



Bryophyllum Pinnatum:-Ane-dible plants and it's pharmacological review

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Abstract

Bryophyllum pinnatum (Lam.) Oken, a native and exotic plant, is widely utilized by traditional practitioners for managing various ailments, including renal calculi, hypertension, asthma, colds, abscesses, and bleeding disorders. In southern India and Bengal, it is commonly employed in treating renal diseases and is identified as Pashanabheda or Parnabeeja, belonging to the Crassulaceae family. This succulent herb, characterized by variable leaves with elliptic leaflets and reddish-purple flowers, is naturally distributed across the country. Research over the years has highlighted its diverse pharmacological properties, such as urolithic, diuretic, anti-diabetic, and wound-healing activities. Phytochemical analyses have revealed the presence of alkaloids, cardiac glycosides, and flavonoids. This review seeks to comprehensively examine the medicinal potential of Bryophyllum pinnatum, focusing on its Ayurvedic significance, botanical characteristics, phytochemical compstudi and pharmacological studies.

Keyword :- Bryophyllum pinnatum (lam.) Oken, Parnabeeja, Diuretic, Cardiac glycoside.

Introduction

Bryophyllum pinnatum (Lam.) Oken, a plant belonging to the Crassulaceae family, is considered an environmental weed but holds significant traditional medicinal value in various regions of India and across the globe. Known primarily for its use in treating urinary stones, this plant is also employed for several other health conditions such as hypertension, skin ailments, asthma, colds, insect bites, and abscesses. In Ayurvedic medicine, it is referred to as Parnabeeja and is used as a substitute for Pashanabheda (*Berginia ligulata* Wall.) in the Bengal

region, where it is commonly called Pathar kuchi. Here, it is extensively utilized in managing urinary stones in place of the original Pashanabheda plant [1, 2].

Traditional practitioners in Bengal, as well as Unani and Ayurvedic physicians, prescribe *Bryophyllum pinnatum* for various conditions, including Raktasrava (bleeding disorders), Ashmari (renal calculi), Vrana (ulcers), and Atisara (diarrhea) [2, 3]. Due to its ethnobotanical significance, numerous research studies have been conducted worldwide to scientifically validate its traditional uses. These studies have confirmed several pharmacological activities of the plant, such as anti-diabetic, wound-healing, antilithogenic, hepatoprotective, and anticancer properties. However, it should be noted that this species is considered toxic to livestock due to the presence of cardiac glycosides [4].

2 .Synonyms

Bryophyllum calycinum Salisb, *Kalanchoe pinnata* (Lam.) Pers, *Cotyledon pinnata* Lam., *Sedum madagascariense* Clus [4].

3. Vernacular names [5, 6]

Sanskrit : Parnabeeja, Asthibhaksha

English : Air plant

Hindi : Zakhmhaiyat, Pathharchoor

Kannada : Gandukalinga, Kadu basale

Malayalam : Elamarunga

Tamil : Malaikalli, Ranakalli

Telugu : Ranapala

Marati : Gayamari

Bengali : Kopatha, Pathar kuchi.

4. Taxonomical classification [7]

Kingdom : Plantae – Plants

Sub kingdom : Tracheobionta – Vascular plants

Division : Spermatophyta – seed plants

Subdivision : Magnoliophyta – Flowering plants

Class : Magnoliopsida – Dicotyledons

Subclass : Rosidae

Order : Rosales

Family : Crassulaceae – stonecrop

Genus : Bryophyllum

Species : *Bryophyllum pinnatum* (Lam.) Oken

The word meaning of *Bryophyllum pinnatum*: Derived from

Greek- Bryo means to sprout & phyllon is a leaf i.e. ability to

Propagate via leaf cutting, *pinnatum* is from Latin feathered,

Winged.

5. Common names [8]

Cathedral bells, curtain plant, floppers, good luck leaf, green Mother of millions, leaf of life, Mexican love plant, miracle Leaf, resurrection plant, sprouting leaf.

6. Family features

The family Crassulaceae which means the plant of crassula

Tribe; the leaves are fleshy & succulent [9, 10].

The family has 25 genera & 450 species.

The plants of this family are herbs/ under shrubs. Stem &

Branches are usually with fleshy & succulent. Leaves are

Alternate/ opposite, simple less commonly pinnately divided,

Ex stipulate. Flowers are usually cymose, hermaphrodite/

Rarely unisexual & regular. Calyx is free, 4-5 fid/ 4-5 partite.

Petals are as many as sepals & alternate to the monopetalous

Corolla. Carpels are as many as petals & are opposite to them

With a hypogynous gland/ scale at the base. Fruits are follicles

& membranous with few seeds.

