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PHYTOCHEMICALS AND PHARMACOLOGICAL STUDIES OF CATHARANTHUS ROSEUS LINN- A COMPREHENSIVE REVIEW

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ABSTRACT

Medicinal plants are used in the traditional medicine of India from many years. Globally, medicinal plants are used in Ayurveda. Catharanthus roseus is well known plant of Ayurveda. Catharanthus roseus has various pharmacological properties such as antidiabetic, anticancer, antiulcer, antioxidant, antimicrobial etc. It has various alkaloids, saponin, flavonoids, carbohydrates and phytochemicals like vincristine, raubasin, vinblastine, vincolinine, vinacardine, leurocristine, catharanthamine etc. Herbal products have less side effects and cost effective. Vinblastine and vincristine are well known for their anticancer activity. The objective of this review is to explore the all information such as phytochemical, pharmacological activities etc. of Catharanthus roseus.

KEYWORDS: Catharanthus roseus, phytochemicals, anticancer activity, vincristine, vinblastine.

INTRODUCTION

Catharanthus roseus is an ornamental and important medicinal plant which is using in traditional medicine for a long time. Commonly it is called as cape periwinkle, Madagascar periwinkle, old maid, graveyard plant, rose periwinkle, pink periwinkle. It belongs to family Apocynaceae. It is native to Southern Asia and Madagascar.[1] Catharanthus roseus is also found in India and grows in Southern and Northern hills of India. Locally it is known as Kemuunting Cina in Malaysia. It is used by National Cancer Council of Malaysia for the cancer patients. Every part of this plant are very useful. The flowers are very colourful and useful of this plant. It is also known as “Sadabahar”. There are many pharmacological activities such as antidiabetic, antibacterial, anticancer, antioxidant etc. are reported. It

contains many alkaloids which very essential for pharmacological response. Vinblastine and Vincristine are well known constituent of this plant. And these constituents are used in the treatment of cancer.[2]

Scientific classification[3]

Kingdom : Plantae
Division : Magnoliophyta (flowering plants)
Class : Magnoliopsida (Dicotyledons)
Order : Gentianales
Family : Apocynaceae
Genus : Catharanthus
Species : Roseus

Vernacular names[3]

Hindi : sada bhahar
Malayamalam : banappuvu, nityakalyani, savanari, usamalari
Tamil : cutkattu malli, cutukattuppu
English : periwinkle, cayenne jasmine, old maid
Kannada : bili kaasi kanigalu, kempu kaasi kanigalu, ganeshana hoo, batla hoo
Bengali : noyontara
Gujarati : baramasi
Telugu : billaganneru

Fig. 1: Catharanthus roseus (copied from google).

Botanical description

Catharanthus roseus is an ornamental and evergreen plant. It is 1 meter or 39-inch-tall, 3.5 in width, hairless, pale midrib and glossy green. It has a short petiole 1.2-1.8 cm tall and arranged in opposite pairs. The colour of flowers are white to dark pink and it has a darker red centre. Fruits are pairs of follicles which are 2-4 cm tall and 0.3 cm in width.

Flowers: It is an elegant, pink or white, centre of this flower may be red, pale yellow, white or purple colour. Follicle is 1.2-3.8 x 0.2-0.3 cm which is wide open on the axial side.

Seeds: 0.1-0.2 cm are grooved and numerous on one side.

Leaves: Leaves are oval and it is 1-2-inch-long, petiole, decussate; elliptic, lamina variable, narrowly obviate; apex mucronate.

Light: Bright colour, it included 3 or 4 hrs of direct sunlight daily which is very significant for better flowering.

Temperature: Normal room temperature is suitable at all times. Temperature is below 10^0C.

Feeding: As the beginning of flowers and apply standard liquid fertilizer each two weeks.

Geological distribution

It arises from the Indian Ocean Island of Madagascar. World widely, it grows various tropical and subtropical regions like India, Pakistan, Bangladesh, Australia and Malaysia. Currently it is a common plant.[1]

Microscopical characteristics

Leaves are dorsoventrally. Cells of lower epidermis are sinuous walled and cells of upper epidermis are marginally sinuous or curved. Stomata is present on lower surface and it is ranunculaceous type. Trichromes are unicellular of sepate. And it is unbranched, uniseriate and nonglandular. Epidermal cells of petiole (Transverse section) of Catharanthus roseus are clearly visible in microscope. Every cells have different shapes and sizes; it may be elliptical or oval. Thin walled parenchymatous cells are present in hypodermis and it is followed by cortex. Prolonged palisade cells are present in upper epidermis and it is permeated with chloroplasts. And the other epidermis (lower epidermis) are almost same as the upper epidermis. Porous arenchymatous palisade cells are present in between the lower epidermis

and palisade cells. The shape of cells may be oblong, oval, polygonal or elliptical which are permeated with cell contents.[4]

