

A Traditional Life Plant *Kalanchoe Pinnata*: Phytochemical and Pharmacognostical Studies

Sourav Mandal¹, Subrata Ghosh², Shekhar Dey³, Tuhin Sarkar⁴

¹Assistant Professor, Department of Pharmaceutics, Birbhum Pharmacy School.

^{2,3,4}B. Pharm Student, Department of Pharmacy, Birbhum Pharmacy School.

Abstract:

Kalanchoe is a plant that grows approx. 5 feet tall. It's also known as 'air plant'. This review presents of detailed of phytochemical and medicinal properties present in the plant *Kalanchoe pinnata*. This plant contains a wide range of active compounds. From phytochemical studies we got the different type of alkaloids, glycosides, phenolic compound, flavonoids, etc. and the pharmacological properties are antioxidant, antiseptic, antidiabetic, anti-cancer, anti-microbial, anti-allergic wound healing activities and many more. The botanical description includes information on its morphology, distribution, and cultivation requirement. Traditional uses encompass its role in folk medicine across different cultures, treating ailments such as wounds, respiratory conditions, and gastrointestinal disorders. In ethnomedicine, it is known for its anthroposophical and tocolytic effects in pregnant women. Also, it is used to facilitate dropping of placenta during child birth. In many clinical trials have to be carried out in order to commercialize the potential pharmaceutical uses of the plant for which one should thoroughly know about the pharmacognostic properties of the plant *Kalanchoe pinnata*.

Keyword: *Kalanchoe pinnata*, Antimicrobial activity, Phytoconstituent.

Introduction:

Kalanchoe pinnata also known as the “miracle leaf”. It has a long history of traditional medicinal use in various culture. Its leaves contain bioactive compound such as flavonoids, phenolic acid etc. these constitute are believed to contribute to the plant's diverse pharmacological effects. *Kalanchoe pinnata* has become naturalized in temperate regions of Asia, Australia, New Zealand, West Indies, Mascarenes, Melanesia, and Hawaii. In many of these, such as Hawaii, it is regarded as an invasive species. In French Polynesia, *Kalanchoe pinnata* has been declared a threat to biodiversity. It is also widely distributed in the Philippines and it is known as *katakataka* or *kataka-taka* which is also an adjective meaning astonishing or remarkable. It is cultivated in gardens and wild on the hills of North-Western India. [1]

- **Taxonomy Kingdom:** Plantae [Plants]
- **Subkingdom:** Tracheobionta [Vascular plants]
- **Super division:** Spermatophyta [Seed plants]
- **Division:** Magnoliophyta [Flowering plant]
- **Class:** Magnoliopsida [Dicotyledonous]
- **Subclass:** Rosidae
- **Order:** Saxifragales

- **Family:** Crassulaceae Stonecrop family
- **Genus:** Kalanchoe
- **Species:** Kalanchoe pinnata [Lam.]
- **Synonyms:** Bryophyllum calycinum, miracle leaf, Crassula pinnata, B. germinans, B. pinnatum, Cotyledon calycina, C. calyculata, C. pinnata, Crassuvia floripendia, Sedum madagascariense, Vereia pinnata.

Figure 1: Kalanchoe plant leaf



Figure 2: Kalanchoe plant flower



Table 1: Local name of plant kalanchoe

Sl.No	Language	Regional name
1	Hindi	zakhm-hayat
2	Bengal	koppata
3	Malayalam	elamurunga
4	Sanskrit	asthi-bhaksha

Morphology of kalanchoe pinnata:

It's maximum height is 1.5m.it's distinctive features include freshly spoon shape leaves arranged in arrested formation with serrated edges and agreenis-gray hue .the leaves are 8-12 and 6-8cm in size. The upper usually 3-5 or sometimes 7 folio late, long pointed, the petioles united by a ridge round the stem. [2] The leaves are reach in bioactive compound, including flavonoids, phenolic acid, alkaloids. These compound contribute to the plants pharmacological activities, such as anti-microbial, anti-inflammatory, anti-oxidant and wound healing properties. The plant produces small, tubular, bell-shaped flowers that very in colour from white to pinkish-red, often attracting pollinators like butterflies and bees. The front of kalanchoe pinnata enclosed in the persistent papery calyx and corolla. The seeds of kalanchoe pinnata possess unique adaption that enhance their chances of germination and establishment. They often have a hard outer coating or seed coat, which protect them from hares environmental conditions and aids in their survival. Germination of kalanchoe pinnata seeds typically occurs in moist, well-draining soil, preferably with indirect sunlight and warm temperatures. Once germinated, the seedlings require care similar to mature plants, including regular watering, proper light exposure and protection from extreme conditions.

