

Kalanchoe Pinnata (Life Plant): A Medicinal Plant with Extraordinary Therapeutic Potential, A Review on its Traditional Uses, Pharmacological Actions, Chemical Composition, and Potential Health Benefits

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ABSTRACT

Kalanchoe Pinnata, it is a perennial shrub belongs to the Crassulaceae family. It is found in tropical regions of Asia and it is one of the most widely grown medicinal plants. It has a wide range of medicinal applications, including wound healing, immunosuppression, anti-inflammatory, anthelmintic, hepatoprotective, anti-diabetic, nephroprotective, antioxidant, anticonvulsant, analgesic, antipyretic, antimicrobial, and anticonvulsant purposes. Clinical uses like treating burns, wounds, skin infections Respiratory relief, asthma, bronchitis, and another respiratory issues, management, headaches, skin conditions like boils, sulcers, and impetigo. Helps with diarrhoea, dysentery, and cholera. Flavonoids, tannins, triterpenoids, steroids, vitamins, macro-elements, micro-elements and polyphenols are among the chemical components of plants that give them their pharmacological properties. To expand the plant's pharmacological use, Clinical testing and additional research are needed. The purpose of this review is to present details regarding the plant's overall taxonomy, chemical makeup, and therapeutic preparation.

Keywords: Kalanchoe Pinnata, Taxonomy, Chemical Composition, Traditional Uses, Therapeutic Uses

INTRODUCTION

Life plant or miracle leaf are other names for Kalanchoe pinnata. This perennial shrub is a member of the family Crassulaceae. Originally from Asia, the plant has spread to many temperate zones worldwide. Known for its therapeutic qualities, Kalanchoe pinnata is a wonderful plant. A natural remedy for various ailments, this succulent bush is a healing force. It is a useful tool in traditional medicine because of its capacity to hasten wound healing, lower inflammation, and relieve respiratory issues. The plant's antifungal and antibacterial characteristics also make it a good cure for skin ailments like fungal infections, abscesses, and ulcers. Kalanchoe pinnata has also been used to treat pain, lower fever, and eliminate parasites, demonstrating its adaptability as a natural remedy. This plant is a well-liked option for people looking for alternative approaches to wellness because of its strong antihistamine and anti-allergic qualities, which reduce inflammation and allergic

reactions. Kalanchoe pinnata, whether utilized in conventional medicine or alternative therapies, has a wealth of health advantages that keep spurring new research and uses. ^[1,2,3]

Physical Characteristics

An upright, succulent shrub, Kalanchoe pinnata can reach a height of 1.5 meters in its natural habitat. Fleshy, dark green leaves with characteristic scalloped edges and scarlet trim adorn the plant's long, hollow stems. The plant bears black, bell-shaped blooms.

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



Figure 01: Kalanchoe Pinnata Flower



Figure 02: Kalanchoe Pinnata Leaf

Propagation

Propagation of *Kalanchoe pinnata* can be easily achieved through stem and leaf cuttings.

TAXONOMY OF THE PLANT *KALANCHOE PINNATA*

Kingdom	Plantae
Subkingdom	Tracheobionta
Super Division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Saxifragales
Family	Crassulaceae Stonecrop Family
Genous	Kalanchoe
Species	<i>Kalanchoe Pinnata</i> (Lam.) Per ^[4]

GEOGRAPHICAL SOURCE:

Kalanchoe pinnata is native to Madagascar. After being neutralized, it has spread rapidly throughout the world's tropical and subtropical regions, including [2,16].

Asia	India
	China
	Southeast Asia
Africa	West, East, South Africa
Australia	
Pacific Islands	Havai
	Tahiti
	Fiji
America	Central America
	South America
	Caribbean
Indian Ocean Islands	Mauritius
	Reunion
	Sechelles

PLANT PROFILE:

Synonyms: *bryophyllum pinnatum*, *bryophyllum germinans*, *bryophyllum calycinum*, *C. culiculata*, *C. pinnata*, *C. rahizophilla*, *crascula pinnata*, *verera pinnata*^[4].

