



Pharmacological Activities of Vinca Alkaloids

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ABSTRACT

Vinca plant are the Large amounts of phytoconstituents from the plant are utilized in traditional Chinese medicine, Ayurvedic medicine in India, and other healing methods. Alkaloids are said to be present in every part of the plant. One of the major health issues facing both industrialized and developing nations is cancer. anti-cancer chemotherapy preventives. One of the most widely available plants with the ability to save lives is vinca. Since cancer is the most common disease at the moment, vinca contains anti-cancer and anti-tumor qualities. The main issue among the bioactive compounds that plants provide us with is obesity, which may be used as a safer therapy to address current ailments.

Plant-based pancreatic lipase inhibitors. Plants have been a rich source of compounds for the development of clinically useful therapeutic agents. Catharanthus Roseus, also known as Madagascar Periwinkle is a pretty ornamental plant of Apocyanate family. Vinca alkaloids, the primary alkaloids of Catharanthus roseus, are significant because they combat cancer. In therapeutic application, there are four main vinca alkaloids: vincristine (VCR), vinblastine (VBL), and vinorelbine (VRL) likewise vindesine (VDS). Vinflunine, a novel vinca alkaloids anticancer agent, was recently found.

Keywords: Vinca rosea, Vinblastin, Catharanthus, Vincristine, Madagaskar periwinkle, and Anti-cancer activities.

Introduction:

The earliest evidence of vinca alkaloids was discovered in the 1950s by Canadian scientists Robert Noble and Charles Beer. Because of this plant's medicinal uses, these chemicals are being watched for their cytotoxic consequences outweigh the significance of their hypoglycemic action. The discovery of vinca alkaloids was made for the first time in the 1950s by Canadian scientists Robert Noble and Charles Beer. Because of this plant's medicinal uses, its Anti -cancer hypoglycemia action must be monitored, albeit this is less significant than its cytotoxic effects.

A subclass of medications known as vinca alkaloids is derived from the periwinkle plant in Madagascar. They are derived organically from Catharanthus roseus G. Don, the pink periwinkle plant, and exhibit both cytotoxic and hypoglycemic properties. Vinca rosea stems contain around 70 distinct types of indole alkaloids and provide a milky sap. There are two of them.

Anti-neoplastic substances made from vinblastin and vincristine-producing plants.

herbal medicine, which continues to be the main medical system 13 to 15 Most ailments are treated using medicinal herbs in traditional medicine and infectious diseases. There are fewer negative effects from using herbal plants, and it is also less expensive. sixteen Among the best and most common herbs, it can be used to treat dermatitis, psoriasis, sores, ringworm, abscesses, eczema, epilepsy, malaria, and to make heart tonics.

Vinblastin is used to treat pediatric leukemia, while vincristin is utilized as a chemotherapy regimen for Hodgkin's lymphoma. utilized Constipation, hair loss, hyponatremia, and peripheral neuropathy are the principal adverse effects of vinca alkaloids, which hinder the metaphase of cellular mitosis.



Figure 1. Catharanthus roseus

Classification of vinca plant:

Domain: Eukarya: eukaryotes.

Kingdom: Plantae: plants.

Subkingdom: Tracheobionta: vascular plants.

Superdivision: Spermatophyta: seed plants.

Division: Magnoliophyta: flowering plants.

Class: Magnoliopsida: dicotyledons.

Subclass: Asteridae.

Superorder: Gentiananae.

Order: Gentianales.

Family: Apocynaceae: dogbane.

Subfamily: Rauvolfioideae.

Tribe: Vinceae.

Genus: Catharanthus G. Don.

Morphology:

Growing up to one meter in height, *C.roseus* is an annual evergreen sub herb or herbaceous plant that secretes milky latex.(8) Up to 70 centimeters are reached by the roots. Corrugated stems .Green or dark crimson, pubescent at least when young, terete, narrowly winged, or longitudinally ridged. The leaves are glossy green on top and light green underneath, with a pale midrib and a short, 1-1.8 cm-long petiole. They are oval to oblong, 2.5–9.0 cm long, and 1-3.5 cm wide. In opposing pairs, they are organized. These are actinomorphic, pentamerous, white to dark pink blooms. Featuring a deep crimson core, the basal tube is around 2.5–3 cm in length, while the corolla has five petal-like lobes and a diameter of 2–5 cm.[9] The fruit consists of two 2-4 cm follicles. 3 mm wide, long, and packed with many black seeds.

