WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal Homepage: www.ijrpr.com ISSN 2582-7421

Development of a Plant-Based Hydrogel Using Bryophyllum pinnatum for Potential Wound-Healing Applications

Sarvesh Diswah[1]*, Mr. Rahul[1], Mehak[2], Pooja[3], Suraj Prakash[4]

[1-4] Abhilashi University

ABSTRACT

Bryophyllum pinnatum is one of the important and most commonly used plant belongs to the family crassularaceae. Bryophyllum pinnatum commonly known as Patharchata. This plant is mainly used as a tropical medicinal plant in India, America and other countries. The physiochemical study shows presence of alkaloid, flavanoid, lipids, organic acids, phenols, triterpene, glycoside. It is widely used in treatment of haemostatic and wound healing. It is also used in treatment of CNS depressant, analgesic, anti-inflammatory, antidiabetic, anticonvulsant, anticancer, antiallergic, nephroprotective, hepatoprotective, antileishmanial, antiulcer activity Medicinal herbs have been utilised for centuries because they are safer, more effective, culturally acceptable, and have less adverse effects than manufactured medications. Therefore, I have focused my interest on making hydrogel from the medicinal plants bryophyllum pinnatum in the present review that have anti-inflammatory and analgesic property.

INTRODUCTION

Medicinal Plant: Medicinal plants or herbs are those plants which have medicinal value in them, these plants used since ancient times for their medicinal purpose and welfare of human beings. These plants mainly use to make Ayurveda medicine, as time passed different pharmaceutical industries also started to use these plants or herbs to herbal preparation. Plants have been major contributors to human welfare since the dawn of civilization. Besides food, shelter and clothing, they are an important source of fine chemicals which find their application in pharmaceutical industries across the globe. Nature indeed serves as a rich storehouse of herbal remedies to cure various ailments [1].

Herbal plants used from ancient time for the treatment of various diseases and used them for different type of therapy. In the modern days this herb is also use as various source of phytoconstuents like alkaloids, flavonoids, terpenoids, phenols, etc. Plant based traditional knowledge has become a recognized tool in search of drugs and neutraceuticals10. Today, according to World Health Organization as many as 80% of the world's people depend on traditional medicine for primary health care needs. The herbal medicines are comparatively safer than synthetic drugs [2].

The plant Bryophyllum pinnatum belongs to the family Crassulaceae, which has been widely utilized in conventional medicine. The term *Bryophyllumpinnatum* is derived from the Greek terms bryo, which means to sprout, and phyllon, which means leaf (1).Alkaloids, flavonoids, tannins, glycosides, and phenolic chemicals are examples of secondary metabolites that can be extracted from various plant sections and have medicinal significance(2). In practically every region of the world, the plant Bryophyllum pinnatum (Crassulaceae), also known as the air plant, love plant, miracle leaf, life plant, Zakham-e-hyat, panfutti, and ghayamari, is recognized as a natural cure (3). Africa and Asia are home to the perennial succulent herb known as Bryophyllum pinnatum, sometimes known as Kalanchoe pinnatum. One of the most often used medicinal plants, it was used to treat a wide range of infectious diseases. The leaves or the entire plant are used to cure external sores, burns, convulsions, syphilis, jaundice, candidiasis, and dysmenorrhea. This plant is used to cure cough, diarrhoea, and ear infections(4).

PLANT DESCRIPTION [1]

Plant Name: Bryophyllum pinnatum Synonym: Kalanchoe Pinnata Family : Crassulaceae

Common name: Life plant, air or Maternity plant, love plant,Canterberry bells, Cathedral bells, Parnabija etc.

TAXONOMICAL STUDIES [2]

Kingdom- Plantae Subkingdom- Tracheobionta Division- Spermatophyta Subdivision -Magnoloiphyta Class-Mangnoliopsida Subclass- Rosidae

Order Saxifragales

Family Bryophyllum

MORPHOLOGY

The succulent glabrous herb *Bryophyllumpinnatum*grows between 0.3 and 1 .2 meters in height.

STEM:

Older Bryophyllum pinnatum stems are light in colour and obtusely four-angled, whereas younger stems are reddish with white speckles. They have thick, hairless stems that stand upright.

