Review Article

www.ijrap.net

(ISSN Online:2229–3566, ISSN Print:2277–4343)

MEDICINAL POTENTIAL OF *BRYOPHYLLUM PINNATUM (*LAM.): A DETAILED REVIEW

Talib Siddiqui [1], Beauty Kharwar [1], Priyanka Singh [1], Ashwini Kumar Kushwaha [2]*

[1] M. Pharma Scholar, Rajiv Gandhi South Campus, Banaras Hindu University, Barkaccha, Mirzapur, Uttar Pradesh, India

[2] Assistant Professor, Department of Dravyaguna, Faculty of Ayurveda, Institute of Medical Sciences, Rajiv Gandhi South Campus, Banaras Hindu University, Uttar Pradesh, India

Received on: 07/7/25 Accepted on: 08/11/25

***Corresponding author**
E-mail: ashwinik.kushwaha@bhu.ac.in

DOI: 10.7897/2277-4343.166231

ABSTRACT

Ayurveda, the traditional system of medicine practiced in India for thousands of years, emphasizes holistic healing through natural remedies, diet, and lifestyle. Medicinal plants form the backbone of this system, offering preventive as well as curative benefits against a wide range of ailments. Among these, *Bryophyllum pinnatum* (Lam.), commonly known as "Parnabeeja," is a native and exotic Ayurvedic herb belonging to the Crassulaceae family, used widely by the ancients practitioners (acharyas) for curing and protecting various disease such as renal calculi, cold, abscesses, bleeding disorders, hypertension, asthma. It's a significant herb in the Ayurvedic pharmacopeia, renowned for its wide-ranging therapeutic properties. The succulent herb indigenous to India, exhibits variable leaf structures with elliptic leaflets and reddish-purple flowers. The plant is readily available, easy to cultivate, and contains a range of secondary metabolites. Phytochemical investigations have identified alkaloids, cardiac glycosides, and flavonoids as key constituent. Given its promising medicinal properties, this review delves into the Ayurvedic perspectives, botanical characteristics, phytochemical composition, and continues to attract scientific interest for its phytochemical richness and pharmacological potential associated with *Bryophyllum pinnatum* (Lam).

Keywords: Ayurvedic herb, *Parnabeeja*, phytochemicals**,** urolithiasis, pharmacology, *Bryophyllum pinnatum.*

INTRODUCTION

Medicinal plants have played a vital role in traditional healing systems for centuries, serving as a rich source of bioactive compounds with the potential to prevent and treat various diseases. Herbs—non-woody, soft-stemmed plants—are frequently cultivated for their therapeutic and aromatic properties. While herbal remedies may offer benefits in managing certain health conditions, it is essential to acknowledge that their efficacy and safety can vary significantly depending on factors such as plant species, preparation methods, and individual patient responses. This plant has been the subject of extensive research, revealing its potential as a therapeutic agent for conditions such as urolithiasis, edema, diabetes, and wound healing. The plant's widespread application in treating renal diseases, reflects its prominent role in Ayurvedic medicine, where it is revered for the diuretic and anti-inflammatory properties.[1] It is highly recommended to consult a healthcare professional before initiating any herbal therapy, especially for individuals with pre-existing medical conditions or those currently taking prescription medications.[2] Research suggests that herbal plants continue to be one of the most widely utilized components of traditional medicine practices worldwide.[3] *Bryophyllum pinnatum* (Lam.), also known as the Life Plant, "Panfuti", Miracle Leaf, or Cathedral Bells, is a medicinal succulent native to Madagascar and now widely naturalized in Asia, Australia, and New Zealand. Celebrated in traditional medicine, particularly for its role in managing kidney stones, this plant is rich in bioactive secondary metabolites such as flavonoids, alkaloids, and terpenoids. These compounds contribute to its diverse pharmacological properties, including anti-inflammatory, antioxidant, anticancer, antihypertensive, and antihelminthic effects. Notably, *B. pinnatum* also produces cardiac glycosides, which, while therapeutically active, can be toxic to livestock if ingested in large quantity.

Botanical Profile of *Bryophyllum pinnatum*

Botanically, *B. pinnatum* is distinguished by its fleshy, quadrangular stems, extensive branching, and hollow internodes.[4] The leaves measure between 10 and 20 cm in length and are arranged in opposite pairs that cross at right angles (decussate).[5] The leaves are supported by long petioles, measuring 2-4 cm in length. The leaf blades themselves are substantial, ranging from 6 and 8 cm long and 3 to 5.5 cm wide. The leaf tips are distinctively acute, adding a touch of sharpness to their overall appearance.[6] *Bryophyllum pinnatum* (Lam) produces an impressive floral display, characterized by its pendulous, bell-shaped flowers. These flowers are arranged in terminal panicles, which can reach a length of 10-40 cm. The calyx tube, an essential part of the flower, measures 2-4 cm in length and features oval nectar scales. Inside the flower, the oblong-shaped stamens and follicles are situated between the petals and the calyx. These structures play crucial roles in the plant's reproductive process. The four-septate fruit pod, which develops from the fertilized flower, houses numerous smooth, ellipsoid seeds. The peak flowering period of *Bryophyllum pinnatum* (Lam) typically occurs between November and March. During this time, the plant's vibrant flowers blanket the ground, creating a stunning visual spectacle. [7]

Figure: 1, 2, 3 Leaf and Plant

Geographical Distribution

This perennial succulent thrives in warm, humid climates and is widely distributed across tropical and subtropical regions of India, with notable abundance in states like West Bengal, Maharashtra, Kerala, and Tamil Nadu. Originally native to Madagascar, *Bryophyllum pinnatum* has adapted well to diverse ecological zones, including forest edges, rocky outcrops, and disturbed soils. It belongs to the Crassulaceae family, which encompasses approximately 25 genera and around 450 species globally, many of which are known for their drought-resistant, water-storing adaptations.

