A Study on Potential Phytopharmaceuticals Assets in Catharanthus roseus L. (Alba)

Priyanka Tolambiya and Sujata Mathur
Department of Botany, University of Rajasthan, Jaipur, India
Email: ptolambiya@gmail.com

Abstract— Herbal medicinal plants are boon for human being as treatment of existing and new diseases are being developed either direct or indirect usage of plants. But availability of such plants and their properties also play an important role. Catharanthus roseus is a very important medicinal herb in this direction as availability and its property both are fortunate thing for humankind. This plant is used in treatment of several diseases like diabetes, cancer, high blood pressure, asthma, inflammation, dysentery, brain imbalance, angiogenesis, malaria and other diseases that occur due to potent micro organisms. Though it's a native of Madagascar but it is found most parts of the world. It is also appreciated for its long flowering period throughout the year. Its roots, plant stems and flowers having active constituents to inhibit the growth of disease and other micro organism. Extracts from the dried or wet flowers and leaves of plants are applied as a paste on wounds in some rural communities. The substances vinblastine and vincristine extracted from the plant are used in the treatment of leukemia and Hodgkin's lymphoma. The fresh juice from the flowers of C. roseus is used to treat various skin problems e.g. dermatitis, eczema and acne. Therefore, the main active constituents present in this plant are alkaloids, flavonoids, steroids and phenolic acid. As C. roseus has mammoth potential to heal many syndrome due to its phytopharmaceuticals assets and it’s intact fractions i.e. root, leaf, stem and flower are drug complaint. Still further research is required to find main utility in healing of diseases arises due to deadly viruses.

Index Terms— Medicinal plants, Catharanthus roseus, Alkaloids, Anti-diabetic, Anti-oxidant, Anti-fungal, Anti-bacterial.

I. INTRODUCTION

Catharanthus roseus, commonly known as the Madagascar periwinkle, is a species of apocynaceae family and endemic to Madagascar. Other English names occasionally used include Vinca rosea, Lochnera rosea, Ammocallis rosea, Cape periwinkle, rose periwinkle, rosy periwinkle and "old-maid".

Catharanthus is a genus of flowering plants in the dogbane family, Apocynaceae. Like genus Vinca, they are known commonly as periwinkles. There are eight known species. Out of eight, seven are endemic to Madagascar[1]. Though one, C. roseus, is widely naturalized around the world[2]. The eighth species, C. pusillus is native to India and Sri Lanka. The name catharanthus comes from the Greek for "pure flower" and roseus means red, rose, rosy. It rejoices in sun or rain, or the seaside, in good or indifferent soil and often grows wild. It is known as 'Sadabahar' meaning 'always in bloom' and is used for worship. These are perennial herbs (small shrub) with oppositely decussate or almost oppositely arranged leaves. Flowers are usually solitary in the leaf axils. Each has a calyx with five long, narrow lobes and a corolla with a tubular throat and five lobes. It grows to 20-80 cm high and blooms with pink, purple, or white flowers[3]. There are over 100 cultivars of C. roseus known [4].

The main active constituents in plants are phenolic acids, flavonoids and alkaloids. These active substances perform a number of protective functions in the human organism and are involved in important anti-oxidative, anti-allergic, antibiotic, hypoglycaemic and anti-carcinogen activities [5] [6] [7]. Catharanthus roseus is formerly known as Vinca rosea and main source of vinca alkaloids, now sometimes called catharanthus alkaloids. These are more than 130 alkaloids[8] including about 100 monoterpoid indole alkaloids[9]. Vinblastine and vincreistine are the dimers, formed by the coupling of Monoidole alkaloids such as catharanthine and vindoline[10] mainly present in aerial part of plants used to treat cancer. Vincreistine and vinblastine require both aerial and root parts of a plant to be synthesized [11]. Catharanthus roseus as a source of valuable alkaloids resembling those from Rauwolfia species. Roots of Catharanthus have more ajmalicine (vasodilating) and serpentine (hypertensive) than even Rauwolfia serpentina. They also possess reserpine[12][13]. The alkaloids possess hypotensive, sedative and tranquillisising properties. The root bark contains the alkaloid Alstonine which has been used traditionally for its calming effect and its ability to reduce blood pressure. Yohimbine (Procomil) is an alkaloid with stimulant and aphrodisiac effects found naturally in Pausinystalia yohimbine[14]. C. roseus also shows the presence of this compound along with another flavonoid hirsutidin[15]. Prepare decoction of C. roseus leaves and drink early in the morning for 7 days its beneficial to diabetes patients.

Catharanthus roseus contains significant amounts of volatile and phenolic compounds including caffeoylquinic acids and flavonal glycosides which are known to antioxidant activity. It has an important role in the body defense system that is acts as a antioxidants.
against reactive oxygen species (ROS) [16]. *Catharanthus roseus* also possess good antibacterial, antifungal, antioxidant, anti-diabetic and antiviral potential [13][17][18].

