Review Article

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A COMPREHENSIVE REVIEW ON *BERGENIA LIGULATA* (PAASHANBHEDA) AND ITS ROLE IN THE TREATMENT OF KIDNEY STONE FORMATION

Ch. Haritha *, D. Ramya, R. Naveen, S.V. Prasanna, P. Salomi

Chalapathi Institute of Pharmaceutical Sciences, Chalapathi Nagar, Lam, Guntur, Andhra Pradesh, India

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***Corresponding author**
E-mail: harithareddy23598@gmail.com

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ABSTRACT

Bergenia ligulata, a member of the saxifragaceae family, is a well-known Ayurvedic medicine Paashanbheda. *Bergenia ligulata* is a highly regarded medicinal herb and one of the most well-known examples of controversial drugs in Indian medicine, commonly referred to as "Paashanbheda." This plant is well-known for its ability to dissolve kidney stones. Bergenia comes in three varieties: *B. ligulata, B. ciliata* and *B. stracheyi*. Bergenin is the species' key chemical constituent. Many secondary metabolites belonging to coumarins, flavonoids, benzenoids, lactone, fructose, tannins, phenols, and sterols have been discovered in phytochemical studies. Anti-urolithic, antiviral, free radical scavenging, anti-diabetic, hepatoprotective, diuretic, antipyretic, anti-oxaluria, antitumor, antibacterial, antifungal, anti-inflammatory, anti-implantation and cardio-protective activities have been observed in crude extracts and isolated compounds from *B. ligulata*. Bergenin, (+) afzelechin, (+) catechin and -sitosterol were discovered in the plant's phytochemistry. Many pharmacological activities of plants have been studied, including antipyretic, anti-diabetic, anti-inflammatory, antitussive, anti-urolithic and antimalarial. The aim of this review is to present the most current knowledge on botany, Pharmacognosy, conventional uses, phytochemistry, pharmacopoeial requirements, pharmacology of *B. ligulata*, as well as the biological activities of Bergenin (active constituent from *Bergenia ligulata*). It covers the information collected from scientific journals, books, theses and reports via a library and electronic search (Google Scholar and PubMed).

Keywords: *Bergenia ligulata, B. ciliata, B. stracheyi*, Controversial drugs, Paashanbheda, Phytochemistry, Pharmacognosy, Traditional uses.

INTRODUCTION

Saxifraga ligulata is a perennial herb in the saxifragaceae family. There are 440 species of Holarctic perennial plants in this genus. In the saxifragaceae family, Saxifraga is the largest genus. Saxifrage is a Latin term that means "stone breaker." In the Indian medical system, it is known as Paashanbheda. Saxifraga is more common among those who are concerned about the climate because they are drought resistant and nontoxic plants[1]. Plants have long been important in sustaining human health and contributing to the betterment of human life. Medicines, cosmetics, dyes, and drinks all contain them in some form etc.

Plant research is receiving a lot of attention these days all over the world. A variety of herbal agents have been successfully used to treat gastrointestinal, cardiovascular, metabolic and diabetes disorders, among other conditions. Plants are thought of as cutting-edge laboratories capable of biosynthesizing a wide range of biomolecules from various chemical groups. Since modern medicines are not available in remote areas in India, 75 percent of the population relies on herbal medicines to treat diseases. For decades, the rhizomes of *B. ligulata* have been used in herbal formulations to dissolve kidney and bladder stones[2]. Despite the fact that the drug is mentioned in the Charak Samhita, Sushruta Samhita, and Ashtanga-Hridaya, it is still controversial because several plants are used and sold as 'Paashanbheda' in different parts of the world. About nine different plants species are known with the single name i.e. Paashanbheda in different regions is shown in Table 1.1[3-5].

