IJLSR (2019), Vol. 5, Issue 7 **Review Article**

IJLSR INTERNATIONAL JOURNAL OF LIFE SCIENCES AND REVIEW

Received on 25 April 2019; received in revised form, 21 May 2019; accepted, 23 June 2019; published 31 July 2019

MORPHOLOGY, PHYTOCHEMISTRY AND TRADITIONAL USES OF *BRYOPHYLLUM PINNATUM* – A REVIEW

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ABSTRACT: Medicinal plants have been known for millennia and are highly esteemed all over the world as a rich source of therapeutic agents for the prevention of various ailments. *Bryophyllum pinnatum* (Lam.) (Crassulaceae) is a perennial herb grows 3-5 feet tall, fleshy dark green leaves that are distinctively scalloped and trimmed in red, and bell like pendulous flowers. It is used in folk medicine in tropical Africa, tropical America, India, China, and Australia. *Bryophyllum pinnatum* (Lam.) Oken is an indigenous and exotic plant used widely by the traditional practitioners for treating various ailments like renal calculi, hypertension, asthma, cold, abscesses, bleeding disorders. The local people of southern India and Bengal use the plant in renal diseases as a source of Pashanabheda, which is commonly known as Parnabeeja, a member of Crassulaceae. Phyto-chemical investigations reveal the presence of alkaloids, cardiac glycoside, flavonoids. The present review is, therefore, an effort to give a detailed survey of the literature on its pharamacognosy, phytochemistry and traditional uses of the plant *Bryophyllum pinnatum*.

Keywords: *Bryophyllum pinnatum* (Lam.), Morphology, Phytochemistry, Traditional uses

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INTRODUCTION: Medicinal plants are rich source of novel drugs that forms the ingredients in traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates, bioactive principles and lead compounds in synthetic drugs. WHO pointed out that more than 80% of world's population depends on plants to meet their primary health care needs? [1]

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.IJLSR.5(7).97-03

Article can be accessed online on: www.ijlsr.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.IJLSR.5(7).97-03

Herbal medicine remains one of the most common forms of therapy widely available throughout the world population [2, 3, 4, 5]. Therefore to meet the increasing demand of manufacturing modern medicines and export, the need of the medicinal plants have enormously increased. In the traditional systems of medicines, most of the remedies were taken from plants, and they were proved to be useful though the rationale behind their use is not well established through systematic pharmacological and clinical studies except for some composite herbal drugs and plants [53]. This demand is generally met with by cultivating uprooted medicinal plants [6].

Bryophyllum pinnatum plant belongs to family Crassulaceae, commonly used as traditional

medicines. *Bryophyllum pinnatum* is derived from greek word Bryo means to sprout and phyllon means leaf [7]. The plant, *Bryophyllum pinnatum* (Crassulaceae) is commonly known as air plant, love plant, miracle leaf, life plant, Zakham-e-hyat, panfutti, Ghayamari [8], has been accepted as a herbal remedy in almost all parts of the world [9, 10, 11] *etc. Bryophyllum pinnatum* (Lam.) Oken plant is an environmental weed from the family Crassulaceae, but commonly used traditionally as a medicine in different regions of India mainly to treat urinary stones, as well as in other parts of world. The traditional practitioners in various parts of world use this plant in numerous conditions like hypertension, skin disorders, asthma, cold, insect stings, abscesses *etc*. [12, 13] The secondary metabolites which are obtained from different parts of plant such as alkaloid, flavanoid, tannin, glycoside, phenolic compounds,which have therapeutic value [7].

Taxonomical Classification: [6]

Kingdom	:	Plantae
Subkingdom	:	Tracheobionta
Division	:	Spermatophyta
Subdivision	:	Magnoloiphyta
Class	:	Mangnoliopsida
Subclass	:	Rosidae
Order	:	Saxifragales
Family	:	Crassulaceae
Genus	:	*Bryophyllum*
Species	:	*pinnatum*

Synonyms: *Bryophyllum calycinum* Salisb, *Kalanchoe pinnata* (Lam.) Pers, *Cotyledon pinnata* Lam., *Sedum madagascaricum* Clus [15].

Vernacular Names: [16, 17]

Sanskrit	:	Parnabeeja, Asthibhaksha
English	:	Air plant
Hindi	:	Zakhmhaiyat, Patharchoor
Kannada	:	Gandukalinga, Kadu basale
Malayalam	:	Elamarunga
Tamil	:	Malaikalli, Ranakalli
Telegu	:	Ranapaluka
Marathi	:	Gayamari
Bengali	:	Koppatha, Patharkuch

Geographical Indication: It is perennial herb growing widely and used in Folkoric medicine in tropical Africa, Tropical America, India, China, Australia, Asia, New Zealand, Philippines. The plant grows all over India in hot and moist areas, especially in Bengal and Uttarakhand [18].

