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Original Article

Dual Herbal Dynamics: A system biology Review of Moringa Oleifera and Cissus Quadrangularis

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ABSTRACT

Moringa oleifera and Cissus quadrangularis are two medicinal plants widely used in traditional systems of medicine due to their diverse therapeutic properties. This review highlights their Pharmacognosics characteristics, phytochemical constituents, pharmacological activities, extraction methods, and toxicological profiles. Moringa oleifera is rich in alkaloids, flavonoids, phenolic compounds, vitamins, and minerals, exhibiting antioxidant, anti-inflammatory, antimicrobial, antidiabetic, cardioprotective, and wound-healing activities. Cissus quadrangularis contains phytosterols, flavonoids, triterpenoids, and ascorbic acid, contributing to its bone-healing, anti-obesity, anti-ulcer, antidiabetic, antioxidant, and neuroprotective effects. Various extraction techniques, including maceration, Soxhlet extraction, microwave-assisted extraction, and ultrasound-assisted extraction, have been employed to isolate bioactive compounds from these plants. Toxicological studies indicate a favorable safety profile for both species. The synergistic therapeutic potential of Moringa oleifera and Cissus quadrangularis suggests promising applications in modern herbal medicine, nutraceuticals, and polyherbal formulations for managing chronic diseases and promoting overall health.

Key words: Moringa oleifera, Cissus quadrangularis, Phytochemistry, Antioxidants, Bone Healing, Herbal Therapeutics.

INTRODUCTION

Moringa oleifera: The "phenomenon tree," *Moringa oleifera*, is allowed to be indigenous to Afghanistan, Bangladesh, India, and Pakistan. [1] multitudinous tropical and subtropical countries are home to the moringa oleifera tree. India, Africa, South and Central America, Mexico, Hawaii, and all of Asia and Southeast Asia are among the places where it is commercially grown.[2] The "drumstick" or "horseradish" tree are other names for the plant *Moringa oleifera*. It is a member of the 13-species *Moringa* genus.[3] In India, it is Known locally as Sigru (Sanskrit), Shajna (Hindi), and Nugge mara (Kannada). Different aspects of this Plant parts like the leaves, roots, fruit, flowers, seeds, bark, and immature pods.[4]

The plant has historically been used extensively, including the bark as emmenagogue and antifungal and aphrodisiac seeds. The roots and leaves have antitubercular, anthelmintic, and anti-inflammatory, antitumor, antispasmodic, abortifacient, antilithic, and antifertility cardiotonic[1,6,7] and the flower possesses anti-inflammatory.[5]

Cissus Quadrangularis



Fig 1.1: Plant of *Cissus Quadrangularis*

Generally appertained to as "Hadjod" *Cissus quadrangularis* is a imperishable factory in the family Vitaceae. Adamant creeper, square-stemmed vine, veldt grape, devil's backbone, asthisamharaka, hadjod and pirandai, Sannalam, Nalleru, Vajravelli, and Manra valli are some of its other names.[29] *Cissus quadrangularis* L., also known as bone, is a member of the Vitaceae family. Setter plant. For the species, there are the morphovariants. They display a lot of Variations in their physical characteristics. The rich history of medicinal plant's in India was taken into consideration when designing the current review study. The study's main goal is to introduce *Cissus quadrangularis*, also known as "Had-Jod" or "Asthisamharaka," one of the key Ayurvedic.

Pharmacognostics Taxonomical Classification:

Moringa oleifera:

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Supermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Dilleniidae
Order	Capparales
Family	Moringaceae
Genus	Moringa
Species	Oleifera

Table 1: *Moringa oleifera* Taxonomy [6]

Cissus quadrangularis:

Kingdom	Plantae
Subkingdom	Tracheobionta
Division	Megnoliophyta
Class	Magnoliopsida
Order	Vitales
Family	Vitaceae
Genus	Cissus
Species	Quadrangularis

Table 2: *Cissus Quadrangularis* Taxonomy [31]

Morphology:

Moringa oleifera:

The tiny, quickly growing evergreen or deciduous tree *Moringa oleifera* typically reaches a height of up to 10 or 12 meters high. It features an open, spreading crown of brittle, drooping branches thick, corky, whitish bark and feathery, tripinnate foliage.[7]

Leaves:	Bipinnate or typically tripinnate leaves Leaflets up to 45 cm long are the top surface is hairy and nearly hairless. These twigs are green and hairy compounds leaves that have 1-2 cm long leaflets.[7]	
Flowers:	The fragrant, yellowish white, bisexual flowers. Flowers range in size from 0.7 to 1 cm. long 2 cm wide, with five uneven, spatulate, yellowish-white petals with thin veins, five stamens with a pistil made up of a single-celled ovary and five smaller, sterile stamens, slim design.[7]	
Fruits:	Known as pods, fruits are trilobed capsules that are brown and pendulous. Triangular, and when dry, it separates into three lengthwise parts that are 30 to 120 cm long and 1.8 cm wide. March and April are the months when most fruits are produced. brown when they mature.	

Cissus quadrangularis:

Stem	The Stem the plant is moist, thick, long, fleshy, deep green in color, glabrous, Angel-winged, quadrangular, node-constricting, and a little downy. Straightforward and, as it ages, nearly leafless.	
leaves	Simple ovate, reniform, entire, or cordate leaves are found on the plant's stem. The inflorescence the plant's umbellate cyme inflorescence has peduncles that are 1 to 2.5 cm in length. There are long, thin and simple tendrils visible on the stem.	
Flower	The stem is about 2 mm long and has a flower that ranges in color from pink to white. The flower's hypanthium is green, cup-shaped, and truncate or obscurely lobed.	

Fruits	The plant's fruit consists of glucose, red, succulent berries that are highly acidic 6-10 across, with a single seed.[32]	
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Macroscopy of moringa oleifera:

Macroscopic or organoleptic characters like appearance, taste, Macroscopic studies of Leaves and Powder, including organoleptic characteristics (appearance, color, smell, taste, Shape, and size) Were performed. [13]

Microscopy of moringa oleifera:

Bark sections were cut by free hand sectioning and numerous sections were examined microscopically. Histochemical tests were carried out using Hydrochloric acid-Phloroglucinol to reveal lignified elements, iodine-iodide for starch, Sudan III for Lipophilic Substances, Dandruff's reagent for Alkaloidal substances, ruthenium red for mucilage, Ferric chloride for phenolic compounds. An analysis of leaf constants under a microscope, including trichomes number, stomatal number, and the number of druses was examined. The quantity of trichomes, druses, and stomata on the leaf's 1 mm upper and lower surfaces at x40 and x100 magnifications in the field of view was computed. The trichomes' length and diameter. [14]

Microscopical description of moringa oleifera:

Drug occurs as dried small pieces of stems, roots, leaves, bud, flowers And fruits; roots Were brown in colour with rootlets, circular, branched, 4-8 cm in length, rough texture; Stem rounded, pale green – light brown, Slightly rough texture, 4-7 cm long; leaflets Shriveled, shrunked, curled, Pale green; flower pale white, shriveled, margins curled; fruit Pale green, Twisted, deep ridges and furrows present, somewhat rounded; seed Pale Reddish brown, winged, wings papery thin, shriveled and shrinke.[15]

Cultivation and preparation of moringa oleifera:

Moringa is a tiny, lean plant that grows quickly. Although India frequently uses vegetative propagation, Moringa has remarkable nutritional value. Typically, plants are grown in tropical and Southeast Asia, Africa, and India's subtropical zones. [16] Moringa oleifera two following methods: sowing and cutting. The seeds must be chosen before sowing, when they are readily available and require little human labor, but transplanting seedlings is an option. Permits field planting flexibility even if it comes with additional expenses and labor. Seeds sprout within two weeks, down to a maximum depth of 2 cm. When the nursery plans to sow, the seedlings when they are around 30 cm (3–6 weeks after germination), they are ready for transplantation. [16] Leaves gathered throughout the peak of phytoconstituents during the early flowering stage (summer or early monsoon). Pods and seeds, which are gathered when they reach maturity (dry season) and become hard and brown. Flowers are gathered from spring to early summer, when they are in full bloom. Bark and roots are taken from plants that are two to three years old, guaranteeing sustainable harvesting without taking down the tree Cuttings, seeds, or both can be used to propagate Moringa oleifera. In soil that drains properly, moringa seeds can sprout all year long. In the case of vegetative propagation. This technique encourages the growth of new shoots. It has a 35–40-day harvest period. However, in when harvesting fodder, the tree should be cut down every seventy-five days. The leaves that were