LEAVES:

The upper leaves are 3-5/7 foliolate with long petioles, while the lower leaves are simple or compound in structure. The colour of the leaf's ranges from green to yellowish green. The stem, which is between 10 and 25 mm long, bears the blooms. When the leaves separate from the stem, the plantlets are mostly created.

FLOWER:

The flowers are mostly bell-shaped, drooping, and grouped in branched clusters near the stem's apex. The flowers have noticeable sepals that are either pale green or yellowish green in colour. Mostly in the winter and spring, flowers are produced[5]



(Fig.1 BRYOPHYLLUM PINNATUM)

GEOGRAPHICAL SOURCE

It is a perennial herb that grows worldwide and is utilized in folk medicine in the Philippines, New Zealand, India, China, Australia, and tropical Africa and America. In hot, humid climates across India, particularly in Bengal and Uttarakhand, the plant thrives.[2]

MACROSCOPICAL CHARACTER

The plant can grow up to one and a half meters in height. The plant typically has a hollow, branching, four-angled stem. The lower leaves are simpler, while the top leaves are foliate (three to seven in number) and have long petioles. The leaves are around 10 to 20 cm long and oriented in the opposite direction. Vegetative buds are also seen on the leaves. Although the corolla is scarlet to purple, the calyx is tubular, and the flowers are bell-shaped. Four ellipsoid septa and smooth, striate seeds are present in the fruit pod. Fruits are typically visible in April, while blossoms are typically seen from November to March (1).

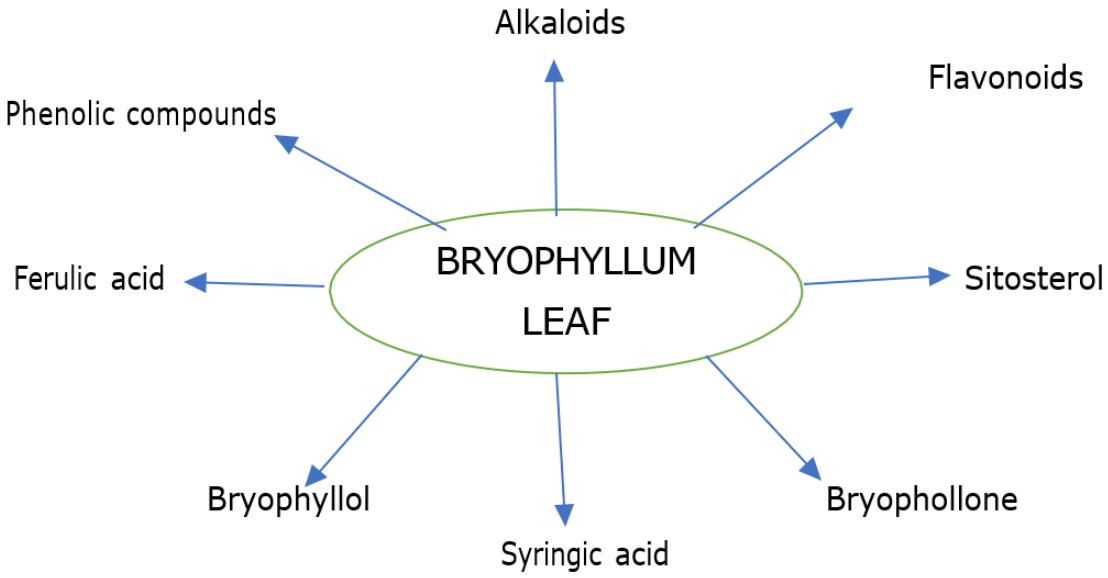
MICROSCOPICAL CHARACTER

1. There is a thin sheet on the abaxial side and a curved surface on the adaxial side of the little character. Its epidermal coating is strident and adaxial, with small, less noticeable compartments. The midrib's stranded tissue is made of parenchyma. They are compressed, spherical, and pointed cells.
2. The vascular strand is small, single, and semicircular in shape. It has a broad band of phloem and a dense parallel symphony of xylem.
3. Xylem is a tiny, tapered wall component. The vascular packs are parallel to each other and upright. While the mesophyll is divided into palisade and mushy parenchyma, the lamina is smooth. These stomata are of the anisocytic type and are richly formed.
4. The longitudinal segment of greeneries shows occurrence of coiled vessels.

