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A Review on *Bergenia Ligulata* Wall

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ABSTRACT

Bergenia ligulata Wall (Saxifragaceae) is perennial herb that grows wild in stones and rocks. This plant has been reported to exhibit various biological activities & thus has several traditional uses. It is used as an antidiabetic, diuretic, astringent, cardiotonic, woundhealer, expectorant, antipyretic, kidneystone & as a tonic. This review presents a comprehensive literature search of different studies carried out on phytoconstituents like ß-sitosterol, ß-sitosterol-D-glucoside, afzelechin and Catechin.Further investigations may help in exploiting its properties.

Keywords: *Bergenia ligulata* Wall, Pashanbheda, Biological activities, Phytoconstituents.

INTRODUCTION

Botanical Information

Bergenia ligulata Wall is a perennial herb belongs to family ***Saxifragaceae.***This family comprises of 90 genera and 750 species, mostly distributed in South East Asia. In India *Bergenia ligulata* grows at high altitudes between 1800-5100 meters in Himalayas usually in rocky areas and cliffs. It is popularly known as ***Pashanbheda*** in Indian system of medicine.

The salient botanical features of the family ***Saxifragaceae*** are: leaves alternate, exstipulate or with stipulate adanate to the base of the petiole or opposite. Flower usually pentamerous more or less adanate to the ovary, lobose imbricate or valvate. Stamens are inserted with the petals, equaling or doubling their number rarely indefinite. Ovary consisted of 3-5 united carpels with axial placenta, occasionally celled with partial placentas, ovules numerous, erect or pendulous. Styles are as many as carpels, free or more or less connate. Stigma capitates or lateral and subcapitate. Fruits capsular or baccate. Seeds usually numerous.

The ***Bergenia*** is a genus of 10 species of flowering plants in the family *Saxifragaceae* native to Central Asia, from Afghanistan to China and Himalayas. They are evergreen perennial plants with spirally arranged of rosette of leaves 6-35 cm long and 4-15 cm broad and pink flower produced in cyme. The leaves of *Bergenia* create wonderful foliage throughout the year. They can be described as leathery or somewhat rubbery. Leaf shape and texture of *Bergenia* has earned the plants with some interesting nicknames. In addition to elephant ear, *Bergenia* may be called heartleaf, pigsqueak, picnic plates, or leather cabbages. Leaf size may vary in length from 5.08-30.48 cm and in width from 2.54-15.24 cm. Plant spread is about 45.72-60.96 cm, so *Bergenia* should be planted about two feet apart from full ground cover.

Bergenia are becoming more popular plants among the environmentally conscious because they are drought resistance. The leaves do tend to attract slugs and snails, though spreading coca beans around the plant can help naturally keep these pests away. *Bergenia* also make an excellent choice for families with young children, as the plants are non- toxic. Roots of the plant have been used in Ayurvedic medicine for centuries and we can find*Bergenia* in over the counter medicinal substance for weight loss and kidney ((Pandey, 1988, Kirtikar and Basu, 1983).

Bergenia ligulata is small plant; approximately 32-35 cm long leaves about 2.5 cm in diameter obovate to suborbicular, hairy, midgreen, obtuse, tapering at base, glabrous on both sides, margin subentire and ciliate; flowers white to rose or purple, petal clawed,

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panicle like cymes of shallowly, funnel shaped, 5 petalled flowers, usually 1.5-2.5 cm across on short, branched oftenned or purple flower stems are produced mainly in early spring.

Vernacular (Local name) Pakhanbhed, Patharchur (Hindi), Ashmabheda, Pashanbheda (Sanskrit), Kachalu (Urdu), Telanurupindi (Telugu), Pakhanabheda (Gujarat), Pashanbheda (Marathi).

Distribution: Temperate Himalayas from Kashmir to Bhutan between 7,000-10,000 feet and Khasia hills at 4,000 feet. Kashmir to Kumaon from 2,600-4,600 meter. North East Garhwal Himalayas from lateral 29°26' to 31°28' North and long 77°49' to 80°6' East and with a total area of about 3,090 sq. km. It comprises of five districts Chamoli, Pauri, Dehradun, Tehri and Uttarkashi. In North-West Himalayas lies between 30°4' to 30°52.5' lateral North and 70° 56' -79° 3' East long (Pandey, 1988, Kirtikar and Basu, 1983).