This succulent herb has successfully established itself in the following regions:
Africa: Madagascar, Southern Africa
Europe: Macaronesia (Azores, Canary Islands, Madeira)
Asia: Nepal, Thailand, Pakistan, Egypt
Oceania: New Zealand, Australia, Hawaii, Polynesia, Melanesia, Galapagos Islands.
Americas: Brazil, West Indies, parts of the United States.
Indian Subcontinent: Khasi Hills of Assam, Kashmir, Himalayan region, Karnataka, Andhra Pradesh, Kerala, and Tamil Nadu.

The ability of *Bryophyllum pinnatum* (Lam.) to thrive in various climatic conditions, from tropical to subtropical, has contributed to its widespread distribution. Its efficient reproductive strategies, including vegetative propagation through leaf-borne plantlets, have further facilitated its colonization of new habitats. [8]

Taxonomical Classification

Kingdom	Plantae
Sub-kingdom	Tracheobionta
Division	Spermatophyta
Subdivision	Spermatophyta
Class	Magnoliopsida
Sub class	Rosidae
Order	Rosales
Family	Crassulaceae
Genus	*Bryophyllum*
Species	*Pinnatum* [9]

Ayurvedic Properties
Rasa (Taste): Kashaya (Astringent), Amla (sour)
Guna (Property): Laghu (light)
Virya (Virya): Sheeta (cold)
Vipaka (Post digestive effect): Madhura (sweet)
Doshik action: Vatakaphahara (Pacifies vata and kapha)
Other action: Shonita sthapana (stops or control bleedings) Ashmarighna (dissolve or destroys), Mootrala (diuretic), Vranaropaka (promotes healing of wounds), Rakta stambaka (stops bleeding), Grahi (adsorbent).
Rogaghnata (Therapeutic Uses): Effective in treating Ashmari (urinary calculi), Raktasrava (bleeding disorders), Atisara (diarrhea), and Visuchika (cholera).
Part used: *Patra* (Leaves) [10]
Dosage
Patra churna (leaves powder): 2.5 to 5g
Swarasa (juice): 10 to 20 ml

Bryophyllum Pinnatum: **Synonyms and their meaning**

Synonym	Meaning
Bryophyllum calcicole	Calcicola[11] - Refers to a plant that thrives in soils rich in calcium, such as limestone-based soils.
Bryophyllum calycinum **Salisb**	Calcycinum [12] - A type of evergreen shrub.
Bryophyllum germinans **Blanco**	Germinans [13] -Refers to potential for growth or germination.
Bryophyllum pinnatum/ Cotyledon pinnata [14]:	Pinnatum - Describes a leaf structure resembling wings or feathers.
Cotyledon calycina [15,16,17]	Cotyledon -Refers to the first embryonic leaves; Calycina -Has woody stems and leaves.
Cotyledon rhizophylla	Rhizophylla [18] -Describes a leaf structure resembling wings or feathers.
Crassula pinnata	Crassula [19] -Characterized by opposite leaves and separate or slightly fused petals.
Kalanchoe brevicalyx [20, 21]	Kalanchoe - Produces miniature plantlets along the leaf margins.
Kalanchoe floripendula	Floripendula [22]- Has tightly packed floral arrangements resembling certain rose varieties.

Other Similar Species and Their Specific Characteristics these species can be differentiated by their distinct shape, size, color and height. [23]

Species	Common Name	Key Characteristics
Bryophyllum delagoense	Mother of Millions	Small, succulent leaves; produces plantlets along the leaf edges; tall, branching stems.
Bryophyllum fedtschenkoi	Lavender Scallops	Lavender-colored, scalloped leaves; compact form; trailing or spreading growth habit.
Bryophyllum proliferum	-	Large, thick leaves with distinctive margins; produces plantlets on the leaf edges.

Ayurvedic Classification
Charaka: Mutravirechaniya mahakashaya
Sushruta: Virataradi gana
Bhavapraksh Nighnatu: Haritakyadi varga
KaiyyadevaNigantu: Aoushadhi varga
Priyanigantu: Shatapushpadi varga
Raj Nighantu: Prabhadradi varga
Dhnavatari Nigantu: Guduchyadi varga
Nigantu Adarsha: Pashanabhedadi [24-26]

Vernacular Names

Language	Name	Meaning
Sanskrit	Pashanabheda, Vatapatri, Parnabeeja	Vatapatri: The leaf, with its thick, fleshy structure, bears a resemblance to the dense foliage of the Vatavriksha tree and is also commonly referred to as Pashanabheda in traditional medicine. Parnabeeja: Refers to a leaf that has the ability to propagate or give rise to new plants, effectively functioning like a seed.
Hindi	Zakhmhaiyat, Ahiraavan, Mahiraavan Pathharchoor,	Zakhmhaiyat Renowned for its ability to promote wound healing. Pathharchoor: Recognized for its ability to dissolve stones
English	Air plant	Refers to plants that take in water and nutrients directly from the air instead of the soil.
Gujarati	Khathkhathambo	This term describes plants that obtain moisture directly from their surrounding atmosphere.
Tamil	Malaikalli, Ranakalli	Malai," meaning mountain, and "Kalli," meaning thorn, together describe thorny plants typically found in mountainous regions. "Rana," signifying blood, suggests the plant's traditional application in treating blood-related ailments.
Kannada	Gandukalinga, Kadu Basale	"Kadu Basale" is the local name for what is commonly known as wild spinach.
Malayalam	Elamulachi	Ela" translates to leaf, while "Mulachi" refers to a bud that sprouts directly from the leaf.
Marathi	Ghaymaari	The term "Ghaymaari" means to "wound healer," describing a plant traditionally employed for wound treatment.
Bengali	Patharkuchi, Koppatta	Patharkuchi: This plant is traditionally recognized for its purported ability to dissolve calculi. Koppatta: "Kop" signifies the action of cutting or breaking. [27,28]

