

PLANTS HAVING ANTIUROLITHIATIC ACTIVITY; A REVIEW

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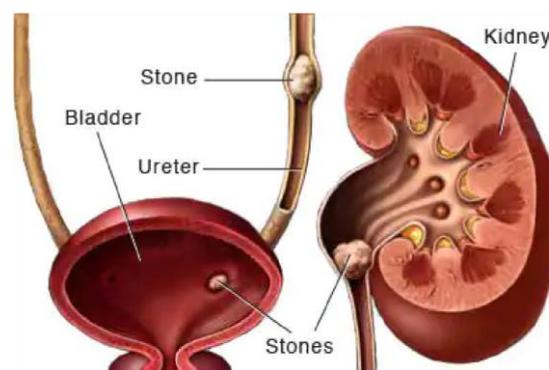
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ABSTRACT

Nowadays, kidney stones have significantly increased globally, which leads to renal failure and also kills patients. So it is essential to take preventive measures for controlling kidney stones. Urolithiasis is the formation of stones in the urinary system, which includes the kidney, ureter, urethra, and urinary bladder. Many antiurolithic drugs and surgical procedures are available now, but they have side effects. Herbal drugs serve as an alternative to this issue. Herbs like Pashanbhed, Punarnava, Gokhru, coconut embryo, and radish are used as antiurolithic. Its different parts contain chemical constituents that are therapeutically significant, such as alkaloids, flavonoids, sterols, phenolic compounds, tannins, terpenes, rotenoids, and lignans.

KEYWORDS: Urolithiasis, Pashanbhed, punarnava, gokhru, coconut embryo, radish.**INTRODUCTION**

A medical condition known as urolithiasis involves the emergence of stones in the kidney, ureter, bladder, and urethra. Urolithiasis = ouron means "urine," and lithos means "stone." It occurs predominantly in males (70–80%) when compared to females (47–60%).^[1] In Ayurveda, kidney stones are called ashmari or mootrashmari. Kidney stones occur due to an imbalance in the dosha (fundamental energy). The defect in the vata, pitta, and doshas is the main cause of kidney stones, which can be cured by ayurvedic treatments that restore balance and promote overall kidney function.^[2] A mass of small crystals can develop over weeks or months when the urine contains too much concentrated substance like oxalate, food, phosphates, or carbonate. Without any surgical procedure, 95% of renal stones can be broken through ayurvedic remedies and therapy.^[3] Stones are excreted through urine by diuretic activity. Urolithiasis is caused by dehydration, nutrition-related factors, heritage, and underlying medical issues. Urinary tract infection, intense pain, urine blockage, burning sensation, nausea, vomiting, and hemorrhagia are the indications of this disease. Panchakarma treatment and ayurvedic detoxification therapy aid in toxin elimination and restore balance.^[4]

**Fig.1: Kidney Stone.****TYPES OF KIDNEY STONES**

The biochemical imbalance in the urine is the main reason for the development of renal stones. Based on the difference in minerals, kidney stones are classified as:

- Calcium stone
- Struvite stone
- Uric acid stone
- Cysteine stone
- Drug-induced stone

1. Calcium stones

Calcium stones are predominant among renal stones (75–85%). Calcium stone is composed of calcium phosphate and calcium urate. A condition known as hyperparathyroidism leads to hypercalciuria. Calcium oxalate stone occurs in urinary PH 5.0 to 6.5 and calcium phosphate stone in PH >7.5.

2. Struvite stones

Struvite stones are also referred to as infection stones, and they occur to an extent of 2 to 15%. It consists of a blend of magnesium and ammonium phosphate. Infection may be due to *Klebsiella pneumonia* and *Pseudomonas aeruginosa*. Most commonly seen in women's than males.

3. Uric acid stones

6–10% of urinary stone sufferers are experiencing them. It is formed as a result of high purine intake and low urinary pH (<5.5). Mostly found in men than women.

