A DETAIL REVIEW: ON VINCA PLANT(CATHARANTHUS ROSEUS)

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ABSTRACT
Ayurveda, the traditional Indian system of medicine, places a strong emphasis on the therapeutic potential of plants. One such plant recognized in Ayurveda is Catharanthus roseus. This plant is renowned for its anti-tumor, anti-diabetic, antimicrobial, antioxidant, and antimutagenic effects. It is an evergreen plant that originated from the islands of Madagascar. The flowers can vary in color from pink to purple, and the leaves are arranged in opposite pairs. Catharanthus roseus produces approximately 130 alkaloids, including ajmalicine, vincine, resperine, vincristine, vinblastine, and raubasin. Vincristine and vinblastine are utilized in the treatment of various types of cancer, such as Hodgkin's disease, breast cancer, skin cancer, and lymphoblastic leukemia. However, Catharanthus roseus is an endangered species and requires conservation efforts, including techniques like micropropagation. This plant possesses significant medicinal properties that warrant extensive exploration and study. Its potential as a source of therapeutic compounds for various ailments highlights the importance of preserving and further investigating Catharanthus roseus.

Keywords: Alkaloids, Vinblastine, Vincristine, Lymphoblastic Leukemia.

I. INTRODUCTION
Catharanthus roseus, known by various names including bright eyes, Cape periwinkle, graveyard plant, Madagascar periwinkle, old maid, pink periwinkle, and rose periwinkle, is a flowering plant in the Apocynaceae family. It is native to Madagascar but cultivated elsewhere as both an ornamental and medicinal plant. Notably, it serves as a source of two important cancer-fighting drugs, vincristine and vinblastine. Medicinal plants have a rich history of use in traditional medicine, and studying the ethno-botanical information regarding their usage by indigenous cultures is valuable for the preservation of traditional knowledge, healthcare, and drug development. Catharanthus roseus, a dicotyledonous angiosperm belonging to the Apocynaceae family, is a significant medicinal plant. It synthesizes two terpene indole alkaloids, namely vinblastine and vincristine, which are widely used in cancer treatment.

II. POTENTIALLY ACTIVE CHEMICAL CONSTITUENTS
Catharanthus roseus contains a group of alkaloids that, despite their high toxicity, have potential applications in cancer treatment. Plants have the ability to synthesize a wide range of chemical compounds that serve important biological functions and provide defense against predators such as insects, parasites, and herbivorous mammals. Some of the chemical constituents found in C. roseus include starch, flavonoids, saponins, and alkaloids. Alkaloids are particularly noteworthy as the potentially active chemical constituents of Catharanthus roseus. Over 400 alkaloids have been identified in the plant, showcasing their wide-ranging applications across various industries. These alkaloids find application in diverse fields such as pharmaceuticals, agrochemicals, flavor and fragrance ingredients, food additives, and pesticides. Their versatility and potential make them valuable components in the development of numerous products and solutions. Alkaloids such as actineo plastidemeric, Vinblastine, Vincristine, Vindesine, Vindeline, and Tabersonine are primarily present in the aerial parts of the plant, while ajmalicine, vincine, vincamine, raubasin, resperine, catharanthine, and others are found in the roots and basal stem. Additionally, Rosindin, an anthocyanin pigment, is present in the flowers of C.
III. BOTANICAL DETAILS

The plant has an erect or accumbent growth habit and can be up to 1 meter tall. The stems are green in color and may be tinged with purple or red. The leaves are oval-shaped, decussate (opposite in arrangement), and have petioles. The leaf size ranges from 1 to 2 inches in length, and the leaf shape can vary from elliptic to obovate or narrowly oblative. The leaf apex is usually mucronate, meaning it has a small, pointed tip.

The flowers of Catharanthus roseus are 4-5 cm in size and can be white or pink. They often have a center that can be purple, red, pale yellow, or white. The plant produces follicles, which are elongated fruit structures measuring 1.2-3.8 cm in length and 0.2-0.3 cm in width. The seeds are numerous, about 1-2 mm in size, and have a grooved surface on one side.