Hindi	Zakhm-Hayat
Bengali	Koppata
Sanskrit	Asthi-Bhakshaka
Telugu	Simajamudu
Tamil	Ranakali
Urdu	Chubehayat ^[4,17,18]

Plant description

Habitat: The plant is a succulent perennial shrub.

Height: The plant grows up to 1 to 1.5 Meters tall (3-5 feet) in the wild.

Stem: the plant has tall, hollow, and fleshy stems, with a diameter of up to 2.5cm (1 inch).

Leaves: It is dark green, fleshy, and has a recognizable scalloping and red trimming. 5–15 cm in length and 2–5 cm in diameter.

Flowers: Dark, bell-shaped, pendulous blooms with merged petals and four petals are produced by the shrub. Clusters of reddish-brown to purple blooms, 1–2 cm long, are found at the tips of branches.

Fruits: The fruit is a follicle that splits open along one side to release seeds.

Seeds: the seeds are small in size, numerous, and brown.



Propagation: It is simple to propagate the plant through seeds, stem, and leaf cuttings.



Figure 04

Invasive Species

The plant is said to be an invasive species in many regions, including Hawaii and French Polynesia. It is

now considered a threat to French Polynesia's biodiversity.

VISUAL ABSTRACT

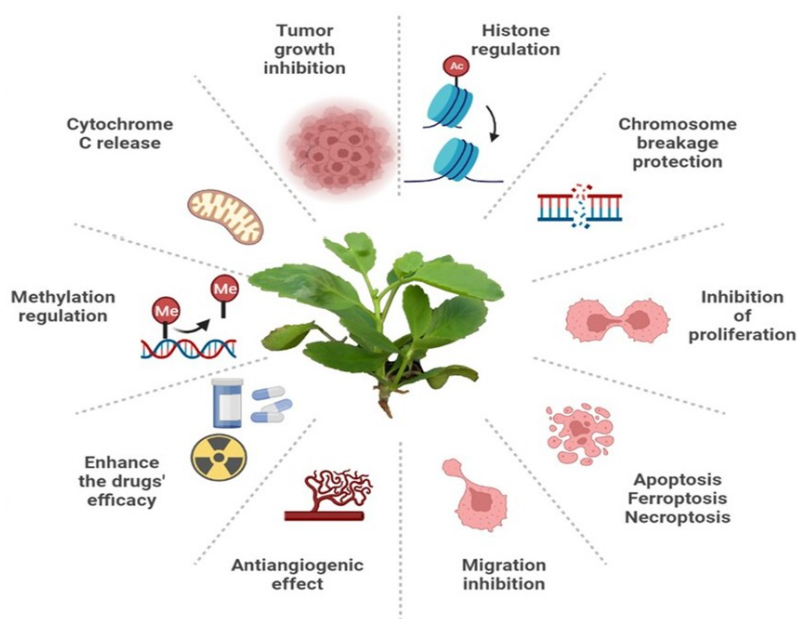


Figure 03: Visual abstract

TRADITIONAL USES

In traditional medicine, *Kalanchoe pinnata* has been used to cure several ailments, such as burns, ulcers, abscesses, earaches, and bug bites. Additionally, it is utilized to alleviate the symptoms of cithiasis, whitlow, and diarrhoea. By promoting placenta delivery, the herb facilitates childbirth. It is possible to treat respiratory conditions such as asthma,

pneumonia, and bronchitis. It helps the body get rid of parasites and worms. Furthermore, it was used to treat oedema, stomach ulcers, and kidney stones. *Pinnata kalanchoe* also has carminative and astringent analgesic properties.

Since the plant has various traditional uses therefore the plant is widely used in medicinal systems. In India, it is used to treat diarrhoea; the juice of leaves



is used to treat cough, constipation, wound healing, bruises, swelling, and insect bites. In addition, the extract of plant leaves is used in kidney stone therapy and fever^[9,10,11].

In Vietnam, it is referred to as an antibacterial and anti-inflammatory agent^[13].

The plant found similar use in Bangladesh as it is used to treat cough, mucus, fever, etc^[12].