Table 1: Plants used as Paashanbheda

Botanical name	Family	Parts used	Phytochemicals
Aerva lanata Juss.	Amaranthaceae	Roots	α-amyrin and β-sitosterol
Bergenia ligulata Wall.	Saxifragaceae	Roots, Rhizomes	Coumarin (bergenin), gallic acid, tannic acid, minerals and wax
Bridelia crenulata Roxb.	Euphorbiaceae	Stem, Bark	Friedelin, epifriedelinol, n -octacosanol, a-amyrin, ß sitosterol, ß-sitosterol-3-ß-D-glucopyranoside and luteoforol
Bryophyllum calycinum Salisb.	Crassulaceae	Leaves	Citric acid, malic acid and flavonoids
Coleus amboinicus Lour.	Lamiaceae	Leaves	Essential oil (contains carvacrol)
Decalepis arayalpathra	Periplocaceae	Roots	2-hydroxy, 4-methoxy benzaldehyde
Homonoia riparia Lour.	Euphorbiaceae	Rhizomes	Isoflavonoids
Rotula aquatica Lour.	Boraginaceae	Whole plant	Tannins
Didymocarpus pedicellata	Gesneriaceae	Whole plant	Chalcones, polyterpenes, flavonoid, dicarboxylic acid, essential oil

Plant profile

Bergenia ligulata Wall, a member of the Saxifragaceae family, is commonly referred to as a "stone flower/stone breaker." *Saxifraga ligulata* Wall is another name for it.

Synonyms

Bergenia ciliate (Haw), *Saxifraga ciliate* (Haw), *Megasea ciliata* (Haw), *Saxifraga ligulata* wall, *Bergenia ligulata* wall, *Saxifraga thysanodes* Lindl[5,6].

Taxonomical classification

Table 2: Taxonomical classification [7]

Classification	Category
Kingdom	Plantae- Plants
Subkingdom	Tracheobionta-Vascular plants
Supervision	Spermatophyta- Seed plants
Class	Magnoliopsida- Dicotyledons
Subclass	Rosidae
Order	Rosales
Family	Saxifragaceae- Saxifrage family
Genus	*Bergenia moench*- elephant ear
Species	*Bergenia ligulata* (Wall.)

Vernacular names

Table 3: **Plant vernacular names [7]**

Language	Vernacular name
Gujarati	Pakhanbheda, Paashanbheda
Hindi	Dakachru, Pakhanabhed, Pakhanabheda Patharcua, Silparo, Silpbheda
Kannada	Alepgaya, Hittaga, Hittulaka, Pahanbhedi, Pasanberu
Kashmiri	Pashanbhed
Malayalam	Kallurvanchi, Kallurvanni, Kallorvanchi
Marathi	Paashanbheda
Punjabi	Batpia, Dharposh, Kachalu, Paashanbhed
Sanskrit	Ashmabheda, Nagbhita, Pashaanbheda, Silabheda
Tamil	Sirupilai
Telugu	Kondapindi, Telanurupindi
Urdu	Kachalu, Pakhanabheda
English	Rockfoil

Microscopical features

Transverse parts of *B. ciliata* rhizomes stained with phloroglucinol and hydrochloric acid or iodine reagents were examined histologically. The cork of *B. ciliata* rhizomes is stated to be divided into two zones with a small cortex of thick parenchymatous cells containing light brown colour and starch grains and a few rosette crystals of calcium oxalate in transverse parts are also present in some cells of secondary cortex. A ring of vascular bundles can be found. They are free, collateral, and conjoint. Tracheid vessels with simple pits, xylem parenchyma, and xylem fibres make up the xylem. In *B. ciliata* rhizomes, pith cells are located in the central region[18].

Geographic distribution

It is primarily found in cold and temperate climates. It can be found at altitudes of 900-3000 m in the temperate Himalayas, from Kashmir to Bhutan[8]. In and around the Murree region, particularly in the Galis, it's very common on rocks. While it has members in the southern hemisphere, the Saxifragaceae is predominantly a north temperate family. *B. ligulata* is a succulent perennial herb that grows up to 50 cm tall. It grows from 2000 to 2700 meters in the temperate Himalaya (from Kashmir to Nepal) and is very common in Pakistan, Central Asia, and East Asia[9,10].