Chemical Constituents of *Bryophyllum pinnatum*

Preliminary phytochemical study of the numerous plant portions revealed the existence of several compounds such as alkaloids, phenols, flavonoids, tannins, saponins [29-31] sitosterol, anthocyanin,[32] quinines, tocopherol malic, acid [33] lectins, [34, 35] coumarins [36] and the principal constituent are Bufadienolides - Bryophyllin B, Bryophyllin A (bryotoxin), Bryophyllol, Bryophynol, Bryophollone, Bryophollenone. [37]

Morphology of *Bryophyllum Pinnatum*

Morphology of leave

The unique macroscopic characteristics of the leaves indicate that they are opposite and arranged in a decussate pattern. They are succulent and can be either simple or compound, measuring approximately 8 up to 12 cm in length and 5 to 8 cm in width. The leaf apex is obtuse, and the shape varies from ovate to elliptic. The margins are either crenate or serrate, with an asymmetrical base and a reticulate venation pattern. The petiole is elongated, and the leaf surface is either smooth or glabrous. The upper side of the leaf appears dark green, while the underside is a lighter shade. Additionally, the leaves have a distinctive smell and an acrid taste.

Microscopy of leave

A transverse section of a *Bryophyllum pinnatum* (Lam.) leaf reveals a distinctive anatomical structure. The adaxial surface is relatively flat, while the abaxial surface is more convex. The epidermis, both adaxial and abaxial, is composed of a single layer of thin-walled cells. The adaxial epidermis is characterized by smaller, less prominent cells, while the abaxial epidermis is slightly thicker. Numerous stomata, primarily of the anisocytic type, are densely distributed on the abaxial surface, facilitating gas exchange and transpiration. The mesophyll tissue, which lies between the upper and lower epidermis, is unique in that it lacks differentiation into palisade and spongy parenchyma. Instead, it consists of a homogeneous mass of parenchyma cells with abundant intercellular spaces. This undifferentiated mesophyll is believed to be an adaptation to water storage and arid conditions.

A prominent midrib traverses the leaf, containing a single, small, collateral vascular bundle. The xylem, responsible for water and mineral transport, forms a thick, horizontal band composed of narrow, angular, thin-walled elements. Adjacent to the xylem lies the phloem, a relatively wide band of tissue involved in the transport of sugars and other organic compounds.[38]

Morphology of Stem

The stem of *Bryophyllum pinnatum* (Lam.) exhibits distinct morphological characteristics throughout its lifespan. When young, the stem is typically light green in color. As it matures, the stem gradually transitions to a light brown hue. The older stem develops a rough texture and is often adorned with lenticels, small, raised pores that facilitate gas exchange. A closer examination of the stem powder reveals additional sensory attributes. The powder possesses a pleasant aroma and a slightly bitter taste.[55]

Microscopy of stem

A transverse section of the *Bryophyllum pinnatum* (Lam.) stem reveals a robust structure adapted to its succulent nature. A thick-walled epidermis, covered by a protective cuticle, forms the outermost layer. Beneath this lies a multi-layered hypodermis composed of sclerenchymatous cells, providing structural support and mechanical strength. The inner cortex, composed of loosely arranged parenchyma cells, stores starch grains.

A ring of vascular bundles encircles the pith region. These vascular bundles are primarily composed of tracheids, with a few vessels interspersed. The pith, located at the center of the stem, is filled with parenchyma cells and contains starch grains and calcium oxalate crystals. This anatomical structure, with its well-developed protective layers and efficient vascular system, contributes to the plant's ability to store water and survive in arid conditions. [56]

Difference Between New and Old Stem

Property	Young stem	Old stem
Epidermis	Thick walled with cuticle	Not prominent
Hypodermis	3-4 layers sclerenchyma	Not present
Cortex	Thin-walled parenchyma (starch storage)	Not prominent
Vascular bundle	Conjoint collateral open	-
Pith	Parenchyma (starch grain)	Enlarge thin-walled parenchyma
Secondary growth	Absent	Extra stelar (periderm) and intra stelar (secondary xylem). [55]

Morphology of Root

The root system of *Bryophyllum pinnatum* (Lam.) is characterized by a simple, tap root morphology. Young roots exhibit a greenish-brown coloration, which gradually transitions to a light brown hue as the root matures. Typically measuring 7-10 cm in length, these roots possess a pleasant aroma and a subtly sweet taste. [59]

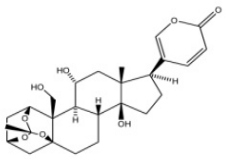
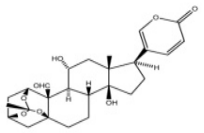
Mode of Reproduction

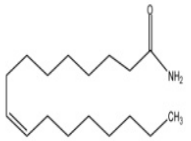
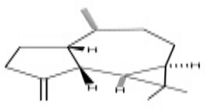
By seed and plantlets [62]

Difference Between New and Old Root

Property	Young root	Old root
Growth	Primary	Secondary
Tissue organization	Simple	Complex
Cortex	Outer (sclerenchyma) and inner (parenchyma cell)	Secondary cortex, called phelloderm, (parenchyma cell).
Stelar	Primary xylem or phloem	Secondary xylem and phloem, primary tissue pushed inward.
Pith	Present	Reduce or absent

