



Review Article

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**CATHARANTHUS ROSEUS: A MEDICINAL PLANT WITH POTENT ANTI-TUMOR PROPERTIES**Punia Sandeep¹, Kaur Jagjit¹, Kumar Raman² and Kumar Kuldeep^{3*}¹Research Fellow, Department of Biotechnology, M. M. University, Mullana, Haryana, India²Assistant Professor, Department of Biotechnology, M. M. University, Mullana, Haryana, India³Assistant Professor, Department of Biotechnology, M.M. Modi College, Patiala, Punjab, India

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ABSTRACT

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. It is known for its anti-tumour, anti-diabetic, anti-microbial, anti-oxidant and anti-mutagenic effects. It is an evergreen plant first originated from islands of Madagascar. The flowers may vary in colour from pink to purple and leaves are arranged in opposite pairs. It produces nearly 130 alkaloids mainly ajmalicine, vinceine, reserpine, vincristine, vinblastine and raubasins. 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 is an endangered species and need to be conserved using techniques like micro propagation. It has high medicinal values which need to be explored extensively.

Keywords: Alkaloids, *Catharanthus roseus*, vinblastine, vincristine, anti-cancer.

INTRODUCTION

The importance of medicinal plants has been renowned since 2600 BC in Mesopotamia¹. World Health Organization (WHO) have prepared a list of 21000 medicinally important plants. One such plant is *Catharanthus roseus* (L.) G Don which is also known as sadabahar or Periwinkle. The other names for *C. roseus* are Old-maid, *Cape periwinkle*, *Vinca rosea*, *Rosy periwinkle*, *Rose periwinkle*, *Ammocallis rosea* and *Lochnera rosea*². It belongs to family Apocynaceae and is a rich source of alkaloids. These alkaloids are the secondary metabolites of plants which differ in their chemical structure. These are used for the various purposes such as pharmaceuticals, food additives; dye etc.³ Being cultivated for hundreds of year *C. roseus* is an evergreen, perennial sub shrub with a height of 30 cm to 1 m. It is known to be originated from island of Madagascar due to which it is also known as Madagascar periwinkle. But now it is found in most of the warm places of the world. It is also considered to be annual as it has the capabilities to tolerate high temperatures, drought conditions as well as heavy rainfall. The flower consist of five petal lobes which form a corolla of 2-5 cm diameter and these are white to pink-purple in colour. The centre is dark red in colour and the basal tube is 2.5-3 cm long⁴. It possesses fruits which are follicle pairs of about 2-4 cm in length and 3 mm in breadth. The fruit is many seeded and the seeds are small, black, oblong or cylindrical^{4,5}. The leaves are 1-3 inches long and arranged in opposite pairs. They may be oval, oblong or elliptic with pale midrib and rounded apex. These are glossy, dark green and hairless with a short petiole^{2,6}. These plants are mostly found in warm places but they have also adapted to cold conditions. It can grow in different types of soils such as slightly acidic or soils with high moisture content and in low to full sunlight⁷. Different alkaloid are produced by different parts of this plant such as roots and basal stems produce reserpine, vinceine, raubasins and ajmalicine

whereas antineoplastin dimeric vinblastine and vincristine are produced by aerial parts⁸ (Table 1). Maximum amount of these alkaloids is present in the root barks which rounds to nearly 0.15-1.34 % and even 1.79 % in some strains⁹. Out of the 130 different alkaloids produced by this plant 25 are dimeric in nature. Two such main examples of dimeric alkaloids are vinblastine and vincristine which are produced by aerial parts and used for the treatment of human neoplasma. Ajmalicine is a monomeric alkaloid produced by roots and used to treat circulatory diseases. Similarly other different alkaloids are used for many diseases such as lymphoblastic leukemia, Hodgkin's disease, skin cancer, breast cancer^{4,10-12} and Reticulum cell sarcoma, neuroblastoma, Wilkin's disease, diabetes, sore mouth, mouth ulcers, etc. These alkaloids are in great demand due to their medicinal importance and India is the third largest producer of vinblastine and vincristine. The production of these alkaloids depends on the developmental stage and physiological stage of the plant and these are obtained mostly from wild plants. Techniques such as tissue culture technique, media optimization and control of pH, temperature, light aeration, phytohormones, etc. are being employed to increase their productivity. These techniques have various advantages such as dimeric alkaloids can be produced in large quantity which reduces their cost, even the slow growing plants can be used¹³ and different alkaloids can be produced in various quantities by bioengineering plants¹⁴⁻¹⁶. *C. roseus* has been used since long times for the treatment of various diseases in different parts of the world. It was used as diuretic, astringent and to treat cough in China and wasp stings in India¹⁷, nose bleed, sore throat, mouth ulcers and bleeding gums. It was used to get relief from lung congestion and inflammation in Central and South Asia, in Europe to treat diabetes¹⁸. It also had some superstitious aspects with it such as in Europe people believed that it could help to get rid of evil spirits and it was called "violet of the sorcerers"

