



A review on phytochemical and pharmacological updates *kalanchoe pinnatum*

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Abstract

The succulent perennial kalanchoe plant reaches a height of three to five feet. Known as the "air plant," it features bell-shaped pendulous flowers, fleshy dark green leaves that are distinctly scalloped and edged with red, and long hollow stems. According to botanical classification, kalanchoe is referred to by two major Latin names, Bryophyllum pinnatum and Kalanchoe pinnatum. This review provides a thorough overview of the literature on the plant's phytochemicals and therapeutic qualities. Many kinds of chemicals, including alkaloids, glycosides, steroids, phenolics, aliphatic compounds, and diterpenoidal lactones, are said to have been found in the plant. Anti-diabetic, anti-neoplastic, antioxidant, immunomodulation, anti-lipidaemic, anti-allergic, and many more actions that are still being investigated are among the noteworthy pharmacological features.

Keywords: *Kalanchoe pinnata*; Patharchatta; Phytochemical Constituents; Pharmacological Activities; Medicinal Plant; *Bryophyllum pinnatum*

1 Introduction

Kalanchoe, or Patharchatta, is a perennial succulent plant that is commonly cultivated in India. Its long, hollow stems have earned it the nickname "air plant" in common parlance.[1] Kalanchoe features dark green, thick leaves and pendulous, bell-shaped blooms. Temperate areas of Asia, the West Indies, Australia, New Zealand, etc. are home to patharchatta cultivation. The plant, which is a member of the Crataegaceae family, is known by its scientific name, bryophyllum pinnatum. In Sanskrit, Patharchatta is referred to as Pashanabheda. It goes by several names, including miracle leaf, air plant, cathedral bells, and wonder of the world. A variety of therapeutic nutrients are known to be present in the medicinal plant Patharchatta. In India, kalanchoe, also known as patharchatta, is a popular perennial succulent plant that is grown. It is commonly referred to as the "air plant" because of its long, hollow stems. The kalanchoe plant has pendulous, bell-shaped blossoms and thick, dark green leaves. Patharchatta cultivation is found in temperate regions of Asia, the West Indies, Australia, New Zealand, etc. The plant, bryophyllum pinnatum, is its scientific name. It belongs to the Crataegaceae family. Patharchatta is called Pashanabheda in Sanskrit. It is known by several names, such as cathedral bells, air plant, miracle leaf, and wonder of the world. The medicinal plant Patharchatta is reported to contain a number of beneficial elements. [1,2]

A perennial succulent herb used for medicine is called parsley. It has densely cut leaves. This has Kalancho's plant's exact appearance. It is a little plant that grows well in any type of container or yard. There are no seeds on this plant; instead, it produces five to ten plants from each leaf. In the garden, the plant is also planted for aesthetic purposes. However, this plant has many advantages. This makes treating the stones simple. Kidney stones can also be treated using the juice of its leaves. The Patharchatta plant is used to treat asthma, blood dysentery, boils, cough, diabetes, insect bites, jaundice, epilepsy, cough, jaundice, nephrolithiasis, painful mites, pneumonia, etc. It stimulates the production of urine and therefore helps in urinary stones. Parsley is a perennial succulent herb used in medicine. Its leaves are finely

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cut. This looks exactly like the plant called Kalancho. It is a small plant that thrives in any kind of yard or container. This plant doesn't have seeds; instead, each leaf generates five to ten new plants. The plant is likewise grown in the garden for aesthetic reasons. But this plant has a lot going for it. This simplifies the stone treatment process. The juice of its leaves is also a treatment for kidney stones. Asthma, blood dysentery, boils, cough, diabetes, insect bites, jaundice, epilepsy, nephrolithiasis, painful mites, pneumonia, and other conditions are all treated with the Patharchatta plant. It aids in the treatment of urinary stones because it increases urine output. [3,4]

2 Plant profile

Synonyms: *Cotyledon calycina*, *C. calyculata*, *C. pinnata*, *C. rhizophilla*, *Crassuvia Floripendia*, *Crassula pinnata*, *Sedum madagascariense*, and *Verea Pinnata* are some examples of *Bryophyllum calycinum*, *B. germinans*, and *B. pinnatum* [3]