Table 2: Traditional use of kalanchoe

Brazil		For arthritis, bronchitis, burns, dermatosis, respiratory infection, scurvy, sedative.[4]
India	Odisha	For diarrhoea.[5]
	Maharashtra	The juice of leaves is used for cough, dysentery.[6]
	In Himalaya	Leaves are applied on wound, bruises, swelling and insect bite.[7]
	Arunachal Pradesh	Extract of leaves is taken in empty stomach in the purpose of the treatment of kidney stones and fever in children's.[8]
Bangladesh		For cough, mucus, fever, epilepsy, etc.[9]
Vietnam		For antibacterial and anti-inflammatory.[10]

Pharmacognostical studies:

Pharmacognostical studies of kalanchoe pinnata studies aim to identify and document its various physical and chemical properties, including leaf morphology, stoma characteristic, vascular bundles, trichrome, and Pharmacognostical studies may include powder microscopy and other analytical techniques to established quality control parameters for its medicinal use

- **Margin:** asymmetric base, petiole is long
- **Surface:** is globous
- **Colour:** upper epidermis dark green in colour
- **Phytochemical constituents** like alkaloids, flavonoids
- **Leaves:** are opposite or simple. 12-18cm and 6-8cm in size, apex is ovate or elliptic lower epidermis lighter in colour
- **Odors:** Bitter characteristic and
- **Test:** bitter. [11]
- **Flowers:** are cylindrical, and pendulous in a large size, terminal panicle.
- **Calyx:** is cylindrical, inflated, brownish or purplish, 3.5 cm to 4 cm long.

- **Corolla:** is tubular, about 5cm long, inflated at the base, and the exerted parts being reddish or purplish.
- **Fruit:** are follicle with many seeds. [12]

Macroscopic Character:

One prominent macroscopic feature of *kalanchoe pinnata* is its succulent, fleshy leaves, are arranged in a rosette formation as asymmetric base, and reticulate venation. The stem is cylindrical, succulent, and can grow up to several centimetres in height. The flowers are typically bell-shaped, with four or five petals and range of colours, including white, yellow, orange, pink, or red and distinctive odors.

Microscopic character:

Microscopic examination of *kalanchoe pinnata* provides insights into its internal anatomical structure in which are essential for botanical identification quality control and pharmacological studies. Under the microscope epidermis consists of a signal layer of cell, in stomatal primarily location on the lower surface of the leaf.