by the French. Then the Western researchers found that the plant produces a number of alkaloids which has the medicinal values such as vindoline, catharanthine, lochnerine, vindolinine and leurosine sulphate lowers blood sugar levels, reserpine and serpentine are powerful tranquilizers and vincristine, vinblastine have anticancerous properties. Alkaloids are the nitrogen containing compounds produced by the plant which are usually bitter in taste and they possess anticancer and pain relieving properties. Vincristine and vinblastine are produced by the leaves^{19,20} whereas vindoline is mainly produced by the green parts of the plant²¹ and catharanthine by the roots. Out of the various alkaloids

produced by this plant more than 100 are monoterpenoid indole alkaloids (MIAs) which have anticancer properties²². Enzymatic and non-enzymatic antioxidants are also produced by this plant^{23,24}. Wound healing, hypoglycaemic, analgesic and vasodilatory effects are some of the other medicinal applications of *C. roseus*²⁵. High blood pressure and cardio-vascular diseases can be treated using ajmalicine and serpentine which are found in the roots. A large amount of phytochemical compounds are present in the leaves and stem of this plant which makes it plant of medicinal value. Its conservation is the point of concern as it comes under the endangered species⁷.

Table 1: Different Alkaloids Produced By *Catharanthus roseus*

Produced by	Alkaloids	Properties
Roots	Ajmalicine	Cardio-Vascular Diseases And High Blood Pressure
	Catharanthine	Anti-Diabetic Properties
	Raubasin	Pain Relieving Properties
	Reserpine	Tranquilizers
	Serpentine	Cardio-Vascular Diseases And High Blood Pressure
Aerial parts like leaves	Vinblastine	Anti-Tumour Properties
	Vincristine	Anti-Tumour Properties
	Vindoline	Anti-Diabetic Properties

Medicinal Properties of *Catharanthus roseus*

Anti-Cancerous Effect

C. roseus produces vinblastine and vincristine which are well known for their anti-cancerous properties.²⁶ El-Merzabani *et al.*, 1979 injected ethanol (70 %) extract of leaves intra peritoneally to female mice. As a result the alkaloids showed great responses against different types of cancers especially those that are multi-drug resistant. The nineteen patients suffering from plantar, genital, flat or *Verruca vulgaris* warts were cured. When the chloroform extract was injected to the patients suffering from Leuk-P3887 then only one was resistant to the treatment, five showed 50 % response and six were completely treated²⁷. Both the malignant and non-malignant, platelet and platelet-associated disorders are effectively treated using the *C. roseus* alkaloids²⁸. In recent studies it has been found that growth of blood vessels that enhance tumour growth is inhibited by alkaloids secreted by *C. roseus*²⁹. These alkaloids, vincristine and vinblastine are used as injectable anticancer drugs³⁰ such as vinblastine as Velban and vincristine as Oncovin⁷. The division of cancer cells is interfered by these drugs along with their derivatives such as vinflunine. Vincristine is used in the treatment of leukemia in children and vinblastine for choriocarcinoma and Hodgkin's disease⁷.

