



A Review: Phytochemical and Pharmacology of *Bryophyllum Pinnatum*

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Mini Review

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Abstract

Bryophyllum pinnatum is traditionally used plant belonging to family Crassulaceae. The plant is derived from the Greek words bryo, which means to sprout, and phyllon, which means leaf. Many plant parts include secondary metabolites with therapeutic potential, such as glycosides, tannin, alkaloids, flavonoids, and phenolic compounds. In addition, it has anti-inflammatory, antidiabetic, nephroprotective, hepatoprotective, immunomodulatory, anti-leishmanial, anti-ulcer, and CNS depressant, analgesic, and anticonvulsant qualities. It is Known as the "life plant," *Bryophyllum pinnatum* is a widely acknowledged as perennial medicinal herb. Has spread to many other Asian, Australian, and New Zealand countries, but it originated in Madagascar.

Keywords: Enantiomeric Impurities; Impurity Profiling; Toxicity; Quantification; Post-Market Surveillance; Pharmacopoeia; Monographs; Regulatory Agencies

Introduction

The plant *Bryophyllum pinnatum* is part of the Crassulaceae family, which has been used extensively in traditional medicine. From the Greek words bryo, which means to sprout, and phyllon, which means leaf, comes the appellation *bryophyllum pinnatum*. The secondary metabolites that have medicinal potential are derived from many plant sections including tannin, alkaloids, flavonoids, glycosides, and phenolic chemicals. Furthermore, it exhibits anti-inflammatory, Anti-diabetic, nephron-protective, hepato-protective, Anti-leishmanial, antiulcer, immunomodulatory, and CNS depressant, analgesic, as well as anticonvulsant properties [1]. *Bryophyllum pinnatum* is a prominent perennial medicinal herb that has been referred to as the "life plant." Originates from Madagascar, but it has spread too many other Asian, Australian, and New Zealand countries alternatively known as panfuti [2].

Plant Description

Plant name- *Bryophyllum pinnatum*, Synonym- *Bryophyllum calycinum*, good luck leaf, leaf of life, live leaf, Mexican love plant, Air plant, Family- Crassulaceae

Vernacular Name:

- Sanskrit: pashanebheda
- Marathi: gayamari
- Hindi: pataharchoor
- English: air plant
- Telugu: ranapaluka
- Kannada: gandukalinga
- Taxonomical classification [3]
- Kingdom: plantae
- Subkingdom: tracheobionta
- Division: spermatophyta
- Subdivision: magnoliophyta
- Class: mangnoliopsida

- Subclass: rosidae
- Order: saxifragales
- Family: bryophyllum

Morphology

Its height ranges from 1 to 1.5 meters, and its hollow, four-angled stem is typically branched. The leaves are 10-20 cm long and oriented oppositely. While the top 3-7 foliate and have lengthy petioles, the lower leaves are simple. Vegetative buds that are rooted adorn the leaves. Terminal panicles of inflorescences measure 10-40 cm. Most flowers are bell-shaped pendulous.

A tubular calyx measuring 2-4 cm, a reddish-purple flower measuring 5 cm with a sparsely ciliate base, ovate lanceolate lobes, stamens placed in the base of corolla, oblong nectar scales, follicles incorporated in the calyx and corolla tube. The fruit-pod has four sepal and several smooth-striate, ellipsoid seeds within. The shrubs develop fruit in April and mature from November to March [4].

Microscopy

The diminutive character has a curved surface on the adaxial side and an extremely thin layer on the abaxial side. Its adaxial epidermal covering is shrill and consists of small, less prominent compartments. The midrib's stranded tissue is parenchymatous. The cells are consolidated, pointed, and circular. The vascular strand has a small, semicircular shape and is solitary. It has an extensive band of phloem and a dense parallel xylem. The xylem component has a tiny wall, narrowing to a point. The vascular packs are parallel and establish in the plane. The mesophyll is separated into soft parenchyma and palisade. The layer of laminate is smooth. The anisocytic kinds of stomata are arranged in rich shape [5].

Phytochemical Review

Flavonoids: Luteolin, kaempferol, quercetin, quercitrin, kaempferol-3-glucoside, afzelin, rutin, diosmine [6-8].

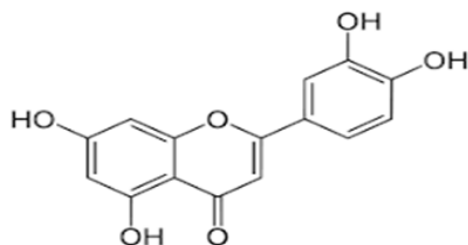


Figure 1: Luteolin.

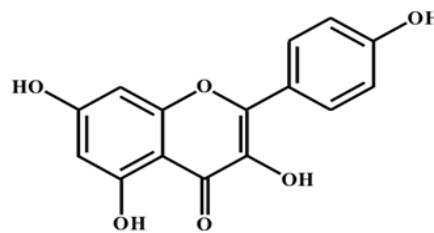


Figure 2: Kaempferol.