4. Cysteine stones

It is a genetic disorder and comprises 1-2%. It is due to the impaired renal tubular absorption of cystine, a condition known as cystinuria.⁵ Drug-induced stone. It accounts for about 1%. Some drugs, like triamterene, guaifenesi, atazanavir, and sulfa, induce these stones.^[5,6,7,8,9]

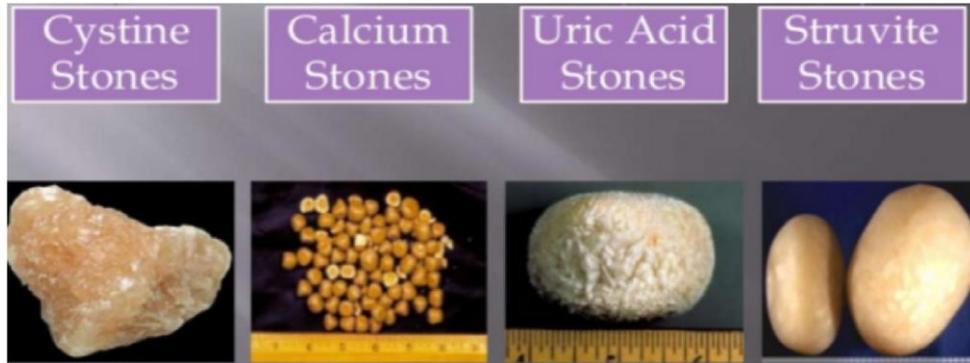


Fig. 2: Types of Kidney Stones.

PASHANBHED

Pashanbhed (stone breaker) is a notable ayurvedic drug, utilized fundamentally as a diuretic and lithotropic. Plants like *Bergenia ligulata* wall, *Aerva lanata* juss, *Coleus aromaticus* benth, *Kalanchoe pinnata* linn, *Homonium ripatia* lour, *Rotula aquatica* lour, and so forth are being utilized under the name Pashanbhed.

Class: Magnoliopsida
 Subclass: Rosidae
 Order: Rosales
 Family: Saxifragaceae
 Genus: *Bergenia*
 Species: *Bergenia ligulata* (Wall.)

Taxonomical Classification

Kingdom: Plantae
 Subkingdom: Tracheobionta
 Superdivision: Spermatophyta

Plant Profile

Bergenia ligulata, otherwise called *Saxifraga thysanodes* Linn, is a lasting spice up to 50 cm tall. It is circulated in calm Himalaya and is exceptionally normal in Pakistan, Central Asia, and East Asia.



Fig. 3: Pashanbhed rhizome and leaf.

Language	Names
Sanskrit	Ashmabheda
English	Rockfoil
Tamil	Sirupilai
Malayalam	Kallurvanchi, kallurvanni
Hindi	Dakachru, pakhanabhed

Pashanbhed is an herb with short, thick, fleshy stems and a stout rootstock. Leaves are praise or cycle, 5–15 cm long. Flowers are white, pink, or purple, with a 3.2 cm breadth. Rhizomes are reduced, strong, barrel-formed, 1–3 cm long, and 1–2 cm across the external surface. They are earthy-colored, shaded with little roots, ridges, furrow wrinkles, and covered with root scars.

Chemical Composition

Bergenia ligulata comprises a significant phenolic compound, bergenin, of about 0.9%. It also consists of gallic acid, tannic acid, catechin, methyl folate, β -sitosterol, glucose, tannin, mucilage, and wax. Coumarin, flavonoids, lactones, glycosides, carbohydrates, phenols, etc. are also present in various parts of Pashanbhed.

Traditional uses

Pashanbhed has been used in Ayurveda and Unani medicines. It possesses a laxative, cooling, analgesic, and libidinous effect and is used in the treatment of urinary discharges, vesicular calculi, dysentery, menorrhage, and heart disease. The dried root is used externally for boils, wounds, cuts, and burns. It is also used to treat urinary disorders, stomach disorders, and urogenital complaints. Topically used in the treatment of ophthalmia.

