A Review on Pharmacological Activities of *Bryophyllum Pinnatum*

Dr. Nutanvarsha P. Deshmukh
Assistant Professor
Department of Botany
Shri Shivaji Arts, Commerce and Science College,
Akot, Maharashtra, India
nutudeshmukh@gmail.com

ABSTRACT

Bryophyllum pinnatum is one of the important and most used plant belongs to the family crassularaceae. This plant is mainly used as a tropical medicinal plant in India, America and other countries. The presence of various chemical constituents in this plant can be used as a medicine for various diseases. The important chemical constituents present in the plant include alkaloids, triterpenes, flavonoids, lipids, glycosides, phenols, bufadienolides, and organic acids. Due to the presence of these chemical constituents *Bryophyllum pinnatum* shows various pharmacological activities like, nephroprotective, antioxidant, analgesic, anti-diabetic, antimicrobial, anticonvulsant antipyretic, and neuropharmacological activity. This review covers various pharmacological activities of the plant *Bryophyllum pinnatum*.

Keywords: *Bryophyllum pinnatum*, Plant, glycosides, leaves.

INTRODUCTION

Bryophyllum pinnatum. Linn (family: crassularaceae) is one of the most important medicinal plant. *Bryophyllum pinnatum*. linn plant commonly known as love plant[1], miracle leaf, life plant…etc[2] .In Nigeria this plant is locally called as "Never Die" plant and one of the popular plants in folklore medicine[1]. This plant is widely used by traditional practitioners for hypertension[3], skin disorders, asthma, cold, insect stings, and abscesses. In Ayurvedic science it is commonly known as *Parnabeeja*[4]. These are also used in bleeding disorder, ulcer, and diarrhoea[5]. The main chemical constituents of this plant include alkaloids, flavonoids, glycosides, steroids, bufadienolides, and organic acid et[6]. It is a perennial herb which is about 1mtall. Stem is fleshy and cylindrical and youngest stem are reddish in colour. It is growing primarily in rain forests and distributed worldwide. It is astringent and sour in taste· The nutritive value of fresh and dried leaves of *Bryophyllum pinnatum* shows that the carbohydrate values were the highest and ash had the least value. Calcium and potassium levels are high and lead and zinc levels are law in both fresh and dried samples. Presence of large amount of various chemical constituents in the plant *Bryophyllum pinnatum* shows various pharmacological actions. So this plant *Bryophyllum pinnatum* can be used for the treatment of various disease conditions. The leaves of *Bryophyllum pinnatum* show various pharmacological activities such as anti-diabetic, anti-inflammatory, anti-nociceptive, anti-hypertensive, neuroprotective etc. The leaves of *Bryophyllum pinnatum* are fleshy simple or compound in nature. Flowers are bell- shaped, drooping and are arranged in branched clusters at the tips of the stem. The fruits of the plant are papery and membranous with four slender compartments. In this review some of the pharmacological activities of *Bryophyllum pinnatum* are mentioned.

Plant Profile

Kingdom	: Plantae – Plants
Sub kingdom	: Tracheobionta
Division	: Spermatophyta
Subdivision	: Magnoliophyta
Class	: Magnoliopsida
Subclass	: Rosidae
Order	: Rosales
Family	: Crassulaceae
Genus	: Bryophyllum
Species	: *Bryophyllum pinnatum* kurz

Synonyms

Hindi	: Jakh Me Hayat, Panfuti
Sanskrit	: Parnabija
Bengali	: Koppata
Gujarati	: Ghaymaari
Telgu	: Simahmudu
Tamil	: Ranakalli Malayalam : Ellamurunga

Morphology

Bryophyllum pinnatum is a succulent glabrous herb with a height of 0.3-1.2m.

Stem:

The younger stems of *Bryophyllum pinnatum* are reddish speckled with white and older one arelight coloured, the stems are obtusely four angled. The stems are upright, fleshy, and hairless.

Leaves:

Lower leaves are simple or compound in nature and the upper leaves are 3-5/7 foliolate with longpetioled. The petioles are united by a ridge around the stem. The leaflets are ovate or elliptic withcrenate or serrate margin. The leaves are green and yellowish-green in colour. The flowers are borne on a stalk, about 10-25 mm long. The plantlets are produced mainly when the leaves become detached from the stem.

