



Review Article

Review on phytochemical, ethnomedical and biological studies of medically useful genus *Bergenia*

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ABSTRACT

Keywords

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cardiotoxic.

The genus *Bergenia* belongs to family Saxifragaceae. Literature review revealed that various species of genus *Bergenia* have been used in folklore and Indigenus system of medicine for various ailments. Many species of *Bergenia* have been studied for antidiabetic, diuretic, astringent, cardiofonic, wound healer, expectorant, antipyretic, and anti-haemorrhoidal, analgesic, antispasmodic, antitumor, cytotoxic, anti-inflammatory, and antimicrobial activities. The species show biological activities due to the presence of various chemical constituents. Some studies revealed the toxic nature of *Bergenia* species. For commercial utilization of this genus further clinical research should be carried out for its cytotoxic and cardiotoxic nature.

Introduction

The genus *Bergenia* belongs to family Saxifragaceae. This family comprises of 30 genera and 580 species, mostly distributed in the cold and temperate Himalayas and Central and Eastern Asia between 4000 to 12000 feet. The genus *Bergenia* comprises about 6 species distributed in temperate Himalayas and central and Eastern Asia. Hooker (1888) has reported three species of *Bergenia* from India in the Flora of British India. Wehmer (1948) was reported three species of *Bergenia* from India in The Wealth of India.

Recently, Sharma (2003) observed two species i.e. *Bergenia stracheyi* from India

on Medicinal plants of India. Pangtey (2005) was reported two species (*Bergenia lingulata* from lower altitude and *Bergenia stracheyi* from higher altitude from Kumaun Himalaya).

The salient botanical features of the genus *Bergenia* are: species of this genus are perennial herbs upto 50 cm tall, succulent. Rhizomes woody, covered with leaf bases. Flowers are white, pink or purplish in terminal cymes. Fruit is a conical capsule having minute seeds (Hooker and Thomson, 1858).

The plant is known as Paashanbheda (Paashan = rockstone, bheda = piercing) in

Hindi and rock-foil in English which itself indicates that the *Bergenia* plants grow between rocks and appears to break them or that they have lithotriptic property.

The species of genus *Bergenia* reported to have tannins, benzanoids, coumarins, quinoids, flavonoids, lactone, and steroids. The rhizomes of genus *Bergenia* are used as folk medicine for antiscorbutic, astringent, diuretic febrifuge and ophthalmic properties. Traditionally the rhizomes are used for curing kidney and gall bladder stone, cough and cold, healing old wounds, cuts and burns, inflammation etc.

Many species of *Bergenia* have been studied for antidiabetic drug, diuretic, astringent, cardiofonic, wound healer, expectorant, antipyretic, and anti-haemorrhoidal, analgesic, antispasmodic, antitumor, cytotoxic, anti-inflammatory, and antimicrobial activities. In this paper we have described all ethanomedical, phytochemical and biological activities of different species of genus *Bergenia*.

Ethnomedical informations

The *Bergenia* species have been used in folklore and Indigenous system of medicine for various ailments. The rhizomes and roots are cooling, bitter, acrid, laxative, astringent, abortifacient, tonic, analgesic, aphorodisiae and are useful in the treatment of tumors, heart diseases, urinary discharge, piles, spleen enlargement, ulcers, pulmonary affection, dysuria, disease of bladders, dysentery, menorrhagia, hydrophobia, biliousness, eye sores, diseases of lungs and liver, and cough, and fever in Unani and Ayurveda system of medicine. In folklore system of medicine they are very effective in

dissolving kidney and urinary bladder stones. The rhizomes are pulveris and made into a paste which is applied for 3-4 days on the burnt parts of body for soothing relief. The burn heals without leaving any scar. The bruised rhizomes were applied on dislocated bones after setting in proper place. The rhizomes are chewed in diarrhea and given with honey in fever. The leaves are also chewed in constipation and juice of the leaves is used in earache. The inflorescence are mixed with barley flour and given to bullocks and cow to check bleeding in urine. Roots of *Bergenia* were effective to combat venereal diseases (Akerele, 1992).

