

Medicinal Uses of Rauwolfia Serpentina Plant

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Abstract- Use of Sarpagandha as traditional medicine in Ayurveda, since ancient times in the treatment of a variety of ailments such as insanity, insomnia, epilepsy, hysteria and hypertension is well known. This curative effect of Rauwolfia root is attributed to the presence of more than 50 different alkaloids. Some amongst them include reserpine, ajmaline, ajmalicine, rescinnamine, deserpidine, rescinnamidine, serpentine, serpentinine, yohimbine, indobine and indobinine. R.serpentina is also known to exhibit antidiuretic, anticholinergic, anticancer, antifungal, antimicrobial and anti-inflammatory properties. However this plant drug also produces some unfavourable adverse effects and produces drug resistance when used for long time to treat hypertension. The present communication throws light on chemical composition and therapeutic uses of R.serpentina with an aim to pave way for safe and judicious use of this drug in the treatment of prescribed ailments.

Keywords- *Rauwolfia serpentina*, reserpine, sarpagandha, alkaloids

INTRODUCTION

In India various plants have long since been used in traditional and ayurvedic medicine to cure a variety of ailments. Over 80% of world population depends on herbal medicine for their therapeutic effects and more than 800 plant species show hypoglycemic activity [1]. Medicinal plants contain various chemical substances such as alkaloids, tannins, saponins, volatile oils, gums, fatty acids, resins, oils and other substances for treating various diseases. According to World Health Organization, any plant or its part containing substance, that can be used therapeutically or as raw material for chemical or pharmaceutical synthesis is classified as a drug. Today about 300 species of medicinal and aromatic plants are used worldwide in the pharmaceutical, food, cosmetics and fragrance industries. Antioxidant and antimicrobial properties of various plant extracts have been reported in several studies [2-4]. One medicinally important

plant used for the purpose of obtaining drugs is *Rauwolfia serpentina*.

This plant belongs to the family Apocynacea and occurs usually in subtropical and tropical regions. The family includes about 50 species distributed worldwide commonly found in regions of Himalayas, Indian Peninsula, Burma, Indonesia and Sri Lanka and is an indigenous plant in India, Bangladesh and other regions of Asia [5, 6]. This plant has been named after the German doctor and traveler Leonhard Rauwolf, who in 1582 published an account of his extensive travels. Roots of *Rauwolfia serpentina* (Benth) have been recognized in India and the Malay Peninsula since ancient times, as antidote to the stings and bites of insects and poisonous reptiles. Mention of this plant dates back to 1000 B.C. as well as in works of Charaka (second century, A.D.) under the Sanskrit name of “ Sarpegandha”[7]. This plant is also known by various other regional names in India such as Chandrika (Sanskrit), Chota-chand (Hindi), Chand (Bengali), Dhan-mura or Dhan-barua or Pagla-kadawa (Bihar), Chandra, Chota-chand, Karawi or Harkai (Bombay), Harkaya (Marathi), Patala-garud or Atalagandhi (Telugu), Covanamiloori (Tamil), Chuvanaavilppuri (Malay) and as Ahanneria (Oriya) [8-9].

Rauwolfia serpentina roots contain reserpine which is one amongst about 50 alkaloids present in this plant. Reserpine has been found in the roots of six Rauwolfia species (*Rauwolfia hookeri*, *Rauwolfia micrantha*, *Rauwolfia serpentina*, *Rauwolfia tetraphylla*, *Rauwolfia verticillata* and *Rauwolfia vomitoria*). Reserpine is a drug commonly used in the treatment of Hypertension, usually along with a vasodilator or a thiazide diuretic. In India roots of this plant have been used since long to treat hypertension, insomnia, agitation, epilepsy, trauma, anxiety, excitement, gastrointestinal disorders, snake bites and psychiatric disturbances. In Siddha medicine *Rauwolfia serpentina* roots have been reported to cure hypertension, associated headaches, dizziness, amenorrhea,