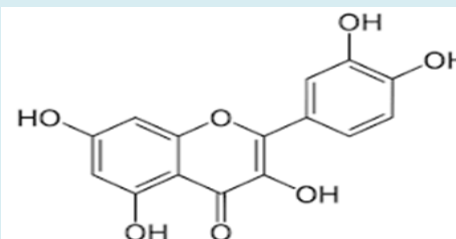


Figure 3: Quercetin.

Phenanthrene derivative- 2-(9-decenyl)-phenanthrene
2-(9-undecenyl)-phenanthrene [3].

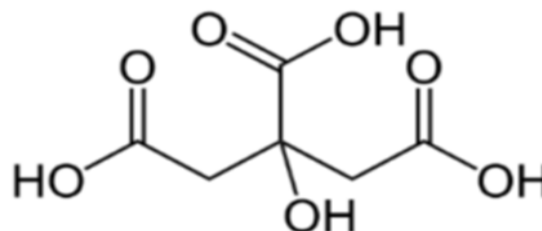


Figure 4: Citric acid.

Carboxylic acid: Citric acid, oxalic acid, succinic acid, isocitric acid [9-12].

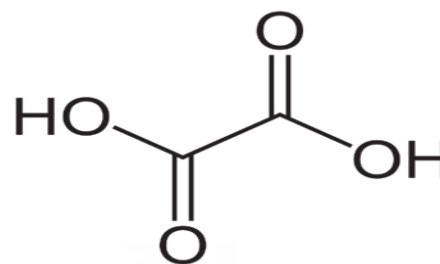


Figure 5: Oxalic acid.

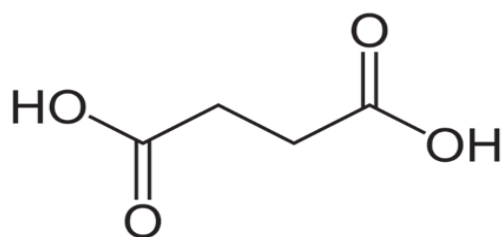


Figure 6: Succinic acid.

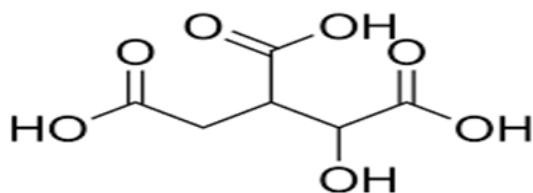


Figure 7: Isocitric acid.

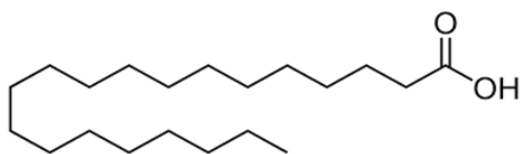


Figure 8: Arachidic acid.

Fatty acid: Arachidic acid, palmitic acid, stearic acid [13].

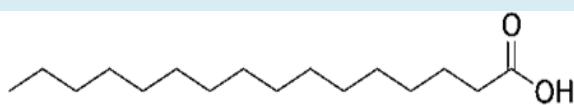


Figure 9: Palmitic acid.

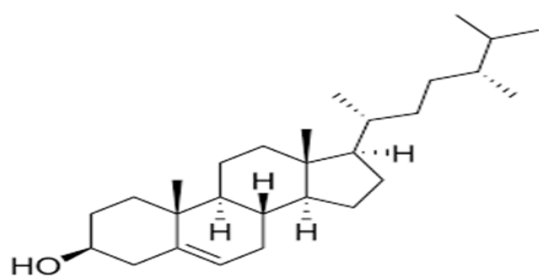


Figure 10: Campesterol.

Phytosterols: Campesterol, clinasterol, brophyllol, Avenasterol [14,15].

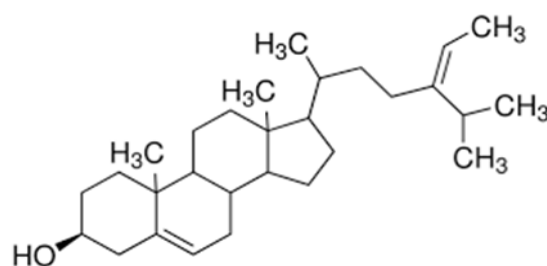


Figure 11: Avenasterol.

Bufadienolides: It is one of the main classes of active constituent in *B. pinnatum*. Bersaldegenin, Bryophyllin A, Bryophyllin B, Bryophyllin C, Bryotoxin A, Bryotoxin B [16-18].