Morphology:

Plant: *Bryophyllum pinnatum* is a succulent glabrous herb 0.3-1.2 m high.

FIG. 1: *BRYOPHYLLUM PINNATUM* PLANT

Stem: Stems obtusely four angled, older one are light coloured & younger ones are reddish speckled with white.

FIG. 2: *BRYOPHYLLUM PINNATUM* STEM

Leaves: Leaves are variable & decussate lower are usually simple / compound, upper ones are 3-5/7 foliolate with long petioled. Petioles are united by a ridge around the stem. Leaflets are ovate/ elliptic with crenate/ serrate margin.

Flower: Flowers are pendent, in large spreading panicles with opposite stout branches, pedicels slender. Sepals are red striated, green at the base & pale green above. Petals are reddish purple, swollen & octagonal at the base, lobes triangular. Filaments green at the base, pinkish below the anthers. Anthers are hastate, black. Styles green.

FIG. 3: *BRYOPHYLLUM PINNATUM* LEAF

FIG. 4: *BRYOPHYLLUM PINNATUM* FLOWER

FIG. 5: *BRYOPHYLLUM PINNATUM* FRUIT

FIG. 6: *BRYOPHYLLUM PINNATUM* SEED

Fruits and Seeds: Fruit are enclosed in a persistent papery calyx & corolla. Seeds are small, oblong-ellipsoid, smooth [19].

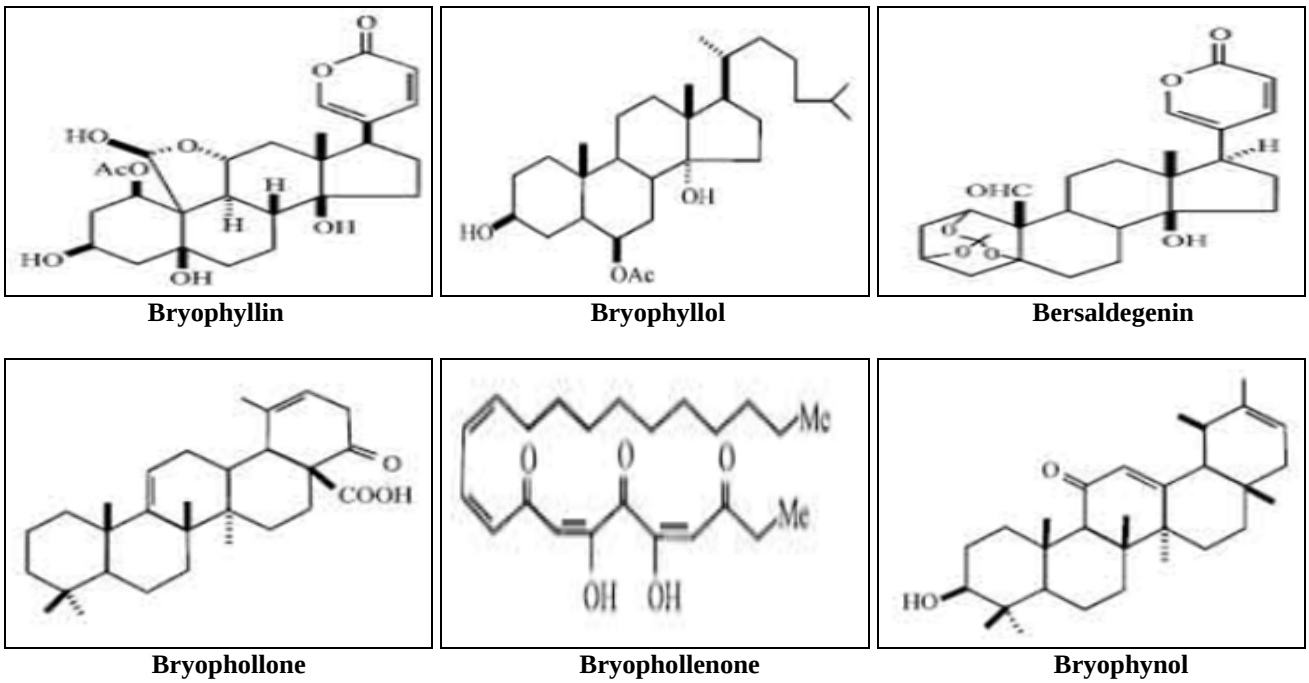
Chemical Constituent: The plant contain alkaloid, flavonoid, tannin, phenolic compound, saponin glycoside [20], macro element such as magnesium, calcium, potassium, sodium, phosphorous, micro-element such as iron, zinc, vitamin, ascorbic acid, riboflavin, thiamin, niacin. It also contain syringic acid, caffeic acid, 4 hydroxy -3-methoxy cinnamic acid, 4-hydroxy benzoic acid, parahydroxy cinnamic acid, para coumaric acid, ferulic acid, protocatechuic acid, phospoenolpyruvate, the leaves of plant also contain protocatechuic acid, astragalin, luteolin, rutin, kaemferol, quercetin, kaemferol-o-glycosides [21]. Three flavonoid was isolated from plant responsible for antileishmanial activity. It also contain Bufadienolides such as Bryophyllin A,B,C, Bryophyllon.