Anti-Microbial Effect

A number of anti-microbial agents have been used to prevent the adverse effects caused by various microbes. It is very important to discover new antimicrobial agents³¹ because the rate of antibiotic production is much lower than the rate at which the microbes are becoming resistant to them³². The plant extracts are useful in attaining the long term health response and also reducing the ill effects of various chemotherapeutic agents³³. Plants like *C. roseus* provide a broad spectrum of resistance against microbial agents and can be used as a prophylactic agent

in the treatment of number of diseases. It has proved to possess efficient anti-viral³⁴, anti-bacterial³⁵ and antifungal³⁶ compound. Tobacco Mosaic Virus (TMV) was inhibited by water extract of callus culture of micro propagated plant³⁷. *Bacillus megatarium* and *Staphylococcus albusi* did not grow on agar plates with 70 % ethanol extract of dried leaves but *B. cereus* and *S. aureus* were resistant to same extract³⁸. *Proteus*, *Staphylococcus*, *Shigella* and *Pseudomonas* species are inhibited by the benzene extract of dried flowers (50 %) whereas the same concentration of benzene extract of dried leaves inhibited *Salmonella* species in addition to the above mentioned bacterial species³⁹. Antifungal effect was shown using different plant part extracts and each of them was active against different fungi. *Trichophyton mentagrophytes* was inhibited by hot water extract of both leaves and stem^{40,41}. There was no effect on *Neurospora crossa* by the acetone and water extract (70 %) of aerial parts of plant⁴². A study by⁴³ Khalil, 2012 has shown the antimicrobial activity of *C. roseus* against bacteria (*S. aureus* and *E. coli*) and fungus (*Candida albicans*). The antibacterial activity of *C. roseus* was also shown by⁴⁴ Govindasamy and Srinivasan in 2012 in which they studied the effects of extracts from leaf, stem, root, and flower against a number of bacteria. The maximum antibacterial activity was shown against *S. typhi* and minimum against *S. aureus* and *E. coli*. The antimicrobial activity of *C. roseus* was studied against *B. fusiformis*, *C. albicans*, *E. coli* and *Aspergillus fumigatus* using agar well disc diffusion assay and paper disc diffusion assay. The methanolic extract of stem was active against *B. fusiformis*, leaves against *A. fumigates* and flowers against *B. fusiformis*⁴⁵. The crude extract from different parts of this plant was used to study the antibacterial activity against *Salmonella typhimurium* (NCIM2501), *S. aureus* (NCIM5021) and *Pseudomonas aeruginosa* (NCIM2036). The results showed that it was a potent antibacterial agent⁷. Stem extracts of *C. roseus* were used to save

rubber trees (*Hevea brasiliensis*) from White rot disease caused by *Rigidoporus microporus* named fungus. It was found that the extract proved to be an efficient healing agent for the infected trees⁴⁶.

Anti-Mutagenic and Anti-Mitotic Effect

The anti-mitotic effect was shown by administrating the female mice with ethanol (70 %) extract of dried leaves which showed positive results on CA-Fhrlich ascites vs. induction of metaphase arrest in ascites cells⁴⁷. In a study conducted by⁴⁸ Sharma *et al.*, 1982 it was found that when the red blood cells (RBCs) were subjected to hot water extract of dried leaves the number of micro-nucleated polychromatic RBCs decreased which proved the anti-mutagenic effect of *C. roseus*. The mutagenic effect of vincristine, an alkaloid secreted by *C. roseus* was studied using sex linked recessive lethal (SLRL) test system in *Drosophilla melanogaster*. The results thus obtained showed that vincristine produced many chromosomal effects, arrest cells at metaphase with highly contracted chromosomes and inhibition of tubulin polymerization⁴⁹. When the root tips of *C. roseus* were treated with ethylmethane sulphonate (EMS) then a number of chromosomal anomalies were observed such as persistent nucleolus, condensation, fragmentation, lagged, bridge, cleft and binucleolated cells⁵⁰.