Botanical distribution

Leaves simple or compound, alternate, sometimes opposite, typically exstipulate, inflorescence cymose or racemose, rarely flowers solitary flowers; bisexual or sometimes unisexual are the main botanical characteristics of the Saxifragaceae family. Stamens are inserted with the petals, often indefinitely doubling or equaling their number. Ovules were numerous, erect or pendulous and the ovary was composed of 3-5 united carpels with axial placentas, sometimes celled with partial placentas. Styles are as numerous as carpels, and they can be free or connate. Stigma capitates, lateral, and sub-capitate are the two types of stigma; Capsular or baccate fruits. Typically, there are a lot of seeds. They are evergreen perennial plants with a spirally arranged rosette of leaves that are 6-35 cm long and 4-15 cm wide, as well as a pink flower formed in a cyme. The leaves of Bergenia produce beautiful foliage all year. They have a leathery or rubbery texture to them. Bergenia's leaf form and texture have given the plants several amusing nicknames. Bergenia is also known as heartleaf, pig squeak, picnic plates or leather cabbages, in addition to elephant ear. Leaf sizes range from 5.08 to 30.48 cm in length and 2.54 to 15.24 cm in width. Bergenia should be spaced about two feet apart from maximum ground cover with a spread of 45.72-60.96 cm. Flowers are normally white and have five petals and sepals. Fruits have a capsular shape. There are a lot of seeds. Rhizomes are strong, cylindrical and barrel-shaped and have small roots. Rhizome is used to treat a variety of ailments. It has rich chemical constituents in its roots, stems and leaves. It is having aromatic odour and astringent taste[11].

Bergenia plants are also non-toxic, making them an ideal alternative for families with young children. For millennia, the plant's roots have been used in Ayurvedic medicine and we can also use Bergenia in over-the-counter weight-loss and kidney-health supplements[11,12]. Autumn leaves turn a bright red colour with short stiff hairs and reach a length of around 30 cm. The upper and lower surfaces of the leaves are hairy at first, but as they mature, they become almost hairless. Flowers are 3.2 cm in diameter, white, pink, or purple, and form a cymose panicle with a flexible flowering stem that is 1025 cm long, leafless, and styles[13,14].

Traditional uses

In Nepal, India, Pakistan, Bhutan, and other nations, *B. ciliata* is used in traditional Ayurvedic medicine to treat a variety of diseases. Bergenia has been reported to dissolve gravel and stones in the kidney and is used as an anti-urolithiatic in all of it species. Fever, cough, diarrhoea, pulmonary affections and lungs diseases have all been linked to the plant's rhizomes. In traditional medicine in Jammu and Kashmir, the drug is also used to treat asthmatic disorders. It's taken orally, simply chewed if it's still fresh, to treat diarrhoea and vomiting. Fever, cough, and pulmonary affections are also said to be treated with it. *B. ciliata* (Zakhnlehayat) has been reported to be used in the Swat and Kashmir areas for fever, diarrhoea, bruises and boils. It's a promising herb with a long list of common uses. According to ethnobotanical and ethnomedicinal literature, the roots of *B. ligulata* have cooling, laxative, analgesic, abortifacient, and aphrodisiac properties and are used in the treatment of vesicular calculi, urinary discharges, prolonged uterine haemorrhage, bladder disorders, dysentery, menorrhagia, splenic enlargement and heart diseases in Ayurveda and Unani medicines[7].

Figure 1: Leaves of *B. ligulata*

Figure 2: Flowers of *B. ligulate*

Figure 3: Roots of *B. ligulata*

Figure 4: Rhizomes of *B. ligulata*

It's also an absorbent that's used to treat dysentery. When children in Sind (Pakistan) are teething, the root is rubbed down and supplied to them with honey. The leaves are ground in a mortar, and the juice is used to treat earaches[15]. Root is used as a tonic, anti-scorbutic, and in ophthalmia, as well as in fever, diarrhoea and pulmonary affections. It has also been used as a poultice in Kashmir, where it is known as "Zakhhmehayat," a locally effective treatment for boils[16]. The juice of the rhizome of *B. ciliata* is used as an anti-tussive for cold and cough by the local people of the Sikkim and Darjeeling districts of West Bengal[17,18].

Phytochemical constituents

The phytoconstituents present in the various extracts of *Bergenia ligulata* (rhizome) is shown in Table 4.

