

"Pharmacological Evaluation of *Catharanthus roseus*: A Medicinal Plant with Promising Therapeutic Value"

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Abstract: *Catharanthus roseus* is one of several naturally growing plants that can be used for medicinal purposes. Plants have been a rich source of compounds for the development of clinically useful therapeutic agents. It is an evergreen plant first originated from islands of Madagascar. Its curative action is due to the presence of alkaloids like Ajmalicine, serpentine and reserpine which are known for hypotensive, anti-diabetic, anti-microbial, antioxidant and antispasmodic properties. There are some major vinca alkaloids in clinical use: Vinblastin, Vincristine, Vindesine, tabersonine, vinorelbine, and Vinpocetine, etc. The flowers juice of *Vinca rosea* is utilized to treat several skin problems e.g. acne, eczema, and dermatitis.

Keywords: *Catharanthus roseus*, Traditional uses, Morphology, Botanical description Chemical constituents, Pharmacological Application, Toxicity and side effects.

1. INTRODUCTION:

Many therapeutic plants can be found in nature. *Catharanthus roseus* is one of those species. Tropical locations are where you'll find it worldwide. *Vinca roseus* is a flowering plant that is native to the Mediterranean region and it is a perennial plant that may be found primarily in the northern hemisphere. They are native to southern Asia and tropical nations. A resurgence of interest in plant-based molecules for drug discovery can be attributed to the growing need for innovative medications that can address the issue of drug resistance. Many therapeutic plants are provided by nature for human survival and well-being. Native to Madagascar, *Vinca rosea* is a perennial flowering plant also referred to as Madagascar periwinkle¹. It belongs to the Apocynaceae family and is characterized by its glossy, dark green leaves and vibrant star-shaped flowers in shades of pink, lavender, or white. *Vinca rosea* is widely cultivated as an ornamental plant in gardens and landscapes around the world due to its attractive blooms and adaptability to various climates. *Vinca rosea* is also renowned for its medicinal properties, containing alkaloids such as vincristine and vinblastine, which have been used in traditional medicine to treat conditions such as diabetes, high blood pressure, and cancer. Additionally, *Vinca rosea* has garnered interest in pharmaceutical research for its potential anticancer properties. With the presence of cancer fighter *Vinca* alkaloids vincristine, vinblastine, vinorelbine and vindesine it became eminent anticancer herb along with many other therapeutic effects. Vincristine is in the List of Essential Medicines of World Health Organization's, the most important medication needed in a basic health system².

Treatment failures linked with multidrug-resistant bacteria have a significant impact on the rise in microbial resistance. Because antibiotic compounds are in danger of losing their efficacy, this scenario has become a global public health concern. Medicinal herbs have been shown to have anti-infective properties in humans. It's used in medicine and is available in a range of colors such as pink, purple, and white. Traditional medicine has always made use of medicinal herbs³. The World Health Organization (WHO) is currently encouraging and promotes folk medical treatment in the National Health Programmes, which are simply available at the cheapest prices and are ethnically accepted. In addition, the WHO estimates that approximately one-third of the world population used herbs and other types of folk medicines to treat the diseases⁴.

V. rosea, this subgreen plant has been used traditionally as a medicine and can grow up to one meter in height. The leaves are elliptic, egg-shaped, and measure 2.5–9.5 cm by 1-3.5 cm in length. The broad, green midrib is hairless and forms a little petiole, measuring 1.8–1.8 cm, which is paired off in opposite directions. The center of the flowers varies in hue from dark pink to dark crimson to white. The basal tube is 2.5–3 cm long, and the corolla, which has five lobes on each petal, has a diameter of around 2.5–3 cm. Fruits are 3 mm broad, 2-4 cm long, and contain a few follicles⁵.



Figure 1: showing catharanthus rosea

Table 1: Scientific classification of *Cathranthus roseus*

Kingdom	Plantae
Division	Magnaliophyta
Class	Magnaliophyta
Subclass	Asteridae
Order	Gentianales
Family	Apocynacea

Genus	Cathranthus
Species	C.Roseus

Vernacular names:

- English: cayenne jasmine, old maid, periwinkle
- Hindi: Sada bahar, sadabahar
- Kannada: batla Hoo, bili kaasi kanigalu, ganeshana hoo, kempu kaasi kanigalu
- Malayalam: banappuvu, nityakalyani, savanari, usamalari
- Marathi: sadaphool, sadaphul, sadaphuli
- Sanskrit: nityakalyani, rasna, sadampuspa, sadapushpi
- Tamil: cutkattu malli, cutukattu malli, cutukattuppu
- Telugu: billaganneru
- Gujarati: Barmasi
- Bengali: Noyontara⁶.