Anti-Oxidant Effect

Tannins, phenolics and flavonoids are the anti-oxidants produced by medicinal plants which are more potent than the anti-oxidants secreted by dietary plants⁵¹. Reactive oxygen species (ROS) are the harmful compounds that our body generates during normal aerobic respiration and anti-oxidants are helpful in eradicating these compounds⁵². *C. roseus* is known to produce many different alkaloids such as flavonol glycosides, caffeoylquinic acids, etc.⁵³⁻⁵⁵. Phenolic compounds are the products of secondary metabolism of plants and act as anti-oxidants, anti-inflammatory, anti-microbial, cardio-protective and anti-allergic agents. Their anti-oxidant potential is because they are efficient hydrogen donors, reducing agents, metal chelators or singlet oxygen quencher⁵⁶⁻⁵⁸. When a number of medicinal plants were screened for their oxygen radical absorbance capacity (ORAC) it was found that *C. roseus* has the highest ORAC value i.e. 22.30 μmol Trolox equivalent (TE)/g of fresh weight⁵⁹. *C. roseus* has also been shown to scavenge the nitric oxide, superoxide and DPPH (1,1-diphenyl-2-picrylhydrazyl) radicals⁵⁴. In 2011 Rasool⁶⁰ and his colleagues demonstrated through their research that *C. roseus* is a viable source of natural antioxidants which can be exploited for food and nutraceutical applications. The anti-oxidant activity of *C. roseus* was studied in different regions of Rajasthan and it was found that plants of Bikaner region had highest phenolic content followed by Kota and Jaipur, India⁶¹. *C. roseus* is free of side effects and cost effective and efficient means to get rid from oxidative stress mediated diseases. The antioxidant effect of *C. roseus* (pink flowers) and *C. alba* (white flowers) was checked and it was found that *C. roseus* has higher antioxidant activity than *C. alba*⁷.

Anti-Diabetic Effect

Diabetes, malaria, dementia, etc. can also be treated by using the different extracts of this plant. *Vinca rosea* has the ability to improve the blood supply to brain which results in increased supply of oxygen and glucose to brain and also preventing the abnormal coagulation of blood. *V. rosea* also helps in increasing the levels of serotonin whose deficiency may cause diseases like migraine, bulimia, phobias and schizophrenia. This plant helps in increasing the insulin production and utilization of sugar from food which helps in curing diabetes. An alkaloid named alstonine which is mainly present in its root bark helps in regulating the blood pressure. In a case study in Malaysia the diabetes patients who took decoctions of this plant in combination with regular medications showed better response as compared to those who undergone only oral medications and insulin^{62,63}. Maximum of the reported work about anti-diabetic potential of this plant is being conducted using the crude extract rather than the pure bioactive compounds⁶⁴⁻⁶⁷. In streptozotocin induced diabetic rat this plant induces hypoglycemic effect^{68,69}. From this plant four alkaloids: vindoline I, II, III and IV were extracted which enabled high glucose uptake in pancreatic β -TC6 or myoblast C2C12 cells and elicited their use against type 2 diabetes⁷⁰. The alkaloid vincamine helps in the treatment of vascular dementia, a disease caused by the plaque development of arteries carrying blood to brain. Vincamine also causes blood thinning and helps to enhance the memory properties². *C. roseus* lowers the blood sugar levels in a dose dependent manner⁷. The anti-diabetic potential of *C. roseus* was evaluated by studying the protein content in its different parts with highest content in half mature leaves⁷¹.

CONCLUSION

Catharanthus roseus is one of the 21000 important medicinal plants found. It is used for the cure of a number of diseases such as diabetes, sore mouth, mouth ulcers, and leukemia. It produces about 130 alkaloids such as reserpine, vinceine, raubasine and ajmalicine. Anti-leukemic activity is shown by vinblastine and vincristine. Different parts of this plant produce different amounts of alkaloids, out of which root bark produces the maximum i.e. nearly 1.79 %. There are a number of reports supporting its anti-microbial activity against *Staphylococcus albusi*, *Bacillus megatarium*, *Shigella*, *Pseudomonas*, etc. Its anti-oxidant and anti-mutagenic effects have also been reported. Further studies need to be done to explore its anti-tumour effects.

REFERENCES

1. Koehn FE and Carter GT. The evolving role of natural products in drug discovery. *Nat Rev Drug Discover* 2005; 4: 206-20. <http://dx.doi.org/10.1038/nrd1657>
2. Gayatri CL, Chakravarthy R. Micro Propagation in *Catharanthus roseus*. *Internat J Innov Tech Exploring Eng (IJITEE)* 2013; 2(5).
3. Taha HS, El Bahr MK and Seif El Nasr MM. *In vitro* studies on Egyptian *Catharanthus roseus* (L.). II. Effect of biotic and abiotic stress on indole alkaloids -production. *J Appl Sci Res* 2009; 5: 1826-31.
4. Cononer RA and Litz RE. *In vitro* propagation of *Catharanthus roseus*. *Hort Sci* 1978; 13: 241-42.
5. Devis DR. Cell and tissue culture potential for *Catharanthus roseus* plant breeding. *Phil Tran R Soc. (London)* 1981; 292: 547-56.