Macroscopical characteristics

The leaves of this plant are the simple, opposite and petiole; soft pubescent; long petioles. It has the oblong or obovate; lamina elliptic, slightly decurrent, base is sub cuneate or cuneate, entire margin and it may be hairy or not. Lower surface is pubescent and upper surface is puberulus, light green in colour and arcuate.[4]

Chemical constituents

Catharanthus roseus contains alkaloids, saponins, carbohydrates, flavonoids etc. Every parts of this plant like roots, bark, leaves, flowers etc contain the essential chemical constituents. Catharanthus roseus contains many essential phytoconstituents such as vinblastine, vincristine, leurosine, ajmalicine, raubasin, reserpine, vincoline, rosicine, leurosidine, vincolinine, vinacardine, leurocristine, vindoliscine, pleurosin, catharanthamine, deoxyvinblastine, vincardine, tabersonine, roseadine etc. These are the chemical constituents which have the various significant pharmacological activities like vincristine and vinblastine are well known for the anticancer activity. And it has other essential pharmacological activities such as antidiabetic, anthelmintic, antimicrobial, antioxidant, anti-alzheimer's, wound healing activities etc. Researchers are working on this plant and investigating the chemical constituents & their activities. The phytochemicals of this plant are used as the flavours, food additives, agrochemicals, pesticides and pharmaceuticals.[4,5,6]

Pharmacological activities

Catharanthus roseus has many pharmacological activities such as antidiabetic, anticancer, antimicrobial, anthelmintic, antioxidant, wound healing, hypolipidemic, alzheimer's etc. which are reported by researchers.

Anticancer activity

Vincristine and vinblastine are the alkaloids derived from the leaf and stem of Catharanthus roseus. It has the significant inhibition in the human tumours. In children, vincristine is used for the treatment of leukaemia. Vinblastine is well known for the treatment of carcinoma and Hodgkin's disease. It is reported that the methanol extract of this plant showed the significant anticancer activity at different concentrations. Clinically, it is administered through intravenously route. It is metabolized and excreted through liver. Vinca alkaloids are also

known as spindle poisons. It prevents aggregation of spindle forms from microtubule which reduces the mitosis phase in cell cycle process. Significant anticancer activities were showed by vinca alkaloids and every vinca alkaloids are well known for their various amazing properties.[7,8,9]

Antidiabetic activity

A study was reported that the ethanolic extracts of both flowers and leaves showed the significant effect in lowering the level of blood sugar. And it also showed the hypoglycaemic effect. Aqueous extract of this plant also decreased the blood sugar level in rats. Enzymes activities of malate dehydrogenase, glucose-6-phosphatedehydrogenase, glycogen synthase and succinate dehydrogenase were also decreased significantly in diabetic rats at the dose of 500mg/kg/p.o. Results concluded that the levels of lipid peroxidation elevated. Another study is also reported that the aqueous extract of leaves of Catharanthus roseus and it showed the significant inhibition in VLDL, LDL, TG and TC in alloxan induced diabetic rats.[12,13,14,15]

Anti-microbial activity

Various extract of different parts of Catharanthus roseus have been performed for anti-bacterial activity. But extract of leaves has the better efficacy than others. Leaf extract of this plant was analysed against some microorganisms such as Salmonella typhimurium NCIM2501, Staphylococcus aureus NCIM2501 and Pseudomonas aeruginosa NCIM2036 for antimicrobial activity and it showed the significant effect.[16]

In another study, roots extract was also examined for the antibacterial with different chemicals but the chloroform extract showed the better antibacterial activity against some microbial culture such as MTCC 441 (Bacillus subtilis), MTCC 1538 (Micrococcus luteus), MTCC 1457 (Clostrdium perfringens), MTCC 441 (Proteus vulgaris), MTCC 443 (E. coli), MTCC 450 (Schigella flexneri), MTCC 109 (Klebsiella pneumoniae) and MTCC 96 (Staphylococcus aureus). Results concluded that Chloroform extract have the most potential than other extract and it showed the good inhibition of microbial growth.[17]