Figure 3: Chemical constituents of kalanchoe

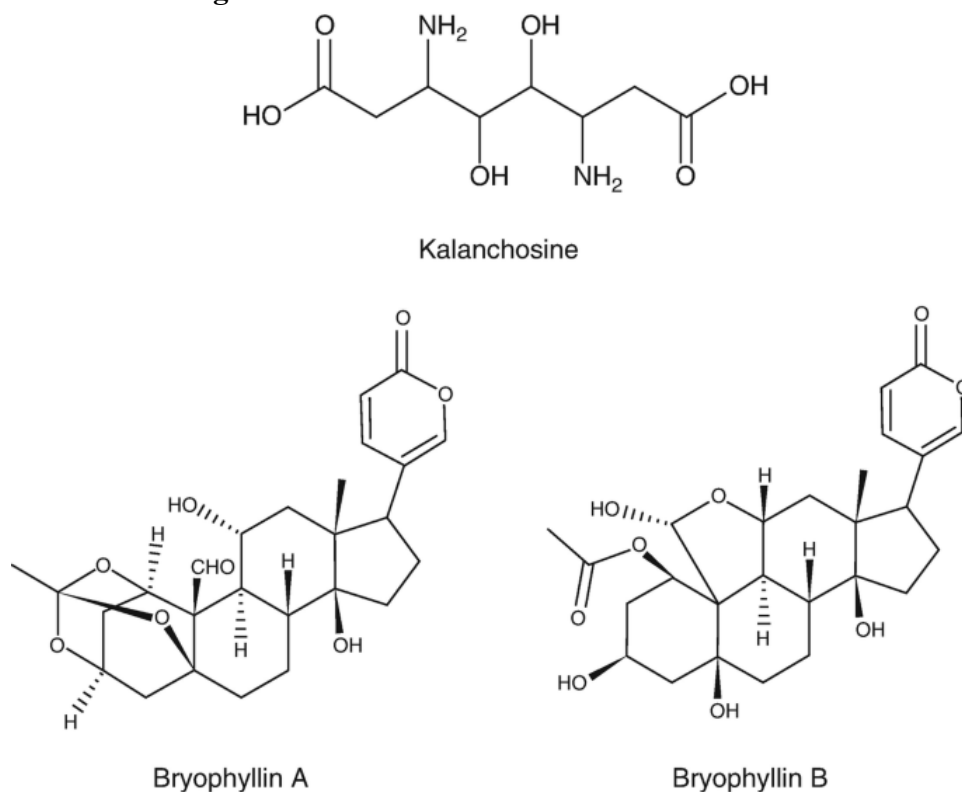


Table 3: Test for phytochemicals studies

Phyto-Chemicals	Name of the tests	Colour for positive test
Flavonoids	Shinoda	Pink
Alkaloids	Wagner	Blue-black
Tannins	Ferric chloride	Blue-black/Green
Tetraploids	Salkowski	Reddish-brown
Saponins	Foam test	Foam formation

Simple phenols	Ferric chloride	Green
Polyphenols	Ferric chloride	Blue
Arithocyanins	NaOH	Blue-green
Cardiac glycosides	Keller-kiliani's	Brown-red ring
Proteins	Biuret	Violet
Amino acids	Ninhydrin	Purple
Fatty acids	Diethyl ethjer	Transparent stain

Phytochemical review:

1. The plant *Kalanchoe pinnata* contains glycosides, alkaloids, flavonoids, phenolic compounds, and also macro elements – calcium, potassium, sodium, zinc, iron, and also vitamins – riboflavin [vit-b2], thiamine [vit-b1], ascorbic acid [vit-c], niacin [vit-b3].
2. *Kalanchoe pinnata* leaves contain 3, 8-dimethoxy-4, 5, friedelin, rutin, quercetin, L-rhamnoside- 1- arabinofuranoside, quercetin glucose arabinose rhamnose, idisorhamnetin hexose pentose. [13]
3. Fresh leaves of *K. pinnata* contain three new compounds, bryophynol and two phenanthrene derivatives have also been identified in the mixture.
4. From the methanol extract of leaves two insecticidal bufadienolides were isolated, which are bryophyllin A and bryophyllin C.
5. The steroidal and cardiolin contents include bryotoxin, isofucosterol, codisterol, 24 epiclesterol, stigma sterol are isolated from the aerial parts of the plant *K. pinnata*.
6. In the plant *K. pinnata* contains various types of enzymes i.e. PCK [phosphoenolpyruvate carboxylase], ribulose-1, 5-bisphosphate carboxylase etc. [14]

Pharmacological applications:

1. Anti-cancer activity

Research suggests that the extract from the plant *K. pinnata* possesses compounds with cytotoxic effects on cancer cells. These compounds, including flavonoids, phenols, and alkaloids, exhibit various mechanisms of action, such as inducing apoptosis in cancer cells, inhibiting tumor growth, and preventing angiogenesis. *Kalanchoe pinnata* extracts have shown promise in enhancing the effectiveness of conventional cancer treatments like chemotherapy and radiotherapy, while also reducing their side effects. Isolated Bufadienolides from *Kalanchoe pinnata* were examined for their inhibitory effects on Epstein Barr virus early antigen activation in Raji cells induced by the tumor promoter, all bufadienolides show good activity, while Bryophyllin A shows the highest activity. [15]

2. Anti-diabetic activities

Many studies have shown that extracts of the plant *K. pinnata* bioactive compounds such as flavonoids, alkaloids, etc. have demonstrated various mechanisms of action in managing diabetes including. The extraction from this plant found to lower blood glucose levels by increasing insulin secretion from pancreatic beta cells, enhancing glucose uptake by peripheral tissue and inhibiting glucose production in the liver [14, 15].