Phenols, Phenylpropanoids and Flavanoids: Syringic acid, caffeic acid [22], 4-hydroxy-3-methoxy-cinnamic acid, 4-hydroxybenzoic acid, p-hydroxycinnamic acid, paracoumaric acid, ferulic acid, protocatechuic acid, phosphoenolpyruvate, protocatechuic acid isolated from aerial parts of plants. Leaves contains astragalin, 3, 8-dimethoxy-4, 5, 7 trihydroxyflavone, friedelin, epigallo-catechin-3-osyringate, luteolin, rutin, kaempferol, quercetin, quercetin- 3L- rhamonsido- L- arabino furanoside; quercetin-3-Odiarabinoside, kaempferol -3-glucoside, kaempferol-3-O-α-L-arabinopyranosyl (1→2) α - L-rhamno pyranoside, quercetin-3-O-α-L-arabino pyranosyl (1→2)α -L-rhamno pyranoside and 4',5-dihydroxy-3',8-dimethoxy flavone-7O-β-D-glucopyranoside. Because of its restricted occurrence and its abundance in *B. Pinnatum*, flavonoid may be a chemical marker of the plant of high therapeutic potential [23, 24, 25].

Triterpenoids and Steroids: The plant contains α-amyrin, α-amyrinacetate, β-amyrin, β-amyrinacetate, bryophollenone, bryophollone, taraxerol, Ψ-taraxasterol, pseudo taraxasterol, 18-α- oleanane, friedelin, glutinol. The cardienolide and steroidal contents includes β-sitosterol, bryophyllol, bryophynol, bryophyllin B (Antitumor), bryophyllin A (bryotoxin C, bufadienolide1, 3, 5-

orthoacetate) with potent cytotoxicity, a insecticidal bufadienolide bryophyllin C and bersaldegenin-3-acetate, bryotoxin A, bryotoxin B, bersaldegenin-1, 3,5-orthoacetate, campesterol, 24-ethyl-25-hydroxy -cholesterol, isofucosterol, clionasterol, codisterol, peposterol, 22-dihydrobrassicasterol, clerosterol, 24-epiclerosterol, 24ethyl-desmosterol, 25-methyl-5α-ergost-24-en-3-β-ol, ergosta-5-24-dien-3-β-ol, 25-methyl-ergosta-5-24 -dien3-β-ol, 5α-stigmast-24-en-3-β-ol, (24s)-stigmast-25-en-3-β-ol, (24r)-5α-stigmasta-7-25-dien-3-β-ol, (24s)-5α-stigmasta-7,25 dien-3-β-ol, 24(R)-stigmasta-5,25-dien-3β-ol, stigmasterol, patuletin, 3- O- (4- O- acetyl-α-L-rhamnopyranosyl)-7O-(2- O- acetyl-α- L- rhamno pyranoside) patuletin, 3-O-α-L-rhamno pyranosyl-7-O-(2-O-acetyl-α-L-rhamno pyranoside) patuletin, 3-O-(4-O- acetyl-α- L- rhamno pyranosyl)-7-Orhamno pyranoside patuletin are isolated from aerial parts [26, 27].

Fatty Acids, Minerals and Others: Fatty acid fraction includes palmitic acid (89.3%), stearic acid (10.7%), traces of arachidic and behenic acid. Plant also contains HCN, oxalic acid, citric acid, isocitric acid, oxaloacetate, malic acid and succinic acid. The plant is rich in vitamins and aminoacids; ascorbic acid, riboflavin, thiamine, niacin, pyridoxine, glycine, cysteine, casein hydrolysate, glutamic acid, protein hydrolysate, methionine, tyrosine, phenylalanine [28]. Food contents are carbohydrates, protein, lipids, acids, iodine. The herb is good source of mineral elements such as Na, Ca, K, P, Mg, Mn, Fe, Cu, Zn. Sugar contents includes raffinose, lactose, sucrose, glucose, galactose, fructose. Plant also contains alkaloids, tannins, phenanthrene derivatives: 2(9-decenyl)-phenanthrene, 2(9-undecenyl) - phenanthrene, alkanes (C 25-35), alkanols (C 26-34), ntriacontane, hentriacontane [29].