Regional name: Local appellations: Sanskrit: *asthi-bhaksha*; Bengali: *koppata*; Hindi: *zakhm-hayat*; Arabic: *kushnulhayat* *Simimajamudu* in Telgu *Elamurunga* in Malayalam, *ganduklinga* in Kannad, and *ranakalli* in Tamil. Origin from biology: Call it *Bryophyllum pinnata* in botany. The *Crussulaceae* family [4,5]

- Kingdom:-plantae
- Sub Kingdom:-Tracheobionta (Vascular plants)
- Super division:-Spermatophyte (seed plants)
- Division:-Magnolia-ophyta(flowering plant)
- Class:-Magnoliopsida(Dicotyledonous)
- Subclass:-Rosodae
- Order:-Saxifragales
- Family:-Crassulaceae Stonecrop
- family Genus:-Kalanchoe
- Species:-Kalanchoe pinnata.

Geographical source Naturalized in Hawaii, Macaronesia, Mascarenes, Galapagos, Melanesia, Polynesia, West Indies, Australia, New Zealand, and temperate parts of Asia. In India, it grows wild and in gardens in the Deccan, Bengal, and northwest regions of the country

3 Geographical source

This plant is to popular house plant and has become naturalized in tropical and subtropical areas. This plant is native to Madagascar 2, inhabiting warm and temperate climates from sea level to 2,600 meters. In India, it grows wild in the hills of Bengal, Deccan, and North-Western India, as well as in gardens.

It is also found in parts of Asia, Australia, New Zealand, the West Indies, Bermuda, the Philippines, Macaronesia, the Mascarenes, Brazil, Suriname, the Galapagos Islands, Melanesia, Polynesia, and Hawaii.

4 Collection and cultivation



Figure 1 *Kalanchoe pinnata*

These plants are very common indoor plants that have naturalized in tropical and subtropical regions. (B.D, 2003)+*Kalanchoe pinnata* leaves are harvest using customary methods in the area. Typically, they are harvested young and free of fungi. After being clean with tap water, the leaves are dried under cover in a space that isn't exposed to the

sun. The dry leaves are ground in a blender to a fine powder. To reduce the loss of volatile chemicals, fine powder is dissolved in ethanol and maintained at a temperature of approximately 28°C.

5 Phytochemical constituents^[6]

Table 1 Phytochemical Constituents of Kalanchoe Pinnata

Sr.No.	Part of plant	Phytochemical constituent
1	The leaves contains	P-coumaric acid
		Ferulic acid
		Syringic acid
		Caffeic acid, citric acid, isocitric acid, malic acid
		P-hydroxybenzoic acid
		Flavonoids as quercetin, kaempferol
		Quercetin-3-diarabinoside
		Kaempferol-3-gucoside
		Quercetin-3-l-rhamnoside-ll-arabino furanoside
		hentriacontane
		tritriacontane
		Sitosterol
		2(9-decenyl)phenanthrene(1),
		2 (undecenyl)phenanthrene(2)
2	The aerial part contains	Bufadienolides-bryophyllin A (bryotoxin), bryophyllin, bryophyllol; bryophyllone; bryophyllenone
		18 α -oleanane
		Taraxasterol
		Alpha and beta-amyrins and their acetates
		24(r)5 alpha-stigmast-7,25-dien-3- beta-o
		5 alpha-stigmast-24-en-3beta-ol and 25-methyl-5alpha stigmast-24-en-3beta-o and 25-methyl-5alpha-ergost-24(28)-en-3beta-ol
		A potent cytotoxic compound-bersaadenin-1,3,5-orthoacetate
		Glutamic acid, methionine, tyrosine and phenylalanine

6 Pharmacological activity

6.1 Pharmacological Activities

6.1.1 Anti-ulcer activity

The herb *Kalanchoe pinnata* exhibits anti-ulcer properties in its ethanol extract, however the indomethacin-induced stomach mucosal lesions were not inhibited by the aqueous extract.^[7]

6.1.2 Uterine relaxant

In vitro, *Bryophyllum pinnatum* exhibits a relaxing effect on human myometrium contractility and reinforces against fenoterol-induced uterine contractility^[7].

