



Review Article

Ethnopharmacological review of vinca plant for anticancer activity

Amit Gajanan Nerkar^{1,2,3,*}, Rushikesh P Nagarkar¹, Shubhangi Badar¹¹Dept. of Pharmacy, CAYMET's Siddhant College of Pharmacy, Sudumbare, Pune, Maharashtra, India²Founder and Director, Ateos Foundation of Science Education and Research, Pune, Maharashtra, India³Founder and Director, Carolene Therapeutics, Pvt. Ltd, Aurangabad, Maharashtra, India

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ABSTRACT

The strive of this assessment shows that Vinca rosea, many obviously grown vegetation round us which can be used for medicinal purposes. It has many known names like vinca Rosea, Madagascar periwinkle, vibrant eyes, Cape periwinkle, graveyard plant, old maid, crimson periwinkle, rose periwinkle myrtle. Ayurveda is the Indian conventional device of medication which focuses on the scientific capability of plant life. Catharanthus roseus is one plant recognized nicely in Ayurveda. It is known for its antitumour, anti-diabetic, anti-microbial, anti-oxidant and antimutagenic effects. It is an evergreen plant first originated from islands of Madagascar. The flowers can also range in color from red to pink and leaves are organized in opposite pairs. It produces nearly 130 alkaloids especially ajmalicine, vinceine, reserpine, vincristine, vinblastine and raubasin. Vincristine and vinblastine are used for the treatment of various types of cancer such as Hodgkin's disease, breast cancer, skin cancer and lymphoblastic leukemia. It has high medicinal values which need to be explored considerably. This ethnopharmacological review deals with anticancer activities and pharmacognostic study of Vinca plant.

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1. Introduction

Medicinal plants have a long history of usage in traditional medicine. Ethno-botanical information on medicinal plants and their usage by indigenous cultures is useful in the conservation of traditional cultures, biodiversity, community health care and drug development. Catharanthus roseus L. (G.) Don,¹ is an essential medicinal plant belonging to the Apocynaceae own family; this plant is a dicotyledonous angiosperm and synthesizes terpene indole alkaloids: vinblastine and vincristine which might be used to combat most cancers. Catharanthus roseus L. In 1910, described the use in Brazil of an infusion of the leaves to govern hemorrhage and scurvy, as a mouthwash for toothache, and for

the healing and cleansing of persistent wounds.² In Europe related species have been used for the proprietary suppression of the flow of milk.³ Within the British West Indies it has been used to deal with diabetic ulcer and in the Philippines has been mentioned as being an powerful oral hypoglycemic agent recently.⁴ The alkaloids remoted from this plant, ajmalicine, has been stated to own brief depressor motion on arterial blood strain Periwinkle” or Catharanthus roseus (circle of relatives Apocynaceae), normally referred to as “Nayantara” or “Sadabahar”. Catharanthus derives from the Greek language meaning natural flower.⁵

1.1. Scientific classification⁶

1. Botanical Name(s): Vinca Rosea (Catharanthus roseus)

* Corresponding author.

E-mail address: dragnerkar@gmail.com (A. G. Nerkar).

2. Family Name: Apocynaceae
3. Kingdom: Plantae
4. Division: Magnoliophyta (Flowering plants)
5. Class: Magnoliopsida (Dicotyledons)
6. Order: Gentianales
7. Family: Apocynaceae
8. Genus: Catharanthus
9. Species: *C. roseus*

1.2. Vernacular names

1. English: cayenne jasmine, old maid, periwinkle
2. Hindi: sada bahar, sadabahar
3. Kannada: batla hoo, bili kaasi kanigalu, ganeshana hoo, kempu kaasi kanigalu
4. Malayalam: banappuvu, nityakalyani, savanari, usamalari
5. Marathi: sadaphool, sadaphul, sadaphuli
6. Sanskrit: nityakalyani, rasna, sadampuspa, sadapushpi
7. Tamil: cutkattu malli, cutukattu malli, cutukattuppu
8. Telugu: billaganneru
9. Gujarati: Barmasi
10. Bengali: noyontara

1.3. Description

While roseus are pink, rose or rosy. It is a shrub that grows to a height of 1-3 feet having smooth, glossy, dark green leaves and flowers throughout the year. The periwinkle flowers are found in different colours blue, purple, violent, pink and white. These plants are native to North America India China almost all parts of periwinkle plant have medicinal characteristics. Periwinkle is a plant of immense medicinal value. All part of the plant is medicinally crucial but alkaloids are commonly focused in roots bark. almost all components of periwinkle plant have medicinal properties. Those encompass three crucial alkaloids of Rauwolfia constitution that are ajmalicine, reserpine and serpentine. In addition to these the other important alkaloids found are vindoline, vincristine, vinblastin. The vinca rosea used both in Ayurvedic medicine and Chinese medicine.

