COMPERATIVE STUDY ON HERBAL ANTIOXIDANT PRESENT IN BRYOPHYLLUM PINNATUM PARTS (LEAVES, STEM AND ROOTS)

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Abstract

Herbs are plantations that lack the wood tissue of trees or shrubs. Herbs are plants grown for their medicinal, flavouring, or aromatic properties. Herbal treatments are safe and efficient for treating a wide range of ailments. Western medicine, or allopathy, is primarily reliant on medicinal plants for some of its constituents. Herbal plants are the traditional and widely used type of medication, according to research. Until the last century, most remedies were made by hand, either from plants or animals. Synthetic pharmaceuticals are becoming increasingly popular, whereas natural drugs are showing promise in treating various disorders. A perennial plant thrives in India's wet and hot regions, like Bengal. It has 25 genera and 450 species. Succulent perennials have hollow stems, four-angled leaves, and numerous branches. The leaves are 10-20 cm long and decussate. A long petiole surrounds the three- to seven-foliate top leaf. They are dark green and scalloped with red ribbons. 30-35 cm long, 2–4 cm petioles, 6–8 X 3-5.5 cm blades, with latent buds that can develop into healthy plantlets with an acute tip8. Rooting vegetative buds are on the leaves. This herb has been used for generations to heal many ailments. These studies look at the plant's acute toxicity, antiulcer effectiveness, and pharmacognostic properties. The plant's macrostructure varied. Microscopic investigation revealed lignified walls in root and stem bark. Phytochemical analysis can identify plant metabolites. Leaves, stems, and roots had more physiologically active components than the other three plant sections. Although more research is required to identify the molecules and their potential health effects, these substances must be extracted and evaluated for future application. This study's findings support B. Pinnatum medicinal qualities. B. Pinnatum roots, stems, and leaves contain

bioactive compounds worth investigating. This could help B. Pinnatum-based pharmaceuticals.

Keywords: *Bryophyllum Pinnatum (Leaves, Stem, Roots), Herbal plant, Phytochemical studies, Anti-inflammatory activity, Anticancer activity.*

Introduction

Herbs are plantations that lack the wood tissue of trees or shrubs. Herbs are plants grown for their medicinal, flavouring, or aromatic properties. Herbal treatments are safe and efficient for treating a wide range of ailments. Western medicine, or allopathy, is primarily reliant on medicinal plants for some of its constituents[1]. Herbal plants are the traditional and widely used type of medication, according to research[2]. Until the last century, most remedies were made by hand, either from plants or animals. Synthetic pharmaceuticals are becoming increasingly popular, whereas natural drugs are showing promise in treating various disorders. It used to refer to organic cures. Herbalists believe that removing a chemical from a herb rather than using whole plant loses the active components responsible for the herb's medicinal properties[3]. Herbs can warm the body, speed metabolism, cleanse the blood, improve surface circulation, improve waste disposal, reduce inflammation, relax and soothe irritation. They can be used topically or taken internally as syrups, infusions, or capsules. According to the World Health Organization (WHO), "it is a combination of skills, information and practises used to improve quality of life and prevent, detect, treat, or cure physical and mental diseases" WHO Traditional Medicine Strategy 2014-2023 In this case, the authors are Jütte and colleagues[4-6].