Pharmacological activity

Antiuro lithic activity
Antiviral activity
Antibacterial activity

Antipyretic activity
Anti-inflammatory
Analgesic
Aphrodisiac
Laxative
Diuretic activity
Liver protective activity.^[10, 11]

PUNARNAVA

Punarnava (*Boerhavia diffusa* L.) is a significant medicinal herb used in Ayurveda, Unani, homeopathy, and tribal systems of medicine. It is mostly used for renal and urinary abnormalities. Punarnava renovates the whole body through its routine consumption.^[12, 13]

Taxonomical Classification

Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Caryophyllales
Family: Nyctaginaceae
Genus: *Boerhavia*
Species: *diffusa*^[13]

Plant Profile

Boerhavia diffusa is a branched, creeping herbaceous perennial plant. It is seen in India and Brazil, where it is abundant in the rainy season but dries during the summer.

Language	Name
English	Hogweed
Malayalam	Thazhuthama
Telungu, Sanskrit	Shothaghni, Varshabhu
Tamil	Thazhuthamai

There are two varieties of punarnava; one is mainly white and red, and the other is blue. Red punarnava is used to adulterate punarnava roots. The root and whole plant are used for medicinal purposes. Punarnava is about 20–60 cm long, and the root is fusiform and woody. The stem is glabrous to rusty puberulous, green, often tinged with

purple. Leaves are an unequal pair at each node; the ovate is rounded or sub-orbicular. Petioles are 3–5mm grooved abaxially, green or reddish purple. Flowers are incomplete, bisexual, hypogynous, and rose to pale pink.^[12, 13, 14]



Fig. 4: Punarnava Leaves.

Chemical Composition

Boerhavia diffusa possesses numerous bioactive compounds, mostly phenolic (punanavoside, trans

caftaric acid, and boerhavic acid), flavonoids (borhavone, quercetin, and kaempferol), alkaloid (liriodenine), steroid (boerhavisterol, β ecdysone),

anthracenes, and lignans. The roots contain 14 essential amino acids: alanine, arginine, glutamic acid, ornithine, serine, threonine, tyrosine, glycine, valine, leucine, methionine, proline, phenylalanine, tryptophan, and asparagine.^[14, 16]

Traditional Use

In India, punarnava has been used by indigenous and traditional people as a diuretic, anti-inflammatory, anemia, edema, and in heart diseases. It is also used for its anti-aging and antioxidant properties. It is also used in conditions like joint pain, eye disease, jaundice, renal stones, immunopotentiators, antioxidants, and antidiabetics.^[14,15,16]

Pharmacological activities

Roots, flowers, leaves, fruits, and seeds of *Boerhavia diffusa* are used to treat various diseases.

Antibacterial

Antidiabetic

Antioxidant

Anticancer

Anti-inflammatory

Diuretic

Asthma

Renoprotective

Cardioprotective

Hepatoprotective

Immunomodulatory

Jaundice.^[14]

GOKHRU

Tribulus terrestris (gokhru), a natural herb, has been utilized in both Indian and Chinese systems of medicine to cure a variety of diseases.^[17] It contains flavonoids, glycosides, alkaloids, steroids, and saponins. It can be used for diuretic, analgesic, anti-diabetic, anti-urolithic, aphrodisiac, anthelmintic, anticancer, and antibacterial activities.^[18]

Taxonomical Classification

Kingdom: Plantae

Division: Phanerogams

Subdivision: Angiospermae

Class: Dicotyledonae

Subclass: Polypetalae

Series: Disciflorae

Order: Giraniales

Family: Zygophyllaceae

Genus: *Tribulus*

Species: *Terrestris* Linn.^[17]

Plant Profile

Tribulus terrestris is distributed over a large geographic area. It is found in Kashmir, Ceylon, and all warm regions of both hemispheres. It is found across India up to an elevation of 11,000 feet. It grows mostly in hot, arid, sandy parts of India, such as West Rajasthan and Gujarat. It is a common weed on pasturelands, roadsides, and other waste locations.^[17]



Fig. 5: Gokhru Seeds.