Ethanomedical Information:

Taking reference from various ayurvedic literatures *Bergenia ligulata* is used in different diseases. It is a key tonic for urinary complaints, kidney stones, sugars, astringent, bitter, purifies the urinary bladder, cold, hemorrhagic disease, distension of stomach and epilepsy. The root is used as tonic, antidiabetic, cardiotonic, antidote to poison, conjunctivitis, in fever, diarrhoea, cough and antiscorbutic. It is mixed with honey and applied to teething in children. The rhizome is used as astringent, diuretic, tonic and in fever. It is an important for dissolving kidney and bladder stone. The drug is indicated against opium poisoning. It is also considered absorbent and given in dysentery. In Indo China, the leaves are ground in a mortar, and the juice used for earache (Pandey, 1988, Kirtikar and Basu, 1983).

Pashanbheda extract has whitening ability, anti-oxidant, anti-aging and anti-inflammatory ability. Developed b-Gulcan extract is made of b-Gulcan, polysaccharide, which is about one million at an average rate of molecular weight. It has acceleration effect on collagen synthesis and immunology power enhancement effect and also it makes cosmetics viscous (Yanaginuma and Murta, 2003).

Chemical Literature:

The literature search on *Bergenia ligulata* has revealed that very little chemical work has been carried out on this plant. The main chemical constituents identified of the plant *Bergenia ligulata* are bergenin, â-sitosterol, â-sitosterol-D-glucoside, (Jain and Gupta, 1962, Bhat et. al 1974), leucocyanidin, gallic acid, methyl gallate, catechin (Dixt and Srivastava, 1989). Its leaves contain two flavonols, quercetin and kaempferol along with three rhamnosides and afzelin and quercitrin. The rhizome of *Bergenia ligulata* contains gallic acid, mucilage, wax, glucoside, albumin and starch (Pandey, 1988, Kirtikar and Basu, 1983). A simple and reproducible high- performance thin- layer chromatographic method was developed for the simultaneous determination of bergenin and gallic acid in *Bergenia ligulata*. Water and methanol were used as the extracting solvents. The concentrations of bergenin and gallic acid were found to be almost the same (Chauhan et al).

A simple TLC method has been developed for the simultaneous quantification of bergenin, catechin and gallic acid from different parts of *Bergenia ligulata* and *Bergenia ciliata* using HPTLC plate precoated with silica gel 60 F_{250}. The method was developed in toluene: ethyl acetate: formic acid (4:6:1,v/v). The linearity range for bergenin, catechin and gallic acid were found to be 160-800, 160-480 and 160-560 ng/spot respectively. The rhizomes were found to contain higher concentration of bergenin, catechin and gallic acid than other parts of the plants (Dhalwal et al., 2008).

Umashankar et al. 2001 isolated 4(4'-b-D- glucopyranosyloxy-1'-benzoyloxy) –6-methyltetrahydropyran-2-one from the rhizome of Bergenia ligulata named as Paashaanolactone.Three species of Bergenia viz *Bergenia ligulata, Bergenia ciliata & Bergenia stracheyi* were evaluated for their botanical, physical, physicochemical and chemical studies. A comparative botanical study of the rhizomes of these species revealed that *Bergenia ciliata* has large number of starch grains. *Bergenia ligulata* has maximum calcium calcium oxalate crystal while *Bergenia stracheyi* is having lesser amount of the starch grains. Physicochemical studies showed that *Bergenia stracheyi* was having almost maximum percentage of all the physicochemical parameters i.e. total ash 15.8, alcohol and water soluble extractives 13.83 and 16.83, sugar 5.5 and tannins 7.86, except starch and acid insoluble ash, which were highest in *Bergenia ciliata*. (Srivastava et al., 2008).