The trichomes are lacking on abaxial cross and adaxial cross [6]

CHEMICAL CONSTITUENT

- Citrus and socitric acid
- Bufadienolides such as bryotoxins A, B, and C
- Phenols, Phenylpropanoids, and Flavonoids: phosphoenolpyruvate, paracoumaric acid, ferulic acid, 4-hydroxy-3-methoxy-cinnamic acid, 4-hydroxybenzoic acid, p-hydroxycinnamic acid, syringic acid, caffeic acid, and protocatechuic acid
- Triterpenoids and steroids: 18-α-oleanane, friedelin, glutinol, bryophollenone, bryophollone, taraxerol, pseudo taraxasterol, α-amyrin, α-amyrinacetate, β-amyrin, β-amyrinacetate, and bryophollenone[7]



(Chemical constituents present in the leaves of Bryophyllum pinnatum) [6]

ETHANOPHARMACOLOGY

In ethanopharmacology, Bryophyllum pinnatum is used to treat lithiasis, burns, abscesses, gastric ulcers, vomiting, diarrhea and insect bites because its leaves and bark are bitter tonic, astringent, analgesic, and carminative. Smallpox, otitis, cough, asthma, palpitations, and general weakness are all treated with the fresh leaf juice [8]. The wound was dressed with leaf powder. The plant's leaves are useful both internally and externally and have many therapeutic qualities. leaves with a variety of uses, including tonic, anti-inflammatory, antibacterial, emollient, mucilaginous, refrigerant, emmostatic, and at-risk. Cuts, wounds, hemorrhoids, skin discoloration, abscesses, soft sores, conjunctivitis, burns, lumps, corn, diarrhea, headache, vomiting, severe inflammation, and bronchitis are among the conditions in which they are helpful. Without leaving a scar, it promotes ulcer cooling and decreases edema [9].