Table 4: Phytoconstituents of various extracts of *B. ligulata*

Chemical constituent	Aqueous extract	Ethanolic extract
Alkaloids	-	--
Tannins	-	+
Flavonoids	-	+
Phenols	+	+
Carbohydrates	+	+
Glycosides	-	+
Steroids	+	+
Amino acids	-	-
Proteins	+	-
Saponins	-	+

Pharmacological activities

Anti-pyretic activity

In rats, a methanol extract of *B. ciliata* rhizome had antipyretic effects on both normal body temperature and yeast-induced pyrexia. It was tested at oral doses of 100, 200 and 300 mg/kg in both versions. At 300 mg/kg, *B. ciliata* extract significantly decreased normal body temperature in rats for up to 5 hours after administration. The extract significantly reduced body temperature in yeast-induced pyrexia for up to 4 hours after administration in a dose-dependent manner and the effect was comparable to paracetamol, a typical antipyretic agent[19].

The ethanolic extract of *B. ligulata*, on the other hand, showed strong anti-pyretic activity in Wistar rats with normal body temperature. Pyrexia was caused by injecting a 20 percent aqueous suspension of Brewer's yeast in normal saline into the skin at a rate of 2.0 ml/kg. The rectal temperature was measured after 18 hours of yeast injection at intervals of 30 minutes, 1 hour, 2 hours, and 3 hours. It caused a major drop in body temperature for up to 4 hours after administration[19].

Anti-diabetic activity

In an *in vitro* model, the hydroalcoholic extract of *B. ciliata* showed strong anti-diabetic activity. The active compounds (-)-3-O-galloylepicatechin and (-)-3-O-galloylcatechin were isolated after extraction and fractionation of the extract. The enzyme inhibitory activities of these isolated compounds against rat intestinal α-glucosidase and porcine pancreatic -amylase is dose dependent[20]. The α-glucosidase inhibiting (or) anti-diabetic activity of the 80 percent ethanolic extract of *B. ligulata* rhizome was fractionated. The ethyl acetate extract exhibited an inhibitory effect of α-glucosidase activity[21].

Anti-tussive activity

Using a sulphur dioxide gas model, the methanolic extract of *B. ciliata* rhizome showed strong and dose-dependent anti-tussive activity in mice. In comparison to the control, the extract had substantial anti-tussive activity in a dose-dependent manner. The extract's antitussive activity was comparable to that of codeine phosphate (10 mg/kg body weight), a common antitussive. Within 90 minutes of the experiment, the extract at doses of 100, 200 and 300 mg/kg body weight (p.o.) demonstrated substantial inhibition of cough reflex by 28.7%, 33.9% and 44.2 percent, respectively[22,23].

Anti-viral activity

In vitro, a methanol water extract from the rhizomes of *Bergenia ligulata*, a plant used in Nepalese ethnomedicine, inhibited influenza virus replication in a dose-dependent manner but lacked virucidal activity at an appropriate concentration. The most powerful way to avoid cell death was to pretreat cells with *B. ligulata* extract. At 10 micro/ml the extract inhibited viral RNA synthesis and decreased viral peptide synthesis. The presence of condensed tannins in the extract is linked to the virus inhibitory effect[24,25].

Anti-inflammatory activity

Paashanolactone, a key component isolated from *Bergenia ligulata* rhizomes, has been shown to have anti-inflammatory properties[26]. The same activity of an aqueous extract of *B. ciliata* rhizomes on carrageenin-induced paw oedema in rats was verified in a dose-dependent manner[27]. In acute rat models (carrageenan- and serotonin (5-HT)-induced rat paw oedema) and a chronic rat model (carrageenan- and serotonin (5-HT)-induced rat paw oedema), the methanol extract of *B. ciliata* rhizome showed important anti-inflammatory activity (cotton pouch-induced granuloma). In carrageenan-induced rat paw oedema, the methanol extract showed a maximum inhibition of 32.4 2.89 percent at 300 mg/kg. In a rat paw oedema model caused by serotonin, 300 mg/kg methanol extracts reduced oedema by 45.33 2.09. The methanol extract inhibited granuloma weight in a dose-dependent manner in the cotton pouch granuloma model[28].

Antioxidant activity

In superoxide radical and nitric oxide scavenging models, the methanolic extract of *B. ciliata* from ligulata rhizomes was also stated to have free radical scavenging properties. With an EC of 36.24 g/ml, the methanolic extract was found to be a strong DPPH radical scavenger. With an EC of 106.48 g/ml, the extract

scavenged superoxide radicals in a dose-dependent manner[28]. The antioxidant activity of methanolic and aqueous extracts of *B. ciliata* was investigated in another study, and both extracts were found to be active radical scavengers. Reducing power and lipid peroxidation inhibition efficiency (TBARS assay) of both extracts showed promising activity in preventing lipid peroxidation and might prevent oxidative damages to biomolecules. The extracts were tested for their ability to protect DNA (pBR322) from UV-induced photolysed oxidative damage. Both extracts were able to prevent DNA from being damaged by oxidation[29].