II. TAXONOMY

A. Description

*Catharanthus roseus* is a long-lived (perennial) sub-shrub or herb, usually erect, 30-100 cm high and at least somewhat woody at the base, sometimes sprawling. White latex is present.

Stems are cylindrical (terete), longitudinally ridged or narrowly winged, green or dark red, pubescent at least when young. Leaves opposite, borne on short petioles, 2.5-9.0 cm long, usually elliptical to obovate (egg-shaped in outline but with the narrower end at the base), green with paler veins. The leaf tip is rounded to acute with a tiny point extending from the midrib. Stems and leaves usually with hairs (pubescent), sometimes hairless.

B. Classification

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phylum</td>
<td>Magnoliopsida</td>
</tr>
<tr>
<td>Class</td>
<td>Annonidae</td>
</tr>
<tr>
<td>Order</td>
<td>Gentianales</td>
</tr>
<tr>
<td>Family</td>
<td>Apocynaceae</td>
</tr>
<tr>
<td>Genus</td>
<td>Catharanthus</td>
</tr>
<tr>
<td>Species</td>
<td><em>roseus</em></td>
</tr>
</tbody>
</table>

| Botanical Name | *Catharanthus roseus* |

C. Vernacular names

<table>
<thead>
<tr>
<th>Common name</th>
<th>Periwinkle, Vinca</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindi</td>
<td>Sadabahar</td>
</tr>
<tr>
<td>Malayalam</td>
<td>ShayamNaari, Usamalari</td>
</tr>
<tr>
<td>Marathi</td>
<td>Sadapuli</td>
</tr>
<tr>
<td>Bengali</td>
<td>Nayantara</td>
</tr>
<tr>
<td>Oriya</td>
<td>Visayan</td>
</tr>
<tr>
<td>Punjabi</td>
<td>Rattanjot</td>
</tr>
<tr>
<td>Sanskrit</td>
<td>Nityakalyani</td>
</tr>
<tr>
<td>Tamil</td>
<td>Sudukattumalikai</td>
</tr>
<tr>
<td>Telugu</td>
<td>Billaganneru.</td>
</tr>
<tr>
<td>Kannada</td>
<td>Kempukesi, Kanigali</td>
</tr>
<tr>
<td>European</td>
<td>Vinca branca</td>
</tr>
<tr>
<td>Spanish</td>
<td>Vinca rosada</td>
</tr>
</tbody>
</table>

There are two major cultivars of *Catharanthus roseus* L., which are distinguishable on the basis of their flower colors, namely ‘rosea’ (Pink) and ‘alba’ (White) shown in Fig. 2, are commonly found in India.

![Catharanthus roseus flowers](image1)

(a) rosea (b) alba

Figure 2. Major cultivars of *Catharanthus roseus*

III. PROPERTIES

A. Alkaloids

*Catharanthus roseus* has been found to contain as many as 130 constituents with an indole or dihydroindole structure. The principal component is vindoline (up to...
0.5%); other compounds are serpentine, catharanthine, ajmalicine, akuammine, lochnerine, lochnerine and tetrahydroalstonine. Alkaloids present in various parts of *Catharanthus roseus* are summarized below:

- **Leaf** - Catharanthine, Vindoline, Vindolidine, Vindolicine, Vindolinine, ibogaine, yohimbine, raubasine, Vinblastine, Vincristine, Leurosine, Lochnerine.
- **Stem** - Leurosine, Lochnerine, Catharanthine, Vindoline.
- **Root** - Ajmalacine, Serpentine, Catharanthine, Vindoline, Leurosine, Lochnerine, Reserpine, Alstonine, Tabersonine, Horhammericine, Lochnericine, echitovenine [19].
- **Flower** - Catharanthine, Vindoline, Leurosine, Lochnerine, Tricin (Flavones).
- **Seeds** - Vingramine, Methylvingramine [20].

The physiologically important and antineoplastic alkaloids, vincristine and vinblastine (Fig. 2), are mainly present in the leaves and antihypertensive alkaloids are found in roots such as ajmalicine, serpentine, and reserpine (2 ref). Vincristine and vinblastine alkaloids are used in the treatment of various types of lymphoma and leukemia (3,4 ref). These Catharanthus alkaloids are also used for the treatment of both malignant and non-malignant diseases and in platelet and platelet associated disorders.