harvested. [17]

Preparation of moringa oleifera:

The plant material is collected, cleaned, and prepared for pharmacognostic and studies of phytochemicals.

A. Sanitization:

Eliminate insects, dust, dirt, and other foreign objects. If required, wash plant parts with clean to eliminate surface moisture, rinse and pat dry.

B. Desiccation:

To preserve active ingredients, shade drying is recommended; direct sunlight can degrade them compounds that are volatile or thermolabile. The material should be dried until it is brittle and completely dry.

C. Diminution of Size:

A mechanical grinder is used to powder the dried material. To achieve a consistent particle size, the powder is run through a 40–60 mesh sieve. whereas finer powder is for microscopy or chemical analysis.[18]

D. Conditions of storage:

The powdered or dried medication should be kept in airtight containers in a cool, dry location, away from moisture and direct sunlight. Label containers with information like the name of the plant, the part used, and the date conditions of collection and storage.[19]

Phytochemical Profile:

Moringa oleifera:

Sr.no	phytochemical Class	Key Constituents
1	Alkaloids	Moringinine, Pyrrolemorine A Pyrrolemorine B, Tangutorid, Pyrrolemorine C, Pyrrolemorine D, Pyrrolemorine E.
2	Flavonoids	Quercetin, Kaempferol and Rutin
3	Phenolic Acids	Caffeoylquinic acid, 4-O-b-D-glocopyranoids benzoic acid , ferulic acid gallic acid and chlorogenic acid.
4.	Tannins	Tannins, tannic acid,
5.	Terpenes	Linalyl -b-D-glucoside,lupeol, tuberonic
6.	Isothiocyanate	benzyl isothiocyanate
7.	Glycosides	Niaziminin A, Niaziminin B, Niazirin
8.	Saponins	Saponins, Oleanolic acid
9.	Vitamins	Vitamins A, Vitamins C, Vitamin E
10.	Minerals	Potassium, Calcium, Magnesium, Iron
11.	Fatty Acids	Linoleic acid and oleic acid
12.	Carotenoids	Lutein and β -Carotene

Table 3: Chemicals Constituents of *Moringa oleifera* [20]

Cissus Quadrangularis:

Sr No	Name of compounds	Phytoconstituents
1	Phytosterols	Stigmasterol, β -Sitosterol
2	Ascorbic acid	Vitamin C
3	Flavonoids	Quercetin, Kaempferol, Daidzein
4	Phenolic acids	Resveratrol-like compounds, Phenolic acids
5	Triterpenoids	B-Sitosterol, Friedelin, Amyrin

Table 4: Chemical Constituents Of *Cissus Quadrangularis* [31]

Sr No	Name of compounds
1	Amyrin alpha
2	Amyrin beta
3	Beta-sitosterol
4	Friedelin
5	Quercetin
6	The Genistein

Table 4: Chemical Constituents Of *Cissus Quadrangularis* [31]

Pharmacological Activities:

Moringa Oleifera:

- Activities and characteristics of antioxidants and free radical scavenging:** Numerous articles that were kept for their pharmacological properties discussed *M. oleifera* antioxidant and free radical scavenging properties. Antioxidants are reducing substances that typically lower the risk of heart attacks, strokes, and aging symptoms, such as ascorbic acid, thiols, and polyphenols. [21]
- Analgesic and anti-inflammatory properties:** We observed more research on *M. oleifera*'s anti-inflammatory, antitumor, and anticancer properties. Vascular cells' diverse biological response to harmful stimuli, such as pathogenic infections or damaged cells, annoys the anti-inflammatory and analgesic properties of *M. oleifera*. efficient drug source to treat conditions

linked to inflammation and pain.