Ayurvedic properties [10] Rasa: Kashaya, Amla Guna: Laghu

Virya: Sheeta

Vipaka: Madhura

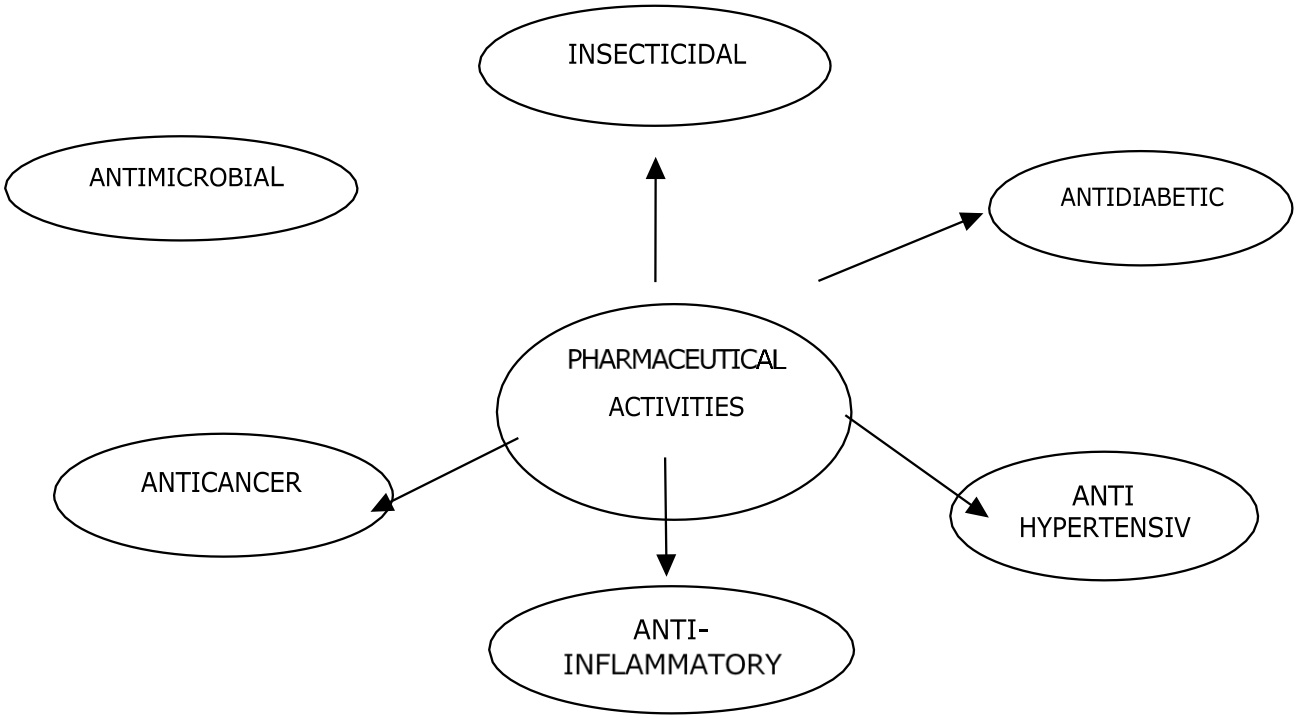
Doshaghnata: Vatakaphahara

Karma: Ashmarighna, Vranaropaka, Mootrala, Shonita

sthapana, Rakta stambaka, Grahi.

Rogaghnata: Ashmari, Atisara, Raktasrava, Visuchika

PHARMACEUTICAL ACTIVITIES:



1. INSECTICIDAL ACTIVITY

B. pinnatum has been used to treat bug bites and insects in ethnomedicine. Methanolic extract of the leaves gathered in Indonesia has been shown to have an insecticidal impact on silkworms. It has also been observed that B. pinnatum leaf ethanolic extracts exhibit insecticidal efficacy against the rice weevil (Sitophilus oryzae)[11]. The third-instar silkworm (Bombyx mori) larvae were used to evaluate the methanol extract of K. pinnata leaves as well as the methanolic extract of K. daigremontiana and K. tubiflora leaves. The findings imply that bryophyllin A, bryophyllin B, and daigromentianin's orthoester and α-pyrone moieties were crucial to this activity [12].

2. ANTIMICROBIAL ACTIVITY

The ethanolic extract of the plant had a moderate antibacterial effect against both gram-positive and gram-negative pathogens. The methanolic extract of the root exhibits antibacterial action against S. aureus, P. aerogenosa, B. subtilis, E. faecalis, A. fumigatus, and E. coli, but it is ineffective against C. albicans [13]. The leaves of Bryophyllum pinnatum are used to stop the growth of bacteria. The plant is also used to treat typhoid fever and other bacterial illnesses, primarily those caused by S. aureus, E. coli, B. subtilis, P. auroginosa, K. aerogenes, K. pneumoniae, and S. typhi [4].

3. ANTIHYPERTENSIVE ACTIVITY

Herbs have historically been used to treat hypertension because of their hypotensive qualities. In Western Nigeria, this plant is often used by some Yorubas to cure hypertension in all its forms and grades. It has been established that Trinidad and Tobago uses the Kalanchoe pinnata as a traditional therapy for hypertension[14].

4. ANTI-INFLAMMATORY ACTIVITY

The complex pathophysiological process of inflammation is brought on by a number of biomolecules, including leucocytes, macrophages, mast cells, platelets, and lymphocytes, which release nitric oxide and cicosanoids. Plants may have anti-inflammatory properties because they contain bioactive substances such flavonoids, saponins, and phenolic chemicals. This supported the findings of Shrivastava and Patel and Somazundram and Sadique who found that flavonoid glycosides of C. splendens modulated calcium transport in isolated inflamed rat livers, thereby reducing inflammation [15]. The extracts of pet ether, chloroform, and methanol, as well as the isolated fractions like flavonoid, alkaloid, and phenolic acid fractions, were administered orally once daily for two days at a dose of 50 mg/kg each. The methanolic extract of leaves exhibits a more notable inhibition of formaldehyde-induced edema than the standard medication [2].