Historical Background of Herbal Plants

Other primates are aware of and employ plant therapeutic properties. Anthropogenic, immunostimulant, antibacterial, anti-diarrheal, anti-inflammatory, digestive aids, analgesic, and reproductive regulators have been reported in several ape and monkey species. While archaeological evidence shows that humans employed medicinal herbs continuously in primordial times. Various ancient cultures used botanical chemicals for psychological and physiological objectives[7-9]. As proven by their use in all medical systems, including Ayurveda, which originated in India, Western Medicine, which originated in Mesopotamia, Chinese Medicine, which developed in China, Unani Medicine, which emerged in Greece, and others[10]. We learned about plants and their medical characteristics through oral tradition, papyrus, printing, manuscripts, and finally computer storage. Herbs have long been used to promote human health. Ancient burials often contain herbal remnants[11]. Eight medicinal plants were unearthed in a 60000-year-old burial in Iraq, including Ephedra sinica, Stapf. Botanicals have been employed since the dawn of time. Herbs were used to treat the sick. They were supposed to contain souls as well as medicinal capabilities. Aristotle, the ancient Greek philosopher, believed plants had Psyche. For example, Juglans regia Linn. looked like brain tissue, and was commonly employed as a brain tonic. The Egyptian "Ebers papyrus" dated 1500 B.C. is the oldest known medical text. In it, you'll find 700 drugs and 800 pharmaceutical formulas, as well as instructions for making poultices and ointments[12].

It's approximately 20 m. Not every medicine suggested worked well, but several have been used for centuries, such as garlic, castor, myrrh, cannabis, and opium. Charka began to study the Vedas around 700 BC. The Ayurvedic literature Charka Samhita describes over 350 medicinal plants. Indians knew of Chalmugra's anti-leprotic, tonic, and soothing effects, as well as Amla and Ashwagandha's. Vedic medicine dates back to 1000 BC[13-15].

Bryophyllum pinnatum

A perennial plant thrives in India's wet and hot regions, like Bengal. It has 25 genera and 450 species. Succulent perennials have hollow stems, four-angled leaves, and numerous branches. The leaves are 10-20 cm long and decussate[16]. A long petiole surrounds the three- to seven-foliate top leaf. They are dark green and scalloped with red ribbons. 30-35 cm long, 2–4 cm petioles, 6–8 X 3-5.5 cm blades, with latent buds that can develop into healthy plantlets with an acute tip8. Rooting vegetative buds are on the leaves[17]. The terminal paniculate is 10-40 cm long. Pendulous bell-shaped flowers blanket the ground. The calyx tube is 2-4 cm long, with oval shaped nectar scales, oblong stamens, and follicles in the petals and calyx. The four-septate fruit-pod contains numerous smooth, ellipsoid seeds. From November to March, the plant at its most productive. This has a hot, astringent, acidic, and sweet aftertaste[18].

Fig: 1 *Bryophyllum pinnatum* Plant

Ethnopharmacology

The plant can also treat leg edoema. This powdered leaf is used to treat wounds. This herb is used in southern Nigeria to help a baby's placenta fall out. This can help children's illnesses. Consider the following: Herbs are widely used to treat high blood pressure and rheumatoid arthritis. B. Pinnatum leaves and bark are used to cure diarrhoea, vomiting, stomach ulcers, and insect stings. Leaf juice is also used to treat ear infections, colds, palpitations, chickenpox, and asthma. This herb can also treat edoema[19]. This plant is frequently used for its liver and vascular health benefits. Bryophyllum is also a muscle relaxant and analgesic. Immunosuppressive and immunomodulatory properties help it fight inflammation[20].

Ethnomedical uses of *Bryophyllum pinnatum* in different countries:

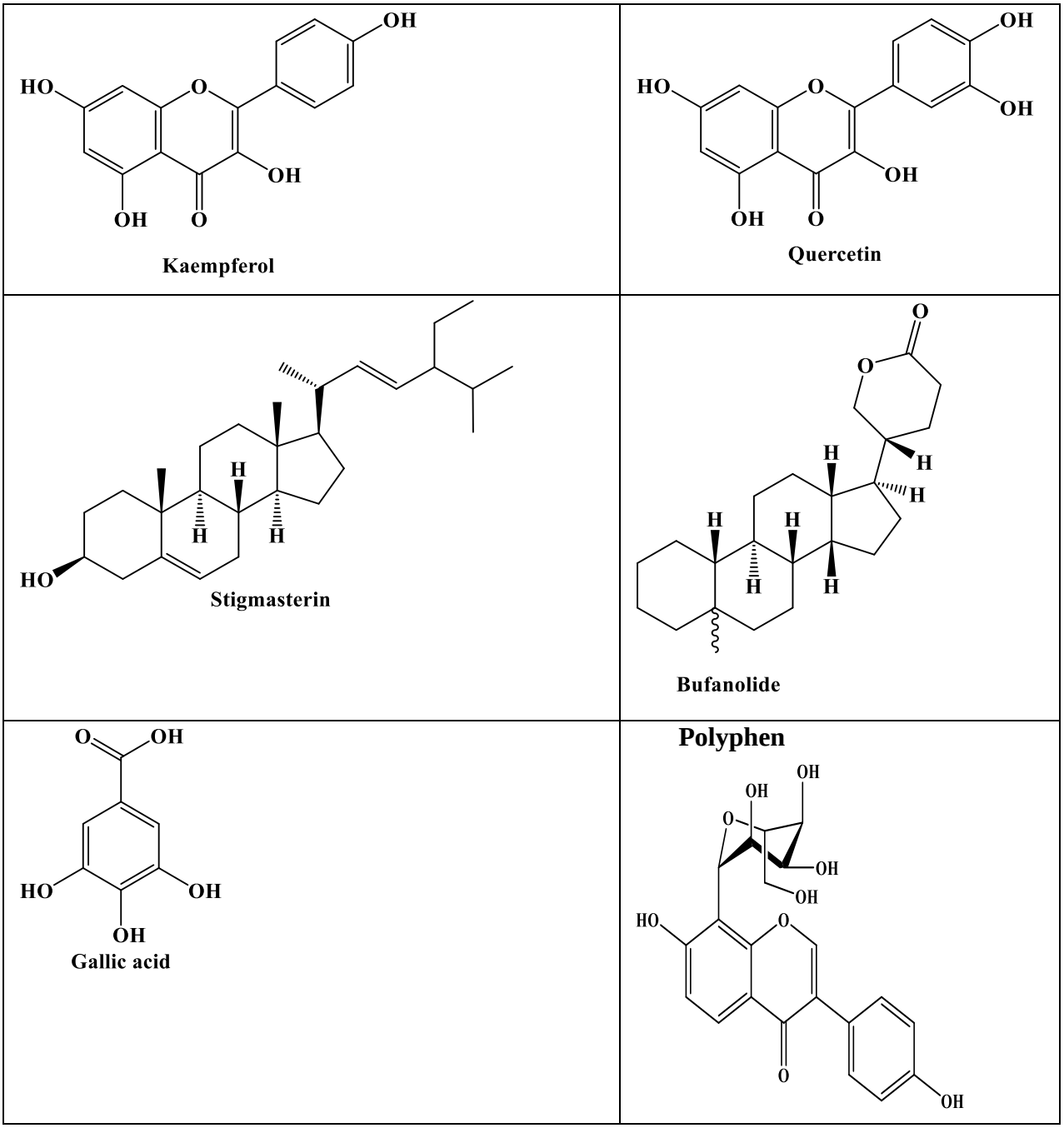
- Brazil has a high prevalence of inflammatory diseases and anti-leishmanial medications.
- South West Nigeria offers treatment for ear, chest, and digestive system ailments. In the Philippines, it is used as a bitter tonic, astringent, inflammation, wound healing, and carminative for a variety of ailments, including diarrhoea and dysentery, vomiting, and bruises. Poultice or powder, they are used to treat ulcers, infection, rheumatism, and inflammation. The fresh juice of the leaf is used to treat Smallpox, otitis, a cold, asthma, and palpitation[21].
- Analgesic, diarrhoea-stimulating and other digestive problems, as well as acute or chronic bronchitis (asthama) and other respiratory ailments can be treated with this product.
- This herb has been used in India for the treatment of cuts, scrapes, burns, and bug bites in order to eliminate kidney stones.
- People in West Africa use the fleshy leaves to treat a variety of ailments, including high blood pressure, diabetes, rheumatism, joint pain, headaches, and muscle aches. Additionally, the leaves are used to treat inguinal lymphadenitis and ear infections[22].
- Treats a wide range of ailments in Malagasy.
- In Europe, this substance is only used in anthroposophic medicine.
- In Germany, it is used as a tocolytic to prevent preterm birth.
- Broken bones and injuries should be treated in Ecuador.
- This Central American country treats skin disorders, aches, diarrhoea, and discomfort.
- For inflammation, menstrual discomfort, conjunctivitis, and migraines, Mexico is a great choice. It also works well for a variety of other ailments such as pain, birthing discomfort, cough, pain, colds, fever, and headache[23-25].

