

Madagascar Vinca (Periwinkle)

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Abstract—*Catharanthus roseus*, also known as Madagascar periwinkle or Madagascar vinca is a plant native to Madagascar with high agricultural and pharmaceutical importance. It is widely cultivated as an ornamental and medicinal plant due to its adaptability to tropical and subtropical climates.

The plant contains over 100 alkaloids, including vincristine and vinblastine, which are important in cancer treatment. Because of its medicinal value and attractive flowers, it has strong commercial potential. However, it can become invasive in non-native regions, affecting local plant species, so proper management is necessary. Medicinal plants are considered effective and safer alternatives to synthetic drugs due to their rich phytochemical content.

Catharanthus roseus has gained significant attention because it contains bioactive compounds with multiple therapeutic properties, including anti-inflammatory. Ayurveda is the Indian traditional system of medicine which focuses on the medical potential of plants. *Catharanthus roseus* is one plant recognized well in Ayurveda. The genus *Catharanthus* consist of eight species of which seven are native to Madagascar and one, *C. pusillus*, to India.

Catharanthus roseus, Madagascar periwinkle is one of the few pharmacological plants that have a long history of therapeutic voyage from Mesopotamian folklore of 2600 BCE till today playing a considerable role as herbal and traditional medicine of various diseases. The *Catharanthus* (or *Vinca*) alkaloids comprise a group of about 130 terpenoid indole alkaloids. Vinblastine is now marketed for more than 40 years as an anticancer drug and became a true lead compound for drug development. Due to the pharmaceutical importance and the low content in the plant of vinblastine and the related alkaloid vincristine, *Catharanthus roseus* became one of the beststudied medicinal plants. Consequently, it developed as a model system for biotechnological studies on plant secondary metabolism.

I. INTRODUCTION



The periwinkle plant (*Catharanthus roseus*), also known as Madagascar periwinkle, is a small evergreen shrub native to Madagascar. It grows up to about 1 meter tall and has glossy green leaves with bright, star-shaped flowers in pink, white, or purple. It is widely grown in tropical and subtropical regions both as an ornamental plant and for its important medicinal properties.

The periwinkle plant is valued for its alkaloids, especially vincristine and vinblastine, which are widely used in chemotherapy to treat cancers such as leukemia, Hodgkin's lymphoma, and breast cancer. It is also used in traditional medicine for conditions like diabetes, high blood pressure, and infections. Besides its medicinal importance, the plant is popular in gardening for its hardiness and continuous blooming, and it also holds cultural and symbolic significance in some traditions□

Catharanthus roseus (commonly known in India as *Nayantara* or *Sadabahar*) is a medicinal plant from the *Apocynaceae* family, widely found in tropical and subtropical regions of India. Its name comes from Greek, meaning “pure blossom,” while “*roseus*” refers to red color.

The plant is rich in important phytochemicals such as alkaloids, flavonoids, tannins, phenols, terpenoids,

and saponins. It contains over 70 indole alkaloids, including vincristine, which is widely used in cancer chemotherapy. It also shows antidiabetic effects by lowering blood glucose levels.

Phytochemicals in the plant are classified into

Primary metabolites (e.g., amino acids, carbohydrates)

Secondary metabolites (e.g., alkaloids, flavonoids, glycosides)

Catharanthus roseus has multiple pharmacological properties including anticancer, antimicrobial, antioxidant, antidiarrheal, antihypertensive, wound healing, and cardioprotective effects. However, its use can cause side effects such as hair loss, neuropathy, constipation, and hyponatremia.

Overall, the plant is highly valuable in traditional and modern medicine due to its diverse *Catharanthus roseus* (Nayantara/Sadabahar) is a medicinal plant from the Apocynaceae family, widely found in tropical and subtropical regions of India. It contains numerous phytochemicals, especially over 70 indole alkaloids, along with flavonoids, tannins, and phenolic compounds.

These are classified into primary and secondary metabolites.

The plant has significant medicinal value, including anticancer, antidiabetic, antimicrobial, antioxidant, and cardioprotective effects. An important compound, vincristine, is used in cancer chemotherapy, while leaf extracts may help reduce blood glucose levels.

However, its use can also cause side effects such as hair loss, peripheral neuropathy, constipation, and hyponatremia. therapeutic potential.

● Distribution and Adaptability

Catharanthus roseus (Madagascar periwinkle) is native to Madagascar, where it grows in tropical and subtropical environments, especially in dry forests and coastal sandy soils. Due to its ornamental value, medicinal importance, and adaptability, it has spread widely across tropical and subtropical regions worldwide, including Asia, Africa, the Americas, Australia, and Pacific islands. □

The plant can grow in diverse habitats such as roadsides, gardens, and disturbed areas, and is often

used for erosion control because of its low maintenance and ability to thrive in poor soils. However, it can become invasive in non-native regions, outcompeting local vegetation, so careful management is necessary despite its benefits.