1.4. Morphology

Catharanthus roseus is an evergreen subherb or herbaceous plant developing to at least one m. Fruit is a couple of elongated follicles. The broad sleek green hairless with a light midrib and a brief petiole approximately 1- 1.8 cm. The flowers are white to dark pink with a dark red center, with a basal tube about 2.5- 3 cm. long and a corolla about 2-5 cm. diameter with five petal like lobes.

1.5. Geographical Distribution

Catharanthus roseus is native to the Indian Ocean Island of Madagascar. In the wild, it is found to be an endangered

plant and 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 states.

1.6. Active chemical constituents

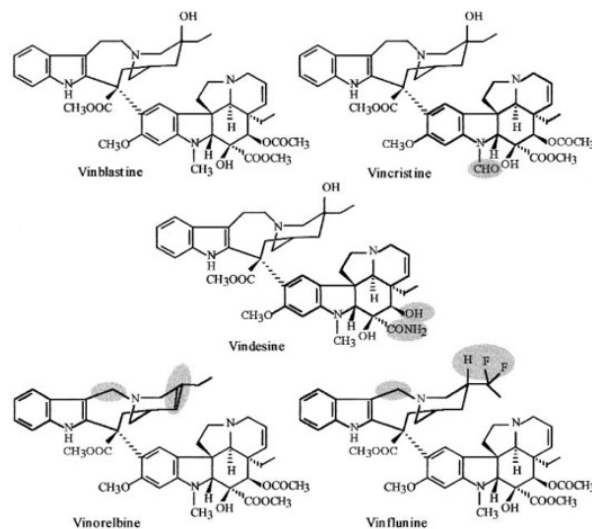


Fig. 1: Active constituents of Vinca Plant

Researchers investigating its medicinal properties discovered that it contained a group of alkaloids that, though extremely toxic, had potential uses in cancer treatment. Flowers have the potential to synthesize a extensive type of chemical compounds that are used to carry out important biological functions, and to protect towards assault from predators which includes bugs, fungi and herbivorous mammals. There are around 400 alkaloids are present in the plant, which are used as pharmaceuticals, agrochemicals, taste and perfume, elements, meals components and insecticides. The alkaloids like Vinblastine, Vincristine, Vindesine, Vindeline Tabersonine etc as shown in Figure 1. Plants have the capacity to synthesize a extensive kind of chemical substances which might be used to carry out critical biological capabilities, and to shield against assault from predators including insects, fungi and herbivorous mammals.

2. Review of Anticancer Activity of Vinca

According to Wilson et al One of the most effective anticancer drug targets is the highly active mitotic-spindle microtubule. Paclitaxel and Vinca alkaloids were once thought to function primarily by raising or lowering the cellular microtubule mass, making them microtubule-targeted medicines.⁷ An increasing number of structurally unique peptides and depsipeptides identified from a

variety of organisms have tubulin as their target. Since microtubules' subunit protein is tubulin, most compounds are highly toxic to mammalian cells. Although these agents can be distinguished by their effects on microtubules and tubulin binding sites, the ultimate consequence is the same because microtubule disruption causes cell cycle arrest at the G2/M phase and apoptotic cell death as a result.⁸

The leaves and stems are the source of alkaloids that have anti-tumor and mostly anti-cancer property. Alkaloids inhibit the tumors. Vinblastine is used for the treatment of neoplasm of Hodgkin's disease, choriocarcinoma. Vincristine is used for the leukemia in youngsters. Vinblastine is offered as Velban or Vincristin pills.⁹ To enhance the healing index, semi-synthetic Catharanthus alkaloids along with vinorelbine and vinflunine were developed. Vincristine is used for the leukemia in children. Vinorelbine and vinflunine exert their antitumor impact by binding to tubulin.¹⁰ The alkaloids are also called mitotic spindle poisons they inhibit the metaphase of microtubules which inhibit the mitosis in cell cycle Hence vinca alkaloids helps in preventing the cancer from further division. Researchers found that Vinca alkaloids have been found to cause the formation of tubulin spiral filaments.¹¹ Also, there were four vinca alkaloids which inhibit the cellular uptake and tubulin binding characteristics.¹² Later it was discovered that the anti-angiogenic effects in murine tumour models for anticancer activity.¹³ According to research, intraperitoneal administration of vinblastine or colchicine to B6D2F1 mice with advanced subcutaneous colon 38 tumours significantly slowed the growth of the tumours, and within 8 hours of therapy, hemorrhagic necrosis gradually developed.^{14,15} Vinflunine had superior in vivo experimental antitumor activity when compared to vinorelbine in a panel of human tumour xenografts.¹⁶ Vinflunine, a novel Vinca alkaloid created from vinorelbine utilizing superacidic chemistry,¹⁷ As having a different mechanism of action from vinorelbine in preclinical tumour models. Vinblastine has varied effects on polymerization and dynamics at opposing microtubule ends.¹⁸

