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An updated review on Catharanthus roseus plant: a medicinal plant with antioxidant property

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Abstract : The herbal remedy is the Indian traditional system of medicine that focuses on the medical potentials of plants. Catharanthus roseus is one such plant recognized well in herbal remedies. It is known for its antioxidant, anti-tumor, anti-diabetic, anti-inflammatory and anti-mutagenic effects. The Islands of Madagascar were the first place of origin of this evergreen plant. It is the most important medicinal plant mainly due to its anticancer alkaloids. The flower of Catharanthus roseus may vary in color from pink to purple. The leaves of these plants are arranged in opposite pairs. It contains nearly 130 alkaloids mainly Indoline alkaloids, Indole, ajmalicine, serpentine, lochnericin, Vincamine, resperine, vincristine, and vinblastine. Vincristine and Vinblastine are used for various types of cancer treatment such as breast cancer, skin cancer, and lymphoblastic leukemia. Ajmalicine is used in the treatment of circulatory diseases. It is a perennial species that became endangered and needs to be conserved using techniques like micropropagation. It has lots of medicinal values which need to be explored extensively. Hence, the main idea behind this updated review is to update comprehensively and analyze critically the phytochemistry, antioxidant properties and medicinal value of various parts of *Catharanthus roseus* and its isolated compounds.

***Keywords*:- alkaloids, *Catharanthus roseus*, anti-oxidant, anti-cancer, ethnobotanical,metabolites**

INTRODUCTION

Among all the plant species used in a medical context, Catharanthus roseus is a well-known name. It is a medicinal plant that has a long history of usage in traditional medicine. The interest in this species arises from its therapeutic role, as it is the source of the anticancer alkaloids vincristine and vinblastine, whose complexity renders them impossible to be synthesized in the laboratory; the leaves of this species are still today, the only source (Costa et al., 2008). Collections of ethnobotanical information on medicinal plants and their uses by different cultures and techniques are useful in the conservation of traditional cultures, communities and medicine development. *Catharanthus roseus L.* is an important medicinal plant belonging to the Apocynaceae family which is used to treat many fatal diseases and contains many useful alkaloids. It synthesizes two terpene indole alkaloids:" Vinblastine" and "Vincristine" that are used to fight cancer (Ajaib M, et al., 2010). It is also used to treat diabetes, blood pressure, asthma, constipation, and menstrual problems. There are about two common cultivators of Catharanthus roseus which are named on the basis of their flower color that is the pink flowered "Rosea" and the white flower "Alba". Most of the reviews and studies on this species focus on the many alkaloids it possesses, over 130 having been already known and identified (Blasko and Cordell, 1930). Regarding metabolites other than alkaloids, the number of available studies is much lower. According to a report given by Ferreires et al., 2008 new phenolics in different plant parts (leaves, stems, seeds and petals), including flavonoids and phenolic acids were identified. The high antioxidant potential of *C. roseus* was demonstrated using the radicals DPPH, superoxide and nitric oxide. Most recently, Chopra et al., have reported that the total alkaloids possess limited antibacterial activity as well as significant and sustained hypotensive action.

SCIENTIFIC CLASSIFICATION:

Botanical name : *Vinca rosea (Catharanthus roseus)*
Family name : Apocynaceae
Kingdom : Plantae
Division : Magnoliophyta (Flowering plants)
Class : Magnoliopsida (Dicotyledons)
Order : Gentianales
Genus : *Catharanthus*
Species : *roseus*

VERNACULAR NAMES:

English : Cayenne jasmine, old maid, Periwinkle
Hindi : Sada bahar
Sanskrit : Sadampuspa, Sadapushpi, rasna

Fig 1: Pink flowered "Rosea"

Fig 2 : White flower "Alba"

MORPHOLOGY

Catharanthus roseus is an evergreen subshrub herbaceous plant growing 1 m tall. The leaves are oval to oblong , 2.5-9 cm long and 1-3.5 cm wide, glossy green, hairless with a pale midrib and a short petiole 1-1.8 cm long; they are arranged in opposite pairs. The flowers range from white with a yellow or red center to dark pink with a darker red center, with a basal tube 1.0-1.2 inches long and a corolla 0.8-2.0 inches in diameter with five petal like lobes. The fruit is a pair of follicles 0.8-1.6 inches long and 0.1 inch wide.

GEOGRAPHICAL DISTRIBUTION

Catharanthus roseus is an endangered plant widely cultivated and is naturalized in subtropical and tropical areas of the world. The Islands of Madagascar were the first place of origin of this evergreen plant. The species can be traced back to 2600 BC. As an ornamental plant, it is appreciated for its hardiness in dry and nutritionally deficient conditions, popular in subtropical gardens where temperatures never fall below 5–7 °C (41–45 °F) and as a warm-season bedding plant in temperate gardens. It is also, however, widely cultivated and is naturalized in subtropical and tropical areas of the world such as Australia, Bangladesh, India, Malaysia, Pakistan and the United States. It is so well adapted to growth in Australia that it is listed as a noxious weed in Western Australia and the Australian Capital Territory and also in parts of eastern Queensland.