6. Rajora RK, Sharma NK and Sharma V. Effect of plant growth regulators on micro propagation of *Catharanthus roseus*. Internat J Adva Biotechnol Res 2013; 4(1): 123-30.
7. Sain M and Sharma V. *Catharanthus roseus* (An anti-cancerous drug yielding plant) - A Review of Potential Therapeutic Properties. Int J Pure App Biosci 2013; 1(6): 139-142.
8. Singh R, Kharb P and Rani K. Rapid Micro propagation and Callus Induction of *Catharanthus roseus* *In Vitro* Using Different Explants. World J Agri Sci 2011; 7(6): 699-704.
9. Singh VP, Jagdev RSD. Ajmalicine (raubacine); A medicinally important alkaloid from *Catharanthus roseus* (*Vinca rosea*). In supplement: Cultivation and utilization of medicinal plants. Handa SS and Kaul MK (eds) RRL, Jammu; p. 199-206.
10. El Sayed A and Cordell GA. Catharanthamine, a new antitumor bisindole alkaloid from *Catharanthus roseus*. J Nat Prod 1981; 11: 289-93. <http://dx.doi.org/10.1021/np50015a009>
11. Matkowski A. Plant *in vitro* culture for the production of antioxidants- A review. Biotechnol Advan 2008; 26: 548-60. <http://dx.doi.org/10.1016/j.biotechadv.2008.07.001>
12. Gomes F, Simoes M, Lopes ML and Canhoto JM. Regulators and genotype on the micro propagation of adult trees of *Arbutus unedo* L. (strawberry tree). New Biotechnol 2010; 27(6): 882-92. <http://dx.doi.org/10.1016/j.nbt.2010.02.009>
13. Zhao R and Verpoorte R. Manipulating indole alkaloid production by *Catharanthus roseus* cell cultures in bioreactors: from biochemical processing to metabolic engineering. Phytochem Rev 2007; 6: 435-57. <http://dx.doi.org/10.1007/s11101-006-9050-0>
14. Moreno PRH, Van Der Heijden R and Verpoorte R. Cell and tissue cultures of *Catharanthus roseus*: A literature survey. Plant Cell Tissue Org Cult 1995; 42: 1-25. <http://dx.doi.org/10.1007/BF00037677>
15. Stern S. Introductory Plant Biology. 8th ed. McGraw- Hill Companies Inc; 2000. p. 238-47.
16. Gragg GM and Newman DJ. Plants as a source of anti-cancer agents. J Ethnopharmacol 2005; 100: 72-9. <http://dx.doi.org/10.1016/j.jep.2005.05.011>
17. Farnsworth NR. The pharmacognosy of the periwinkles: *Vinca* and *Catharanthus*. Lloydia 1961; 24(3): 105-38.
18. Swanston Flatt CK, Day C, Flatt PR, Gould BJ and Bailey CJ. Glycaemia effects of traditional European plant treatments for diabetes studies in normal and streptozotocin diabetic mice. Diabetes Res 1989; 10(2): 69-73.
19. Svoboda GH and Blake DA. The phytochemistry and pharmacology of *Catharanthus roseus* (L) G. Don. In: Taylor WI, Farnsworth NR, eds. The catharanthus alkaloids. New York, NY: Marcel Dekker; 1975. p. 4583.
20. Neuss N. The spectrum of biological activities of indole alkaloids. In: Phillipson JD, Zenk MH eds. Indole and biogenetically related alkaloids. London: Academic Press; 1980. p. 293-313.
21. De Luca V, Balsevich J, Tyler RT, Eilert U, Panchuk BD and Kurz GW. Biosynthesis of indole alkaloids: developmental regulation of the biosynthetic pathway from tabersonine to vindoline in *Catharanthus roseus*. J Plant Physiol 1986; 125: 147-56. [http://dx.doi.org/10.1016/S0176-1617\(86\)80252-8](http://dx.doi.org/10.1016/S0176-1617(86)80252-8)
