



ANTIVIRAL PLANTS OF INDIA

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PREFACE

Documentation of antiviral plants is an important task for the development of future drugs to fight against existing and emerging viral infections. In this context, 5 researchers from different organizations have recorded the information on 20 antiviral plants and presented it in this book entitled “Antiviral Plants of India”. *Acorus calamus*, *Aegle marmelos*, *Andrographis paniculata*, *Anisomeles indica*, *Azadirachta indica*, *Bridelia retusa*, *Calotropis procera*, *Catharanthus roseus*, *Celastrus paniculatus*, *Cissus quadrangularis*, *Curcuma longa*, *Elephantopus scaber*, *Eryngium foetidum*, *Justicia adhatoda*, *Memecylon umbellatum*, *Piper longum*, *Punica granatum*, *Terminalia chebula*, *Tinospora cordifolia*, and *Zingiber zerumbet* were presented along with their botanical description, medicinal properties, and antiviral potential. We hope that this book will be useful for researchers, students, academicians, and intellectuals.

(Authors)

BACKGROUND



In the contemporary world, the last decade faced different viral threats including the COVID-19 pandemic. Rising antibiotic resistance, limited availability of effective antiviral drugs, emerging viral diseases, need for assessable, affordable, and sustainable treatments are some of the causes of viral diseases. Anti-viral plants have been a part of traditional medicine for centuries offering protection against viral infections. Antiviral plants are gaining significant attention in the current situation, particularly in the COVID-19 pandemic. Some common antiviral plants reported by different researchers are *Allium sativum*, *Zingiber officinale*, *Curcuma longa*, *Camellia sinensis*, *Olea europaea*, *Azadirachta indica*, *Andrographis paniculata*, *Glycyrrhiza glabra*, *Sambucus nigra*, etc. These plants enhance the immune system, reduce inflammation, reduce the severity of colds, and have immune-modulatory effects. Some challenges are observed in the research of antiviral agents like identification of the plant, collection of traditional knowledge, standardization, and quality control of plant extracts, addressing potential interaction with conventional medication, ensuring sustainable harvesting and cultivation practices, and integrating traditional knowledge with modern scientific methods. Therefore, documentation of antiviral plants is crucial for future drug development and to fight against viral diseases. In this aspect, the book entitled “Antiviral Plants of India” provides details about 20 antiviral plants along with photographs for easy identification. The book plays a vital role in the preservation of traditional knowledge preventing loss of information on antiviral plants, and suggests that there is a need for standardization, phytochemical analysis, and clinical trials.

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Acorus calamus L.



Botanical Name: *Acorus calamus* L.

Synonym: *Acorus calamus* var. *calamus*

Family: Acoraceae

Local Name: Bacha

DESCRIPTION

It is also known as the sweet flag, and possesses distinct morphological characteristics that aid in its identification and classification within the plant kingdom.

Root system (Rhizome): The most remarkable feature of *Acorus calamus* is its elongated, creeping, cylindrical, and fragrant rhizome. It branches out and bears the marks of previous leaf growth. The outer surface of the rhizome is brown, while the inner part exhibits a white to yellowish colour.

Leaves: It has basal sword-shaped leaves that can reach a length of up to 1 meter and a width of 2.5 cm. The leaves are vibrant green, with a prominent central vein and slightly undulating margins.

Stem: It lacks a true stem. Instead, its leaves and inflorescence appear to emerge from the rhizome directly.

Flower: It produces an inflorescence known as a spadix. This densely packed spadix consists of numerous tiny, greenish-yellow flowers enclosed by a bract called a spathe. It is cylindrical.

Fruit: It bears berries as its fruit, although they are rarely observed due to their inconspicuous nature.

MEDICINAL USES

A. calamus has a rich history of medicinal use in cultures around the world. Due to its wide range of bioactive compounds, it has a variety of ethnomedicinal applications. The aromatic root of the plant is the main ingredient in medicine.

Digestive aid: One of the most common uses is as a digestive aid. It is believed to stimulate the appetite, shrink the stomach, and improve digestion. In traditional medicine, the rhizomes are often used to treat various gastrointestinal ailments such as indigestion, gas, constipation, and ulcers.

Neuroprotective and cognitive enhancer: *A. calamus* has been used in Ayurveda and Chinese medicine as a mental tonic and for treating neurological disorders. It improves memory and speech, calms the mind, and is used to treat conditions such as epilepsy and mental illness.

Anti-inflammatory and analgesic: This plant has been used for various ailments such as arthritis, rheumatism, and headaches. The antioxidant properties are attributed to compounds such as α -asarone and β -asarone found in the rhizomes.

Antimicrobial: It exhibits antibacterial properties and has been used to treat infections. Traditional uses include treating wounds, preventing infections, and healing minor cuts and wounds due to its antiseptic properties.

Respiratory health: In traditional medicine, it has been used to treat respiratory ailments. It is used as a nasal decongestant to prevent obstruction.

Other uses: *A. calamus* rhizomes have been traditionally utilized in culinary applications as a seasoning in a wide range of dishes and drinks. Additionally, they are occasionally incorporated in the making of alcoholic beverages and fragrances.

ANTI-VIRAL PROPERTIES

The ethnomedicinal applications of the *A. calamus* also show its antiviral properties. This plant, particularly its aromatic rhizome, contains bioactive compounds such as phenylpropanoids, sesquiterpenes, and flavonoids, which have demonstrated antiviral effects. Studies have shown that extracts and compounds from *A. calamus* can combat various viruses:

Influenza Virus: *A. calamus* extracts can hinder influenza virus replication, potentially aiding in the treatment of flu infections.

Herpes Simplex Virus (HSV): *A. calamus* extracts may inhibit HSV-1 and HSV-2, the viruses responsible for oral and genital herpes.

Human Immunodeficiency Virus (HIV): *A. calamus* has the potential to prevent HIV replication, but further research is necessary to assess its efficacy and safety.

Hepatitis B Virus (HBV): Limited research has been done against HB Virus, need more studies to confirm these effects and their clinical significance.

While those effects are promising, most investigations into *A. calamus*' antiviral properties have been carried out in vitro or in animal models. Extensive scientific trials are important to determine the efficacy and safety of *A. calamus* compounds against viruses in humans. Additionally, the quality and concentration of these compounds must be considered for future research.



Acorus calamus

Aegle marmelos (L.) Correa



Botanical Name: *Aegle marmelos* (L.) Correa

Synonym: *Crateva marmelos* L.

Family: Rutaceae

Local Name (s): Bael, Bela

DESCRIPTION

Aegle marmelos, also known as bael or bael fruit, is a deciduous tree indigenous to India, Bangladesh, Pakistan, and Sri Lanka.

Tree structure: It usually grows as a medium to large-sized tree, reaching up to 15-20 meters.

Trunk: It features a straight, cylindrical trunk with a moderate to thick girth. The bark has a rough texture and ranges in color from light brown to greyish.

Root: The root system is deep and extensive, aiding in anchorage and nutrient absorption for the tree.

Leaves: The leaves are trifoliate, consisting of three leaflets. Each leaflet is broadly oval or elliptical with serrated margins. The leaves are typically glossy green and are arranged alternately on the branches.

Flower: The flowers are fragrant and bisexual, containing both male and female reproductive organs. They are white or pale green and grow in clusters at the axils of the leaves.

Fruit: The bael fruit is a distinctive feature of *A. marmelos*. It is round to oval, with a smooth, hard, woody shell that changes from yellowish-green to brownish when ripe. The fruit usually measures around 5-10 cm in diameter. Upon opening, the fruit reveals a soft, aromatic, orange-colored pulp with numerous seeds embedded in sticky mucilage.

Seeds: The seeds are small, oval-shaped, and typically light brown to black. They are found within the pulp of the fruit.

MEDICINAL USES

A. marmelos has been utilized in traditional medicine for generations due to its diverse medicinal properties.

Digestive health: Bael fruit is recognized for its positive effects on digestion. It is commonly employed to address various digestive ailments such as diarrhoea, dysentery, constipation, and irritable bowel syndrome. The pulp of the ripe fruit or its juice is frequently ingested to alleviate these digestive problems.

Respiratory disorders: In traditional medical systems like Ayurveda, *A. marmelos* is utilized to manage respiratory conditions like cough, cold, bronchitis, and asthma.

Diabetes: Bael fruit is at times utilized in traditional medicine to aid in managing diabetes. It is believed to assist in regulating blood sugar levels and enhancing insulin sensitivity.

Gastrointestinal disorders: In addition to its impact on digestion, bael fruit is also used to address gastrointestinal issues such as gastritis, gastric ulcers, and indigestion. The fruit pulp or its juice is consumed to calm the stomach lining and support ulcer healing.

Cardiovascular health: It offers beneficial effects on cardiovascular health. It is believed to assist in regulating blood pressure and cholesterol levels, thereby reducing the risk of heart disease and stroke.

Antimicrobial properties: The leaves, fruit, and bark are said to possess antimicrobial properties. They may aid in inhibiting the growth of bacteria, fungi, and other pathogens, thus assisting in infection treatment.

Other uses: The leaves and fruits of *A. marmelos* have significant nutritional value and are consumed for their health benefits in many cultures.

ANTI-VIRAL PROPERTIES

A. marmelos, specifically from its leaves and fruit, has displayed promising antiviral properties. It may possess certain compounds with antiviral properties, but more research is needed to fully understand its effectiveness against viruses.