2. Traditional Uses:

There are many traditional uses of cathranthus roseus in our daily life.

- **Medicinal purposes:** Vinca rosea has been used as traditional medicine systems such as Ayurveda, Traditional Chinese Medicine, and folk medicine in various parts of the world . Such as : Cancer, Anti diabetic, Hypertension, Circulatory disorder etc.
- **Wound healing:** It is also used as wound healing to cure the wound and prevent the infection.
- **Fever reduction:** Vinca rosea has been used for reducing the fever in some culture.
- **Menstrual disorder:** Vinca rosea is used as the traditional medicine to regulate the menstrual cycle and prevent the menstrual disorder like PCOS and PCOD.
- **Anti-inflammatory:** It has been used to reduce the inflammation and allivate the inflammation disorder.
- **Digestive disorder:** It has been used to treat the digestion related problems such as diarrhea and dysentery.
- **Neurological disorder:** It is also used for the treatment of the neurological disorders suc as epilepsy and nervous disorders.
- **Skin condition :** Vinca rosea has been used topically to treat the skin condition such as dermatitis and eczema.

Table 2: Traditional uses of cathranthus roseus in developed countries:

COUNTRIES	USES
Australia	Leaves are orally taken for menorrhagia diabetes. Extract of root bark is taken orally as afebrifuge.
Brazil	Dried whole plant is taken orally by a human for diabetes mellitus.
China	Aerial part is taken orally as amenstrual

	regulator.
Cook- Island	Dried leaves used orally to treat diabetes, hypertension and cancer.
England	Whole plant is taken orally for the curing of diabetes.
USA	Extract of leaves is smoked as a euphoriant.
Venda	Dried root is taken orally for venereal disease.
West Indies	Leaves are orally taken for menorrhagia diabetes.
Philippines	Extract of roots is taken orally by pregnant woman to produce abortion. ⁷

3. Morphology:

Vinca rosea, also known as Madagascar periwinkle or rosy periwinkle, is a flowering plant with several notable morphological features:

Leaves:

- **Shape and Size:** The leaves are simple, glossy, and typically ovate to lanceolate in shape. They are usually around 2 to 6 cm long.
- **Arrangement:** They are arranged in an alternate pattern along the stem.
- **Surface:** The leaves have a smooth surface and a prominent central vein.

Stems:

- **Structure:** The stems are slender, smooth, and can be either erect or trailing, depending on the growth habit. They often have a slightly reddish tint.
- **Growth:** They can grow up to 30 to 45 cm (12 to 18 inches) in height, with some varieties spreading out as ground cover.

Fruit:

- **Type:** The fruit is a small, dry capsule that splits open when mature.
- **Seeds:** Inside, it contains numerous tiny seeds.

Roots:

- **Structure:** The root system is fibrous and relatively shallow but can spread outwards to support the plant.
- **Function:** The roots absorb water and nutrients from the soil and anchor the plant.

General Growth Habit:

- **Growth Form:** *Vinca rosea* can grow as an upright shrub or as a trailing plant, depending on environmental conditions and cultivation practices.
- **Adaptability:** It is known for its adaptability to different soil types and conditions, often used as ground cover in landscaping⁸.

Table 3: Alkaloids present in different organs of the plant

Plant organ	Name of Alkaloids present.
Leaf	Catharanthine, Vindoline, Vindolidine, Vindolicine, Vindolinine, ibogaine, yohimbine, raubasine, Vinblastine, Vincristine, Leurosine, Lochnerine.
Stem	Leurosine, Lochnerine, Catharanthine, Vindoline
Root	Ajmalacine, Serpentine, Catharanthine, Vindoline, Leurosine, Lochnerine, Reserpine, Alstonine, Tabersonine, Horhammericine, Lochnericine, echitovenine.
Flower	Catharanthine, Vindoline, Leurosine, Lochnerine, Tricin (Flavones).
Seeds	Vingramine, Methylvingramine ⁹ .