In Brazil, it is used for the treatment of burns, sedatives, respiratory infections, dermatosis, arthritis, bronchitis, scurvy, etc^[8].

CLINICAL USES

The plant has many clinical uses, including:

1. Wound care: Effective in treating burns, wounds, and skin infections.
2. Respiratory relief: Helps with asthma, bronchitis, and other respiratory issues.
3. Pain management: Provides relief from pain, including headaches.
4. Skin health: Treats skin conditions like boils, ulcers, and impetigo.
5. Gastrointestinal issues: Helps with diarrhoea, dysentery, and cholera^[3,15].

PHYTOCHEMISTRY

Chemical composition of the plant contains various chemical constituents such as alkaloids, flavonoids, phenolic compounds, tannins, etc.

Macromolecules like phosphorus, sodium, potassium, calcium, magnesium, and so forth.

Macromolecules such as zinc and iron.

Vitamins such as niacin, riboflavin, thiamine, and ascorbic acid.

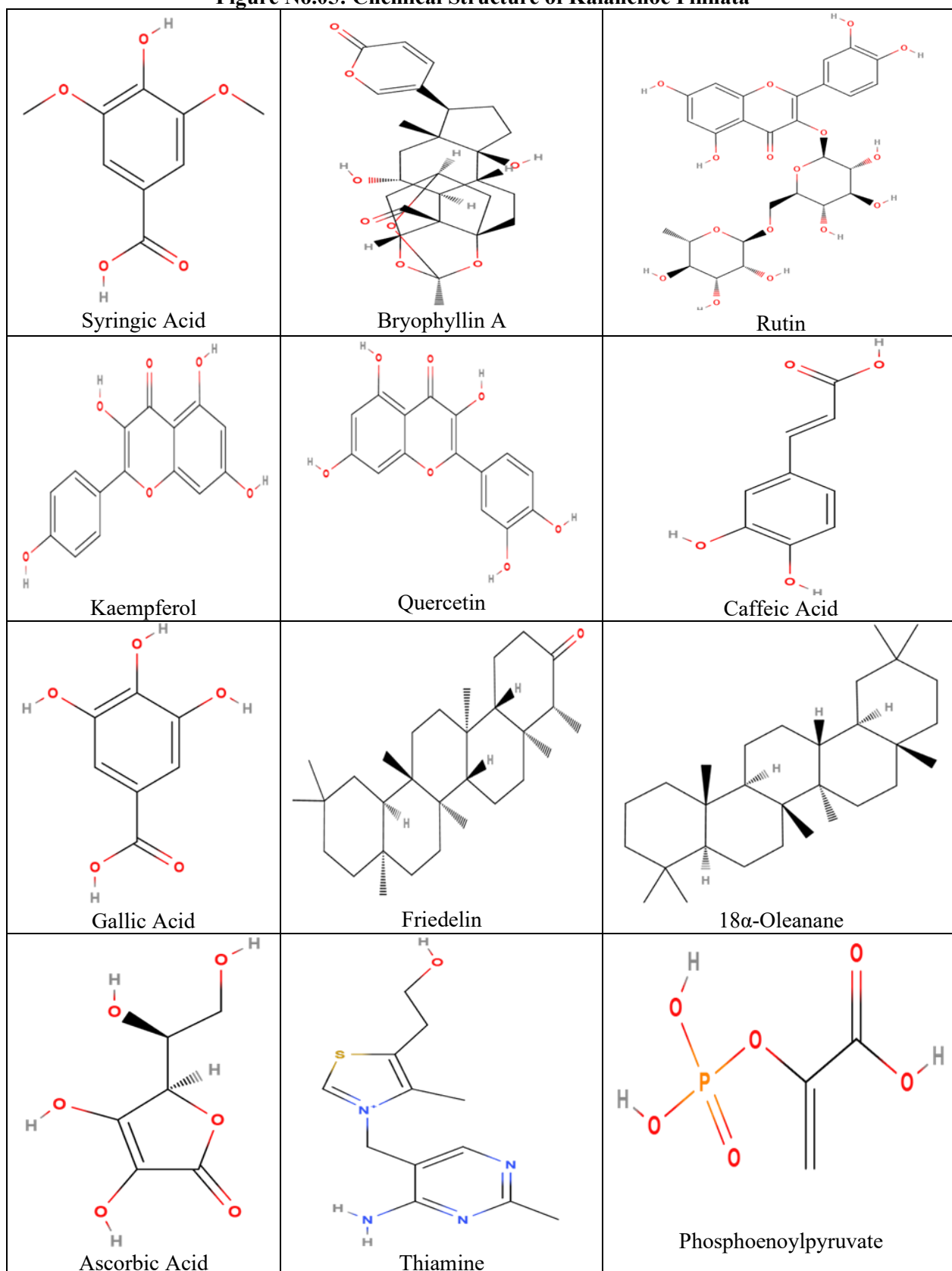
CHEMICAL COMPOSITION

Alkaloids	Buffadienolides *
	Bryophyllin A *
	Bryophyllin C
Flavonoids	Astragalin
	Luteolin
	Rutin *

	Kaempferol *
	Quercetin*
	Quercetin-3L-rhamnosido-L-arabino furanoside
	Quercetin-3-O-diarabinoside
	Kaempferol-3-glucoside
	Kaempferol 3-O- α -Larabinopyranosyl (1 $\rightarrow$ 2) α -L-rhamnopyranoside
	Quercetin 3-O- α -Larabinopyranosyl (1 $\rightarrow$ 2) α -L-rhamnopyranoside
Phenolic Compounds	4',5-dihydroxy-3',8-dimethoxyflavone 7-O- β -D-glucopyranoside
	Syringic acid*
	Caffeic acid*
	4-hydroxy-3-methoxy-cinnamic acid
	4-hydroxybenzoic acid
	p-hydroxycinnamic acid
	Para-coumaric acid
	Ferulic acid*
	Protocatechuic acid
Tannins	Phosphoenolpyruvate
	Gallic acid*
Terpenoids	Ellagic acid
	Friedelin*
	Epigallocatechin-3-o-syringate
	Bryophyllol
	Bryophollone
Steroids	Bryophollenone
	18 α -Oleanane*
	ψ -Taraxasterol