Flower:

The flowers are pendent in large spreading panicles with opposite stout branches, pedicles are slender[4]. Flowers are mainly bell-shaped, drooping and are arranged in branched clusters at the tip of the stem. The flowers are yellowish green or pale green coloured prominent sepals. Flowers are mainly produced during winter and spring.

Chemical Constituents

The plant *Bryophyllum pinnatum* shows various pharmacological activities. The chemical constituents present in the various parts of the plant are responsible for these activities shown by the plant. The major chemical constituents present in the plant are,

- Isocitric acid & citric acid.
- Bufadienolides like bryotoxin A, B, C
- Phenols, Phenylpropanoids and Flavanoids: Syringic acid, caffeic acid, 4-hydroxy-3-methoxy-cinnamic acid, 4-hydroxybenzoic acid, p-hydroxycinnamic acid, paracoumaric acid, ferulic acid, protocatechuic acid, phosphoenolpyruvate, protocatechuic acid.
- Triterpenoids and Steroids: α-amyrin, α-amyrinacetate, β-amyrin, β-amyrinacetate, bryophollenone , bryophollone , taraxerol , pseudo taraxasterol, 18-α-oleanane, friedelin, glutinol[8].
- Vitamins including ascorbic acid, riboflavin, thiamine, niacin and minerals such as calcium, zinc and phosphorous are present in the leaves.
- Study on phytochemical constituents present in the ethanol extract of the leaves of *Bryophyllum pinnatum* on GC-MS analysis shows the presence of compounds like, butyrolactone,3,4-Epoxytetrahydrothiophene-,1,1-dioxide,1-Octen-3ol, Benzaldehyde,Oleic acid, Octadecanoic acid, n-Hexadecanoic acid[9].
- Study of *Bryophyllum pinnatum* stem shows the presence of active constituents alkaloids,flavonoids, saponin, Tannin, phytate, phenol, calcium, magnesium, phosphorous, sodium,and potassium[10].

Ethanopharmacology

The *Bryophyllum pinnatum* leaves and bark are bitter tonic, astringent, analgesic and carminative, so ethanopharmacologically it is used for the treatment of diarrhoea, vomiting, ear ache, burns, abscesses, gastric ulcers, insect bites and lithiasis. The fresh leaf juice is used for thetreatment of smallpox, otitis, cough, asthma, palpitation and general debility[11]. The leaf powderis used for wound dressing. It is largely used in folk medicine for treating hypertension, kidney stones[12], pulmonary infections and rheumatoid arthritis…etc[13]. In Odisha the plant *Bryophyllum pinnatum* is known as Basampatri and the leaves of this plant is used in fluctulence. In Kerala theleaves of *Bryophyllum pinnatum* is crushed and is externally applied over the wounds and tied[4]. The juice of the leaves is used to treat dysentery with ghee. Two tea spoon leaf juice is used inthe treatment of renal calculi[14]. In Nagpur the steamed leaf juice along with ghee or garlic is usedfor the treatment of cough. The leaves with palm oil are also used for the treatment of sore eyes externally.

Ayurvedic properties

Rasa : Kashaya, Amla

Guna : Laghu

Virya : Sheeta

Vipaka : Madhura Doshaghnata : Vatakaphahara
Karma : Ashmarighna, Vranaropaka, Mootrala, Shonita

Pharmacological Uses

The leaves of *Bryophyllum pinnatum* used in holistic medicines for curing kidney and urinary bladder stone, intestinal problems, ulcers, arthritis, inflammation, conjunctivitis, menstrual disorders, migraine, wound and dysentery[5]. According to Ayurveda the leaves are moderately toxic to insects. But in Unani the bark of this plant is toxic, alexipharmic, mordant to the bowel. The leaves of this plant is also used against various microbial infections. They act as antineoplastic[16], antibacterial, antiviral, anti-fungal, anti-insecticidal, anti-inflammatory, anti-ulcer, and also possess anti-allergic and anti-histaminic property. Some of the important pharmacological properties of *Bryophyllum pinnatum* are given below.