3. **Antimicrobial and anti-inflammatory properties:** Cheaper, more dependable, and effective antibiotics derived from plants *M. oleifera* is among the plant species that have demonstrated evidence of having a lot of antioxidants and antimicrobial properties.
4. **Anti-cancer, neuroprotective, and cytotoxic properties:** Rich bioactive compounds found in *M. oleifera* can be used to treat and manage a variety of chronic illnesses, such as HIV/AIDS and cancer moringinine and quercetin, two well-characterized phytochemicals that reverse tumorourigenesis, have been linked to *M. oleifera*'s antitumor effects.[22]
5. **Anti-diabetic and anti-obesity activities:** Potential hypoglycemic activity of phenolic glycosides from *M. oleifera* seed also showed significant therapeutic properties in reducing blood pressure, blood sugar and enhancing the immune system in humans. *M.oleifera* leaves extract was thus confirmed to exhibit hypolipidemic and anti-obesity potentials.
6. **Cardio protective and anti-hypertension activity:** Natural remedies that lower high blood pressure and reverse hypertension are being sought after as viable treatments for cardiovascular conditions. *M. oleifera* is a viable option for the treatment of hypertension.
7. **Wound healing and anti-ulcer activities:** Rich phytochemical contents of alkaloids and antioxidants have been linked to *M. oleifera*'s wound healing and anti-ulcerative pharmacological properties, which have been documented numerous times.
8. **Anti-malaria activities:** Both *Gynostemma pentaphyllum* and *M. oleifera* when administered to *Plasmodium berghei*-infected mice, leaf extracts and artesunate were found to be an effective treatment for malaria.
9. **Anti-oxidant activities:** Reactive oxygen species have been studied using bioactive substances from *Moringa* pods, including flavonoids, thiocarbamates, glycosylates, isothiocyanates, and some other compounds. According to earlier research, kaempferol, which is mostly present in plant leaves, maybe the cause of the antioxidant protection.[23]

Cissus quadrangularis:

1. **Activity that heals bones:** The *Cissus quadrangularis* plant's anabolic steroid demonstrated a significant impact of early generation on fracture healing rate of every connective tissue. Vitamins are found in *Cissus quadrangularis*, and steroids, which have been shown to affect bone fractures in a particular way recovery.[39]
2. **obesity action:** A formulation of *Cissus quadrangularis* was used in the study cylaris. The research employed double-blind, placebo-control design. The test subject's waist shrank, according to the results. Serum lipid levels were lowered by the circumference body mass index.
3. **Activity that prevents ulceration:** *Cissus quadrangularis* extract's anti-ulcerative effect on enzymes, The enzyme H⁺K⁺-ATPase is thought to be in charge of creating acidity in stomach is seen.
4. **Activity against diabetes:** A study found that *Cissus quadrangularis* has anti-diabetic properties. Where *Cissus quadrangularis* dry powder is produced using extraction of ethyl acetate. This is examined for diabetes in women. Albino rats through the use of alloxan.
5. **Scavenging of free radicals and antioxidants:** *Cissus quadrangularis* methanol extract shows potent antioxidant and scavenging of free radicals in vitro and in vivo systems primarily because of β -carotene Scavenging of free radicals and antioxidants *Cissus quadrangularis* methanol extract shows potent antioxidant and scavenging of free radicals in vitro and in vivo systems primarily because of β -carotene. [40]
6. **Protective action on the stomach:** Due to its substantial supply of triterpenoids, carotenoids, *Cissus quadrangularis*, which contains ascorbic acid, is used for the gastrointestinal illnesses in

conventional medicine, Several studies showed *Cissus quadrangularis* extract's (CQE) effects on the gastrointestinal Toxicity as well as gastro protective properties.