Bryophyllin **Bryophyllol** **Bersaldegenin**

Bryophollone **Bryophollenone** **Bryophynol**

FIG. 7: PHYTOCHEMICAL OF *BRYOPHYLLUM PINNATUM*

Traditional Uses:

- The leaves and bark of *B. pinnatum* are bitter tonic, astringent, analgesic and carminative, ethanopharmacologically used for the treatment of diarrhea and vomiting, earache, burns, abscesses, gastric ulcers, insect bites, and lithiasis [30, 31, 32, 33].

- The plant has also been employed for the treatment of edema of legs [34]. Leaves powder used as wound dressing and sold as 'Jakhmehayat'. In Southeastern Nigeria, the herb is used to facilitate the dropping of the placenta of newly born baby [35, 36].

- The juice from fresh leaves is used to treat smallpox, otitis, cough, asthama, palpitatious, headache, convulsion and general debility 37. Leaf juice is also used in the treatment of bronchial affections, blood dysentery, jaundice and gout [38].

- In traditional medicine, the leaves of the plant also have been used for antifungal, potent antihistamine and anti-allergic activity [39, 40].
- This is also applied on the bodies of young children when they are ill [30].
- It is largely used in folk medicines for the treatment of hypertension and kidney stones, [41] pulmonary infections, rheumatoid arthritis *etc*.[42]
- The plant proved to be useful in vitiated conditions pitta and vata, epilepsy, piles [43], haematemesis, haemorrrhoids, menorrhagia, cuts and wounds, discolourations of the skin, boils, ophthalmia, scalds, corn [44, 45].
- *Byophyllum pinnatum* is a refrigerant, emollient, mucilaginous, haemostatic, vulneray, depurative, constipating, anodyne, disinfectant, antitonic. The plant has hepatoprotective activity and is also used to increase vascular integrity [46].
- *Bryophyllum* can reduce fever and does provide anti-inflammatory & muscle relaxant effects [47].
- Its anti-inflammatory effects have been partially attributed to the immunomodulatory and immune suppressant effect [48, 49].
- In Odisha the plant is identified as Basampatri, its leaves are used in flatulence.
- Thukotali is the local name in poojapura (Kerala), people use crushed leaves externally to apply over the burn wound.
- Similarly in West Bengal & Andhra Pradesh the matured leaves are made warm and are placed over the wounds and tied [50].
- In konkan the leaf juice is used in dysentery with ghee. Two tea spoon of leaf juice is given in renal calculi [51].
- In Chota Nagpur the steamed leaf juice is used in cough along with ghee/ garlic. The leaves are treated with palm oil & used externally in sore eyes [52].

Uses: The leaves of *Bryophyllum pinnatum* plant have been reported to possess antileishmanial anticancer, Immunosuppressive, antiulcer, anti-inflammatory and anthelmintic, antihistaminic, antifungal, analgesic antihypertensive, antidiabetic and antimutagenic activities. CNS depressant antibacterial and insecticidal actions. It was studied that the juice of leaves is used in hepatoprotective activity of plant and also used in treatment of jaundice. The nephrotoxicity in rats which may be due to its antioxidant and oxidative radical scavenging activities. It is also used for the treatment of kidney stones in India The leaves of juice also used in cholera, also used in toothache and wound healing. The quercetin has nephro-protective and antioxidant role in panfuti plant. The fatty acids present in *Bryophyllum pinnatum* may be responsible for immunomodulatory activity [18].

CONCLUSION: *Bryophyllum pinnatum* (Lam.) Oken is an indigenous and exotic plant used widely by the traditional practitioners for treating various ailments like renal calculi, hypertension, asthma, cold, abscesses, bleeding disorders. This paper provides information about the *Bryophyllum pinnatum* plant. In this paper highlighted part of plant like stem, leaves, flower, fruit, seed *etc*. and also describe phytochemistry, Traditional use and use.

ACKNOWLEDGEMENT: The authors thank Prof. Dr. Raghuvir Irchhaiya, Head of Department of Institute of Pharmacy, Bundelkhand University. The authors also thankful to Mr. Nandlal Singh and Dr. Shashi Alok for his valuable suggestion during the work.

CONFLICT OF INTEREST: We declare that we have no conflict of interest.

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How to cite this article:
Salauniyan S, Irchhaiya R, Singh N, Alok S, Chanchal DK and Bijauliya RK: Morphology, phytochemistry and traditional uses of *Bryophyllum pinnatum* – A review. Int J Life Sci & Rev 2019; 5(7): 97-03. doi: 10.13040/IJPSR.0975-8232.IJLSR.5(7).97-03.

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