![Figure 3. Structure formulae of vincristine (a) and vinblastine (b) in *Catharanthus roseus* L.](image)

**IV. USES**

A decoction of all parts of *Catharanthus roseus* is well known as an oral hypoglycaemic agent. The decoction is also taken to treat

**TABLE I. THERAPEUTIC PROPERTIES CATHARANTHUS ROSEUS**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Therapeutic Properties</th>
<th>Plant parts and methods used</th>
<th>Doses</th>
<th>Organism</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Anti-diabetic activity</td>
<td>Dichloromethane: methanol extract (1:1) of leaves and twigs</td>
<td>500mg/kg</td>
<td>streptozotocin (STZ) induced diabetic rat model.</td>
<td>23,24,25</td>
</tr>
<tr>
<td>2.</td>
<td>Anti-oxidant activity</td>
<td>Methanolic leaf extract , Dichloromethane extract (DE), Ethanolic extracts of the roots</td>
<td>12.5and 25.0 µg/mL</td>
<td>β-T6C6 cells</td>
<td>6,26</td>
</tr>
<tr>
<td>3.</td>
<td>Hypolipidemic Activity</td>
<td>Leaf juice of <em>Catharanthus roseus</em>, Aqueous extract of leaves.</td>
<td>-</td>
<td>Guinea Pigs, Alloxan induced diabetic rats.</td>
<td>22,27</td>
</tr>
</tbody>
</table>
4. Wound Healing Activity  Methanolic extract of *C. roseus* leaf  200 and 400 mg/kg  Streptozotocin-induced diabetic Mice  28,29

5. Cytotoxic activity  Methanolic extract  -  HCT-116 colorectal carcinoma cell  30

6. Antifungal activity  Different extract (acetone, methanol, ethanol), Ethanolic leaf extract  -  Aspergillus niger, Candida albicans, Penicillium chrysogenum  31,32, 33

7. Antimicrobial activity  Different extract (acetone, methanol, ethanol), Ethanolic leaf extract  -  Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa,  31,32,33

8. Antidiarrheal activity  Ethanolic leaf extract  200 and 500 mg/kg  Wistar rat  17,32

9. Hypoglycemic activity  Aqueous extract of flowers, leaves, roots, and stems  250 mg/kg  Healthy and alloxan diabetic mice  34

10. Anti-hyperglycemic activity  Leaf powder, leaf dichloromethane: methanol (1:1) Extracts  55mg/kg, 500 mg/ body weight  Streptozotocin-induced diabetic rats, normal and Alloxan induced diabetic rats.  23,27,35

11. Anticancer activity  Ethanolic, Methanolic and Aqueous Extract of leaves , stem, root, aerial part of *Catharanthus roseus*  50 and 100 mg/kg  MCF (breast cancer) cell lines, Jurkat, HCT-116, 9KB-P-338 cell lines  36,37, 38,39

12. Anti-helminthic activity  Ethanolic extract of *Catharanthus roseus*(Whole plant)  250 mg/ml  Phertility posthuma  16,40

13. Antiviral activity  Selected Catharanthus alkaloids.  -  Vaccinia and polio type III viruses.  41

**TABLE II. *CATHARANTHUS ROSEUS* IN DIABETIC TREATMENTS**

Diabetes milius is disease common in all parts of the world. The use of insulin and control achieved over the disease are of comparatively recent origin when one takes into account the long history of this disease. The problem of drug intolerance, hypersensitivity and resistance to insulin makes it all the more important to search for safe, effective and cheaper remedies. Even before the advent of modern medicine, man has been using various forms of plant therapy to fight this disease. *C. roseus* has been traditionally used for diabetes. Recent studies have shown that *C. roseus* has significant anti-diabetic activity. Leaf extract of *C. roseus* reportedly lowered blood sugar in STZ-diabetic rats[42]. Hypoglycemic activity has also been reported for dichloromethane-methanol extract of stems and twigs of the plant in STZ-diabetic rats[24]. The extract reportedly improved enzymic activities of glycogen synthase, glucose 6-phosphate dehydrogenase, succinate dehydrogenase and malate dehydrogenase in liver of diabetic animals. Juice of fresh leaves of the plant was observed to reduce blood glucose in normal and alloxan diabetic rabbit[43]. Extract of the plant also stimulated glucose utilization in hepatocytes[44]. Ethanolic extract of the plant lowered blood glucose levels in oral glucose tolerance tests in glucose induced hyperglycemic rats[45]. Antihyperglycemic activity has been reported following administration of leaf powder in STZ-diabetic rats[46]. Inhibition of aldose reductase (a key enzyme in cataractogenesis) as well as free radical scavenging activity was reported for the plant extract, suggesting that administration of the extract can delay diabetes-induced cataract formation[47]. Also some studies has shown that *C. roseus* is effective in both insulin dependent and non-insulin dependent diabetes (Table II).

**VI. CONCLUSION AND FUTURE WORK**

The leaf juice or water decoction of *Catharanthus roseus* L. (Apocynaceae) is used as a folk medicine for the treatment of diabetes all over the world. In continuation to this its other parts like root, stem & flower have active components like alkaloid, flavonoids, steroids and phenolic acids which effectively make it in usage as antimicrobial, anti diabetic, anti- syndrome, anti-oxidant. The above study reveals that *C. roseus* has a potential Phytopharmaceuticals assets and further more research is require to find out its actual responsible components, so that its main utility can be used in healing of diseases arises due to deadly.

**REFERENCES**