7. **Activity of the central nervous system:** The stimulant CNS function of the root extract is suggested by lowering exploratory activity. Methanol root extract is made up saponins that have a strong sedative effect and prevent mice from moving on their own.
8. **Anti-inflammatory, analgesic, and stimulatory properties:** As a result of flavonoids and β -sitosterol, methanol extract has analgesic, non-inflammatory. The neutrophil inflow into the inflammatory tissue has significantly decreased, as indicated by this.[41]

Methods Of Extraction Process:

Moringa Oleifera:

Within the herbal garden, fresh *Moringa oleifera* leaves were gathered. After two weeks of air drying, the fresh leaves were ground into a fine powder in a mortar. This was placed aside for later extraction in a herbarium.

1. *The Cold Method of Extraction:*

- i. For nine (9) days, 70 g of the air-dried leaves were soaked in 400 ml of n-hexane in a 500 ml beaker. To recover the n-hexane, the mixture was put into a distillation flask. In a beaker, the leaf's crude extract was allowed to dry out over the course of one to two day.[25]

2. *Method of maceration:*

- i. For roughly seven days, fresh *Moringa oleifera* leaves were allowed to air dry. The dried substance was macerated in distilled water (100 g in 2 L) at 30 °C. Twenty-four hours later, the extract was decanted. With a yield of 22%, the filtrate was dried out in an oven set at 40 °C for four days, resulting in a greenish brown color. Prior to being given to experimental animals, the dried extract was weighed and reconstituted in distilled water (pH = 6.8) to create a stock.

3. *Soxhlet extraction:*

- i. Another popular method for extracting plant phytochemicals is Soxhlet extraction, which is carried out with a specialized device called the Soxhlet apparatus. By heating the solvent in a round-bottom flask, the vapor rises to the condenser and moves through the extraction chamber in this extraction method. After that, the condensed droplets fall into the sample-containing porous thimble. The extraction chamber gradually fills as the solvent dissolves the target compounds from the plant material. The solvent returns to the round-bottom flask once the level has risen above the siphon bend. A comprehensive extraction procedure and repeated exposure of the solid material to fresh solvent are ensured by the solvent's continuous cycling through the sample. Soxhlet extraction speeds up the extraction process by using less solvent and improving solute diffusion than the maceration method.[26]

4. *Microwave-Assisted Extraction (MAE):*

It is a modern technique that has become an interest to researchers for its capability. The MAE facilitates the separation of analytes from the plant material into the solvent by using microwave energy. The microwave oven runs at 2.45 Hz with a wavelength of 12.2 cm, and phenolic compounds have previously been extracted from *Moringa oleifera* leaves.

5. **Ultrasound-assisted extraction (UAE):**

It has been used in extracting bioactive compounds from plants on a laboratory scale and industrial scale. UAE uses ultrasonic frequencies between 20 kHz and 2000 kHz. According to a study by Rodríguez-Pérez, the UAE technique produced a higher phenolic content than the maceration method when crude *Moringa oleifera* extracts were extracted using 25 mL of solvents for 15 minutes at room temperature.[27]

Cissus Quadrangularis:

1. **Soxhlet extraction:**

The Soxhlet extraction method was used to extract the stems of *Cissus quadrangularis* approach 50 g of dried *Cissus quadrangularis* L. stem powder was put in a Soxhlet thimble. Equipment. 350 milliliters of different solvents, including acetone, dichloromethane, methanol, chloroform, hexane, and Aqueous (MACDHA)—were applied one after the other. The active biomolecules were dissolved by the solvents, but the stems Stayed in the form of precipitation. The extraction process went on until the thimble's solvent turned clear, usually taking about eight hours. A dark orange residue was then obtained by drying the extract in a water bath. [32]

2. **Extraction using successive solvents:**

Cissus quadrangularis after drying, the stem pieces were ground into a coarse Powder. To grind and defat, petroleum ether was utilized. Fresh plant matter, one kilogram. The air became dry. About 50 g of defatted, powdered plant material. Later, a Soxhlet device was used to extract it using water, ethanol, pet ether, and chloroform. The marc was Every time, air dried below 50°C prior to extraction using the solvent that comes after. Following the solvent's approval the extracts were allowed to evaporate at room temperature.[33]