Phytochemical evaluation was carried out for the rhizomes of *Bergenia ligulata*, and the amount of gallic acid in the rhizome was found to be 1.54 % by HPTLC methods. The methanolic extract of *Bergenia ligulata* was found to scavenge DPPH radical with EC50 of 36.24 microg/ml and super oxide radicals in dose dependent manner with EC50 of 106.48 microg/ml in vitro models tested (Bagul et al., 2003). Chemical investigation have revealed the presence of bergenin and gallic acid as important bioactive components of Bergenia, a simple, highly precise RP-HPLC method coupled with photodiode-array detection has been developed and validated for simultaneous determination of these compounds in the Bergenia species *Bergenia ligulata*, *Bergenia ciliata* and *Bergenia stracheyi*. *Bergenia ciliata* and *Bergenia stracheyi* were found to contain the most bergenin, 3.275 and 3.277% respectively; *Bergenia ligulata* contained 2.1419 % bergenin (Singh et al., 2007). A reverse phase high-pressure liquid chromatographic method with an optimized extraction procedure for the quantitative estimation of bergenin and (+)–afzelechin in different parts of the popular Indian herb Paashaanbhed (*Bergenia ligulata*) has been developed. The method is sensitive, precise and gives more than 99% recovery of the active constituents. The rhizomes of the plant were found to contain higher concentration of bergenin (0.907%w/w) and (+)–afzelechin (0.168%) than other parts of the plant (Umashankar et al., 1999). Inhibitory compound of a- Glucosidase activity (+)-afzelechin (1), was isolated from rhizome of *Bergenia ligulata* (Junichi et. al., (2008).

Biological Activities:

Soxhlet extract of seeds of *Dolichos biflorus* and rhizomes of *Bergenia ligulata* were tested for their in vitro antilithiatic activity by the homogeneous precipitation method.

Extracts of *Dolichos biflorus* showed activity almost equivalent to cystone while *Bergenia ligulata* showed less activity and the combination was not as active as the individual extracts (Garimella et al., 2001). Methanol water extract from rhizome of *Bergenia ligulata*, a plant used in Nepalese ethno medicine, inhibited in vitro the replication of influenza virus in a dose dependent manner and did not show virucidal activity at effective concentration. Pretreatment of cells with *Bergenia ligulata*

extract was shown to be most effective to prevent cell destruction. The extract inhibited viral RNA synthesis and reduced viral peptide synthesis at 10 microg/ml. The virus inhibitory effect is related to the presence of condensed tannins in the extract (Rajbhandari et al., 2001). *Tribulus terrestris* and *Bergenia ligulata* are commonly used as herbal medicines for urinary calculi in India. To verify the inhibitive effect, aqueous extracts of *Tribulus terrestris* and *Bergenia ligulata* were added along with the supernatant solutions. The growth was measured and compared, with and without the aqueous extracts. Inhibition of calcium oxalate monohydrate crystal growth was observed in the herbal extracts. Maximum inhibition was observed in *Bergenia ligulata* followed by *Tribulus terrestris* (Joshi et al., 2008). The dried rhizome of *Bergenia ligulata* was subjected to a successive series of solvent extraction using the soxhlet extractor. 100 gm of the above extract was extracted using solvents like hexane, chloroform, acetone and methanol with the increasing order of the polarity. Very low yield were obtained with hexane, chloroform and acetone. Hence the methanolic extract was selected for further fractionation process. This fraction was then partitioned between n-butanol and water. IC_{50} value of n-butanol fraction was found to be 4.5 mg/ml whereas water fraction gave an IC_{50} value of 30 mg/ml. Based on the IC_{50} value n-butanol fraction was studied for the bioactivity guided fractionation process. The fractions obtained were screened for in vitro free radical scavenging activity using DPPH radical scavenging assay (Vaishali et al., 2008).

The alcoholic extract of the plant has been reported to exhibit significant anti-inflammatory, analgesic and diuretic properties (Gehlot et. al., 1976).Herbal combination of *Bergenia ligulata* (100mg), *Tinosphoroa cordifolia* (100mg), *Eclipta alba* (100mg), *Asperagus racemosus* (50mg), *Withania somnifera* (50mg), *Myristica fragrans* (100mg) was used to treat the renal calculi. Cases with various complications had been effectively treated with the 450 mg capsule without any side effects and calculi disintegration had taken place with in 15 days (Karnick, 1992).

CONCLUSION:

The present review can be concluded that *Bergenia ligulata Wall* possesses considerable medicinal properties which need to be exploited. Further investigations may help in developing phtopharmaceuticals based on it.

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