Vitamins	β -Amyrin acetate
	Ascorbic acid*
	Riboflavin
	Thiamine*
Macro Elements	Niacin
	Magnesium
	Calcium
	Potassium
	Phosphorus
Micro Elements	Sodium
	Iron
Other Compounds	Zinc
	Phosphoenolpyruvate*
	Bryophynol
	Phenanthrene derivatives

CHEMICAL STRUCTURES OF KALANCHOE PINNATA



Figure No.05: Chemical Structure of *Kalanchoe Pinnata*

ALKALOIDS

Alkaloids are special compounds found in plants that can help with various issues. They are made up of

nitrogen and can affect the body in powerful ways. Some alkaloids like bufadiolones, Bryophyllum A, and Bryophyllin C are used as medicines to relieve



pain, treat disease, or even fight cancer. Caffeine for energy, quinine for malaria, and morphine for pain treatment are a few examples. These substances continue to play a significant role in contemporary healthcare after centuries of use in traditional medicine. Because of their special qualities, alkaloids are useful in the treatment of variety of illness. They function by interacting with the body's cells and processes.

FLAVONOIDS

Flavonoids are potent substances present in a wide variety of fruits, vegetables, and plants. They offer incredible health advantages, including lowering inflammation, fending off the radicles, and even assisting in the prevention of some illnesses. Due to their well-known antioxidant properties, flavonoids may be able to shield our cells from harm. Flavonoids are present in a variety of foods, including dark chocolate, tea, citrus fruits, and berries. They have been associated with several health advantages, such as enhanced cognitive function, decreased risk of several types of cancers, and better heart health. All things considered, flavonoids are a class of substances that can significantly our health and well-being, which makes them an important component of a balanced diet.