4. Botanical description:

Vinca rosea, commonly known as Madagascar periwinkle or rosy periwinkle, is a perennial herbaceous plant native to Madagascar but also cultivated worldwide for its medicinal and ornamental purposes. It is an herbaceous plant or an evergreen subshrub growing to 32 in 80 cm high. It has glistening, dark green, and flowers all summer long. The flowers of the naturally appear pale pink with a purple “eye” in their centres. Erect or accumbent suffrutex, to 1 m, usually with white latex. Stems is green, often permeate with purple or red. Here's a brief botanical description.

- **Appearance:** *Vinca rosea* is a spreading, low-growing plant that normally grows to a height of between 30 and 60 cm and 1 to 2 feet. It grows in a bushy, spreading manner.
- **Leaves:** Mucronate apex; lamina variable, elliptic, obovate or narrowly oblong; oval leaves, 1-2 in. long, decussate, petiolate.
- **Flowers:** Elegant, 4-5 cm, white or pink, with a center of pale yellow, purple, red, or white 1.2-3.8 × 0.2-0.3 cm follicule, axially susceptible. The 1-2 mm seeds are many, with a groove on one side. soil, climate, and propagation.
- **Flowering period:** From spring to late fall in moderate temperate areas, and all year round in equatorial settings.
- **Fruit:** The plant yields tiny, paired, cylindrical seed capsules containing a large number of microscopic seeds once it has flowered.
- **Soil:** It is best to have full sun and well-drained soil.
- **Light:** For optimal flowering, three or four hours a day of direct sunlight are necessary.
- **Temperature:** At all times, room temperature is appropriate. It is intolerant of temperatures below 10°C (50°F). Watering: Don't let the pot stand in water; instead, generously water the potting mixture.
- **Feeding:** Start applying a regular liquid fertilizer every two weeks as soon as flowering starts. Overfertilizer is not tolerant of plants.
- **Irrigation:** They should not be watered from above; they require consistent hydration. Once established, it is quite drought resistant, though it should receive a reasonable amount of water during the growing season. Once well watered, they will recover.
- **Fertilising:** The plants are not heavy breeders. If necessary, feed biweekly or once monthly with a fair amount liquid fertilizer. Too much fertilizing will produce abundant foliage instead of more blooms¹⁰.

5. Chemical constituents of *Vinca rosea*:

- In *vinca rosea* the leaf and root contain more alkaloids.
- About the 90% alkaloids have been isolated from *vinca* like **Ajmalicine, Serpentine** are known are present in the other species of **Apocynaceae**.
- The most important alkaloids in *catharanthus* are the dimmer indole indoline alkaloids **Vinblastin and Vincristine** and they possess anti cancer activity. **Vindoline and catharanthine** are indole monomeric alkaloids.
- It also contains **monoterpenes, sesquiterpene indole and indoline glycoside**¹¹.

Geographical description: *Vinca rosea* is native of Madagascar and found in countries especially in India, Australia, South Africa and North and South America. The plant is cultivated as garden plant in Europe and India. The main cause of their decline is the habitat destruction by the slash and burn agriculture however, it is now common in many tropical and subtropical regions worldwide, including the Southern United States¹².

Geographically, *Vinca rosea* can be found in various habitats, including:

Tropical and subtropical region: Due to its origin in Madagascar, *Vinca rosea* thrives in tropical and subtropical climates. It is commonly found in regions with warm temperatures, high humidity, and ample sunlight.

Coastal Areas: *Vinca rosea* can tolerate coastal conditions and is often found growing near the coast in sandy or rocky soils.

Garden and landscape: *Vinca rosea* is frequently cultivated as an ornamental plant in gardens, parks, and landscapes worldwide. It is valued for its attractive flowers and ability to thrive in a variety of soil types and growing conditions.

Roadside and distributed areas: In some regions, *Vinca rosea* has escaped cultivation and become naturalized in disturbed areas such as roadsides, waste areas, and abandoned fields.

6. Pharmacological Application:

Anti-oxidant properties: The anti-oxidant potential of the ethanolic extract of the roots of two varieties as *C.roseus* (pink flower) and *Alba* (white flower) was obtained through different systems of assay. *Vinca rosea* extracts have shown antioxidant activity, which may contribute to reducing oxidative stress and inflammation. It is beneficial for various conditions linked to oxidative damage and overall health of the body and also prevent the various chronic diseases.