Language	Names
English	Puncture vine, land caltrops
Sanskrit	Gokshur
Hindi	Gokharu
Tamil	Nerinjil
Urdu	Khar-e-khusak khurd

Tribulus terrestris is a yearly fluctuating prostrate with a maximum length of 90–95 cm. It has a cylindrical, thin, fibrous root that is light brown in color. Leaves are compound, sub-opposite, paripinnated, and stipulate. They are pubescent on both surfaces and of the macronate type, oblong to linear-oblong, sub-equal shapes. Flowers, which have an 8–12 cm diameter and are axillary solitary, hypogynous, pentamerous, bisexual,

sub-sessile, and actinomorphic, are pale yellow to yellow in color and bloom in July and August.^[19]

Chemical Composition

Various parts of *Tribulus terrestris* contain steroids, flavonoids, saponins, sterols, alkaloids, and cinnamic acid amides. Studies revealed the presence of alkaloids in *Tribulus terrestris*.^[20,21,22] It contains β carboline alkaloid, tribulusterine in fruits, Flavonoids like kaempferol,

astragalin, kaempferol-3-rhamnoglucoside, tribuluside, and rutin Sterols like β -sitosterols and stigmasterols, furostanol and spirostanol saponins of tigogenin, neotigogenin, gitogenin, neogitogenin, hecogenin, neohecogenin, diosgenin, chlorogenin, ruscogenin, and sarsasapogenin types. Tribulus terrestris also contains tribulusamides A and B and lignan amides.^[17,23,34,25,26]

Traditional Uses

Gokhru has been utilized in traditional medicine for its tonic, aphrodisiac, palliative, astringent, stomachic, antihypertensive, diuretic, lithotriptic, and urinary disinfecting properties. The herb's dried fruit works well for the majority of genitourinary tract conditions where urinary stones are removed. The fruit and root are said to have cardiotoxic qualities, per the Indian Ayurvedic Pharmacopoeia. The fruits were used to treat eye problems, edema, stomach distension, emission, morbid leukorrhea, and sexual dysfunction in traditional Chinese medicine. TT is used as a general tonic, mild laxative, and diuretic in Unani medicine.^[27]

Pharmacological Activities

- Anti-urolithic activity
- Anti-inflammatory activity
- Antibacterial activity
- Aphrodisiac activity
- Antimicrobial activity
- Antioxidant activity
- Antitumor activity
- Analgesic activity
- Diuretic activity
- Hypoglycemic activity^[28,29,30]

COCONUT EMBRYO

Sprouted coconuts, also known as coconut apples or coconut embryos, occur when a coconut has begun to germinate. This process typically starts when a coconut falls from the tree and remains on the ground for an extended period of time. As it lies in a warm, moist environment, the coconut begins to sprout. Coconuts were first domesticated thousands of years ago in India and Southeast Asia, and they were subsequently traded by humans and ocean currents over long distances. A

sprout appears on the mature coconut, which develops into a new coconut palm. As the coconut ages, it begins to sprout and forms a ball that resembles a yellow sponge. By lowering the concentration of numerous substances in your urine, such as phosphates, uric acid, calcium, and others, coconut water facilitates the dissolution of kidney stones by making it easier for your body to detoxify. Its natural diuretic properties and ability to enhance urine flow account for this.^[31,39]

Taxonomical Classification

Kingdom: Plantae
Division: Magnoliophyta
Class: Liliopsida
Order: Arecales
Family: Arecaceae
Genus: Cocos
Species: *C. nucifera*

