colombo 7, Sri Lanka, Part 5, 2006; 191.
4. Compendium of medicinal plants - a Sri Lankan study. Department of Ayurveda, Colombo, Sri Lanka, Volume 3, 2003; 238.
5. Point Map of *Cissus quadrangularis*. (cited 11. 07. 2015); available from www.discoverlife.org/
6. *Cissus quadrangularis*. (cited 06. 07. 2015); available from <https://en.wikipedia.org/wiki/>
7. Compendium of medicinal plants - a Sri Lankan study. Department of Ayurveda, Colombo, Sri Lanka, Volume 3, 2003; 238.

8. Deraniyagala PEP. Ali Pilibanda Vidyava - Veterinary science (Elephants). Ceylon National Museums, Sri Lanka, Volume 1, 1952; 70.
9. Rajapaksha CDA. Bhaishajjartha. Rajapaksha CDA, Colombo, Sri Lanka, 1872; 37.
10. Kannagara JC. Osuvaga Namavaliya. Kannagara ET, Homagama, Sri Lanka, 1982; 63.
11. Sharma PC. *et al.*, Database on Medicinal Plants used in Ayurveda. Central Council for research in Ayurveda & Siddha, New Delhi, India, Volume 1, 2000; 43.
12. Jayaweera DMA. Medicinal plants used in Ceylon. The National Science Foundation, Colombo 7, Sri Lanka, Part 5, 2006; 191.
13. Sharma PC. *et al.*, Database on Medicinal Plants used in Ayurveda. Central Council for research in Ayurveda & Siddha, New Delhi, India, Volume 1, 2000; 43.
14. Singh A. Bhavaprakasha Nighantu. Chaukhambha Publishers, Varanasi, India, 2007; 118-119.
15. Kumarasinghe A. Vaidyaka Sarartha Samgrahaya. Department of National Museums, Sri Lanka, 1987; 135.
16. Sharma PC. *et al.*, Database on Medicinal Plants used in Ayurveda. Central Council for research in Ayurveda & Siddha, New Delhi, India, Volume 1, 2000; 44.
17. Compendium of medicinal plants - a Sri Lankan study. Department of Ayurveda, Colombo, Sri Lanka, Volume 3, 2003; 238.
18. *Cissus quadrangularis* L. (cited 31. 08. 2015); available from www.prota4u.org/
19. Shah U. *Cissus quadrangularis* L.: phytochemicals, traditional uses and pharmacological activities – a review. Academic sciences. 18 June 2011 (cited 10.07.2015); available from www.ijppsjournal.com/
20. Mishra G. *et al.*, Pharmacological and therapeutic activity of *Cissus quadrangularis*- An overview. International journal of pharmtech research, 2010; Vol 2 (No.2): 1298-1310.
21. Mishra G. *et al.*, Pharmacological and therapeutic activity of *Cissus quadrangularis*- An overview. International journal of pharmtech research, 2010; Vol 2 (No.2): 1298-1310.
22. Mishra G. *et al.*, Pharmacological and therapeutic activity of *Cissus quadrangularis*- An overview. International journal of pharmtech research, 2010; Vol 2 (No.2): 1298-1310.
23. Mishra G. *et al.*, Pharmacological and therapeutic activity of *Cissus quadrangularis*- An overview. International journal of pharmtech research, 2010; Vol 2 (No.2): 1298-1310.
24. Mishra G. *et al.*, Pharmacological and therapeutic activity of *Cissus quadrangularis*- An overview. International journal of pharmtech research, 2010; Vol 2 (No.2): 1298-1310.
25. Mishra G. *et al.*, Pharmacological and therapeutic activity of *Cissus quadrangularis*- An overview. International journal of pharmtech research, 2010; Vol 2 (No.2): 1298-1310.