Figure1: Bryophyllumpinnatum leaves

Figure 2: *Bryophyllum pinnatum* leaf reproduction

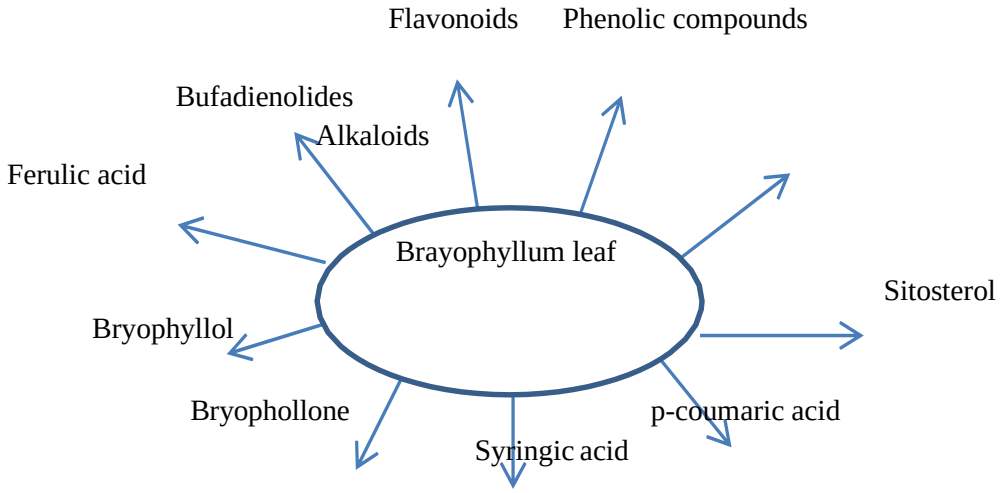

Figure 3 : Chemical constituents present in the leaves of *Bryophyllum pinnatum*

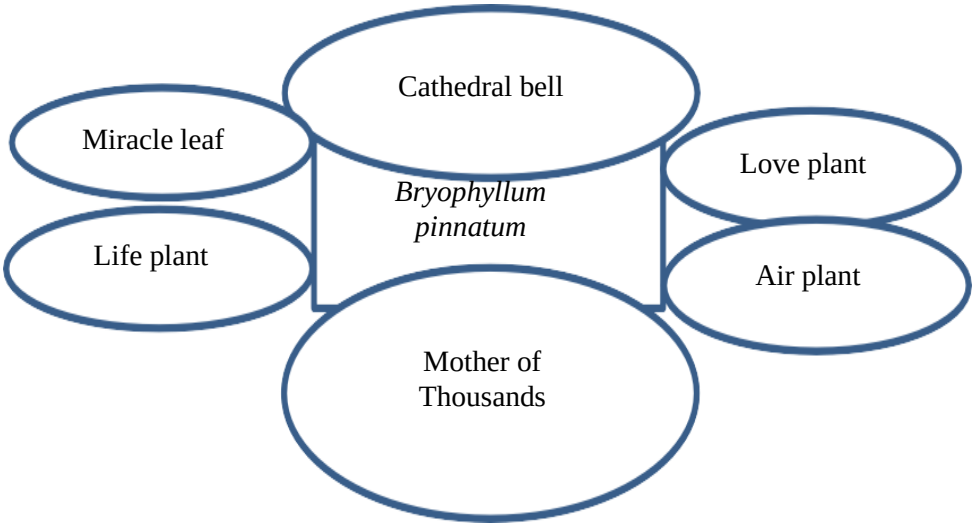

Figure 4: common names of *Bryophyllum pinnatum*

Antimicrobial activity

The antibiotic resistance among bacteria to synthetic drug is increasing day by day, so the needof new and safer antimicrobials mainly from natural sources like plants is important. *Bryophyllum pinnatum* leaves are used to inhibit bacterial growth, also the plant used in the treatment of typhoid fever and other bacterial infections, mainly *S.aureus, E.coli, B.subtilis, P.aeuroginosa, K.aerogenes, K.pneumoniae* and *S.typhi.* Chemical compounds bryophyllin Aand bryophyllin C shows strong insecticidal activity against third instar larvae of the silkworm. 5-methyl-4,5,7-trihydroxy flavones and 4,3,5,7-tetrahydroxy-5-methyl-5-propenamine anthocyanidines these are two novel flavonoids which