Bhattacharaj (1994) in his studies reported that in Nepal, one teaspoonful of the juice of dried rhizome of *B. ciliata* along with equal volume of honey has been taken orally 2-3 times a day by post-partum women, against the digestive disorders as carminative, and tonic as well. Bhattacharaj (1994) has also cited that in Nepal, juice of the rhizome of *B. ciliata* has been taken orally by human adults to treat low fever (Hypothermia) and intermittent fever. In another study (Bhattacharaj, 1993) further mentioned that its decoction is also taken orally by the human adults, as antipyretic. Manandhar (1995) reported that in Nepal, rhizomes of *B. ciliata* have been taken by human adult as an antihelminthic.

B. ciliata leaves have been used name paashanbheda is descriptive of its litholytic property (Bahl, and Seshadri, 1970). Mukerjee (1984) reported that the hot water extract of whole dried plant of *B. ligulata* was employed orally by human adults for renal and urinary calculi.

Bhattacharaj (1993) reported that in Nepal, about 10g of rhizome paste of *B. ligulata* was to treat many diseases like pulmonary

infusion, dysentery, ulcer, dysuria, spleen enlargement, and cough and fever. *B. ligulata* has been recognized for its action on the urinary tract since ancient times. The rhizomes were taken orally by human adults with the molasses, twice a day for 3-4 days for the expulsion of round worms. Manandhar (1995) described that in Nepal, the decoction of roots of *B. ligulata* were taken orally by human adults for the treatment of cold.

Shah and Jain (1988) have reported that in India, dried roots of *B. ligulata* were used externally by human adults for the treatment of dysentery, cut, boils, wounds, and burns. The decoction of roots of *B. ligulata* was found to be beneficial for kidney trouble.

Chandra and Pandey (1983) also reported that in India, decoction of roots of *B. ligulata* was taken orally by human adults to treat urinary disorders. This study was further confirmed by Jain and Puria (1984). Kapur (1983) described that hot water extract of fresh roots of *B. ligulata*, when taken orally by human, was found to be useful for the treatment of stomach disorders, urogenital complaints and stone problems. He was further mentioned that hot water extract of *B. ligulata* was applied externally for boils, and ophthalmia. *B. ligulata* is also effective in the treatment of fever, eye ailments, dysentery and diarrhea, piles, inflammation, chronic ulcers etc.

Chemical constituents

The different species of the genus *Bergenia* have been studied for chemical analysis and their results have been published and literature cited there on. All these showed the interesting chemistry of different species of genus *Bergenia*. The

main phytochemical constituents reported from the genus *Bergenia* are tannins, benzanoids, coumarins, quinoids, flavonoids, lactone, and steroids.

The leaves of *B. ciliata* contain tannins and hydroquinone (benzanoids). The chemical compounds isolated from the rhizomes of the *B. ciliata* were (+) afzelechin, (+) catechin, quercetin-3-o- β -D-xylopyranoside, quercetin-3-o- α -L-arbinofuranoxide, eryodictiol-7-o- β -D-glucopyranoside, arbutin, 6-o-p-hydroxybenzoyl arbutin, bergenin, 4-o-galloylbergenin, 11-o-galloylbergenin, p-hydroxy benzoic acid, protocatechuic acid, 6-o-protocatechuoylarbutin, 11-o-p-hydroxy-benzoyl-bergenin, 11-o-protocatechuoyl bergenin and 6-o-p-hydroxybenzoyl-parasorboside (O. Sticher, 1979, V. I. Kuzmin, 1985, and M. Fuji *et al.*, 1996).