● Hardiness and Tolerance □

Catharanthus roseus is highly hardy and adaptable, showing strong drought tolerance and the ability to grow in poor soils such as sandy, loamy, or rocky types. It can survive in diverse climates and harsh conditions where many plants cannot. Additionally, its natural alkaloids help protect it from pests and herbivores, aiding its survival in new environments.

● Reproductive Success

Catharanthus roseus reproduces efficiently by producing many seeds, increasing its spread. It can both cross-pollinate and self-pollinate, allowing reproduction even in isolation. Its rapid growth and early maturity enable it to quickly establish and colonize new areas.

● Botanical description

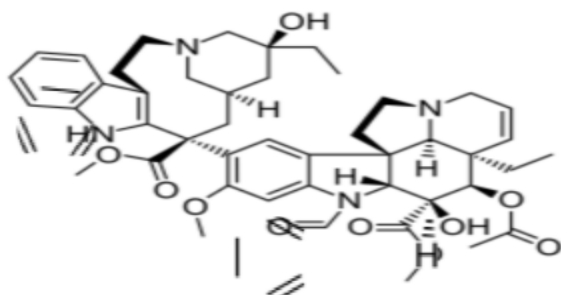
Catharanthus roseus is an evergreen plant which grows about 32 to 80cm in height. The flowers are appeared naturally in pale pink colour. Stems are usually green often permeate with red or purple. Leaves: leaves are oval in shaped to oblong, 3 to 10 cm long and 1 to 4 cm in width. They are arranged in opposite pair. Flower – length of flower approx. 4 to 5 cm, white or pink with red, purple or pale-yellow centre follicle 1.3-3.5x0.2- 0.4cm opens to the axial side.

● Phytochemical Compound □ *Catharanthus roseus* is a valuable medicinal plant rich in diverse phytochemicals. Its major bioactive compounds—especially alkaloids, along with flavonoids, tannins, and terpenoids—contribute significantly to its pharmacological properties. These compounds make the plant an important source for medicinal and therapeutic applications. *Catharanthus roseus* is rich in a wide variety of pharmacologically important phytochemicals, especially alkaloids, along with flavonoids, tannins, terpenes, and others. The plant

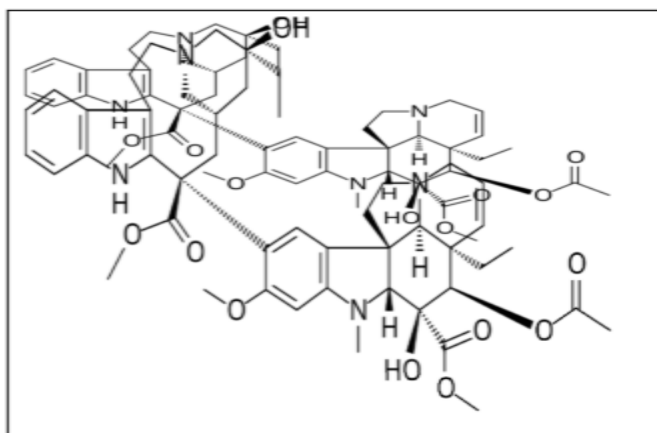
contains around 400 alkaloids, including over 100 monoterpenoid indole alkaloids, which are the most biologically active. Different plant parts contain different compounds—leaves are rich in alkaloids and sugars, flowers contain tannins and pigments like rosinidin, aerial parts have compounds such as vincristine and vinblastine, while roots contain alkaloids like ajmalicine and reserpine. These compounds exhibit strong medicinal properties such as anticancer, anti-inflammatory, antibacterial, antiprotozoal, and antimalarial effects. Vinblastine, in

particular, is widely used in treating various cancers including Hodgkin's disease and breast cancer.

1. Kingdom: -Plantae
2. Division: - Magnoliophyta (flowering plant)
□ Class: - Magnoliopsida (dicotyledons) □
3. Order: - Gentianales
4. Family: - Apocynaceae
5. Genus: - Catharanthus
6. Species: - Roseus



Vincristine



Vinblastine

• Traditional Uses

Catharanthus roseus is a globally recognized medicinal plant used traditionally to treat diabetes, infections (urogenital and stomach), gonorrhoea, and even cancer-related conditions, with different parts of the plant used in various regions

• Alkaloids

Catharanthus roseus is well known for its rich content of alkaloids—

complex nitrogen-containing compounds. More than 130 alkaloids have been identified from this plant. The most important are vincristine and Vinblastine which are complex dimeric indole alkaloids derived from tryptophan and terpenoid pathways. These compounds act as anti-mitotic agents by inhibiting microtubule formation, making them highly effective in chemotherapy for cancers such as leukemia, lymphoma, and breast cancer.

Other significant alkaloids include ajmalicine, which functions as a vasodilator and antihypertensive agent improving blood flow, and serpentine, known for its

hypotensive and sedative effects with potential cardiovascular applications. Additionally, catharanthine and vindoline serve as precursor molecules in the biosynthesis of vincristine and vinblastine.

These alkaloids are produced through the monoterpenoid indole alkaloid pathway, involving tryptophan metabolism, terpenoid synthesis, formation of monomeric alkaloids, and their eventual dimerization into pharmacologically important compounds.