3. Anti-fungal activity

Many studies have shown that extracts of the plant *K. pinnata* bioactive compounds such as flavonoids,

alkaloids, terpenoids, phenolic compound, which have demonstrated potent antifungal cell membranes, inhibit essential enzyme activity, and interfere with fungal cell wall synthesis, ultimately leading to fungal growth inhibition and death.

4. Anti-microbial activity

Leaf extract of *K. pinnata* was found to inhibit the growth of microorganism used, with concentration of 25mg per ml.

Many studies shown that hepatotoxicity was induced by chloroform is due to its metabolic CCl_3 . A free radical that binds to lipoprotein leads to peroxidation of lipids of endoplasmic reticulum. The result of that experiment are the decreases of bilirubin level by the plant extract up to 104% and decreases of SGPT level by extract up to 92% respectively. These data along with histopathological studies clearly show the hepatoprotective activity of *Kalanchoe pinnata*. [15]

5. Wound healing activity

Kalanchoe pinnata has been recognized for its remarkable wound healing properties, which have been attributed to its diverse phytochemical and pharmacological activities. Effect of *K. pinnata* leaf extract on wound healing, incision and dead space wound in albino rat has been investigated. The three extract shown increase in the breaking strength of incision wound. Which stimulated the proliferation and migration of various cells involved in the wound healing process, including fibroblasts, keratinocytes, and endothelial cell. This accelerates the formation of granulation tissue and re-epithelialization, leading to faster wound closure.

Conclusion:

Kalanchoe pinnata, commonly known as the "miracle leaf" or "life plant," has a rich history of traditional medicinal use across various cultures. Its leaves contain a plethora of bioactive compounds, including flavonoids, alkaloids, and phenolic acids, which have sparked interest in its potential therapeutic applications in modern medicine. While traditional uses include wound healing, inflammation reduction, and antimicrobial actions, recent research has delved into its broader pharmacological effects, such as antioxidant properties and potential anticancer activity. Experimental studies have provided promising results, suggesting that *Kalanchoe pinnata* extracts may offer benefits in managing conditions ranging from skin ailments to chronic diseases like cancer. However, despite the growing body of preclinical evidence supporting its medicinal properties, several crucial aspects warrant further investigation. First and foremost is the need for rigorous clinical trials to validate the efficacy and safety of *Kalanchoe pinnata* preparations in humans. Additionally, research is needed to elucidate the mechanisms underlying its pharmacological effects and to optimize dosage regimens for specific health conditions. Furthermore, as with any herbal remedy, there are considerations regarding quality control, standardization of extracts, and potential interactions with medications. It's essential for individuals considering the use of *Kalanchoe pinnata* for medicinal purposes to consult healthcare professionals to make informed decisions. In conclusion, while *Kalanchoe pinnata* holds promise as a valuable source of natural remedies, particularly in wound care and inflammatory conditions, its full therapeutic potential remains to be fully understood. Continued scientific inquiry is crucial to unlock the secrets of this fascinating plant and harness its benefits for human health in a safe and effective manner. As we find that clinical trial on the plant yet not done hence the plant can be explored for clinical study.

Appendix:

Kalanchoe pinnata also known as the “miracle leaf”. It has a long history of traditional medicinal use in various culture. From this plant exaction the pharmaceutical sector may get various type of medicinal benefit to prepare various type of dosage forms for both internal and external use. This review work ensure that that extraction has the potency to prevent microbial growth and having anti-cancer and anti-diabetic effect also.

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