PHENOLIC COMPOUNDS

Phenolic compounds are a group of powerful antioxidants found in many plants, fruits, and vegetables. They have amazing health benefits, like protecting our cells from the damage, reducing inflammation, and even helping to prevent certain diseases. Phenolic compounds can be found in foods like berries, green tea, olive oil, and whole grains, etc. they work by neutralizing free radicals, which can harm our cells and can result in aging and disease. By eating a diet rich in phenolic compounds, we can help support our overall health.

TANNINS

Certain plants contain compounds called tannins, which give food and drinks a characteristic bitter and astringent flavour. Their capacity to bind to proteins and other molecules is well-known, and it may also have some negative health impacts. Foods high in tannins include tea, coffee, chocolate, fruits, nuts and

more. Their antioxidant qualities aid in shielding our cells from the harm that free radicals can do. Additionally, tannins have antibacterial and anti-inflammatory activities that aids general health. Although large level of tannins can prevent absorption of nutrients.

TERPENOIDS

Terpenoids are a broad class of substances that give plants their distinct flavour and scents. They are present in spices, herbs and essential oils. These are compost of isoprene units. Among the many health advantages of terpenoids are their anti-inflammatory, antibacterial and antioxidant qualities. Terpenoids with possible health benefits, such as lowering stress and anxiety, elevating mood and even treating cancer cells, include limonene and pinene. Plants including lavender, tea tree, and cannabis contain terpenoids, which are frequently utilized in natural medicine and aromatherapy. These substances promote overall health and well-being. Terpenoids which have pleasant scent and possible advantages are significant component of plant kingdom.

STEROIDS

Steroids are a class of chemical compounds that can be produce in the library or found naturally in the body. Steroids are similar to hormones and they play a crucial role in controlling metabolism, growth, and development in the human body. Some steroids are used in the treatment of hormonal imbalance, inflammation and asthma. while anabolic steroids are used to promote muscle growth, corticosteroids can help in minimizing swelling and inflammation. However, steroids have various side-effects, therefore a doctor should prescribe and carefully monitor their usage. To guarantee safe and efficient use, its critical to comprehend the various among different kinds of steroids and how they affect the body.

VITAMINS

A balanced diet rich in whole foods can provide most of the vitamins we need, vitamins can be also be taken as a supplement to fill the gaps in the diet. These substances play an important role in maintaining our overall health, and getting enough of them can prevent deficiencies and support the body functioning. Vitamins support various body functions like energy



production, immune function and growth. There are 13 different vitamins, each has a unique role, such as vitamin D supports bone health and vitamin C helps to fight infections.

MICRO-ELEMENTS

Tiny quantities of vital microelements sometimes referred to as micronutrients, which are crucial for preserving human health are found in medicinal plants. Iron, zinc, copper, manganese, and other minerals are example of these microelements. They support the normal operation of enzymes and other biological molecules by acting as catalysts. For example, zinc promotes wound healing and immunological functions, while iron is essential for connective tissue. These macromolecules assist the body processes, including energy synthesis, neuron function, and antioxidant defences. We can take advantage of therapeutic uses of medicinal plants that are high in these microelements, which can help in preventing many illnesses.

MACRO-ELEMENTS

These are also referred to as macro-minerals; these are vital nutrients that our body needs in significant amounts in order to function correctly. The macro-elements such including sodium, potassium, calcium, magnesium and phosphorous. phosphorous helps to promote bone health and the production of health, calcium is essential for teeth and bone development. Magnesium is essential for heart health and the function of muscles and nerves. Potassium improves the regulation of blood pressure and muscle function. These macro-elements support overall body function.

THERAPEUTIC ACTIVITY (PHARMACOLOGICAL APPLICATION)

Wound Healing Activity

According to reports, the plant has strong wound-healing abilities. One study used a rat excision wound model to assess *Kalanchoe pinnata*'s ability to heal wounds. They made season wounds on rats' backs. There were three groups of rats: the control group, the normal treatment group, and the group that received ethanolic extract from *K. Pinnata*. To assess *Kalanchoe pinnata*'s capacity for wound healing, a histological investigation was conducted. The results

of the investigation showed that *k. pinnata* leaf extract has a considerable capacity for wound healing, marked by elevated angiogenesis, epithelialization, and collagen synthesis^[4,19].