Herpes Simplex Virus (HSV): Leaves and fruits of *A. marmelos* exhibit inhibitory effects against HSV. The bioactive compounds present in the extracts may disrupt viral replication or entry into host cells.

Hepatitis B Virus (HBV): Extracts derived from *A. marmelos* possess inhibitory effects against HBV. These effects could be attributed to the existence of bioactive compounds in the extracts that impede the replication of HBV or its ability to infect liver cells.

Human Immunodeficiency Virus (HIV): Leaves and fruits of *A. marmelos* exhibit inhibitory effects against HIV. The antiviral activity against HIV may encompass various mechanisms, including interference with viral replication or entry into immune cells.



Aegle marmelos

Andrographis paniculata (Burm.f.) Wall. ex Nees



Botanical Name: *Andrographis paniculata* (Burm.f.) Wall. ex Nees

Synonym: *Justicia paniculata* Burm.f.

Family: Acanthaceae

Local Name (s): Kalmegh, Chireita, Bhuin neem, Kalibohu

DESCRIPTION

Andrographis paniculata, also known as "king of bitter" or green Chireita, is extensively cultivated in India, China, and Thailand, and grows abundantly in south-eastern Asia, including India, Sri Lanka, Pakistan, Java, Malaysia, and Indonesia for its medicinal properties.

Whole plant: It is an erect, annual herb and 30-90 cm tall with the upper part of the stem quadrangular while the lower part nearly rounded stem.

Leaves: Leaves are opposite, simple, exstipulate and petiolate. Leaf petiole pubescent but glabrous on abaxial surface, quadrangular and winged. Leaf shape ovate, base rounded and attenuate, apex obtuse, margins entire.

Flowers: Flowers are pedicelled, biliped, white-purple or spotted purple and solitary. Pedicel slender and glandular pubescent. Bracts are acicular. Calyx lobes are subacute, and glandular. Corolla is a tube, about half as long as the corolla. Filaments are hairy and anthers are purple bearded at the base.

Fruits: Fruit is a capsule, oblong, young ones sparsely glandular and hairy; when mature it is glabrous.

Seeds: Seeds are subquadrate, yellow to brownish in colour and rugose.

MEDICINAL USES

A. paniculata is a widely utilized medicinal plant with great potential. It has been traditionally employed for treating various ailments such as the common cold, diarrhoea, fever caused by infections, jaundice, and as a tonic for liver and cardiovascular health.

Skin health: The herb is also used topically for treating skin conditions like skin infections, wounds, ulcers, and itchiness. Its anti-inflammatory and antimicrobial properties aid in faster healing and reducing skin inflammation.

Diabetes: It helps to regulate blood sugar levels, making it potentially beneficial for managing diabetes.

Cardiovascular problem: It helps in managing cardiovascular health by lowering blood pressure, reducing cholesterol levels, and preventing blood clots. This contributes to a lower risk of heart disease and stroke.

Digestive support: It has been traditionally utilized to promote digestive health. It promotes healthy digestion and can be used to relieve symptoms of gastrointestinal discomfort, diarrhoea, and dysentery.

Fever reduction: Leaves are sometimes employed to lower fever due to their antipyretic properties. They can assist in reducing body temperature and alleviating fever symptoms.

ANTI-VIRAL PROPERTIES

The antiviral properties of *A. paniculata* are primarily attributed to its bioactive compounds, notably andrographolide, along with several other diterpenoids, flavonoids, and polyphenols. These compounds contribute to its antiviral effects through various mechanisms. These compounds work together to make *A. paniculata* effective in managing and preventing various viral infections.

SARS-CoV-2: It interferes with the entry of SARS-CoV-2 into the host cell responsible for causing COVID-19.

Influenza Virus: *A. paniculata* extracts can inhibit viral multiplication of influenza A (H₃N₂) virus. It helps in reducing the severity and duration of flu symptoms.

Hepatitis C: In human hepatoma cells, the p38 MAPK/Nrf2 pathway is activated by Andrographolide, leading to the up-regulation of heme oxygenase-1. This mechanism enables Andrographolide to exhibit anti-hepatitis C virus activity.

Dengue Virus: *A. paniculata* exhibited a 75% inhibition of the dengue virus, indicating the need for a thorough investigation into its mode of inhibition properties. It is essential to conduct purification and characterization of the active compounds to identify potential anti-dengue viral agents.

Human Immunodeficiency Virus (HIV): Andrographolide, a diterpene lactone found in *A. paniculata*, demonstrates anti-HIV properties when tested in vitro. Various derivatives of andrographolide have been created and tested for their effectiveness against HIV in a cell-free virus infectivity assay using TZM-bl cells.



Andrographis paniculata

Anisomeles indica (L.) Kuntze



Botanical Name: *Anisomeles indica* (L.) Kuntze

Synonym: *Anisomeles ovata* W.T.Aiton

Family: Lamiaceae

Local Name (s): Kala bhangra

DESCRIPTION

Anisomeles indica is a perennial herbaceous plant. It typically grows as a low shrub, ranging from about 0.5 to 1.5 meters in height.

Root: The root system of *A. indica* is typically fibrous and shallow. This allows the plant to spread extensively in search of nutrients and moisture.

Stem: The stems of *A. indica* are typically slender, erect, and slightly hairy. They may branch out from the base and have a greenish to reddish-brown coloration.

Leaves: The leaves exhibit a simple, opposite arrangement typically lanceolate to ovate. They feature serrated edges and a coarse texture.

Flower: The flowers are borne in terminal spikes or racemes. Each flower is tubular with a bilaterally symmetrical corolla and a distinct upper lip and lower lip. They are usually purple, lavender, or white and have a pleasant fragrance.

Fruit: It produces small nutlets containing seeds. These nutlets are typically rounded and brown.

MEDICINAL USES

A. indica, also referred to as Indian Catmint or Mexican Mint has a rich history of traditional medicinal uses.

Anti-inflammatory properties: It has been traditionally employed to alleviate inflammation and related conditions. It has the potential to treat arthritis, rheumatism, and inflammatory skin disorders.

Antimicrobial activity: The plant contains bioactive compounds that exhibit antimicrobial properties. Traditionally, it has been used to treat wounds, skin infections, and respiratory tract infections.

Analgesic and antipyretic properties: It has been employed to alleviate headaches, muscle pains, and fever symptoms.

Gastrointestinal disorders: It has been traditionally used in the treatment of gastrointestinal ailments such as diarrhoea, dysentery, and stomach-aches.

Respiratory conditions: It is traditionally used in treating respiratory disorders such as coughs, colds, and bronchitis.

Menstrual disorders: In certain traditional practices, it has been employed to regulate menstrual cycles and alleviate menstrual cramps.

ANTI-VIRAL PROPERTIES

A. indica has gained attention in traditional medicine for its various pharmacological activities, including its potential against diverse viruses.

Anti-HIV Activity: *A. indica* has the potential to inhibit the human immunodeficiency virus (HIV). The bioactive compounds within the plant may interfere with different stages of the HIV replication cycle. Some research suggests that extracts of *A. indica* may exhibit anti-HIV activity by inhibiting viral entry into host cells or interfering with viral replication processes.

SARS-CoV-2: Research has shown that (-)-Anisomelic acid exhibits inhibitory effects against SARS-CoV-2, the virus responsible for the COVID-19 pandemic. It effectively suppresses viral replication, thereby reducing the spread of the virus within host cells. Additionally, it mitigates viral-induced cytopathic effects, which are the detrimental effects that viruses have on host cell structure and function.

Additional research is needed to fully clarify the mechanisms of action and assess the clinical relevance.



Anisomeles indica

Azadirachta indica A.Juss.



Botanical Name: *Azadirachta indica* A.Juss.

Synonym: *Melia indica* (A.Juss.) Brandis

Family: Meliaceae

Local Name (s): Neem

DESCRIPTION

A. indica, is a tree species that is indigenous to the Indian subcontinent and can be found in tropical and subtropical regions across the globe.

Tree structure: *A. indica* can either be evergreen or deciduous, and it falls within the medium to large-sized category. It has the potential to reach heights of 15-35 meters.

Bark: The bark of the neem tree is rough and can be described as dark grey to brown in color. As the tree ages, it develops deep furrows with longitudinal fissures.

Leaves: Neem leaves are compound in nature, and consist of multiple leaflets. They are arranged alternately along the central axis and measure around 20-40 cm. in length. Each leaf is comprised of 8-15 leaflets, which are lanceolate or oblong. These leaflets have serrated margins and pointed tips.

Flowers: Trees produce small, white, and fragrant flowers that are arranged in clusters or panicles. These flowers are typically bisexual and actinomorphic. They consist of five sepals, five petals, ten stamens, and a superior ovary.

Fruits: The fruit is known as a drupe. When young, the fruit appears green and elongated, but as it matures, it turns yellow. Each fruit contains a single seed.

Seeds: Neem seeds are oval-shaped and have a brown coloration. They measure around 1-1.5 cm in length and possess a thin outer seed coat (testa).

MEDICINAL USES

Neem has rich medicinal applications in traditional medicine systems like Ayurveda, Unani, and traditional Chinese medicine.

Antimicrobial properties: Neem possesses strong antibacterial and antifungal properties. It can be applied topically to treat skin infections, wounds, and acne.