Identification test of *Cissus Quadrangularis*:

Sr No	Test	Procedure	Observation
1	Alkaloids Test (Mayer's Test)	3 ml dried extract + 1 ml 1% HCl → shake → add few drops of Mayer's reagent (potassium mercuric iodide)	White, creamy precipitate formed
2	Phenol Test (Ferric Chloride Test)	0.5 ml extract + 4 ml distilled water → heat → filter → add 3 ml neutral FeCl ₃ solution to filtrate.	Brown coloration observed.
3	Terpenoids Test (Salkowski Test)	0.5 ml extract + 2 ml chloroform → carefully add 3 ml conc. H ₂ SO ₄ .	Reddish-brown layer formed at interface
4	Tannins Test (Ferric Chloride Test 1)	1 ml extract + 2 drops 5% FeCl ₃ . Blue-green precipitate (not brown).	Indicates presence of other natural compounds.

Table 6: Phytochemical screening of *cissus quadrangularis* [27]

Toxicological study:

Morning Oleifera:

To assess the plant's potential for toxicity, a number of experimental techniques were used. An oral dose of 2000 mg/kg aqueous methanol solution was administered to a randomly selected group of female Wistar albino rats who were not pregnant. The levels of ALT, AST, and total bilirubin were measured in blood samples. The study's findings indicated that the aqueous extract's lethal dose in female rats was greater than 2000 m. [28]

Investigation of acute toxicity:

1. Acute toxicity via oral:

A total of six groups of five mice each were randomly selected. Graded extract dosages (400, 800, 1600, and 3200 as well as 6400 mg/kg) were given to the animals orally whenever they wanted. 0.1% distilled water was given to the control group by mouth. For 24 hours after treatment, mice were monitored for mortality. Alterations in behavior (agitation, boredom, and restlessness) and indicators due to toxicity.

2. Acute toxicity in the intraperitoneum:

The mice were split up into five groups of five animals each at random. Graded intraperitoneal doses of the extract (250, 500, 1000, and 2000 mg/kg) were used. They gave 0.1 ml of distilled water to the control group. For 24 hours after treatment, mice were monitored for mortality, behavioral changes, and indications of toxicity.[29]

Cissus Quadrangularis:

The basic science of poisons is toxicity. The group for Economic and According to the OECD, acute toxicity is the advance effect that happens in a short amount of time. Duration of oral administration of a single dosage or several doses administered over a 24-hours Poisons' phytochemical interactions cause harm or death to living tissues. It involves collecting data through observation & data use to forecast human and animal exposure outcomes. The prehistoric humans classified certain plants as safe and others as dangerous.[42] An Analysis of Toxicology Numerous Investigations revealed that the *Cissus quadrangularis* the extract has been shown to have no adverse effects Stated.[43]

Future Prospects:

Making polyherbal mixtures of *Moringa* and *Cissus* for: Healing of bones anti-

inflammatory properties anti-diabetic and antioxidant properties. Because of their antioxidant and collagen-stimulating qualities, herbal creams, serums, wound-healing gels, and anti-aging treatments have been developed.

Conclusion:

The curative effects, divergent phytochemistry and ethnopharmacological value of *Moringa oleifera* and *Cissus quadrangularis* are highlighted in Dual Herbal Dynamics. Both the plants were found bearing wide range of bioactive compounds such as alkaloids, flavonoids, phenolics, terpenes, vitamins and mineral contents along with good nutrients that make them an effective drug source. Scientific studies have shown that These compounds are effective in treating Oxidative stress, Inflammation, Metabolic Disorders, Bone regeneration Cancer and Neuropathic pain. There is still a lot to learn about these plants potentials for modern medicine, hence the need of more clinical trials to demonstrate their effectiveness and safety. Natural therapies are nowadays gaining importance and plants like *Moringa oleifera* and *Cissus quadrangularis* could be interesting candidates for future treatment purposes.

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