oligomenorrhoea and dysmenorrhoea like abnormalities. According to Rajendran and Agarwal, (2007) [10] fruits and seeds of this plant have also been used since a long time for their medicinal end ethnobotanical purposes by the ethnic tribes in Tamil Nadu, India. Dymock [11], detected the presence of alkaloids and yellow resin in the roots of *Rauvolfia serpentina* plant. It contains two strong yellow crystalline bases termed serpentine and serpentinine. Reserpine was first isolated in 1952. Reserpine and similar alkaloids are efficacious in reducing arterial pressure when used with a diuretic. Reserpine is added to the treatment regimen if response to a thiazide (or thiazide like) diuretic is inadequate. It is a good drug for treating hypertensive emergencies [12, 13]. Reserpine produces a depressant action on the central nervous system thereby lowering blood pressure. For pharmacological and physiological studies involving body functions such as blood pressure deviations, reserpine is a very useful tool. *Rauvolfia* root tablets were very popular in India in the past six decades and about 90% of doctors prescribed them routinely, in the treatment of hypertension. However certain unfavorable adverse effects made them unpopular, such as cancer, depression with suicidal tendencies, lethargy, sedation, and nausea. The depressant effect on the peripheral and central nervous systems is due to its binding to catecholamine storage vesicles in central and peripheral neurones. Reserpine depletes the neurotransmitters present in adrenergic neurones and activates the cholinergic system, thereby producing its therapeutic effects. It produces sedation by depressing the sympathetic nervous system.

Scientific classification of *Rauvolfia serpentina* plant

Kingdom: Plantae
 Phylum : Angiosperms
 Subphyllum: Eudicots
 Class: Asteroids
 Order: Gentianales
 Family: Apocynaceae
 Genus: *Rauvolfia*
 Species: *Serpentine*

MORPHOLOGY

Rauvolfia serpentina is an evergreen, glabrous, woody and perennial shrub which grows usually up to a height of 60 centimeters. The plant has tuberous roots with pale brown cork and elliptical to lanceolate or obovate

leaves usually in whorls of three. Leaf is pale green and bright green from above and quite thin. Flowers of this plant are cymes, irregular corymbs, and white in color often having a violet tinge. Flowering time is from March to May, in India and other south east Asian countries. Fruits are single or didymous, drupe, shining black, having inflorescence with red pedicles or calyx and white corolla [14, 15]

PHYTOCHEMICAL CONSTITUENTS

Various phytochemical constituents present in *R. serpentina* include alkaloids, tannins, phenols and flavonoids. Alkaloids identified include ajmaline, ajmalicine, ajmalimine, deserpidine, rescinnamine, serpentine, serpentinine, yohimbine etc. Amongst others, reserpine is the principle alkaloid present [16, 17].

Reserpine

Reserpine is a pure crystalline alkaloid derived from the roots of *Rauvolfia* plant. It is a weak tertiary base present in the oleoresin fraction of the roots and is useful in the treatment of hypertension, cardiovascular disease and neurological disorders [18, 19]. Reserpine (3,4,3- trimethibenzoic acid) ester of reserpic acid, (an indole derivative of 18- hydroxyl yohimbine type) is responsible for antihypertensive properties of *Rauvolfia*. Reserpine is now being utilized as a tool in physiologic studies of body functions and in pharmacological studies. Antidepressant action on central nervous system and peripheral nervous system and binding to catecholamine storage vesicles in the nerve cell, is responsible for anti-hypertensive actions of reserpine [20, 21].

Ajmaline

This compound was first isolated by Salimuzzaman Siddiqui in 1931 from roots of *R. serpentina*. He named it Ajmaline after Hakim Ajmal Khan, one of the most illustrious practitioners of Unani medicine in South Asia [22, 23]. Ajmaline is a sodium channel blocker that shows instant action when given intravenously, which makes it ideal for diagnostic purposes. The administration of *Rauvolfia* alkaloid to patients with this type of arrhythmia is known as the "Ajmaline test". Ajmaline is reported to stimulate respiration and intestinal movements. The actions of ajmaline and serpentine on systemic and pulmonary blood pressure are similar [24].

Ajmalicine

Ajmalicine has large number of applications in the treatment of circulatory diseases especially in providing relief to normal cerebral blood flow. It affects the function of smooth muscle, preventing strokes, and helps in lowering blood pressure. Ajmalicine is derived from tryptophan which is converted to tryptamine via secologanin, strictosidine and cathenamine. Reduction of cathenamine to ajmalicine is facilitated by enzyme NADPH and tryptophan decarboxylase (TDC) [25].

Serpentine

A type II topoisomerase inhibitor, serpentine, exhibits antipsychotic properties. The enzyme peroxidase (PER) is responsible for oxidation of ajmalicine to serpentine by catalyzing bisindole alkaloid localized in the vacuole [26].