22. Magnotta M, Murata J, Chen J, De Luca V. Identification of a low vindoline accumulating cultivar of *Catharanthus roseus* (L.) G Don by alkaloid and enzymatic profiling. Phytochem 2006; 67: 1758-64. <http://dx.doi.org/10.1016/j.phytochem.2006.05.018>
23. Jaleel CA, Gopi R, Alagulakshmanan GM and Panneerselvam R. Triadimefon induced changes in the antioxidant metabolism and ajmalicine production in *Catharanthus roseus* (L.) G. Don. Plant Sci 2006; 171: 271-76. <http://dx.doi.org/10.1016/j.plantsci.2006.03.018>
24. Jaleel CA and Panneerselvam R. Variations in the anti oxidative and indole alkaloid status in different parts of two varieties of *Catharanthus roseus*, an important folk herb. Chinese J Pharmacol and Toxicol 2007; 21: 487-94.
25. Nayak BS and Lexley MPP. *Catharanthus roseus* flower has wound healing activity in Sprague Dawley rats. BMC Complimentary Alternat Med 2006; 6: 41. <http://dx.doi.org/10.1186/1472-6882-6-41>
26. El Merzabani MM, El Aaser AA, Attia MA, El Duweini AK, Ghazal AM. Screening system for Egyptian plants with potential antitumour activity. Planta Med 1979; 36: 150-55. <http://dx.doi.org/10.1055/s-0028-1097255>
27. Chattopadhyay SP and Das PK. Evaluation of *Vinca rosea* for the treatment of warts. Indian J Dermatol Venerol Leprol 1990; 56(2): 107-08.
28. The Wealth of India. Raw Materials (Revised Edition), Vol. 3, C.S. Ambusta (Editor in Chief), Publication and Information Directorate, CSIR, New Delhi; 1992.
29. Zhang LB, Gou LH and Zeng SV. Preliminary study on the isolation of endophytic fungus of *Catharanthus roseus* and its fermentation to produce product of therapeutic value. Chinese Traditional Herbal Drugs 2000; 11: 805-07.
30. Duflos A, Kruczynski A and Barret JM. Novel aspects of natural and modified vinca alkaloids. Curr Med Chem Anti Cancer Agents 2002; 2: 55-70. <http://dx.doi.org/10.2174/1568011023354452>
31. Gootz TD. Discovery and development of new antimicrobial agents. Clin Microbiol Rev 1991; 2: 176-81.
32. Russell AD. Antibiotic and biocide resistance in bacteria: Introduction. J Appl Microbiol Symp Supply 2002; 2: 176-81.
33. Kaushik P and Dhiman AK. Medicinal Plants and Raw Drugs of India; 2002. p. XII + 623.
34. Farnsworth NR, Svoboda GH and Blomster RN. Antiviral activity of selected *Catharanthus* alkaloids. J Pharmacol Sci 1968; 57: 2174-75. <http://dx.doi.org/10.1002/jps.2600571235>
35. Carew DP and Patterson BD. The effect of antibiotics on the growth of *Catharanthus roseus* tissue cultures. Lloydia 1970; 33: 275-77.
36. Jaleel CA, Manivannan P and Sankar B. Induction of drought stress tolerance by ketoconazole in *Catharanthus roseus* is mediated by enhanced antioxidant potentials and secondary metabolite accumulation. Colloids and surf. B, Biointerfaces 2007; 60: 20-206. <http://dx.doi.org/10.1016/j.colsurfb.2007.06.010>
37. Misawa M. Production of natural substances by plant cell cultures described in Japanese patents. Plant Tissue Culture its Bio-Technol Appl Int Cong; 1976. p. 17-26.