Anticancer Activity

Five bufadienolides extracted from *Kalanchoe pinnata* leaves were studied for their ability to suppress Epstein-Barr virus early antigen (EBV-EA) activation in Ruji cells that was triggered by the tumour promoter 12-O-tetradecanoylphorbol-13-acetate (TPA). Against EBV-EA activation, the bufadienolides exhibited inhibitory action^[4,20].

Analgesic Effect

The analgesic properties of methylene chloride/methanol (1:1) extract and its fractions were assessed by the use of acetic acid, formation, and pressure tests. The result should be that the extract & its fraction exhibited significant analgesic activity, with the methylene chloride fraction showing the most potent effect (78.49% inhibition of acetic acid-induced pain). The extract & its fraction also significantly reduce the first & second phases of pressure and formalin-induced discomfort.

Anticonvulsant Effects

According to earlier studies, the chloride/methanol extract decreased the duration of seizures caused by three convulsant drugs and markedly lengthened the latency period in seizures caused by PTZ.

Antimicrobial Activity

At a 25 mg/ml dosage, it was discovered that the plant leaf extract of *Kalanchoe pinnata* inhibited the growth of five of the eight bacteria examined. A free radical called CCL3 is formed when chloroform attaches to lipoprotein, causing lipid peroxidation in the endoplasmic reticulum and causing hepatotoxicity, as demonstrated by earlier research. Additionally, it was discovered that the plant's leaf extract may reduce bilirubin levels by up to 104% and SGPT leaves by up to 92%. *Kalanchoe pinnata*'s hepatoprotective efficacy was validated by histopathology investigations, indicating that it has the capacity to shield the liver from harm^[21,8].

Antidiabetic Activity



Kalanchoe pinnata extract contains bioactive compounds like flavonoids, alkaloids, etc.

Their compound increases insulin secretion, enhances glucose uptake, and inhibits glucose production which resulting in lowered blood glucose levels, improved insulin sensitivity, and reduced diabetic complications. Therefore, Kalanchoe pinnata can be used as a natural remedy for managing diabetes^[8,20,21].

Antifungal Activity

Kalanchoe pinnata could potentially have antifungal properties against some strains of the candida species that cause vaginal candidiasis, according to earlier studies evaluating the plant's antifungal effectiveness against different strains of the species^[4,22].

Antiallergic Activity

Standard use of the plant Kalanchoe pinnata to treat coughs and upper respiratory conditions stems from its strong anti-allergic and antihistaminic properties. It reduces airway congestion and inflammation by inhibiting the histamine receptor in the lungs, which decreases allergic symptoms like coughing and wheezing^[6].

Antihypertensive Activity

Studies on the effects of plant leaf extract on cats and rabbits revealed that it significantly lowers blood pressure in cats under anaesthesia and lessens the effects of adrenaline, which raise blood pressure. NOTE: Due to its possible organ toxicity, kalanchoe pinnata could not be an appropriate treatment for hypertension^[6].

Diuretic Activity

By promoting the production of urine, plant leaf extract may have diuretic effects and aid in the body's elimination of waste products and fluids. It also lowers the chance of unpleasant and possibly dangerous renal issues by preventing kidney stones from forming. Plant leaf extract was given orally or by injection to male Wistar rats in order to assess the diuretic impact of the extract. We examined the rat's urine production and looked at how the extract affected kidney stones. In addition to causing urine output, kalanchoe pinnata extract also stopped kidney stones from forming^[4].

Antioxidant And Nephroprotective Activity

The DPPH assay was used to evaluate the formulations of kalanchoe pinnata and P. longum for their capacity to scavenge free radicals. In the assay, different concentrations of P. longum and kalanchoe pinnata formulation are mixed with a methanol solution that contains DPPH. Standard ascorbic acid was used to compare the antioxidant activity. P. longum and kalanchoe pinnata formulations had encouraging antioxidant properties^[4].