Blood cleansing: In Ayurvedic medicine, neem is recognized as a blood purifier. It aids in detoxifying the blood, eliminating toxins, and enhancing overall well-being.

Digestive support: Neem has been traditionally utilized to promote digestive health. It may help alleviate gastrointestinal issues such as indigestion, constipation, and flatulence.

Fever reduction: Neem leaves are sometimes employed to lower fever due to their antipyretic properties. They can assist in reducing body temperature and alleviating fever symptoms.

Diabetes: Neem has hypoglycaemic effects and potentially aids in managing diabetes by regulating blood sugar levels.

ANTI-VIRAL PROPERTIES

The antiviral activity of neem extracts against viruses like herpes simplex virus (HSV), human immunodeficiency virus (HIV), and others has been demonstrated in laboratory studies.

Herpes Simplex Virus (HSV): Neem extracts have demonstrated the ability to directly impede the replication of HSV. It effectively diminishes the generation of new viral particles, thereby restricting the dissemination of HSV infection.

HIV: Neem compounds have the potential to hinder the attachment of HIV to host cells and inhibit the virus from entering. Neem has immunomodulatory properties, meaning it can modulate the activity of the immune system. Neem extracts can stimulate the production of cytokines and activate immune cells such as T cells, B cells, and natural killer (NK) cells. By enhancing the immune response, neem may help the body better control HIV infection and reduce the progression of AIDS.

Polio Virus: It has also antiviral effects against poliovirus, responsible for causing poliomyelitis or polio.

Dengue Virus: Neem contains bioactive compounds such as azadirachtin, nimbin, and nimbidin, that inhibit the dengue virus replication cycle, including viral attachment, entry into host cells, and replication of viral genetic material. Disrupting these processes reduces the production of new dengue viral particles and limits the spread of the infection.

Coxsackievirus B (CV-B): CV-B is a member of the Enterovirus genus and is associated with various human illnesses, including myocarditis, pericarditis, meningitis, and hand, foot, and mouth disease (HFMD). Neem has demonstrated broad-spectrum antiviral properties against this virus by interfering with different stages of the CV-B replication cycle.



Azadirachta indica

Bridelia retusa (L.) A.Juss.



Botanical Name: *Bridelia retusa* (L.) A.Juss.

Synonym: *Clutia spinosa* Roxb.

Family: Phyllanthaceae

Local Name (s): Kasi

DESCRIPTION

Bridelia retusa, commonly known as Porcupine Wood. It is widely distributed across the Indian Subcontinent, Southeast Asia, and Australia.

Roots: It possesses a taproot system. The taproot system features a main root that grows vertically downward, from which smaller lateral roots branch off. This structure helps the tree anchor firmly into the soil, making it resistant to wind and soil erosion.

Bark: The bark is grey to dark brown and rough, deeply fissured, with small, sharp, and spiny projections, especially in young trees. Wood is hard, dense, red, brown, durable, and of good quality. It is used for construction and furniture.

Leaves: The leaves are simple, alternate, ovate to elliptic, with an approximate length of 5-15 cm and 2.5-7.5 cm in width. The color on the upper surface varies from a glossy greenish shade on the upper surface and paler beneath. The leaves have a leathery texture and are smooth or slightly hairy on the surface. The leaf margins are entire and often somewhat wavy.

Flowers: It produces unisexual flowers. The flowers are greenish or yellowish, occasionally with a pinkish tint. The male flowers are typically in clusters, while the female flowers are solitary or a few-flowered.

Fruits: The fruit is a globose or slightly lobed drupe 1-1.5 cm in diameter, turning from green to black or dark purple when mature.

Seeds: Each fruit contains one to two seeds. The seeds are oblong and encased in a hard endocarp.

MEDICINAL USES

B. retusa is highly valued for its medicinal properties, especially in the Indian Subcontinent and Southeast Asia. Different parts of the plant, such as the bark, leaves, roots, and fruits, are utilized in traditional medicine to treat a range of ailments. The

pharmacological properties attributed to *B. retusa* are supported by phytochemical studies revealing the presence of compounds such as tannins, alkaloids, flavonoids, and saponins, which are known for their therapeutic effects.

Wound healing: The bark of *B. retusa* is commonly utilized in traditional medicine for its wound-healing attributes. It is administered topically on cuts and wounds to facilitate healing and diminish the chances of infection.

Dysentery and diarrhoea: Infusions of the bark are employed in the treatment of dysentery and diarrhoea. The presence of tannins in the bark may enhance its efficacy by lessening inflammation and impeding the growth of specific bacteria.

Skin diseases: The leaves are incorporated in traditional remedies for managing skin diseases and infections, owing to their antimicrobial and anti-inflammatory qualities.

Antipyretic: The leaves are utilized to reduce fever, serving as a natural antipyretic.

Laxative: The fruits are sometimes used as a natural laxative to alleviate constipation.

ANTI-VIRAL PROPERTIES

B. retusa, possesses a range of phytochemicals such as flavonoids, tannins, saponins, and alkaloids. These compounds are renowned for their extensive therapeutic properties and show potential antiviral activities.

Flavonoids: These compounds are recognized for their antioxidant properties, but they have also been investigated for their capacity to hinder various stages of viral lifecycles, including attachment, penetration, and replication.

Tannins: Tannins have demonstrated potential in inhibiting viral enzymes and proteins that are essential for virus replication.

Alkaloids and Saponins: These compounds have been studied for their immunomodulating effects and their potential to impede viral replication.

Coronavirus 2 (SARS-CoV-2): *B. retusa* plant could stop the virus causing COVID-19 from replicating. It targeted a specific part of the virus known as 3CL pro, which is crucial for the virus to multiply. Ellagic acid and (+)-sesamin, from this plant are effective at binding to the virus's target site, potentially more effectively than a known inhibitor. Both ellagic acid and (+)-sesamin showed promise as natural inhibitors of the virus, supporting their potential as natural treatments against COVID-19.

Research on the antiviral properties of *B. retusa* might be limited, but investigating its phytochemicals shows potential for uncovering new antiviral treatments.



Bridelia retusa

Calotropis procera (Aiton) W.T.Aiton



Botanical Name: *Calotropis procera* (Aiton) W.T.Aiton

Synonym: *Asclepias procera* Aiton

Family: Apocynaceae

Local Name (s): Arakh, Aak

DESCRIPTION

The plant species *Calotropis procera*, also known as "milkweed" or "apple of Sodom".

Stem: The stem is woody, robust, and typically displays a pale greyish. In older plants, it may exhibit a somewhat twisted or gnarled appearance.

Leaves: The leaves are large, wide, and usually arranged alternately along the stem. broadly ovate, ovate-oblong, elliptical, or obovate, acute, pubescent when young and glabrous on both sides on maturity

Flowers: The flowers are highly distinctive, and hermaphroditic, usually appearing in clusters at the branch ends. They are large, showy, and possess a unique structure. Each flower consists of five petals fused at the bottom to form a star-shaped corolla. Flower color ranges from white to pale lavender or pink.

Inflorescence: The inflorescence is a compact, many-flowered, umbrella-like cluster that emerges from the nodes and can be seen as either axillary or terminal.

Fruits: Fruit simple, pulpy, swollen, round to slightly egg-shaped follicle that can reach a diameter of 10 cm or larger.

Seeds: The seeds are plentiful, flat obovate and are accompanied by a silky white pappus that is 3 cm or longer.

Latex: A notable feature of *C. procera* is the milky latex present in its stems, leaves, and other parts. This latex contains toxic compounds that deter herbivores and pests.

MEDICINAL USES

C. procera, including the leaves, roots, flowers, and latex, are believed to contain medicinal properties.

Anti-inflammatory properties: The latex of *C. procera* is recognized for its anti-inflammatory effects. It has been traditionally applied topically to reduce inflammation associated with conditions like arthritis, rheumatism, and skin disorders.

Wound healing: Latex has been traditionally used for wound healing. It is believed to possess antiseptic properties that aid in preventing infections and promoting the healing of cuts, wounds, and burns.

Respiratory diseases: In traditional medicine, *C. procera* has been used to alleviate respiratory symptoms such as coughs, asthma, and bronchitis.

Pain relief: Certain traditional medicinal systems utilize *C. procera* for its analgesic properties, which help in alleviating pain related to various conditions.

Antimicrobial activity: Leaves and latex, exhibit antimicrobial activity against a broad spectrum of bacteria, fungi, and other microorganisms.

Cardiovascular effects: Traditional uses of *C. procera* include its application in cardiovascular conditions.

ANTI-VIRAL PROPERTIES

Specific compounds in *C. procera* may have antiviral effects against certain viruses. The plant contains bioactive compounds like alkaloids, flavonoids, glycosides, and terpenoids, which have been studied for their antiviral properties.

Herpes Simplex Virus (HSV): Leaves and latex of *C. procera*, could potentially exhibit antiviral effects against Herpes Simplex Virus (HSV). Studies have demonstrated the inhibitory effects of *C. procera* extracts on HSV replication in vitro.

Dengue Virus (DENV): *C. procera* shows inhibitory effects against dengue virus (DENV), indicating a possible role in managing dengue infections.

HIV Virus: *C. procera* shows inhibitory effects on HIV replication, check the fatal disease AIDS.

Although there are some reports available on the antiviral properties of *C. procera* it is crucial to emphasize the necessity for further in-depth research, such as clinical trials, to validate its effectiveness and safety for antiviral use. However, further research is necessary to understand the mechanisms and potential applications of this activity.