Catharanthus roseus can flower throughout the year in equatorial conditions, while in warm temperate climates, flowering occurs from spring to late autumn. It prefers full sun and well-drained soil. Bright light, including a few hours of direct sunlight each day, is necessary for optimal flowering. The plant can tolerate normal room temperatures but cannot withstand temperatures below 10°C (50°F).

Regarding watering, the potting mixture should be watered generously, but it is important to avoid waterlogging the pot. Regular watering is needed during the growing season, but once the plant is established, it is relatively drought-resistant. Overhead watering should be avoided. Feeding the plant with a standard liquid fertilizer every two weeks during the flowering period is recommended, but excessive fertilization should be avoided as it can lead to abundant foliage growth instead of increased blooms.
A) Anti-cancer Activity
Catharanthus roseus (C. roseus), commonly known as the Madagascar periwinkle, exhibits significant anticancer activity. It is administered intravenously and subsequently processed by the liver before being eliminated from the body. However, this medication can cause side effects such as hair loss, peripheral neuropathy, constipation, and hyponatremia. To enhance its therapeutic efficacy, semi-synthetic Catharanthus alkaloids like vinorelbine and vinflunine have been developed. These compounds exert their antitumor effects by binding to tubulin. Vinorelbine and vinflunine have shown growth inhibition effects on certain types of human tumors. Vinblastine, another Vinca alkaloid derived from C. roseus, is used experimentally to treat neoplasms and is recommended for Hodgkin’s disease and choriocarcinoma. C. roseus has demonstrated significant anticancer activity against various types of cancer cells in vitro, particularly showing strong activity against multidrug-resistant tumor types. Vinca alkaloids, also known as mitotic spindle poisons, inhibit the assembly of spindle structures from microtubules, thereby blocking mitosis in the cell cycle. By disrupting the formation of a functional mitotic spindle, Vinca alkaloids effectively prevent cancer cells from dividing. Different Vinca alkaloids possess their own unique properties. They specifically bind to β-tubulin and inhibit its polymerization with α-tubulin, leading to the disruption of microtubule formation. Without a functional mitotic spindle, replicated chromosomes cannot align properly on the division plate, resulting in cell division arrest at metaphase. Cells arrested in mitosis undergo changes characteristic of apoptosis. Vinca alkaloids are also used in the treatment of leukemias, lymphomas, and testicular cancer. It is important to note that the provided information is based on the knowledge available up until September 2021. Newer developments in pharmacology may have occurred since then.

B) The antioxidant properties
The antioxidant properties of Catharanthus roseus (C. roseus) have been investigated, along with the production of the indole alkaloid ajmalicine. The study focused on the effects of gibberellic acid (GA(3)) treatment on these parameters. Two methods of GA(3) application were employed: foliar spray and soil drenching. The treatments were administered at specific time points, namely 30, 45, 60, and 75 days after planting (DAP). The study aimed to determine how GA(3) treatments, applied through foliar spray and soil drenching, influenced the antioxidant capacity of C. roseus. Additionally, the production of ajmalicine, a bioactive compound with potential medicinal properties, was investigated. The specific effects of the treatments on these parameters would be determined through the analysis of the different plant parts (roots, stems, and leaves).

C) The anti-diabetic and antimicrobial activities
The anti-diabetic and antimicrobial activities of Catharanthus roseus (C. roseus) have been investigated in different studies. Regarding the anti-diabetic activity, it was observed that control rats fed with the experimental leaves did not show any hypoglycemic effect. However, significant changes in body weight were not found, indicating that C. roseus has anti-diabetic activity. The experiment involved inducing diabetes in male Wistar rats by intraperitoneal injection of streptozotocin (STZ) at a dose of 55 mg/kg body weight. The effects of C. roseus on glucose levels and plasma lipid levels were evaluated. The specific outcomes or measurements of these parameters in response to C. roseus treatment are not mentioned.