Anti-diarrheal property: Anti-diarrheal property is tested in wistar rats by the ethanolic leaf extract and castor oil as an experiment of diarrhea has pretreatment extract. The dose-dependent reduction of castor oil-induced diarrhea demonstrated the anti-diarrhea efficacy. At 200 and 500 mg/kg, there is a dose-dependent inhibition of the castor oil-induced diarrhea as well as a suppression of the gastrointestinal motility of the charcoal meal. This data corroborates the traditional use of *vinca* in the treatment and management of diarrhea.

Anti-Microbiology Activity: Vinca has immense medicinal values which also helps for the creation of novel pharmaceuticals as most of bacterial pathogen which improve the resistance against many of the available anti-microbial drugs. Vinca rosea exhibit antimicrobial properties against a wide range of pathogens including bacteria, fungi, and viruses. It useful in traditional medicine for treating infections¹³.

Anti-Helminthic activity: Cattle and humans are more vulnerable to this chronic helmenthic infection disease. The antihelmenthic properties of vinca have been developed using piperazine citrate as a standard reference and an experiment model of Pherithema postuma. The ethanolic extract's anti-helmenthic activity is 250 mg/ml.

Wound healing: Vinca rosea extracts have been shown to promote wound healing by stimulating the proliferation of skin cells and enhancing collagen synthesis.

Anti-diabetic activity: Some studies suggest that the ethanolic extract which obtained from leaves and flower of the Vinca rosea show a dose dependent lowering of blood sugar level in comparable to standard drug. They can lower blood glucose levels by various mechanisms, including increasing insulin secretion and enhancing insulin sensitivity. Lowering of the blood sugar in comparison to the standard drug glibenclamide. The hypoglycemia effect has approved due to result of increasing glucose utilized in liver¹⁴.

Anti- ulcer property: Vincamine and vindoline are two alkaloids that possess anti-ulcer properties. The plant leaves that contain vincamine have neuroprotective and cerebrovasodilatory properties, but they also cause stomach damage in rats.

Enhancement of memory: One alkaloid called vinoceptine has the ability to enhance memory and brain function, which is advantageous for Alzheimer's patients. In clinical trials for dementia and stroke, vinpocetine was administered at a well-tolerated dose of up to 60 mg/d with no discernible side effects.

Anti-cancer activity: Vinblastine and Vincristine are anticancer alkaloids which obtained from leaf and stem of Vinca rosea. In some human tumors growth is exhibited by these alkaloids. It works against numerous type of cells and mostly greater activity was found against the multidrug resistant type of tumor. hese alkaloids interfere with the microtubule structures in cells, inhibiting cell division and proliferation, thus making them effective against various types of cancer such as leukemia, lymphoma, and solid tumors¹⁵.

7. Toxicity and Side effects of Catharanthus roseus: C. roseus can be extremely toxic if consumed orally by humans, and is cited (under its synonym Vinca rosea) in the Louisiana State Act 159. All parts of the plant are poisonous. On consumption, symptoms consist of mild stomach cramps, cardiac complications, hypertension, systematic paralysis eventually leading to death.

Hepatic toxicity

Renal toxicity

Hematological Toxicity

Pulmonary Toxicity

Gastrointestinal Toxicity

Cardiovascular Toxicity

Side effects: Vomiting, Low blood sugar, Nausea, Hair loss, Liver damage, Nerve problem, Seizures, Dizziness, Bleeding, Hearing loss¹⁶.

CONCLUSION:

Medicinal plants are the potent source of various novel pharmaceutical products that shows potent pharmacological effects on the human beings. It is more effective with lesser side effects and also cheaper in cost. *Vinca rosea* have proved the medicinal properties of the plant, and it also continuously used to prevent various diseases. There are many other plants which have anti cancer and anti diabetic properties. *Vinca* alkaloids which are widely used to produce anti-cancer, anti diabetic, anti malarial, anti ulcer, anti microbiological, anti diarrheal and other drugs. They continue to be an important therapeutic aid in future due to the proximity of vast phytochemicals present. *Vinca rosea* plant has reached beside in the modern medicine. *Vinca* alkaloids and its derivatives were widely used drugs in combination regimens with cyclophosphamide, doxorubicin, procarbazine, Methotrexate and dacarbazine etc. in various types of cancer.

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