CULTIVATION AND HARVESTING

Cultivation

- **Climate:** Warm, subtropical temperatures between 15°C and 30°C (59°F and 86°F) are ideal for Kalanchoe pinnata.
- **Soil:** For cultivation, well-draining soil with a pH between 6.0 and 7.0 is ideal.
- **Propagation:** Kalanchoe pinnata can be propagated through leaf cuttings, stem cuttings, or seeds.
- **Watering:** Regular watering is necessary, but the plant can tolerate some drought.
- **Fertilization:** Applying balanced fertilizers throughout the growth season is an option.

Harvesting

- **Timing:** Six to twelve months after planting, or when the leaves are ripe and sensitive, one can harvest them.
- **Method:** You can harvest the entire stem or just a piece of it to allow for regeneration, or you can pick the leaves one at a time.
- **Handling:** Harvested leaves should be handled carefully to avoid damage and contamination.
- **Drying:** Leaves can be dried in the shade or using a desiccant to preserve them for later use.

POST-HARVEST PROCESSING

1. **Cleaning:** To get rid of any dirt or debris, cleansed leaves should be harvested.
2. **Storage:** To maintain the effectiveness and freshness of dried leaves, store them in airtight containers.





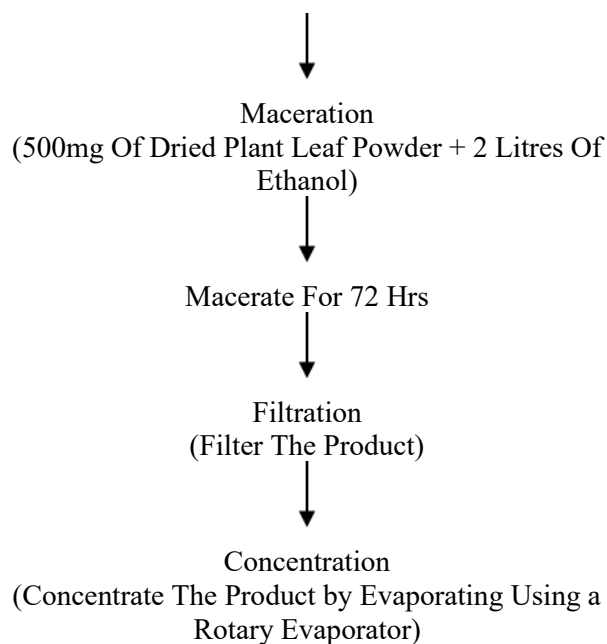
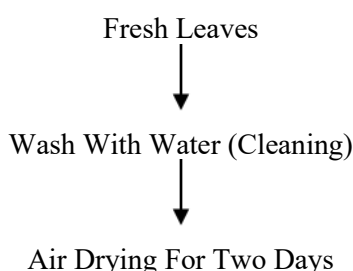
Fig.06: Dried Plant Leaf



Fig. 07: Packaging

METHOD OF EXTRACTION

Extraction procedure for crude drug: (for ethanolic extract)



PLANT MATERIAL PREPARATION

- **Collection:** Collect the harvested leaves of *Kalanchoe pinnata*.
- **Cleaning and drying:** The leaves are cleaned and dried in the shade to prevent degradation of the antioxidant.
- **Grinding:** The dried leaves are ground into a fine powder to facilitate solvent extraction.

SOXHLET EXTRACTION

Using a Soxhlet apparatus, the plant material is continuously extracted for 48 hours at 60 °C using a solvent such as ethanol, methanol, or water.



OTHER METHOD

SFE and microwave-assisted extraction (MAE) are further techniques. While SFE uses a supercritical fluid, such as carbon dioxide, at high pressure and temperature to extract desired molecules, MAE uses a microwave to speed up the extraction process.

POST EXTRACTION

- **Filtration:** The extraction process eliminates any leftover plant matter.

- **Evaporation:** A dry powder or residue is left behind after the solvent is evaporated in order to concentrate the extract.
- **Storage:** To facilitate future applications and analysis, the dried extract is kept in an airtight container.