Calotropis procera

Catharanthus roseus (L.) G.Don.



Botanical Name: *Catharanthus roseus* (L.) G.Don.

Synonym: *Vinca rosea* L.

Family: Apocynaceae

Local Name (s): Sadabahar, Sadabihari

DESCRIPTION

Catharanthus roseus, also known as the “Madagascar periwinkle” or “Rosy periwinkle”.

Stem: The stem of *C. roseus* is upright, slender, and typically grows to a height of 1-2 feet. It is usually green in color and may have a slightly woody texture as the plant matures.

Leaves: The leaves are shiny and dark green, oppositely arranged along the stem, and have an elliptical or lanceolate shape with smooth edges. The leaves have a smooth texture and can reach a length of 5-7.5 cm.

Flowers: The flowers are usually solitary and appear at the tips of the branches. They have five petals and come in different colours such as white, pink, lavender, and red. The center of the flower contains a prominent cluster of yellow stamens. The flowers have a tubular shape and often emit a pleasant fragrance.

Fruits: After pollination, the flowers develop into small, paired, slender seed capsules. These capsules contain numerous small seeds. When fully mature, the capsules split open to release the seeds.

MEDICINAL USES

The leaves of the plant are known for their significant medicinal properties.

Anti-diabetic activity: Leaves of *C. roseus* are used in reducing blood sugar levels, offering potential benefits in the treatment of diabetes.

Antimicrobial activity: *C. roseus* has exhibited antimicrobial properties against diverse bacteria, fungi, and viruses, suggesting potential applications in the treatment of various infectious diseases.

Cardiovascular health: Certain compounds found in this plant have potential cardiovascular advantages. They have the potential to lower blood pressure and cholesterol levels, thereby reducing the risk of heart disease.

Wound healing: In traditional medicine, *C. roseus* has been topically applied to treat wounds, skin infections, and other dermatological conditions. Its antimicrobial properties aid in preventing infections and promoting wound healing.

Eye disorder: In some traditional medicinal systems *C. roseus* is used to treat eye-related ailments such as conjunctivitis and eye inflammation.

ANTI-VIRAL PROPERTIES

Ongoing studies have indicated that extracts or compounds derived from *C. roseus* may have antiviral effects against certain viruses.

1. Herpes Viruses: Extracts from *C. roseus* can inhibit Herpes Simplex Viruses (HSV-1 and HSV-2), which cause oral and genital herpes. These effects have been observed in both laboratory settings and animal models.

2. Dengue Virus: The bioactive compounds found in *C. roseus*, such as alkaloids like vincristine and vinblastine, have been found to inhibit the dengue virus.

3. Respiratory Syncytial Virus (RSV): *C. roseus* may have antiviral effects against respiratory syncytial virus (RSV), a common cause of respiratory infections in infants and young children.

4. Human Immunodeficiency Virus (HIV): *C. roseus* extracts and compounds have potential against human immunodeficiency virus (HIV), the virus that causes AIDS.

Further research, including clinical studies, is necessary to gain a comprehensive understanding of the antiviral capabilities of *C. roseus* and its components. Moreover, the effectiveness and safety of utilizing *C. roseus* extracts or compounds as antiviral agents in humans need to be further explored.



Catharanthus roseus

Celastrus paniculatus Willd.



Botanical Name: *Celastrus paniculatus* Willd.

Synonym: *Catha paniculata* (Willd.) Scheidw.

Family: Celastraceae

Local Name (s): Jyotismati, Pengu, Kujuri

DESCRIPTION

Celastrus paniculatus, commonly known as the Black Oil Tree. It is a woody climber that can grow up to 30 meters in height, with slender and twining stems.

Leaves: Their leaves are alternate, elliptical, or ovate, and have a smooth or slightly serrated margin, apex abruptly acuminate, base rounded or acute, crenulate. Petiole 6 mm long. Panicle terminal, axillary, oblong; pedicel 6 mm long.

Flowers: The flowers of *C. paniculatus* are small and greenish-white in color, arranged in panicles or clusters. Sepals 5, small, imbricate, ciliate. Petals white, ovate, obtuse.

Fruits: The plant produces small, round fruits that turn bright red when ripe. These fruits contain 3-valved, 3-celled contain 3-6 black shining seeds with a white aril. The fruiting season is from May to December.

Seeds: Seeds are subquadrate, yellow to brownish, and rugose. Ellipsoid seed is enclosed in orange, red fleshy aril and grows inside the fruits.

MEDICINAL USES

C. paniculatus, is a woody vine species that has been utilized in both Traditional Chinese medicine and Indian medicine for countless centuries.

Skin health: Oil is applied on infected areas of skin infection. The seed oil is also used to treat eczema. The plant's leaves have also been shown to have wound-healing properties.

Neurological disorder: Sushruta, Charaka, and Vagbhatta recommended it as a remedy for mental illness. Decoction of the root or seed internally in prescriptions as a brain tonic for headache, depression, and swooning. It is considered in Ayurveda to stimulate memory.

Respiratory problem: In Ayurveda, the plant is used to treat asthma. It also helps to inhibit the inflammatory responses in respiratory diseases like COPD.

Digestive support: Seeds are used as an appetizer. Root or seed is internally used as a laxative for cleaning the digestive system. It is used to treat various digestive issues such as dyspepsia, stomach cramps, and constipation. Its seeds are believed to promote healthy digestion and alleviate gastrointestinal discomfort.

Cardiovascular problem: The fruit juice is used as a cardiotonic. It helps in improving cardiovascular health by managing blood pressure and cholesterol levels.

Pain relief: The oil extracted from the seeds has been traditionally used for its analgesic properties, providing relief from various types of pain including headaches, joint pain, and muscle aches.

Immune system support: The plant may have immunomodulatory effects, helping to regulate and enhance the body's immune response. This can be beneficial in preventing infections and supporting overall immune health.

ANTI-VIRAL PROPERTIES

The antiviral properties of *C. paniculatus* are attributed to its rich composition of sesquiterpenes, alkaloids, flavonoids, glycosides, triterpenoids, steroids, and phenolic compounds. These bioactive compounds work through various mechanisms to inhibit viral replication, modulate immune responses, and protect host cells from damage, making the plant a promising candidate for further antiviral research.

Adenovirus: Phenolic compounds found in *C. paniculatus* are effective for their antiviral activity against adenoviruses.

Influenza Virus: Studies have shown that the plant extract can be utilized to combat Bronchitis caused by the influenza virus.

Coronavirus: extracts or specific compounds from *C. paniculatus* can inhibit SARS-CoV-2 replication. The interference hampers the entry of SARS-CoV-2 into the host cell, which is accountable for inducing COVID-19.

Rhinovirus: Sesquiterpenes present in *C. paniculatus* may offer potential benefits against Rhinovirus.



Celastrus paniculatus

Cissus quadrangularis L.



Botanical Name: *Cissus quadrangularis* L.

Synonym: *Vitis quadrangularis* (L.) Wall. ex Wight

Family: Vitaceae

Local Name (s): Hadjod, Harjor, hadajoda

DESCRIPTION

Cissus quadrangularis, commonly known as Veldt grape, is a deciduous, woody climber.

Leaves: The leaves are simple, alternate, and fleshy. They are generally ovate to elliptic in shape, with entire margins.

Flowers: It produces small greenish-white flowers arranged in clusters called cymes. The inflorescence is compact and arises from the leaf axils or at the ends of branches. The flowers are typically inconspicuous compared to the foliage.

Fruits: The fruits are small berries that turn black when mature. Each fruit contains seeds.

Stem: Stems are succulent and square-shaped. The quadrangular shape is a notable characteristic, giving rise to the species name "*quadrangularis*".

MEDICINAL USES

C. quadrangularis has been revered for its medicinal properties for thousands of years.

Bone health and joint support: One of the most well-known uses of *C. quadrangularis* is for promoting bone health and aiding in the healing of fractures. It is believed to have properties that enhance bone mineralization and accelerate fracture healing processes.

Wound healing: Applied topically, *C. quadrangularis* has been used to promote wound healing and skin regeneration. Its anti-inflammatory and antioxidant properties may contribute to these effects.

General health tonic: In some cultures, *C. quadrangularis* is used as a general health tonic to boost energy levels, improve overall vitality, and enhance physical performance.

Gastrointestinal health: In traditional medicine, it has been used to treat digestive disorders such as indigestion, gastritis, and peptic ulcers. It is believed to have gastroprotective properties.

Weight management: Extracts of *C. quadrangularis* are sometimes used to support weight loss and management. It is believed to help reduce appetite and inhibit the accumulation of fat in the body.

ANTI-VIRAL PROPERTIES

C. quadrangularis is renowned for its diverse array of bioactive compounds, which contribute to its medicinal properties and therapeutic potential. Among the key bioactive compounds found in this plant are Ketosteroids Such as β -sitosterol and stigmasterol, phytosterols (campesterol and cholesterol), flavonoids, triterpenoids, carotenoids, phenolic acids (chlorogenic acid and caffeic acid), calcium, vitamin C, resveratrol, harmine, etc. These bioactive compounds collectively contribute to the medicinal properties attributed to *Cissus quadrangularis*, including its use in traditional medicine for bone health, joint support, anti-inflammatory effects, and potentially other therapeutic applications.