D) Antimicrobial activity
In terms of antimicrobial activity, the study evaluated the effects of Vinca rosea (synonymous with C. roseus) against pathogenic bacterial strains, including Bacillus subtilis, B. The antimicrobial activity of various strains, including bacterial strains like Bacillus licheniforms, Azotobacter sp., and fungal strains such as Aspergillus niger, Alternaria solani, and Rhizopus oryzae, was evaluated using the agar well diffusion method. This method involves measuring the antimicrobial efficacy of test substances by creating wells in an agar medium inoculated with target microorganisms. The presence of inhibitory zones around the wells indicates the antimicrobial activity of the tested strains. By employing this technique, researchers were able to assess and compare the antimicrobial potential of these strains against specific pathogens or microorganisms of interest.
Methanolic extracts from various sources of C. roseus, such as in vivo leaves, in vitro leaves, in vitro calluses of leaves, nodal explants, and fruit explants, were tested. The antimicrobial activity was determined by measuring the minimum inhibitory concentration (MIC). However, specific results or findings regarding the MIC values or the extent of antimicrobial activity are not provided. It is important to note that the information provided is a summary of the studies and lacks specific details or quantitative results.

**E) The anti-diarrheal activity**

The anti-diarrheal activity of C. roseus ethanolic leaf extract was evaluated in Wistar rats in an in vivo study. Experimental diarrhea was induced in the rats using castor oil. Prior to inducing diarrhea, the rats were pretreated with the leaf extract at doses of 200 mg/kg and 500 mg/kg to assess its anti-diarrheal effect. As a reference, loperamide and atropine sulfate, which are known standard drugs for treating diarrhea, were used in the two experiments.

**F) Anti-Ulcer Activity**

Vincamine and Vindoline alkaloids found in Catharanthus roseus have demonstrated anti-ulcer properties. The combination of cerebrovasodilatory and neuroprotective activities makes vincamine a promising compound for potential therapeutic applications in the field of neurology and cognitive health. Its mechanisms of action and effects on brain function continue to be investigated for a better understanding of its potential benefits. In an experiment using rats, the plant leaves were tested for their anti-ulcer activity against induced gastric damage, and positive results were observed.

**G) Anti-Helminthic Activity**

Catharanthus roseus has also been traditionally used as an anthelminthic agent. To verify its ethnomedical claims, the anthelminthic property of Catharanthus roseus was evaluated using Pherithema posthuma, an experimental model for testing anthelminthic activity.

**H) Hypotensive property**

To investigate the hypotensive property of Catharanthus roseus leaf extract, an intraperitoneal (i.p) route was chosen for administering the extract to rats. The study involved a one-week treatment period where rats were injected with Catharanthus roseus leaf extract each morning. The dosage administered was 30 mg per rat weighing approximately 155+/−15 grams. In parallel, a commercial drug called Atenolol, known for its hypotensive effects, was also administered to another group of rats using the same i.p route. The dosage of Atenolol was determined based on its pharmacokinetic parameters, ensuring a suitable and comparable dose for the study. Throughout the treatment period, various biochemical parameters were monitored and measured to assess the effects of the Catharanthus roseus leaf extract and Atenolol. These parameters included heart weight, blood glucose level, serum cholesterol level, serum triglyceride level, body weight, and their interrelationships. By analyzing these measurements, researchers aimed to evaluate the impact of the Catharanthus roseus leaf extract on the cardiovascular system and related metabolic factors in comparison to Atenolol. This study design allowed for the assessment of the hypotensive potential of the Catharanthus roseus leaf extract, as well as the comparison of its effects with a known hypotensive drug like Atenolol. The chosen route of administration, dosage, and monitoring of various biochemical parameters aimed to provide insights into the hypotensive properties and potential mechanisms of action of the Catharanthus roseus leaf extract in a controlled experimental setting.