The plants of *B. ligulata* reported to have coumarins, bergenin, bergenin-11-o-galloyl, bergenin-11-o-p-hydroxy-benzoyl, bergenin-11-o-brotocatechuoyl, and bergenin-4-o-galloyl; Flavonoids: catechin, (+) afzelechin, catechin, eriodictyol-7-o- β -d-glucopyranoside, reynoutin. Benzanoids: arbutin, arbutin-6-o-p-hydroxy-benzoyl; Lactone: ide-hexan-5-olide, 3-(6-o-p-hydroxyl), β -sitosterol, β -sitosterol-D-glucoside, bergenin, (+) afzelechin, leucocyanidin, gallic acid, methyl gallate, catechin, gallic acid, mucilage, wax, glucoside, albumin, and starch (Chandra, 1998, Jain and Gupta., 1996, Tucci *et al.*, 1969, Dixit *et al.*, 1989, and Pandey, 1995).

The literature review on *B. crassifolia* revealed that very little is known about their chemical constituents. Plants of this species contain arbutin, aergenin, catechin-7-o- β -D-glucoside, paashano-

lactone, and β -sitosterol (Sticher, 1979; Kuzmin, 1985, Furmanowa, *et al.*, 1993; Ostrowska *et al.*, 1988; Vasi *et al.*, 1981). Arbutin, a benzanoid compound was isolated from the leaves of *B. pacifica* (Shnyakina, 1981).

The compounds reported in *B. purpuracens* were arbutin, 2-3-4-6-tetra-o-galloyl, arbutin, 2-4-6-tri-o-galloyl, arbutin, 4-6-di-o-galloyl, arbutin-6-o-galloyl, bergenin, 11-o-galloyl, bergenin-4-o-galloyl, catechin (+), 7-o-galloyl, glucose-1-2-4-6-tetra-o-galloyl- β ; A, D-glucose, 2-4-6-tri-o-galloyl, procyanidin- β 1, 3-galloyl and procyanidin β -3 (Vasi *et al.*, 1981; Bahl and Seshadri, 1970; Chen, 1987; Chen and Nie, 1988). The aloe emodin, aloemodin- 8-o- β -D-glucoside, chrysophanein, emodin-1-o- β -o-glucoside and physeion were reported from of the rhizome and root extracts of *B. hissarica* (Fuji, 1996). This review suggests that a very little is known about the chemical constituents of this genus. Further research work should be carried out on various species of genus *Bergenia*.

Biological activities

The many species of this genus has studied for various biological activities. These studies suggest that these species have potential biomedical applications. The different biological activities shown by different extracts prepared from various species of genus *Bergenia* are given below:

In study conducted by Shilova *et al.*, (2006), showed that ethanol extract of *B. crassifolia* (L.) Fritsch green leaves exhibit antioxidant properties. The most significant activity has been observed for 70% ethanol extract, which is a typical acceptor of peroxy radicals.

The alcoholic extracts of *B. ciliata* were shown to have analgesic, anti-inflammatory, and diuretic properties (Sinha *et al.*, 2001). Other biological activities of *B. ciliata* include antibacterial (Sinha *et al.*, 2001), anti-inflammatory (Sinha *et al.*, 2001), antitissue (Rajbhandari *et al.*, 2001), antiviral (Rajbhandari *et al.*, 2003), and antilithamic activities (Garimella, 2001).

In another citation, it was observed that root and leaves extracts of *B.ciliata* were promising against gram positive and gram negative bacteria viz. *Bacillus subtilis*, *Bacillus megaterium* and *Pseudomonas aeruginosa* (Ashok *et al.*, 2010]. Ashok *et al.*, (2010) were described that the methanolic and aqueous extracts of *Bergenia ciliata* rhizomes exhibited antioxidant activity (Mazhar *et al.*, 2002). The aqueous, alcoholic, and acetone extracts of roots of *B. ciliata* each in a dose of 20mg/kg intravenously, produced transient fall in blood pressure of anaesthetized dogs. Only alcoholic extract potentiated pentobarbitone induced hypnosis in mice in a dose of 50mg/kg. An oral dose of 0.5g/kg of alcoholic extract showed significant diuretic activity in rats. However its potency was found to be less than that of urea, 0.95g/kg orally (Govindchari, 1992).