Hepatoprotective activity

Hepatoprotective activity was evaluated on male albino rats. SGPT, SGOT and total bilirubin levels were estimated. CCl_4 toxicant increased the levels of SGPT, SGOT and total bilirubin. *Bergenia ligulata* showed significant decreased in the levels of SGOT, SGPT, ALP. Hence the ethanolic extract of roots of *Bergenia ligulata* can be used as hepatoprotective[30].

Anti-ulcer activity

The gastro-protective effects of *B. ciliata* on ethanol/HCl, indomethacin, and pylorus ligation-induced gastric ulcers in rats were investigated. Anti-ulcer activity was observed in doses of 15, 30 and 60 mg/kg b/w of aqueous and methanol extracts of the rhizome. In all models, the aqueous extract reduced the ulcer lesion more than the methanol extract (p 0.05), but the effect was reduced at higher doses. Rather than preventing gastric acid secretion or reducing pH and acidity, the antiulcer activity appears to be mediated by cytoprotective effects conferred by enhancement of the mucosal barrier[31].

Anti-urolithiatic activity

The anti-urolithic activity of *Bergenia ligulata* rhizome crude aqueous-methanolic extract was mediated probably by CaC_2O_4 crystal inhibition, diuretic, hypermagneseuric and antioxidant effects[32]. Another research used a hydro-alcoholic extract of *Bergenia ciliata* and the standard medication Cystone® at doses of 150 and 300 mg/kg body weight/day, p.o., along with ethylene glycol (0.75 percent v/v) for 28 days. The body weight and absolute organ weight of ethylene glycol-treated rats changed significantly. In ethylene glycol-treated animals, histopathological findings revealed disturbed renal parenchyma, degenerative changes in glomeruli, and focal calcification in glomerulo-tubular structures. *Bergenia ciliata* extract/ Cystone® combined with ethylene glycol had a strong protective impact on body weight and organ weight, with just a few stray areas of glomeruli calcification. Moreover, *Bergenia ciliata* extract shows higher renoprotective index than Cystone® at the same dose level[33].

Anti-bacterial activity

At a concentration of 200-1000 g/disc, the methanolic extract of *B. ciliata* rhizomes displayed a broad range of concentration dependent antibacterial activity[34]. The antibacterial activity of the crude drug in aqueous extract was also reported to be broad spectrum and concentration dependent.

Anti-malarial activity

The plant's leaf extract had good antiplasmodial activity *in vitro*, with an IC50 of 10 g/ml. Different concentrations of the extract (250 to 1,000 mg/kg) showed significant chemosuppression on day 7 in a dose-dependent manner when tested *in vivo*. At 1,000 mg/kg, the maximum chemosuppression was found to be 87.50 percent. In contrast to infected control mice, which had a mean survival period of 8.6 ± 1.5 days, mice given (750 and 1,000 mg/kg) had a slightly ($P < 0.0005$) longer mean survival time[33].

Anti-diuretic activity

The lipschitz model was used to assess diuretic function in Wistar albino rats. The animals were housed in metabolic cages that were built to keep urine and faeces apart. At the end of the 5-hour cycle, the amount of urine collected was weighed and the animals were not given any food or water. The concentrations of Na^+ and K^+ were measured using flame photometry, and Cl^- was calculated using a titration with silver nitrate solution and 3 drops of 5% potassium chromate solution as an indicator. The ethanolic extract was found to have substantial diuretic efficacy.

Role of *Bergenia ligulata* (Paashanbheda) in kidney stone formation

Attempts to research the identical, chemistry, pharmacology and clinical investigations of Paashanbheda plants used for dissolving kidney stones have been made over the last decade 6. Paashanbheda is an Ayurvedic medication used to treat a variety of ailments, primarily as a diuretic and lithotriptic. It is said to have properly of breaking and disintegrating the stones and is widely used drug. However, its identity is yet debatable.