shows potential anti-microbial activities against *Pseudomonas aeroginosa, Klebsiella pneumonia, E.coli* etc. Using 60% methanolicextract of *Bryophyllum pinnatum* leaf which shows good antibacterial activity by inhibiting the bacterial growth at a concentration of 25mg/ml. These compounds show varying levels ofinhibitory activity against these pathogens. Microbial infections on wounds delay the healing process, and which will cause acute inflammatory reaction, which will cause tissue injury and damage. The antimicrobial activity of *Bryophyllum pinnatum* leaves due to the presence of these two compounds may contribute to wound healing, eliminate infections, and there by resulting to cell proliferation. These studies help to understand the use of *Bryophyllum pinnatum* in ethanomedicine in Southeastern Nigeria for the treatment of burns, abscesses, ulcers, boils and healing of placenta of newly born baby. Similarly this study also helpful for understand the useof *Bryophyllum pinnatum* for the treatment of asthma, cough, bronchitis, skin infections such as boils, carbuncles, abscess, sores and wounds treatment in herbal medicine[28]. Phenanthrene alkaloid isolated from ethanolic extract of *Bryophyllum pinnatum* leaves 1-ethanamino-7-hex— yne-5-one phenanthrene shows antimicrobial activity. This compound inhibits *Pseudomonas aeroginosa, Klebsiella pneumonia, Staphylococcus aeroginosa, Escherichia coli, Candida albicans* and *Aspergillus niger*[17].

Anti-ulcer activity

The studies on the methanolic extract of *B.pinnatum* leaves shows inhibition in the development of variety of types of acute ulcers induced in the stomach and duodenum of rats and guinea pigs. This extract helps to increase the healing rate of acetic acid induced gastric ulcers in rats[18]. The methanolic extract of *Bryophyllum pinnatum* shows a dose-dependent gastro-protective effect on indomethacin induced ulceration in rats. The extract causes a decrease in both basal and histamine-induced gastric acid output. The decrease in gastric acidity was progressively duration and dose dependent.

Antileishmanial activity

Bryophyllum pinnatum consist of flavonoids like quarcertin, leuteolin was recently described as antileishmanial drug with low toxicity. Similarly proanthocyanin, kaempferol di-glycoside, flavonol and flavone glycosides also show antileishmanial activity. The aqueous leaf extract of *Kalanchoe pinnata* contain kaempferol di-glycoside, named kapinnatoside, which later identifiedas kaempferol-3-o-L-arabinopyranosyl-L-rhamnopyranoside,40,5-dihydroxy-30,8-dimethoxyflavone-7-O-b-Dglucopyranoside. Two unusual flavonol and flavone glycoside already reported the presence of these chemical. *Kalanchoe pinnata* contain abundant of these chemicals these plant shows high therapeutic potential. These flavonoids separately tested to determine their antileishmanial activity by comparing with quercitrin, quercetin, and afzelin. Presence of quercetin aglycon type structure and a rhamnosyl unit linked at C-3 is important for antileishmanial activity.

Antihelmintic activity

Helminthic infection is one of the most common infections in man, affecting a large population. The tannins present in the *Bryophyllum pinnatum* shows antihelmintic activity. The chloroform, methanol and aqueous extract of *Bryophyllum pinnatum* root causes death of worms and showed significant antihelmintic activity. The activity against Indian earth worm *Pheretima posthuma* is also investigated. Various concentrations of deferent extracts are tested (30 and 50 mg/ml) and determined the time of paralysis and death of the worms. The studies show that the methanolic extract shows significant anthelminthic activity compared to piperazine citrate (15mg/ml). Studies shows the potential usefulness of *Bryophyllum pinnatum* whole plant shows anthelminticactivity.

Anticancer activity

The ethanolic extract of *Bryophyllum pinnatum* shows anticancer activity. Various studies show that the bufadienolides present in *B.pinnatum* is a potent chemopreventive agents. Through MTT assay on the highly metastatic human HT-1080 fibrosarcoma cell line showed that the methanolic, aqueous, and methanolic-aqueous extracts have mild antiproliferative activity[22]. The chloroform extract of *Bryophyllum pinnatum* leaf can act as an anti-HPV molecule and

shows an apoptosis inducing property. This study provides an important lead for developing anticancer therapeutic agent for the management of cervical cancer. In this study the growth inhibitory activity of the crude leaf extract was studied and investigation of the antiviral activity of the extract showed a specific anti-HPV activity on cervical cancer cells. So the study demonstrates the presence of anticancer and anti HPV activity of *Bryophyllum pinnatum* leaf extract, so this extract can be used for therapeutic treatment for HPV infection as well as cervical cancer[23].