ANTIDIABETIC ACTIVITYIES

The anti-diabetic effects of the ethanolic extract of K. pinnata are dependent on the plant's environment. There will be more activity in a dry climate. Due to the sun's near-wavelength influence, plants can adjust to the light and produce better flavonoid components. Flavonoid components in leaves can also be influenced by seasonal variations in temperature and water availability The extract from K. pinnata Aqueous showed hypoglycemia and hypocholesterolemic effects as well as a reduction in body weight, all of which are advantageous for the treatment of diabetes [16]. It has been observed that K. pinnata leaves contain phytosterols, flavonoids, and polyphenols. The anti-inflammatory and antidiabetic properties of the herb's leaf aqueous extract are thought to be attributed to the chemical components of the plant, specifically flavonoids, polyphenols, triterpenoids, and phytosterols [17].

NEPHROTOXICITY ACTIVITIES

Urolithiasis, also known as renal or urinary calculi, is a disorder in which a stone or stones form and remain in the kidney, bladder, and/or urethra. It causes renal colic, urine retention, and flank and abdominal pain. The development of renal calculi caused by ethylene glycol was inhibited by Bryophyllum pinnatum leaf extracts. Extracts may have an antilithiatic impact by preventing the production of CaOx crystals, dissolving preformed stones, or having antioxidant properties. This study supports the use of Bryophyllum pinnatum leaves in traditional medicine to treat kidney stones [18].

SKIN :

The skin serves both the body's protective covering and a bustling interface between the environment and the human body. Along with preventing radiation and harmful foreign elements from penetrating and protecting against mechanical shock, it also controls heat loss and transduces incoming impulses.

The skin is made up of a continuous layer that covers the whole body. The epidermis and dermis are its two primary layers.

EPIDERMIS

The epidermis is the skin's outermost layer. The epidermis's cells create a barrier and a multi-layered system. The epidermis is made up of five different layers. The horny layer is called stratum corneum, the refractile layer is called stratum lucidum, the granular layer is called stratum granulosum, the spiny layer is called stratum spinosum, and the base layer is called stratum basale.

DERMIS

The dermis, a thick layer of strong, viscoelastic tissue beneath the epidermis, is home to sweat glands, hair follicles, nerve endings, and blood vessels. The dermal structure is made up of a comparatively limited number of cells that are encased in an amorphous "jelly" known as ground material and situated inside a network of protein fibers. Fibroblasts are the main cells of the dermis. These cells produce the two primary fibrous protein types, collagen and elastin.

CONCLUSION

From the above review it is clear that Bryophyllum pinnatum is the most common medicinal plant in India, and exhibits various medicinal functions. The leaves of Bryophyllum pinnatumare used widely in the treatment of a number of medical conditions. Phytochemicals analysis of leaf showed presence of alkaloid, flavonoid, phenol, steroids, and saponins.It Indicates medical activities such as anti-bacterial activity, antifungal, anticancer, anti-tumor, and pesticide actions. Although, a number of scientists are working in this area but still a lot more is required to explore the complete potential of B. pinnatum.

REFERENCE

1. Rahul*Dr. Dev Prakash Dahiya International Journal of Research Publication and Reviews, Vol (6), Issue (9), September (2025), Page – 2479-2485.
2. Rahul's, Subh Karan*, Dr. Dev Prakash Dahiya A Review of Phytoconstuents, Pharmacological Activity Along with Its Traditional and Medicinal Use of The Plant Ricinus Communis, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 3, 2127-2133.
3. Kamboj A, Saluja AK. Bryophyllum pinnatum (Lam.) Kurz.: Phytochemical and pharmacological profile: A review. Pharmacogn Rev. 2009;3(6):364–74.
4. Thorat SS, Shah RR, Mohite SA, Patel NR. a Review on Bryophyllum Pinnatum. Int Res J Pharm. 2018;8(12):1–3.
5. Afzal M, Kazmi I, Khan R, Singh R, Chauhan M, Bisht T, et al. Bryophyllum pinnatum : A review. Int J Res Biol Sci. 2012;2(4):143–9.
6. Yadav S, Raut D, Nayak S. Antibacterial activity of Plectranthus Amboinicus against multiple drug-resistant isolates obtained from samples of urinary tract infection. Int J Bot Stud [Internet]. 2021;6(1):558–65. Available from: *www.botanyjournals.com*
7. Thorat SS, Shah RR, Mohite SA, Patel NR. INTERNATIONAL RESEARCH JOURNAL OF PHARMACY.
8. Afzal M, Kazmi I, Khan R, Singh R, Chauhan M, Bisht T, Anwar F. Bryophyllum pinnatum: a review. Int J Res Biol Sci. 2012;2(4):143-9.