Plant Profile

Mature coconut fruits that are starting to sprout contain sprouting coconuts. Coconut seeds' endosperm can contain them in varying sizes, from marble-sized to fully filling the cavity. 20 to 24 weeks following germination is when they reach their greatest size. Being cotyledonary structures that take up water and nutrients from the liquid and solid endosperm, they are technically haustoria. The mature coconut visible on the tree looks a lot like this outer shell, but a sprouted coconut may be identified by its location it fell to the ground from the tree and occasionally carried a small root and a short, green branch. The endocarp, or core, is encircled by a gray-brown, inedible shell that has three germination holes, or eyes, on the stem-end beneath the husk. Thick, sponge-like flesh with a yellow, grooved exterior and a pristine white interior surrounds a thin layer of slippery, crisp white meat inside the endocarp that is covered in coconut oil. There is a snap to the spongy meat, but it soon melts into a mushy consistency. Comparable to the texture of angel food cake, with a light, delicate feel and consistency. There is occasionally a subtle, musky scent to sprouted coconuts. The spongy flesh is very mildly sweet and savory, with a hint of taginess and a faint salinity that is evocative of coconut water.^[35,36]



Fig. 6: Coconut Embryo.

Chemical Composition

About 66% of the carbohydrates in sprouted coconuts are made up of soluble sugars. They are rich in minerals, including calcium, phosphorus, magnesium, manganese, and potassium, as well as dietary fiber.

- Calories: 80
- Carbohydrates: 6 grams
- Protein: 2 grams
- Fat: 6 grams
- Fiber: 4 grams
- Vitamin C: 8% of the Recommended Daily Intake (RDI)
- Folate: 10% of the RDI
- Iron: 4% of the RDI
- Potassium: 5% of the RDI
- Magnesium: 5% of the RDI^[37]

Traditional uses

Sprouted coconuts have practical applications in traditional cuisine. In some regions where they are abundant, people use them as ingredients in various dishes, such as salads or desserts, due to their distinctive taste and texture.^[34, 38]

Medicinal uses

Coconut sprouts are high in minerals, so they help dissolve kidney stones.

Antiviral, antibacterial, antifungal, and antiparasite properties support the health of the immune system.

Improves athletic and physical performance and offers a rapid energy source that is natural.

Enhances nutritional, vitamin, and mineral absorption and digestion

Enhances the production of insulin and reduces diabetes symptoms. reduces insulin, eliminates free radicals that hasten aging and degenerative disease, and helps shield the body against cancer.

Enhances healthy cholesterol and lowers the risk of heart disease (HDL).

It replenishes and maintains thyroid function.

Aids in guarding against bladder infections and kidney illness.

Encourages losing weight.

It helps prevent age spots, sagging skin, wrinkles, and sun damage while maintaining healthy, youthful-looking hair and skin.^[31,33]

RADISH

Radish (*Raphanus sativus*) belongs to the Brassicaceae family. It is an edible vegetable. This food crop has a greater role in the treatment of jaundice, gynecological disorders, and diarrhea and is used as an appetizer.

Radish contains bioactive components having beneficial effects on the human body from a medicinal perspective. It is generally grown as an annual or biennial plant with a taproot that is much enlarged when it is cultivated.^[40,41,43]

Taxonomical classification

Kingdom: Plantae
Division: Tracheophyta
Class: spermatophytina
Order: Brassicales
Family: Brassicaceae
Genus: *Raphanus L.-sativa*
Species: *Raphanus sativus*^[43]

Plant profile

South West Asia, East Asia, the Mediterranean Sea, South Asia, tropical nations, and Europe have all been home to radish cultivation. Optimum temperature: 15–20 degrees Celsius. In Asia, the surface hue of radish is white, but in Europe, it is purple, green, and black. It generally grows on hills. The most favourable season for cultivation is winter.^[44]

Language	Name
English	Black radish
Urdu	Mooli
Japanese	Daikon



Fig.7: Radish.

