Short Research Communication:

Overview of *Catharanthus roseus* (L.) G. Don Alkaloids

Catharanthus roseus (L.) G.Don; syn. *Vinca rosea* L.
Family : Apocynaceae
English name : Periwinkle
Hindi name :Sadabahar, Baramasi

Introduction

A tropical perennial herb, hardy and resistant to attack by fungi or insects. It grows wild but now cultivated scientifically for ornamental and medicinal use. Flowers white or deep rose coloured; follicles long. Earlier civilisations knew about its use in medicine.

The plant originated from Malagasy (Madagascar), then spread to Mozambique, followed by several South East Asian countries *viz*., South Vietnam, Philippines and Australia, including India and Ceylon (Tiwari *et al.*, 2011).

Alkalodial Composition

Catharanthus roseus (L.) G.Don contains two important classes of compounds, *viz;* alkaloids and tannins. Although it is a poisonous plant, but under close medical supervision its alkaloids have been employed successfully for the treatment of cancers *viz*; Hodgkin's carcinoma and leukemia.

There are over 130 organic constituents present in *Catharanthus roseus* (L.) G.Don plant. These have indole or di-hydro-indole moieties present in their molecular structure, which exhibited oncological activity. The chief alkaloids which we shall focus upon here are known as *Vinblastine* and *Vincristine*. They occur together naturally and the yield of the former alkaloid is pre-dominating. The 17-de-acetyl vinblastine has been synthetically converted to the corresponding lactone, which was found to be associated with chemotherapeutic activity.

Applications

The alkaloidal components of *Catharanthus roseus* (L.) G.Don have been claimed to be good for brain health. These alkaloids help in improving the supply of nutrient (glucose) and oxygen to the brain, which it can effectively utilize. Additionally these components are highly effective in the abnormal coagulation of blood and in raising the level of serotonin. This molecule is well known blood neurotransmitter in the Central Nervous System (CNS); its vital function is to regulate the heart function, memory including sleep and appetite. Lack of serotonin may lead to several mental disorders like schizophrenia. The other application of *Catharanthus roseus* (L.) G.Don alkaloids are;

- Hypotensive
- Sedative
- Tranquiliser
- Anticancer
- Relief from pain in muscles and wasp stings
- Provides relief to depression of the CNS
- Stop bleeding from nose/gums
- Relief to mouth ulcers and sore throat
- Decrease glucose concentration in blood (hypoglycaemia) (specially from plant leaves)
- Controls diarrhea
- Taken internally it produces memory enhancing action
- Reduces the inflammation of urinary bladder, stomach and intestines
- Wound healing properties

According to literature reports there are over 100 alkaloids isolated from the various parts of the plant (*viz*; leaves, stem, root, root bark etc.).Amongst them two medicinally important alkaloids may be mentioned here *viz*; vinblastine and vincristine. The yield of vincristine is extremely small (0.00025%) in comparison to vinblastine (root : 0.78-1.22; root bark : 4.5-9.00)% respectively (Tiwari *et al.,* 2001). Amongst the other bio-active alkaloids may be mentioned reserpine ,ajmalicine (raubasine), serpentine and vincamine. The laboratory synthesized derivative of vincamine (alternatively known as vincopectine) is a well known triple action medicine, *viz*; vaso-dilator, blood thinner and memory enhancer. Praubasine has been reported to be useful in checking fragility of capillaries (tiny thin walled blood vessels).

One outstanding property of *Catharanthus roseus* (L.) G.Don extract is that it exhibits anticancer activity against numerous cell type in general and against multi drug resistant cancer tumors in particular (Favretto *et al.,* 2001). This observation points to the fact that some components of the *Catharanthus roseus* (L.) G.Don exerts a synergic effect which counters the multi drug resistance offered by the tumors cells.

In this article we shall highlight the pharmaceutical uses of the two clinically important alkaloids *viz*; vinblastine and vincristine used for the treatments of cancers.

Vinblastine

This alkaloid exhibits quite a different and wide spectrum of activity, and is used for the following types of cancers;

Hodkgin's lymphoma, cancer of breast, head, lungs, neck, ovaries and testicles. The vinblastine is biosynthesized in the plant by joining together two alkaloidal residues(*viz;* Cathaanthine and vindoline).

According to the regimen of chemothraphy directed from the Hodgkin's lymphoma, vinblastine is incorporated into belomycin and metotrenote. This allows the use of lower dose of belomycin thereby reducing the overall toxicity and providing larger resting periods between chemotherapy cycles (Gobbi *et al.,* 2003).

Caution should however, be exercised in the use of vinblastine, since it is associated with wide adverse side effects, namely, hair loss, stomach and intestinal disorders, elevation of blood pressure, depression, involuntary and painful contraction of muscles, giddiness, headache etc.

Vincristine

Vincristine is the second vinca alkaloid, which is used for the treatment of cancer. This cytotoxic drug acts by inhibiting the ability of the cell to divide, which in turn stops the proliferation of the disease .The alkaloid has quite a different and wide spectrum of activity. It is employed for the acute lymphobic cancers in children, malignant tumor (Favretto *et al.,* 2001) and breast cancer.

The use of the extract of *Catharanthus roseus* (L.) G.Don on a rabbit led Beer & Noble (Western Ontario, Canada) to a chance discovery. They noticed that there was reduction of white blood cells (WBCs)and which decreased further with the administration of higher concentration of the drug. Besides, the blood platelets count, including the immunity of the animal fell considerably. There was practically no resistance in the body of the rabbit and the animal died due to infection of *Pseudomonas* sp. This led the investigators to conclude that *Catharanthus roseus* (L.) G.Don. alkaloid could be used to cure leukaemia – a medical condition wherein there is a large increase of WBCs than the normal. This conclusion was found to be correct and was based on the positive results obtained with the leukemic patients. The property of *Croesus'*s alkaloid to suppress immunity could be exploited in organ transplant operations to overcome the problem of ‘rejection’ by the body .At this stage a need was felt to devise a method of obtaining vincristine alkaloid in sizeable amounts. Recourse was taken to extractive procedure from vinca rosea, involving the use of tons quantity of dried leaves. This, however, is a cumbersome and time consuming process. Thanks to the efforts of synthetic organic chemists, who were able to prepare the valuable vincristine alkaloid on a pilot plant scale, in order to cope up with the demand of its use as a drug in cancer therapy as well as an immuno-suppressant drug.

These two alkaloids (vinblastine and vincristine) are now available in the US markets in the form of their respective sulphates.

Isolation of the alkaloids

The modern technique has been employed for the isolation of the above mentioned alkaloid in a pure form;

Methods involving the;

- Selective or differential extraction.
- Method based on pH gradient based separation.

Flavonidal/terpenoidal composition

The flowers of *Catharanthus roseus* (L.) G.Don contained flavonids. The major anthocyanidins present consist of Petunidin, malvidin, including kaempferol and Quercetin (both are strong antioxidants). The whole plant is reported to contain tri-terpenoid,viz ; ursolic acid, accompanied with loganin, deoxyloganin severoside etc.

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