Chemical Constituent:

Vinca alkaloids are a significant class of anti-cancer medications. Vinca alkaloids work by interfering with the microtubular structure of cells to prevent their growth dynamics during mitosis, which results in a distinctive block that leads cell apoptosis. The Madagascar periwinkle, *Catharanthus roseus* G. Don, is the source of the vinca alkaloid Vinblastine (VLB), Vincristine (VCR), Vinorelbine (VRLB), and Vindesine (VDS) (Apocynaceae).

1. Vinblastine: One of the main naturally occurring active substances is vinblastine (VLB). The salt of an alkaloid known as vinblastine sulphate is taken from *Vinca rosea* Linn., a Periwinkle, a common blooming plant (officially named *Catharanthus roseus* G. Don). Previously, vincalukoblastine, or VLB, was the generic name. This agent is stathmokinetic oncolytic. Growing cells are stopped in their metaphase when this preparation is applied in vitro.

2. Vincristine Vincristine, also marketed under the trade name Oncovin, was once known as leurocristine and is commonly shortened to "VCR". It is a vinca alkaloid derived from the *Catharanthus roseus* plant, which was formerly known as *Vinca rosea*, thus its name. It is a mitotic inhibitor that is applied during chemotherapy for cancer. Vinca plant's indole alkaloids vindoline and catharanthine combine to form vincristine.

3. Vinorelbine: The first 5-NOR semi-synthetic vinca alkaloid is vinorelbine. It is produced by semi-synthesis using alkaloids that are taken out of rose periwinkles. *Rosa catharanthus*.

4. Vinflunine: The vinca alkaloids are a class of medications that includes vinflunine.

5. Vindesine: Used in chemotherapy, vindesine is an anti-mitotic vinca alkaloid.

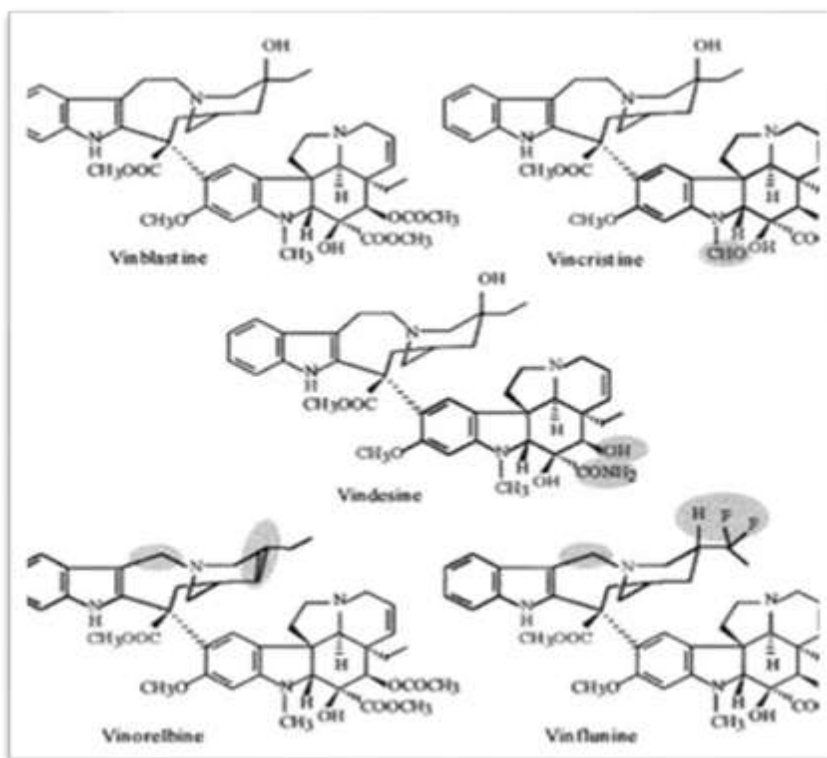


Figure 2. Chemical structures of the four Vinca alkaloids vincristine (A), vinblastine (B), vinorelbine (C), vinflunine (D) and vindesine (E)