Phytochemical review

- Flavonoids, coumarins, saponin sterols, bufadienolides, and anthocyanins were found in plant extracts from the leaves of B. pinnatum. The green callus and the juice of fresh leaves included malic acid, quinines, tocopherol, and lectins, as well as other antioxidants.
- Classifying the various flavonoids found in nature has been made possible by recognising flavonoids, flavanones, and isoflavonoids like falvans and anthocyanidines like aurones and chalcones[26].
- The cytotoxic properties of bufadienolide-bryophyllin B and bersaldegenin-1,3,5-orthoacetate were identified.
- Bryophyllin A and Bryophyllin C, two insecticidal bufadienolides, were isolated and identified from a methanolic extract of Bryophyllum pinnata leaves[27].
- To identify flavonoids from the Bryophyllum pinnatum plant in Nigeria, scientists used the following methods: spectroscopy, mass spectrometry, chromatography, and spectroscopy.
- Potassium malate, ascorbic acid, malic acid, and citric acid have all been isolated from B. pinnatum leaves.
- The dichloromethane/methanol extract and all fractions contained a 3-sitosterol glycoside, except for the aqueous residue.
- The chemical composition, vitamins, and minerals of Bryophyllum pinnatum were studied. There were alkaloids (ranging from 1.23 percent to 1.45 percent by weight), flavonoids

(ranging from 1.49 to 1.85 percent by weight), saponins (ranging from 1.4 to 1.71 milligrammes per 100 milligrammes of protein), phenols (ranging from 0.6 to 0.7 percent by weight), and tannins (ranging from 0.06 to 0.7 percent by weight) (ranging from 0.04-0.05 percent by weight)[28].

- The mixture also contained bryophynol and two phenanthrene derivatives. One more hydrolyzed product was 180-Olcananc, y-taraxasterol, and the B-arnyrin acetate, together with an amyrin combination and its acetate[29].