Phytochemical Profile of Leaves

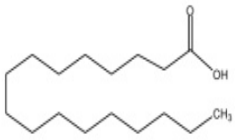
Part of Plant	Major Bioactive Compound	Structure	References
Leave	Flavonoids, coumarins, saponin sterols, bufadienolides, and anthocyanins, Bufadienolide included – Bryophyllin B bersaldegenin–1,3,5-orthoacetate, Bryophyllin C, and Bryophyllin A		4 39
	Protocatechuic-40-O-b-D-4C1-glucopyranoside, 40-methoxy-myricetin-3-O-a-L-1C4-rhamnopyranoside isorhamnetin-3-O-a-L-1C4-rhamnopyranoside and 1-octane-3-O-α-L arabinopyranosyl-(1-6)- -glucopyranoside.	 Bryophyllin C	40, 41 42
	25-methyl-5α ergost-24 (28)-en-3β-ol, 5α-stigmast-24-en-3β-ol, 24-epiclerosterol, 4(R)-stigmasta-5. 25-dien-3β-ol, 24(R)-5α stigmasta-7, and 25-dien-3β-ol. Steroidal derivative included, n-undecanoyl n-octadec-9-en-1-oate, n-dodecanoyl noctadec-9-en 1-oate, α–amyrin, β-D-glucopyranoside, Stigmast-4, 20(21), 23-trien-3-one, stigmata-5-en-3β-ol.flavones, Flavonoids, flavanones, isoflavonoids, chalcones, and, anthocyanidines. Rutin, 3,8-dimethoxy-4,5,7-trihydroxyflavone, astragalin, epigallocatechin-3-o-syringate, luteolin. Kaempferol. Quercetin. Potassium malate, sodium, Calcium, phosphorus, and trace essentials, iron, zinc. vitamins like, nicotinamide, riboflavin, ascorbic acid, thiamine, niacin, casein hydrolysates.	 Bryophyllin A	43,44 45 46,47,48 49 50 51 52, 53,54

Part of plant	Maor bioactive compound	Structure	References
Stem	Alkaloids, flavonoids saponins, tannin, HCN phylate, and phenol.	 Oleamide	57
Stem oil	(E)-5-eicosene, oleamide ,5 isolongifolol and β-gurjunene, (E)-2-nonenal, phytol β-bisabolene, hexahydropseudoionone, cycloheptane and (Z) hexadecanamide.	 β-gurjunene	58

Phytochemical profile of Root

The chloroform extract's phytochemical profile indicates the presence of diverse flavonoids and steroidal compounds [4] Additionally, Quantitative phytochemical analysis of *Bryophyllum pinnatum* (Lam.) roots revealed a higher concentration of carbohydrates and phenolic compounds compared to other plant parts. These findings suggest that the roots may serve as a valuable source of these bioactive compounds, which contribute to the plant's medicinal properties.[60]

Phytochemical profile of Root oil

Part of plant	Major bioactive compound	Structure	Reference
Root oil	Linoleic acid, ethyl ester Hexadecanoic acid, 9,12-Octadecanoic acid, ethyl ester, (z, z)-methyl ester, 9-Octadecenoic acid, amino acid, amines or amino sugar.	 Hexadecanoic acid	61

Traditional uses of *Bryophyllum pinnatum*
Various parts of the plant like flower, stem, and seeds, leaf, root—are used for treating a wide range of health conditions.

1. Leaf Juice:
Swelling: Applied raw leaf topically over affected area to reduce inflammation and swelling.
Skin Problems: A decoction made from the leaves is used to treat skin conditions like scabies.
High BP: Decoction
Pain Relief: Rubbing or massage a paste of the leaves can help alleviate pain in bones, injuries, or numbness in limbs.
Lung Inflammation and Cough: The syrup or juice Mixed with milk is beneficial for managing lung inflammation and coughing.
Kidney Health: Eating raw leaves is known to aid in treating kidney issues, including kidney stones, as well as high cholesterol.
Headaches: Crushed leaves can be applied topically to relieve headaches.

2. Flower Juice:
Wound Ulcers: The juice from both the flowers and leaves is useful for healing ulcers.
Diabetes: It is believed to help manage blood sugar levels.
Analgesic: The flower juice acts as a natural pain reliever.
Convulsions: The flower juice can be helpful in managing convulsions.

3. Root Decoction or Juice:
Gastrointestinal Issues: Used to treat conditions like dysentery, ulcers, and other digestive disorders.

4. Stem Extract:
Anti-Tumor: The stem extract has shown anti-tumor properties, potentially assisting in the management of certain cancers.

5. Seed Juice:
Eye Health: The juice, when applied as 1-2 drops in each eye three times a day, is used to treat stye disease. [4]

Marketed Preparation
1. Amantol cream: This topical formulation is indicated for the symptomatic relief of respiratory ailments such as sinusitis, nasal congestion, allergic reactions, and bronchitis.
2. Parnabija juice: Anti-obesity. [63]

Pharmacological Actions

Pharmacological Activity	Part of Plant Used	Observation
Anti-inflammatory and Analgesic	Leaf and Flower Extracts	Studies have demonstrated that *Kalanchoe pinnata* leaf and flower extracts show analgesic and anti-inflammatory properties in rats. These extracts have been shown to reduce acetic acid-induced abdominal writhing.[64] Flavonoids from *Kalanchoe pinnatum* inhibited the cyclooxygenase enzyme when injected intramuscularly. A novel steroidal compound in the plant's aqueous extract also reduced inflammation in a carrageenan-induced rat paw edema model. Additionally, the plant's watery extract provided 75.72% protection against acetic acid-induced pain in a mouse test.[65]
Anticonvulsant	Leaf Extract	The anticonvulsant potential of a *Bryophyllum pinnatum* leaf ethanolic extract was investigated in mice models of acute seizure. Utilizing a dose-dependent approach, the extract's efficacy was assessed by quantifying its impact on the duration of the tonic extensor phase and the subsequent recovery period in the maximal electroshock (MES)-induced seizure model. Furthermore, the extract's ability to modulate seizure susceptibility was evaluated in the pentylenetetrazole (PTZ)-induced seizure mode. [66] In the maximal electroshock (MES) model, administration of the *Bryophyllum pinnatum* leaf ethanolic extract at dosages resulted in a statistically significant dose-dependent reduction in the duration of hind limb tonic extension and a concomitant decrease in the latency to recovery. Conversely, in the pentylenetetrazole (PTZ)-induced seizure model, the ethanolic extract demonstrated a proconvulsant effect. Specifically, a statistically significant dose-dependent increase in the duration of clonic convulsions was observed at extract different dosages. Furthermore, the extract was associated with a reduction in the latency to the onset of convulsions. [67]
Antiallergy	Leaf Extract	*Bryophyllum pinnatum* (Lam.) has been found to exhibit anti-allergic properties. In vitro studies have demonstrated that the plant can reduce allergic responses by inhibiting mast cell degranulation and histamine release.[68]
Anticancer	Leaf Extract (Chloroform)	Chloroform extracts of *Bryophyllum pinnatum* (Lam.) leaves exhibit promising anti-testicular cancer activity by inhibiting the proliferation of human testicular cancer cells. Further investigation using an apoptosis-associated protein electrophoretic mobility shift assay in human cervical carcinoma cells *in vitro.* [69]
Antileishmanial	Leaf Extract	Plant extracts containing compounds like coumarin and quercetin have shown promise in combating leishmaniasis. *Bryophyllum pinnatum* (Lam.), for instance, produces the anti-leishmanial flavonoid quercitrin. Oral administration of these