Plant	Name of Alkaloid Present
Parts	Catharanthine, Vindoline, Leurosine, Lochnerine,
Flow er	Tricin Stem Leurosine, Lochnerine, Catharanthine, Vindoline
Leaf	Catharanthine, Vindoline, Vindolidine, Vindolicine, Vindolinine, iboga ine, yohimbine, raubasine, Vinblastine, Vincristine Root Ajmalicine, Serpentine, Catharanthine, Vindoline, Leurosine, Lochnerine, Reserpine, Alstonine, Tabersonine
	Horhammericine, Lochnericine, echitovenine



● Medicinal Value□

Catharanthus roseus has been spread worldwide by humans due to its attractive ornamental value and important medicinal uses, especially for producing anticancer compounds like vincristine and vinblastine. Its easy cultivation and low maintenance also make it a popular choice for gardens and landscaping.

II. HEALTH AND PHARMACOLOGICAL BENEFITS OF CATHARANTHUS ROSEUS

★ **Anticancer Property:** - *Catharanthus roseus* is an important source of anticancer alkaloids such as vinblastine and vincristine, mainly found in its stems and leaves. Extracts of the plant and several isolated indole alkaloids show strong anticancer (cytotoxic) activity against various cancer cell lines in laboratory studies. Newly identified compounds like catharoseumine and other alkaloids also demonstrate significant inhibitory effects on cancer cells. Vinblastine and vincristine are widely used in treating cancers such as leukemia, Hodgkin's disease,

breast cancer, and neuroblastoma by stopping cell division (mitosis). *Catharanthus roseus* produces important anticancer alkaloids, vincristine and vinblastine, which are widely used in chemotherapy to treat cancers such as leukemia, lymphoma, breast, lung, and testicular cancer. These compounds work by inhibiting cell division through disruption of microtubule formation.

★ **Antidiabetic Property:** - *Catharanthus roseus* has been traditionally used to manage blood sugar levels and treat type 2 diabetes, although its clinical use requires caution due to possible toxicity. Studies show that leaf extracts can lower blood glucose in a dose-dependent manner. Several alkaloids from the plant—such as vindoline, vindolidine, vindolicine, and vindolinine—enhance glucose uptake and inhibit Protein Tyrosine Phosphatase-1B (PTP-1B), indicating antidiabetic potential. Among them, vindolicine shows the strongest activity, including antioxidant effects that protect pancreatic cells from damage.

★ **Potential use as Anti-Alzheimer's Diseases Agent:** - About 50–60% of dementia cases are due to Alzheimer's disease (AD), a neurodegenerative disorder marked by memory loss and behavioral changes. One key treatment approach is inhibiting acetylcholinesterase (AChE) to increase acetylcholine levels in the brain. Extracts from *Catharanthus roseus* (leaves, stems, and roots) have shown strong AChE inhibitory activity in laboratory studies, suggesting potential benefits in AD treatment. Additionally, compounds like vinpocetine have demonstrated good tolerance and safety in clinical trials for dementia and stroke.

★ **Antiulcer:** - *Catharanthus roseus* contains alkaloids such as vincamine and vindoline that exhibit anti-ulcer properties, as shown in experimental studies on animals. Additionally, vincamine is known for its neuroprotective effects and its ability to improve blood flow in the brain.

★ **Microbial Activity:** - *Catharanthus roseus* is an important medicinal plant with notable antibacterial properties. Extracts from different parts of the plant show activity against various bacteria, though effectiveness depends on factors like the plant part used, extraction method, and solvent. Leaf extracts, in particular, have shown antimicrobial effects against pathogens such as *Staphylococcus aureus*, *Salmonella typhimurium*, and *Pseudomonas aeruginosa*. These findings suggest its potential use as a preventive or therapeutic agent against infections.

★ **Anti-diarrheal Activity:** - *Catharanthus roseus* shows significant antidiarrheal activity. Experimental studies in Wistar rats demonstrated that its extracts reduce the frequency and severity of diarrhea, decrease fecal output, and slow gastrointestinal movement.

The extracts also effectively inhibited castor oil-induced diarrhea in a dose-dependent manner, supporting its traditional use in treating diarrhea

III. CONCLUSION

Catharanthus roseus is increasingly valued worldwide due to the growing demand for plant-based medicines. It is important not only as an ornamental plant but also as a source of anticancer compounds and as a model in scientific research. The plant contains alkaloids and phenolic compounds with multiple biological activities, including anticancer, antidiabetic, antioxidant, antibacterial, and antihypertensive effects. Despite many identified compounds, further research is needed to discover new phytochemicals and explore their potential applications in pharmaceuticals and nutraceuticals.

Catharanthus roseus is an important source of anticancer alkaloids like vincristine and vinblastine, making it highly valuable to the pharmaceutical industry. Ongoing research is expanding its potential use in treating diseases such as diabetes and hypertension. The plant is increasingly cultivated in tropical and subtropical regions to meet rising demand, but overharvesting of wild populations has raised sustainability concerns. As a result, efforts are being made to adopt sustainable.



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