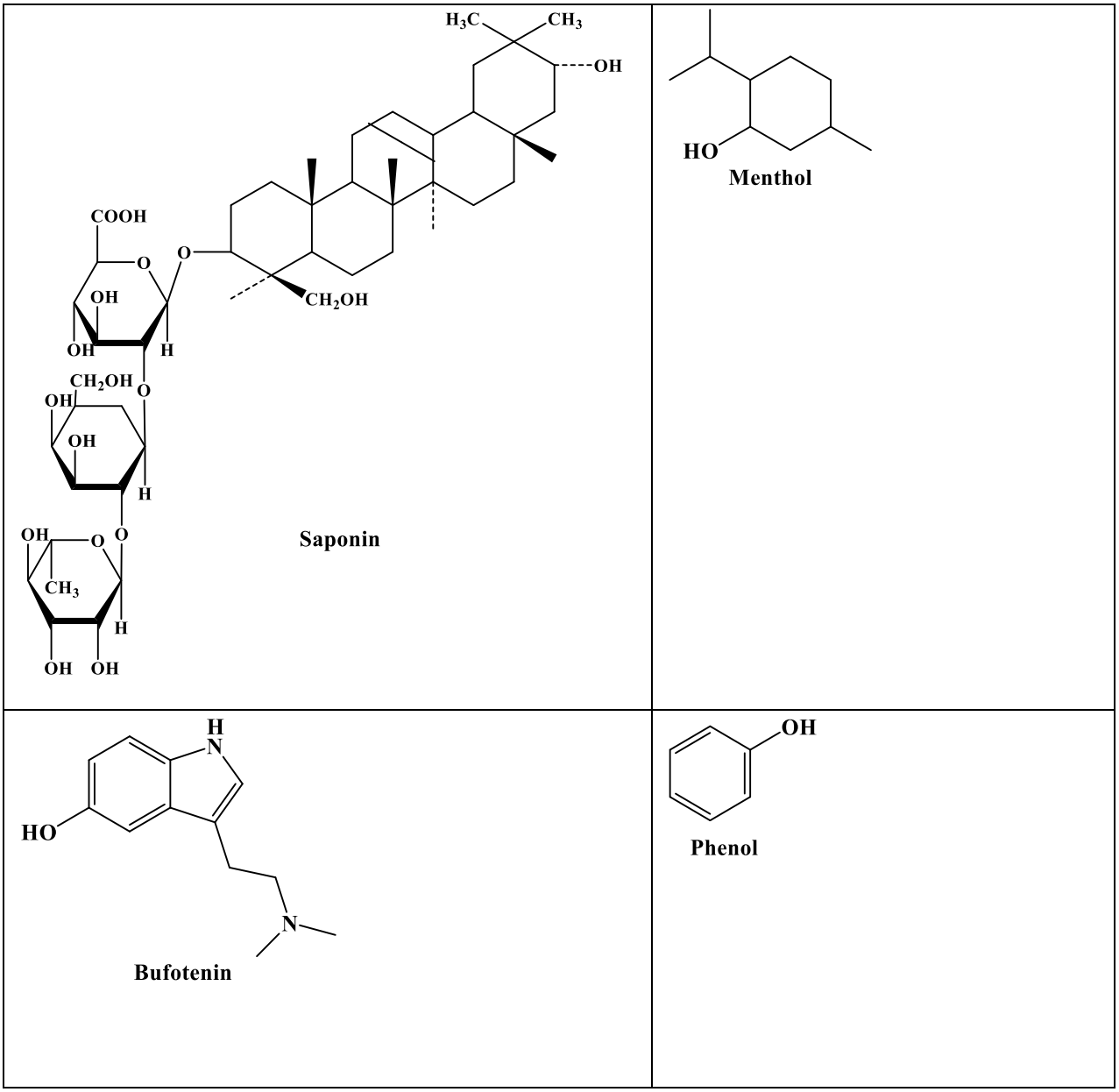


Table 1: Traditional use of Bryophyllum pinnatum

Parts of plant	**Uses As**	**Preparation for**
Leaf	Used as Swelling	Application of raw leaf topically over affected area
Leaf	Used As Skin problem like scabies	Decoction and juice
Leaf	High blood pressure (Bp)	Decoction
Whole plant & Leaves	Pain in bones, injury due to fall, numbness of limbs	Rubbing and massaging of leave paste

Leaf	Inflamation in lungs, cough	Syrup, juice with milk
Leaf	Kidney problems, stone, high cholesterol	Ingestion of raw leaves
Leaf	Headache	Crushed leave application
Leaf, Flowers	Wound ulcer, diabetes, analgesic, convulsion	Flower and leaf juice
Leaf, Root	Dysentery, ulcer, GIT disorders	Decoction of roots and leave juice
Stems, leaf	Antitumor activity	Extract
Leaves	Snake bite	Every hour after a snake bite, 1-3 teaspoons of a decoction of leaves should be taken.
Leave	Sexually transmitted disease	Chopped leaves mixed with *Opuntia stricta* stem and *Euphorbia hypericifolia,* heated in 2l of water and administered O.D as an enema
Seeds	Stye disease	The eye is treated with crushed seed juice (1-2 drops daily for 3 times a day)