Pharmacological Activities of *Vinca Rosea* :

Antioxidant Activity:

The ethanolic extract of the roots of the plant has the ability to exhibit antioxidative characteristics. Two varieties—*C. roseus*, which has pink flowers, and *Alba*, which has white flowers—were produced using various assay systems. In the concentration department's full assay, the extracted roots of *Vinca rosea* varieties demonstrated a reasonable scavenging effect. cific epithet: Rose's (Linnaeus) G. Don.

Anti-neoplastic Activity:

Vinca rosea contains bisindole alkaloids, which are known for their capacity to disrupt In split cells, microtubules result in the disintegration of mitotic spindles and metaphase arrest. In vitro tests revealed that varying percentages of *Vinca rosea*'s methanolic extracts had significant anti-cancer activity against a variety of cell types.

Antimicrobial Activity:

Making it a valuable therapeutic tool for developing new medications. The majority of the Resistance to many antimicrobial medications is emerging in microorganisms. It has been demonstrated that these plants are valuable natural resources for potent chemotherapy agents. Many microorganisms, including staphylococcus aureus, salmonella typhimurium, and pseudomonas aeruginosa, are susceptible to the antibacterial action of plant extracts derived from various plant parts. As a preventive medication, these extracts are also utilized in the treatment of several bacterial infections

Anti-cancer Activity :

Alkaloids with anticancer properties that are derived from the leaves and stem of *Vinca rosea* are vinblastine and vincristine. Within certain humans These alkaloids show malignancy development. The significance of the anticancer activity was discovered to be demonstrated by varying percentages of methanolic crude extracts of *C. roseus*. In vitro, it has action against a variety of cell types, with the majority of its potency being shown against tumors that are resistant to many drugs. The solid form of Velban is vinblastin, while vincristine is Oncovin.²⁴

Cytotoxic Activity:

Vinca rosea's stem and leaves exhibit growth-promoting anticancer activities because of the alkaloids vinblastin and vincristine. inhibiting impact on cancers in animals. Vinblastin, vincristine, and its derivatives, such as deacetylvinblastin amide, primarily cause disruptions to the division of cancer cells. They have generally been proven to be successful in treating both malignant and non-malignant platelets as well as platelets linked to disorders. The *Vinca rosea* alkaloid, which promotes tumor development, has been shown to prevent the formation of new blood vessels. Children's vincristine leukemia is treated with vinblastin, whereas hokin's disease and choriocarcinoma are treated with vinblastin.

Anti-malarial Activity:

400 mg/kg of chloroform extract of *Vinca rosea* roots was administered orally along with a dosage of water extract. 4.42 g/kg to chickens results in little *Plasmodium gallinaceum* activity.

Anti-helminthic Activity:

Anti-helminthic medications are a class of antiparasitic medications that eliminate parasitic worms. An infection with helminths may cause Ethanol extract has strong anti-helminthic action when it comes to chronic sickness. Twenty Both humans and livestock are impacted. It was discovered that *vinca rosea* has been utilized historically as an anti-helminthic medication.

Antidiarrheal Activity

Castor oil was used as an anti-diarrhea agent when the plant's ethanolic leaf extract was tested on wistar rats. a drug that induces experimental diarrhoea in addition to extract preparation. The usual medications were atropine sulphate and loperamide. The antidiarrheal properties of extracts derived from ethanol At dosages of 200 and 500 mg/kg, *C. roseus* demonstrated dose-dependent suppression of the castor oil-induced diarrhea.

Wound healing activity

The process of healing a wound involves mending damage to the skin and other soft tissues. Describe how the ethanolic extract of *Vinca rosea*, when applied to injured rats, mostly exhibited wound-healing properties. These properties were attributed to the granulation tissue's increased hydroxyproline content and tensile strength. Plant extract has been shown to be beneficial in managing wound healing.

Memory Enhancement Activity

The most interesting dietary supplement is vinpocetine, which is derived from the alkaloid vincamine. It is said to provide a number of benefits for memory and brain function, especially for those with Alzheimer's disease.