		flavonoids has been found to be more effective than intravenous methods in treating mice with leishmaniasis. Research suggests that plants may combat this disease by stimulating the production of reactive nitrogen intermediates within macrophages.[70]
Herbal Tonic	Whole Plant (Leaf, Flower)	*Bryophyllum pinnatum* (Lam.) contains niacin and ascorbic acid. Traditionally, it has been used to treat prostate cancer and the common cold. Extracts of this plant are often incorporated into herbal remedies, which are considered tonics that promote overall health and respiratory function.[71]
Nephroprotective	Leaf Juice	Scientific studies have confirmed the nephroprotective properties of *Bryophyllum pinnatum* (Lam.). Research has indicated that the plant's protective effects are dose dependent. Scientists have investigated whether the plant's antioxidants can mitigate kidney damage induced by gentamicin in Wistar rats. Furthermore, leaf juice from *B. pinnatum* has shown superior efficacy compared to traditional anticholinergic medications in managing overactive bladder. [72]
Antibacterial	Leaf Extract	*Bryophyllum pinnatum* (Lam.) possesses significant broad-spectrum antibacterial activity, effectively inhibiting the growth of clinically relevant pathogens including *Escherichia coli*, *Pseudomonas aeruginosa Staphylococcus aureus, Bacillus subtilis*, *Klebsiella aerogenes*, and *Salmonella typhi*. Beyond direct antibacterial effects, this plant holds traditional importance in preventing neonatal infections, particularly those affecting the placenta and navel. further research supports its therapeutic potential, demonstrating notable anti-inflammatory and antispasmodic properties in addition to its established antibacterial action, as evidenced in studies utilizing its leaf juice. [73] The plant extract demonstrated potent bactericidal action against a wide range of bacterial species. [74-77]
Neuropharmacological	Aqueous Extract	Aqueous extracts of *Bryophyllum pinnatum* (Lam.) induce central nervous system (CNS) depressant effects in mice. Administration of the extract, resulted in a reduction of locomotor activity without inducing over physical sedation, as evidenced by the absence of ptosis. Further behavioral analysis revealed decreased muscle tone and impaired balance. Notably, the extract potentiated the sedative effects of pentobarbital and reduced the risk of sudden death. These findings suggest that water-soluble components of the plant, potentially including bufadienolides, contribute to its CNS depressant activity. Consistent with these results, other studies have reported sedative and neural depressant effects of *Kalanchoe* species in animals. These effects may be linked to increased GABA levels in the brain. [78-80]
Urolithic	Leaf Extract	*Bryophyllum pinnatum* (Lam.) extract has shown promise in reducing urinary oxalate levels, suggesting its potential as a treatment for kidney stones. Historically, this plant has been used to address this condition. Research indicates that the plant's mechanism of action may involve converting calcium oxalate dehydrate crystals into monohydrates, thereby inhibiting stone formation. Furthermore, leaf extracts have been found to reduce oxidative stress, a factor implicated in kidney stone development. [79-81]

CONCLUSION

Bryophyllum pinnatum (Lam.) a versatile medicinal herb that has been used for centuries in traditional medicine systems. It possesses array of phytochemicals, such as bufadienolides alkaloids, and flavonoids, which are responsible for its wide range of pharmacological effects. Scientific studies have validated the broad pharmacological potential of *Bryophyllum pinnatum* (Lam.), highlighting its nephroprotective, analgesic, anti-allergic, anti-inflammatory, antileishmanial, antibacterial, and anticancer effects. Although additional investigation is necessary to thoroughly understand its mechanisms of action and to refine dosage protocols, this plant holds significant promise as a source for innovative therapeutic approaches. However, it is essential to use *Bryophyllum pinnatum* (Lam.) under the supervision of qualified healthcare professionals, as the plant contains cardiac glycosides, which can be harmful or toxic when consumed in excessive amounts. Proper guidance ensures safe and effective use while minimizing the risk of adverse effects.