BRYOPHYLLUM PINNATUM BIOLOGICAL ACTIVITY SURVEY

1. **Anti-Inflammatory and Analgesic Activity**

] In rats, kalanchoe pinnatum leaves and flowers have anti-inflammatory and analgesic activities against acetic acid-induced abdominal writhing, according to the results of this study[30]. The cyclooxygenase enzyme was inhibited by intramuscular injection of kalanchoe pinnatum flavonoids (1, 3&10mg/kg) reducing the potency of tissue necrosis factor by 164.8 & 9.4mg/kg. A novel steroidal compound helped reduce inflammation in aqueous extract when tested on carrageenan-induced rat paw edoema. This plant's watery extract showed 75.72 percent protection against acetic acid-induced writhing in a mouse test[31].

2. **Anti-convulsant activity**

Ethanolic extract of Bryophyllum pinnatum leaf was tested for anti-convulsant properties in mice utilising the maximum electro-shock (MES) and pentyl-enet-trazole (PTZ) seizure models. A dose-dependent technique was used to increase the duration of tonic extension and recovery in maximal electroshock-induced seizure study[32]. The length of hind limb tonic extension and recovery time decreased considerably (p0.01) at extract dosages of 200, 300, and 400 mg/kg, or 11.33, 8.33, and 5.5 seconds, respectively. Bryophyllum pinnatum leaves ethanolic extract extended the clonic convulsion and reduced the time it took for the convulsion to begin. There was a substantial ($p<0.01$) increase in clonic convulsion duration

at doses of 200, 300, and 400 mg/kg. In addition, the duration of convulsions was slashed significantly[33].

3. **Anti-allergy activity:**
   Bryophyllum pinnatum was found to reduce allergic responses in an in vitro research. Since mast cell degranulation is inhibited and histamine release is reduced, it has anti-allergenic properties[34].
4. **Anti-cancer activity**:
   Leaf chloroform extract and its components reduced the growth of Human testicular cancer cells [HCCC]. Apoptosis-associated protein Electrolyte Mobility Shift Assay (EMSA) were utilised to analyse human cervical carcinoma cells in vitro. Contaminants outperformed extracts in preventing cervical cancer[35].
5. **Antileishmanial activity**:
   Chemically defined natural substances showed antileishmanial activity in plant extracts (coumarin, quercetin). B. Pinnatum has antileishmanial flavonoid quercitrin. a function in antileishmanial activity Oral administration of these flavanoids proved more efficient against leishmaniasis in mice than intravenous or tropical administration. To prevent leishmaniasis, plants may stimulate reactive nitrogen intermediates in macrophages[36].
6. **Herbal Tonic**:
   Dietary fibre, niacin, and ascorbic acid are all found in the plant. This plant is used to cure prostate cancer as well as the common cold. B.Pinnatum and other herb extracts in herbal compositions are said to operate as tonics, boosting health and respiration[37].
7. **Nephroprotective effects:**
   Scientific research has confirmed Bryophyllum pinnatum's nephroprotective properties. The study found a dose-dependent effect. Whether plant antioxidants and radical scavengers could prevent gentamycin-induced kidney injury was studied in Wistar rats. It is stated that leaf juice is more effective than anti-cholinergic medicines in treating overactive bladder[38].
8. **Antibacterial:**
   The plant has been used to treat S. aureus, E. coli, B. subtilis, P. aeruginosa, K. aerogenes, and S typhi. The extracts were tested against S. aureus ATCC 13709, E. coli, Bacillus, P. aeroginosa, K. pneumonia, and S. typhi. This medication prevents infections of the placental and navel of newborns. They are anti-inflammatory, antispasmodic, and antibacterial[39]. studied the antibacterial effects of leaf juice. The extract proved bactericidal against B. subtilis, S. aureus, S. pyogenes, S. faecalis, E.coli, Klebsiella, Salmonella, and P. aeruginosa clinical isolates. Schmitt and colleagues used dilution tubes to test antibacterial action against Gram-positive bacteria. Akinpelu discovered that at 25mg/ml, 60% methanolic leaf extract reduced the development of five out of eight bacteria tested. The extract had no effect on K. pneumoniae, P. aeruginosa, or C. albicans[40].
9. **Neuropharmacological activities**:
   Aqueous leaf extract depressed the CNS. The mice given 50-200mg/kg showed no signs of ptosis, although their locomotor activity significantly lowered. During the chimney, ascending, and inclined tests, mice given aqueous extract decreased muscle tone and balance. Pentobarbitone led to greater sleep and lower chances of sudden death. Bufadienolide and other extract water-soluble components may cause CNS depression. Kalanchoe has been