Vinca alkaloids, cause tubulin to form ordered paracrystals and indeterminate spirals that compete with the development of microtubules.¹⁹ The discovery that the Vinorelbine (VLB) group of alkaloids are known as "spindle poisons" due to their ability to obstruct tubulin's ability to polymerize, which is a protein necessary for the formation of the microtubule system, which is crucial for nerve conduction, as well as the mitotic spindle, which manifests during cell division.²⁰ Synthetic derivatives were prepared wherein Anhydrovinblastine Nb -oxide 4 was subjected to the modified Polonovski reaction and found that the resulting reaction medium produced 5'-nor anhydrovinblastine after hydrolysis., the resulting compounds showed anticancer activity.²¹

Further it was discovered that Vinca rosea Linn's anticancer principles have an experimental basis for clinical examination.²² The structure-activity correlations of dimeric Catharanthus alkaloids have been the subject of diligent effort.²³ Vinorelbine, synthesized by C' ring contraction of anhydrovinblastine, is currently sold all over the world thanks to Fahy J et al. tireless efforts to discover novel chemistry that allowed the semi synthesis of derivatives changed in the velbenamine "upper" end of the molecule.²⁴ The pharmacology, physicochemical factors, naturally occurring bisindole alkaloids from Catharanthus, modifications of the upper half (velbanamine portion) of bisindole alkaloids, modifications of the lower half (vindoline portion) of bisindole alkaloids, multiple modifications: 4'-epideoxyvincristine, and new concepts in medicinal chemistry of bisindole alkaloids are all discovered by him. Further the successful molecular constructions included additional three-membered rings into the 14,15-position of the vindoline component of the dimer alkaloid by the Simmons-Smith reaction. This led to the synthesis of cyclopropanated vinblastine and its derivatives. In the presence of diethylzinc, reactions with iodoform and bromoform, respectively, were used to produce halogenated 14,15-cyclopropanovindoline.^{25,26} Alkaloid Vinorelbine (VLB) caused C-mitosis in vivo in both the normal rat bone marrow and the cells of the L1210 ascites tumour. Post-metaphase completely vanished as a result of the afflicted cells being halted in metaphase. Stages of the prophase were unaffected. Tryptophan or glutamic acid treatment can change how VLB affects the production of metaphase arrest.²⁷ It was further discovered the Vinorelbine effect on cells expanding in tissue culture. J-96 and LLC-He1 cells treated with VLB experience metaphase arrest and characteristic C-mitotic chromosomal alterations.^{28,29} Acute lymphoblastic leukaemia (ALL), malignant lymphoma, and neuroblastoma are only a few of the cancers that are frequently treated using done work on Vincristine (VCR), an alkaloid derived from vinca.³⁰ Further it was noted reported and discovered that the anti-cancer medications taxol, vincristine, and cisplatin clinically induce severe sensory neuropathy in addition to autonomic neuropathy. Although experimental sensory neuropathies brought on by these anti-cancer medications have been discovered to be prevented by nerve growth factor (NGF) administration, and to state that information about autonomic neuropathy is sparse.^{31,32}

3. Conclusion

Vinca is one of the in most cases found to have the lifesaving properties in most of the cancers, vinca have the anticancer and the anti-tumor houses. The semi synthetic derivatives of vinca are well documented for the anticancer activity and the crude extract also possesses the anticancer activity. Also, it belongs to the category of

cytotoxic agents which have been approved with FDA such as vinblastine, vincristine and vinorelbine. Further other agents such as vinflunine that are used in cancer as second-line transitional carcinoma of the urothelium are in pipeline. Overall review and literature thus conclude that vinca is potential ethnopharmacologically as anticancer agent.

4. Source of Funding

None.

5. Conflict of Interest

None.


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Author biography

Amit Gajanan Nerkar, Professor and Research Head
 <https://orcid.org/0000-0002-1377-8466>

Rushikesh P Nagarkar, Student

Shubhangi Badar, Student

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