REFERENCES

1. Hegde PL, A comprehensive review on Parnabeeja [*Bryophyllum pinnatum* (lam.) Oken], Journal of Plants Studies 2015; 3(5): 166-171.
2. Kalanchoe pinnata: In: urs: eggi (ed). Succulent Lexicon: Crassulaceae (Thick Leaf). Stuttgart: PIU Eugenumer; 2003. p.175. Article in Pharmaceutical Biology. 2003; 5(3):203-217. ISBN: 3-8001-3998-7.
3. Kane SG. Extracts from Plant and Non-Plant Biomass and Uses Thereof. US Application Publication, Publication No. US2004/0156920 A1; 2004.
4. Selvakumar P. Phytochemical and pharmacological profile review of *Bryophyllum pinnatum* (Lam.). Biomed Biotechnol Res J. 2022; 6(3):295-301.
5. Nguelefack TB, Nana P, Atsamo AD, Dimo T, Watcho P, Dongmo AB, *et al.* Analgesic and anticonvulsant effects of extracts from the leaves of *Kalanchoe crenata* (Andrews) Haworth (Crassulaceae). Journal of Ethnopharmacology. 2006; 106(1):70-75.
6. Liu KCS, Yang SL, Roberts MF, Phillipson JD. *Eupafolin rham*nosides from *Kalanchoe gracilis*. Journal of Natural Products. 1989; 52(5):970-974.
7. Misra S, Dixit S. Antifungal activity of leaf extract of some higher plants. Acta Botanica Indica. 1979; 7:147-150.
8. Padhi A, Yadav S, Sharma U, Kumari G, Gupta VK. Ethnomedicinal, botanical, chemical and pharmacological properties of *Bryophyllum pinnatum* (Lam.). International Journal of Pharmaceutical Sciences Review and Research. 2024; 84(2):31-40.
9. Some Magnetic Island Plants. *Bryophyllum pinnatum*. Available from: http://www.somemagneticislandplants.com.au/index.php/plants/396-bryophyllum-pinnatum [Cited 2014 Sep 17].
10. Dwivedi V, Misra BL, Sharma SK, editors. Dravyaguna Hastamalak. Jaipur: Publication Scheme; 2006. p.423.
11. Collins Dictionary. Calcicole. Available from: https://www.collinsdictionary.com/dictionary/english/calcicole [Cited 2024 May 22].

12. Almaany.com. Calycinum. Available from: https://www.almaany.com/en/dict/en-en/calycinum/ [Cited 2024 May 22].
13. Merriam-Webster. Germinant [Internet]. Springfield (MA): Merriam-Webster; [cited 2024 Sep 29]. Available from: [https://www.merriam webster.com/dictionary/germinant] (https://www.merriam-webster.com/dictionary/germinant).
14. Dictzone. Pinnatum [Internet]. Dictzone Latin-English Dictionary; [cited 2024 Sep 29]. Available from: [https://dictzone.com/latin-english-dictionary/pinnatum] (https://dictzone.com/latin-english-dictionary/pinnatum).
15. Cambridge Dictionary. Cotyledon [Internet]. Cambridge: Cambridge University Press; [cited 2024 Sep 29]. Available from: [https://dictionary.cambridge.org/dictionary/english/cotyledon] (https://dictionary.cambridge.org/dictionary/english/cotyledon).
16. Almaany. Calycina [Internet]. Almaany Online Dictionary; [cited 2024 Sep 29]. Available from: [https://www.almaany.com/en/dict/en-en/calycina/] (https://www.almaany.com/en/dict/en-en/calycina/).
17. Almaany. Calyculata [Internet]. Almaany Online Dictionary; [cited 2024 Sep 29]. Available from: [https://www.almaany.com/en/dict/en-en/calyculata/] (https://www.almaany.com/en/dict/en-en/calyculata/)
18. Almaany. Calyculata [Internet]. Almaany Online Dictionary; [cited 2024 Sep 29]. Available from: [https://www.almaany.com/en/dict/en-en/calyculata/] (https://www.almaany.com/en/dict/en-en/calyculata/)
19. Merriam-Webster. Crassula [Internet]. Springfield (MA): Merriam-Webster; [cited 2024 Sep 29]. Available from: [https://www.merriam-webster.com/dictionary/crassula] (https://www.merriam-webster.com/dictionary/crassula)
20. Merriam-Webster. Kalanchoe [Internet]. Springfield (MA): Merriam-Webster; [cited 2024 Sep 29]. Available from: [https://www.merriam-webster.com/dictionary/kalanchoe] (https://www.merriam-webster.com/dictionary/kalanchoe)
21. Merriam-Webster. Kalanchoe [Internet]. Springfield (MA): Merriam-Webster; [cited 2024 Sep 29]. Available from: [https://www.merriam-webster.com/dictionary/kalanchoe] (https://www.merriam-webster.com/dictionary/kalanchoe)
22. Merriam-Webster. Floribunda [Internet]. Springfield (MA): Merriam-Webster; [cited 2024 Sep 29]. Available from: [https://www.merriam-webster.com/dictionary/floribunda] (https://www.merriam-webster.com/dictionary/floribunda)
23. Eggli U. Succulent Lexicon: Crassulaceae (Thick Leaf). Stuttgart: Eugen Ulmer; 2003. p.175. Article in Pharmaceutical Biology. 2003; 5(3):203-217. ISBN: 3-8001-3998-7.