shown to have sedative and Neural depressing activities in animals. A few of these effects were connected to an increase in GABA levels in the brain[41]

10. Urolithic activity:

This extract significantly decreases urinary oxalate levels, suggesting it may be beneficial in treating urolithiasis. This plant has long been used to cure kidney stones. Bryophyllum pinnatum dissolves kidney stones by breaking down calcium oxalate dehydrate crystals into monohydrates. Leaf extracts lowered oxidative stress and kidney stone development[42].

Physico-Chemical Analysis

Table 2: Physico- Chemical Analysis of *B. pinnatum* (Lam.) Kurz.

Parameters	**Root**	**Stem**	**Leaf**
loss Drying %	80.06±0.75	77.66±0.83	91.46±0.80
Total ash %	10.03±0.30	13.50±0.43	13.76±1.01
Acid insoluble ash %	0.86±0.05	0.93±0.11	1.73±0.05

PHYTOCHEMICAL INVESTIGATION

Table shows the outcomes of the phytochemical studies.

Table 3: *Bryophyllum pinnatum* leaves were examined for phytochemicals.

Type of Constituent s	**Distilled Water.**	**Petroleum Ether.**	**Chloroform**	**thanol.**	**Ethyl acetate**	**Benzene.**
Carbohydrate	+	+	+	+	-	+
Flavonoid	+	-	+	+	-	+
Saponin	-	-	-	-	-	-
Glycosides	+	-	-	+	-	-
Alkaloids	+	-	+	+	+	-
Triterpenoids	+	-	-	+	-	-
Tannins and phenolic	+	-	-	+	-	-

Table 4: Bryophyllum pinnatum Stem Phytochemical Examination.

Type of Constituent s	istilled Water	Petroleum. Ether	roform	Methanol	Ethyl Acetate	Benzene
Carbohydrate	+	+	+	+	-	+
Flavonoid	-	-	+	+	-	+
Saponin	+	+	+	+	-	+
Glycosides	-	-	-	+	-	-
Alkaloids	-	-	-	-	+	-
Triterpenoids	-	+	-	+	-	-
Tannins and Phenolic	-	+	-	+	-	-

Table 5: Testing of Bryophyllum pinnatum root for phytochemical Study

Type of Constituent s	istilled water	Petroleum ether	roform	thanol	Ethyl acetate	nzen e
Carbohydrate	+	+	+	+	-	+
Flavonoid		-	+	+	-	+
Saponin	+	+	+	+	-	+
Glycosides	-	-	-	+	-	-
Alkaloids	-	-	-	-	+	-
Triterpenoids	-	-	-	+	-	-
Tannins and phenolic	-	+	-	+	-	-

Keywords: (+) shows the presence, (-) shows absence.

Conclusion

This herb has been used for generations to heal many ailments. These studies look at the plant's acute toxicity, antiulcer effectiveness, and pharmacognostic properties. The plant's macrostructure varied. Microscopic investigation revealed lignified walls in root and stem bark. Phytochemical analysis can identify plant metabolites. Leaves, stems, and roots had more physiologically active components than the other three plant sections. Although more research is required to identify the molecules and their potential health effects, these substances must be extracted and evaluated for future application. This study's findings support *B. Pinnatum* medicinal qualities. *B. Pinnatum* roots, stems, and leaves contain bioactive compounds worth investigating. This could *help B. Pinnatum*-based pharmaceuticals.

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