DOSAGE FORMS

Kalanchoe Pinnata Juice

Its functions include promoting digestion, improving gastrointestinal functioning, and having anti-diabetic



properties. Key features include its ability to effectively cure kidney stones, control blood sugar, lessen joint pain and edema, and treat cough, asthma, and cold. Ayurvedic medicine is a type of medicine. Physical manifestation: as juice. Take 20–30 ml twice a day with warm water after eating, or as prescribed by a doctor. Age group: children older than two. Storage: Keep in a dry, cool location. Details of the packaging: bottle.



Figure 08: Kalanchoe Pinnata Juice

Kalanchoe Pinnata Tea

Tea of the Leaf of Life. Supplement for Blood Sugar Support, Immune Booster, and Antioxidant. Kalanchoe Pinnata, also known as Leaf of Life, is a premium-quality natural product made with the best, purest, and most natural ingredients. It is native to Madagascar and Africa. There are 15 tea bags each box. Its many health advantages have made it well-known worldwide. It supports heart health, weight loss, digestion, energy, mental clarity, skin health, and much more. The Leaf of Life, or Kalanchoe Pinnata (*Bryophyllum pinnatum*), is a popular herbal treatment believed to support overall health.



Fig. 09: Kalanchoe Pinnata Tea

Powerful Antioxidant

The most potent antioxidant found in nature, kalanchoe pinnata enhances long-term health on the

inside while reducing external aging indications. **EFFECTIVE DETOX:** Help boost your metabolism and detox and cleanse your body right now. 100% natural support for blood sugar. It keeps blood sugar at a normal range. **CARDIOVASCULAR SUPPORT:** Assists in preserving a normal range of cholesterol. **IMMUNE SYSTEM SUPPORT:** Native to Madagascar and Africa, Kalanchoe Pinnata-Leaf of Life capsules are a rich source of antioxidants and may be grown in most tropical regions of the world. Its many health advantages have made it well-known worldwide. It helps with digestion, energy, mental clarity, immune system function, weight loss, heart health, skin, and much more.



Fig 10: Kalanchoe Pinnata Capsules

Dietary Supplement

Originally from Africa and Madagascar, Kalanchoe Pinnata, also known as the Leaf of Life (*Bryophyllum pinnatum*), is grown in most tropical regions of the world and is popular in the Caribbean and Spanish-speaking nations like Mexico, Brazil, and Peru. "Air plant," "Cathedral bells," "Miracle leaf," and "Goethe plant" are some of the other names for Kalanchoe pinnata- Leaf of Life. Its many health advantages have made it well-known worldwide. Effective detoxification: cleanse and detox your entire body with 100% natural support. **CARDIOVASCULAR SUPPORT:** Assists in keeping cholesterol levels within a healthy range. Packed in antioxidants to support the immune system.



Figure 11: Plant Dietary Supplement



One of the most potent plants in nature, *Kalanchoe pinnata*, also known as the Leaf of Life, is well known for reducing the external indications of aging while fostering long-term health and wellness on the inside.

CONCLUSION

This article has briefly reviewed the pharmacological effects of *Kalanchoe pinnata*, a plant with numerous medical uses, including anticancer, analgesic, anticonvulsant, antibacterial, antidiabetic, and wound healing properties. The plant's chemical components, including flavonoids, tannins, triterpenoids, steroids, vitamins, macro- and micro-elements, and polyphenols, can be used to cure a number of illnesses. The plant's isolated macromolecules and extracts have been the subject of studies to investigate their potential for medical use. Traditional uses of the plant include treating burns, insect bites, earaches, ulcers, and abscesses; it also helps with delivery and relieves the signs and symptoms of diarrhoea, whitlow, and cithiasis. Treatable respiratory conditions include bronchitis, pneumonia, and asthma. Some areas view the plant as dangerous. Methods of plant cultivation and extraction are briefly covered. In conclusion, *kalanchoe pinnata* is a powerful natural remedy for a variety of illnesses. To fully comprehend the intricacies of this amazing plant and to safely and effectively utilize its health benefits for humans, more scientific research is necessary.

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