24. Hegde LP. Dravyaguna Vijnana. 1st ed. Varanasi: Chaukhamba Sanskrit Sansthan; 2018. p. 640, 991.
25. Vaidhya BG. Nigantu Adarsha. Reprint ed. Varanasi: Chaukhamba Bharati Academy; 2009. p. 543, 841.
26. Pandit SN. Raja Nigantu. 1st ed. Varanasi: Chaukhamba Orientalia; 2012. p. 425, 1306.
27. Gurudeva MR. Botanical and Vernacular Names of South Indian Plants. Bangalore: Divya Chandra Prakashana; 2003. p. 245-246.
28. Chunekar KC, Pandey GS, editors. Bhavaprakasha Nighantu of Bhavamishra. Varanasi: Chaukhamba Bharati Academy; 2010. p. 107.
29. Kanika P. Pharmacognostic and phytochemical evaluation of *Bryophyllum pinnatum* (Lam.) leaves. J Adv Sci Res. 2011;2(4):429.
30. Nguelefack TB, Nana P, Atsamo AD, Dimo T, Watcho P, Dongmo AB, *et al.* Analgesic and anticonvulsant effects of extracts from the leaves of *Kalanchoe crenata* (Andrews) Haworth (Crassulaceae). J Ethnopharmacol. 2006;106(1): 70-5.
31. Okwu DE, Josiah C. Evaluation of the chemical composition of two Nigerian medicinal plants. Afr J Biotechnol. 2006;5(4):357-361.
32. Nielsen AH, Olsen CE, Møller BL. Flavonoids in flowers of 16 *Kalanchoe blossfeldiana* varieties. Phytochemistry. 2005;66(23):2829-35.
33. Pal S, Sen T, Chaudhari AK. Neuropsychopharmacological profile of the methanolic fraction of *Bryophyllum pinnatum* (Lam.) leaf extract. J Pharm Pharmacol. 1999;51(3):313-8.
34. Adinike K, Eretan OB. Purification and partial characterization of lectin from the fresh leaves of *Kalanchoe crenata* (And.) Haw. J Biochem Mol Biol. 2004;37(2):229-33.
35. Nguelefack TB, Nana P, Atsamo AD, Dimo T, Watcho P, Dongmo AB, *et al.* Analgesic and anticonvulsant effects of extracts from the leaves of *Kalanchoe crenata* (Andrews) Haworth (Crassulaceae). J Ethnopharmacol2006; 106:70-5.
36. Liu KC, Yang SL, Roberts MF, Phillipson JD. *Eupafolin rhamnosides* from *Kalanchoe gracilis*. J Nat Prod. 1989;52(5):970-4.
37. Okwu DE, Josiah C. Evaluation of the chemical composition of two Nigerian medicinal plants. Afr J Biotechnol. 2006;5(4):357-361.
38. Misra S, Dixit S. Antifungal activity of leaf extract of some higher plants. Acta Bot Indica. 1979; 7:147-50.
39. Kane SG. Extracts from plant and non-plant biomass and uses thereof. *US Patent Application Publication*. No. US2004/0156920 A1; 2004.
40. Alabi DA, Onibudo MZ, Amusa NA. Chemicals and nutritional composition of four botanicals with fungitoxic properties. World J Agric Sci 2005; 1:54-88.
41. Ram PR, Mehrotra BN. Compendium of Indian Medicinal Plants. Vol. 1. New Delhi: Drug Research Institute; 2004.
42. Quazi M, Sayyed N, Sheikh S, Gomase P, Choudhari A. Phytochemical analysis of chloroform extract of roots of *Kalanchoe pinnata* by HPLC and GCMS. Int J Pharm Sci Res. 2011;2(9):1693-9.
43. von Mandach U, Plangger N, Rist L, Zimmermann R. Intravenous tocolysis with *Bryophyllum pinnatum* (Lam.) is better tolerated than beta-agonist application. Eur J Obstet Gynecol Reprod Biol. 2006;124(2):168-72.
44. Recknagel R. Carbon tetrachloride hepatotoxicity. Pharmacol Rev. 1967;19(2):145-96.
45. Almeida AP, Costa SS. Octane-3-O-α-L-arabinopyranosyl-(1→6)-glucopyranoside, a minor constituent from leaves of *Kalanchoe pinnata*. Braz J Pharm Sci. 2006;16(4):485-9.
46. Afzal M, Gupta G, Kazmi I, Rahman M, Afzal O, Alam J, *et al.* Anti-inflammatory and analgesic potential of a novel steroidal derivative from *Bryophyllum pinnatum* (Lam.). Fitoterapia. 2012;83(5):853-8.
47. Amnlou M, Ariae S, Farsam H. Phytochemical studies on medicinal plants. J Med Aromat Plant Sci. 2005;27(3):469-75.
48. Okwu DE, Nnamdi FU. Two novel flavonoids from *Bryophyllum pinnatum* (Lam.) and their antimicrobial activity. Pharm Chem J. 2011;3(2):110-3.
49. Wagner WL, Herbst DR, Sohmer SH. Manual of the Flowering Plants of Hawaii. Honolulu: University of Hawaii Press; 1999. p. 568.S.
50. Costa S, Jossang A, Bodo B. Propriétés biologiques et phytochimie des *Kalanchoe pinnata*. In: Systematiqueecophysiologie et phytochimie. Paris: Karthala; 1995. p. 219-35.
51. P Mathew PJ, Unithan MC. Search for plants having anticancer properties used by the tribals of Kerala. Indian Aryavaidan. 1992; 6:54-60.
52. Akinpelu DA. Antimicrobial activity of *Bryophyllum pinnatum* (Lam.) leaves. Fitoterapia. 2000;71(2):193-4.