The most commonly used part of radish is the root. The leaves and sprouts are also consumed in raw form. Flowers are symmetrical in nature; the petals are seen in white, pink, and red. Leaves may be simple or compound.^[40,42,43]

Chemical composition

The medicinal activities of *Raphanus sativus* have been associated with the production of secondary metabolites, including tannins, terpenoids, coumarins, alkaloids, and flavonoids. Phytoconstituents present in radish are:

- Squalene
- Quercetin
- Catechin
- Lutin
- Palmitic acid
- Linolenic acid

- Oleic acid
- Methyl palmitate
- Ascorbic acid
- β -carotene
- Myricetin
- Zeaxanthin
- Violaxanthin
- Glucoraphenin
- 2,4 dimethyl phenol
- 4-ethyl-2-methyl phenol^[43]

Traditional uses

In Ayurveda, radishes are used as a powerful tool to balance bodily energies, or doshas: vata, pitta, and kapha. With their unique heating quality, radishes are particularly adept at stimulating Agni (digestive fire), essential for efficient digestion and metabolism. Drinking filtered water after boiling radish seeds is an effective remedy for kidney stones.^[45,46]

Pharmacological activities

- Extracts of Radish are an effective diuretic.
- Radish acts as a promoter for inhibitors of calcium oxalate crystallization.
- It increases the excretion of calcium oxalate.
- Inhibit cancer cell growth.
- Radishes are useful for enhancing the capacity of the liver and gallbladder.
- Radishes can manage the generation and stream of bile and bilirubin, as well as acids and proteins. It helps in digestion.
- Reduce your blood sugar and blood pressure.
- Radish leaves have more protein, calcium, ascorbic acid (vitamin C), and antioxidants than the roots.
- Radish extract resulted in reduced oxidative stress and prevented fat accumulation.
- Black radish has been used to treat jaundice.
- Helps to purify blood.^[47,48,49]

DISCUSSION

Urolithiasis, or kidney stones, is the formation of stones in the urinary system. Recently, it has increased all over the world. Treatment is based on the location, size, and composition of the stone. Treatment measures include drinking plenty of water, medication to remove stones, or a procedure like lithotripsy (a surgical procedure).

Medication for kidney stones includes narcotics and non-steroidal anti-inflammatory drugs for pain relief. Alpha adreno receptor antagonist or calcium channel antagonist in medical expulsion therapy. This medical expulsive therapy can cause dizziness, sinus congestion, or a runny nose. Surgical procedures result in side effects like:

- Mild burning feeling on urination
- Mild discomfort in the bladder area or kidney Blood in urine.
- Temporary discomfort
- Pain, bleeding, and a frequent urge to urinate.

Herbal medicine has received significant attention for its potential as an antiurolithic activity, primarily due to its improved effectiveness and lack of side effects compared to synthetic drugs. They contain a complex mixture of bioactive compounds that may work synergistically to prevent the formation of urinary stones. Medicinal plants contain compounds that can dissolve certain types of urinary stones and prevent their growth. These also possess anti-inflammatory properties, which help lower inflammation and relieve associated symptoms. Herbs with diuretic properties promote urine production and thereby the excretion of stone-forming substances from the urinary system. Herbal medicines are generally considered safer and gentler on the body, reducing the risk of such side effects. Since the present system of medication and surgery is only a temporary solution, after a certain period of time, there will be the formation of stones. Since the herbs are acting as a root cause treatment, further occurrences of the disease won't happen.

However, it's important to note that while herbal medicines hold promise as antiurolithic agents, more research is needed to validate their efficacy, safety, and optimal dosage regimens.

CONCLUSION

This literature study explains kidney stones and their herbal remedies. Various plants and their parts are used to cure kidney stones; their traditional use, pharmacological effects, taxonomical classification, and chemical composition were understood. It helped in understanding the benefits of using herbal drugs to cure kidney stone issues and the reduced side effects of herbal drugs as compared to synthetic antiurolithic drugs and surgical procedures.

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