In South India, there are many diuretic and other plants such as *Alternanthera sessilis* and *Aerva* species. Paashanbheda has been applied to a variety of plants, including *Rotula aquatica* in Mysore, *Ammaunia baceifera* in Kerala, *Bauhinia racemosa*, *Coleus* spp., *Bryophyllum* spp., *Didymocarpus pedicellata*, *Opium basilicum* in Bengal, and many others. This name is commonly used to refer to *Saxifraga ligulata*. *Bergenia ligulata* chemical efficiency in dissolving urinary stones justifies the use of various names assigned to it, including Paashanbheda, Pashana, Asmaribheda, Ashmabhid, Ashmabhed, Nagabhid, Upalbhedak, Parwatbhed and Shilabhed (dissolving or piercing stones or slabs) etc.

The very first mention of this drug in Ayurvedic literature is Charak Samhita (210 BC-170 AD) under the name Paashanbhed. It is prescribed for painful micturition, the treatment of abdominal tumors and the dissolution of calculi. Sushruta Samhita (170 AD-340 BC) lists the drug in Chikitsa silianam under different names, including Paashanbheda for uric acid calculi and Ashnibhid for biliary calculi. In Sushruta Samhita, decoction of Paashanbheda, Ashmantaka, Shatavari, Vrihati, Bhalluka, Varuna (*Crataeva nurvula*), kulatha, kola and kataka seeds have been described for the patients of Vataja Ashmari, while Kusa, Ashmabhid, Patala, Trikantaka, Sirisha, Punarnava and Silajatu and Meduka flower for Pittaja Ashmari have been mentioned. Ashtanga Hridaya (341 AD-434 AD) mentions the drugs in chiktsit Sthanam- Upalbhed for extreme pain due to obstructed micturition, Paashanbheda for uric acid calculi and ashmabid for biliary calculi.

Importance of *Bergenia ligulata* in the treatment of kidney stone formation

Urolithiasis, also known as kidney-urinary tract stone disease, has become a major public health issue around the world[35]. Kidney stones, also known as Urolithiasis (nephrolithiasis), are caused by the development of urinary calculi in the urinary tract. They have a high recurrence rate in both men and women and affect around 12% of the global population[36]. In certain parts of the world such as the Middle East countries the hazards of Urolithiasis are there is much greater[37]. Kidney stones are more common in males than in females due to oestrogen's inhibiting ability, high oestrogen power, and greater muscle mass. They affect people of all ages, from newborns to those in their 70s. Increased nephrolithiasis occurrence has resulted in increased morbidity and economic burden around the world. The main cause of nephrolithiasis is excessive calcium and oxalate in the urine, which causes

abnormal mineralization in the kidneys[38]. As a result, the formation of a kidney stone or Urolithiasis is a complex process involving a variety of physicochemical events such as super-saturation, nucleation, growth, aggregation, and retention within the kidneys.

Stones may be found in various parts of the urinary tract, including the urinary bladder, ureters, and kidneys. The kidney stones have been classified as Staghorn (filling multiple major and minor calices) or non-staghorn (not filling multiple major and minor calices). Although the proximal, middle or distal are the various locations that have been reported for ureteral stones, the non-staghorn stones are mainly pelvic or calyceal in nature. Small kidney stones of less than 5 mm in diameter possess the largest possibility of being passed out easily followed by stones of 5 mm to 7 mm that have about 50% possibility but stones over 7 mm do not pass out on their own and often require urological intervention. Although only 10% of kidney stones need surgical removal, 90% of them pass through the urinary tract, and as the stone passes through the urinary tract, renal colic or flank pain develops[39]. While various procedures such as shock wave lithotripsy, percutaneous nephrostolithotomy, ureteroscopy, and open or laproscopic treatments can be used to remove kidney stones, these therapies have serious side effects and are also very costly and painful. Several medicinal plants have shown to be beneficial in the treatment of kidney stone disease.