26. Sen MK and Dash BK. A review on phytochemical and pharmacological aspects of *Cissus quadrangularis* L. International Journal of Green Pharmacy, Vol 6(3), 20 December 2012; 173. (cited 09. 07. 2015); available from www.greenpharmacy.info/
27. Sen MK and Dash BK. A review on phytochemical and pharmacological aspects of *Cissus quadrangularis* L. International Journal of Green Pharmacy, Vol 6(3), 20 December 2012; 173. (cited 09. 07. 2015); available from www.greenpharmacy.info/
28. Sen MK and Dash BK. A review on phytochemical and pharmacological aspects of *Cissus quadrangularis* L. International Journal of Green Pharmacy, Vol 6(3), 20 December 2012; 173. (cited 09. 07. 2015); available from www.greenpharmacy.info/
29. Gupta AK. *et al.*, Effect of Majja Basti (therapeutic enema) and Asthi Shrinkhala (*Cissus quadrangularis*) in the management of osteoporosis (Asthi-majjakshaya). Ayu. 2012; Vol 33(1): 110-113.
30. Oben J. The use of *Cissus quadrangularis* formulation in the management of weight loss and metabolic syndrome. (cited 10. 07.2015); available from www.ncbi.nlm.nih.gov/pmc/
31. Shah U. *Cissus quadrangularis* L.: phytochemicals, traditional uses and pharmacological activities – a review. Academic sciences-International Journal of Pharmacy and Pharmaceutical Sciences, 2011; Vol 3 (Suppl 4): 41- 44 (cited 10.07.2015); available from www.ijppsjournal.com/
32. Enechi OC. *et al.*, Effects of ethanol extract of *Cissus quadrangularis* on induced gastric ulcer in rats. African Journal of Biotechnology, 2013; Vol 12 (43): 6197-6202. (cited 10. 08. 2015); available from <http://www.academicjournals.org/AJB>
33. Potu BK. *Et al.*, Anti-osteoporotic Activity of the Petroleum Ether Extract of *Cissus quadrangularis* Linn. in Ovariectomized Wistar Rats. Chang Gung Med J, 2010; Vol 33(No 3): 252-257.
34. Mishra G. *et al.*, Pharmacological and therapeutic activity of *Cissus quadrangularis*- An overview. International journal of pharmtech research, 2010; Vol 2 (No.2): 1298-1310.
35. Kothari SC. *Et al.*, Safety assessment of *Cissus quadrangularis* extract (CQR-300): subchronic toxicity and mutagenicity studies. Food Chem Toxicol, Dec 2011; 49 (12): 3343-57.
36. Jainu M. *et al.*, Protective effect of *Cissus quadrangularis* on neutrophil mediated tissue injury induced by aspirin in rats. Journal of Ethnopharmacology (cited 09. 07. 2015); available from www.sciencedirect.com/science/
37. Potu BK. *et al.*, Evidence based assessment of antiosteoporotic activity of petroleum- ether extract of *Cissus quadrangularis* Linn. On ovariectomy-

- induced osteoporosis. Upsala Journal of Medical Sciences, 2009; 114: 140 - 148 (cited 10. 07. 2015); available from www.ncbi.nlm.nih.gov/pubmed/
38. Panthong A. *et al.*, Analgesic, anti-inflammatory and venotonic effects of *Cissus quadrangularis* Linn. (cited 10. 07. 2015); available from www.ncbi.nlm.nih.gov/pubmed/
 39. Raj SJ. Pharmacognostic and traditional properties of *Cissus quadrangularis* Linn – An overview. International journal of pharma and bio sciences, 2011; Vol 2 (1):131-139.
 40. Niture NT. *et al.*, Antioxidant, anti-inflammatory and antiasthmatic activity of *Cissus quadrangularis* Linn. International journal of pharmacy & pharmaceutical research, 2015; Vol 3 (3):264-281.
 41. Mishra G. *et al.*, Pharmacological and therapeutic activity of *Cissus quadrangularis*- An overview. International journal of pharmitch research, 2010; Vol 2 (No.2):1298-1310.