38. Ross SA, Megalla SE, Bishay DW and Awad AH. Studies for determining antibiotic substances in some Egyptian Plants. Part I. Screening for antimicrobial activity. Fitoterapia 1980; 51: 303-08.
39. Rajas MCN and Cuellar MCA. Comparative microbiological studies of the alkaloids of *Catharanthus roseus* and other related compounds. Rev Cubana Farm 1988; 15(2): 131-38.
40. Chile SK, Saraf M, Barde AK. Efficacy of *Vinca rosea* extract against human pathogenic strains of *Trichophyton rubrum* Sab. Indian Drugs Pharm Ind 1981; 16(1): 31-33.
41. Rai MK, Upadhyay S. Screening of medicinal plants of Chhindwara district against *Trichophyton mentagrophytes*: A casual organism of Tinea pedis. Hindustan Antibiot Bull. 1988; 30(1/2): 33-36.
42. Kubas J. Investigation on known or potential anti tumour plants by means of microbiological test. Part III. Biological activity of some cultivated plant species in *Neurospora crassa* test. Acta Biol Cracov Ser Bot 1972; 15: 87-100.
43. Khalil A. Antimicrobial Activity of Ethanol Leaf Extracts of *Catharanthus Roseus* from Saudi Arabia 2012; 48: 6-11.
44. Govindasamy C and Srinivasan R. *In vitro* antibacterial activity and phytochemical analysis of *Catharanthus roseus* (Linn.) G. Don. Asian Pacific J Tropical Biomed 2012; S155-S158.
45. Kumari K and Gupta S. Phytopotential of *Catharanthus Roseus* L. (G.) Don. Var. Rosea and Alba against Various Pathogenic Microbes *In Vitro* 2013; 3(3): 77-82.
46. Zaini HM and Halimoon N. Stems Extract of *Kemuning cina* (*Catharanthus roseus*) as Bio fungicides against White Root Fungal (*Rigidoporus microporus*) of Rubber Trees (*Hevea brasiliensis*). J Biofertil Biopestic 2013; 4(2): 1-4.
47. El Merzabani MM, El Aaser AA, El Duweini AK, El Masry AM. A Bioassay of anti mitotic alkaloids of *Catharanthus roseus*. Planta Med 1979; 36: 87-90. <http://dx.doi.org/10.1055/s-0028-1097246>
48. Sharma OP, Makkar HPS and Dawra RK. Biochemical effects of the plant *Lantana camara* in guinea pig liver mitochondria. Toxicol 1982; 20: 783-86. [http://dx.doi.org/10.1016/0041-0101\(82\)90125-8](http://dx.doi.org/10.1016/0041-0101(82)90125-8)
49. Ahmed ES, Twaty NH, Fakiha KG and Bibars MA. Mutagenic and anti mutagenic effects of some plant extracts in *Drosophilla melanogaster*. Nature and Sci 2010; 8(4): 77-82.
50. Verma AK, Singh RR and Singh S. Cytogenetic effect of EMS on root meristem cells of *Catharanthus roseus* (L.) G. Don var. Nirmal. International Journal of pharma and bio sciences 2012; 2(1): 20-24.
51. Ghimire BK, Seong ES, Kim EM, Ghimeray AK, Yu CY, Ghimireand BK et al. A comparative evaluation of the antioxidant activity of some medicinal plants popularly used in Nepal. J Med Plants Res 2011; 51: 884-91.
52. Salah N, Miller NJ, Paganga G, Tijburg L, Bolwell GP and Rice Evans C. Poly phenolic flavanols as scavengers of aqueous phase radicals and as chain-breaking antioxidants. Arch Biochem Biophys 1995; 322: 339-46. <http://dx.doi.org/10.1006/abbi.1995.1473>