Wound healing activity[4]

The wound healing property of *Bryophyllum pinnatum* leaf extracts in petroleum ether, water,and alcohol in the dose of 400mg/kg orally on healing of excision wound, re-sutured incision anddead space wound models in Albino rats for 10 consecutive days. When compared to control group all the three extracts water, alcohol, and petroleum ether showed significant increase in thebreaking strength of incision wound. The water extract was topically applied for excision wound model for 21 days till the formation of eschar[24].

Uterine Contractility

The studies using *Bryophyllum pinnatum* shows that it increases contraction frequency by 91% atconstant amplitude and inhibited oxytocin stimulated contraction by 20% at constant amplitude with slightly decreased frequency[25]. Studies show that *Bryophyllum pinnatum* and beta agonists were equal in the prolongation of pregnancy, pre and postpartum duration of pregnancy, with less adverse effects. In case of *Bryophyllum pinnatum* the neonatal outcome and morbidity were equal or better. *Bryophyllum pinnatum* is no or less effective when compared to beta agonists butis significantly better tolerated in the management of preterm labour[26].

Hepatoprotective activity

According to the study of Yadav.et.al the aqueous extract of *Bryophyllum pinnatum* or juice of leaves is more effective than ethanolic extract of *Bryophyllum pinnatum*. It was determined by *in-vivo* and *in-vitro* histopathological study of rat by oral route of administration. The ethanolic extract of *Bryophyllum pinnatum* also shows the hepatoprotective activity[27].

Neuroprotective activity

The aqueous leaf extract of *Bryophyllum pinnatum* shows neuropharmacological activities in mice. The extract was found to produce a profound decrease in exploratory activity in dose dependent manner. The *Bryophyllum pinnatum* extract also showed a marked sedative effect as evidenced by a significant reduction in gross behaviour and potentiation of pentobarbitone- induced sleeping time. It also delayed the convulsion (seizure) induced by strychnine and picrotoxin. It also decreases the rate of mortality induced by picrotoxin in mice with LD50 of 641mg/kg. All these studies show that the *Bryophyllum pinnatum* possesses depressant action on CNS[28].

Immunosuppressive effect

The aqueous extract of leaves of *Bryophyllum pinnatum* shows significant inhibition of cell- mediated and humoral immune response in mice. Similarly the animals pre-treated with plant extract, the spleen cells of animal showed a decreased ability to proliferate in response to both mutagen and antigen *in-vivo*. In mice treated with the extract shows a delayed type hypersensitivity reaction to ovalbumin[29].

Antihypertensive activity

The aqueous and methanolic leaf extract of *Bryophyllum pinnatum* shows antihypertensive activity in arterial blood pressure and heart rates of normotensive and spontaneously hypertensive rats. Also reduce the force of contraction of guinea pig isolated atria in dose dependent manner[30].

Anti-diabetic activity

The present study reveals that the aqueous leaf extract of *Bryophyllum pinnatum* in four different doses ie, 200,400,800mg/kg and 800mg/kg+ glibenclimide 2mg/kg in diabetic induced rat shows anti-diabetic activity. In these

four the mixture of 800mg/kg aqueous extract+ glibenclamide 2mg/kg is more effective and efficient than other extracts.

Neuropharmacological action

Studies shows that the crude extract of *Bryophyllum pinnatum* leaf produce significant alteration in the general behaviour pattern, potentiation of phenobarbitone induced sleeping time in dose dependent manner and reduction of spontaneous mortality. The aqueous extract of *Bryophyllum pinnatum* shows minor anticonvulsant effect by delaying seizure produced by strychnine and picrotoxin.

CONCLUSION

From the above review it is clear that *Bryophyllum pinnatum* is a most commonly available medicinal plant in India, and it shows various pharmacological activities. It possesses a few active constituents. Which mainly consist of flavonoids, steroids, bufadienolides, glycosides, and organic acids etc. It shows pharmacological activities such as antimicrobial activity, antifungal, anticancer, anti-tumour, and insecticidal actions. And shows anti-ulcer, anti-inflammatory, analgesic, antihypertensive, hepatoprotective, nephroprotective, diuretic, anti- diabetic, anticonvulsant, antioxidant, muscle relaxant, tocolytic activity, and neurosedative activity. This review shows the pharmacological potential of plant *Bryophyllum pinnatum* this review is helpful for researcher to know more about this plant.

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