PHYTOCHEMICAL COMPOSITION

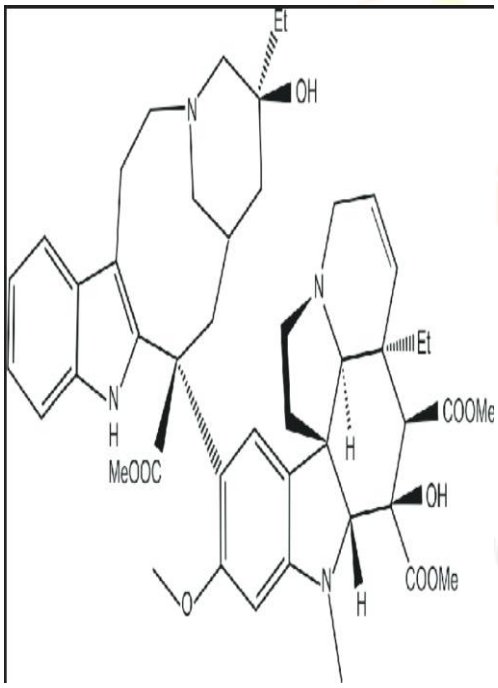

Fig 3:- Structure of vinblastine

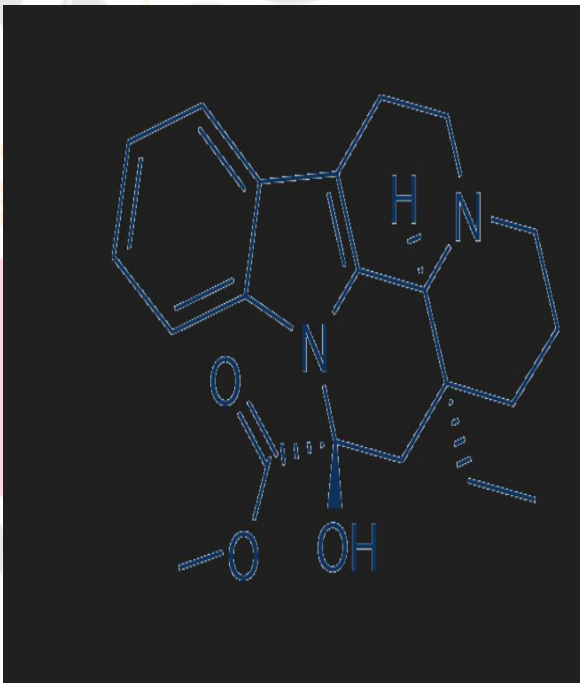

Fig 4 :- Structure of vincamine

Catharanthus roseus is an important medicinal plant distributed in many countries. It has attracted increasing attention due to it being shown to possess a range of phytochemicals with various biological activities such as antioxidant, antibacterial, antifungal, antidiabetic and anticancer properties. Researchers investigating its medicinal properties discovered that it contained a group of alkaloids that though extremely toxic, had potential uses in cancer treatment. Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions and to defend against attack from predators such as insects, fungi and herbivorous mammals. It is one of the most important medicinal plants mainly due to its anticancer alkaloids. It possesses Indole, indoline alkaloids, ajmalicine, lochnerin, serpentine, flavonoid, and saponin. Alkaloids are the most important potentially active chemical constituents of *C. roseus.* Smooth, glossy, and dark green colored leaves along with flowers are said to

act as a natural medicine for type-2 diabetes. More than 400 alkaloids are present in the plant which are used for different purposes like flavor and fragrance, food additives and agrochemicals. Alkaloids like vinblastine, vincristine, vindesine, vindeline, tabersonine, etc are mainly present in aerial parts whereas ajmalicine, vinecine, cathranthine, etc are present in roots and basal stem. Rosinidin is the pink anthocyanidin pigment found in the flowers of *C. roseus* and Lochnericine is a major alkaloid in roots.

ANTI-OXIDANT PROPERTIES

C. roseus has a compatible antioxidant activity. This can be helpful for the treatment of diseases caused by free-radical oxidative stress. According to Asma Nisar et al., 2017; in *Catharanthus roseus* plant parts, the flower petal contains the highest total phenolic content, and the root, stem, and leaves have the lowest total phenolic content. The anti-oxidant potential of the ethanolic extract of the roots of the two varieties of *C. roseus* namely rosea (pink flowers) and alba (white flower) was obtained by using a different system of the assay such as Hydroxyl radical scavenging activity, DPPH radical scavenging activity and nitric oxide radical inhibition method. The results obtained proved that the ethanolic extract of the roots of periwinkle varieties has exhibited a satisfactory scavenging effect in the entire assay in a concentration-dependent manner but *C. roseus* was found to possess more antioxidant activity than *C. alba.*

MEDICINAL VALUE

Catharanthus roseus plant is used in cancer and diabetes; root paste is used in septic wounds; root decoction is used in fever; leaves are used in menorrhagia; leaf juice is used in blood dysentery .It is widely used to manage testicular cancer. Vinblastine and Vincristine chemotherapy medications are used to treat several types of cancer and are biosynthesized from the coupling of the alkaloids catharanthine and vindoline. The newer semi-synthetic chemotherapeutic agent "Vinorelbine" used in the treatment of non-small cell lung cancer, can be prepared either from Vindoline and Catharanthine or from the Vinca alkaloid leurosine. The insulin-stimulating" Vincoline" has been isolated from the plant.

CONCLUSION

Catharanthus roseus can be considered a rich source of alkaloids and phenolics, which possess diverse biological properties including anticancer, antidiabetic, antioxidant, antimicrobial and antihypertensive activities. Numerous alkaloids and phenolics have been identified in this material but many compounds are still unknown. Consequently, the identification and isolation of new phytochemicals within the different structural components of *C. roseus* should be continued. In addition, the potential uses of bioactive compounds derived from these materials need to be further investigated for applications in the pharmaceutical industry.

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