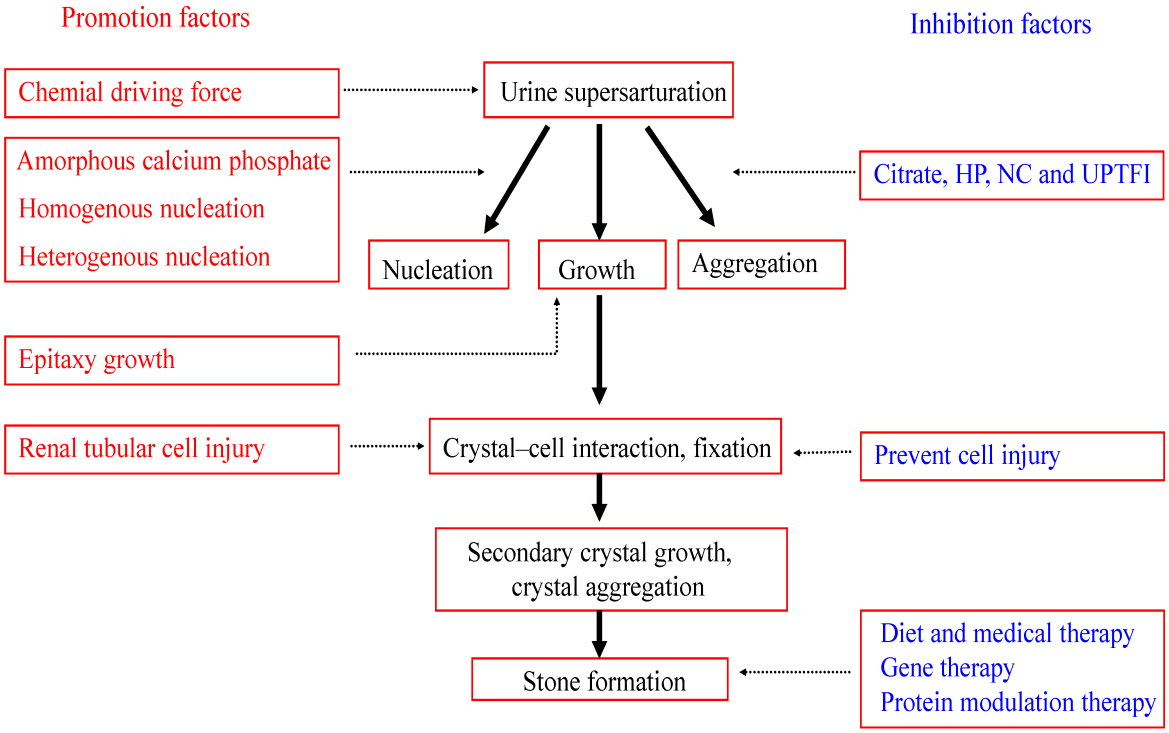

Figure 5: Mechanism of action of kidney stone formation

Medications associated with kidney stone formation

Table 5: Medications associated with Kidney stone formation

Type of Medication	Examples
Antibiotics	Ampicillin, Amoxicillin, Ceftriaxone, furans, pyridines, quinolones, sulfonamides
Carbonic anhydrase inhibitors	Acetazolamide, topiramate
Diuretics	Furosemide, triamterene
Ephedra alkaloids	Herbal products used as stimulants and appetite suppressants
Laxatives	Overuse of any laxatives resulting in electrolyte losses
Potassium channel blockers	Amiodarone, darfampridine, sotalol
Reverse transcriptase inhibitors and protease inhibitors	Efavirenz, Indinavir, nelfinavir, raltegravir
Sulfonylureas	Therapies for type II diabetes mellitus
Others	Aluminium magnesium hydroxide, Ascorbic acid, Calcium, Dexamethasone, Guaifenesin, Phenytoin, Vitamin D

CONCLUSION

Paashanbheda, i.e. *Bergenia ligulata*, is considered to be one of the high-quality temperate medicinal herbs. Many plants are known to have the same name in different regions. Therefore, proper identification and standardization should be made in order to achieve the desired therapeutic effect and minimize adulteration. It is quite clear from this review that *Saxifraga ligulata* contains a number of Phytoconstituents substances which reveal its uses for various therapeutic purposes. Plants or parts thereof may be used to treat various human disorders such as diabetes, liver toxicity, bacterial infection, inflammation and pyrexia and pain relief. According to botanical, phytochemical and pharmacological data, the present review will help in the proper identification and authentication of *Bergenia ligulata* and will contribute to further exploration of this potential clinical candidate.

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