53. Mustafa RN and Verpoorte R. Phenolic compounds in *Catharanthus roseus*. *Phytochem Rev* 2007; 6: 3243-58. <http://dx.doi.org/10.1007/s11101-006-9039-8>
54. Ferreres F, Pereira DM, Valentão P, Andrade PB, Seabra RM and Sotomayor M. New phenolic compounds and antioxidant potential of *Catharanthus roseus*. *J Agric Food Chem* 2008; 56: 9967-74. <http://dx.doi.org/10.1021/jf8022723>
55. Ferreres F, Figueiredo R, Bettencourt S, Carqueijeiro I, Oliveira J, Gil Izquierdo A, et al. Identification of phenolic compounds in isolated vacuoles of the medicinal plant *Catharanthus roseus* and their interaction with vacuolar class III peroxidase: an H₂O₂ affair? *J Exp Botany* 2011; 62: 2841-54. <http://dx.doi.org/10.1093/jxb/erq458>
56. Strube M, Dragstedt LO and Larsen JC. Naturally Occurring Anti tumour gens. *Plant Phenols. The Nordic Council of Ministers, Copenhagen; 1993. p. 39-40.*
57. Kahkonen MP, Hopia AI, Vuorela HJ, Rauha JP, Pihlaja K and Kujala TS. Antioxidant activity of plant extracts containing phenolic compounds. *J Food Chem* 1999; 47: 3954-62. <http://dx.doi.org/10.1021/jf990146l>
58. Balasundram N, Sundram K and Sammar S. Phenolic compounds in plants and agri industrial by-products: Antioxidant activity, Occurrence, and potential uses. *J Food Chem* 2006; 68: 191-203. <http://dx.doi.org/10.1016/j.foodchem.2005.07.042>
59. Zheng W and Wang SY. Antioxidant activity and phenolic compounds in selected herbs. *J Agric Food Chem* 2001; 49: 5165-70. <http://dx.doi.org/10.1021/jf010697n>
60. Rasool N, Rizwan K, Zubair M, Naveed KR, Imran I and Ahmed VU. Antioxidant potential of different extracts and fractions of *Catharanthus roseus* shoots. *Internat J Phytomed* 2011; 3: 108-14.
61. Kumar A, Singhal KC, Sharma RA, Vyas GK and Kumar V. Analysis of Antioxidant Activity of *Catharanthus Roseus* L. and it's Association with Habitat Temperature. *Asian J Exp Biol Sci* 2012; 3(4): 706-13.
62. Letchuman GR, Wan Nazaimoon WM, Wan Mohamad WB, Chandran LR, Tee GH, Jamaiyah H, et al. Prevalence of diabetes in the Malaysian national health morbidity survey III 2006. *Med J Malays* 2010; 65: 173-79.
63. Kevin LYW, Hussin AH, Zhari I, and Chin JH. Sub-acute oral toxicity study of methanol leaves extract of *Catharanthus roseus* in rats. *J Acute Dis* 2012; 1: 38-41. [http://dx.doi.org/10.1016/S2221-6189\(13\)60009-8](http://dx.doi.org/10.1016/S2221-6189(13)60009-8)
64. Nammi S, Boini MK, Lodagala SD and Behara RB. The juice of fresh leaves of *Catharanthus roseus* Linn. reduces blood glucose in normal and alloxan diabetic rabbits. *BMC Complement Altern Med* 2003; 3: e2. <http://dx.doi.org/10.1186/1472-6882-3-2>
65. Ohadoma SC and Michael HU. Effects of co-administration of methanol leaf extract of *Catharanthus roseus* on the hypoglycemic activity of metformin and glibenclamide in rats. *Asian Pac J Trop Med* 2011; 4: 475:77.
66. Gacche RN and Dhole NA. Profile of aldose reductase inhibition, anti-cataract and free radical scavenging activity of selected medicinal plants: An attempt to standardize the botanicals for amelioration of diabetes complications. *Food Chem Toxicol* 2011; 49: 1806-13. <http://dx.doi.org/10.1016/j.fct.2011.04.032>
67. Ganga RM, Satyanarayana S and Esvar KK. Safety of Gliclazide with the aqueous extract of *Vinca rosea* on pharmacodynamic activity in normal and alloxan induced diabetic rats. *J Pharm Res* 2012; 5: 1555-58.
68. Chattopadhyay RR. A comparative evaluation of some blood sugar lowering agents of plant origin. *J Ethnopharmacol* 1999; 67: 367-72. [http://dx.doi.org/10.1016/S0378-8741\(99\)00095-1](http://dx.doi.org/10.1016/S0378-8741(99)00095-1)
69. Singh SF, Vats P, Suri S, Shyam R, Kumria MM, Ranganathan S, et al. Effect of an antidiabetic extract of *Catharanthus roseus* on enzymic activities in streptozotocin induced diabetic rats. *J Ethnopharmacol* 2001; 76: 269-77. [http://dx.doi.org/10.1016/S0378-8741\(01\)00254-9](http://dx.doi.org/10.1016/S0378-8741(01)00254-9)
70. Tiong SH, Looi CY, Hazni H, Arya A, Paydar M, Wong WF, et al. Antidiabetic and Antioxidant Properties of Alkaloids from *Catharanthus roseus* (L.) G. Don. *Molecules* 2013; 18: 9770-84. <http://dx.doi.org/10.3390/molecules18089770>
71. Aparajita J, Chauhan UK, Singh AK, Kumar D and Praveen N. Pharmacological evaluation for the presence of protein in the leaves of *Catharanthus roseus*. *Pharma Sci Monitor* 2014; 5(2): 50-52.

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