Herpes Simplex Virus (HSV): It has shown promising antiviral activity against Herpes Simplex Virus (HSV) in laboratory studies. Extracts of *C. quadrangularis* have been found to inhibit HSV replication and reduce viral load in vitro. The plant's bioactive compounds may interfere with viral attachment or replication processes.

Further research is indeed needed to explore the antiviral activity of *C. quadrangularis*, particularly against a broader range of viruses.

Cissus quadrangularis



Curcuma longa L.



Botanical Name: *Curcuma longa* L.

Synonym: *Amomum curcuma* Jacq.

Family: Zingiberaceae

Local Name (s): Haldi

DESCRIPTION

Curcuma longa, also known as “Turmeric”, belongs to the group of oldest cultivated spice plants in Southeast Asian countries.

Rhizome: The rhizome is medium-sized, conical, deep orange-yellow inside, and strongly aromatic; sessile tubers are numerous, cylindrical, and branched; root tubers are rare. It has a pepper-like aroma with a somewhat bitter, warm taste, and a strong orange-yellow colour. It undergoes boiling, cleaning, and drying to yield a yellow powder (Haldi).

Leaves: Leaves 8-12, arranged alternatively, 4-6. The petiole measures about 35-40 cm, while the lamina is oblong-lanceolate. The lamina tapers at both ends and has wavy margins. It is glabrous and pubescent near the extreme tip. The ligule is short and located close to the lamina.

Flowers: The inflorescence comes from the center of the leafy stem, with a closely arranged bract. Bracts are fused to create a pouch and the tips are curved back. The outer surface is pubescent. Two flowers emerge from the lower bract, whereas a single flower from the upper one. The corolla is tube-shaped, white in colour, and smooth. The labellum is with three lobes, a middle lobe that is notched, light yellow with a wide dark yellow band in the center.

Fruits: Fruits are born on only a few occasions, if ever produced (the fruit does not seem to be known), dry fruits contain seeds.

MEDICINAL USES

Turmeric has a long tradition of use in the Chinese and Ayurvedic systems of medicine.

Digestive problems: *C. longa* is used to relieve digestive troubles like discomfort or pain in the upper abdomen and acidity, indigestion, gas, and ulcers, additionally, it helps in mitigating the hallucinogenic effects of hashish and other psychoactive drugs.

Blood purifier: Rhizome is considered a source for blood purification, used to remove accumulation in the blood vessels and remove toxins from the body.

Diabetes: Curcumin present in this plant is also useful in lowering blood sugar levels and showed a significant reduction of lipid peroxidation.

Respiratory problems: Rhizome has potential against asthma and cough-like respiratory problems. By reducing inflammation, turmeric might soothe the effects of bronchitis.

Skincare: Treatment of acne, dark spots, and hyperpigmentation, as well as the alleviation of skin conditions like eczema and psoriasis, are key focuses. Furthermore, it aids in the healing and prevention of dry skin, and in slowing down the skin aging process. Turmeric has been applied as a home remedy to heal wounds.

Immunity booster: Curcumin of *C. longa* use on myeloid-derived suppressor cells resulted in an elevation of CD8⁺ T cells and a reduction in Treg cells, consequently enhancing the immune response.

ANTI-VIRAL PROPERTIES

Curcumin is one of the major compounds in *C. longa*, that play a significant role against certain viruses.

1. Human Immunodeficiency Virus (HIV): Curcumin can impact HIV function at several different stages of the HIV lifecycle.

2. Influenza A Virus (IAV): Curcumin is likewise an amazing inhibitor of IAV, and probably checks the virus lifecycle. Incubation of IAV with curcumin outcomes in decreased infectivity, probably because of the ability of curcumin to interfere with viral haemagglutinin activity.

3. Zika Virus (ZIKV): Zika virus is a mosquito-borne flavivirus, that could cause congenital Zika syndrome (CZS), characterized by neurological complications and fatal deaths. It was inhibited when the virus was incubated directly with curcumin.

4. Chikungunya Virus: Curcumin shows potential against Chikungunya virus (CHIKV). Its effects are corroborated by the reduction of the viral genome, confirming the reduction of the infectivity of enveloped viruses. Therefore, curcuminoids proved promising in the treatment of outbreaks of CHIKV.

5. Corona Virus: Curcumin prevents cell infection and viral replication in the SARS-CoV, preventing COVID-19.

6. Noro Virus: Curcumin reduces the ability of Noro Virus to contaminate cells, it is due to the capacity of curcumin to bind to and inhibit the action of surface glycoproteins at the virus.

7. Herpes Simplex Virus 2: Curcumin inhibits anti-herpesvirus activities by targeting multiple steps in herpesvirus life/infectious cycle.



Curcuma longa

Elephantopus scaber L.



Botanical Name: *Elephantopus scaber* L.

Synonym: *Scabiosa cochinchinensis* Lour.

Family: Asteraceae

Local Name (s): Mayurachulia, Samdudri, Gojivha

DESCRIPTION

Elephantopus scaber, also known as the “Elephant foot” or “Prickly leaved elephant's foot.” It is a terrestrial, aromatic, erect, perennial herb, up to about 60 cm in height.

Stem: Stem branches dichotomously and has a short and stiff stem with rough hair

Leaves: Leaves are dark green, 5-18 cm long, 2-4 cm wide. They are spatulate or oblanceolate (lance-shaped with the wider end closer to the tip), arranged in a rosette-like shape.

Flowers: The compound inflorescence is composed of many capitula (compound flowers composed of 4, purplish or pink florets). Flowers are small, actinomorphic, epigynous, purple to dull pink, each cluster supported by a rigid ovate leaf-like bract, inner bracts leafy, distinct, pale green.

Fruits: The fruits are one seeded known as achenes, about 4 mm long. They are elongated, angled, and covered in soft hairs. The fruit is attached to a pappus which is composed of 5-6 spiny bristles, and white bristles.

MEDICINAL USES

Roots, leaves, the aerial part and even the whole plant of *E. scaber* have been used in traditional oriental medicine to treat various diseases.

Stomach troubles: Root decoction of *E. scaber* is widely used to treat diarrhoea, dysentery, stomach troubles and blood vomiting in tuberculosis. Whole plant decoction is also used to treat diarrhoea. The roots and leaves are utilized as a soothing agent for the treatment of dysuria, diarrhoea, dysentery, and stomach pain.

Wound healing: Leaves have been used externally to treat wounds. Leaves have been used to treat wounds. Leaf juice is also useful for treating wounds.

Respiratory problems: Leaves have been used to treat chest pain, cough, bronchitis, and asthma. Fresh roots can be chewed to treat cough and cold. Decoction of root is also used in respiratory problems.

Liver protection: Roots are utilized for liver trouble. Its root juice has been also consumed to relieve liver troubles.

Antioxidant activity: The whole plant possesses antioxidant activity, which may help in scavenging free radicals and reducing oxidative stress in the body.

Rheumatism: Paste has been made from the either leaves or the whole plant to treat menorrhagia or rheumatism. Also, the whole plant has been reported to be useful for curing rheumatism. Leaves of *E. scaber* have been made into powder and heated with castor, coconut, and gingelly oil to cure rheumatism.

ANTI-VIRAL PROPERTIES

E. scaber possesses certain compounds with antiviral potential. Studies have identified various phytochemicals present in the plant, such as flavonoids, triterpenoids, and sesquiterpene lactones, which are known to exhibit antiviral activity against certain viruses.

1. Human metapneumovirus (HMPV): Compounds such as 3,4-dihydroxy benzaldehyde, p-coumaric acid, Vanillic acid, Syringic acid, Isovanillic acid, p-hydroxybenzoic acid, Ferulic acid, 3-methoxy-4-hydroxyl cinnamic aldehyde, Tricin 2-hydroxybenzolate acid have been found to inhibit the HMPV virus.

2. Respiratory Syncytial Virus (RSV): A di-caffeoyl derivative from *E. scaber*, 1 α , 2 β -O-dicaffeoylcyclopentan 3 β -ol showed in vitro antiviral activity against Respiratory Syncytial Virus (RSV). Four dicaffeoylquinic acids 4,5 di-O-caffeoylquinic acid, 3, 4, di-O-caffeoylquinic acid and their methyl esters also possessed strong anti-RSV activity.

3. HIV: Potent HIV-1 inhibitory actions were obtained from the water extract of *E. scaber* leaves and root, potential to treat AIDS.

While *E. scaber* shows promising potential as a traditional remedy for various ailments, including respiratory conditions, further research is essential to determine its efficacy against viruses. Comprehensive research, including in vitro and in vivo experiments, is needed to evaluate its effectiveness, safety, and mechanism of action against specific viral pathogens. Such research could provide valuable insights into the potential role of this plant in combating viral infections.



Elephantopus scaber

Eryngium foetidum L.



Botanical Name: *Eryngium foetidum* L.

Synonym: *Eryngium antihystericum* Rottler

Family: Apiaceae

Local Name (s): Ban dhaniya

DESCRIPTION

Eryngium foetidum is a very aromatic, glabrous, erect, perennial herb. It is commonly known as “False coriander”.

Leaves: Leaves green, glabrous, and oblanceolate. Leaves are arranged in a basal rosette. The leaf margin is serrulate. Basal leaves are lanceolate or oblanceolate, broad, cuneate, obtuse, the petiole short or obsolete, cauline leaves numerous, the upper sessile, and usually opposite.