Rescinnamine

Rescinnamine is a purified ester alkaloid of alseroxyton fraction present in species of *Rauvolfia*, related chemically and pharmacologically to reserpine with similar uses. Investigated in 1950s and used for the treatment of hypertension as an antihypertensive agent. It is clinically a less potent alkaloid than reserpine and not so effective in lowering blood pressure [27]. Rescinnamine Inhibits Angiotensin converting enzyme, peptidyl dipeptidase that catalyzes the conversion of angiotensin I to the vasoconstrictor substance Angiotensin II which stimulates aldosterone secretion by the adrenal cortex [28].

Deserpidine

Deserpidine is an ester alkaloid present in the plant *Rauvolfia*. It differs from reserpine only by absence of a methoxy group at C-11, which is synthesized from reserpine. Deserpidine is used mainly for its antihypertensive and antipsychotic properties. It reduces blood pressure by exercising control over nerve impulses along various nerve pathways [29].

Yohimbine

Yohimbine is a selective alpha adrenergic antagonist or an alpha blocker and is an effective remedy in the treatment of erectile dysfunction [30-33].

MEDICINAL USES OF *Rauvolfia serpentina*

The roots of the plant have been used since centuries in ayurveda to treat high blood pressure, insanity,

insomnia and to calm down the patient in agitation and hysteria. *R. serpentina* root extract is also helpful in treating ailments such as malaria, fever, eye diseases, asthma, pneumonia, headache, skin and spleen disorders. *Rauvolfia serpentina* is a herb which contains therapeutically viable indole alkaloids and most of them are present in the roots of the plant. Fabricant and Fransworth have emphasized the use of the herb to cure various circulatory disorders. Extracts of the root are useful in the treatment of various circulatory disorders. Extracts of the roots finds applications in the treatment of intestinal disorders especially diarrhea and dysentery. The use of the herb also finds application in the treatment of cholera, colic and fever. The root stimulates uterine contractions and is recommended for use in child birth. Pioneers such as Azmi and Qureshi showed invaluable effects of this root extract with incomplete hypoglycaemic action in diabetic hypertensive patients. The juice of the leaves has been used to treat opacity of the cornea. Leaf juice also finds applications in treating stomach pain, liver pain, and dysentery and to expel intestinal worms. Root extract and juice of the plant has been used to treat gastrointestinal and circulatory disorders. Other therapeutic applications of this plant are mentioned below [34].

Prostate Cancer

Various parts of the plant especially root and bark are enriched with compounds of β -carboline alkaloid family of which the main constituent is alstomine. This compound is reported to reduce luminal cell growth in mice inoculated with YC8 lymphoma cells or Ehrlich ascetic cells. The plant extract has anti-prostate cancer activity in both in vitro and in vivo model systems, which based upon analysis of gene expression patterns of treated prostate cancer cells, may be modulated by its effects on cell cycle control signaling pathways and DNA damage [35, 36].

High blood pressure

Roots of *Rauvolfia serpentina* have been used in traditional Indian system of medicine to treat high blood pressure. The alkaloids directly affect hypertension and are also used by practitioners of modern medicine to treat hypertension. To reduce blood pressure, half a teaspoonful of powder of dried roots of the plant is taken three times a day.

Insanity

To treat insanity the Rauvolfia plant is highly useful. One gram of the powdered root can be taken twice a day with 250 ml of sweetened goat's milk. However it is not suitable in patients having low blood pressure and depression [37].

Hysteria

Beneficial effects such as reduced psychomotor agitation and excitement, and calmness of mind are seen when the drug is orally administered to a hysterical patient. One gram of dried powdered root taken thrice a day with goat's milk is beneficial in hysteria. Treatment must be continued till complete cure is obtained [38, 39].

Insomnia

Because of its sedative property Rauvolfia is very beneficial in treating insomnia. Used early it enables a patient of gouty and phlegmatic nature to go to sleep. Usually 1 to 1.25 g of the powder is given with warm milk, after meals, and is very helpful in insomnia [40].

Itching skin

In disorders of skin and urticaria one gram of root powder is taken with plain water and promptly relieves itching [41].

CONCLUSION

Rauvolfia serpentina, commonly known as Indian snakeroot, has significant medicinal uses. It contains alkaloids like reserpine, which are effective in treating hypertension and certain mental disorders. The plant is also used for its sedative and tranquilizing properties. Overall, Rauvolfia serpentina is a valuable medicinal plant, but its applications require careful consideration of benefits and risks.

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