6.1.3 *Hepatoprotective*

In the traditional medicine of the Indian state of Bundelkhand, jaundice is effectively treated using fresh leaf juice^[7].

6.1.4 *Anti-cancer activity*

Ingredients in *kalanchoe pinnata* may suppress cancer's hallmarks, including cell migration, apoptosis, proliferation, angiogenesis, and metastasis, and they may also control processes like autophagy and oxidative stress. Compounds from *bryophyllum* exhibit significant therapeutic anticancer efficacy against cancer cells. On multiple cancer lines, *besaldeenin-1*, *3*, and *5* *orthoacetase* slowed the development of cancer cells^[7].

6.1.5 *Wound healing activity*

By reducing the size of the affected area and the amount of edema at the wound site, the ethanolic extract of *K. pinnata* demonstrated considerable wound healing activity. According to Nayek et al., the presence of phenolic antioxidants and steroidal glycosides may be the cause of this^[7].

6.1.6 *Anti-fungal activity*

Adenike A. O. Ogunshe worked on the Nigerian Traditional plants to evaluate antifungal activity. They evaluated the plants against the various strains of these species (*Candida albicans*, *C. glabrata*, *C. tropicalis*, *C. pseudotropicalis*). It was later concluded that none of the strains of *C. pseudotropicalis* got inhibited by ethanolic extract of *kalanchoe pinnata*. While it shows the good inhibitory effects against other species. In order to assess the antifungal activity of Nigerian traditional plants, Adenike A. O. Ogunshe worked on them. The plants were assessed in comparison to the several strains of *Candida albicans*, *Candida glabrata*, *Candida tropicalis*, and *Candida pseudotropicalis*. Later research revealed that the ethanolic extract of *kalanchoe pinnata* did not suppress any of the strains of *C. pseudotropicalis*. Even so, it exhibits strong inhibitory effects on other species^[7].

6.1.7 *Insecticide activity*

Two bufadienolides were extracted from the methanolic extract of *K. Pinnata* by Supratman et al. in 2000. Because of the presence of the 1, 3, 5-orthoacetate moiety of bufadienolides, isolated compounds were reported to have high insecticidal activity against silkworm larvae in their third instar state^[7].

6.1.8 *Urolithic activity*

This extract profoundly lowers oxalate levels in the urine, indicating potential therapeutic benefits for urolithiasis. For centuries, kidney stones have been treated using this plant. Kidney stones are broken down into monohydrates by *B. pinnatum* which does this by dissolving calcium oxalate crystals. Kidney stones developed less frequently when leaf extracts were used^[8,9].

6.1.9 *Astringent*

It's an attribute that can halt the transfer of dangerous substances, so averting infection. It works similarly to a substance like cetrimide or chlorhexidine that degrades or inhibits the growth of pathogenic germs. Antiseptics are applied externally to clean wounds and are used internally to treat intestinal and bladder infections. Iodine, hydrogen peroxide, povidone-iodine, polyhexanide, boric acid, alcohol, benzalkonium chloride, etc. are some of the best examples of antiseptics^[8,9].

6.1.10 *Analgesic*

This quality functions as a sort of analgesic, effectively lowering discomfort. Good pain medications block the enzyme that controls the synthesis of prostaglandins, just like aspirin does. It reduces pain, heat, and inflammation by reducing prostaglandin synthesis^[8,9].

6.1.11 *Anti-aggregate*

They assist in preventing blood clots or reducing their danger. They are sometimes known as anticoagulants or antiplatelets. They are often called blood thinners even if they haven't actually thinned blood. It works by blocking or breaking up potentially lethal blood clots that develop in the blood vessels or heart^[8,9].

6.1.12 *Anti dysenteric*

This characteristic could potentially help prevent or treat dysentery. For diarrhea, constipation, colic, and other conditions, it is effective. Numerous infectious organisms, such as bacteria, viruses, and parasites, can cause dysentery, one type of illness^[8,9]

6.1.13 *Anti-inflammatory*

It's a quality that helps lower inflammation by acting on the body's processes. Generally speaking, chemicals released into the bloodstream or injured tissues by the body's white blood cells are the first cause of inflammation. The body generates chemicals to defend itself against foreign objects, and these chemicals increase blood flow to the wounded or infected location, resulting in redness and warmth^[8,9].