Inflorescence: The inflorescences are cymose and can be solitary, paired, formed by a floral axis.

Flowers: Flowers are creamy white, bisexual, arranged in a reduced umbel inflorescence that is cylindrical with a dome-shaped top.

Fruits: Fruits are globose and scaly. The fruits are indehiscent, densely papillate, white, and globose to ovoid.

MEDICINAL USES

Fresh or dried aromatic leaves with a strong coriander-like aroma are commonly utilized in soups, noodle dishes, and curries, as well as combined with various vegetables to create spicy sauces and salsa, useful in treating various ailments.

Female problems: The tea of the plant is recommended to treat female reproductive problems, promote menstruation, relieve cramps, treat infertility, and facilitate labor, and is considered to have aphrodisiac action.

Child health: A decoction of the leaves is used to bathe the child and a small amount of the mixture is given to drink.

Fever: The leaves and roots are mixed with coconut oil and used in treating fever.

Skin diseases: Leaves and roots are useful in treating smallpox, and eczema-like skin-related diseases.

Stomach disorders: It is used in traditional medicine to treat constipation and other gastrointestinal ailments.

ANTI-VIRAL PROPERTIES

Several bioactive compounds contribute to the medicinal properties of *E. foetidum*. The essential oil of *E. foetidum* contains a variety of volatile compounds that contribute to its distinct aroma and therapeutic properties. Major constituents include eryngial, dodecanoic acid, p-cymene, terpinolene, etc.; phenolic compounds like caffeic acid, chlorogenic acid, flavonoids, quercetin, kaempferol, etc. It also contains steroids and saponins like stigmasterol, saponins, and other compounds like alkaloids, tannins, etc.

Influenza Virus: *E. foetidum* has been employed to manage symptoms of the common cold and flu, including congestion and cough.

Modern scientific studies have started to explore and validate these traditional applications. Research has identified various bioactive compounds in *E. foetidum*, such as phenolic compounds and flavonoids, which contribute to its antiviral properties. Essential oils extracted from *E. foetidum* leaves contain significant amounts of (E)-2-dodecenal and 13-tetradecenal, compounds known for their antimicrobial and antioxidant activities. These properties help in combating viral infections by boosting the immune system and directly inhibiting viral replication. Studies have shown that *E. foetidum* essential oils exhibit strong antioxidant activity, which is crucial in mitigating oxidative stress caused by viral infections. The antioxidant properties help neutralize free radicals, thus supporting the body's defense mechanisms against viruses.

Eryngium foetidum



Justicia adhatoda L.



Botanical Name: *Justicia adhatoda* L.

Synonym: *Adhatoda vasica* Nees

Family: Acanthaceae

Local Name (s): Arusa, Basanga

DESCRIPTION

Justicia adhatoda, also known as the “Malabar Nut” or “White Vasa.” It is a perennial erect shrub, up to 4m tall, grows commonly in open plains.

Stem: The stem of *J. adhatoda* is erect, and woody at the base. It is typically green when young and turns brown and woody with age.

Leaves: Leaves are simple, opposite, and decussate. Leaf blade ovate to elliptic-ovate, adaxially densely tomentose when young but glabrescent except tomentose along veins, base broadly cuneate, margin entire, apex acuminate, and sometimes slightly falcate.

Flowers: Flowers large, Corolla white or pink with purplish or pinkish stripes outside, borne in compact, axillary, pedunculate spikes with large bracts. Corolla 2-lipped, with 5-lobed. Upper lip ovate-oblong, erect, shallowly 2-lobed; lower lip oblong-circular, spreading, 3-lobed, middle lobe subcircular and lateral lobes ovate.

Fruits: The fruits are small capsules that contain numerous tiny seeds. When mature, the capsules split open to release the seeds. Seeds globular.

MEDICINAL USES

J. adhatoda has been utilized for its healing properties since ancient times, with all its parts being employed. It has a long history of use in the Ayurvedic system of medicine for treating a variety of health issues.

Respiratory disorders: Leaves and roots of the plant are used for asthma, bronchitis, and cough. Mainly the decoction of leaf is used for curing cough and asthma. Juice of fresh leaves along with honey is given as an expectorant, inhaled for sinusitis, and used also to treat bronchitis and cough.

Stomach problems: The leaf juice is used to cure diarrhoea and dysentery. The boiled leaves are crushed and the paste is used to cure dysentery. The fruit of *J. adhatoda* is also used for curing diarrhoea and dysentery.

Fever reduction: The leaf juice is used to relieve fever. The paste, powder, and decoction of the root are used for curing malarial fever. Fruit juice is also useful in treating fever.

Skin diseases: The various preparations of leaves are used for curing skin diseases, and wounds.

Diabetes: The extract of roots of *J. adhatoda* is commonly used against diabetes. Leaves are also useful in diabetes.

Rheumatism: The leaves and roots are used for rheumatism. Juice of fresh leaves is employed for treating rheumatism.

ANTI-VIRAL PROPERTIES

Various phytochemicals, including polyphenols and alkaloids, have been proposed as potent inhibitors of different viruses. The alkaloids from leaf extracts of *J. adhatoda* have also been reported to possess anti-viral activity.

1. Influenza Virus: Studies revealed that the methanolic extract has the potential to inhibit influenza virus infection suggesting the possible ways of viral inhibitions by blockage of viral attachment by inhibition of viral Hemagglutinin (HA) protein.

2. Herpes Simplex Virus: Six alkaloids namely vasicoline, vasicolinone, vasicinone, vasicine, adhatodine, and anisotine have been isolated from the leaves of *J. adhatoda*. The Methanolic extract of the leaves of this medicinal plant has been reported for inhibitory activities against Herpes Simplex Virus (HSV).

3. SARS CoV-2: The anisotine, an alkaloid derived from *J. adhatoda* has potential antiviral activity against SARS-CoV-2 by inhibiting the enzymatic/proteolytic activity of the main protease (Mpro), a key component for the cleavage of the viral polyprotein.

4. HIV: *J. adhatoda* alkaloids possess proper drug-likeness properties and two anti-HIV drugs (lopinavir and darunavir).

J. adhatoda has been traditionally used against diverse ailments, but scientific evidence supporting its efficacy in some of these areas is still limited. Future research efforts could focus on isolating and characterizing the specific compounds responsible for its antiviral effects. Research is needed to elucidate how its bioactive compounds interact with viral targets and host cells to inhibit viral replication and dissemination. Developing formulations that optimize the bioavailability, stability, and efficacy of *J. adhatoda* extracts or isolated compounds is essential. This may involve exploring different extraction techniques, formulation excipients, and delivery methods to enhance their therapeutic potential.



Justicia adhatoda

Memecylon umbellatum Burm.f.



Botanical Name: *Memecylon umbellatum* Burm.f.

Synonym: *Memecylon ramiflorum* Desr.

Family: Melastomataceae

Local Name (s): Anjan, Neymaru

DESCRIPTION

Memecylon umbellatum, also known as the “Ironwood tree” or “Delek air tree.” It is a small tree, commonly found in habitats like semi-evergreen, shola, and moist deciduous forests, also in plains of peninsular India and Sri Lanka.

Bark: The bark is greyish-brown, very thin, fissured, and flaky but not ridged.

Leaves: Leaves are simple, opposite, decussate; apex acuminate, sometimes acute, base acute to sub attenuate, margin entire. The leaves are dark green and glossy on the upper surface and lighter green on the underside.

Inflorescence: The flowers are arranged in dense, terminal, umbellate clusters, hence the species epithet "*umbellatum*." These clusters consist of numerous small, five-petaled flowers.

Flowers: Flowers are small, petals and stamen stalks brilliant blue, calyxes pink, barely scented. Each flower has five sepals and five petals, giving a showy appearance. The flowers are bisexual, possessing both male and female reproductive organs.

Fruits: Fruits are small globular berries, with persistent calyx at the base, borne in small axillary bunches, ripening from green to pinkish-red to black, and eaten by birds.

MEDICINAL USES

M. umbellatum has been used in traditional medicine to treat a variety of ailments.

Diabetes: The leaf powder is used for the treatment of diabetes. It has hypoglycemic effects, and the potential to lower blood sugar levels.

Stomach problems: Decoction of young leaves is taken against stomach disorders. Leaf decoction mixed with rice flour is used as a treatment for indigestion.

Skin diseases: The paste of leaves is used in the treatment of herpes. Leaves and bark, paste is applied externally to promote faster healing of wounds and cuts. Preparation from the bark used for the treatment of bruises. It is also useful in chickenpox.

Women's problems: Leaves are used in the treatment of gonorrhoea and leucorrhoea. A decoction of leaf is used in the treatment of menstrual pains. The decoction of the root is used in excessive menstrual discharge and menorrhagia.

Eye troubles: A lotion prepared from leaves is used to treat eye troubles.

ANTI-VIRAL PROPERTIES

M. umbellatum contains diverse bioactive compounds like terpenoids, flavonoids, tannins, phenols, alkaloids, glycosides, phenolic compounds, memecylaene, umbelacton, amyrin, sitosterol, tartaric acid, malic acid, oleanolic acid, triterpenes, ursolic acid etc.

1. Herpes Simplex Virus (HSV): Extracts of *M. umbellatum* exhibited significant antiviral activity against both HSV-1 and HSV-2 in vitro, suggesting its potential use in treating herpes infections.