 42. Shah U. *Cissus quadrangularis* L.:phytochemicals, traditional uses and pharmacological activities – a review. Academic sciences. 18 June 2011 (cited 10.07.2015); available from www.ijppsjournal.com/
 43. Shah U. *Cissus quadrangularis* L.:phytochemicals, traditional uses and pharmacological activities – a review. Academic sciences. 18 June 2011 (cited 10.07.2015); available from www.ijppsjournal.com/
 44. Subhashri S. *et al.*, Review – Pharmacological activities based on different extracts of *Cissus quadrangularis*. International journal of pharmacognosy and phytochemical research, 2013; Vol 5 (2): 128-133.
 45. Raj SJ. *et al.*, Pharmacognostic and traditional properties of *Cissus quadrangularis* Linn – An overview. International journal of pharma and bio sciences, 2011; Vol 2 (1):131-139.
 46. Shah U. *Cissus quadrangularis* L.:Phytochemicals, traditional uses and pharmacological activities - a review. International journal of pharmacy and pharmaceutical sciences, 2011; Vol 3 (Suppl 4): 41-44.
 47. Jayasekara DC. Saraushadhamala Nohot Geydima Vedakam. Granthadarsha- Siriwardhana PKW, Colombo 10, Sri Lanka; 4.
 48. Sharma PV. Classical uses of medicinal plants. Chaukhambha Vishvabharati, Varanasi, India, 2004; 32.
 49. Rev. Girimananda B. Perani Pinas Veda Pota. Modern Pot Samagama, Nugegoda, Sri Lanka, 1965; 64.
 50. Rev. Kirielle Knanawimala. Yogarnawaya. Jayatilaka WVP, Maligakanda, Sri Lanka, Part 1, 1943; 19 - 20.
 51. Rev. Waradiwala Dhammarama and Rev. Dumbara Dhammaddhaja. Bhishakkalpataru or Bhaisajja Manjusa Kavya Sinhala translation. Rajapaksha WR, Maradana, Sri Lanka, 1934; 62.
 52. Deraniyagala PEP. Ali Pilibanda Vidyava - Veterinary science (Elephants). Ceylon National Museums, Sri Lanka, Volume 1, 1952; 200.
 53. Deraniyagala PEP. Ali Pilibanda Vidyava - Veterinary science (Elephants). Ceylon National Museums, Sri Lanka, Volume 1, 1952; 208.
 54. Attygalle J. Sinhalese Materia Medica. Nirmal Singal for Navrang, New Delhi, India, 1917; 45.
 55. Deraniyagala PEP. Ali Pilibanda Vidyava - Veterinary science (Elephants). Ceylon National Museums, Sri Lanka, Volume 1, 1952; 203.
 56. Raj SJ. *et al.*, Pharmacognostic and traditional properties of *Cissus quadrangularis* Linn – An overview. International journal of pharma and bio sciences, 2011; Vol 2 (1): 131-139.
 57. Infomercial-pitchman-cissus.html (cited 16. 07. 2015); available from plantsarethe strangest people.blogspot.com/
 58. Sen MK and Dash BK. A review on phytochemical and pharmacological aspects of *Cissus quadrangularis* L. International Journal of Green Pharmacy, Vol 6(3), 20 December 2012; 173. (cited 09. 07. 2015); available from www.greenpharmacy.info/
 59. Dissanayake M. Demala Hatpattuwe Edahili Vishvasa Ha Shantikarma. S. Godage and Brothers, Colombo 10, Sri Lanka, 2003; 79.
 60. Dissanayake M. Kohomba Yak Kankariya Saha Samajaya. S. Godage and Brothers, Colombo 10, 1995; 135.
 61. Ven. Seelaratana T. Sri Lankave Roga Suvayata Yodana Shantikarma Krama. S. Godage and Brothers, Colombo 10, 2005; 43.
 62. Dissanayake M. Vinakepum Yaga Vigrahaya. S. Godage and Brothers, Colombo 10, 2000; 26.
 63. *Cissus quadrangularis* L. (cited 31. 08. 2015); available from www.prota4u.org.

Source of support: Nil, Conflict of interest: None Declared