Antioxidant activity

The antioxidant activity of ethanolic extract of roots of two different varieties of this plant namely alba (white flower) and rosea (pink flower) were investigated on various system assay like superoxide radical-scavenging activity, DPPH-radical-scavenging activity, hydroxyl radical-scavenging activity & nitrous oxide radical inhibition method. Result

explored that the rosea (pink flower) showed the more significant potential than alba (white flower). Another study was revealed the antioxidant activity of this plant was investigated at different concentrations such as 200, 400. 600, 800 & 1000 µg. 800 µg showed the better antioxidant activity than other concentrations in these five concentrations.[10,11]

Wound healing activity

Ethanolic extract of Catharanthus roseus was examined with the dose of 100 mg/kg/day in rats. And result showed the significant increase in dry weight, hydroxyproline content of granulation tissues and it also reduced the epithelization period significantly when it was compared with control groups. So result concluded that the ethanol extract has the potential of wound healing property.[18]

Hypolipidemic activity

The leaf juice of Catharanthus roseus showed the significant anti atherosclerotic and observed the inhibition in the serum levels of triglycerides, cholesterol, VLDLc & LDL-c and histopathology of kidney, aorta and liver. Result proved that the leaf juice of Catharanthus roseus has the potential of hypolipidemic and also inhibit the biomarkers of it.[19]

Anthelminthic activity

Helminths causes the persistent illness and it affects the human beings as well as cattle also. This plant is used from traditional period for its anthelminthic activity. This activity of Catharanthus roseus was evaluated by using Pheretima posthuma model and in this study piperazine citrate was used as the standard reference. There were many concentrations of ethanolic extract of Catharanthus roseus were used and the dose of 250 mg/ml showed the better anthelminthic activity than others.[20]

Anti-ulcer activity

There are some alkaloids such as vindoline & vincamine have the antiulcer property. Vincamine is found in the leaves of Catharanthus roseus and it shows the neuroprotective and cerebrovasodilatory activity. The leaves of Catharanthus roseus showed the significant antiulcer activity against empirically induced gastric destruction in rats.[21]

Anti-Alzhiemer's activity

Vinpocetine showed the significant action in Alzheimer's disease. It is reported that vinpocetine has the potential to improve memory and brain functions. When this was

examined clinically at the dose of 60mg/d for dementia and stroke showed no significant adverse events.[22]

Antidiarrheal activity

The ethanolic extract of leaves of Catharanthus roseus was investigated for antidiarrheal activity against the castor oil induced method in rats. In this study, atropine sulphate and loperamide were used as reference drug. The ethanolic extract of leaves of this plant showed the inhibition which was induced by castor oil and the doses were 200 & 500 mg/kg. It showed the significant antidiarrheal activity and as well as it also prevented the GIT propulsion of charcoal meal.[23]

Hypotensive activity

The extract of leaves of Catharanthus roseus proved the potential of hypotensive. Leaves of this plant contain very useful phytochemical constituents which are important for various pharmacological responses. Leaf extract (dichloromethane- methanol or hydro alcoholic) of Catharanthus roseus showed the hypotensive and antihyperglyacaemic activity in experimental animals.[24]

CONCLUSION

There are many medicinal plants which are used in traditional medicine. Medicinal plants are the source of many important phytochemical and pharmaceutical products which have the various significant pharmacological properties. The medicines are very costly and also have the side effects which are available in the market. Medicinal plants have lesser side effects and these are also cost effective. Researchers revealed that medicinal plants have the various chemical constituents which show the significant pharmacological activities. Many organizations and researchers are continuously working on medicinal plants. Catharnathus roseus contains many active chemical constituents such as vincristine and vinblastine are well known for their anticancer activity. Every parts of this plant such as bark, roots, leaves and flowers contain saponins, alkaloids, carbohydrates, flavonoids etc. And it also contains various phytochemicals like ajmalcine, reserpine, raubasin, vinceine, leurocristine, vindoliscine, pleurosin, catharanthamine etc. which are responsible for various pharmacological activities such as antimicrobial, antiulcer, antioxidant, hypolipidemic, antidiabetic etc. Results proved that the Catharanthus roseus has significant potential of many pharmacological activities. The main objective of this review is to reveal the information of Catharanthus roseus and all about of it. Here, all information like chemical constituents and

pharmacological properties of Catharanthus roseus are well described and it may be very useful for further research on this plant.

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