2. Ranikhet Virus: It is also known as Newcastle disease virus (NDV), is a contagious and often fatal viral disease affecting birds, especially poultry. *M. umbellatum* has potential against this virus.

M. umbellatum is known to contain various bioactive compounds with potential medicinal properties, research on its antiviral activity is relatively limited compared to other activities like anti-inflammatory, antioxidant, and antimicrobial effects. As the diverse range of bioactive compounds present in *M. umbellatum*, it is possible that some of these compounds may exhibit antiviral activity. However, thorough scientific studies are necessary to identify, isolate, and characterize these compounds and evaluate their efficacy against various viruses. Further research is needed to fully understand its antiviral mechanisms and effectiveness against other viruses.

Memecylon umbellatum



Piper longum L.



Botanical Name: *Piper longum* L.

Synonym: *Chavica longa* (L.) H.Karst.

Family: Piperaceae

Local Name (s): Pippali

DESCRIPTION

Piper longum, commonly known as long pepper, is a perennial climbing vine that can reach lengths of several meters.

Stem: It has slender, wiry stems that twine around supports as it climbs. The stems are green and become woody with age.

Leaves: The leaves of *P. longum* are alternate and simple. They are dark green, lanceolate to ovate, and have entire margins. The leaves are typically leathery and somewhat glossy. Lower leaves are broadly ovate and deeply cordate; upper leaves are dark green and cordate with short petiole or nearly sessile

Inflorescence: The flowers of *P. longum* are arranged in spikes known as spadices. The spadices are cylindrical and dense, with numerous tiny flowers arranged closely along their length.

Flowers: Male and female flowers occur on separate plants. Male flowers are arranged in a narrow spike inflorescence. A male flower has 2 stamens which have short stalks and oval-shaped anthers. Female flowers are also arranged in a spike inflorescence

Fruits: The fruits of *Piper longum* are small, berry-like structures known as drupes. These drupes are green when young and turn red or black as they mature. Each drupe contains a single seed.

MEDICINAL USES

P. longum has a rich history of medicinal use, particularly in traditional medicine systems such as Ayurveda, Siddha, and traditional Chinese medicine.

Stomach problems: *P. longum* is widely used to promote digestive health. It is believed to stimulate appetite, improve digestion, and relieve gastrointestinal discomfort such as bloating, flatulence, and indigestion. Traditional preparations of *P. longum*, such as decoctions and powders, are often consumed to support overall digestive function.

Respiratory health: Traditionally the fruits, roots, and stems of *P. longum* are prepared as paste, juice, or decoction for the treatment of bronchitis, asthma, cough, and cold.

Anti-inflammatory and analgesic properties: *P. longum* is believed to possess anti-inflammatory and analgesic properties, making it useful for alleviating pain and inflammation associated with conditions such as arthritis, rheumatism, and muscle soreness. Traditional preparations of *P. longum*, such as poultices and liniments, may be applied topically to painful or inflamed areas for relief.

Antimicrobial activity: *P. longum* exhibits antimicrobial properties and is used traditionally to treat infections caused by bacteria, fungi, and parasites.

Antioxidant activity: *P. longum* contains bioactive compounds with antioxidant properties, which may help protect cells from oxidative damage caused by free radicals.

ANTI-VIRAL PROPERTIES

P. longum, contains diverse bioactive compounds like Piperine, piperlongumine, guineensine, chabamide, pellitorine, phenolic compounds, alkaloids, etc. contribute to its potential antiviral activity.

1. **Herpes Simplex Virus (HSV):** *P. longum* exhibits inhibitory effects against HSV, both HSV-1 and HSV-2. Compounds isolated from *P. longum*, such as piperine, exhibit antiviral activity by interfering with viral replication processes.

2. **Influenza Virus:** *P. longum* has the potential as an inhibitor of influenza virus replication. Studies suggest that certain constituents of *P. longum* may target different stages of the influenza virus life cycle, including viral attachment, entry, and replication.

3. **Respiratory Viruses:** *P. longum* extracts have also shown activity against respiratory viruses such as respiratory syncytial virus (RSV). These effects may be attributed to the presence of bioactive compounds that modulate host immune responses or directly inhibit viral replication.

4. **Human Immunodeficiency Virus (HIV):** *P. longum* extracts possess anti-HIV activity by interfering with viral replication or inhibiting viral entry into host cells.

The antiviral activity of *P. longum* appears to be mediated by its diverse array of bioactive compounds, including alkaloids, flavonoids, and terpenoids. These compounds may act through various mechanisms, including inhibition of viral replication enzymes, interference with viral attachment and entry, and modulation of host immune responses. While *P. longum* shows promise as a natural antiviral agent, further studies, including clinical trials, are necessary to evaluate its efficacy and safety for use in antiviral therapy.

Piper longum



Punica granatum L.



Botanical Name: *Punica granatum* L.

Synonym: *Rhoea punica* St.-Lag.

Family: Lythraceae

Local Name (s): Pomegranate, Anar, Dalimba

DESCRIPTION

Punica granatum is a small multi-stemmed small tree, 5-10 m tall. Canopy open, crown base low.

Stem: The stem is woody and can grow as a shrub or a small tree. The bark is reddish-brown when young and turns greyish-brown as the plant matures. Branches are thorny, especially in wild varieties, and can become tangled and bushy.

Leaves: The leaves are opposite or sub-opposite. They are simple, glossy, and oblong to lanceolate in shape, usually 3-7 cm long and about 2 cm wide, bright green and leathery in texture.

Flowers: Flowers are borne singly or in clusters at the ends of branches. They are bisexual and have a funnel-shaped calyx. Typically, there are 5 to 7 petals, which are crumpled and papery, bright red to orange-red, and numerous stamens with yellow anthers.

Fruit: The pomegranate fruit is a berry, spherical to slightly flattened. It ranges from 5 to 12 cm in diameter. The outer skin is tough and leathery, ranging in color from yellow-orange to deep red. Inside, the fruit contains numerous seeds, each surrounded by a juicy, edible aril. The arils are usually red or pink, depending on the variety.

Seeds: A single fruit can contain several hundred seeds. The seeds are angular and vary in hardness depending on the variety.

MEDICINAL USES

P. granatum, has a long history of use in traditional medicine for a variety of ailments. Modern research has supported many of these traditional uses, highlighting the fruit's potential health benefits.

Cardiovascular health: Pomegranate juice has been shown to reduce LDL cholesterol levels and increase HDL cholesterol. Regular consumption of pomegranate juice can help lower blood pressure, improving overall cardiovascular health.

Diabetes management: Pomegranate can help improve insulin sensitivity and lower blood sugar levels, aiding in diabetes management.

Digestive health: Pomegranates are a good source of dietary fibre, which aids in digestion and helps maintain a healthy digestive system. Its extract is effective in preventing ulcers and protecting the gastric lining.

Skin health: The antioxidants in pomegranate help in reducing the signs of aging by promoting skin regeneration and reducing wrinkles. Pomegranate extracts can promote wound healing and improve skin health.

Memory improvement: Pomegranate juice may improve memory and cognitive function, potentially beneficial for conditions like Alzheimer's disease.

ANTI-VIRAL PROPERTIES

Pomegranate has demonstrated significant antiviral activity against a variety of viruses. This antiviral effect is largely attributed to its high content of polyphenolic compounds, such as ellagitannins, anthocyanins, and other flavonoids.

Influenza Virus: Pomegranate extract has shown inhibitory effects on the influenza virus by preventing its entry into host cells and interfering with its replication process.

Herpes Simplex Virus (HSV): Studies have demonstrated that pomegranate extract can inhibit both HSV-1 and HSV-2 by preventing viral attachment and entry, as well as disrupting the viral replication cycle.

Human Immunodeficiency Virus (HIV): Pomegranate juice and extracts have shown potential in inhibiting the activity of HIV by preventing the virus from binding to and entering host cells.

Hepatitis C Virus (HCV): Pomegranate extract has been found to inhibit HCV entry into host cells and reduce viral replication.

Human Papillomavirus (HPV): Research suggests that pomegranate may have a protective effect against HPV by interfering with the viral lifecycle.

Poxviruses: Pomegranate has exhibited antiviral activity against poxviruses, such as vaccinia virus, by reducing viral titers.

The antiviral activity of pomegranate highlights its potential as a natural remedy for various viral infections.



Punica granatum

Terminalia chebula Retz.



Botanical Name: *Terminalia chebula* Retz.

Synonym: *Myrobalanus chebula* (Retz.) Gaertn.

Family: Combretaceae

Local Name (s): Harida, Harra, Haritaki

DESCRIPTION

Terminalia chebula is a large deciduous tree that can grow up to 30 meters tall. It has a straight trunk with a spreading crown.

Leaves: The leaves are alternate, oval-shaped, and about 7-8 cm long. They are clustered towards the ends of branches. The upper surface of the leaves is glossy green, while the lower surface is paler and smooth.

Inflorescence: They are borne in dense spikes or clusters at the ends of branches.

Flowers: The flowers are small, about 5 mm in diameter, and pale yellow to creamy-white in color. Flowering usually occurs during the spring months.

Fruits: It produces drupe fruits. The fruits are initially green and turn yellowish-brown to blackish as they mature. They are ovoid or ellipsoid in shape, about 2-4 cm in diameter. When dried, the fruits become wrinkled and have a leathery texture.