Anti-ulcer activity

The anti-ulcer efficacy of the plant leaves was demonstrated against experimentally induced stomach injury in rats. The plant's alkaloids, vincamine and vindoline, have anti-ulcer properties. Vincamine, an alkaloid found in plant leaves, has neuroprotective and cerebrovasodilatory properties.

Conclusion:

Vinca alkaloids, which are frequently utilized to manufacture anti-cancer treatments, are one among the many life-saving medications that may be found in *Catharanthus roseus*. They remain an significant medicinal help in the future because of the abundance of phytochemicals in the area. Recently, there have been several studies conducted to improve the plant's medicinal properties, produce more alkaloids by cultivating new types, and lessen the toxicity of *vinca* alkaloids. There are also some fruitful outcomes obtained. For example, vincristine encapsulated nanoparticles show promise for the future of medication delivery since encapsulation decreased the drug's toxicity and enhanced its anti-cancer properties.

REFERENCES

1. Prajapati ND, Purohit, SS, Sharma AK, Kumar T. "A hand book of medicinal plants". 1st ed. India: Agrobios, 2003, IDMA. Indian Herbal Pharmacopoeia. Mumbai: 2002. 14.

2. Balaji H. Versatile Therapeutic effects of *Vinca rosea* Linn. *IJPHC* 2014; 1(4):59-76.
3. Van der Heijden, RD I Jacobs, Snoeijer W, Hallard D, Verpoorte R. The *Catharanthus* alkaloids: Pharmacognosy and biotechnology. *Curr. Med. Chem.* 2004; 11:1241-1253.
4. Mohammed Fazil Ahmed, Syed Mohammed Kazim, Syed Safiullah Ghori, Syeda Sughra Mehjabeen, Shaik Rasheed Ahmed et al. Antidiabetic Activity of *Vinca rosea* Extracts in Alloxan-Induced Diabetic Rats. *International Journal of Endocrinology.* 2010. <http://dx.doi.org/10.1155/2010/841090>
5. Dessisa D. Preliminary economic evaluation of medicinal plants in Ethiopia: trade, volume and price. *Proceedings of the National Workshop on biodiversity Conservation and Sustainable use of Medicinal Plants in Ethiopia.* Addis Ababa, Ethiopia. 2001, 176-188.
6. Ambusta CS. Publication and Information Directorate, The Wealth of India. *Raw Materials.*, CSIR, New Delhi. 1992, 3.
7. Mishra P, Uniyal GC, Sharma S. Pattern of diversity for morphological and alkaloid yield related trades among the periwinkle *Catharanthus roseus* accessions collected from in and around Indian Subcontinent. *Genetic Research in Crop Evolution.* 2001; 48:273-286.
8. Preeti Singh Sisodiya. *Plant derived anticancer agents: a review.* ISSN: 2278-0238, 2013.
9. Sayeed MA, Mst H Jesmin, Sarker TC, Rahman MM, Alam MF. Antitumor Activity of Leaf Extracts of *Catharanthus roseus* (L.) G. Don. *Plant Environment Development.* 2014; 3(2):24-30.
10. Nor Hazwani Ahmad, Rohanizah Abdul Rahim, Ishak Mat. *Catharanthus roseus* Aqueous Extract is Cytotoxic to Jurkat Leukaemic T-cells but Induces the Proliferation of Normal Peripheral Blood Mononuclear Cells. *Trop Life Sci Res.* 2010; 21(2):101-113.
11. Fernández-Pérez F, Almagro L, Pedreño MA, Gómez Ros LV. Synergistic and cytotoxic action of indole alkaloids produced from elicited cell cultures of *Catharanthus roseus*. *Pharm Biol.*, 2012. doi:10.3109/13880209.2012.722646.
12. Kruczynski A, Hill BT. Vinflunine, the latest *Vinca* alkaloid in clinical development. 2001; 40(2):159-73.