9. 4 Yadav S, Raut D, Nayak S. Antibacterial activity of Plectranthus Amboinicus against multiple drug-resistant isolates obtained from samples of urinary tract infection. CEP.;30(18):15-7.
10. Idoko OD. EFFECTS OF HYDRO-METHANOL LEAF EXTRACT OF BRYOPHYLLUM PINNATUM ON DIAZEPAM-INDUCED SLEEPING TIME AND PENTYLENETETRAZOLE-INDUCED SEIZURE TEST IN MICE. Journal of Arts & Humanities. 2024;17(2)
11. Selvakumar P. Phytochemical and pharmacological profile review of Bryophyllum pinnatum. Biomedical And Biotechnology Research Journal (Bbrj). 2022 Jul 1;6(3):295-301.(microscopic)
12. Prasad AK, Kumar S, Iyer SV, Sudani RJ, Vaidya SK. Pharmacognostical, phytochemical and pharmacological review on Bryophyllum pinnata. International Journal of Pharmaceutical & Biological Archives. 2012 Oct 24;3(3):423-33.
13. TOLARAM GM. EVALUATION OF THERAPEUTIC EFFICACY OF PLANTS Bryophyllum calycinum AND Achyranthes aspera ON ADENINE INDUCED CHRONIC KIDNEY DISEASE IN RATS.(.ijrp)
14. Nagaratna A, Hegde PL. A comprehensive review on Parnabeeja [Bryophyllum pinnatum (Lam.) Oken]. Journal of medicinal plants studies. 2015;3(5):166-71.
15. Elufioye TO, Oyedeji AO, Habtemariam S. A review of the traditional uses, phytochemistry and pharmacology of Bryophyllum pinnatum (Lam.)(Crassulaceae). Journal of Biologically Active Products from Nature. 2022 May 4;12(3):190-222.
16. Supratman U, Fujita T, Akiyama K, Hayashi H. New insecticidal bufadienolide, bryophyllin C, from Kalanchoe pinnata. Bioscience, biotechnology, and biochemistry. 2000;64(6):1310-2.
17. Singh S, Verma P, Verma P, Fatima K, Sharma S, Sharma A, Bhatt A, Sharma N, Barthwal J, Kumari P, Pant HC. A Review on In Vitro Culture Method and Assessment of Therapeutic potential of Bryophyllum pinnatum (Lam.).
18. A. Arun Joseph UA, Kishore R, Harishankar RA, Sivakumar M, Deepa N. AN OVERVIEW OF THE PHYTOCHEMICAL AND PHARMACOLOGICAL EFFECTS OF BRYOPHYLLUM PINNATUM. Biochemical & Cellular Archives. 2023 Oct 1;23(2).
19. Okwu DE, Uchenna NF. Exotic multifaceted medicinal plants of drugs and pharmaceutical industries. African Journal of Biotechnology. 2009;8(25).
20. Singh RK, Garg A, Shrimali K. Botanical description, photochemistry, traditional uses, and pharmacology of the “wonder plant” Kalanchoe Pinnata (Linn.) Pers: an updated review. Journal of Pharmaceutical and Medicinal Chemistry. 2022 Jan;8(1).
21. Menon N, Sparks J, Omoruyi F. Hypoglycemic and hypocholesterolemic activities of the aqueous preparation of Kalanchoe pinnata leaves in streptozotocin-induced diabetic rats. Asian Pacific Journal of Tropical Biomedicine. 2015 Jan 1;5(1):3-9.
22. Yadav M, Gulkari VD, Wanjari MM. Bryophyllum pinnatum leaf extracts prevent formation of renal calculi in lithiatic rats. Ancient science of life. 2016 Oct 1;36(2):90-7.