53. Alabi DA, Onibudo MZ, Amusa NA. Chemical and nutritional composition of four botanicals with fungitoxic properties. World J Agric Sci. 2005;1(1):54-8.
54. Okwu DE, Josiah C. Evaluation of the chemical composition of two Nigerian medicinal plants. Afr J Biotechnol2006; 5:357-61.
55. Seema VP. *Kalanchoe pinnata*: Phytochemical and pharmacological profile. Int J Pharm Sci Res. 2012;3(4):993-1000.
56. Sharma AJ, Naresh C. Pharmacognostical studies of *Bryophyllum pinnatum* (Lam.) Kurz. Pharmacogn J. 2014;6(1):5. doi:10.5530/pj.2014.6.5
57. Shaheer T, Ali ST, Rizwani GH, Qaisar MN, Abbas K, Qadir MI, *et al*. Morphological characterization, phytochemical profile, and cytotoxic and insecticidal activities of diverse parts of *Bryophyllum pinnatum* (Lam.). Trop J Pharm Res. 2019;18(10):2147-54. doi:10.4314/tjpr. v18i10.21.
58. Okoye EI, Anyaegbunam LC, Obi ZC, Ibemenuga KN. Pharmaceutical constituents of stem of *Bryophyllum pinnatum* (Lam.). J Health Med Nurs. 2015; 16:54-60.
59. Mbachu KA, Gabriel IM, Akintunde AAM, Esther AO. Chemical compositions and antioxidant activity of leaf and stem essential oils of *Bryophyllum pinnatum* (Lam.) Kurz. J Chem Pharm Res. 2013;25(9):4991-3.
60. Q., S. Nazim, S. Shaikh, P. Gomase, and A. Choudhari. Phytochemical analysis of chloroform extract of roots of *Kalanchoe pinnata* by HPLC and GCMS. Int. J. Pharm. Sci. Res. 2011;2: 1693-1699.25(9):4991-4993 Aug2013. http://keyserver.lucidcentral.org/weeds/data/030308000b07-490a-8d04 0605030c0f01/media/Html/ Bryophyllum_pinnatum.htm [Cited September, 17], 2014.
61. Orisakeye OT, Oladoye SO, Peters OA. Chemical composition and antioxidant activity of *Bryophyllum pinnatum* (Lam.) root. Nat Prod Chem Res. 2015;3(5):173. doi:10.4172/2329-6836.1000173.
62. Majaz QA, Tatiya AU, Khurshid M, Nazim S. The miracle plant (*Kalanchoe pinnata*): A phytochemical and pharmacological review. Int J Res Ayurveda Pharm. 2011;2(5):1478-82.
63. Pal S, Nag Chaudhuri AK. Studies on the anti-ulcer activity of a *Bryophyllum pinnatum* (Lam.) leaf extract in experimental animals. J Ethnopharmacol. 1991;33(1-2):97-102.
64. Patil PA, Shobha JC. Influence of *Bryophyllum pinnatum* (Lam.) leaf extract on wound healing in albino rats. J Nat Remedies. 2004;4(1):41-6.
65. Pal S, Nag Chaudhuri AK. Studies on the anti-ulcer activity of a *Bryophyllum pinnatum* (Lam.) leaf extract in experimental animals. J Ethnopharmacol. 1991;33(1-2):97-102.
66. Adesanwo JK, Raji Y, Olaleye SB, Onasanwo SA, Fadare OO, Ige OO, *et al.* Antiulcer activity of methanolic extract of *Bryophyllum pinnatum* (Lam.) in rats. J Biol Sci. 2017;7(3):409-12.
67. Gwehenberger B, Rist L, Huch R, von Mandach U. Effect of *Bryophyllum pinnatum* (Lam.) versus fenoterol on uterine contractility. Eur J Obstet Gynecol Reprod Biol. 2004;113(2):164-71.
68. Awuchi CG, Amagwula AO, Priya P, Kumar R, Yezdani U, Khan MG. Aflatoxins in foods and feeds: A review on health implications, detection, and control. Bull Environ Pharmacol Life Sci. 2020;9(3):149-55.
69. Kumar R, Dubey A. Phytochemical investigation and hepatoprotective evaluation of *Acacia rubica* extract in isoniazid and paracetamol induced animal toxicity. Turk J Physiother Rehabil. 2020;32(3):1-8.
70. Kumar R, Saha P, Sarkar S, Rawat N, Prakash A. A review on novel drug delivery systems. Int J Res Anal Rev. 2021;8(2):183-99.
71. Roshan K, Priya D, Shivam K, Adarsh S, Usha S. An overview on health benefits and risk factors associated with coffee. Int J Res Anal Rev. 2020;7(4):237-49.
72. Pal S, Nag AK Chaudhuri N. Anti-inflammatory action of *Bryophyllum pinnatum* (Lam.) leaf extract. Fitoterapia. 1990;61(6):527-33.
73. Sahana S, Saha P, Kumar R, Das P, Chatterjee I, Roy P, *et al.* A review of the 2019 coronavirus (COVID-19). World J Pharm Pharm Sci. 2020;9(5):2367-81.
74. Kumar R, Saha P, Kumar Y, Sahana S, Dubey A, Prakash O. A review on diabetes mellitus: Type 1 & Type 2. World J Pharm Pharm Sci. 2020;9(10):838-50.
75. Faujdar SS, Bisht D, Sharma A. Antibacterial potential of neem (*Azadirachta indica*) against uropathogens producing beta-lactamase enzymes: A clue to future antibacterial agent? Biomed Biotechnol Res J. 2020;4(3):232-8.
76. Mehrishi P, Agarwal P, Broor S, Sharma A. Antibacterial and antibiofilm properties of *Azadirachta indica*, *Aloe vera*, and *Mentha piperita* against multidrug-resistant clinical isolates. Biomed Biotechnol Res J. 2022;6(2):98-104.
77. Mollaei S, Ghanavi J, Farnia P, Abedi-Ghobadloo P, Velayati AA. Antimicrobial evaluation of medicinal plants against drug-resistant pathogens. Biomed Biotechnol Res J. 2021;5(1):45-52.
78. Joseph J, Deborah K, Raghavi R, Mary Shamya A, Aruni W. Green synthesis of silver nanoparticles using *Phyllanthus amarus* seeds and their antibacterial activity assessment. Biomed Biotechnol Res J. 2021;5(1):35-8.
79. Sharma A, Bhot M, Chandra N. Protein profiling of *Bryophyllum pinnatum* (Lam.) Kurz leaf. Int J Pharm Pharm Sci. 2014;6(4):496-7.
80. Akpantah AO, Obeten K, Edung ES, Eluwa AM. Effect of ethanolic extract of *Bryophyllum pinnatum* (Lam.) on the microanatomy of the testes of adult male Wistar rats. Eur J Biol Med Sci Res. 2014;2(1):37-44.
81. Bind A, Das S, Singh VD, Kumar R, Chourasia A, Saha P. Natural bioactives for the potential management of gastric ulceration. Turk J Physiother Rehabil. 2020;32(3):1-6.

Cite this article as:

Talib Siddiqui, Beauty Kharwar, Priyanka Singh and Ashwini Kumar Kushwaha. Medicinal potential of *Bryophyllum pinnatum* (Lam.): A Detailed Review. Int. J. Res. Ayurveda Pharm. 2025;16(6):153-160
DOI: http://dx.doi.org/10.7897/2277-4343.166231

Source of support: Nil, Conflict of interest: None Declared