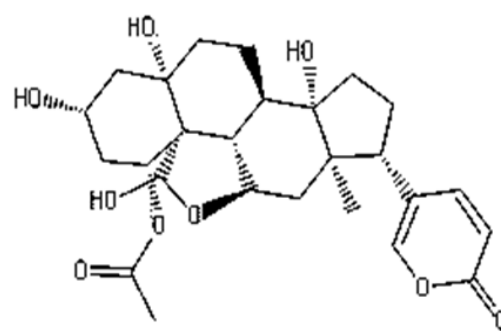


Figure 12: Bryophyllin B.

Triterpenoids: Bryophollone, bryophynol, Glutinol, Taxaxerone [19,20].

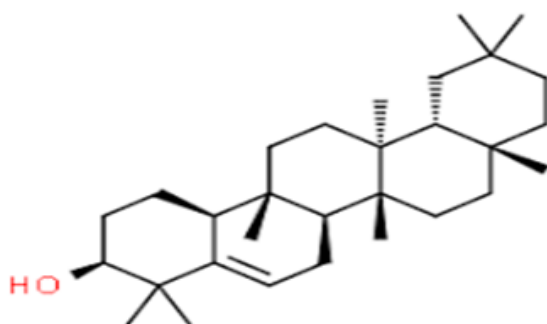


Figure 13: Glutinol.

The nutritional composition of *B. pinnatum* includes carbohydrates, protein, lipids, iodine, vitamins such as ascorbic acid, riboflavin, thiamine, niacin and pyridoxine,

amino acids including phenylalanine, glycine, cysteine, methionine, tyrosine and glutamic acid. The plant contains minerals such as Fe, Zn, Cu, Mg, P, Mn, K, Ca, Na. Sugar constituents include raffinose, lactose, sucrose, glucose, galactose, fructose [21,22].

Pharmacology

Dilation of vessels seem to play a major role in the herb's antihypertensive effect, while additional information is needed to clarify the plant's likely mechanism of hypotensive activity [23].

Hepatoprotective and Nephroprotective: Jaundice can be effectively treated using the juice of fresh leaves. Studies on the hepatoprotective action of the plant in vivo and in vitro demonstrated that the juice of leaf was more efficacious than the ethanolic extract [24]. The potential role of antioxidant and oxidative radical scavenging compounds in decreasing gentamicin-induced nephrotoxicity [25].

Anti-Ulcer Activity: Flavonoid is the potent water-soluble antioxidants and free radicals, that prevent oxidative cell damage, have *Bryophyllum pinnatum* strong anticancer activity [26]. It was discovered that a leaves methanolic fraction has remarkable antiulcer effects. A major decrease in the prevalence of ulcers and a dose-dependent elevation of stomach acid secretion by histamine, so validating its application as an anti-ulcer drug [27].

Anti-leishmanial Action: Leishmania protozoa infections are a significant global health issue, with a high endemicity in developing nations. Since the introduction of AIDS, the disease's incidence has increased substantially. Effective medications are sorely required to replace or enhance that now in use in the rare circumstance that a vaccination is not attainable. Plant extracts with naturally occurring chemicals with chemical descriptions (quercetin, coumarin) that have antileishmanial action [28].

Anti-diabetic Activity: Considering zinc is found in plants, it is possible that these plants can help manage diabetes, which is characterized by an inability to synthesize insulin [29,30].

Anti-bacterial Activity: The plant's antimicrobial effect is indicated by the presence of phenolic compounds. Plants have medicinal properties in managing bacterial infections, including typhoid fever and those caused by *K. pneumoniae*, *E. coli*, *B. subtilis*, *S. aureus*, *K. aerogenes*, *S. typhi*, *P. aeruginosa* [29]. Multiple gram-positive and gram-negative bacteria, including clinical isolates of *Shigella* spp, *B. subtilis*, *S. coli*, *Klebsiella* spp, *S. aureus*, *S. pyogenes*, *Proteus* spp, *Salmonella* spp, *S. marcescens*, and *P. aeruginosa* [30]. Five of the eight bacteria that were employed were shown to be inhibited by the methanolic leaf extract: *B. subtilis*, *E. coli*, *P. aeruginosa*, *P. vulgaris*, *S. dysenteriae*, *C. albicans* and *S. aureus*. In contrast, *Pneumonia*, *C. albicans* were found to be resistant to the extract's effects [31].

Anti-nephrolithiasis: Kidney stone occurs by aggregation of

CaOx. *Bryophyllum pinnatum* leaves extract shows inhibition of aggregation of crystal of CaOx and inhibition of stone formation [32].

Conclusion

The plant *bryophyllum pinnatum* has various phytochemicals like bufadienolides, phytosterols, carboxylic acid, flavonoids, fatty acids, phenanthrene derivative having various pharmacological properties such as anti-hypertensive, hepatoprotective, anti-ulcer, antileishmanial action, anti-nephrolithiasis, anti-bacterial property, originating from Madagascar and has spread in various countries. The review shows that many properties have yet to be explored as it has known to be as medicinal plant with numerous uses.

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