6.1.14 *Antiseptic*

It's an attribute that can halt the transfer of dangerous substances, so averting infection. It works similarly to a substance like cetrimide or chlorhexidine that degrades or inhibits the growth of pathogenic germs. Antiseptics are applied externally to clean wounds and are used internally to treat intestinal and bladder infections. Iodine, hydrogen peroxide, povidone-iodine, polyhexanide, boric acid, alcohol, benzalkonium chloride, etc. are some of the best examples of antiseptic^[8,9].

6.1.15 *Antispasmodic*

These kinds of properties are used, particularly in the tubular organs of the gastrointestinal tract, to reduce impulsive muscle spasms and calm smooth muscles. It is effective in avoiding spasms of the intestines, bladder, and stomach. It functions by causing the muscles in the stomach and intestines to relax and delaying the regular function of the digestive system^[8,9].

6.1.16 *Cytotoxic*

A family of drugs known by another name, antineoplastics are made up of ingredients that are either toxic or fatal to cells. They are specifically used to treat cancer by preventing cells from proliferating or developing. Qualities may also be used to treat a number of other diseases, such as multiple sclerosis and rheumatoid arthritis^[8,9].

6.1.17 *Diuretics*

A multitude of conditions, including edema, high blood pressure, and glaucoma, can be helped by its properties, earning it the nickname "water pill". It functions well because it promotes urine excretion and/or substances that raise the amount of urine ejected. It helps flush out salt and water from the body by causing the kidneys to release more sodium into your urine^[8,9].

6.1.18 *Disinfectant*

In general, surfaces that are not living, such as floors, are used to remove bacteria using disinfectant properties. Disinfectant is primarily used as an antiseptic, applied to clean wounds before medication is administered^[8,9].

6.1.19 *Emollient*

It is a quality that prevents skin fissures and keeps the skin smooth and hydrated. These moisturizers come in the form of lotions, gels, ointments, and creams and are natural or non-cosmetic. Emollients are safer for the skin and can help people feel more relaxed and less agitated. It is a vital ingredient that protects and soothes irritated or inflamed skin while hydrating and restoring the skin's natural tissues^[8,9]

6.1.20 *Hemostatic*

Medication that helps achieve hemostasis, or the stopping of bleeding, is referred to as an antihemorrhagic. One type of antihemorrhagic medication called hemostasis works by constricting tissue to seal broken blood vessels. It is also known as a styptic or hemostatic agent. It is advantageous in the early stages of wound healing^[8,9].

6.1.21 *Immunomodulatory*

It has a chemical component (methotrexate or azathioprine) that either modifies or boosts the immune response. Stated differently, it either promotes the generation of antibodies or inhibits the function of leukemic cells. In addition to having toxic or immunotoxic effects, it prevents allergic responses and the deterioration of immune effectors^[8,9]

6.1.22 *Styptic*

It has the capacity to stop bleeding when applied topically to a wound. The process of clotting, or coagulation, is what stops a cut from bleeding. These days, styptic pencil is used to seal small wounds and nicks, particularly those caused by wet shaving^[10,11]

6.1.23 *Harbel tonic*

Niacin, riboflavin, thiamine, and ascorbic acids are all present in good amounts in the plant. For the body to function properly and for intercellular components like collagen, bone matrix, and tooth dentine to grow normally, natural ascorbic acid is essential. Ascorbic acid and proper connective tissue metabolism are thus linked to the clinical signs of scurvy, which include bleeding from the mouth, gastrointestinal tract, anemia, and joint pain. Ascorbic acid's usual ability to heal wounds is explained by this function. Because of this, the plant is utilized in herbal therapy to treat conditions like prostate cancer as well as regular colds^[10,11].