Seeds: Each fruit typically contains hard, rough seed.

MEDICINAL USES

T. chebula, has a rich history of medicinal use in traditional systems of medicine, particularly Ayurveda.

Digestive health: It is valued for its mild laxative effect, which helps promote regular bowel movements and relieve constipation.

Digestive tonic: It aids in digestion by stimulating digestive juices and improving appetite.

Detoxification: It is believed to cleanse and detoxify the body, removing toxins and wastes from the gastrointestinal tract and improving overall health.

Respiratory health: It is used to manage respiratory disorders such as cough, asthma, and bronchitis by promoting expectoration and easing breathing.

Cardiovascular health: It is traditionally used to support cardiovascular function and strengthen the heart.

Skin disorders: It is used externally and internally to treat skin conditions like acne, eczema, and wounds due to its healing and antibacterial properties.

Diabetes management: It may help regulate blood sugar levels and improve insulin sensitivity.

Immune system support: It is known to strengthen the immune system, helping the body fight off infections and illnesses.

Dental health: Its astringent and antibacterial properties are utilized in oral care to maintain gum health and prevent dental issues like gingivitis.

ANTI-VIRAL PROPERTIES

T. chebula, is a medicinal plant rich in bioactive compounds found in its fruits, seeds, bark, and leaves. Key bioactive compounds include tannins (chebulagic acid, chebulinic acid), gallic acid, ellagic acid, chebulic acid, quercetin, and vitamin C. These compounds contribute to its antioxidant, antimicrobial, and anti-inflammatory properties.

Herpes Simplex Virus (HSV): Extracts of *T. chebula* possess inhibitory effects against Herpes Simplex Virus types 1 and 2 (HSV-1 and HSV-2). These viruses cause oral and genital herpes, respectively.

Influenza Virus: Research suggests that extracts of *T. chebula* may have antiviral activity against influenza viruses. It has been shown to inhibit viral replication and reduce viral load in experimental models.

HIV/AIDS: Some studies have explored the potential of *T. chebula* against HIV, the virus responsible for AIDS. While findings are preliminary, there is interest in its ability to potentially inhibit viral entry or replication.

Respiratory Viruses: It has been traditionally used for respiratory ailments in Ayurveda. Its expectorant and anti-inflammatory properties may help alleviate symptoms caused by respiratory viruses.

Further research, especially clinical trials, is essential to validate its efficacy and safety for treating viral infections in humans.



Terminalia chebula

Tinospora cordifolia (Willd.) Hook.f. & Thomson



Botanical Name: *Tinospora cordifolia* (Willd.) Hook.f. & Thomson

Synonym: *Menispermum cordifolium* Willd.

Family: Menispermaceae

Local Name (s): Giloy, Guduchi, Amrita

DESCRIPTION

Tinospora cordifolia is a large, gregarious glabrous, perennial twiner.

Stem: The stem is succulent, cylindrical, and twining, enabling the plant to climb. The stem surface is rough and warty due to the presence of lenticels.

Leaves: Leaves are arranged alternately on the stem, broadly ovate or heart-shaped, reflecting the species name "*cordifolia*". They are thin, smooth, and membranous with prominent veins. Apex is acute or pointed, margin entire.

Flowers: The plant is dioecious. Flowers are small and borne in axillary and terminal racemes. They are clustered and have six sepals arranged in two whorls of three each, along with six petals arranged in two whorls. Flowers are typically greenish-yellow or yellowish.

Fruits: Fruits are drupes, oval or ellipsoid, and turn red upon ripening.

Seed: Each fruit contains a single seed.

MEDICINAL USES

T. cordifolia, is renowned in Ayurvedic medicine for its extensive range of therapeutic properties.

Immune system booster: *T. cordifolia* is known for its immunomodulatory properties, enhancing the body's resistance to infections. It is used to increase immunity and protect against common infections and flu.

Antipyretic: It has antipyretic properties, which help in reducing fever. It is commonly used to treat malaria and dengue.

Detoxification: *T. cordifolia* is known for its detoxifying properties, aiding in the removal of toxins from the body. It is used to cleanse the liver, kidneys, and blood, improving overall organ function.

Diabetes management: It is used as an adjunct therapy for managing diabetes, helping to control blood sugar levels.

Digestive health: *T. cordifolia* aids in improving digestion and alleviating gastrointestinal disorders.

Skin health: It promotes healthy skin and aids in the treatment of various skin conditions. Like eczema, and psoriasis.

Respiratory health: It supports respiratory health by reducing symptoms of respiratory disorders. It is used to treat conditions such as asthma, bronchitis, and chronic cough.

ANTI-VIRAL PROPERTIES

T. cordifolia has shown promising antiviral activities, which contribute to its use in traditional medicine for treating viral infections.

Dengue Virus: *T. cordifolia* is used to manage dengue fever. It helps in reducing fever, boosting platelet count, and enhancing the overall immune response.

Hepatitis: The plant has hepatoprotective properties, making it useful in managing viral hepatitis by protecting liver cells and promoting liver function.

Respiratory Syncytial Virus (RSV): Studies have indicated potential effectiveness against respiratory viruses like RSV, which causes respiratory tract infections.

Human Immunodeficiency Virus (HIV): Preliminary research suggests that *T. cordifolia* may have supportive effects in managing HIV by boosting the immune system and improving the quality of life in affected individuals.

Influenza virus: It is used to manage symptoms of influenza and other viral respiratory infections, helping reduce fever, cough, and other related symptoms

T. cordifolia exhibits significant antiviral activities through mechanisms like inhibition of viral replication, immunomodulation, and antioxidant protection. It is used traditionally to treat a variety of viral infections, including dengue fever, hepatitis, and influenza. Continued research is validating these traditional uses, making it a valuable plant in the field of antiviral therapy.

Tinospora cordifolia



Zingiber zerumbet (L.) Roscoe ex Sm.



Botanical Name: *Zingiber zerumbet* (L.) Roscoe ex Sm.

Synonym: *Amomum zerumbet* L.

Family: Zingiberaceae

Local Name (s): Parsukedar

DESCRIPTION

Zingiber zerumbet, commonly known as shampoo ginger, bitter ginger, or pinecone ginger. It is a perennial herb, and grows to about 2.1 m tall.

Rhizome: It has tuberous, aromatic rhizomes, and robust, upright pseudo stems that grow 0.6–2 meters tall.

Leaves: Leaves are sessile or short-petiolate, long, narrow, sheaths glabrescent, sometimes purplish beneath young shoots, blades broadly lanceolate or oblong-lanceolate, acuminate at apex, cuneate at base.

Inflorescence: It has short, bracted inflorescences, green when young and becomes red when old that look like red pine cones appear from the ground on 10-inch-tall stalks.

Flowers: The flowers of *Z. zerumbet*, which can be pale yellow or white, are delicate and short-lived, lasting only a few hours, emerging from the lower bracts first. The flower's lip is divided into three lobes. As the bracts age, they change color, gradually turning a vibrant crimson from the bottom up. The corolla tube is the same length as the bract, while the style is long and slender. The stigma slightly protrudes and has a fringed edge.

Fruits: Fruit is white, glabrous, thin-walled, and approximately 1.5 cm long. The seeds, which are covered with lacerate aril, are ellipsoid and black.

MEDICINAL USES

Z. zerumbet has long been used in traditional herbal medicine for the treatment of inflammations, rheumatism, sprains, colic pain, diarrhoea, tonsillitis, and various other ailments.

Stomach problems: The rhizomes of *Z. zerumbet* are used for the treatment of stomach ailments, poisoning, appetite enhancement, and constipation.

Wound healing: External application of *Z. zerumbet* extracts or poultices made from its rhizomes has been used to promote wound healing and alleviate pain associated with cuts, bruises, and inflammatory skin conditions.

Skin diseases: The rhizomes of *Z. zerumbet* are used for the treatment of skin diseases.

Respiratory health: *Z. zerumbet* has been traditionally used to relieve respiratory symptoms such as coughs, colds, asthma, and congestion. It may help alleviate respiratory inflammation and promote clearer breathing.

ANTI-VIRAL PROPERTIES

The main bioactive compound in *Z. zerumbet* is zerumbone, a sesquiterpene that is widely studied for its medicinal properties. Other bioactive compounds in *Z. zerumbet* include pinene, humulene, linalool, caryophyllene, limonene, etc.

1. **Herpes Simplex Virus (HSV):** Curcumin is an important bioactive constituent active against herpes simplex 2.

2. **Influenza Virus:** Some bioactive compounds derived from *Z. zerumbet* exhibit anti-influenza activity and can prevent swine flu infection.

3. **Human Respiratory Syncytial Virus (HRSV):** *Z. zerumbet* extracts have also shown activity against the Human Respiratory Syncytial Virus (HRSV). These effects may be attributed to the presence of bioactive compounds that modulate host immune responses or directly inhibit viral replication.

The antiviral effects of *Z. zerumbet* on HSV, influenza virus, and HRSV in lab experiments may be due to the presence of bioactive substances like flavonoids, phenolic compounds, and terpenoids. These substances could potentially hinder viral replication, lower viral infectivity, or boost the immune system's defence against viral infections. Nevertheless, additional studies are necessary to uncover the precise mechanisms of action and therapeutic benefits of *Z. zerumbet*-derived compounds on these viruses.



Zingiber zerumbet

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