Tehseen *et al.*, (2010) were carried out a study to evaluate the antibacterial and anti-inflammatory activities of aqueous as well as 50% ethanolic extract of *B. ligulata*. Results provide evidence that suggesting the anti-inflammatory as well as the antibacterial role of *B. ligulata*, thus implicating the plant extract in treatment against the bacterial infection and inflammation.

The roots of *B. ligulata* were used as an antidiabetic, diuretic, astringent, cardiofonic, wound healer, expectorant, antipyretic, and anti-haemorrhoidal drug (Furmanowa and Rapczewska, 1993). Alcoholic extract of *B. ligulata* plants exhibits significant anti-inflammatory, analgesic and diuretic properties (Gehlot *et al.*, 1976). Ethanolic extracts of roots and rhizomes of *B. ligulata* were exhibited antipyretic activity (Singh *et al.*, 2010). Ethanol-water extract (50%) of rhizome of *B. ligulata* shows analgesic activities (Abraham *et al.*, 1986). In another citation, diuretic activity of ethanol-water extract of rhizome of *B. ligulata* was studied on rats by administering a dose; the result shows that the extract has no diuretic activity in the rat (Dhar *et al.*, 1968).

Dhar *et al.*, (1968) were reported that the ethanol-water (1:1) extract of *B. ligulata* exhibited antispasmodic activity. In another citation, ethanol-water (1:1) extract of *B. ligulata* was administered to rat through intraperitoneal route for the determination of antitumor activity. Test results exhibited activity against SARCOMA-WM1256 1M. The cytotoxic activity is reported wherein 25mg/ml of the ethanol-water extract of *B. ligulata*, but when examined on cell tissue was found inactive (Aswal *et al.*, 1984). Yet in another study 170mg/kg of the same extract when administered intraperitoneally in the mouse was found to be inactive for antitumor activity (Aswal *et al.*, 1984). However, details are described which shows that the ethanol-water (1:1) extracts of the *B. ligulata* exhibit no cytotoxic activity with ED₅₀ on cell culture at the dose of 20.0 mg/ml (Dhar *et al.*, 1968).

The acetone extract of rhizomes was reported to be cardiotoxic in higher doses,

and has depressant action of central nervous system (CNS). The extract has shown significant anti-inflammatory activity, but activity decreases with increasing dosage. In lower doses, the extract is mildly diuretic but in higher doses it exhibited antidiuretic action in experimental animals (The Wealth of India, 1998).

The alcoholic extract of rhizome of *B. ligulata* showed anti-protozoal activity against *Entamoeba histolytica* (Tehseen *et al.*, 2010). The ethanol-water (1:1) extract of *B. ligulata* exhibits positive hypertensive activity in dogs by administering 50mg/kg through intravenous route (M. L. Dhar *et al.*, 1968). Govindchari (1992) was mentioned that antiviral activity of alcoholic extract of rhizome of *B. ligulata* against influenza-A virus. Sekizaki (1995) was described that when ethanol (95%) extract of the dried roots of *B. schmidii* exhibited antifungal activity. Dukushima and Kanbe (1987) were reported that the extract of whole plant of *B. purpurascens* exhibited emollient effect when applied externally at the concentration of 5.5% to the human adult.

Aswal *et al.*, (1984) were observed that ethanol-water (1:1) extract of dried roots of *B. stracheyi* at the dose of 200mg/kg, when administered to the pregnant rat through gastric intubation, exhibited no response and devoid of abortifacient effect in the rat. In another study conducted by Aswal *et al.*, (1984) the ethanol-water extract (1:1) extract of dried root of *B. stracheyi* was administered to the rats through gastric intubation for the evaluation of hypoglycemic activity at the dose 250mg/kg.

The species of genus *Bergenia* were used in folklore system of medicine for the

treatment of many diseases from ancient time. The medicinal properties of genus *Bergenia* are due to the presence of tannins, benzanoids, coumarins, quinoids, flavonoids, lactone, and steroids. The plant extracts and isolated compound exhibited many biological activities. Due to cytotoxic and cardiotoxic activities of species of this genus, need further clinical research for the claim of this genus for the treatment of various diseases.

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