13. Braguer D, Barret JM, McDaid H, Kruczynski A. Antitumor activity of vinflunine: effector pathways and potential for synergies. *Semin Oncol*, 2008. doi: 10.1053/j.seminoncol. 2008.01.011.
14. Ngan VK, Bellman K, Panda D, Hill BT, Jordan MA, Wilson L. Novel actions of the antitumor drugs vinflunine and vinorelbine on microtubules. *Cancer Res.*, 2000; 60(18):5045-51.
15. Furuse K, Fukuoka M, Asamoto H, Niitani H, Kimura I, Sakuma A et al. A randomized comparative study of 254-S plus vindesine (VDS) vs. cisplatin (CDDP) plus VDS in patients with advanced non-small cell lung cancer (NSCLC). *Gan To Kagaku Ryoho.* 1992; 19(7):1019-26.
16. Maurya S, Yadav P, Prajapati V, Gupta VK, Singh V, A *Phytomedicine– Catharanthus roseus.* 2021; 9(1): 454-458.
17. Sain M, Sharma V. *Catharanthus roseus* (An anti-cancerous drug yielding plant) - A Review of Potential Therapeutic Properties, *Int JPure App Biosci* 2013;1(6):139-142.
18. Pathania A. Traditional herbs *Catharanthus roseus* used as a anti-cancer- A Review. 2018;7(4):1019.
19. Ingalwad P, Veer V, Bhosale A. Overview on a *Vinca* Alkaloid & Its Medicinal, Therapeutic Properties, *IJTSRD* 2020;4(3):846-849.
20. Sain M. *Biotechnological Studies On Catharanthus roseus L*, Department of Botany
21. Government College, Kota (RA2018. [https://www.uok.ac.in/notifications/Monika%20Sen%20\(Botany\).pdf](https://www.uok.ac.in/notifications/Monika%20Sen%20(Botany).pdf))
22. Nayak S, Influence of Ethanol Extract of *Vinca rosea* on Wound Healing in Diabetic Rats. *Online J Biol Sci* 2006; 6(2): 51-55.
23. Edrah SM, Meelad FM, Alafid F. *Phytochemical Study and In Vitro Antibacterial Activity of Two Traditional Medicinal Plants (Vinca rosea and Vinca Difformis) from Libya.* *Open Acc J of Toxicol* 2019; 4(1): 1-6.
24. Aziz S, Saha K, Sultana N, Ahmed S, Mansur AA. *Phytochemical and elemental screening on leaves and flower of Vinca rosea: An important medicinal plant of Bangladesh.* *Int J Chem Sci* 2014; 12(4):1328-1336.
25. Octaviana L, Affandy D, Sanjaya EH. *Phytochemical screening and antibacterial activity of different fractions of Indonesian Vinca rosea leaves (Catharanthus roseus L. G. Don),* *Laurent Octavian,* 2015; 7(11):144-146.
26. Ramaiah M, Sravani MR. An updated clinical and clinical trial profile of *Catharanthus roseus*: A peerless medicinal plant. *AJMP* 2018;6(11):392-401.
27. Lahare RP, Yadav HS, Dashahre AK, BisenYK. An Updated Review on *Phytochemical and Pharmacological Properties of Catharanthus rosea,* 2020;6(12):759-766.
28. Johnson IS, Armstrong JG, Gorman M, Burnett JP, JR. The *Vinca* Alkaloids: A New Class of Oncolytic Agents, *Cancer Res* 1963; (23)(8 Part 1): 1390-1427.

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29. Nayak BS, Pereira LMP. Catharanthus roseus flower extract has wound-healing activity in Sprague Dawley rats, *BMC Complement Altern Med* 2006;6:41.
 30. Wahyu Widowati, Tjandrawati Mozef, Chandra Risdian, Yellianty Yellianty. Anticancer and free radical scavenging potency of Catharanthus roseus, Dendrophthoe petandra, Piper betle and Curcuma mangga extracts in breast cancer cell lines. *Oxid Antioxid Med Sci.*, 2013; 2(2):137-142, doi: 10.5455/oams.100413.
 31. G.Parthasarathi, N.Udupa, P. Umadevi & G.Pillai, "Niosome Encapsulated of Vincristine sulphate: Improved Anti-cancer activity with reduced toxicity in mice". *Journal of Drug Targeting*, 1994; 2(2): 173-182.