7. Habitat

Bryophyllum pinnatum is native to Madagascar and southern Africa but has become naturalized in tropical regions worldwide.

8. Morphology

This plant is a succulent, glabrous herb that grows to a height of 0.3–1.2 m. The stems are obtusely four-angled, with older stems being light-colored and younger ones showing reddish speckles with white. The leaves are variable and arranged in a decussate pattern. The lower leaves are typically simple or compound, while the upper leaves are 3–5 or 7 foliolate with long petioles. The petioles are connected by a ridge encircling the stem. Leaflets are ovate or elliptic with crenate or serrate margins.

The flowers are pendulous and arranged in large, spreading panicles with opposite, sturdy branches and slender pedicels. The sepals are striated red, green at the base, and pale green at the top. The petals are reddish-purple, swollen, and octagonal at the base, with triangular lobes.

Filaments are green at the base and pinkish near the anthers, which are black and hastate. Styles are green.

The fruit is enclosed within a persistent, papery calyx and corolla, and the seeds are small, smooth, and oblong-ellipsoid in shape.

9. Ethno-Botanical Importance

Odisha (Basampatri): Leaves are used to alleviate flatulence.

Kerala (Thukotali): Crushed leaves are applied externally on burn wounds.

West Bengal & Andhra Pradesh: Warmed, mature leaves are placed on wounds and tied.

Konkan Region: Leaf juice mixed with ghee is used to treat dysentery. Two teaspoons of leaf juice are also used for treating renal calculi.



Chota Nagpur: Steamed leaf juice is consumed with ghee or garlic for cough treatment. Leaves treated with palm oil are applied externally to soothe sore eyes.



10. Ayurvedic Properties

Rasa (Taste): Kashaya (astringent), Amla (sour)Guna (Quality): Laghu (light)Virya (Potency): Sheeta (cooling)Vipaka (Post-digestion effect): Madhura (sweet)

Doshagnata (Dosha action): Vatakaphahara (balances Vata and Kapha)

Karma (Actions):

Ashmarighna (removes urinary stones)

Vranaropaka (heals wounds)

Mootrala (diuretic)

Shonita sthapana (stops bleeding)

Rakta stambaka (hemostatic)

Grahi (absorbent)

Rogaghnata (Indications): Effective in treating ashmari (urinary stones), atisara (diarrhea), raktasrava (bleeding disorders), and visuchika (cholera).

11. Part Used

Patra (Leaves)

12. Dosage

Leaves powder: 2.5–5

13. Pharmacognosy

Microscopic Features of Leaf

Epidermis:

Upper and lower epidermis fragments have cyclocytic stomata, guarded by three cells forming a griddle.

Upper epidermal cells are larger with slightly wavy anticlinal walls.

Transverse Sections:

Thick cuticle with a two-layered upper epidermis.

A hypodermal layer contains anthocyanin pigments.

Palisade cells lie beneath the hypodermis.

Petiole (Longitudinal Section):

Contains prismatic crystals of calcium oxalate within parenchymatous cells.

Meristele (Longitudinal Section):

14. Reproduction

Bryophyllum pinnatum reproduces through seeds and plantlets.

15. Growth and Propagation

Leaf sections were used as explants, with plant hormones like TDZ, BAP, and BAP & NAA at various concentrations (2.5–20 μM).

TDZ at 10 μM showed optimal results for shoot proliferation and elongation.

Lower BAP concentrations (1 μM) produced shoots, but the survival rate was highest (91%) in a mixture of 75% sand and 25% coco peat.

16. Phytochemical Constituents

Contains alkaloids, saponins, flavonoids, tannins, and a cardiac glycoside (bryophyllin-A).

Flavonoids identified include 5I Methyl 4I, 5, 7 trihydroxyl flavone and 4I, 3, 5, 7 tetrahydroxy 5-methyl 5I-propenammine anthocyanidines.

Nutritional analysis: carbohydrates are highest, ash is lowest. Calcium and potassium levels dominate, while lead and zinc are minimal.

17. Pharmacological Activities

17.1 Antimicrobial Activity

Extracts (aqueous, methanol, and others) exhibited antibacterial properties.

Methanol extracts were most effective against *Staphylococcus aureus*, *Enterococcus faecalis*, *Bacillus subtilis*, and *Pseudomonas aeruginosa*.

Flavonoidal compounds showed antibacterial and antifungal activity, with *Escherichia coli* resistance observed for one compound.

17.2 Anticancer Property

Leaf extracts and fraction F4 inhibited the growth of cervical cancer cells and reduced HPV18 viral transcription.

17.3 Antihypertensive Activity

Aqueous and methanolic extracts (50–800 mg/kg) reduced blood pressure and heart rate in hypertensive rats, showing dose-dependent effects.