6.1.24 *Antileishmanial activity*

B. pinnatum has antileishmanial properties because of a flavonoid called quercitrin. Antileishmanial activity appears to be dependent on the quercetin aglycone-type structure and a rhamnosyl unit connected at C-3^[10,11].

6.1.25 *Antihypertensive activity*

The herb's hypotensive properties support the folklore usage of the plant in the treatment of hypertension. Some Yorubas in Western Nigeria frequently use this plant to treat hypertension of all kinds and grades. It has been documented that *Kalanchoe pinnata* is used as a traditional therapy for hypertension in Trinidad and Tobago^[12].

6.1.26 *Anti-allergic activity*

According to several recent studies, oral medicines containing quercitrin that has been discovered and extracted from plants can up to 75% prevent animals from dying from anaphylaxis. These findings indicate that pro-anaphylactic generated immune response modules can be effectively slowed down by oral administration of different forms of *Kalanchoe pinnata*. Quercitrin-achieved protection revealed that flavonoids are *Kalanchoe pinnata*'s most important component and the one that protects against severe allergic reactions^[12].

6.1.27 *Anti-tumor activity*

Raji cells, the tumor promoter 12-O-tetradecanoylphorbol-13-acetate was used to stimulate EBV-EA (Epstein-Barr virus early antigen) activation. Five distinct bufadienolides that were extracted from *Kalanchoe pinnata* leaves were tested for their ability to block this process. Hence, among the substances studied, bufadienolides demonstrated possible inhibitory effects, whilst bryophyllin-A shown strong inhibition. Bryophyllin-C, a reduction counterpart of type-1, and bersaldegenin-3-acetate, which lacks the orthoacetate moiety, were found to be less active. According to these findings, bufadienolides may be an effective anti-cancer and anti-chemopreventive agent^[13]

6.1.28 *CNS-depressant activity*

Bryophyllum pinnatum leaf methanolic fractions significantly altered behavioral patterns, with notable impacts on analgesic efficacy and dose-dependent potentiation of pentobarbitone sleeping time. Conversely, there was a noticeable decline in exploratory performance as well as a lack of lingering curiosity^[14].

7 Drug interact with other substances

To find out how *patharchatta* interacts with other drugs, there is not enough information available. Further investigation on the interaction of *patharchatta* is necessary. Thus, if you are taking any other medications, see your physician before starting *patharchatt*^[15]

8 Marketed product table

Table 2 Marketed formulation table

Sr.No	Brand Name	Dosage Form	Activity	Price
1	Herbal Terra	Liquid	Immunity booster	2072.41Rs
2	Hawaii Pharm	Liquid	Immunity booster	1653.81Rs
3	Ozengluz	Capsules	Antioxident	3314.04Rs
4	Hawaii Pinnata	Liquids	Dermatitis	1902.43Rs
5	Yoghi Organic	Powder	Effective digetion	7376.67Rs
6	Agrestal	Tea Power	Dermatitis	1657.08Rs

9 Conclusion

Known as the Goethe plant or love bush, *Kalanchoe pinnata* is an uncommon plant. Since they have been thoroughly evaluated for efficacy and are widely regarded as safe for human use, ethnobotanical and traditional uses of natural substances, particularly those derived from plants, have garnered a lot more attention in recent years. This review provides the most important details on *kalanchoe pinnata*. It provides details about *kalanchoe pinnata* in addition to the medicinal benefits of the plant. It provides useful information for upcoming developments by displaying the various dosage forms and formulations that are offered in the market. The study discovered that *kalanchoe cranata* leaf extract has analgesic properties, which may be due to their effects on the brain and nerves. This indicates that the anti-inflammatory properties of *kalanchoe brasiliensis* leaves .even though the extract showed no lethan toxicity when collected before plant flowering and a proinflammatory effect when picked during plant blooming.The plant *kalanchoe pinnata* is rich in phytoconstituents. A *kalanchoe pinnata* extract with anti-urolithiatic action has demonstrated the capacity to avert kidney stone development.Succulent *kalanchoe pinnata* plants grow in dense stands on arid, uneven terrain. Alkaloids, triterpenes, glycosides, flovolooids, steroids, and lipids are abundant in it. A very active substance called bufadienolipids is found in the leaves.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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