**I) Hypolipidemic property**

The administration of C. roseus has demonstrated hypolipidemic properties in diabetic rats. In diabetic rats, there were significant increases observed in plasma total cholesterol, triglycerides, LDL (low-density lipoprotein) cholesterol, VLDL (very low-density lipoprotein) cholesterol, as well as the atherogenic index. These changes in lipid parameters indicate a dysregulation in lipid metabolism and an increased risk of atherosclerosis. However, when the diabetic rats were treated with C. roseus, these abnormal lipid parameters were effectively normalized. The hypolipidemic effects of C. roseus led to a reduction in plasma total cholesterol, triglycerides, LDL cholesterol, VLDL cholesterol, and improvement in the atherogenic index. These findings suggest that C. roseus has the potential to alleviate dyslipidemia in diabetic conditions. Furthermore, the diabetic control rats exhibited decreased hepatic and muscle glycogen content, indicating impaired glycogen metabolism.
storage. Additionally, alterations were observed in the activities of enzymes involved in glucose metabolism, including glycogen phosphorylase, hexokinase, phosphofructokinase, pyruvate kinase, and glucose-6-phosphate dehydrogenase. These changes reflect disruptions in glucose utilization and glycogen synthesis pathways in diabetic rats. However, treatment with C. roseus helped restore glycogen content and normalize the activities of these key enzymes involved in glucose metabolism. This indicates the potential of C. roseus to improve glucose homeostasis and glycogen storage in diabetic conditions.

J Wound Healing property
The wound healing activity of the ethanol extract of C. roseus flower was evaluated in rats using three different wound models: excision, incision, and dead space wounds. In the study, rats were administered the ethanol extract at a dose of 100 mg/kg body weight per day. For the excision model, the animals were divided into two groups. Group 1 served as the placebo control and received topical treatment with carboxymethyl cellulose. Group 2 topical application refers to the direct application of a substance onto the skin or mucous membranes, allowing for localized effects. In this case, the ethanol extract of C. compressive was applied externally, potentially allowing the active compounds present in the extract to interact with the skin and underlying tissues. roseus at the specified dose. Further details regarding the results, methodology, and any additional information about the study, such as the duration or specific measurements, are not provided in the given text. If you have any specific questions or require more information, please let me know.

V. CONCLUSION
Medicinal plants have emerged as potent sources of various novel pharmaceutical products, exhibiting significant pharmacological effects on human beings. Instead of relying solely on chemical drugs with potential side effects, exploring ancient medicinal practices allows for the identification of new drug formulations that are not only more effective but also have fewer side effects and lower costs. Although many traditional medicines were historically used without a comprehensive understanding of their mechanisms, present-day technology and tools enable further investigation and validation of their effects. Catharanthus roseus, one of the 21,000 important medicinal plants, has been traditionally utilized for treating various ailments such as diabetes, sore mouth, mouth ulcers, and leukemia. It contains approximately 130 alkaloids, including reserpine, vincine, raubasin, and ajmalicine. Vinblastine and vincristine, derived from Catharanthus roseus, exhibit anti-leukemic activity. Different parts of the plant contain varying amounts of alkaloids, with the root bark being the richest source at around 1.79%. Numerous reports support the antimicrobial activity of Catharanthus roseus against microorganisms like Staphylococcus albusi, Bacillus megatarium, Shigella, and Pseudomonas. Additionally, it has been found to possess antioxidant and antimutagenic effects. Further research is needed to explore its anti-tumor properties and conduct comprehensive studies on its antioxidant and antimutagenic effects. Catharanthus roseus holds significance as an important medicinal herb with diverse biological properties. Ongoing work aims to identify new bioactive compounds, understand the transformation of these compounds, develop new extraction techniques such as green extraction, and improve drying methods like solar drying. These endeavors contribute to expanding our knowledge of Catharanthus roseus and its potential applications in medicine.

VI. REFERENCES