17.4 Antidiabetic A Aqueous extracts reduced blood sugar levels in diabetic rats. The combination of 800 mg/kg extract with 2 mg/kg glibenclamide was the most effective.

17.5 Wound Healing

Petroleum ether, alcohol, and water extracts (400 mg/kg) enhanced wound healing in various models. Water extract showed significant scar formation and faster healing.

17.6 Antilithogenic Activity

Fresh leaf juice (10 ml/day for 30 days) helped 87% of lithiasis patients pass or reduce kidney stones and improved urinary biochemistry.

17.7 Hepatoprotective Activity

Aqueous and ethanolic extracts (250–500 mg/kg) provided liver protection in N-diethylnitrosamine-induced hepatic injury, with the ethanolic extract at 500 mg/kg offering better results.

17.8 Anti-inflammatory Activity

Research has demonstrated the anti-inflammatory properties of *Bryophyllum pinnatum* leaf extracts, including fractions of petroleum ether, chloroform, acetone, methanol, aqueous

solutions, alkaloids, flavonoids, phenols, and phenolic acids. When administered orally at 500 mg/kg for two days in a formaldehyde-induced hind paw edema model in rats, these extracts displayed notable anti-inflammatory effects. The methanolic fraction, in particular, showed significant inhibition of edema during later phases compared to the standard drug Indomethacin.

17.9 Cytotoxicity on Testis

Studies revealed the cytotoxic effects of ethanolic extracts of *B. pinnatum* leaves on rat testicular cells at doses of 100 mg/kg and 200 mg/kg, administered orally over eight weeks. At 100 mg/kg, seminiferous tubules exhibited shrinkage with visible intracellular spaces. At the higher dose, a significant increase in intracellular spaces and a reduction in spermatozoa were observed. In contrast, control groups displayed normal testicular histology.

17.10 Uterine Contractility

In-vitro studies investigated the tocolytic effects of *B. pinnatum* in human myometrium. Strips of myometrium biopsied during caesarean sections were exposed to varying concentrations of *B. pinnatum*, with or without oxytocin. Results showed that *B. pinnatum* inhibited spontaneous contractions in a concentration-dependent manner, increased contraction frequency by 91%, and reduced oxytocin-stimulated contractions by 20%. A comparative study of intravenous *B. pinnatum* extract versus beta-agonists in 67 pregnant women in preterm labor found similar outcomes in pregnancy prolongation and gestational age at delivery. However, *B. pinnatum* was better tolerated, with fewer adverse effects and improved neonatal outcomes, such as reduced oxygen use and respiratory distress syndrome rates.

17.11 Immunosuppressive Effect

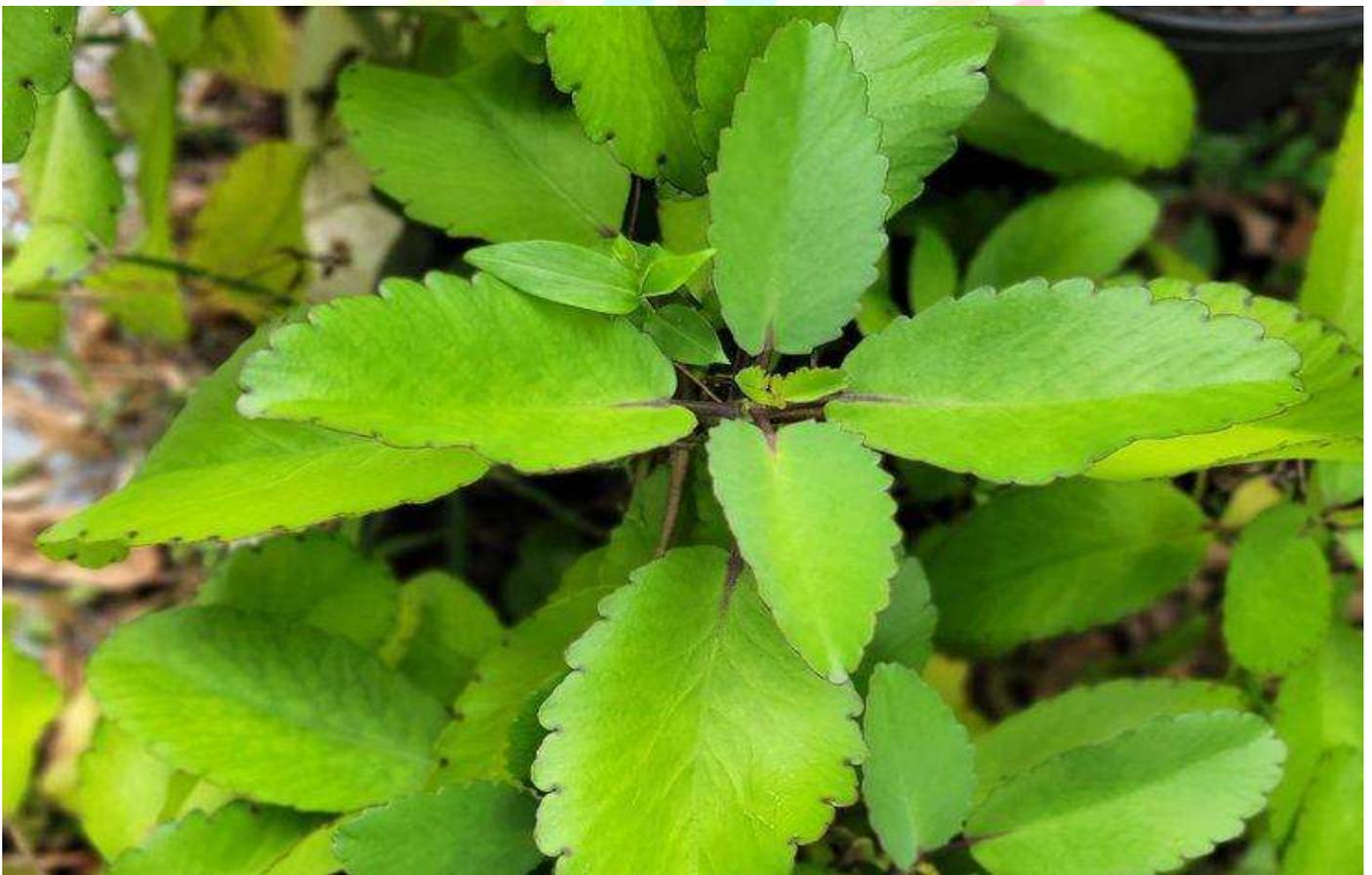
The fatty acids in *B. pinnatum* contribute to its immunosuppressive properties. In vivo studies on mice revealed that aqueous leaf extracts significantly suppressed cell-mediated and humoral immune responses. Pre-treated mice showed reduced spleen cell proliferation, impaired delayed-type hypersensitivity (DTH) reactions, and lower antibody production. A purified fraction from the ethanolic extract (KP12SA) was found to be twenty times more potent in inhibiting lymphocyte proliferation than the crude extract, highlighting the immunosuppressive role of saturated fatty acids.

Protein Profiling:-

Protein extraction from *B. pinnatum* leaves, using phosphate buffer and SDS-PAGE separation, identified Proteinase K via LC-MS/MS analysis. Proteinase K, commonly used to digest keratin and other proteins, was the main protein isolated.

Neuropharmacological Activity

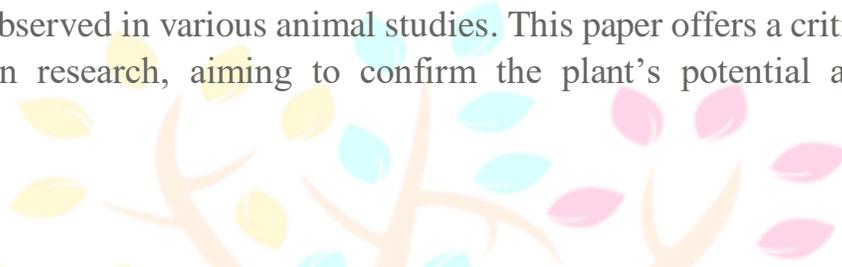
Studies on mice demonstrated that aqueous leaf extracts of *B. pinnatum* have significant neuropharmacological effects. Administered at doses of 50, 100, and 200 mg/kg, the extract reduced exploratory behavior in a dose-dependent manner, induced sedation, and prolonged pentobarbital-induced sleep. It also delayed the onset of convulsions induced by strychnine and picrotoxin, with stronger protective effects against picrotoxin. Additionally, it reduced picrotoxin-induced mortality, with an LD50 of 641 mg/kg. These findings indicate the extract's central nervous system depressant activity.



18. Conclusion

Bryophyllum pinnatum is a globally recognized medicinal herb with evidence-based therapeutic applications in conditions like inflammation, cytotoxicity, uterine contractility, and neuropharmacology, especially in urinary disorders. These studies confirm its safety and efficacy with minimal adverse effects.

The findings obtained *in vitro* require further investigation to assess the toxicity of specific plant compounds, particularly bufadienolides, and their safety during pregnancy, as well as to explore their mechanisms of action. Additionally, there is a need for clinical trials to validate the outcomes observed in various animal studies. This paper offers a critical review of recent advancements in research, aiming to confirm the plant's potential as a versatile medicinal resource.



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